DESIGN OF AN INFORMATIVE AND INTERACTIVE ENERGY DISPLAY FOR A SOLAR PV- SYSTEM

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TITLE PAGE

PROJECT TITLE
Design of an informative and interactive energy display for a solar PV-system in Jayapura

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PREFACE

This report is by Tim van de Heide and Jael Loermans, written as a result of the final bachelor assignment of the career Industrial Design at the University of Twente. The goal of the project is to design an interactive installation in which solar energy can be communicated to the user. The installation will be placed in the hall of the governmental building of Jayapura, the capital city of West Papua, Indonesia. Initially the project should have been executed entirely in Jayapura,. Because of unexpected turmoil, it was no option to stay longer than five weeks. Because of this the project has taken a different direction; which should have been a project in which an entire interactive installation should have been produced and installed has become a project in which the design got the main focus. Although this change in focus had result to some complication, we are happy that it was possible for us to still continue with this project. This couldn't have happened without the help of our tutors Angele Reinders, Hans Veldhuis and Mieke van der Bijl-Brouwer, who all helped us to make the switch in the project and where very flexible when things didn't go according to plan. Beside our tutors we want to thank Jelle Ferwerda and Inge Broekman, because they responded as quick as possible when we told them about the turmoil that was going on in Jayapura and did do all the arrangement needed to get us back home safe. Moreover we want to thank Andonowati for taking us in, during our changeover in Bandung, and helping us with everything we need on such a short notice. Finally we want to thank the people from the government for helping us with receiving all information needed during and after our stay in Jayapura and making our trip even more interesting than it already were.

SUMMARY

The goal of the project is to design an interactive installation for the governmental building of Jayapura, the capital of West Papua, Indonesia. In cooperation with universities, the government, a producer of solar panels and WWF – Indonesia, a project is set up, in which solar panels are placed on the roof of the governmental building and provides the building from this clean energy. Because the visitors are not able to see anything of this project, an installation has to be designed to communicate the solar panels to the visitors of the governmental building. Two students from Holland have visited the city and investigated the culture, location and technical possibilities. Based on these findings ideas are generated which are converted in four main concepts. The highlights of these concepts are combined together to design a final concept: An installation in which multiple people should 'work' together to create a healthy city, which is animated on a screen on the wall. The working together is translated in turning on lights by touching the right part of information. These lights drive solar panels to generate energy, which stimulate the image on the screen to change. This concept has been elaborated, specified and processed in model. Based on this model the interactions of the installation are tested. Based on these, as well as the experiences of building the model and interviewing people about the product, conclusions are drawn and recommendations are done. Once optimized a manual is send to Papua, in combination with the electrical equipment. Both the manual is written and added to the appendix and the electrical equipment is connected and the software is written. These should be adapted to the changes that will be made based on the recommendations.

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PROJECT DESCRIPTION

1.1 Introduction

Problems like the lower availability of oil and environmental problems like the greenhouse effect are not well known around the whole world. Although these problems take place across the globe, the solutions for these problems are mainly sought in wealthy societies in the west. In contrast to the poorer and developing countries at the world, these countries have the luxury to think about tomorrow's problems. Though, the less wealthy countries should not be forgotten here. These countries are developing, and need to be supported by applying clean technologies instead of generating energy from oil. To support the use of technologies which are cleaner and therefore better for the world, people in these countries should be informed about the possibilities.
In this project report the design process of an interactive installation will be described. The installation is designed to communicate information about solar energy. In cooperation of different parties, these panels are installed on the roof of the governmental building of the capital of Papua, one of the provinces of Indonesia. During this project two designers have been in this city for over a month to get to know the culture and analyze the context in which the product is going to be used. Because of rebellion this analysis on location was cut off, which result in some lack of knowledge or change in requirements. These adoptions will become clear while reading the report.
The design is performed in a cooperation of two designers, each with their own focus. One of the focuses contained the technical part of the design. This part holds the possibilities of building the product in Jayapura; what materials are available, what are the relating prices and how can these be shaped into a final product. Tim van der Heide is the person focusing on this part. He has a background on designing computer related systems and keeps track of the technical requirements during the design phases.

The second focus maintains the context in which the design is placed. This part holds the cultural

and user analysis based on observation and interviews done in Jayapura as well as literature analysis. Jaël Loermans is the person focusing on this part. She is responsible for the product being understandable and attractive to its user and will eventually evaluate this by user tests.

This concept report is to give a basic overview of what is done so far. After its evaluation the specification of the final concept will be set and the building will start. In combination with a to-be-designed scenario this concept will be evaluated with users that are related to Indonesia or Papua. The final conclusions and evaluations of the product as well as the project will be executed after this stage.

1.2 The project description

Below, the description of the project will be discussed. First a general overview will be given for the project. This will be based at the original assignment description written by our prior supervisor, Angele Reinders. This short description is updated to the current situation of the project since some aspects have changed during its progress. The next section will include a more detailed description of the progress of the project and what situations led to changes in the project.

1.2.1 Project overview

Overall project description

In early 2012 a medium sized photovoltaic (PV) solar system is installed at the roof of the Walikota building, the public municipality building of the capital of Papua, Jayapura. This happens in the framework of an international collaborative project between University of Twente and several Indonesian parties, a.o. Institut Teknologi Bandung (ITB), WWF-Indonesia, SolInvest and local governmental parties in Jayapura.

The project

To inform regular users and visitors of the building about the benefits of solar energy in general and -in particular- about the functioning of the PV solar system and its electricity production, a display (or object) has to be developed which provides this information in an interactive way. After one month of research at location, the concept will be designed back in the Netherlands. Here, a prototype of the product will be built and tested, leading eventually to shipment of some parts and a construction manual so it can be produced on location. Remaining parts for this have to be bought in Jayapura. According to Thijs Sablerolle, project developer for this project; the available budget would be around €170,00 (2 000 000 IDR), as part of the launching event of the overall project.

1.2.2 Project progress

On the basis of a previous version of the above description two parties, Jaël Loermans and Tim van der Heide, were assigned to this project. After a short time of research, both traveled to Jayapura to complete the project in the predetermined three months. Following the first plan of the project, the product has to be built within three months and be operational at the Walikota in the end. However, after four weeks on location, the ongoing rebellions in the city led to a too dangerous situation for the students to be in. This resulted in a return to the Netherlands, and a continuation of the project from here. This situation has led to the change of certain aspects in the project. Since the product can't be built on location by the students themselves anymore the final product requires to be built on location in Jayapura. Also during its development, the product cannot be tested with real end-users. A prototype will be built in the Netherlands to still receive input from other users. All of this will result in a final design, expressed in a construction manual to be built on location.

1.3 Distribution of tasks

To efficiently work together two parties work

together on this project, both with a different focus. The contextual party is focused on the user in all his aspects. This will include user analysis, like how people live in Papua and their knowledge about (solar) energy; but also research related to the user and his culture. The product will eventually be evaluated by user tests with the prototype of the product. These cultural parts are performed by Jaël Loermans.
The technical party focuses on the technical implementation of the installation, including an analysis of the technical possibilities and the eventual build of a prototype. This will result in some physical parts to be sent to Jayapura including a construction manual to build the actual product. This part is performed by Tim van der Heide.
Below, a list of the distribution of tasks:

What	Who
User analysis	Jaël
Culture analysis	Jaël
Knowledge analysis	Jaël
Practical analysis	Tim
Build prototype	Tim
Full specification of product	Tim
Construction manual	Tim

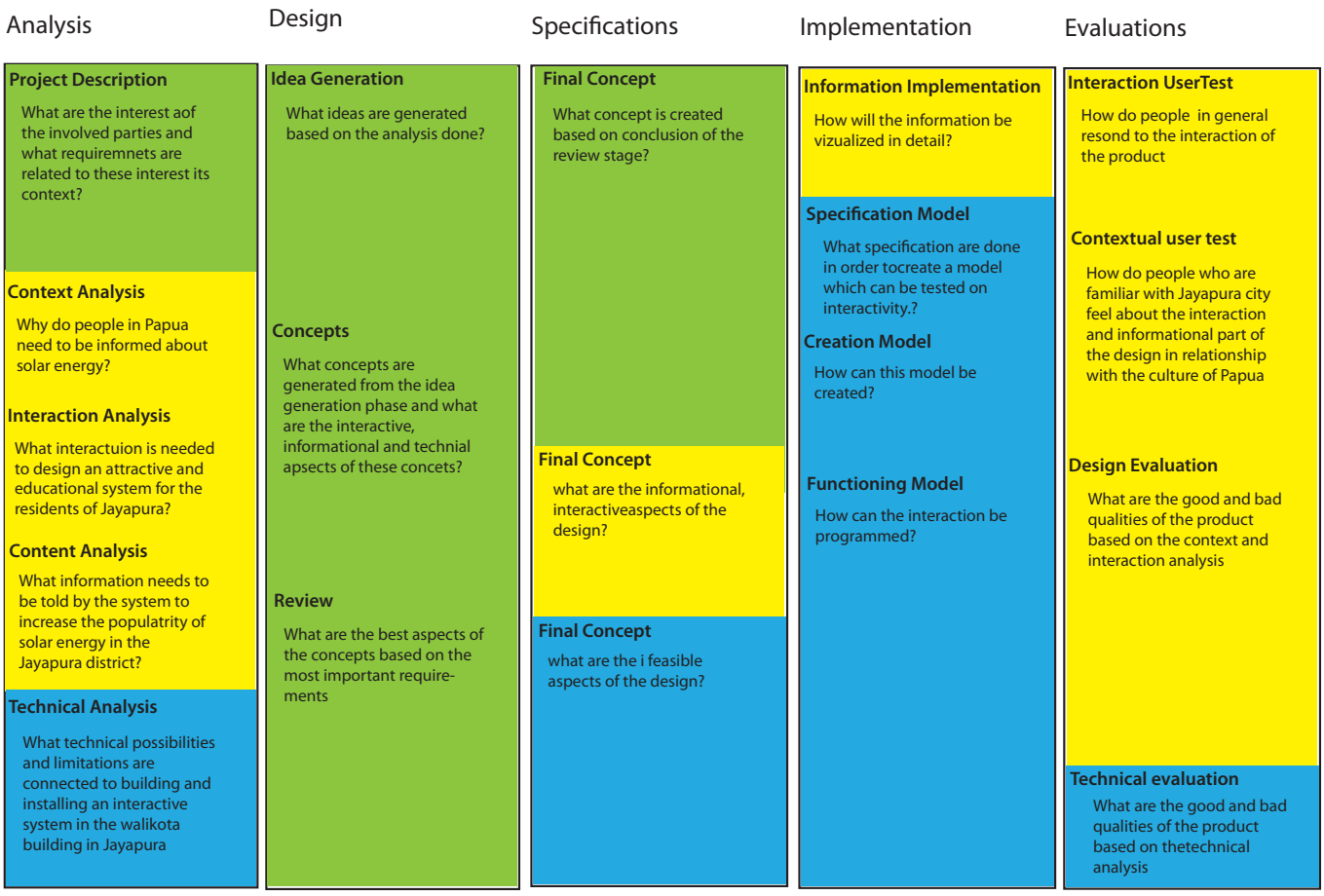


Figure 1.1. Overview of main questions

What	Who
User test with prototype	Jaël

In figure Figure 1.1 an overview of the main questions and who has researched them can be found. Yellow is Jaël, Blue is Tim and green is both.

1.4 Parties involved to the project

1.4.1 WWF

WWF-Indonesia is an Indonesian member of WWF, the global conservation organization. This organization is a network of WWF organizations and affiliates operating in close to 100 countries worldwide.

According to the website of the Indonesian party of WWF (http://wwf.panda.org/) “Indonesia is very rich in terms of terrestrial and marine biodiversity, yet so many Indonesians live in poverty. Cities are some of the most polluted in the world, year after year a forest goes up in flames, and in the monsoon seasons so many people must suffer the woes of floods and landslides, which are often fatal. They say that their mission is conserving biodiversity and reducing human impact trough promoting conservation for well-being of people trough sustainable use of natural resources and trough promoting strong conservation ethics, awareness and actions in Indonesian society.”

WWF wants to create a worldwide awareness of the importance of the use of sustainable energy sources. Although most of the fossil fuels produced in Papua are not actually used by its inhabitants, still the cities of Papua do use mostly diesel, which still has an impact on the climate change and the environment. As part of the solar system project, WWF-Indonesia contributes to an increase of awareness of the importance and the possibilities of solar energy. This will contribute to an increase in use and so a decrease of fossil fuels.

This non-governmental organization is the mediator between the project, the governmental parties and the inhabitants, but moreover puts the project on the list. The WWF has also interest in using this project as an example for other cities. Above all that, the WWF supports this project to improve the environmental awareness of people in Jayapura and increase their knowledge about solar energy.

1.4.2 Solinvest

Solinvest Renewable Energy presents them as being “an independent financial and investment consultant and project developer with its main focus on the renewable energy sector. Established in Jakarta in 2010, Solinvest serves the growing energy markets of South East Asia with a special focus on Indonesia. The growing demand for energy all over the world will result in increasing energy costs in the next decades, if it does not add renewable energy to its energy mix; the region will suffer from this leak.”(http://www.solinvest.co.id). Therefore Indonesia (including Papua) is an attractive region to focus on. “In mid 2011 Solinvest was the company that prepared the project proposal which included the installation of a 35 kWp photovoltaic solar power system in Jayapura, the capital of Papua province in eastern Indonesia as well as improving the curriculum on solar energy at one of Indonesia’s most prestigious universities.”

Solinvest has its focus at the region of Indonesia to support new solar project. By informing the visitors of Jayapura about solar energy, people will get more aware of the advantages and the current environmental problems involved. To get solar energy more well-known among the people, Solinvest creates the possibility to develop new projects in the future.

1.4.3 Government

The government of Jayapura is aware of the environmental problems that arise in the city. For this, the solar project is addressed to the environmental department (BLH), which

is focusing on a clean and healthy city. Like WWF, the government's main purpose with the installation is to create awareness among the inhabitants of Jayapura. If the people are better educated about the environmental problems and their reasons, it will be easier for them to make the change. The government also wants to promote the used PV system at the roof. Since it is not accessible for visitors it has to be brought down in informational form to the entrance hall where everybody can see it. The government tries to stimulate the use of sustainable energy sources, by giving the right example with the system at the roof.

1.5 Location

1.5.1 Jayapura

Jayapura is the provincial capital of Papua, Indonesia. It is situated on the island of New Guinea, in the top east sector of the Indonesian western part of this Island. According to the Bureau of Statistics Jayapura City the population of the city in 2011 was 256705. The city is divided into five districts: Abepura, Jayapura Selatan (south), Jayapura Utara (north), Muara Tami and Heram; with most of the people living in the two main Jayapura districts. Currently, energy in Jayapura is produced by some power plants using oil as primary energy source. While the city is very closely situated to the equator, no other solar energy projects have been performed before in this area.

1.5.2 The Walikota building

The Walikota building is part of a set other governmental buildings located next to each other in the hills of Jayapura. The Walikota is the main building for visitors from the municipality of Jayapura city. In this building, inhabitants of Jayapura can arrange municipality related tasks like applications for spatial planning and to pick up their KTP-card (personal identification). Also the environmental department (BLH) is located in this building. The visiting hours are from 8:00 till 15:00 and the amount of visitors varies from 100 to 400 a day.

The installation will be placed in the central hall of the building. A more detailed analysis including the appearance of this hall is further elaborated in Practical Analysis chapter.

1.6 Conclusion

The project description describes what the product has to achive in the first place. This is subdivided in various tasks which are assigned to the contextual and the technical party, so that the product will be designed together but with own particular focus to certain subjects. Also the different involved parties have their particular focus on the project. The universities are more interested to the knowledge about the techniques of solar energy while others, like WWF and the government, will center on an improved awareness of the environmental aspects and solar energy as a solution. These requirements, including the ones from the project description, will result in the development of the interactive installation eventually to be situated in the central hall of the Walikota to inform people of Jayapura about the need of solar energy as an alternative source for energy.

- The requirements that can be concluded from this analysis are as follow:
- The product should be an interactive installation (display/object)
- The product informs about solar energy in general
- The product informs about the PV system at the Walikota
- To be bought parts will be below €170 in total.
- The installation can be built on location
- All the required parts are provided or available in Jayapura

2.

THE EFFECT OF INFORMING

» J.R. Loermans

2.1 Introduction

As mentioned in the project description, according to the involved parties the purpose of informing people about solar energy is to enlarge the knowledge of people about solar energy and contribute to an increase of the use of solar energy. To find out how information can influence this growth and what is needed to do so, the perception of the user on solar energy today is investigated.
Because perception can be interpreted in multiple ways, the comparison with projects done in Papua New Guinea (PNG) is made. The reason for the failures of the majority of these projects in PNG is compared with its chance of failing in the culture of Papua, Indonesia. This shows what is needed to make a solar project succeed in Jayapura and what can be done to influence the increase of the use of solar panels.
Information about this culture is based on a literature investigation, interviewing people at the office of BLH (responsible for a clean and healthy city), the experience of living and working in the area for more than one month and the observations done in that period The interviews and conversations with the people from BLH are done partly in English and partly in Indonesian. Both parties didn't speak the other language properly. For this reason some information could have been wrongly interpreted.
The differences, as well as the similarities, of these perceptions can give insights on what information is needed to increase the popularity and introduction of solar panels.

2.2 Complications of introducing solar energy in a 3rd world country

Benjamin K (2010) shows the difficulties of implementing solar home systems (SHS) into a country as Papua, viz. Papua New Guinea

(PNG). The article mentioned 4 cultural barriers of the penetrations of SHS in PNG: Technical, Economical, Political and Social. In this paragraph the barriers are discussed which can be affect by or which affect the installation.

The technical Barriers:

- Limited availability of high quality SHS products:
  Because of a lack of a diversity products in general, the development as well as the maintenance of products is very complicated.
- Lack of training in maintenance:
  After the project finishes, all professionals leave, and there is nobody left to maintain the project, so it perishes.

The Economic Barriers:

- Poverty and high upfront costs:
  Although solar panels need low maintenance and have fuel costs, due to the high poverty rate people are not able to think about the future. Therefore saving money is not an option. High upfront costs are therefore opposing factors in the introduction of solar panels.

The social Barriers:

- Unrealistic expectations
  People are misunderstood about the amount of energy one panel can generate and the life expectancy of the product.
- Theft, neglecting and vandalism
  There are no geographical communities but clans or families. When introducing panels in an area no one feels responsible which results in negligence. Moreover personal SHS can feel like an affront because in a 'wantok 'they share everything together. For this reason it increases jealousy and therefore neglecting and aggression within as well as between clans.
- Unfamiliarity with technology
  People are not familiar with the technology of solar energy or even electricity. Moreover because of bad experience with solar panels, solar energy is known but without any success stories.

Papua and Papua New Guinea (PNG) have been the same country until 1828(Wikipedia, 2012), when the Dutch claimed the left part of the island New Guinea. Moreover the 'two countries' (one being a province of Indonesia) have been and still are the only countries part of the island New Guinea. For this reason a lot of problems will be similar in both countries.
Because the article refers to solar home systems (on top of a single house/on the ground) while the solar system in Jayapura is built on the roof of a governmental, some of the arguments mentioned in the article might not seem to address this project. Still, the involved parties are not only interested in promoting this project, but also in eventually enabling the introduction of solar systems to the rest of the city, the barriers mentioned in the article are applicable.
Still there are some differences between the project of Walikota and the projects discussed in the article that have to be taken into account. The most obvious difference is that the users in PNG are mainly rural inhabitants. These people mainly live in tribes and have their own individual culture. In the Jayapura district, the majority of people live in urban areas. About 40% of the people are immigrants from other parts of Indonesia (BPS-Statistics of Jayapura Municipality, 2010) which are not at all comparable to the tribes mentioned in the article. Moreover the standards of living in a city differ remarkably from those of different tribes. Only a very small amount of people is recalled by governmental numbers as being rural. Still the largest part of the inhabitants did grow up in a rural society. It is very likely that some habits, norms and values had been passed on to these people. To investigate what these differences or similarities are the barriers mentioned above are compared to the situation of Papua. This way becomes clear what Jayapura needs to know, think and feel about solar panels to introduce them in this part of the province.

2.3 Introducing solar energy in Jayapura

Figure 2.1. Way of living in Jayapura

As the article discussed before, the majority of solar projects that are set up in countries comparable to Papua, generally failed. The reason for these failures had to do with political and economical reasons as well as social and technical reasons. Still, the way solar energy is used in the projects mentioned in the article differs in some aspects from the use on which the installation should have an impact. For this reasons the perception on solar energy in Jayapura is being investigated. This way, the reason for the failure of the introduction of solar panels in Papua New Guinea (PNG) can be translated into the creation of opportunities of the use in Jayapura.

2.3.1 Technical and economical aspects

In the article limited availability of products and high poverty rate where discussed of being reasons for the failure of solar projects in PNG. In Jayapura this appears to be rather similar. Because a high percentage of the population lives in urban areas whereas in the article 90 percent lived in rural the conception of money is different from that of PNG; people do own property, and do use money for personal/ family use. Still their perception of money differs from the one in the western world. The majority of the people living in the Jayapura district live under the poverty level, without a large amount of extremely rich people. All respondents were asked about their reason to work and answered the question uniformly with 'To survive'. In Jayapura a high percentage of the population struggles with unemployment and a low income per capita. Moreover the prices of products in general are extremely high. The latter has a lot to do with the accessibility. As well as undeveloped infrastructure in Papua New Guinea which means that the roads only reach about one percent of the country. The only big city which is connected to Jayapura is Sentani, in which the airport is located. When going to other parts of the province, airplanes are required. This results

Figure 2.2. Selling diesel generators

in a low diversity of products as well as high prices per product. This results in the fact that the majority of the population cannot fulfil their basic needs due the lack of money.
The large upfront-costs that are needed with the purchase of a large set of panels are therefore unaffordable. Colleagues at the government mentioned the following: 'most people spend their money on alcohol instead of saving some for the future'. Thinking about the future is not an option, so saving or investing money is not that obvious either. Therefore, as long as producing and buying solar panels will be this expensive, a large increase of use in solar panels in Papua isn't very likely.
Besides high upfront costs, low diversity of products also contributes to problems to introduce solar panels to the city. People installing the solar system on the roof of the Walikota building had trouble finding the right products to do so. Often parts had to be shipped or flown in because No shop in the entire city was able to deliver the parts. It would be far too expensive for local people to import these parts.
These are the main reasons why it is not expected that visitors will be convinced of buying solar panels after getting in touch with the installation. The political and economical situations have a very large say in this. Therefore the goal of the installation is to convince people of solar energy being good for the society, so that, although they can't buy the panels, they can make decisions with this mind.
A final technical barrier that is making it hard to introduce solar energy in Papua is that,

Figure 2.3. Dumped waste in te city

according to the employees of the Walikota, the knowledge about solar energy in Jayapura is very little. Although this knowledge is not as little as in tribe communities, also in Jayapura people do not know how solar energy can be converted into electricity. The lack of information about solar panels will never stimulate this niche which makes it even harder to introduce and increase the use of solar energy. This is something on which the installation can anticipate.

2.3.2 Social aspects

The article mentioned lack of information and misunderstanding about solar energy as well as energy in general one of the main reasons for the failure of the projects. The Lonely Planet shows that over 90 percent of the people in Papua are educated with at least primary school. Almost 50 percent have also been in secondary school. Moreover over 98 percent (source) of the young adults were able to read and write. This information would expect the population to be known with electricity, solar energy and environmental problems. This can be questioned: different colleagues from

BLH told in an interview that all people where educated about the environmental problems in secondary school. When asking one of the educated people working at Walikota about the consequence of the exhaust of cars and motorcycles, the only thing she could mention was the quality of air. The actual knowledge about the problems of the environment isn't as self-evident connected to high education as is expected. For this reason the knowledge about and perspective on electricity, solar energy and environmental problems is discussed.

Perception of Energy

Papua is an island in which the majority of the people live in rural areas, in which luxury and energy are barely known, Jayapura is one of the little areas in which the majority of the people are inhabitants of urban areas. The exact amount of households that are connected to the grid is unknown. Neither the employers of the government nor any literature was in possession of the exact number of electricity users. Still a large amount of people are using a cell phone, or watch television, which shows that the majority of the people living in this part of the district are aware of the use of electricity and what it is used for. Moreover, Diesel generators are used all over the city. In at least two parts of the city two large energy generating installations are located, of which one in the city centre. Because of the grid being instable, black outs occur almost daily. For this reason nearly every individual employee owns their own diesel generator. In every part of the city multiple shops sell all kinds of generators and its needed diesel (which cynically is called solar). Furthermore, the majority of the people are using little motorcycles or small busses every day. Therefore also lots of garages and car parts are available in small shops in the streets. This proves that people are aware of diesel and the fact that in can be converted into electricity. Although the connection between electricity and diesel should be really obvious for the majority of the population, the knowledge about the relation between energy and electricity is not that certain. According to the majority of people asked, the average person in Jayapura has no idea about the fact that sun can be converted into electricity, whereas most people where aware of biogases and its use.
Because people don´t know a lot about solar panels, overenthusiastic western people introducing solar energy can create misconception about the capability of solar panels. These too high expectations might lead to disappointment.

Perception of environmental issues

Although Benjamin (2010) didn't mentioned any disinterest in environment problems of today as being a reason for the failure of solar projects, this is taken into account in this analysis too. The reason for this is that spreading this information might contribute to a better acceptance of the panels while introduced; evaluating the awareness of the environmental situation clarifies the impact this knowledge can have on the introduction of solar energy.
According to an investigation on the opinion about the environment, the majority of the people believe there's a deterioration of their forest, wildlife and rivers. On the other hand they believe the condition of the air, the seas and oceans and soil have improved. Still rural residents are more optimistic about these cases. Urban residents are more likely to be pessimistic about their environment. Although it's not completely clear in this article who are the urban residents and who are the rural residents, the article does show the higher amount of sceptical people about the environment in total. For Jayapura being the largest city of Papua, it is reasonable to assume that the majority of the residents in Jayapura are urban and therefore are worried about their environment. Moreover one respondent quoted: 'People do talk about the environment. They complain about the contaminated drainage, the erode mountain, factories outlet and the garbage'. One respondent mentioned that the city had become so dirty in the past forty years. Another subject people complained about was the increasing prices of diesel meaning that people did notice oil becoming scarce. If the people could make the connection between the scarcity and the high prices of oil is unknown.

Perception of owning

Another social fact mentioned in the article is

jealousy and theft being the reason for people not to be involved in solar energy. It is important to let people use, or even appreciate people for using, solar energy rather than being jealous of, stealing from or even killing others. People should know the importance of every individual to contribute to the whole. Only one person can't make a difference. Jealousy and stealing would hinder this coherence.
The difference between poor and wealthy people isn't obviously large, though existing. Generally everyone is in need of money. When introducing this expensive product in Jayapura, social involvement should be stimulated to avoid this mentality of jealousy, so that a realistic idea about the abilities of solar energy can be created which can contribute to coherence with the users and effect the environment.
Moreover, involvement is needed to create social responsibility in case panels are placed in communities. As well as in PNG family is very important in Jayapura. This means that geographical communities have lower priority. Sharing something as electricity means social involvement and knowledge about this involvement. Respondents all reacted pretty positively when asked about their bond with their neighbourhood. One even mentioned their neighbourhood as being a motivation for the development she'd gone trough. Only sharing things within a tribe or family might not be the only option in the society of Jayapura.

2.4 Conclusion

Although the government of Jayapura as well as the organization of WWF would like to see the people of district of Jayapura using only solar energy, it's not to be expected that an informative system will convince people to purchase solar cells on their roofs soon. Economical as well as political reasons mentioned in the analytical phase before, make it impossible to expect that solar energy is going to be a part of the daily consumption in Jayapura. But not only the ability to purchase solar panels is missing, the desire to have solar energy in the first place isn't apparent. Inhabitants probably would more easily find themselves buying diesel generators than solar panels, even when having similar prices. People don't know what solar energy is, so knowing the benefits over benzene is not to be expected. Therefore the goal of the user-interface is: to create awareness about what solar energy is and why it is important to people from Jayapura. An involvement in the problems of the worlds environment, and there for the environment of Papua, has to be stimulated. People have to know it's not only cheaper to use solar energy; it's caring for their country and society. Though, because of their poverty rate and the disability to look in the future that is addressed to this poverty, they have to be aware of the ability to do so without having to give up their basic needs. The sustainable trend that is dominating the western world today should also reflect in this part of the world. Although the use of solar energy might not be available for everyone at this point, people should want to use solar energy over benzene; the reason that could still hold them back should not be their disinterest but the lack of available money. If this trend will rise, advantages will come along. Big companies and parties will be able to use solar energy and sustainability as a campaign while competing with other, just like this is happening in other parts of the world (green energy). Maybe other governments can see the benefits and want to share this with their district to promote their 'leadership'. But also when sustainable projects are installed in a public building, people might see the urge to do maintain the panels. Even more important, people won't see the panels as property but as an involvement, so that jealousy and corruption is not as expected end there for neither are destroying panels and intimidating complete villages. If people know the panels are not only a sign of wealth, but a sign of caring for the country, jealousy and corruption might decrease.

3.

INTERACTION

» J.R. Loermans

3.1 Introduction

Educating people trough interactive systems has many benefits compared to doing so by more regular ways of informing. This chapter discusses what interaction the design needs, to create the characteristics of a good interactive system based on a theory of David Benyon, Phill Turner and Susan Turner(2005). The exact formulation as well as the reason for the use of such a system in general in this specific case is discussed. This is continued by features which improve the design of interactive systems. In some cases these features are general, while in other cases the features depends on a certain environment. In the latter case the characteristics of the user in this project and its culture are integrated. These characteristics are based on the outcomes of interviews held with people from the population of the district of Jayapura, as well as people from the BLH office of the Walikota building, literature analysis and the experience of living and working in Jayapura. The features result in a list of requirements which are used in the previous stages of the design.

3.2 Interactive Systems

According to David Benyon (2005), interactive systems are things that deal with the transmission, display, storage or transformation of information that people can perceive. They are devices that respond to peoples actions. The term is intended to cover components, devices, products and software systems that are primarily concerned with processing information. In the article of Jeff Barker and Khaled Sabry (2009) the effectiveness of the use of interactive ways of learning is discussed. In this article the opinion of multiple experts is mentioned to show how interaction can attribute to a higher educational level. According to Moore and Kearsly (1996), ‘interactivity is at the heart of learning system design: for the influential role it plays in the effectiveness of the learning

processes. Streetman and Goodman (1998) are mentioned while proving that 'using an interactive web-based learning program can increase the learning enjoyment level, which in turn may increase students' understanding and effectiveness learning in a longer timeframe in terms of information retention.

Because interactivity addresses to an increase of the enjoyment level, it also contributes to attractiveness of the product. So besides a high effectiveness of the education level, the product is also more inviting than plain texts.

According to the book, good interactive design does not only focus on the functioning of the system; the system does more than what the user want the system to do. To create an attractive product it also has to experience the system positively. To create this attractive design, features to take into account doing so are discussed in the continuing paragraph.

3.3 Features of interactive system design

3.3.1 Human centred Design

To create a successful system, the product is believed to be human centred. Human centred is all about putting people first.

Depending on the type of product, the user could wrongly understand the functioning of the product. This could result in safety risks. Designing a human centred product, the understanding about the user and his actions increase. Safety risks are therefore not as probable.

Effectiveness reason is the term that addresses the acceptability and productivity of the user with the product. For the product to be used, the product should fits in people's way of 'working'. Being human centred, products are designed based on this 'working' environment instead taking the technique as a starting point.

In case of the use of the installation should fit the schedule the visitor have when coming to the governmental building; how much time does the person have to interact with the installation and will he be interrupted while doing so.

Designing interactive products has to do with people using a technology to undertake activities in particular contexts. To design human centred products the high variety of people, contexts and activity have to be taken into account. Integrating these objects in the design many can be prevented. Moreover integrating this in the design process, not only problems can be solved, possibilities for new designs can be discovered. The analysis in which People, Activity and Context is evaluated is called the PACT analysis. The 'T' stands for technique. This part is discussed in the Practical Analysis.

People differ in all kind of aspects. Being human centred, the user has to be analyzed in detail. Doing so, the physical and psychological difference has to be taken into account

Because the product is designed for a different culture than the western, the cultural part of the psychological characteristics should be investigated with more care. According to Hofstede (1994) addressed in the book of Benyon(2005), there are four key dimensions in which cultures vary that could influence the installation:

- Power-distance: how far do people accept that power and influence are distributed unequally in society
- Individualism: How far do people see themselves as distinguishable from a wider society
- Uncertainty avoidance: how far ill-defined and ambiguous situations are tolerated
- Long-term orientation: The extent to which people see the present in the context of the future.

Activities are considered as being all

dealings the user will do to or with the interface of the interactive systems. The book 'Designing interactive systems' (David Benyon, 2005) describes ten important characteristics that need to be considered designing and evaluating the system:

- Temporal aspects: How often do people need the use the product?
- Time pressure: Do feel people feel time pressure? And if so, how are the activities integrated in the 'schedule'?
- Continuity: Are people able to continue the entire action? And are people able to restart if being interrupted.
- Response time: Is there that much time between the action of the user and the reaction of the product so that the user is not frustrated but still able to see the connection.
- Cooperating with others: If people are working together, are people aware of others?
- Safety-critical: Are the possibilities of mistakes not serious effective?

Context can be interpreted as surroundings of the activities or the features that glue the activities together. Analyzing the context, a division can be made in physical and social context. In the first the physical environment is discussed. The social context is considered as the level in which the environment influences the well-being of the person in its use: being supportive, helpful, culturally connected etc.

3.3.2 Human centred for the visitors of Walikota

This PAC(T) analysis described in the previous paragraph is applied in to create a extended picture about the user of the interactive system.

Figure 3.1. Ways of informing in Jayapura

The people and the context are analyzed by observing, interviewing people working at the Walikota building as well as literature analysis. Because the operations that the user will execute with the system are not clarified in this stage of the project, the characteristics of the previous paragraph can't be decided so far. While evaluating the final concepts, these points can be taken into account.

The users can be divided in two groups: the direct and the indirect user. The indirect users are the people that have responsibility over the system. They are the people that manage the installation, the maintenance of the product and all daily arrangements needed to keep the system working. These users are people working at the walikota building and who got responsibility on the maintenance of the entire solar project and there for also the interactive system. The direct users are all users who will be interacting with the interface of the product. They are the people who perceive and manipulate the information in the system. These users are all visitors of the building. These people could be all people living in the Jayapura district, including employees of the government (these people might also want to see what the system can do). In this paragraph the characteristics of these two groups of users are discussed. The cultural aspects are discussed separately because they are assigned to both parties.

Characteristics of Direct Users

Age

According to the employee of the BLH department only people with the age between 20 and 65 years old are visiting the building. Moreover children aren't noticed while working in the building for over four weeks. The document 'Jayapura municipality in figures' (2010) visualizes a figure which indicates that almost 50 percent of the population is between 15 and 39 years old, while only 5 percent is over 55 years old of whom 1.5 percent is 65 plus.

Experience with interactive products

Multiple articles indicate that majority of people from Jayapura use of television, radio and newspaper/magazine. Literature about the use of other comparable interfaces is harder to find. Still the experience of living in Jayapura for one month showed that Internet is known and used by almost all people, though computers are not owned by the majority. Internet cafés are located all over Jayapura. Still the computer is used a lot less than in Holland, though people are aware of its possibilities and its existence.

Cell phones are just as popular in Indonesia as they are in the western world. Especially internet is a lot cheaper and there for used by all target groups. Still in Papua the internet is not working as accurate as in Holland.

Cultural background

The population of Papua is diverse: According to Wikipedia this region knows over 300 different tribes, all with their own cultures and languages. The main language spoken by almost all inhabitants is Bahasa Indonesia. Because Papua has been a Dutch colony for a long time, the main religions executed are Protestants and Christian, over 75 percent. Since the province became part of Indonesia in 1962 many people immigrated to Papua. Almost 40 percent of the inhabitants of the Jayapura district are immigrants nowadays. These people contributed to the increase of Muslim people into Papua. Nowadays over 20 percent of the population supports this religion (BPS-Statistics of Jayapura Municipality, 2010).

Education

As mention in the previous chapter over 90 percent of the population finished primary school and about 50 percent also finished secondary school. In spite of this people were not able to speak proper English, and if they tried, Google-translate was required to clarify the sentences. Older people were more likely to speak more languages according to one of the respondents because they had been to school during the time in which Papua was still

Figure 3.2. Variety of religions

a colony of Holland. The amount of people that can't read and write is 60 percent of the people living in the highlands of Papua (which includes Jayapura) according to the Jakarta Post (2009).

Knowledge electricity, solar energy, environment

People are familiar with electricity. Almost all families own television. All electricity comes from two large diesel plants. Because the network is unstable, blackouts occur almost daily. Some stores, hotels or restaurants are in possession of their own diesel generator. These generators are for sell everywhere in the city. Therefore it is very likely to expect that people are acquainted with electricity as well as diesel generators.

As mentioned in the previous chapter people are educated about the environmental problems. The level of this education is unknown. People interviewed had trouble answering questions about the problems of the environment.

Moreover the employees of the government expected the inhabitants of Jayapura not being aware of the possibilities of solar energy and other types of energy generations.

Posture

The most obvious difference between the posture of People form Papua/Indonesia and Europe is that in people from Papua a lot smaller. The average man in Indonesia is 1.58m and the average woman is 1.47m. (diabled_world, 2010)

Characteristics of Indirect Users

The information about the indirect user is received by an interview done with the employee of the BLH department of the government, who is part of the management of the solar project. He mentioned that the group of people responsible for the installation as well as the solar project is working at the Public Work Department, the General Secretariat of Jayapura as well as the

Environmental Agency. Their task up till now is to clean the solar system, make sure this systems system works and he or she delivers information from the integrated devices to the universities.

The people are aged between 25 and 56 years old. They are graduated in a discipline of electrical engineering and environmental engineering. Their main language is Bahasa Indonesia and they have a general understanding about solar energy.

Cultural Characteristic

- Long-term vision: Because the poverty rate of the people is really low, a large amount of the people doesn't have the possibility to think about the future. As one participant mentioned during an interview:' although more educated people try to save money, many people don't have that opportunity and would rather spend the little money they have left on alcohol.
- Uncertainty Avoidance: Working with one of the departments of the government clarifies the difference in the way tasks are being operated by people. Because people always have to ask for permission to do so as well as been living in a socialistic environment it is more expected that people are less initiating and in more need of rules. This was noticeable when working with the people: People had to be reminded very often before the thing was executed; they didn't remember this by themselves.

Moreover people in Indonesia being very polite. As Lonely Planet (2010) states: 'people rather seek consciousness than confrontation or disagreement'. One respondent described manners between people as always keeping their patience and being respectful.

- Individuality: In contrast with the western world, family is really important to the people in Indonesia as well as in Papua. One respondent mentioned a typical habit for people in Papua: 'People don't only work for the wife and children, but they work for the entire family.

Moreover, as mentioned in the previous paragraph, people won't give their opinion and will always put the importance of agreement first. They do not try to be different in their opinion.

Context

As mentioned in the project description, the product will be place in the one of the governmental buildings. The context of the product therefore doesn't varies. In this part of the analysis the physical context of the product is described as well as the social influence this effect has on the user. More technical aspects of the context are discussed in the chapter about Practical Analysis.

- Surroundings: The governmental building in which the product is placed is one of two governmental buildings located on the higher situated location of the city. Standing one of the 'balconies' of the building, almost the entire city can be seen. The entrance of the governmental terrain as at the bottom of the hill, separated from the rest of the land with a large but open pass hole. Because of this separation as well as the steep roads it is not attractive for people to visit if not in need of any governmental businesses. Besides these two buildings, one of the provincial governmental buildings is located on the terrain, as well as a bus stop, parking spaces, childcare, few food stands, a random places house and large field (used for governmental ceremonies).
- Tasks: People need to go to the office to take care of licenses for business, marriage, birth certificates etc. Their tasks are related to the departments located in this building: Public Work Department, Social Services, Environmental Agencies, Department of Tourism, Fishery and Marine, Public Health Service, Departure of Agriculture and the Department of Labour.

Therefore people are not visiting the building

to be informed about solar energy. To reach people the product has to ask for their attention once it catchers their eyes.

- External Entities: Besides visitors, over 6000 person are working in the Governmental buildings. All these people could be interested in checking out the project after mouth to mouth campaign, but moreover the people located most closely to the system can be interrupted in their jobs while working because of the sounds and commotion the system could bring along. These employees also include cleaning teams which clean the entire office every morning before opening hours and cafeteria personal.

Because the building is pretty remote, visitors as well as employees are transported by cars, busses, or ojeks (little motorcycles who drive people around as taxies). These drivers are located around the building in case people want to return.

Sometimes people have to wait or are in no hurry to leave. This results in people standing, chatting and eating beadle nut in the entrance hall. The latter is the reason for the red stains around the building; people chew these fruits and spit them wherever.

- Time Spending: Besides fulfilling their tasks at the office people are passing by the hallway, waiting and chatting with people passing by, eating beadle nut, using the bathroom or going to the canteen to eat or drink something. Because their applications usually take a lot of time, people are waiting a lot and have to return in a lot of cases. This means two things. First of all there is a high chance, when at least 100 up till 400 people are visiting the office; there multiple

Figure 3.3. Context of the Walikota

people are waiting in the hall. The office is opened from 8 a clock in the morning until 3 a clock in the afternoon, with one break hour. (max. 66 people pass the hallway every hour).The product should therefore be attractive for a large amount of users. In case the interaction takes about 10 min, 10 people are interacting with the product.

The second thing that has to be taken into account is that people might have to turn back. If so it should still be interesting interact with the product. In case people haven't perceived all information they should be able to pick up where they'd left.

- Climate: Because Jayapura is located in a low part of Papua close to the equator the climate is equatorial: humid and warm. The sun is very bright and it is not uncommon for heavy rain showers to occur. The building is located higher than the rest of the city which makes it a little windier. Because the building is entirely open, including the entrance hall this climate will have effect on the maintenance of the product as well as the interaction a person can have. Hot weather makes people less active, although people are used to it.

3.3.3 Key features for good design

Good design does not only do what the user wants the system to do, it also it also focuses on the whole experience of using it. Besides being human centred by balancing the characteristics of the user and its context with the expected activities, other concerns can bring the design to a higher level; the user does experience the use of the product instead of only being able to work with it. The features influencing the design of the installation are divided in accessibility and engaging. While the PAC(T) method collects the right information of the user, these concerns show how to integrate this information in the design.

Accessibility

Design has to be available for a wide range of users. Especially in this project because the people using the project will be all people living in the Jayapura district. Accessibility is the focus that a design has on the ability of the user. The principles for universal design should be addressed while designing the system compiled by advocated of universal design:

- Equitable use: It does not disadvantage/ stigmatize any groups of users
- Flexible in use: It is designed for a high variety of preferences/abilities
- Simple intuitive use: It is easy to understand regardless of the user
- Perceptual information: It communicates information effectively regardless of the user
- Tolerance for error: It minimizes hazards and anticipates on unintended actions
- Low physical effort: It can be used comfortably and efficiently
- Size and space for approach and use: appropriate space is provided for reach, manipulation and use regardless of the user's body.

Engaging

Engaging is concerned with all qualities of an experience that pulls people in: the sense of immersion, challenge and fascination. It makes a system memorable, satisfying, enjoyable and rewarding. According to Shedkoff (experience design, 2001) the key elements of engaging are:

- Identity: A sense of authenticity is needed for identity and expression of the self. Identifying with something is contributing the engagement of the system
- Adaptively: Things can be experienced ad different levels of skill and enjoyment. This has everything to do with the ability to change and personalization.

- Immersion: The design should give the user the feeling of being wholly involved within its information or interaction. It created the feeling of being taken over and transported to somewhere else.
- Flow: The sense of smooth movement, with gradual changes of states addresses to a higher engagement within the product.

Design Principles

To guide the design process and evaluate the design process and designed product, David Benjamin (2005) describes a list of most important principles:

- Visibility: show what functions are available and show what the system is doing
- Consistency: Show what functions are available and what the system is currently doing
- Familiarity: be consistent with design features as well as standard ways of working
- Affordance: Design so that is clear how to be used and what for
- Navigation: Use maps, directional signs and information signs
- Control: Make clear who is in control and allow people to be in control
- Feedback: Make clear what effect the action of the user have on the system
- Recovery: Enable people to recover from action
- Constraints: Make sure people aren't able to do inappropriate things
- Flexibility: Assign multiple ways of acting to accommodate the users with different levels of experience
- Style: Create a stylish and attractive interface
- Conviviality: Be polite, friendly, pleasant and supportive.

3.4 Conclusion

Designing interactive systems brings along a lot of analyzing, recommendations and requirements. The PAC(T) method contributed to a complete list of characteristics about the user and the context in which is used. This analysis in combination with recommendation put together by different expert is concluded in the following list of requirements:

- The product should be understandable for the visitors
  - The product is attractive and understandable for people with a primary education.
  - The product should be attractive enough for people with a secondary or universal education
  - The product should be understandable with basic knowledge about solar energy
  - The product is attractive and understandable for illiterate people
  - Only use text to support the image
  - The language used in the product is Bahasa Indonesia
- The product should have a universal design
- The product should be culturally and socially accessible for the user:
  - The product should invite the user to participate
  - The user should be able to pick up where he left in case he has to leave abruptly
  - The design of the product should take into account the cultural differences (paragraph 4.3.2)
  - The product should be engaging according to the key elements of Sherdoff (2001)
  - The design should meet the principles discussed in paragraph 4.3.3
  - The product should be easy to learn
- The product should be physically accessible for the user:
  - The product is attractive to use for people with an average length between 1.47m and 1.58m

- The product can be used in a crowded environment
- The product should be attractive for at least 10 people at the same time

4.

CONTENT

» J.R. Loermans

4.1 Introduction

Until now, it is clear what things need to be taken into account, talking about the interaction. The information, important to communicate with the user, is described in this chapter of the project. The informational chapter concluded with the goal of the 'message' having to create 'awareness about what solar energy is and why it is important to people from Jayapura'; people who can't afford buying panels, do want to have them and appreciate other people, companies or even the government for using them. It should contribute to stimulating a trend in which people sustainable product as an investment in their country as well as in them. To create this awareness, the following information should be told:

- Basic technology of solar energy
- The problems of Papua and the people in Papua
- The benefits of solar energy for the individual as well as for Papua
- Realistic ideas of solar energy
- Importance of using it together
- The benefits of solar energy for the individual as well as for Papua
- Promotion of the project and Walikota building.
- (Information about this is discussed in project description)

4.2 Information/Content of the installation

4.2.1 Technology Solar energy

According to Wikipedia solar energy is the energy that is sent to earth from the sun in the form of heat and lightning. Earth receives 174 *10^15

joule per second of solar radiation on the upper atmosphere. Almost 50 per cent of the energy is reflected by the atmosphere, clouds or earth surface, absorbed by the atmosphere or radiated back into space. 89 PW is absorbed by land and oceans. This total amount of energy on yearly basis is about twice as much of energy as all of earth non-renewable sources combined. A part of this energy can be converted into electricity by using for example photovoltaic or CSP's (concentrated solar power). The latter is a passive type, in which all sunlight is converted into usable heat, causing air movement for ventilation or future use with little use of external energies. An example can be orienting a building to the sun and selecting materials with favourable thermal characteristics. Active solar on the other hand converts solar energy into a more use full way of energy. To generate electrical energy this type of conversion includes the use of photovoltaic panels and solar thermal collectors. The panels on the roof of the Walikota are based on an active solar system. The panels are integrated with photovoltaic cells which immediately convert the energy from the sun intro electricity.

4.2.2 Understanding the problems of Papua

Asian countries have been struggling in a difficult 'battle' between economic growth and environmental quality for a long period. Environmental ministries often lack of real control, inefficient production and use of energy and resources, combined with rapid urbanization and motorization, have led to unprecedented environmental consequences. This situation would worsen because Asia will likely keep rapid economic growth in order to alleviate the poverty of the two-third of the world's poor population. Meanwhile Asian countries have to face various environmental impacts of climate change and natural disasters, which make regional environmental problems even worse and more complicated. In south Asia and China, where the highest concentrations of rural poor relying on agriculture production, it will exacerbate stresses on agricultural production: adversely affect wheat productivity; will reduce rise yields increase demand for water. More over Asia exists of large plateaus and high mountains, the largest parts of dry and semi-dry areas and the longest complex shorelines. Those areas are especially vulnerable to fluctuation of air temperature and precipitation and rise of sea levels. Besides, high percentage of rural poor and urban dwellers in Asia are vulnerable to climate change and weak in adaption and mitigation. Poor communities can be especially vulnerable, in particular those concentrated in high risk areas. They tend to have limited adaptive capacity and are more dependent on climate-sensitive sources such as local water and food. Tough the upcoming economy is enormous in Asia; the biggest influence on the environment is still the way people live in the western world. But because of the current economic growth, the level of pollution in these eastern countries is increasing. Instead of reversing the way production as we do in the western world, these countries should have the possibility to start growing hand in hand with new sustainable technologies. Moreover because of the outrun of fossil fuel, oil will become more expensive every day. Solinvest expects the point in which developing countries are not able to pay for their own energy supplies if they won't integrate sustainable energy sources in energy supply.

4.2.3 General benefits of solar energy

Using solar energy is beneficial for multiple reasons. In this chapter the benefits of solar energy are divided in direct and indirect consequences. The direct consequences are the benefits of solar energy that the user will notice straight after using it. The indirect consequences are the benefits that will become noticeable after a large amount of people start using solar energy for a longer period. As mentioned in the previous chapters this division is made because people of Papua are not able to consider the future while making economical choices. For this reason the direct benefits of using solar energy will be more convincing to buy and use panels for themselves while the indirect pros will stimulate the change in the mindset of people.

Direct consequences

The benefits that are noticeable right after using solar energy are particularly related to the clean way of use. Although they have very high upfront cost, using them will be economical beneficial. The direct benefits are listed below (Renewable Energy Development, 2012):

- Little maintenance needed
- No decrease of air quality
- No noise
- No bad smell
- Eventually cheaper in use

Indirect Consequences

The indirect consequences of the use of diesel are mostly results from the greenhouse effect. The way of living most people in the western world do influences the environment. The most familiar influence is the impact of carbon dioxide on the climate of the earth Too much carbon dioxide in the air increases the world's temperature. This change in temperature does not only influences the way of living in the way of diseases and changes in the agricultural sectors, but also makes the poles melt, which leads to a rise of the sea level. Besides the results of the greenhouse effect, scarcity of oil and toxic gases that are part of the emission from oil consuming generators are also consequences that can be solved by solar energy. The problems cited here are the long-term consequences of the use of diesel generators. In case the society will start using solar energy instead of these diesel generators, these problems could be prevented (Renewable Energy Development, 2012).

- Scarcity of oil and depending on other countries
- Relocation of people living in low areas to higher located places
- Bad water quality and insufficient drinking water
- Diseases are results from bad air and water quality.
- Change in agriculture and insufficient food
- Bad air quality; smog and toxics

4.2.4 Limitations of Solar energy

Although using solar energy is very beneficial, it also has some limitations. Because people in Papua know almost nothing about solar energy, they could get unrealistic expectations when people try to 'sell' it to them. This brings disappointments and a bad reputation. To prevent this to happen the limitations about solar energy should be communicated to the user as well. Limitations from solar energy are listed here (wiki_answers, 2012):

- Large surface needed to generate enough energy
- At night no energy is generated nor emitted
- Still depending on diesel
- High upfront costs
- Less robust than diesel generator
- Converter need to be replaced every certain amount of years

4.2.5 Using solar energy together

To create a more interesting and attractive product, cooperation and interaction between people is also valuable. But besides this reason, cooperation between people within the use of the product is also representing the need for all people to be responsible for solar energy to become successful and more attractive to purchase. The reasons for this to be beneficial are as follows:

- Lower upfront cost when purchased by more people
- Improving the environment only when many people are involved
- Less high peaks in the electricity networks and less blackouts?

- When more people buy the panels the production and transportation will be cheaper.
- Appreciating others who are using solar energy stimulates them to also invest in your environment.

5.
PRACTICAL ANALYSIS

» T.F. van der Heide

5.1 Introduction

The practical analysis consists of information needed to actual implement the installation in the Walikota. This will be elaborated using various subjects. First the location will be analyzed: what facilities are available at the location and where will the product going to be located? Also the PV system at the roof of the building will be shortly described to know how this is implemented and which data is available. Because the installation will be built on location, it would be necessary to know which materials and tools are available in Jayapura. This will be elaborated in the last section.

5.2 Location analysis

5.2.1 Introduction

The installation will be placed in the main entrance hall of the Walikota building. Because visitors can't reach the system at the roof, this will be the place to show the implementation of solar energy to people. Below, there's a short analysis about the building, to get a better understanding which facilities are available in the hall and in which environment the product will be placed. This will lead to a suggestion for the best spot in the hall to position the installation.

5.2.2 The main hall

When visitors enter the Walikota building, they first arrive in the main hall. The hall is very bare and little furnished, there are only a couple of posters on the wall. From here there are stairs to each floor with each the possibility to access to the left or right side of the building. At the ground floor there's the reception and some hallways leading to spatial planning. A big staircase in the middle leads to the second floor. Remarkable on this floor is the way to the counter for the personal identification cards, here a lot of visitors are coming and going. On the third floor the remaining departments can be found. There is

Figure 5.1. Entrance hall of the Walikota

also the entrance to the 'machine room' of the PV system, which is not accessible to visitors. The empty and low-lit hall has no classy appearance except to a few style elements. In the middle, the floor is tiled in the form of a wind rose, and above it there is a small chandelier hanging under a simple coffered ceiling. In addition to these elements, there is little added to the style of the hall, only a few plants and two large posters informing about the need for having an identification card. There seems not to be one particular style which will have to be adhered by the installation.

5.2.3 Available facilities

During the first walk in the Walikota it became clear a particular space for the installation has not yet been assigned. Therefore it is difficult to analyze what exactly will be available at this spot. Still the ground floor has wall outlets at various spots, which should be reachable by using an extension cord if necessary. There is no Wi-Fi available in the building. To get a connection to the network and the internet it would be necessary to set up a new wireless one, or make a wired connection possible. Connections to the network are easily reachable and available at the ceiling of some side-halls though.
The Walikota is frequently suffering from power blackouts. This will not be backed up by the solar system since there is no use of backup batteries. An uninterruptible power supply (UPS) would be necessary, if the installation could not withstand these sudden shutdowns
It would be best to position the installation at the ground floor of the main hall since this would reach the most visitors. There are two spots at this floor that would be the best. In the middle-low picture of the collage (Figure 5.1) these spots are towards the visible walls left and right of the column. These are two open spaces and would not hinder people in their way through the building. The position near a wall makes it easy to reach wall outlets and to put cables out of sight.

5.3 The PV system

Although the main focus of the installation will be at solar energy in general, considering the wishes of the Walikota (1.6), something has to be told about the solar system at the roof too. For this there will be a short analysis of the system and its available data below.

5.3.1 System

The solar panels are installed at around 2 meters high supports on the roof of the Walikota. They are slightly tilted to the north for optimal profit. There are two varieties of panels being used, one type at the west and partially at the east wing, and the other type only at the east wing. The panels differ in technique and production process. The second type has lower costs but the profit is also lower. Another difference is the connection of the panels to their inverters; the devices switching the direct current tot usable alternating current. The major part of the panels used a common inverter. Another part uses micro-inverters instead. In this case every panel has its own inverter which can have a positive impact at the total profit.

5.3.2 Data

There has been an interview with Hans Veldhuis to learn more about the captured information from the system (Appendix). For his research there will be captured various data including temperature and the profit of the panels. Except the profit, everything is recorded by a data logger, a special device for this goal. It would relatively difficult to readout the device and not disturb the research. The profit will be recorded by another device though. This device features an internet connection to make the data accessible by network. For the installation this would be far easier to read the data. This data can't be displayed together with the current use of power of the building though, this data is not easily available. A lot of information about the underlying techniques would probably be too specific for people. Detailed information will result in too much information, resulting in missing the key features of solar energy. To explain solar energy with reference to the installed PV system at the roof of the Walikota would support a better understanding. The possibility exists to support the explanation of a PV system by displaying the current profit of the system on the roof.

5.4 Available materials in Jayapura

Jayapura is a city with a lot of small stores. Among the generally identical kiosks there are some specialized shops. These are rarely as big as in the West; this results in having almost the same basic inventory every time. It has to be possible and easy for people to build the installation in Jayapura with a provided construction plan. The required parts and tools should match the availability in Jayapura. Below an analysis of four kinds of materials and tools, which can be bought in Jayapura to build the actual product, is discussed.

5.4.1 Tools & Parts

The various hardware stores sell all kinds of tools. Simple tools like screwdrivers and a saw are the best available and very cheap. Power tools are around the same prices as in the Netherlands. Additionally, parts like nails, screws and other parts are commonly available. Also materials for finishing the product, like sanding paper and paint, are available in this kind of shops.

5.4.2 Wood

Sometimes the previously described stores sell building materials like wood as well. Usually this is only very thin plywood, ideal for closing a frame, but not for making a construction. Sheets of plywood from around 244x122 cm with a thickness of 9 and 12 mm will cost respectively €11 and €15. For construction wood it is better to go to a sawmill. At these 'wood factories', wood is very cheap and available in a variety of sizes. As an indication, a 4 meter tall beam of 5x10 cm will cost around € 3.30. A list with prices and all the available sizes can be found in the Appendix. For the possibility to build the product in Jayapura it would be best to match these sizes in the construction plan.

5.4.3 Electronics

Although every hardware store sells a soldering iron for electronics, none of them

sell electronic components like resistors. One specific store sells resistors and switches, but unfortunately no active components like sensors. This makes it necessary to supply almost all the electronics to Jayapura.

5.4.4 Computer Peripherals

There are only small stores of this kind, much like the hardware stores. They do not have a very wide product range, but sell some specific things in comparison to each other. It is better to trust in the availability of this kind of stores in more common products, like cables.
The availability of products in Jayapura mainly includes wood and other building materials.
For this part of the installation, a construction manual could be made, including a list of parts, so people can build some parts of the installation on location. For the electronic part it would be better to build something in the Netherlands and send it to Jayapura. This will prevent necessary products from being unavailable and it would make the instruction of building the product a lot easier.

5.5 Conclusion

The location of the display will be a very open environment and no major technical problems have been foreseen so far. Only the lack of a stable power supply and a wireless network could cause some problems. In- time- notification could prevent them this from happening. The PV system on the roof provides some relatively easy accessible information about the profit of the panels. This would be a possibility to implement in the product. Finally, the analysis of available parts in Jayapura made clear that for the required parts only can be relied on very common products; rare items like specific electronics should be provided from the Netherlands.

- The parts to be bought should be available in the stores of Jayapura
- The installation will fit the entrance hall by size and style
- The installation will not rely on a stable power or internet connection

6.
IDEA GENERATION

6.1 Introduction

The idea generation phase combines the different analyses and shapes this information into concrete ideas. To connect the analyses with this generation phase, some early thoughts from these analyses are visualized in inspirational images. Collages, mind maps and drawings are examples of these translations. Because both parties came from different backgrounds, these translating are executed individually. The interactive and informational inspirations are mainly influenced by the cultural designer while the technical inspirations are more executed by the technical designer. These images are shown in the Appendix.
All these inspirations have been input for the conceptual ideas. Brainstorm sessions as well as drawings have contributed to more tangible ideas. These ideas are not generated individually; ideas are shared during brainstorms, thought out and visualized in drawings on paper. These drawings are divided in four groups: electricity related, solar related, Papua related and others. The reason for this division is create a better overview of the different images. All these ideas are ranked in a graph with three axes: feasibility, ways of informing and attractiveness. This ranking is used to generate three main ideas. These main ideas are a combination of the majority of the best ideas from the graph, so these could be used during the next phase. By evaluating these ideas together with tutors who are familiar with interactive systems or with the Papuan culture, some changes have been made which eventually lead to ideas for the concepts, as well as additional requirements.

6.2 Conceptual Ideas

The images shown in this section visualize the more tangible ideas; the precursor of the final concepts. The images are divided in different kind of ideas related to, electricity, solar, Papua and one for anything else. This relation can be interpreted by the way in which the interaction of the idea tells something about that subject. This division is provided to give a clear overview

of the ideas. The ideas are generated during different stages in the beginning of the project.

6.2.1 Electricity related

The ideas shown in this section all have an interaction that communicates the use and functioning of electricity. In some ideas, information blocks are connected through an electricity grid or literal wires. Some drawings show the interaction being related to electricity by using plugs and power points or comparable inputs. This way the information about solar energy will be associated with electricity by the user at its first sight.
The last idea combines the electricity with charging cell phones. This not only clarifies the relationship between the sun and electricity, it also stimulates people to interact because they are rewarded doing so; their phone will be charged. Using rewards within the interaction stimulated the user to become more involved in the subject.

6.2.2 Solar Related

The interaction of the ideas below is all based on the functioning of solar energy. Visualizing solar panels in combination with beams of light symbolizes the generation of energy by sunlight. Reflecting these beams or catching the beam are interactions with this light.
The installation shows the necessities of producing sunlight in its first interaction.

6.2.3 Papua Related

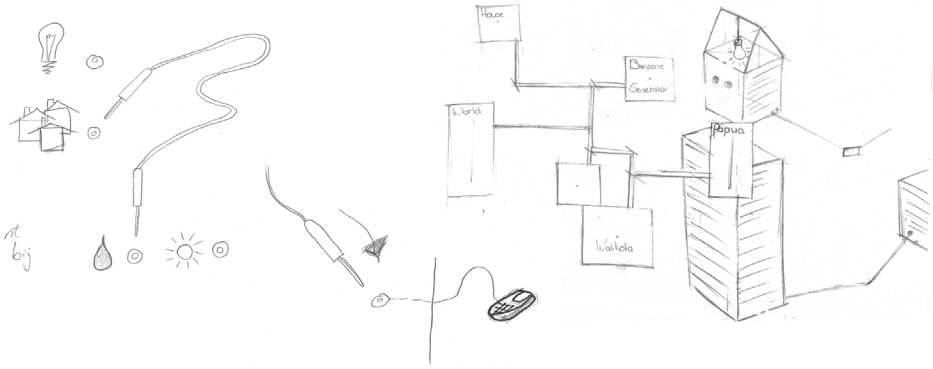
These ideas visualize the connection with Papua within its interaction. On the map of Papua or Indonesia the influence of solar energy is visualized in as well 3D as 2D. The connection with the subject solar energy is less visualized in these ideas. The relation between the first interaction with the product and something familiar like their province or country can result in higher involvement and understanding of the user.

6.2.4 Other

These last set of ideas are not related to one of the subjects on which the installation is based. Still, the ideas have some interesting interactions. The first set of ideas interacts with their user by revealing new, interesting information while interacting. The covering of information will create curiosity with the user which results in attraction of entering the product. This way of stimulating people to start using the product trough curiosity is intergraded in the ideas in different ways; by peepholes, by lights that reveal the information, by a digital 2D world that will only show information if the person virtually enters a room or by a turning wheel that will reveal or cover the information.

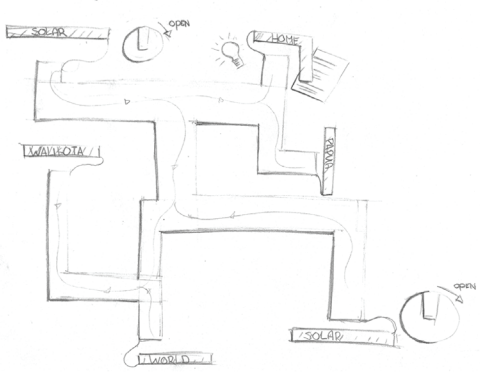
6.3 Ranking Ideas

All the ideas generated in the previous sections are grouped and ranked in two diagrams below. In both diagrams the vertical axis represents the attractiveness and the horizontal axis the feasibility. The ideas in the top right corner are most feasible and most attractive. This attractiveness factor is chosen because although Papua might not be as familiar with new technical equipment as we are, they do have to be stimulated to take-in the information told. Because standard ways of informing in Papua are generally similar to the way in the Netherlands, innovation and originality are characteristics that motivate people to learn. This innovation and originality is summarized in the word attractiveness, and so this will be the meaning of that word in this case.
The value feasibility is for the requirement of the installation to be built in Papua in a short time with little facilities. Ideas can be very innovative, though hard to produce. For that reason the ideas are ranked on feasibility too.
The first diagram has a third division, in which three colors dived three types of ideas. The green words are for telling the information, the orange words are for the general shape and the blue words represent interactions. This way, ideas from different color division can be chosen to combine to one final concept.
In the second diagram the third dimension



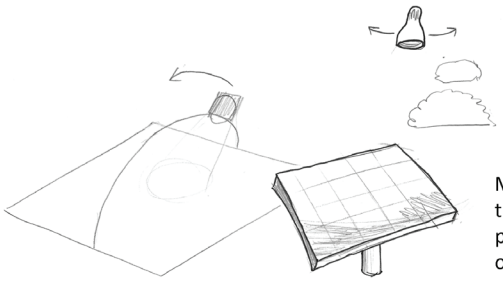
Boxes, representing houses with information about one subject. The houses are connected to each other. The connection can be changes by the user. This way different houses will show information every time.

With contacts and wires images of houses are connected to images of sun or oil. When people connect the images correctly the images will light up

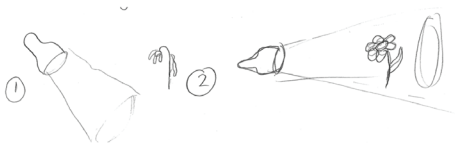


Walls ware connected by a flow of energy, which is projected on the floor. When the wall about solar energy is opened, the flow will start running which will result in new information becomming visible

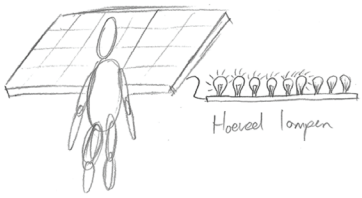
Figure 6.1. Elektricity related



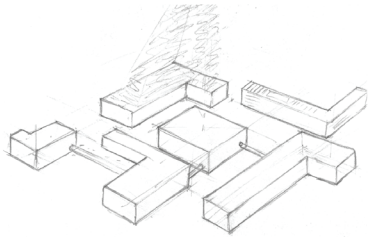
Moving a light over the surface of solar panels. The amount of light caught is regestred. Clouds are obstacles in this 'game'



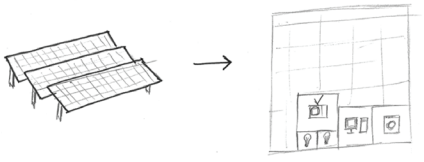
Brightnes of light is represented by the health of a flower



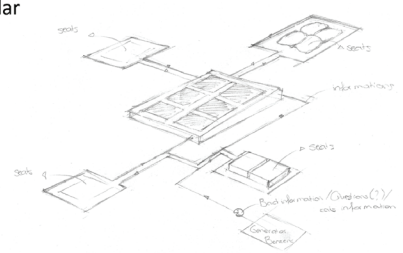
Showing what can be done with a solar panel (real size)



Movable blocks on which information can be projected. One block introduces a line of light. The light will be reflected by the sides of the blocks. The blocks that are enlighted will give information

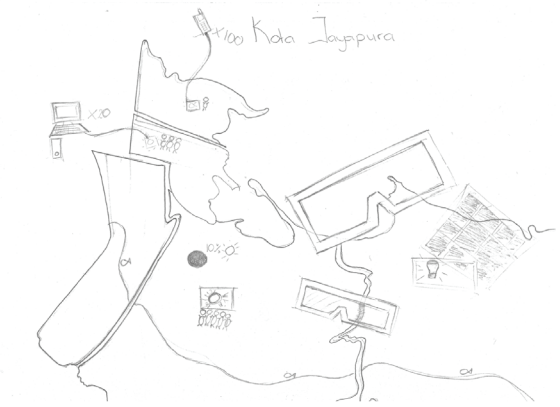


Indicating how many panels are needed to generate different kinds of equipments

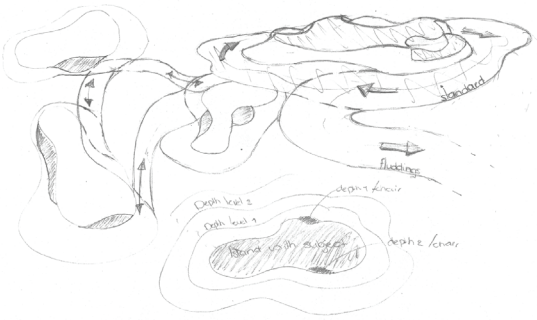


A projector projects lightballs around a model of a solar panel. Once a lightball is touched, information will be shown on the platforms around the panel

Figure 6.2. Solar related

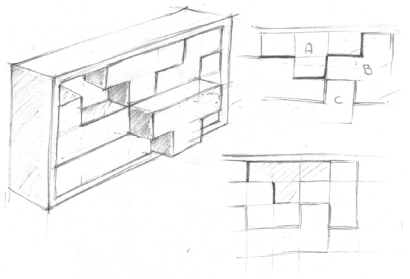


A map of Jayapura will be be shown on a table. Around the map glasses are attached. Each pair of glasses shows different effects solar energy can have on the city

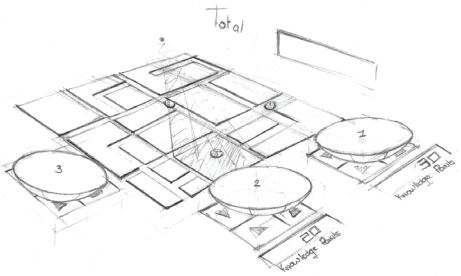


Different seats are lacted in the hall. The seats are shaped like islands. Around the islands flows of water are projected. When enough people are sitting on the seats information flows are slowing down and information becomes visible

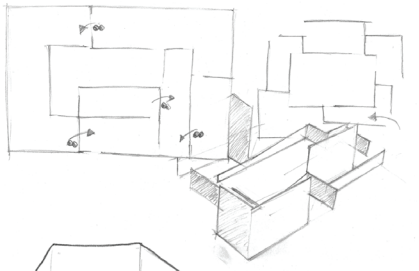
Figure 6.3. Papua related



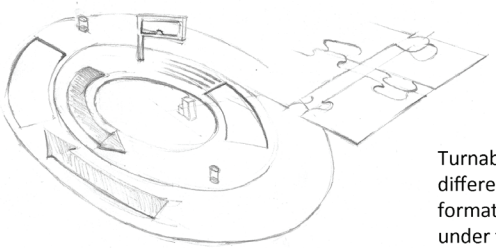
Controlling the information by pushing blocks in wall: Each block tells different information



Real life computergame. The chairs control a unit trough the maze. Each block communicates a different subject



Moving trough a maze. Each 'room' tells different stories. Peepwholes in the wholes creates curiousity for the next room



Turnable table with different kind of information on or under the wheel.

Foldable walls with peepholes to stimulate curiousity. In the middle of the walls a map of the city is shown. Each peephole shows a different version of the map

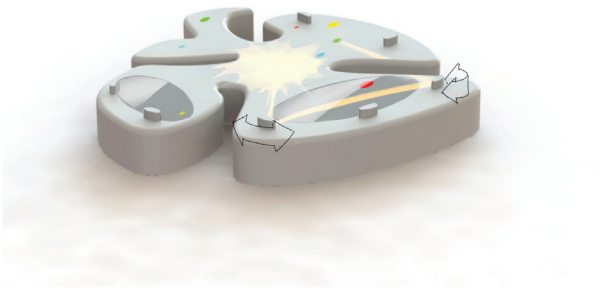
Figure 6.4. Other

is visualized by the shade of red of the words. It tells the amount of freedom the idea has to communicate what has to be told according to the analysis; the brighter the color of the word, the better the information can be integrated in the idea.

6.4 First combinations of ideas

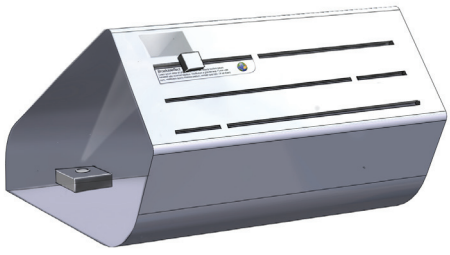
Three combinations of ideas are developed as a subsequent stage in the process of the idea generation. This way the individual ideas are embodied as a basic-concept for the first time.

6.4.1 Idea 1



At the surface of this odd shaped table there are three sets of flat objects which will function as virtual mirrors. In the middle of the table there will be a projection of the sun. The sun will emit a ray of light towards one of the mirrors. By rotating these mirrors, the user can select one of the subjects which are floating over the table surface. When a subject is selected, the information will be displayed on one of the three designated areas on the table. People on the other sides can use a new ray of light to select another topic.

6.4.2 Idea 2



The main feature in this idea is the possibility to support the printed information with multimedia additions like a short movie clip or animation. The clip will be shown above the information by shifting a given object from side to side in a timeline slot. A projector is placed at the inside of the product. By projecting on a see-trough-screen the projector will facilitate the display of the media form the inside.

6.4.3 Idea 3

This situation offers a relatively passive interaction to the information. One can participate in the installation just by sitting down on a seat at the bench. When this requirement is met, a flow of icons will start to hover over the surface next to the seat. By tapping on the desired subject the related information will be presented on the same surface.

6.5 Evaluations

To evaluate this phase the most important ideas are discussed. These three ideas give an insight in the importance of their different characteristics and which of these characteristics can be used in the conceptual phase. To expand the vision on the ideas as well as on the process the tutors of the project gave some new insights in this evaluation. Firstly, all the combinations of ideas make use of the provided projector. This is a characteristic for this part of the idea stage, as a lot of the ideas rely on the use of a projector as main information source. This way of thinking can be used as a creative tool, though assuming the necessity of a projector makes it harder stay within the boundaries of the budget. But moreover it keeps the ideas from being original in a simple way.

Attributing to this is the fact that using a projector brings the opportunity separate the interaction form the story that has to be told. While ranking the ideas by their ability to adapting the information in as many ways as possible, the connection between the subject and the interaction got lost. Instead of the importance of the fact that all information has to be told it became clear that the information should communicate their goal/subject to be attractive and informational. Most users will have little time for the information. To reach the user, the information has to be brought catching and tersely. For this reason it's important to integrate the interaction with the subject. Because these two depend on each other the design of both has to be done simultaneously.

6.6 Conclusion

Although the ideas chosen to combine haven't been good combinations to proceed with, enough ideas have been generated to combine for good conceptual ideas. The choice for the better ideas are based the new insights revealed in this idea generation phase.
The first set of insights is created during the design of conceptual ideas. In this stage of the design multiple interaction requirements became clear. Relating the user to something familiar as well as making the user curious, or even rewarding them, will influence the attractiveness of the product and therefore increases the involvement of the user with the interface and its information. Clarifying the subject what the installation is about might spoil the surprise but as mentioned in the evaluation contributes to quick and terse way of communicating the message. For this reason the ideas mentioned in the 'others' paragraph have to be integrated with an idea based on a relating subject.
The ranking of the ideas in the fourth paragraph have led to some misunderstanding about the usability of ideas. Working with the value of ideas that have a high possibility of integrating the text separately from its interaction has led to conceptual ideas with no connection to the subject. Ideas that generally are less adaptable are more related to the content of the information. In this case dark ideas are more effective. Moreover the attractiveness factor has been overrated; although it is important to design an innovative product, the standards for this are not as high as they are in the Netherlands. For that reason this has to be original and innovative according to the Indonesian standards; known with most electrical equipment though less experiences in its use and less familiar with more 'artificial' interactions. Being innovative for the people in context, as well as creating an involvement of the user in the product will result in an installation that is inviting to use; the installation does not only inform its user but increases the joy of learning. Enjoying education will positively influence the ability to learn

Based on these insights new requirements are formulated:

- The interaction should be clearly connected to the connected of the information.
    - The link between the use of solar energy and benzene is visualized clearly.
    - The interaction communicated solar-energy.
    - The interaction communicates the difference between daylight and night
    - The interaction links the information to the Electricity network.
- The display has to be inviting.
    - The installation has to stimulate the curiosity of the user.
    - The installation stimulates the involvement of its user.
    - The installation uses rewarding to stimulate people to learn/read/ understand the information.
    - The installation is innovative, according to the Papuan standards (information analysis)

With the insight of the importance of this new combination of requirements, the right combination of ideas from this phase can now be used to be inputs for the generation of the concepts in the next stage.

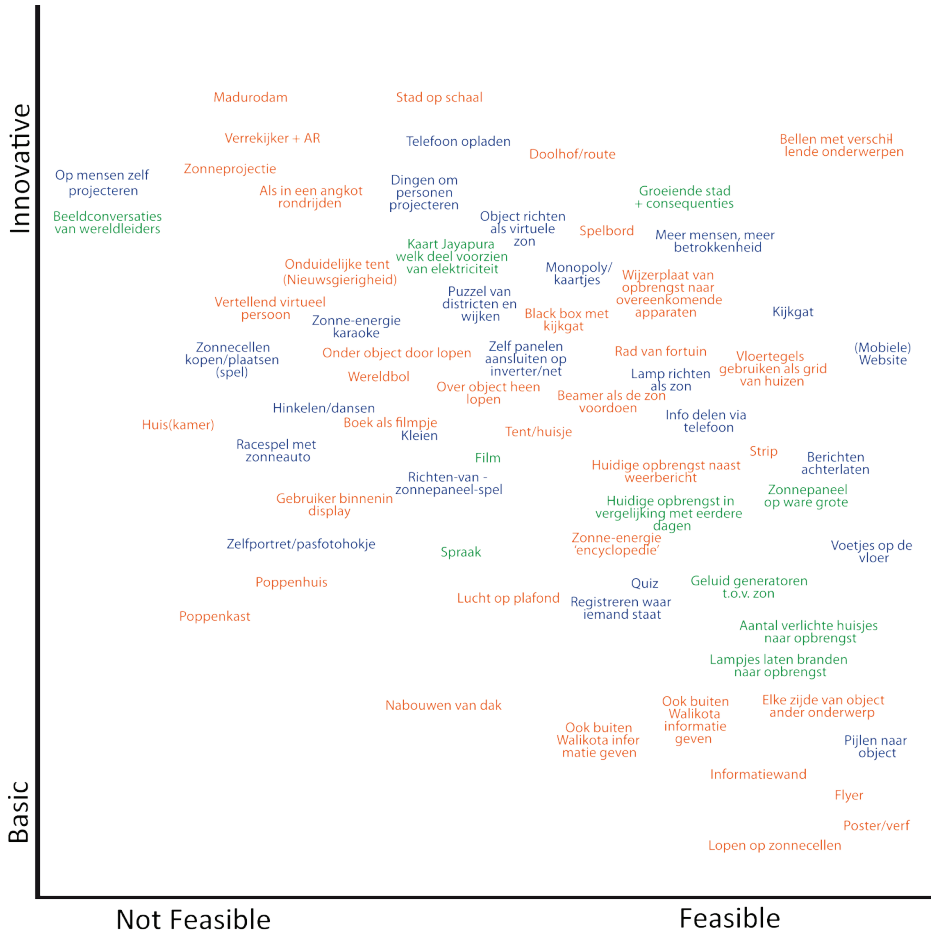


Figure 6.5. First ranking of ideas

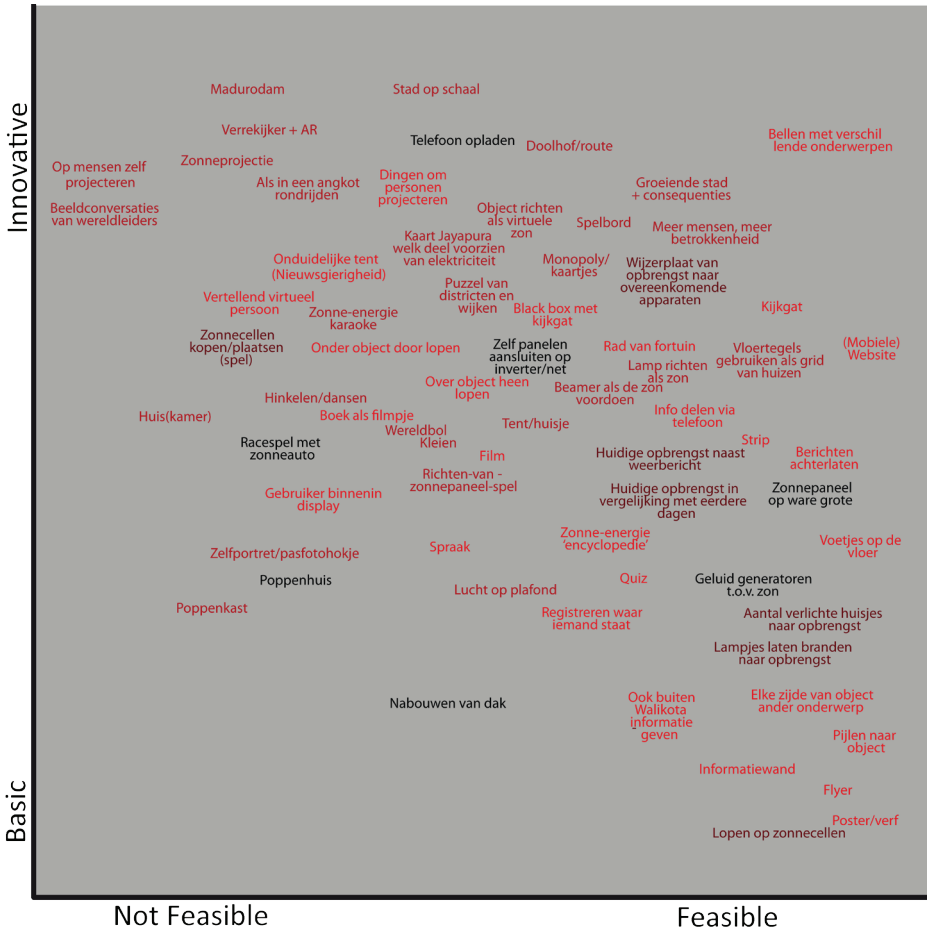


Figure 6.6. Second ranking of ideas

7.
CONCEPTS

7.1 Introduction

Four concepts are composed from the different ideas in the Idea Generation. Below they will be described using a description of their interaction, information and possible implementation. This chapter will end with a conclusion, including a list of the most notable features of the concepts. In the next chapter, these concepts will be reviewed to find their best features. Eventually, these will apply as input for the generation of the final concept.

7.2 Concept 1

7.2.1 Interaction

» J.R. Loermans

The first concept is a direct visualization of the functioning of the PV solar system. Along with the day and night rhythm of the sun, it brings together models of solar panels, a diesel generator and the city to show the consequences of using these two different energy sources.

The light of the sun, shown as a beam of light, moves across the table surface. Moving from one end to the other end of the semicircular table, it represents the movement of the sun. To support this idea, the light has a higher intensity at the middle of the table, this will represent the afternoon.
On the tabletop there are various models of solar panels, which can be moved by the user. By shifting them over the table, the cells can receive different amounts of lights, which is translated into various amounts of produced electricity.
In addition to the solar cells, a model of an engine is also placed on the table. This model represents the production of electricity by diesel generators. Both the energy produced by the cells and the engine will be displayed on a screen in the middle of the installation. Along with a picture of the city, a bar will display the amount of distribution of the two different forms of energy. When the cells fully lighted, most of the energy will be produced by solar energy. The opposite will happen when there is no light on the cells. In this case the engine will take it all over and the

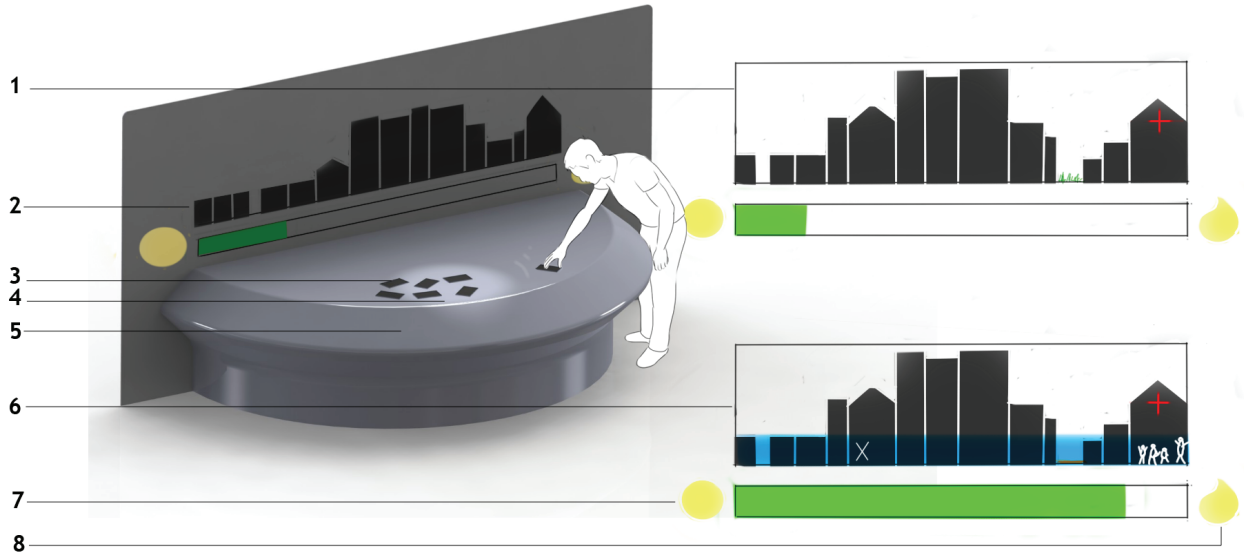


Figure 7.1. This image visualizes the table on which the solar panels have to be kept into the sunlight. (1.Image of city when a lot of sun reaches the panels: 2.The projection of the image on the wall: 3. Small models of solar panels: 4. The light beam showed on the table: 5.sloping part of the table to place extra information: 6.Image of city when little sun reaches the panels: 7. Symbol representing sunlight: 8.Symbol representing oil)

noise of the model of the engine will increase. This installation will reflect the functioning of the system at the Walikota, by visualizing transportation of the energy produced by the solar system to the city. Because there is no energy backup system present, the diesel generators has to produce the remaining required energy.
Besides the energy distribution bar, a 2D representation of the city is visualized on the screen. Based on the characteristic parts of the city it will clarify the graphic representing Jayapura. The city is under the influence of both energy sources. When there is a long time use of a lot of oil energy, the city will be affected by floods, pollution, smog, etc. A greener, healthier city will appear when the use of solar energy increases. One major power source generating energy for a relatively longer time will lead to long-term effect appearing on the screen.

7.2.2 Information

» J.R. Loermans

Although the interaction will show a part of the information, some extra explanation will be necessary for a complete view on the subject. The interaction shows a relation between the use of solar cells and the diesel generator. When there is a lot of light on the cells, the generator has to work less, but it will never stop. This shows that the solar cells depend on the grid created by the generator. There's also a connection between light and electricity, placing the panels in the light will have its effects on the screen, showing the production of electricity by placing a surface in light. The concept contains multiple panels that would be hard to move by one user, for the best effect you will need to be with more than yourself. This relates to the involvement needed for solar energy, you won't make a significant change unless you work together. The day and night rhythm of the light increases the notification of the light being a representation of the sun.
To complement this information there will be further explanation on the side of the table, directed to the users around the table. This information could be additional background information on the long-term effects of diesel generators, like the origin of the floods in the graphic.
The various consequences can be divided into

the following four categories. A more advanced explanation about these consequences is discussed in the chapter about content.

- The direct effects of using solar energy
- The indirect effects of using solar energy
- The direct effects of using diesel generators
- The indirect effects of using diesel generators

7.2.3 Implementation

» T.F. van der Heide

Instead of using a single moving lamp, it would be the best to use multiple lights placed on the semi-circle orbit. Switching these lights on and off after each other, will create the sense of a moving beam across the table. The various light intensities can be approached by different powers of light bulbs or dimmer switches.
In order to register the light at the cells there have to be real cells in the models or other lights sensing electronics, for example photo resistors. This signal has to be transmitted to the main system so the total amount of received light can be calculated. With this data the graphic can be adapted to the new situation. For the display it will have the preference to use a projector. This will result in a big picture, in which a lot of detail can be displayed. Also many people, even non participants, can see what is going on. This will include attraction of other people in the entrance hall.

7.3 Concept 2

7.3.1 Interaction

» J.R. Loermans

This second concept uses the reflection of light to integrate solar energy in the interaction. The whole product is build out of several blocks, on which each of them represents a certain subject. The first (round) block is the sun. It will emit a line of sunlight across the ground. The direction of the ray will change each time after a time interval to be determined later.

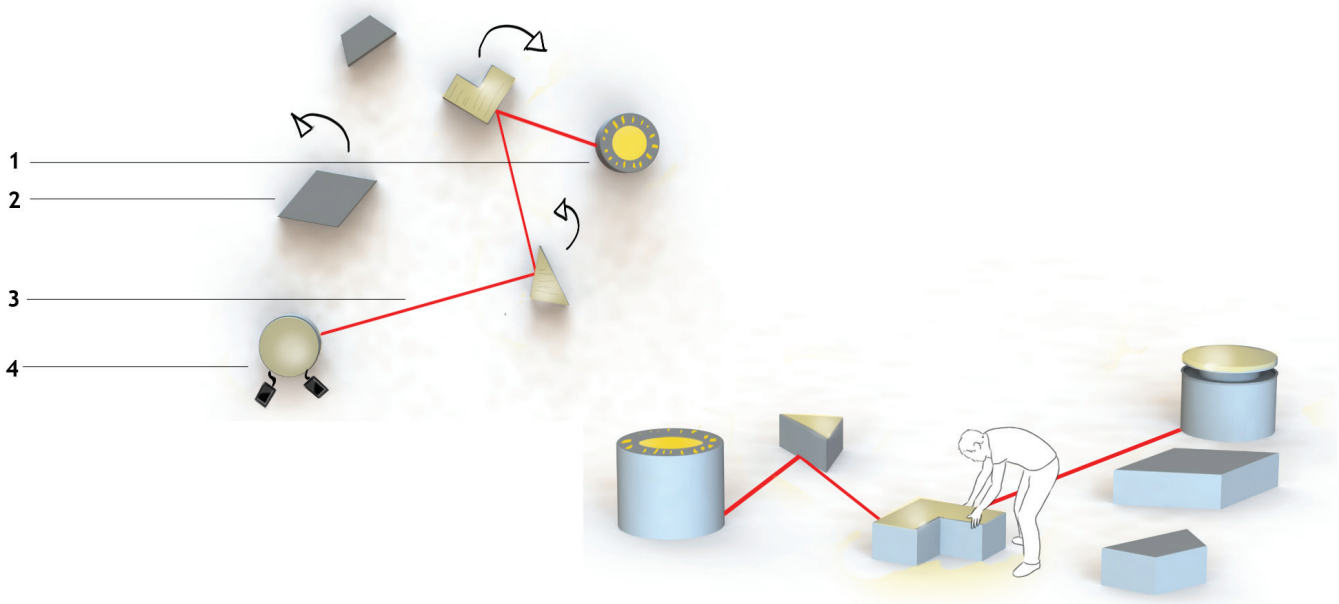


Figure 7.2. This image shows the different blocks of the second concepts. (1 The block representing sunlight: 2.A block which is not activated because it is not connected to the light beam: 3.The light beam projected on the floor: 4The final block, activated because it is in contact with the light beam. Once this final block is connected, the phones can be charged)

The last block represents a solar panel. The goal will be to get the ray of light at this last block. The blocks in the middle, each representing a sub-subject, are required to reflect the light across the floor. These blocks can be freely rotated and moved and have side planes acting like mirrors. When a block is hit by the ray of light, the information on top of the object will light up so the information becomes readable. The final goal will be to reach the last block by using as many blocks as much as possible. To motivate the use of more than one object, different obstacles will be projected on the floor on which the ray has to be directed through or around. The direction of the outgoing ray of light varies every time. Each time this happens other blocks are hit by the light beam and other information becomes visible. Turning the blocks is the interaction that provokes this change in information. When more people are shifting the blocks, this ray of light will stimulate a kind of involvement between the different users: they want to reach the same goal with the similar objects.
The last block which finally has to receive the light represents a solar panel. It will generate electricity to show final product of the technique. This electricity will be transported in two directions. The first cable carries out electricity through various cables available for people to charge their phones with. This will act as an extra reward for taking part in the interaction. Besides providing a better explanation of the process of solar energy, charging a phone will also stimulate people to let the beam reach his goal. The second cable transports the electricity to a block that represents the city of Jayapura. This will show the consequences that solar energy will have on the city of Jayapura

7.3.2 Information

» J.R. Loermans

The interaction supports broadly the understanding of a solar panel: light on the panel will generate a flow of electricity which will influence the city of Jayapura. Besides this influence to the city, the products also explains the connection with electricity by the possibility of charging the user's cell phone. But it will not only tell the technical part of solar energy. The interaction also represents the need for involvement en cooperation in order to accomplish something. The fact that one user is depending on the orientation of a block moved by another user contributes to this. The interaction does not explain anything about what is needed to create a better Jayapura besides the technology of solar energy. This is explained on the top planes of the blocks. The information can be subdivided into the following subjects:
Knowledge - First, everybody needs a basic understanding of what solar energy is to see its advantages. For this reason there will be an explanation on the block with the solar panel:
Awareness - Before people can really see the advantages of solar energy they should be aware of the consequences of the use of diesel generators. To show these effects in relation to Papua, people may be able to better understand them.
Involvement - The information should also increase the involvement of people. A lot of people in Papua don't have the luxury to think about the future. By showing the direct consequences and the use of solar energy, people will get closer connected to the problem.
Relativity - Because people are not familiar with the solar panels, it's also difficult to see what's possible and what not. This could lead to high expectations and disappointment. To prevent this, one block will contain information on the possibilities of a solar panel.
Implementation - To complete the overall picture, people should be able to combine all the subjects to see what the final possibilities will be for solar energy on Papua. This block will show what influence solar energy will have on Jayapura.

7.3.3 Implementation

» T.F. van der Heide

To get the desired effect of the ray of light, a projector will be used on top of the playing field (floor). This device will project its image downwards so it can influence the objects and the floor. A camera next to the projector, will detect the different blocks using their distinctive

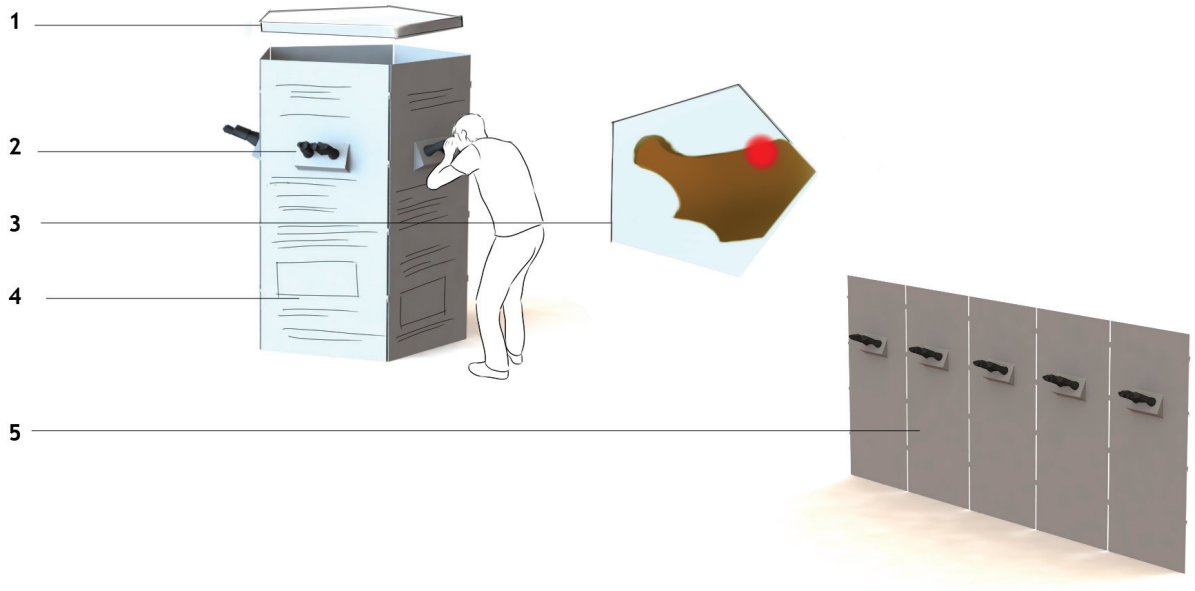


Figure 7.3. This image shows the concept folded out as well as set up. (1.A side view of the map of Jayapura, placed in between the walls: 2. Binoculars: 3.A top view of the map of Jayapura: 4.Information shown on all sides of the walls: 5. Information walls unfolded)

shapes en colors. Using the position and their orientation, the ray of light can be calculated and projected between the blocks. When the software detects a ray on a block, it will calculate the reflection and shine light on top of the concerned object. This will highlight the printed media on top so that the information is 'turned on'. When the ray touches the last block (the one representing the solar cells) the object will light up and will provide power on the telephone chargers in the object. To serve the majority of phones it will only be necessary to provide a micro- and mini-usb connection. These are common standards and they require the same voltage.

7.4 Concept 3

7.4.1 Interaction

» J.R. Loermans

This concept focuses on various visions at the future. It is build out of six walls, connected to each other, all surrounding a horizontal plane, forming a hexagon shape. This plane shows an image of the map of Jayapura. Each 'future vision' is provided through an augmenting pair of peepholes in each wall, pointed towards the map in the middle. The corresponding walls will describe the perspective associated to the vision shown trough the wholes. At each peephole the image will differ, for example from an environmental perspective the hills will be green to show the growth of vegetation, while another will show a polluted city. The binoculars have levers to switch between two views: one for the future with oil and one for the future with energy from the sun. The binocular shape of the peephole will be inviting to take a look.

7.4.2 Information

» J.R. Loermans

This concept doesn't give any information about solar energy. This is why the information about the subject should all come from the given information. The information is subdivided into six subject, all assigned to a specific side. The information will be described by the printed information on the six walls and by the image

shown on the map l giving visions of Jayapura in the future. The information is divided in the following sic subjects. Within each subject the result of using diesel or solar energy is showed:

- Environment - This side shows the impact the use of diesel generators and solar energy has on the environment. It will show the amount of forest left and the bad air quality hanging around the ciity
- Agriculture - This side tells how the agricultural sector will change when more fuel is used. The difference is shown on the map by displaying agriculture in the two situations: dry and brown, compared to the green situation in which solar energy is used.
- Care - This side will tell which diseases will develop with the prolonged use of oil as fuel. This is for instance shown by overcrowded hospitals and the increase of the amount of ambulance. In case solar energy is used, the amount of sick people will decrease
- The city - This side tells how the city has changed and will change through the use of oil. Here references are made to smog, population density, and waste. When talking about the use of solar energy, all these result will disappear.
- Walikota - This part tells what the overall project entails to the Walikota and which advantages it has. At the map the panels are displayed at the Walikota supported by its generated energy.
- Social - This side tells what the social developments the use of solar energy and oil entails. The increase of the population and the development of different jobs are examples of this.

7.4.3 Implementation

» T.F. van der Heide

A print on a transparent sheet is used to provide various views through the binoculars. The print contains the additional information as an overlay for the map in the middle of the object. The sheet is divided into two halves, each containing a different vision associated to the vision, generally

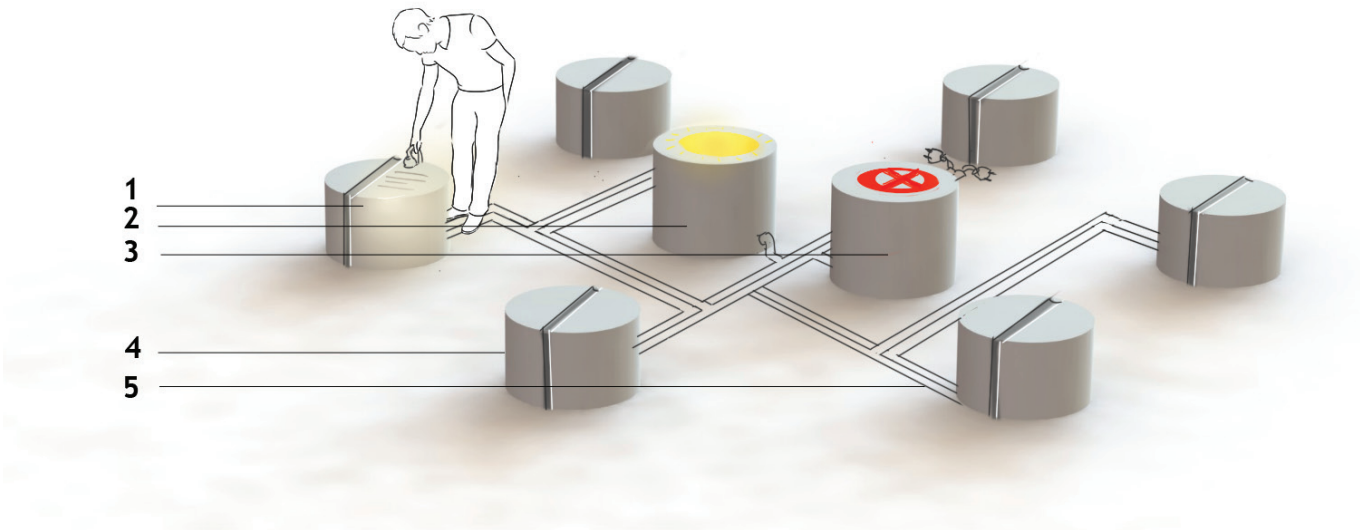


Figure 7.4. This image shows the different blocks connected by the wire. (1.Activated part of the block: 2.The block representing solar energy: 3.The block representing diesel: 4.Unactivated block: 5. Wires connected to the blocks)

one for solar and one for oil energy. This sheet will be placed between two sheets of acrylic glass, to give it more strength. It is possible for the user to slide this combination back and forth to switch between the two visions. A little magnet at each end fixates the position of the view.

7.5 Concept 4

7.5.1 Interaction

» J.R. Loermans

The interaction in this concept represents the flow of energy from good or bad energy sources, respectively the sun and diesel.
The installation is build from various cylindrical shaped objects, each representing a specific subject. They are connected by power cables to both the two energy sources in the middle, one representing solar energy, the other energy from oil. The interaction entails choosing one of the two power supplies for the subject-objects. Every object, except the two energy sources, is divided into two halves at its top surface. When the object is connected to a source, the effects of this source to the subject will be displayed on the corresponding half. This information will be divided using a timescale to make clear there is a difference between the direct effects and the consequences on the long term. This scale provides the estimation for the amount of time a source has to be used before the effect will occur. The interaction takes place by switching the power sources using the various plugs and outlets. The information will only show up when the corresponding plug is connected to an outlet. Because only one side visible side can become visible at the same time, the user will be forced to switch the outlet to see the other information. In this concept, curiosity is the trigger to let people switch from outlet. Because it is often the case that unplugging a plug is a prohibited action, this interaction has to invite this user to perform this action instead. This is why the plug and outlet are out of proportion, so this will make clear these plugs will differ from the normal situation. It also makes the concept more playful and better accessible.

7.5.2 Information

» J.R. Loermans

The main aspect of this concept is the comparison between the two energy sources. A user can choose between good and bad energy to see both their effects. Also the plugs and outlets will connect the notion of electrical power to solar energy and oil. The different subjects on the surrounding objects will represent different establishments in Jayapura. The two power sources in the middle will contain information too.

Sources

- Solar panel – This block tells what solar energy is and what the limitations and possibilities are of the using solar energy.
- The diesel generator – This block explains what energy and electricity is, and their relationship with oil. Additionally to this a description of ending oil reserves and its rising prices.

Establishments

- Farm – This block tell what the long- and short-term consequences for agriculture are; what crops will still grow and which will not, what influence a lack of water will have on the crop and how this scarcity will result in too little food for everyone. Which crops would not be able to grow anymore?
- Hospital – This block shows the long- and short-term consequences of sick people; what influence will the air and water quality on the health of the people.
- Market – This block is connected to the farm. It shows what the long- and short-term consequences are for the availability of food? This influences the people selling as well as people buying the food.
- House – This block tells the long- and short-term consequences of the domestic energy use? This can be explained by the rising prices of the use of benzene generators, the physical impact this use has on the residents and how solar energy can influence this impact.

- Oil refinery – This block tells the long- and short-term consequences with regarded to the availability of jobs, the presence of oil and the prices of oil in Papua.
- Walikota – This last block explains the project PV-system on the roof of the Walikota building and its advantages. This object can only be connected to the solar source.

7.5.3 Implementation

» T.F. van der Heide

The plugs plugged in by the user will not carry the main power source for the objects. It would be too dangerous to let people play with real high voltage cables. The cables can be used for the transmission of signals instead. This signal will be an identifier for the connected power source, so the right half of the object can be switched on. There are cables duct towards each object to provide power to it. The cables for the interaction will be guided through cable ducts on the floor so they won't get tangled up. These ducts will contain lights to show which cable is 'powered'. To achieve this effect a rope light is integrated in the duct as well. When an object is connected to a certain source, the corresponding half will light up to make the information visible. There will be no information visible when there is no corresponding source connected or none at all. In order to ensure the non-activated information is not visible, the information will be placed at a semitransparent surface which only makes it visible when a light underneath the surface is turned on.

7.6 Conclusion

As can be seen in this chapter, the four concepts all describe various features in a plausible form. They all have their benefits, but also disadvantages. These will be further elaborated in the next chapter, where the concepts will be reviewed. Below a summary of features from the described concepts in this chapter: Concept 1 is very strong in the combination made by light and the solar panels. Placing the panels in or out the light will immediately give a notion of electricity being generated or not. In this way people can discover the underlying techniques by themselves by hand. The second concept is also very interesting in its direct interaction. Moving the blocks is a very playful way to discover the interaction of solar energy. The third concept stands out in its ability to do a lot with fewer materials. It's also the only concept using no complex electronics but still providing an interesting interaction. The last concept suits the aspect of the electrical grid. People can choose between both a good and bad power source and see the consequences of their choice.

8.

CONCEPT REVIEW

8.1 Introduction

This review stage assesses the concepts described in the previous chapter. To do so, the concepts are evaluated based on the most important requirements. Interviewing an expert specialized in designing interactive systems (Erik Kijk in de Vegte) about his opinion about the concepts contributed to this evaluation. Moreover the ideas are discussed with the tutors of the projects who are familiar with the culture as well as experienced in product design. To conclude this review of discussions and feedback, the concepts are placed in a matrix grading them in four values to the feature requirements. This will giv a general overview about good and bad characteristics of the concept designs and indicates the characteristics of the concepts that stand out. Based on all these type of reviews the best characteristics of the concepts are summarized so they can be integrated to one final concept.

8.2 Feature Requirements

Generating ideas along the list of requirements has led to a better understanding of the different values of importance for each requirement. This resulted in the following four requirements as the main features for the final product. Based on these requirements the four concepts will be reviewed.

8.2.1 Interaction requirements

- The display has to be inviting.
- The display has to educate people.
- The interaction should be clearly connected to the content of the information.

8.2.2 Informational requirements

- The display communicates the direct and indirect consequences of the use of solar energy compared to diesel generators.

- The display shows the importance of using the technology together.
- The display communicates about the solar system located on the Walikota building.

8.2.3 Feasibility requirements

- The total costs of the acquired parts of the display are less than €175,-.
- The display can be installed and maintained by mechanics on location.
- The display is solid; It is not subjected to wear or other insecurities.

8.3 Review

Each of the four concepts is evaluated by the feature requirements described in the previous paragraph. The evaluation are executed by as well interviewing an expert about his opinion of the four concepts, reviewing the concepts with the tutors as well as comparing them with requirements set during different phase of the project.

8.3.1 Interaction

» J.R. Loermans

- The display has to be inviting.
- The display has to educate people.
- The interaction should be clearly connected to the content of the information.

Concept 1

The interactions of the first concept meet the requirements in more than one way. Firstly, according to the expert Erik Kijk in de Vegte, the round shape of the table invites people to approach and use it. Moreover he says that the combination of the flat table and the wall projection can be related to the use of laptop. This representation makes the form insinuate the installation has to be used and in what form this use has to be executed. Once arrived at the table, Erik expects the user to be confused about the exact use of the panels. Moving light beams and some models of solar panels might not immediately communicate what has to be done. Secondly the wall projection visualized the section of the city of Jayapura. Recognizing certain buildings or characteristics of the city will increase in the involvement of the user in the interaction. This involvement contributes to a more inviting product as well as a higher change of the message getting across.
Because of the large shape of the wall projection as well as the table itself, people that won't have time to enter will get a glance of the project. Although the panels might be not as big, the projections as well as the lights do show these visitors the relation between sunlight and the influence of their city and its environment.
Besides inviting to start interacting with the installation, one of the requirements also expects the product to be attractive enough to remain its use. Erik notes the challenge of a creative game which is integrated in the interaction being a good point for staying involved in the installation.
Erik recommends to reverse the interaction; moving a light beam while fixing the solar panel(s).

Concept 2

This concept meets the feature requirements though it misses the connection with some basic ones.
The interaction is innovative which should be inviting for its user. Moreover the rewards for participating in the interaction as well as the partly hidden information should stimulate curiosity and challenge the user. Although these characteristics of interaction are stimulants regarding to the attractiveness of the product, the lack of affordance might hinder this attraction. The interaction itself is related to general daily performances, more than it is related to interactions with known interactive products in Papua. Still, Erik wonders if it will be clear for the user what is expected from them. He proposes to have the same interaction executed on a tabletop. Moreover he doubts the fact of charging phones being used as a reward; people with no phone might not participate he says. This part of the concept does generate the relation with electricity though.

Once understanding the functioning of the installation, rewarding the user with a fully charged phone and information becoming visible might increase the level of enjoyment. Erik advises to implement a certain challenge to emphasize this challenging character of the interaction. Especially because the installation is intergraded with a beamer, the possibility to keep the product interesting is extended. The number in which the installation educates the people about the subject can be disputed. The interaction is related to the sun, but only has far connection to solar energy. Because the interaction doesn't stimulate the user to actually read the information, but only to the make the information visible, the educational aspect of the concept could get lost.

Concept 3

Although this concept is less innovative it does meet the requirements to some points.
As said, renewal is not the characteristic to be inviting in this concept. Moreover the concept lacks the challenging aspect or rewards with stimulated people to interact with the product. The strength of this concept is based on creating curiosity with the user in a really simple way. Peepholes of binoculars symbolize the idea of something mysterious being hidden behind it. Because the act of peeking through a hole is without any effort though inviting, it can be expected as an effective way of drawing people to the installation. Moreover the interaction immediately stimulates people to take in the information. Because of the lack of challenge, the only reason for people to stay interested in the interaction is the information told. To keep it interesting, Erik advices to create a large variety of images visualized behind the wholes. Although the interaction immediately stimulated people to read the information, the interaction has no connection with the content of the information. The amount of information received by a passenger who doesn't enters the product, depends on the information shown on the sides. Large fonts and informative images might contribute to this. Though as mentioned in the feature requirements, when a more active attitude is required to receive the information, the information will get across is more effectively. Because reading the texts on the sides of the installation as well as reading the map in the middle is a rather passive activity. Finally Erik mentions expected problems with the heights of the different holes. In comparable designs, he noticed the need of little small stairs or steps for small people who couldn't reach the holes. He advises adjustable whole, although this brings along other disadvantages.

Concept 4

Just like the second concept, this concept does meet all requirements, though only partly. Again, just like the second concept, concept 4 is innovating: the interactions are based on daily performing more than the use of computers. In this case though, the interactions are related to the content of the information: electricity. This in combination with the covered information might lead to an inviting product. The shape of concept though, might create misunderstanding with its user. Unplugging plugs from their electricity point is normally not allowed or can even result in accidents. Because people are familiar with these tools as well as the accompanying situations, people might misunderstand the interaction and won't undertake anything. For this reason Erik advises to increase the affordance by for example use oversized plugs or giving them a strange color. Erik also doubts if the installation will stimulate people to keep interacting with the product once started. Because no challenges and rewards are added in the interaction, people might get bored and stop interacting. To keep people interested, the information placed on the top of the blocks has to be renewing and inviting as well.

8.3.2 Information

» J.R. Loermans

- The display communicates the direct and indirect consequences of the use of solar energy compared to diesel generators.
- The display shows the importance of using the technology together.

- The display communicates solar system located on the Walikota building.

Concept 1

Although this concept communicates a lot of the information already trough its interaction, some of the subjects are still missing or even contradicting.
The consequences of solar energy as well as diesel are visualized in the animation on the wall projection. The amount of detail this information has as well as the understandability of the information depends on the image. A more extending image is needed to tell the entire story, while too much detail might be confusing and less catchy. The difference between indirect and direct consequences is represented by time in which the panels are receiving a sufficient amount of light. Again, the understandability of this information depends on the extensive of the image as well as its ability to distinct the amount of light reaching the panels from the amount of time the panels reach the same amount of light. Moreover the battle between solar energy and diesel emphasizes the difference between the consequences and the two sources even more. According to the expert this difference should be even more underlined in the wall projection, for example by using different colors. He even recommends including a visualization of the amount of diesel left in the motor to clarify the battle.
The more contradicting information is the proportion between the models and the image; to generate enough energy for the entire city, a lot more solar panels are needed as well as diesel generators. These proportions might result in unrealistic expectations about the capability of solar panels. Modeling an oversized but familiar (because of personal use) generator might put the proportion of the solar panel into perspective.
The second contradiction is situated in the interaction. Because the user is interacting with the panels more than with the generator, it might create the idea that solar energy costs more effort using than diesel. It might tell the user that solar panels have to be moved multiple times during day, while the low maintenance of solar panels is one of the more importance benefits of solar energy.
The information missing in this concept is as well the integration of the Walikota-project as the symbolization of the importance of working together. This information could be assimilated as extra information at the sides of the table. Doing so though will degrade the information to secondary information, while telling this information is one of the feature requirements.

Concept 2

Although reflecting light beams might not be as connected to the content of the information, this concept does tell most of the information required.
The idea behind the concept tells the story in which the technology of solar energy in combination with the required information a better Papua can be developed. Besides the fact that this idea the concept shapes, it also summarizes all information which is required to include; The awareness and involvement tell the direct and indirect consequences of as well solar energy and diesel generators. Moreover the consequences are visualized in the final block, which visualized how the city will look like with the use of solar energy.
The block that puts the use of solar energy in perspective informs the user about the importance on working together. This importance is emphasized in the interaction in which people have to work together to set the blocks right and create a better Papua.
The link with the Walikota project is represented in the execution block. Because this information is also rather important for the involved parties the block is emphasized more by the being the end of the circle and responsible for changing the model of Papua.
Besides meeting the feature requirements by information on blocks as well as in its interaction and visualizations, the concept tells another kind of information: it puts the use of solar energy in perspective, so too high expectations will be prevented as well as the explanation of the functioning of solar energy is told. The first type of information I told in one of the blocks while the latter is also told in its interaction, in which a lighting beam shines upon the panels

of the Walikota to change the status of Papua. The rather contradicting part of the information told in this concept is the relation between the amounts of solar panels needed and the change in the state of the province. The concepts seems to indicate that only the panels on the roof of the Walikota can make the change, while an entire society is needed.

Concept 3

Because the interaction of this concept is not related to the content, the kind of information can be chosen freely. This means that all information can be told though emphasizing it in the interaction is not the case.
The sense of involvement of the user is emphasized by using the map of a familiar area. By relating the general environmental situation to their own situation, the information becomes more authentic which contributes to a better identification with the product (source previous chapter).
Besides the feeling of being involved with their area, the importance of general involvement of the entire society is not included in this concept. The interaction doesn't provoke interaction with different users in any way. Because communicating the importance of this collaboration is one of the key features this should be added in a previous stage.
Another required subject to communicate is showing the consequences of the consequences of the use of solar energy in combination with the use of benzene. Trough the two peepholes these consequences are visualized on the map of Jayapura. One hole shows the consequences of the use of benzene while the other shows the consequences of using solar energy. Because everything has to be shown on a map, detailed information could get lost. This has to be invested as well, in case this concept will be elaborated in the previous phase. The difference between the direct and indirect consequences is not emphasized in this concept. This is incorporated in the different subjects. The project the Walikota is in incorporated in the concept by devoting one side entirely to the project. This can be emphasized by placing a small model of the building on the map.

Concept 4

Although the interaction of this concept is clearly intergraded in the interaction of the product, the concept is not fulfilling all requirements completely.
The concept does have the possibility to tell everything. On the different blocks a lot of different situations can be showed while using benzene as well as solar energy. This means that the consequences of its use are told clearly. This concept does also lack an emphasis to distinct the direct and indirect consequences. The information does make a good connection with electricity. To understand the link with solar energy people should be already be involved in the interaction though. Moreover the link between solar energy and general involvement and cooperation is not made in this concept. Interaction between people as well as the explanation of its importance should be integrated in later stages of the process.
The project of the Walikota building is shown in one of the blocks, which makes the integration of this part of the previous two projects Because small blocks should visualize a lot of information, people could get lost a lot of information. Enlarging the more important parts of the product could bring structure to the concept. Moreover this might also affect how the information reaches the people passing by at a further distance

8.3.3 Feasibility

» T.F. van der Heide

- The total costs of the acquired parts of the display are less than €175,00.
- The display can be installed and maintained by mechanics on location.
- The display is solid; It is not subjected to wear or other insecurities.

Concept 1

This concept includes the display of an animation at the back wall of the installation. The bar will just have to change between the two colors of the energy sources, but the city will need a

higher level of detail. This will probably need a computer display, projector or other medium which facilitates the output of a digital image. These solutions would be very expensive though, taking a major part of the budget. When display like this is necessary, it would be better to use a used television set; able to display a fair resolution image at a very low price. Another part related to the budget would be the lights used in the product. Erik notes that to get a non-diffuse spotlight, you would need a relatively expensive type of light. The moving beam can be realized in two ways: by mechanical movement or in a fixed position. Using movement, the light could be mounted on a motorized tray to make the circular motion. A better solution would be to use an amount of fixed lights next to each other. Switching them one after the other will create an idea of motion. This last solution would be preferable since it has no moving parts and thus is less prone to error. To make the light shine brighter in the middle of the table, there is just the need of putting some stronger light bulbs in that section. For the solar panels at the table it would be possible to use real solar cells, but a representation with photoresistors would also be able to measure the light intensity.
The round shape of the table could cause some problems building the installation. Though, the radius is big, so a thin sheet of plywood could be bended in the right position. The tilted border of the table creates a very complex shape, this should be simplified. The installation would not require any special maintenance in particular. Wear could be expected at the solar panels at the table surface. Shuffling the solar cells will cause a certain amount of wear to the table surface. This should lead to an unattractive look after some time of use. Also the wires might get tangled up, or get worn out. Using no wires at all, would remove the security of keeping the parts at the installation as well. Erik has a very interesting proposal is to use lights as being the interactive tool instead of the panels. Difficulties to the implementation of this concept could appear at the ‘moving’ beam of light and the solar panels at the table. Another problem could be the display at the wall, but using an old television set will be sufficient as well.

Rapid costs estimation for primary parts

	Amount	€	Comments
Lights	10	25	
Light sockt	10	25	
Solar ‘cells’	6	20	Inc. photoresistors
Arduino	1		Provided
Computer	1		Provided
Display	1		Provided
Total		70	

Left for secondary parts like wood, printed media and miscellaneous like various connection materials: €175 – 70 = €105

Concept 2

In order to correctly display the rays of light between the objects there will be used a projector mounted on the ceiling pointing downwards. This defines the area which the display will cover. A webcam directed from the same point as the projector will record where each object is located. Using this information the system can calculate the rays of light and their reflection so they can be correctly projected on the floor between the objects. The software would also be able to expose the selected information on the selected objects by projecting white light on its top surface. For all this, the camera needs to be correctly aligned with the projection. With the obtained image the software should be able to recognize its shape, position and orientation. For this it is essential that the light conditions are sufficient. Erik notes that there may be a need of using an infrared filter, so noise can be filtered.

In this case a projector will be used to show the ray of light between the objects. Another way of realizing this effect is by using a real light in the strong object. This could be a strong lamp or a laser line. In this way there is a need of actual

mirrors in the object to reflect the ray of light. This ray would likely lose too much of its intensity along the way. Also the use of mirrors would be expensive and the display would be very fragile as well. Another problem which is solved in the case of the projector is that there is no way to detect which subjects are selected by the ray of light.

It is important for the reflections of the ray of light that the objects consist of straight sides. This makes the objects fairly simple to build. The round shapes for the first and last object would be more difficult. This will depend on the final diameter.

To show the electrical product from the solar panels at the last object, there is a possibility for people to charge their phones. For the most commonly used connections there should be a connection. Because nowadays many of these connections are standardized to micro- and mini-USB it would be sufficient to provide these two types for the majority of phones. Another advantage is that both connections require the same voltage, so the power supply could be really straightforward.

It seems inevitable that there is a need of using a projector in this concept. A projector has its advantages but certainly in this project also its disadvantages. There is a projector available for use in the final product, but still the lifetime of the lamp is not guaranteed. A new lamp will cost around €100, which will take a major part of the budget. Furthermore, there is a need of relatively complex hard- and software. In theory the detection and interaction would be possible, but in practice it will be expected to be very prone to error. Because it is already a very abstract display, any errors in the interaction will only further confuse the users. Therefore this concept is not very realistic to actually build in this way.

Difficulties

- Light projection by projector
  - New lamp is expensive
  - Collaboration and alignment with camera
  - Requires relatively complex software to identify the objects
- Construction of cylindrical objects

Rapid costs estimation for primary parts

	Amount	€	Comments
Projector lamp	1	100	
Webcam	1	20	
Arduino	1		Provided
Computer	1		Provided
Projector	1		Provided
Total		120	

Left for secondary parts like wood, printed media and miscellaneous like various connection materials: €175 – 120 = €55

Concept 3

This concept stands out in its simplicity; in interaction and implementation. The walls themselves and the way they are connected to each other are not very complicated. Difficulties will be expected at the different views in the viewport. It is important to fix the users view to properly add information to the common graphic in the middle of the object. When the user moves his or her head there must be no possibility for the two graphics to move in respect to each other. The use of an extended piece, like a binocular, should make these differences smaller. According to Erik, even with the use of binoculars, it will be hard to focus at the transparent sheet and the image in the middle. The distance from the eye to the sheet should be long enough in order to focus on both the images.

There are different ways to let users change the augmented information. One way is to use an automatic mechanism which changes the view by a press of a button. Another approach is to

let people change the information by hand. A manual slider could provide this possibility by sliding the information from left to right. Sliding these different views back and forth could cause problems after some time of use. It's important to keep the image fixed in the right position, so it cannot move around in the viewer and will stay aligned with the picture. When using a system with peepholes at different heights, more complexity will rise. Extra pairs of binoculars would be required, or the viewer has to be able to move.

Creating the information slides themselves would be the most difficult part. To correctly align the information with the map in the middle there should be used a clever method. One possible way is to recreate the object in CAD software and to take a virtual look into the holes. Another method would be to build the object first and to take a look through the holes using a camera. Both images could be used to make a sheet of information that will augment the standard view. Without doubt his will take some trial and error. The resulting slides can be cheaply printed on overhead sheets.

Difficulties

- Alignment of information with object

Rapid costs estimation for primary parts

	Amount	€	Comments
Toy binoculars	5	40	
Transparant sheet material	1	10	
Light + socket	1	5	\
Total		55	

Left for secondary parts like wood, printed media and miscellaneous like various connection materials: €175 – 55 = €120

Concept 4

The interaction of plugging in the power cables seems to have the advantage it can actually power the objects. Including Eriks second thoughts, this would be too dangerous to implement in such a public interaction. Wires might get worn out, and the high voltage would be dangerous. This makes the objects to be powered in another way, maybe by using also fixed cables at the floor. This power can be used to make the right information visible. This can be performed by switching on a light in the object which will shine its light through the semi-transparent top surface. When the light is out, the information should be hardly readable. To what extent this is possible is unknown, but maybe there is a possibility to let ambient light be insufficient so it will be necessary to use the build in light to be able to read the information. Another difficulty would be the cylindrical shapes of the objects. Depending on the radius there may be a possibility to bend a thin sheet of plywood.

It should be clear to the user that the real power supply to the objects is not part of the interaction. As a solution these two objects could be placed to a wall at which the actual power cable can be mounted out of sight. In that case the other objects will be placed in a semicircle around it. The cables to those objects could be placed in wire channels placed on the floor to make sure they will not get entangled. It will be preferable to add lights to those channels to provide better feedback for which cable is connected. To achieve this it would be a possibility to split the power cable at the beginning to connect one parallel thread of lights to the cable.

Difficulties

- Power supply to middle objects, no part of the interaction
- Construction of cylindrical objects
- Information on top of object only readable when selected

Rapid costs estimation for primary parts

	Amount	€	Comments
Lights	12	30	
Light sockt	12	30	
Transparant surface	6	30	
Cables	12	72	
Cable channels	6	30	
Arduino	1		Provided
Total		192	

Left for secondary parts like wood, printed media and miscellaneous like various connection materials: €175 – 192= - €17

8.4 Conclusion

All concepts have good and bad characteristics which can be taken into account in the following stages of the project. Based on the evaluation of the interactive, informational and feasible aspects of the four concepts, the most usable ideas, wishes and suggestions can be used for defining the final concept.
Good interactive aspects mainly came from the first concept: Using a table in combination with a screen is recognizable with the use of the computer and therefore increases the affordance. Moreover the half round shape of the table invites people to come and take a look. The rather large size emphasizes this attraction and also catches the eyes of the people only passing by.
Aspects coming from other concepts included challenge within a game, a variety of information and images as well as rewards as for example charging a phone make people continue the interaction. Curiosity aspects by peepholes or covered information and innovation aspects stimulate the attractiveness of the product.
The latter aspect could be realized by designing interactions related to the people's daily life performances. In case this interaction leads to confusion, as might happen with the concept with the plugs, extreme colors or sizes can be used to explain the artificiality of the product but at the same time keep the affordance.
Good aspects concerning the informational part of the concepts are mainly recognizable in the second concept. Using the main message as being the idea behind the interaction influences the profundity and the completeness of the content.
All concepts tell the consequences of the use of benzene en solar energy. This is done by using two ways of looking at parts of the city or the city as a whole. Information about the Walikota is or can be integrated in all concepts also. This is done by using the story of the project as one of the main subjects. This can be emphasized by modeling the building including the solar panels within the part that explains the project.
The difference between direct and indirect consequences can be visualized by a change in the interaction as the user spends less or more time with the product.
Social involvement can be told be a cooperation of the user to eventually complete a challenge; putting a large amount of panels in the sun, or as the expert suggested: putting a large amount of sun on the panels. At least cooperation is needs to complete the challenge.
Regarding the feasibility of the concepts some of them feature some very outstanding aspects. It seems to be very important to be aware of complexity, wear and work required to build the object. A concept like concept two will bring to much complexity; the software has to fit the hardware exactly and is probably very prone to error. The table as described in concept 1 will be a lot of work to construct; maybe it's not even necessary to build such an object. It's also important to be aware of the possible wear at the surface of the table.
Finally concepts like 3 and 4 will be plausible to implement, but should need some further thoughts concerning the precise interaction.

Interaction requirements

The display has to be inviting.

The display has to educate people.

The interaction should be clearly connected to the content of the information.

Informational requirements

The display communicates the direct and indirect consequences of the use of solar energy compared to diesel generators.

The display shows the importance of using the technology together.

The display communicates about the solar system located on the Walikota building.

Feasibility requirements

The total costs of the acquired parts of the display are less than €175,-.

The display can be installed and maintained by mechanics on location.

The display is solid; It is not subjected to wear or other insecurities.

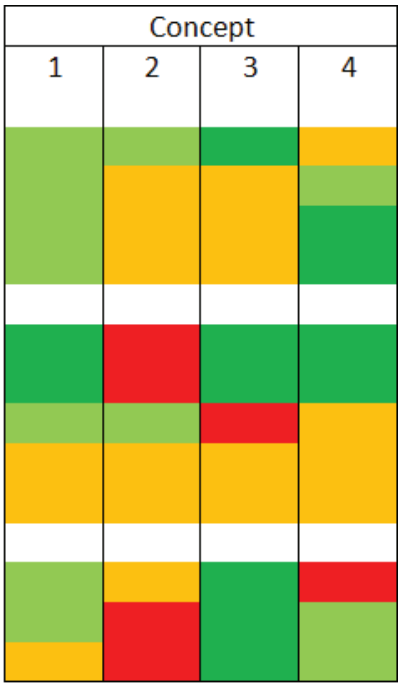


Figure 8.1. Rating matrix with feature requirements per concept

9.

FINAL CONCEPT

9.1 Overview

At its base the installation exists of five information pillars positioned in a semi circle, directed to a wall. In the middle at the floor there are models representing a solar panel and a diesel generator, and at the wall a screen is attached. On each top plane of the information pillars different subjects are discussed. On the front plane of the pillar, at the inner side of the circle, three lights are pointing towards the solar panel. On top of the object, three sensors are placed to sense the placement of a hand.

9.2 Interaction

The information of and the inputs for the interaction will be presented towards the users due to the overall round shape of the installation and the tilted top surface of each information pillar. Each pillar provides information separated in three sections. Each section contains an integrated sensor surrounded by a hand silhouette. When the user places his hand at the silhouette, one of the three lights at the side of the pillar will switch on. All the lights are directed at the solar panel in the middle of the installation. When more people are interacting with the installation by placing their hands, the panel will be illuminated more. The amount of light reaching the panels depends on the amount of people being involved in the interaction. To emphasize to notion about the light switching on, LEDs located above the corresponding section will switch on as well. At the same time, a small LED above the top plane will shine its light across the chosen section. So when the hand is placed at the silhouette of one section, three lights will start shining: The light at the back of pillar to illuminate the solar panel, the LED on top of the plane which emphasizes this occurrence and one LED shining at the corresponding text.

All the light on the solar panel will create a fictional supply of electric energy. The model of the diesel generator will generate a flow of energy too, accompanied by a buzzing sound relatively loud as the engine has to work. Both

Figure 9.1. Final concept

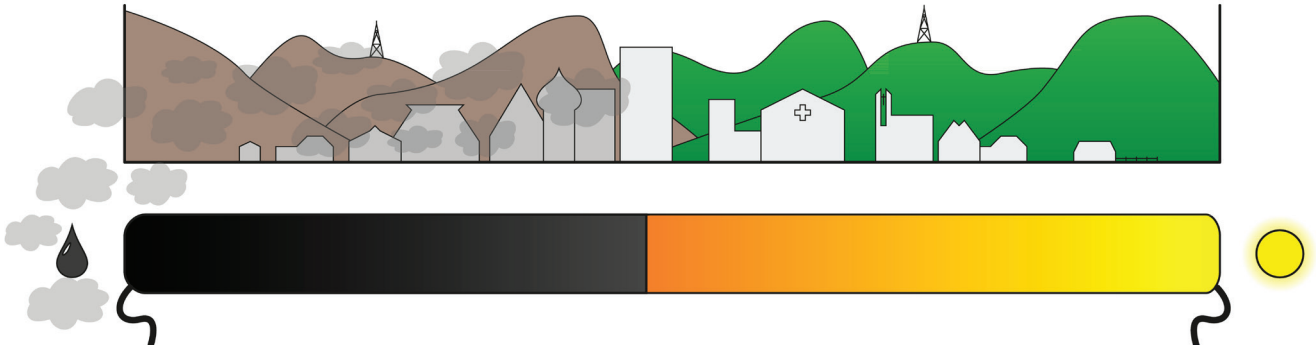


Figure 9.2. Representation of the city

the power sources will be visually connected to the screen using power cables.
These cables will stop at the edge of the screen, continuing at the screen in digital form. In this situation the cables will show tiny dots flowing through the cable, representing the amount of energy that moment in the cable. Eventually the two power cables will be connected to a power distribution bar at the bottom half of the screen. This bar displays the distribution of the used power in the city. It shows that there's always a steady amount of energy, but the use of solar and diesel energy fluctuates. The city itself is displayed above the bar using a 2D visualization including characteristic city landmarks. This graphic will be under the influence of the major power source used at a certain moment. When the major part of the power distribution bar consists of one energy source, the short-term effects from this source will be displayed. For example, when there is a lot of oil use, the city's air pollution will rise. After a longer period use of one energy source its long-term effects will become clear in the animation. For example in the case of solar energy this may result in healthy green hilltops and happy people on the streets.

Thirdly a bar shows the mount of people being involved in the interaction and the influence

this has on the power supply. The units used in this bars are hands, to represent the amount of people. If more people are involved, the solar bar changes faster and the interaction the speed in which the electricity bar increases. The interaction reaches its highest point when all the people interact with the product.

To support the desired action to participate in the interaction, hand silhouettes are displayed around the sensors. Together with the round and slanted presentation towards the user, the hands will stimulate curiosity and will encourage people to get involved in the product. Moreover it communicates its use which makes people understand how to use the product.

Various light intensities are met by using three lights in every one of the five information pillars. This will make a total variety of 15 light intensities possible at the solar panel. More covered hand silhouettes will result in a higher light intensity and thus in a more positive effect on the city. Because every one of the five pillars provides three hand silhouettes increasing the positive effect will be the work of multiple users. It will motivate users to work together and to encourage others to participate.

To increase the influence one person can have on the image; a time interval is added to the system. When a person takes off his hand, the light will stay on for a short period of time. This will give the user the opportunity to switch on multiple lights by themselves to see further effects on the animation. The interval has not to be set too long, to not negatively affect the cooperation of multiple people.

9.3 Information

» J.R. Loermans

The concept tells the story that with the right mentality of the people in combination with the technique of the (PV) solar system is needed to create a development in the environment and society of Papua. The topsides of the five pillars will provide the information needed to contribute to the development of the right mentality towards the use of solar energy. The installation symbolizes the need for a (PV) solar system as well as a certain mentality of people to stimulate the development of solar energy in Papua. This development is visualized on the screen. On that account, the information can be divided in two parts: Information about solar energy itself and information required to support this mentality.

9.3.1 Information about solar energy

Information regarding to the functioning of a PV system is centrally translated into the interaction. When the lights shine in different intensities on the solar panel, an electrical current is generated and sent to the screen: light produces electricity. By involving the diesel generator within the animation, the ‘battle’ between solar energy and diesel is represented. The bad influence of the diesel generator is visualized by shaking of the generator and the release of filthy gases. On the other hand, clean solar energy can avoid these bad effects on the city. The light intensity depends on the amount of people that are participating in the interaction of the product. The fact that people are expected to work together to create the perfect Jayapura, tells the importance of working together

9.3.2 Consequences of the use of solar energy

The animation on the screen shows four different states of the city: the long-term consequences of the use of diesel, the immediate consequences of diesel, the long-term consequences of solar energy and the immediate consequences of solar-energy. Depending on how long someone is involved in the interaction, more long-time consequences of solar energy will evolve in the animation. So in case of an increase of involved users, a transition will occur from a dark, brown, clouded city, with a lot of sick people, little space, and lots of energy break-outs to a green sunny city with lots of happy cheering people. These animations represent the effect that the information about solar panels in combination with the information

needed to create the proper mentality of the society has on the city. The animation reaches its peak when the city is very clean and pretty and the people in the city are clearly happy.

9.3.3 Topics to support the right mentality

To support this right mentality there is information provided on the top of the five information pillars. This information is divided in five different topics, each with three subtopics. The topics are chosen in a way that they all represent an important role to all the required information.

- Knowledge - Everybody needs a basic understanding of what solar energy is to see its advantages. For this reason there will be an explanation about what solar energy is. This information is divided by knowledge about energy and electricity, information about solar panels and information the world and electricity. More information is mentioned in the content analysis: the paragraph about solar energy and the limitation of solar energy.
- Awareness - Before people can really see the advantages of solar energy they should be aware of the consequences of the use of diesel generators. To show these effects in relation to Papua, people may be able to better understand them. This information is divided in information about the indirect effect of diesel on Jayapura, information about the indirect effect of solar-energy on Jayapura and what can be done to improve Jayapura on the long term. More information about this topic is mentioned in the content analysis: the paragraph about direct and indirect consequences and environmental problems of Papua.
- Involvement - A lot of people in Papua don't have the luxury to think about the future. By showing the direct consequences and the use of solar energy, people will get closer connected to the problem. This will result in feeling more involved in the situation. This topic is divided in information about the direct effect of diesel on Jayapura, information about the direct effect of solar energy and what can be done to affect Jayapura directly.
- Qualification - Because people are not familiar with the solar panels, it's also difficult to see what's possible and what's not. This could lead to high expectations and disappointment. To prevent this, one block will contain information on the possibilities of a solar panel. This subject is divided in pros of solar energy, the cons of this use and the possibilities that solar energy brings in the future.
- Realization - To create an understanding about the how all these factors are needed to make a difference, this realization step is needed. An example of how solar energy can be implemented is the project of the Walikota building. Therefore this subject is divided in information about the bigger project, information about the idea behind the stand and a model of the Walikota. Explaining all things needed to obtain a better environment and using the general project as an example will be the connection between the information of the blocks and the interaction itself.

Although in essence each pillar offers different information, some information might overlap others. Sometimes this will be necessary to improve the understandability of the individual information. Yet it will be encouraged to also read other pillars by supplying enough new information each time. This should be taken into account while designing the interfaces of the pillars.

9.4 Implementation

» T.F. van der Heide

9.4.1 Display

An important component of the final product is the animation in the middle of the installation. This display that visualizes this animation has to be capable of showing a colored bar and

the transformation of the city. Although the bar is a relatively simple representation, the city view requires a higher level of detail. For this purpose some sort of graphic display, like a computer monitor, is necessary.
As described in the practical analysis, there are various ways of displaying this information using a graphical display. However, the most realistic would be the use of an old television set. This device will be capable of displaying sufficient level of detail and will not take a big part of the budget. The connection to the television could be provided by a standardized connection like composite video.

9.4.2 Information pillars

The pillars will support the information on top and will contain the lights and required electronics. Though the five pillars will be the same, the middle will contain the main controlling unit of the installation and the connections to the other pillars and the screen. Despite previous ideas the pillars will not be fully covered. The sheet material would make the construction too expensive and would add extra build complexity. Still the top of the pillars, below the information plane will be enclosed to assemble the electronics. Three lights will be integrated into the surface at the inner side of the installation. On top of the casing the information will be displayed.. The case for the electronics with the information on top will be supported by an open frame of wood.

9.4.3 Lights

Three lights will be mounted at the back of each object. To get a nice spotlight effect it will be helpful to use a lamp that reflects the light in one direction with a small angle. Still it would be difficult to see a difference in light intensity at the panel when multiple lights are switched on at the same time. In addition, users need immediate feedback on what happens when they place their hand on the surface, to understand their influence. To support this, there will be placed a bar containing LEDs at the top of the information surface. A couple of LEDs will shine their lights across the surface to highlight the corresponding information. Another LED, placed in a positional relation with the light at the front, will provide the status for that light. When the light switches on, this LED will light up too.

9.4.4 Interaction

Registration of a placed hand on a silhouette will be achieved by placing a photo resistor in the middle of each silhouette. The measured light intensity will decrease rapidly when the resistors get covered. These signals will be transmitted to the central control system. This unit switches on the corresponding lights and will give a value of how much light approximately will shine on the panel in this way. This value will be transported to the computer where it will be imported to the software generating the graphic on the screen. An inverted value will be transmitted to the motor model, on which it will increase or decrease its noise and oil use indicator.

10.
SPECIFICATION

» T.F. van der Heide

10.1 Introduction

After settling the final concept in the previous chapter, the design needs to be specified in more details. This will be elaborated in this chapter. First, the design of the pillars will be described in more detail and secondly for the model of the solar panel. After this the section about the electronics will tell about the electronics used and needed for the installation. Finally, the software section will describe the underlying software and so the control of the interaction. This chapter will finish with a schematic overview of the installation and final cost estimation based on the specifications.

10.2 Objects

10.2.1 Pillar

The specific design of the pillar is developed from a basic idea and some limiting factors. The basic idea is to have a high table, with printed information on top facing towards the visitors standing in front of it. At the other side there will be lights pointing to a solar panel in the middle of the installation, surrounded by four other pillars. Some limiting factors described below co-shape this object in the specified design.

Dimensions

The dimensions of the pillar aren't set in the initial idea. An important dimension will rely on the size of the users of the installation. It will need a proper height to easily read the information and reach the position to place your hand. This height is determined using a chart of the average height of people in Indonesia and someone of approximately this height. A height of 90 cm seems to be a decent height to both read the information and reach the sensor. Another important factor is the placement of the lights at the back of the pillar. These lights need to be directed towards the solar

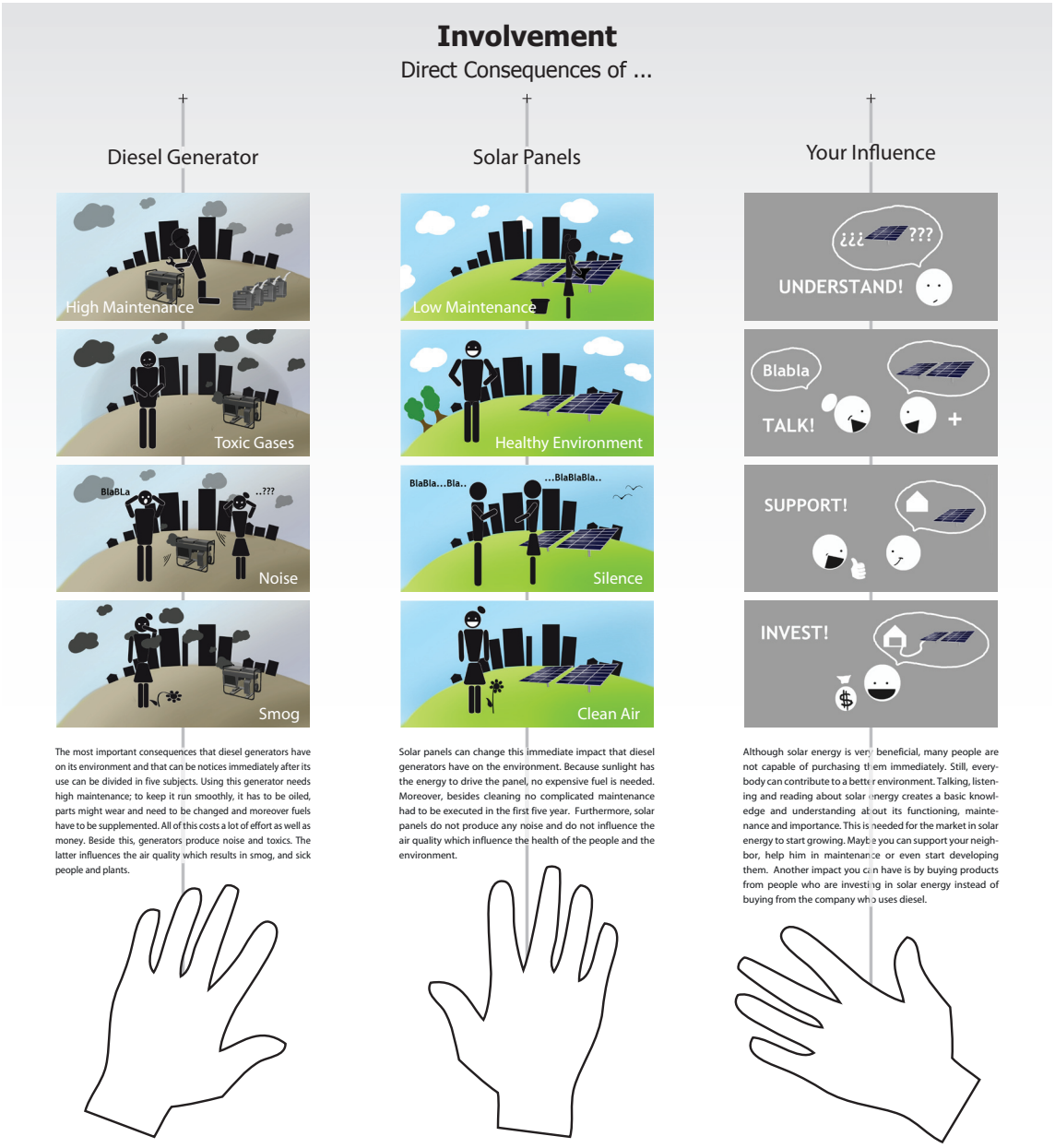


Figure 10.1. Top plane (J.R. Loermans)

panel in the middle. This relates the radius of the semicircle of the five different pillars to the angle of the lights. Setting the radius of this circle to approximately 1,5 meters and using the above described height, provides an estimation for the placement of the lights. Dimensions determining the depth and width of the object are chosen with various considerations in mind. First, the surface has to be big enough to display all the necessary information. Also the frame has to be wide enough to prevent the structure to be top-heavy, but it shouldn't be too wide since it has to be possible to place the five pillars next to each other at the semi-circle. For the casing and the top surface plywood is required of a relative small thickness. The high price of sheet material and the fact it will not have to bear a lot of force results in a set thickness of 5 mm. This size may vary later on, but will influence the precise sizes of the sheets to be cut.

Assembly

Because the five pillars will be built in Indonesia, a major part of the installation is designed with the construction by other people in mind. The objects have to be built using available materials. For this the wood size chart from described in the practical analysis chapter is used (Appendix). The frame will be built from wooden beams with a cross section of 4 cm x 2 cm. To keep things easy, most of the components can be cut using a right angle. Assembling the

frame can be achieved using only one screw at each end of a beam, while no beam will have the possibility to axially rotate in that way. The continuous diagonal beam creating the angle for the lights will create a rigid construction. For a large part the frame will be open, but there will be a casing at the top. This will hold the electronics and the lights. Also it makes the construction somewhat extra sturdy. The sheet material used is plywood as sold in the shops of Jayapura. The relatively high price of these sheets is another reason for not choosing to make a full case.

Top plane

» J.R. Loermans

The surface on the top of the object will also be made out of plywood. The size of the plane is slightly wider and deeper than the top of the object itself, so the plane will reach a bit out of the object at each side. This enlarges the surface available for information and also covers some possible small gaps between the vertical and horizontal plywood. The surface will be 64 cm high and has a width of 58 cm. The information at the top plane is separated into three columns. At the top of each section will be a pair of LEDs, one status LED and one shining across the selected surface. These LEDs will turn on when a hand is placed. A user can place his hand at the bottom of the plane at the position of three printed hand silhouettes. In the middle of these silhouettes a light dependent resistor (LDR) senses the placement of the hands.

Information Top Plane

An example of how the information of the top plane will be visualized is shown in the image attached. In this visualization the information about involvement is told: direct consequences of solar energy, direct consequences of solar energy and how people can influence these consequences. The visualization shows that all information is told by images supported by text. In case people aren't able to read, the message should still be clear to them.

Lights

Each object will hold three halogen lamps at the side of the pillar towards the solar panel. These will light up when a hand is placed on the top of the pillar. To maintain a low price a type of halogen is chosen that can be connected directly to a wall outlet. Using 12 Volts lamps would require an additional transformer and thus a higher price. Because of the relatively high power needed for the lights, each pillar will require a power cable towards a wall outlet.

10.2.2 Solar panel

In the middle of the installation a model of a solar panel will be positioned. This is the place where all the lights from the objects will direct their lights to. The model has to show how a panel approximately looks like, and shows the generation of electricity using a power cable towards the screen. The goal is to make a sufficient model, but to not demand a big part of the budget. The panel has no previously set dimensions since it's not physically connected to other components. Though, a full size panel would be too big for this installation. The size chosen for the panel is 100 x 60 cm, resembling approximately the original proportion of solar panels (2:1). Painting this surface black will be the first step to obtain the appearance of a solar panel. Although some full black panels exist, some more detail will better fit the global archetype of a solar panel. Using correction tape roller white lines can be added, subdividing the surface in twenty 'cells'. Aluminium profiles at the edges of the plane, together with the final attachment of a power cord, will be the final step for a complete solar panel model.

10.3 Electronics

Some internal electronics are required for the desired interactions. For this, each pillar contains some similar electronics like status LEDs, the sensors for the hand and the relays switching the internal lights on and off. The central pillar contains the processing unit of the system, controlling all the electronics in the five pillars. Each of these components of the electrical system will be described below.

10.3.1 Controlling unit

In addition to its function just like the other four pillars, the central pillar does contain the main controlling unit of the installation as well. This is the place from which all the electronics in the installation will be controlled. For this an Arduino Mega is used; an open-source circuit board containing a programmable microcontroller. The board provided various in- and outputs to control electrical components, and an USB connection for communication with an external computer. The board is built inside a small box to be mounted underneath the information surface of the pillar.

The Arduino Mega provides sufficient in- and outputs to control all of the components in the installation. Though each connection towards a 'end component' needs some additional supporting components, like resistors, to make the signals usable. For the central pillar these components are soldered onto a circuit board mounted directly on top of the Arduino. From this board there are nine connections to female jack connectors mounted at the side of the box, providing an easy connection for three pairs of status LEDs and three LDRs of the information surface. At another side of the box there are three pairs of connections for the lights used in the pillar. A power plug connector creates the possibility to power these connections, on which one lead will be switched by the Arduino. Four RJ45 connectors in the controlling unit will provide a connection towards the four other pillars. The RJ45 connection is regularly used in computer networking and uses Ethernet cables commonly available in shops in Jayapura. At the other end of the cable, there will be a small circuit board in each pillar to transform the signals into a Arduino friendly format. Three input signals (from the sensors), three output signals (controlling the relays and the LEDs), a 5 volts supply and ground will be directed

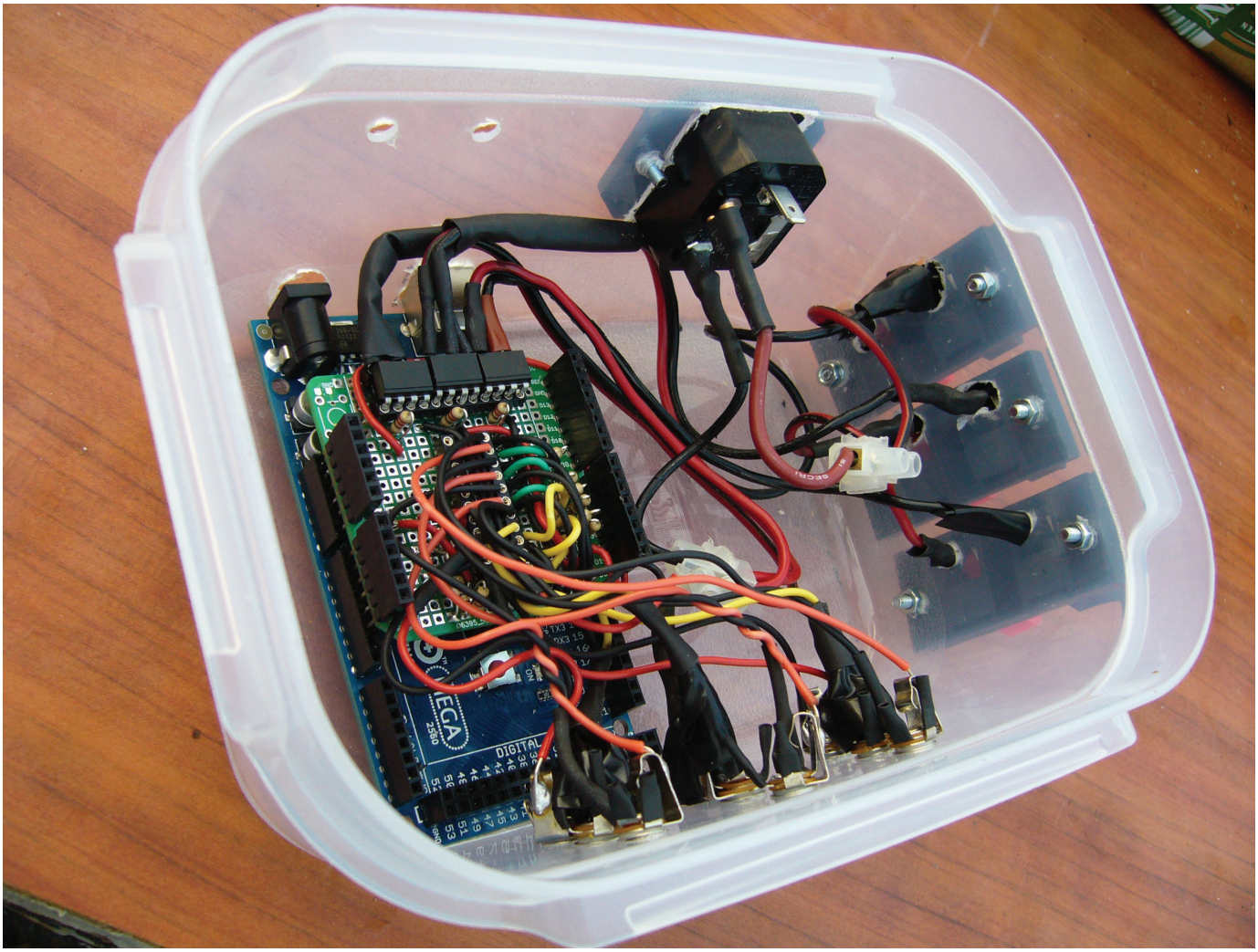


Figure 10.2. Main controlling unit

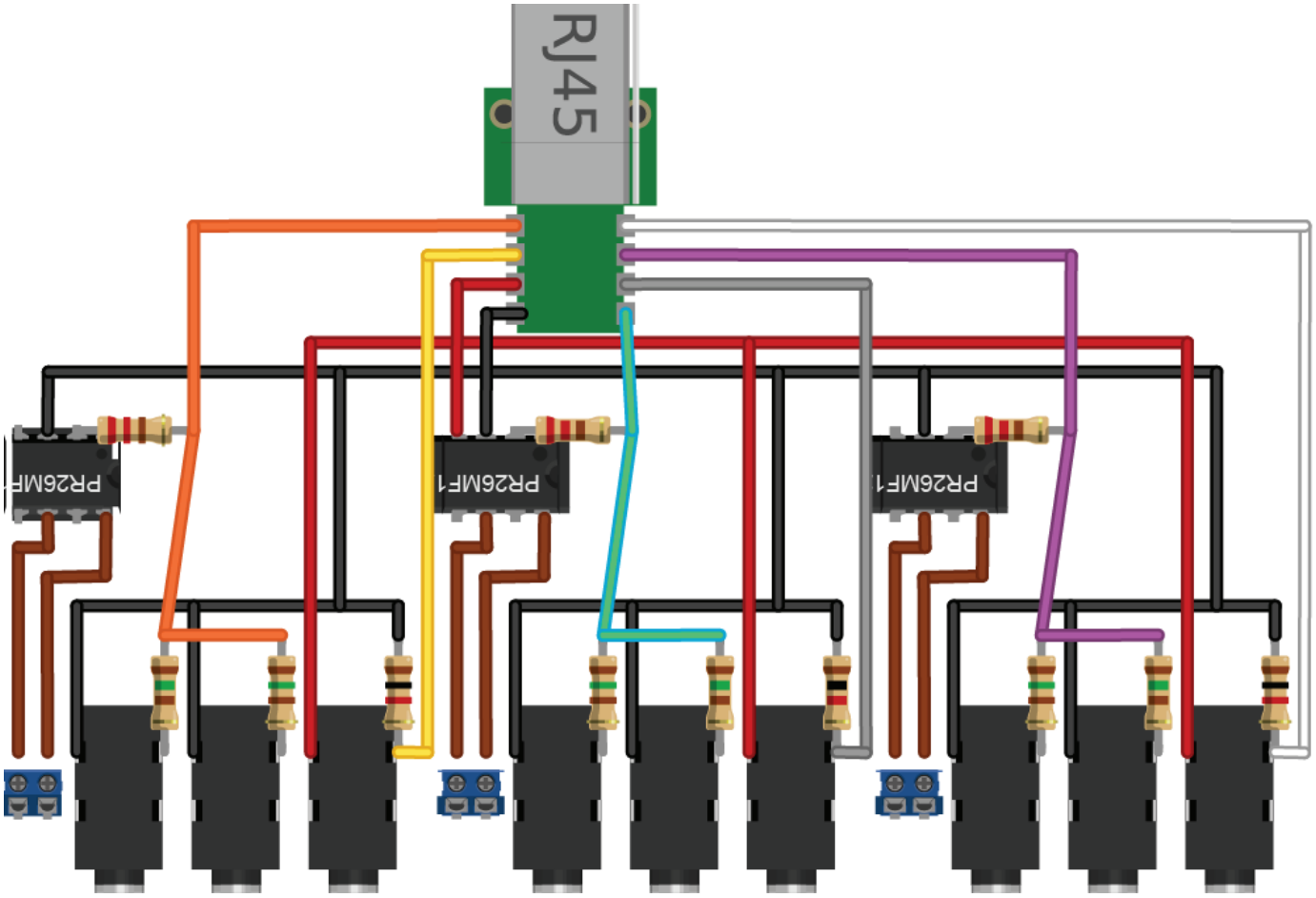


Figure 10.3. Pillar circuit board

through the eight wires of the Ethernet cable. Below, you see a schematic design of this circuit board. Note the three similar circuits for each column of the pillar. The next image shows the connection to the Arduino in the main controlling unit. The circuit board in the prototype contains the same circuit.

The controlling unit has been built up to a level that provides functionality to the central pillar. This is used for user testing the prototype and to review the build process.

10.3.2 Peripherals

The interaction of placing hands will eventually lead to a change of the city of Jayapura on the screen in the middle. Although the Arduino acts as controlling unit in the installation, its hardware isn't sufficient for generating full color images to output at a screen. For this the Arduino will be connected through USB to a notebook which will be provided by the Walikota. This system will run the software, communicate with the Arduino and generate an image to display at the screen. This screen will be another additional component. It's difficult to see what the exact possibilities are for obtaining a screen in Jayapura. Assuming that even people in Jayapura nowadays switch from old CRT television sets to newer models; it would be possible to obtain such a television set for a reasonable price. To retain a clear image, the animation displayed at the screen provides a simplified representation, not to be lost in a possibly low resolution of the display.

10.4 Software

The software running at the notebook computer controls the electronics used in the system, evaluates the values of the sensors and displays an image at the screen. This section will describe these roles of the software in the installation. The software is programmed using the open source programming language Processing. This language is developed with a graphical context in mind and has many similarities with the Arduino platform. In this case these similarities

are useful as the Arduino will be used as a tool to communicate with the electronics from the PC's software environment. To fully control the Arduino, a feature called 'Firmata' will be used. This is a special program loaded onto the Arduino's microcontroller to let a connected PC take control of the electronics connected to the Arduino. In this way it is possible to read a sensor's value directly in the Processing program and you will not be required to write an Arduino program that fits this specific use. The program is an executable able run on Linux and Windows PCs. Depending on the hardware provided by the Walikota, one of these operating systems should be installed with the recommendation to start the installation software at system boot.

The source code can be found in the appendix.

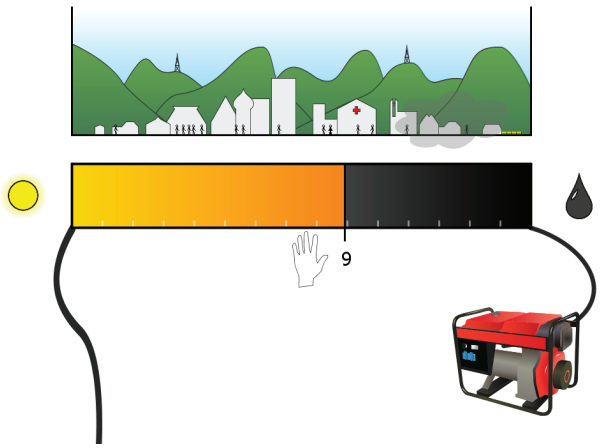


Figure 10.5. Screenshot of the animation to be displayed at the display

10.4.1 Basic functionality

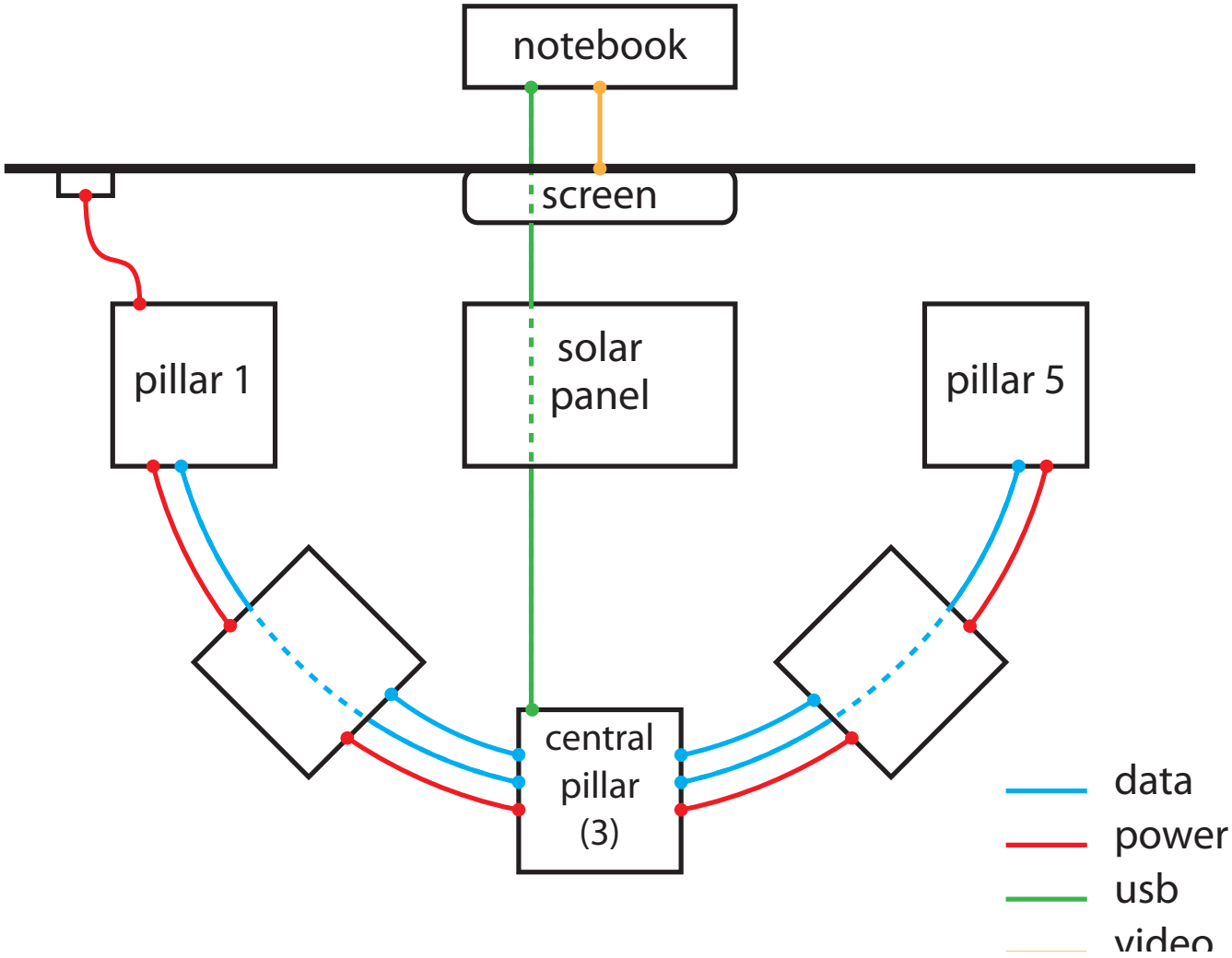


Figure 10.4. Schematic overview of installation

Twenty times per second the software will check the values of the LDRs at each pillar. The values may vary a bit during the light conditions of the environment, but when one sensor will be covered, the value will drop significantly. When it drops below a certain threshold value the software will set the corresponding section to active and turns on the corresponding two status LEDs and the relay connected to the corresponding light. Also the total amount of placed hands will be increased by one. When the light starts to shine at the panel, the amount of produced solar energy at the screen will rise gradually. This value will rise or fall faster when the difference is higher and will be directly visualized using a power distribution bar with oil and the sun on both sides.
The changing distribution of power will also influence other attributes at the screen. For these effects there's a representation of Jayapura displayed at the top of the screen. One of the first things to notice on a high oil power usage is the amount of clouds created by the generator at the bottom of the screen. These clouds will rise to the top of the screen and will pollute the air of the representation of Jayapura. The shaking generator unveils it has to work harder at a high oil power level. Both the shaking and he clouds will decrease when more solar energy is generated. On a high oil power level, a grey and polluted Jayapura can be seen through the drifting clouds. There's no vegetation at the hilltops in the background, and the local hospital has a high amount of visiting pedestrians. Vice versa, a higher solar level will affect these things in a positive way; the air will be clear, the hills will become green, crops rise and pedestrians will walk around and eventually cheer. This last situation will occur in the case of all sensors being covered, so there will be full light at the solar panel leading to full solar energy for Jayapura. Removing the hand of the sensor will not directly switch off the light in the cabinet. Because halogen light is used, it would decrease the lamps lifetime dramatically when users could switch on the light for just a split second. This could even occur unintentionally when someone covers the sensor by accident. The software is programmed in a way that will continue to shine for a couple of seconds when a hand is removed from the sensor.

10.5 Schematic overview of installation

The following diagram shows the different components and their interconnections which each other. The central pillar contains the main controlling unit. There will be four data cables from here to the four other pillars.
To provide power to the lights in each pillar a power connection will lead to every pillar. The latter connection doesn't need more than one channel; the power can be split at every pillar to proceed to the next one.

10.6 Final cost estimation

Pillars	Wooden beams	16
	Plywood	20
	Screws	5
	Prints	10
Solar panel	Plywood	5
	Aluminum profile	15
	Screws	2
	Correction tape roller	2
	Power cable	2
Electronics	Lights	40
	Power cable	5
	Networking cables	5
	Electronics in pillars	45
	Video cable to screen	3
Total		€ 175

11.
ASSEMBLY

» T.F. va n der Heide

This chapter describes the installation in terms of its implementation Jayapura. For this the installation will be described using the parts assembled in the Netherlands and the parts to be constructed in Jayapura. When all these parts are available on location the last part the assembly will consist of the final implementation of the product.

11.1 Parts to be shipped

To review the use and assembly of the product a prototype is assembled in the Netherlands. The prototype consists of one pillar, one solar panel model and software running on a computer. This single pillar acts as the central pillar of the total installation and holds all the necessary electronics for a working model of the full installation.

11.1.1 Controlling unit

The controlling unit in the constructed prototype pillar contains a major part of the electronics to be used in the actual installation. Thanks to an extended version of the Arduino used in this unit, enough pins are available to connect all the sensors, LEDs and relays of the other pillars to the control system as well. This system is built into a box mounted in the casing of the prototype and will be shipped to Jayapura. It does contain connections for the lights, LEDs and sensors of the corresponding pillar, but does not yet contain the four RJ45 connectors as described in the previous chapter. Some space in the box is kept free to add these connections afterwards.

11.1.2 Electronics for the remaining pillars

The signal cable towards the remaining pillars will end at a small circuit board at each pillar. This circuit board is previously described in the previous chapter. Because the controlling unit already contains these electronics, still four of these boards need to be provided. They contain some simple electronic components like relays

Figure 11.1. Assembled prototype

to switch the lights and some resistors to lower the voltage for the LEDs. The connections towards the lights will be provided by three pairs of screw terminals. Just like in the controlling unit the connections to the LEDs and sensors will be provided by mono jack connectors for an easy and unambiguous connection. The LEDs and sensors to be built into the top surface of the pillar will also be provided in a way that they are easy to work with. Each of these components can be attached to the surface using a LED mount at the side of the component. The other side will contain a male jack connector so it can be plugged in the pillar's circuit board.

11.2 Parts to be built

The structural parts of the installation will be built on location in Jayapura. For this, a construction manual is created for the construction of five pillars and the solar panel. These manuals will include a list of required materials and will explain its construction step by step. The steps are explained in a way using only graphic representations to avoid problems due to language differences. Below, the activity of constructing the pillar and solar panel will be described. The corresponding sections in the construction manual can be found in the appendix.

11.2.1 Pillar

For the frame of the pillar wood is required with cross sectional dimensions of 4 x 2 cm. These dimensions are set using the diagram found at the wood mill described in the practical analysis chapter. The manual will first describe the required sizes of the beams and sheet material. After this section, the two sides of the frame will be built first. When these are completed, the cross beams can be installed to shape the final frame. The next stage of building the pillar consists of applying the sheet material to the frame. Before assembling the top surface of the pillar, the lights will be installed in the designated holes and the electronics to the informational surface. Installing the LEDs and the sensors will first require a print to be applied to the surface. This print will indicate the positions of the holes for those components. Creating the holes with a 5 mm drill allows the mounts of the LEDs and sensors to be attached to the surface. Finally the circuit board or controlling unit can be attached to the bottom of the surface, before eventually applying the information surface to the pillar.

11.2.2 Solar panel

The model of the solar panel only requires a couple of materials. First a sheet of plywood (or other kind of wood, when available) should be sawn to the proper size of 100 x 60 cm. Black paint can be applied after obtaining a smooth surface by sanding. Correction tape roller seemed to be the best solution to obtain nice straight lines at the panel to divide the black surface into smaller 'cells'. It will also be possible to use paint, but it would require more time, higher precision and probably more money. As finishing touch aluminum profiles will be applied to the edges of the surface. These have to

be cut in some the dimensions of the panel with corners of 45° at both ends. Finally, a power cable has to be attached from the panel to the screen.

11.3 Final implementation

11.3.1 Positioning

The installation can be implemented in the entrance hall of the Walikota when all the parts are available and a final location has been chosen. The different parts should first be positioned like the diagram shown in Figure 10.4. First the screen and the notebook should be positioned against the wall. This will determine the approximate location of the solar panel which can be placed around half a meter in front of it. It will determine the central point of the installation. The five pillars should be placed in a semicircle with a radius of 1,5 meters surrounding the solar panel.

11.3.2 Connecting

All the parts can be connected to each other when the parts are properly positioned. First the power connection towards the five pillars, the screen and the notebook should set up. The power cord to the first pillar could be split to lead towards the others. Connecting the signal cables requires another approach. These will be connected to each pillar with a separate cable from the central pillar containing the controlling unit. The last connection from this unit will be the data cable towards the notebook computer. It should be best when those cables can be aligned next to the power cables across the ground. Placing these in a way they describe the semicircle would be the solution with the highest esthetic value. At last, the cable from the solar panel should be attached to the border of the screen. The exact position for the virtual cable can be recognized after the first run of the software.

11.3.3 Running the system

It should be possible to start the installation when all the parts are correctly connected to each other. Still, for a final installation the hardware of the provided notebook and screen has to be known first. In this way the notebook can be prepared to be fully operational for this particular task. A recommended setting would be to run the program instantly when the notebook is turned on. Another favorable settings is the right resolution for output to the screen. These properties are still unknown in this stage of the project; but can be easily adopted when more information about the system is available.

12.
EVALUATION

12.1 Introduction

» J.R. Loermans

The evaluation of the final concept is based on the most important requirements, set during the concept review phase. The evaluation is divided in the review of the interaction, information and technical aspects. The first two subjects are discussed by the contextual designer. This evaluation is based on the two user tests. The first test (Appendix) is an interview done with a person who has been living in Papua for over thirteen years. Because she has experienced this culture, she can give insight in how people could respond to the installation; if they would feel attracted to the installation, if they would involve other person in their actions and if they would understand what is meant with the information. In this test the concept is explained, supported by images of the installation, the scenario, the animation that will be visualized on the screen and an example of the top plane of a pillar. Based on this explanation the participant has been interviewed.

The second test (Appendix) is done with people in a similar situation as the visitors of the Walikota. A model of part of the installation is placed in the entrance hall of a technical university. People are confronted with the object but are not focused on interacting with it. By observing and questioning people about the installation, feedback about the functioning of the installation is collected. The information from these two tests is discussed in the following two paragraphs.
The technical evaluation is performed by the technical designer. This evaluation will describe the aspects encountered at the implementation of the installation based in the experience of building the model.
Finally, all the evaluations will be concluded in the last section of this chapter. Here some recommendations will be given for the further development of the product as well.

12.2 Interaction Evaluation

» J.R. Loermans

Figure 12.1. Evaluation at the university of Twente

- The display has to be inviting.
- The display has to educate people.
- The interaction should be clearly connected to the content of the information.

The two user tests, described in the introduction and appendix, highlight some expected and unexpected characteristics regarded to the interaction.
Observing people passing by the model showed that the installation did draw attention. Even in an environment in which people are familiar with similar installations or art works, people did glance at the model. According to the questionnaires the parts of the installation that attracted people to approach the installation were the solar panel and the hands on the top plane. Because in Holland solar energy is a current topic, it is not unexpected that people address this for drawing their attention. The popularity of solar panels in Jayapura is not so obvious. The panels' being attractive isn't as apparent either.

The people who are observed while passing the installation did mainly focus on this top plane. The hands and pictures on there are possibly inviting people to approach the installation. These people almost never start touching the hands though. This means that only an image of a hand might not always be sufficient to explain the functioning. One participant recommended a small manual sign, to explain what is expected from the user.
The experienced participant expected the unfamiliarity of the installation and the innovative techniques already being striking enough to stimulate the curiosity of people. She thinks that products that are different, are generally striking enough to attract people to approach, especially if the product is related to the western world. Still, because the people of Jayapura are generally more cautious in taking action, people interacting with the installation is not as obvious as it was during the test in Holland. Moreover the product will be placed in an official organization, which might increase

the degree of cautiousness of people. Because the affordance of the hands didn't seem to be self explanatory during the second test, adding this manual sign is sensible to introduce.
After asking people about the message that was told during the interaction, it became clear that everybody understood the information told on the screen as well as the top plane. They even mentioned the information being too easy because they had known everything already. The reason for this might very likely be that sustainability is a current topic nowadays. To find out the level of complexity required in the installation, this has to be tested with the official user in Papua.
That message told by the interaction was not as self explaining. Participants judged the hands as being incoherence with the rest of the installation. They didn't connected hands with working together and therefore sometimes didn't even think about asking another person to step in. Moreover it seemed more obvious for them to interpret the hands as being the representatives of the related text above. This led to a misunderstanding: people expected the left hand of the top plane being related to the consequences of diesel, while this did have a positive impact on the environment of Papua. This hand should have a negative impact on the animation. This could be solved by also connecting the positive hand by lines or arms and leaving the negative hands. By connecting the 'positive' hands the installation could still explain the need of all people involved, while the coherence of the interaction remains.
The lights that should 'drive' the solar panel has not always been noticed because the hall was too enlightened. This made the connection with what was happening on the screen and on the top plane very vague. In the real installation more pillars are installed. This way people do not only see their own light but also the lights of the neighbors. This means that the connections with light and the solar panel are more obvious. Moreover the hall of the Walikota building is a bit darker, which emphasizes the light on the panel more than it did in the hall of the university. Still to support this connection, images of solar beams can be placed on the floor or around the lamps. This will clarify the connection of the sun and the panel. By creating a smoother connection between the solar panel and the screen will also contribute to the coherence of the installation.
Many participants mentioned missing the goal of the interactive system. Because the image of the city didn't have a lot of detail, the only result they saw after placing the hand was the bar that moved. They didn't get a lot of information from the interaction. Moreover, because the installation only showed the information of only one pillar, a lot of information was missing. Creating a more detailed animation will already increase the amount of information showed. This might not only affect the attractiveness of interaction but also emphasize the installation being more informative. By connecting all pillars to the main pillar (which explains the overall project and the functioning of installation) the goal of the installation be emphasized. This connection could be done by a small map on each pillar, which explains what is told on what pillar. People will have an overview of what is going on in the installation and know where they don't understand one part of the information.

12.3 Information Evaluation

» J.R. Loermans

- The display communicates the direct and indirect consequences of the use of solar energy compared to diesel generators.
- The display shows the importance of using the technology together.
- The display communicates solar system located on the Walikota building.

The direct and indirect consequences are very obviously integrated in the design of the installation. In the model that was tested, only the pillar with direct consequences has been tested. On the screen some of the indirect consequences have been visualized though. Generally all participants understood immediately what the images on the pillar meant. These people are educated people, who can read

and already knew a lot about solar energy. The understandability of the individual pillars as well as the image on the screen should be tested with people of Jayapura to get a better insight in the understandability of this topic. The experienced person with the culture of Papua did mention the difference between the image showing the low and high maintenance not being striking enough. She recommended adding people to emphasize the effort needed to maintain diesel generators, especially because she expects this being the convincing part of the image. She also misunderstood the buildings at the background of these images. She related these to industrial buildings because of the clouds hanging around. These images should be more like the buildings in the animation on the screen. Finally she mentioned not understanding the image that explained 'supporting each other'. Because of the house in the image, she related it to governmental support, while support between people was meant.
As mentioned in the previous paragraph, the message about involvement that supposed to be explained by the interaction has not been understood by all users. Besides the options brought up in this paragraph already, this information should also be emphasized on the top planes of the pillars. Information about the Walikota building has not been tested, though it is noticed that because this part of the information was missing people didn't understand the goal of the installation. Information about the Walikota and the project that is happening there appeared to be very important to make the information complete. Because of this importance this could be emphasized by the map on the different top planes mentioned in the previous paragraph or by integrating it in the image of the screen. The goal of the installation is more obvious at the first moment the user is introduced to the installation

12.4 Technical Evaluation

» T.F. van der Heide

- The total costs of the acquired parts of the display are less than €175, 00.
- The display can be installed and maintained by mechanics on location.
- The display is solid; It is not subjected to wear or other insecurities.

The technical evaluation will be based on constructing the prototype pillar and the electronics built to this point. These experiences will be described and will lead to some recommendations for further development of the project. The above requirements will be taken into account evaluating these technical aspects.

Although the pillar is designed with an easy construction in mind, constructing the pillar some undesirable effects did occur. For instance the diagonal beam used in the pillar's frame. It does not only provide rigidity and esthetics, it also provides some very uncommon dimensions thanks to the diagonal. This results in very strange dimensions of the wooden beams to be cut, maybe leading to errors or confusing by the constructors. Nevertheless, this would not be a problem since woodworking isn't precise at a millimeter more or less. Also these dimensions occur at cutting the beams to their lengths. Diagonal cuts, that would be harder to measure, are all chosen to make common angels of 45° and 35° cuts. During the construction of the prototype pillars some problems did occur but most of them could be fixed during the process. One of them is the low thickness of the chosen sheet material for the casing of the pillar. For the sides this didn't seem to be a big problem, although the top plane does need some strength since people will place their hands on it. During the construction a thicker material is chosen for this plane. Notable is the fact that this second type of wood has another origin than the material used for the sides. The wood for the top is actually hardwood from Malaysia. It is expected that this type of plywood will also be the kind available in Jayapura. A nice side effect is that this wood is a lot prettier (especially at the edges) and a lot stronger than the cheap plywood used for the sides.

The final design is pretty resistant to wear. No movable parts are used in the product and the

only parts that could get worn out, like the halogen lights can easily be replaced on location. Parts like the electronics would be a greater problem in case of failure. However, these parts are securely mounted at the inside of the table and are not prone to wear or failure.

The total costs as estimated in 10.6, are pretty much near the maximum budget made available for this project. This is a great achievement with regard to the extensiveness of the final product. However it should be noted that this is with taking positive assumptions towards obtaining a screen. Also there will most certainly be extra costs during the construction thanks to human errors or some unforeseen parts needed. It will depend on how strictly the budget is taken in account.

12.5 Conclusions

After testing, the installation appeared to be striking enough to get the attention of people, also when it's not their goal to receive information. People are curious about the installation, are held back to interact with it though.
The information told seemed clear for the user; all participants asked could, mentioned the information being very understandable, sometimes even too understandable. These people are higher educated then the official users though. Moreover their general knowledge about the subject is strikingly more.
The participants did mentioned incoherence between the different parts of the installation. This can partly be related to the model being incomplete and partly to the context being different from the official context. Still, the concept itself should be adapted a little so that the relation between the different parts becomes more self explaining. People didn't realize that hands can be related to people being involved in the interaction. But moreover they linked the hands to the information. This way the 'negative hands' have a positive impact on the situation the screen. Although it's good that the hands are closely related to the top plane, the integration between the hands and the screen should also be obvious. Finally people missed the link between the lights and the solar panel. This is mainly due to the different context though. Many of the participants didn't understand what the goal of the installation was. Of course this is also because only part of the installation was being used in the test, so a lot of the information was missing. Still these comments did clarify the need of emphasizing the project and the goal of the project.

12.6 Recommendations

Although the installation is concluded to be pretty inviting, some changes will be needed to increase the affordance and attractiveness of the installation.
First of all a manual sign should be designed to communicate the use of the hands and motivate people to start interacting.
Secondly, because the hands are related the content of the top plane, also negative hands should be taken into account. These hands should have a negative impact on the image; the bar will move in the opposite direction. To emphasize the relations of the positive hands, and therefore the need of working together, these should also be connected by images of lines or arms. This should also be underlined in the information about involvement.
Thirdly the coherence between the different parts should be clarified more. This can be done by images of sunlight around the light, to connect the panel to the lights around.
By creating a more detailed image on the screen, the connection between the changes happening in the image of the city on the screen and the hands on the top plane, the relation between the image on the screen and the top plane is emphasized. Moreover, by doing so a lot more information can be told this underlines the installation being informative.
Finally the goal of the installation should become clear to the user. This can be done by showing a map of the top view of the installation on each top plane of the pillar. This way an overview of the entire project will be created and people know where to go if they want to know more about why

this installation is standing in the hall. By involving the Walikota building in the general interaction, for example a symbol of the building in the image on the screen, the reason why the installation is standing there becomes clear immediately.

A lot of the encountered problems related to the technical part of the evaluation have been solved during the specification and construction of the prototype. Still some aspects would need some further work after the end of this project. First, the construction manual is not yet complete for sending the construction task to Jayapura. Due to the scope and the available time of this project, it was only possible to create a manual for the construction of the pillar and the solar panel. The finishing step of the final implementation should also be necessary to guarantee a fully functional realization. Though, these required actions are documented in 11.3 and will only need similar elaboration in graphical form like the construction of the pillar and solar panel.

13.
GLOSSARY

Animation	The dynamic graphic shown at the screen in the middle of the installation. This graphic will be under the influence of the amount of hands placed at the pillars
Entrance hall	The central hall of the Walikota building. From here each part of the building can be reached.
Hand silhouette	A hand shaped silhouette is drawn around the sensor at the top plane to show people to place their hands at this spot.
Installation	The (interactive) installation is the total product to be developed for the entrance hall of the Walikota.
Interaction	The interaction includes all the actions in communication between the installation and its user.
Jayapura	Jayapura is provincial capital of Papua, Indonesia.
Papua	A province of Indonesia located at the western half of the island of New Guinea.
Pillar	The installation includes five pillars. These are the objects providing information and a way to interact with the installation.
Power distribution bar	The amount and origin of electricity virtually generated in the interaction is displayed in the animation by the power distribution bar.
PV	Photovoltaics is a technique generally used in solar panels to generate electricity from solar radiation.
Screen	The screen is positioned behind the model of the solar panel and displays the power distribution bar and representation of Jayapura influenced by the two power sources.
Top plane	The surface with printed information at the top of the pillar. It also contains the status LEDs and hand silhouettes
Walikota	The Walikota building is the public municipality building of Jayapura. At the roof a PV solar system is installed. The installation is developed to inform the visitors of the building about this system and solar energy in general.

14.
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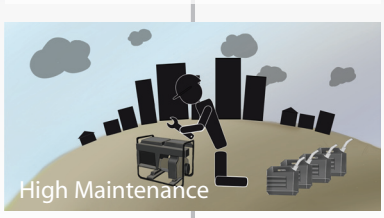
APPENDIX

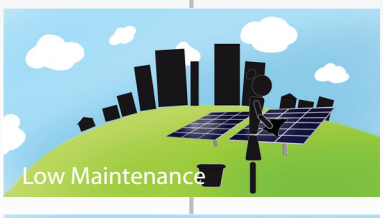
A. OVERVIEW OF TOP PLANE

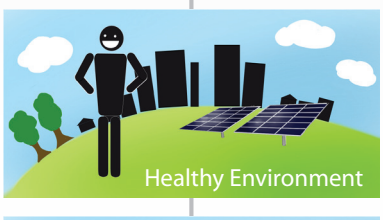
Involvement: Direct Consequences

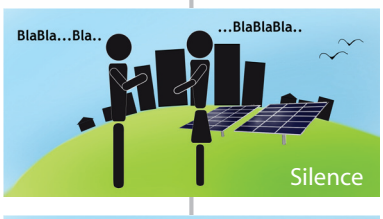
The most important consequences that diesel generators have on its environment and that can be notices immediately after its use can be divided in five subjects. Using this generator needs high maintenance; to keep it run smoothly, it has to be oiled, parts might wear and need to be changed and moreover fuels have to be supplemented. All of this costs a lot of effort as well as money. Beside this, generators produce noise and toxics. The latter influences the air quality which results in smog, and sick people and plants.

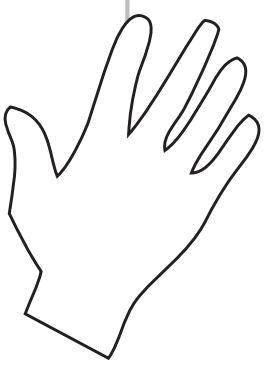


Solar panels can change this immediate impact that diesel generators have on the environment. Because sunlight has the energy to drive the panel, no expensive fuel is needed. Moreover, besides cleaning no complicated maintenance had to be executed in the first five year. Furthermore, solar panels do not produce any noise and do not influence the air quality which influence the health of the people and the environment.

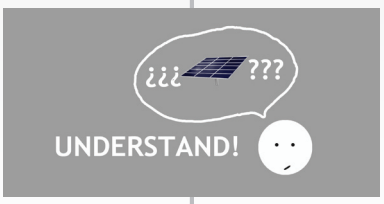


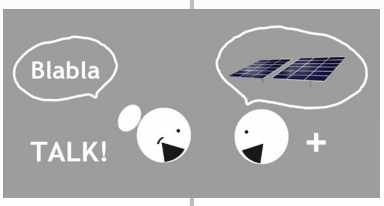


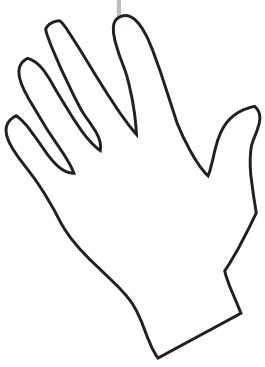




Although solar energy is very beneficial, many people are not capable of purchasing them immediately. Still, everybody can contribute to a better environment. Talking, listening and reading about solar energy creates a basic knowledge and understanding about its functioning, maintenance and importance. This is needed for the market in solar energy to start growing. Maybe you can influence the neighbor, help him in maintenance or even start developing them. Another impact you can have is by buying product from people who are investing in solar energy instead of buying from the company who uses diesel.







B1. SOURCE CODE - ANIMATION CLASS (MAIN CLASS)

```
import processing.serial.*;
import cc.arduino.*;

boolean clickMode =false;

// Arduino Values
int listNum = 1;
int lightThreshold = 60;
int ldrVal1;
int ldrVal2;
int ldrVal3;
boolean led1State;
boolean led2State;
boolean led3State;
int ldr1Pin = 3;
int ldr2Pin = 1;
int ldr3Pin = 5;

int led1Pin = 3;
int led2Pin = 4;
int led3Pin = 5;

int relay1Pin = 2;
int relay2Pin = 10;
int relay3Pin = 9;
int relay1Countdown = 10;
int relay1Counter;
int relay2Countdown = 10;
int relay2Counter;
int relay3Countdown = 10;
int relay3Counter;

// General Values
int width = 1024;
int height = 768;
int imageWidth = 720;
int imageX;
int MAX_HANDS = 3;
int maxSunValue = 15000;

// City Values
int cityY = 80;
int cityHeight = 200;
int hospitalX = 434;
int buildingsHeight = 120;
int buildingsWidth = 700;

// Bar Values
int barX;
```

```
int barY = 325;
int barHeight = 100;
color color1a = #FAD608;
color color1b = #FF8503;
color color2a = #404040;
color color2b = #000000;

// Counter Values
int counterWidth = 170;
int counterHeight = 100;
int handHeight = 100;
int handWidth = 60;
int counterSpace = 20;

// Cloud Values
int cloudDelay;
int cloudWaitCounter;
int amountClouds = 15;
int currentCloud;
boolean[] cloudVisible =new boolean[amountClouds];

// Generator Values
int generatorX = 750;
int generatorY = 550;

// Pedestrian Values
int amountPedes = 16;
int pedesImgWidth = 70;
int pedesImgHeight = 150;
int pedesScale = 7;
int pedesWidth;
int pedesHeight;

// Initialize objects and remaining variables
boolean placedHand1 =false;
boolean placedHand2 =false;
boolean placedHand3 =false;
Arduino arduino;
City city;
PFont font;
Bar bar;
Clouds[] clouds = new Clouds[amountClouds];
Pedestrian[] pedes = new Pedestrian[amountPedes];
Counter counter;
Generator generator;

int placedHands;
int sunValue;
float target;
```

```
float dtarget;

void setup() {

  // Check if clickmode or Arduino mode is enabled
  if (clickMode ==false) {
     arduino =new Arduino(this, Arduino.list()[listNum], 57600);
   arduino.pinMode(led1Pin, Arduino.OUTPUT);
   arduino.pinMode(led2Pin, Arduino.OUTPUT);
   arduino.pinMode(led3Pin, Arduino.OUTPUT);
   arduino.pinMode(relay1Pin, Arduino.OUTPUT);
   arduino.pinMode(relay2Pin, Arduino.OUTPUT);
   arduino.pinMode(relay3Pin, Arduino.OUTPUT);
  }

  // Window settings
  size(width, height);
  background(255);
  smooth();
  frameRate(20);

  imageX = (width-imageWidth)/2;
 pedesWidth = pedesImgWidth/pedesScale;
 pedesHeight = pedesImgHeight/pedesScale;
  barX = imageX;

  // Create objects
   city =new City(imageX, cityY, imageWidth, cityHeight);
   bar =new Bar(barX, barY, imageWidth, barHeight);
   generator =new Generator();

  for (int i = 0; i < amountClouds; i++) {
     clouds[i] =new Clouds();
  }

  for (int i = 0; i < amountPedes; i++) {
     pedes[i] =new Pedestrian(false);
  }
}

void draw() {
  background(255);

  // Clickable testmode for placement of hands
  if (clickMode ==true) {
    if (mousePressed && (mouseButton ==LEFT && placedHands != MAX_HANDS)) {
      placedHands++;
       mousePressed =false;
      }
```

```
    else if (mousePressed && (mouseButton  ==RIGHT && placedHands > 0 && place
      placedHands--;
      mousePressed  =false;
    }
  }
  else {
    readHands();
  }

  // Difference current transition and target
 target = (maxSunValue/MAX_HANDS)*placedHands;
 dtarget = target - sunValue;
 if (target > sunValue) {
   sunValue += dtarget * 0.10;
  }
 else if (target < sunValue) {
   sunValue += dtarget * 0.01;
   }

 // Update display of objects
city.display(sunValue);
generator.display();
bar.display(sunValue);

 cloudDelay =int(map(sunValue, 0, 15000, 20, 100));
 print(cloudDelay+  "  ");
 println(cloudWaitCounter);
 if (cloudWaitCounter <= 0 && cloudDelay < 90) {// Show a new cloud
   cloudVisible[currentCloud] =true;
  currentCloud++;
   if (currentCloud >= amountClouds) {
     currentCloud = 0;
   }
  cloudWaitCounter = cloudDelay;
 }
 else {
  cloudWaitCounter--;
 }

 // Display visible clouds
 for (int i = 1; i < amountClouds; i++) {
   if (cloudVisible[i] ==true) {
     if (clouds[i].display() ==false) {
       cloudVisible[i] =false;
     }
   }
 }
}
```

```
// Read Arduino sensors
void readHands() {
  ldrVal1 = arduino.analogRead(ldr1Pin);
  ldrVal2 = arduino.analogRead(ldr2Pin);
  ldrVal3 = arduino.analogRead(ldr3Pin);
  println(ldrVal2);

  // Check LDR1
  if (ldrVal1 < lightThreshold && placedHand1 ==false) {
     placedHand1 =true;
    placedHands ++;
   arduino.digitalWrite(led1Pin, Arduino.HIGH);
   arduino.digitalWrite(led1Pin, Arduino.HIGH);
   }
  else if (ldrVal1 > lightThreshold &&placedHand1 ==true) {
     placedHand1 =false;
    placedHands--;
   arduino.digitalWrite(led1Pin, Arduino.LOW);
  }

  // Check LDR2
  if (ldrVal2 < lightThreshold && placedHand2 ==false) {
     placedHand2 =true;
    placedHands ++;
   arduino.digitalWrite(led2Pin, Arduino.HIGH);
   }
  else if (ldrVal2 > lightThreshold &&placedHand2 ==true) {
     placedHand2 =false;
    placedHands--;
   arduino.digitalWrite(led2Pin, Arduino.LOW);
  }

  // Check LDR3
  if (ldrVal3 < lightThreshold && placedHand3 ==false) {
     placedHand3 =true;
    placedHands ++;
   arduino.digitalWrite(led3Pin, Arduino.HIGH);
   }
  else if (ldrVal3 > lightThreshold && placedHand3 ==true) {
     placedHand3 =false;
    placedHands--;
   arduino.digitalWrite(led3Pin, Arduino.LOW);
  }

  // Switch Light 1
  if (placedHand1 ==true) {
   arduino.digitalWrite(relay1Pin, Arduino.HIGH);
    relay1Counter = relay1Countdown;
   }
```

```
  else {
    relay1Counter--;
      if (relay1Counter <= 0) {
     arduino.digitalWrite(relay1Pin, Arduino.LOW);
    }
  }

  // Switch Light 2
    if (placedHand2 ==true) {
   arduino.digitalWrite(relay2Pin, Arduino.HIGH);
    relay2Counter = relay2Countdown;
    }
  else {
    relay2Counter--;
      if (relay2Counter <= 0) {
     arduino.digitalWrite(relay2Pin, Arduino.LOW);
    }
  }

  // Switch Light 3
    if (placedHand3 ==true) {
   arduino.digitalWrite(relay3Pin, Arduino.HIGH);
    relay3Counter = relay3Countdown;
    }
  else {
    relay3Counter--;
      if (relay3Counter <= 0) {
     arduino.digitalWrite(relay3Pin, Arduino.LOW);
    }
  }



}
```

B2. BAR CLASS

```
class Bar {
  int x;
  int y;
  int barWidth;
  int barHeight;
  int barValue;
  int transition;
  PImage sunIcon;
  PImage oilIcon;
  PShape wire;
  PShape wireRight;
  Counter counter;

  Bar(int  tempX,int  tempY,int  tempBarWidth,int tempBarHeight) {
    x = tempX;
    y = tempY;
    barWidth = imageWidth;
    barHeight = tempBarHeight;
     wire =loadShape("wire.svg");
     oilIcon =loadImage("oilicon.png");
     sunIcon =loadImage("sunicon.png");
     counter =new Counter();
  }

  void display(float sunValue) {
    drawIcons();
    pushMatrix();
    translate(x, y);
    shape(wire, -35, barHeight, 100,height-y-barHeight);
     barValue =int(barWidth*sunValue/maxSunValue);
    strokeWeight(1);
    drawSolarBar();
    drawOilBar();
    drawScale();
    drawBorders();
   counter.display(barValue, barHeight);
    popMatrix();
  }

  void drawIcons() {
    image(sunIcon,  (width-imageWidth)/8,barY+((barHeight-(width-imageWidth)/
    image(oilIcon, imageWidth+((width-imageWidth)/8)*5, barY+((barHeight-wid
  }

  void drawSolarBar() {
    // Calculate and display gradient of solar bar
    for (int xPos = 0; xPos <= barValue; xPos++) {
      float inter  =map(xPos, 0, barValue, 0, 1);
      color c  =lerpColor(color1a, color1b, inter);
```

```
      stroke(c);
      line(xPos, 0, xPos, barHeight);
    }
  }

  void drawOilBar() {
    // Calculate and display gradient of oil bar
    for (int xPos = barValue; xPos <= barWidth; xPos++) {
      float inter =map(xPos, barValue, barWidth, 0, 1);
      color c =lerpColor(color2a, color2b, inter);
      stroke(c);
      line(xPos, 0, xPos, barHeight);
    }
  }

  void drawBorders() {
    stroke(0);
    line(barValue, 0, barValue, barHeight + 20);
    strokeWeight(3);
    fill(0, 0, 0, 0);
    strokeWeight(10);

    // Rounded rectangle
    strokeWeight(4);
    line(0, 0, barWidth, 0);
    line(0, 0, 0, barHeight);
    line(barWidth, 0, barWidth, barHeight);
    line(0, barHeight, barWidth, barHeight);
  }

  void drawScale() {
    for (int i = 1; i < MAX_HANDS; i++) {
      stroke(255, 255, 255, 120);
      strokeWeight(3);
      line(i*barWidth/MAX_HANDS, barHeight, i*barWidth/MAX_HANDS, barHeight-1(
    }
  }
}
```

B3. CITY CLASS

```
class City {
  int x;
  int y;
  int cityWidth;
  int cityHeight;
  PShape hillsDead;
  PImage hillsAlive;
  PShape buildings;
  int sky;
  int cropHeight;
  int textFade;

  // Set initial values in constructor
  City(int  cityX,int  cityY,int  tempCityWidth,int tempCityHeight) {
     hillsDead =loadShape("hills_dead.svg");
     hillsAlive =loadImage("hills_alive.png");
     buildings =loadShape("buildings.svg");
    x = cityX;
    y = cityY;
    cityWidth = tempCityWidth;
    cityHeight = tempCityHeight;
     font =loadFont("Tahoma-30.vlw");
    textFont(font);
  }

  void display(int sunValue) {
    pushMatrix();
    translate(x, y);
    drawAir();
    drawHills();
    drawBuildings();
    drawCityArea();
    // Update display of pedestrians
    for (int i = 0; i < amountPedes; i++) {
     pedes[i].display(sunValue);
    }
    if (sunValue > maxSunValue*(MAX_HANDS-1)/MAX_HANDS) {
      fullSun();
     }
    popMatrix();
  }

  void drawAir() {
    noStroke();
    // Calculate sky tint
     sky =int(map(sunValue, 0, maxSunValue, 0, 255));
    fill(255);
    rect(0, -0, cityWidth, cityHeight);
```

```
    // Draw sky gradient
    for (int i = 0; i < cityHeight/3*2; i++) {
      strokeWeight(1);
      stroke(0, 162, 234, i*sky/cityHeight);
      line(0, i, imageWidth, i);
    }
  }

  void drawHills() {
    shape(hillsDead, 0, 0, cityWidth, cityHeight);
    // Calculate hills tint
    float tintValue =map(sunValue, 0, maxSunValue, 0, 255);
    tint(255, tintValue);
    image(hillsAlive, 0, 0, cityWidth, cityHeight);
    tint(255, 255);
  }

  void drawBuildings() {
    pushMatrix();
    translate((cityWidth-buildingsWidth)/2, cityHeight-buildingsHeight);
    noStroke();
    fill(242, 250, 0, 200);
     cropHeight =int(map(sunValue, 0, maxSunValue, 0, 10));
    rect(cityWidth-55, buildingsHeight-cropHeight, 30, cropHeight);
    shape(buildings, 0, 0, buildingsWidth, buildingsHeight);
    popMatrix();
  }

  void drawCityArea() {
    stroke(0);
    strokeWeight(3);
    line(0, 0, 0, cityHeight);
    line(0, cityHeight, cityWidth, cityHeight);
    line(0+cityWidth, cityHeight, cityWidth, 0);
  }

  void fullSun() {
     textFade =int(map(sunValue, 14000, 15000, 0, 255));
    fill(251, 188, 6, textFade);
    strokeWeight(1);
    textAlign(CENTER);
    text("Congratulations!", cityWidth/2, -10);
    fill(14, 152, 55, textFade);
    text("100% Solar Energy in Jayapura", cityWidth/2, 30);
    textAlign(LEFT);
  }
}
```

B4. CLOUDS CLASS

```
class Clouds {
  PImage cloud;

  // Cloud path attributes
  float beginX;
  float beginY = 600;
  float endX = -200;
  float  endY;
  float           distX;// X distance to move
  float           distY;// Y distance to move
  float exponent = 10;
  float x = 0.0;
  float y  =  0.0;
  float  step   =   0.005;// Step size
  float   pct    =    1.0;// Percentage to travel (1 to 0)
  float sinus = 0.0;
  int transp;
  int waitingTime;
  int counter;
  boolean visible  =false;

  Clouds() {
    beginX = imageX+imageWidth;
    endY = cityY+100;
     cloud =loadImage("cloud.png");
    distX = beginX - endX;
    distY = beginY - endY;
    transp = 255;
  }

  boolean display() {
    pct -= step;
    sinus -= step*10;
    if (pct > 0) {
      x = endX + (pct * distX);
      y = endY + (pow(pct, exponent) * distY) +sin(sinus)*15;
     }
    else if (pct <= 0) {// New cloud
      pct = 1.0;
      x = beginX;
      y = beginY;
      transp = 255;
       visible =false;
      return visible;
    }
    if (x < 300) {
       transp =int(map(x, endX, 300, 0, 255));
    }
    tint(255, transp);
```

```
    image(cloud, x, y, 200, 100);
    tint(255, 255);
     visible =true;
    return visible;
  }
}
```

B5.. COUNTER CLASS

```
class Counter {

  PShape handIcon  =loadShape("handicon.svg");
  int textX = handWidth + counterSpace;
  int textY = (handHeight + 20)/2;

  Counter() {
     font =loadFont("Tahoma-30.vlw");
    textFont(font);
  }

  void display(int  x,int y) {
    x = x - counterWidth/2;
    pushMatrix();
    translate(x, y);
    // Draw hand
    shape(handIcon, 0, 0, handWidth, handHeight);
    // Draw count
    text(placedHands, textX, textY);
    popMatrix();
  }
}
```

B6. GENERATOR CLASS

```
class Generator {

  PImage generatorIcon;
  int imageWidth = 200;
  int imageHeight = 170;
  int shake;
  int shakeMultiplier = 1;

  // Wire curve attributes
  float  cpx1  =width-imageX-700;
  float cpy1 = barY+barHeight;
  float  x1  =width-imageX-1;
  float y1 = barY+barHeight;
  float x2;
  float y2 = generatorY+60;
  float cpx2 = x2-400;
  float cpy2 = y2;


  Generator() {
     generatorIcon =loadImage("generator.png");
  }

  void display() {
    // Calculate shake
     shake =int(map(sunValue,  0,  15000,  3,  0));
    shakeMultiplier = shakeMultiplier * -1;

    // Draw wire
    stroke(40);
    strokeWeight(7);
    noFill();
    x2 = 80 + generatorX + shakeMultiplier * shake;
    curve(cpx1, cpy1, x1, y1, x2, y2, cpx2, cpy2);

    // Draw generator
    image(generatorIcon, generatorX + shakeMultiplier * shake, generatorY, ima
  }
}
```

C. QUESTIONNAIRESIN JAYAPURA

Questionnaire Culture in Jayapura/ *Kuesioner Budaya di Jayapura*

The following page shows some questions based on the Papuan culture and the culture you're living in. Please for every question write down as much as you know, also if it seems less relevant; We don't know much about your culture so the things that seem obvious to you might me new to us.
We apologize if some questions feel like an invasion of your privacy. If so please leave the question unanswered. You can answer in English as well as in Baha Indonesian. I apologize for the translation not being optimal.

Halaman berikut menunjukkan beberapa pertanyaan berdasarkan budaya Papua dan budaya Anda tinggal masuk Silahkan, untuk setiap pertanyaan tuliskan sebanyak yang Anda tahu, juga jika tampaknya kurang relevan, Kami tidak tahu banyak tentang budaya Anda sehingga hal-hal yang tampak jelas bagi Anda mungkin baru bagi kita. Kami mohon maaf jika beberapa pertanyaan merasa seperti invasi privasi Anda. Jika demikian silakan tinggalkan pertanyaan terjawab. Anda dapat menjawab dalam bahasa Inggris maupun dalam bahasa Indonesia Baha. Saya minta maaf untuk terjemahan tidak optimal.

Personal/Personawi

Name/nama:
Date of Birth/ *tanggal lahir*:
Occupation/ *pendudukan*:
Study/ *belajar*:
Graduation year/ *lulus tahun:*

Papua:

How would you describe the Papuan culture? *Bagaimana andamenggambarkan budaya papua?*

How would you describe the culture in Jayapura? What is the difference?
Bagaimana Anda menggambarkan budaya di Jayapura? Apa bedanya?

What does Papua/Jayapura mean to you?/ *Apa artinya bagi Anda Papua/Jayapura?*

Social Life/ kehidupan sosial

Who are the most important people in your life, why?/ Siapa orang-orang paling penting dalam hidup Anda, *mengapa?*

How is the social network in Jayapura? (who knows who, whom are important to who, are their social classes etc?) /*Bagaimana jaringan sosial di Jayapura? (yang tahu siapa, yang penting siapa, adalah kelas sosial mereka dll?)*

How do people in Jayapura respond to strangers (people they don't know) in public spaces? Is that different from private places? *Bagaimana orang di Jayapura menanggapi orang asing (orang yang mereka tidak tahu) di ruang publik? Apakah itu berbeda dari tempat-tempat pribadi?*

Family/ keluarga:

Who does your family consist of? *Siapa yang keluarga Anda terdiri dari?*

What is your role in the family and the role of the rest of your family members? *Apa peran Anda dalam keluarga dan peran seluruh anggota keluarga Anda?*

Describe ways of manner between the different members? How to address each other? *Menjelaskan cara cara antara anggota yang berbeda? Bagaimana untuk mengatasi satu sama lain?*

Where do the different members of your family live? When do you contact them and why? *Di mana anggota berbagai keluarga Anda hidup? Kapan Anda menghubungi mereka dan mengapa?*

Do you believe you're family to be an average family from Jayapura? Why (not)?/ *Apakah Anda percaya Anda keluarga menjadi keluarga rata-rata dari Jayapura? Mengapa (tidak)?*

Neighborhood/ Lingkungan

Where do you live and with whom? Describe your neighborhood and your roommates.*Di mana Anda tinggal dan dengan siapa? Jelaskan lingkungan Anda dan teman sekamar Anda.*

How is your relationship with the people in your neighborhood? *Bagaimana hubungan Anda dengan orang-orang di lingkungan Anda?*

How do you address people in the streets? *Bagaimana Anda mengatasi orang di jalanan?*

Do you believe your neighborhood and the relation with your neighborhood to be standard in Jayapura/Papua? Why (not)? *Apakah Anda percaya lingkungan Anda dan hubungan dengan lingkungan Anda menjadi standar di Jayapura / Papua? Mengapa (tidak)?*

Colleague and Friends / Rekan dan Teman

How did you meet your friends?/ Bagaimana Anda bertemu teman Anda?

Where do you and your friends do during weekdays/weekend?/ *Di mana Anda dan teman Anda lakukan selama hari kerja dan akhir pekan?*

When and where do you meet you colleagues?/ *Kapan dan di mana Anda bertemu rekan?*

Do you believe this to be typical in the Papuan Culture/Culture in Jayapura?/
Apakah Anda percaya ini menjadi khas di Papua Budaya / Budaya di Jayapura?

Religion/Agama

What is your religion*?/ Apa agama Anda?*

What do people think of people with an other cultures in Jayapura?And how do they respond to that? *Apa orang berpikir dari orang dengan budaya lain di Jayapura? Dan bagaimana mereka menanggapi itu?*

Do people in Jayapura talk about their religion?/ *Apakah orang di Jayapura bicara tentang agama mereka?*

Daily Rhythm and Activities/ Harian Rhythm dan Aktivitas

Could you describe your standard routine during week and work days? *Bisakah Anda menggambarkan rutin standar Anda selama seminggu dan hari kerja?*

What are the activities that you do inside the house? *For how long? Apa kegiatan yang Anda lakukan di dalam rumah? Untuk berapa lama?*

Do you believe this to be typical in the Papuan Culture/Culture in Jayapura? What's the difference? *Apakah Anda percaya ini menjadi khas di Papua Budaya / Budaya di Jayapura? Apa bedanya?*

Customs/ Bea cukai

What is the difference between men and women? *Apa perbedaan antara pria dan wanita?*

Can you describe typical habits from the Papuan or jayapuran culture? *Dapatkah Anda menjelaskan kebiasaan khas dari Papua atau budaya Jayapura?*

Do your believe people in Jayapura to be helpful to eachother? In which situation? *Apakah Anda percaya orang-orang di Jayapura untuk membantu dengan eachother? Dalam situasi?*

Do people rather act together of like individuals, why? Apakah orang lebih bertindak bersama-sama individu seperti, mengapa?

What do you do if you meet an older person/someone youo don't know? *Apa yang Anda lakukan jika Anda bertemu orang tua atau seseorang yang Anda tidak tahu?*

What do you do if someone leaves? *Apa yang Anda lakukan jika daun seseorang?*

Fashion/Mode

What do the following colors mean to you? *Apa warna berikut bagi Anda?*

Red/*merah:*
Yellow/*kuning:*
Green/*hijau:*
Brown/*coklat:*
Blue/*biru:*
Orange/*jeruk:*
Purple/*ungu:*
Pink/*berwarna merha muda:*
Black/*hitam:*
White/*pituh:*
Golde/*Emas:*

What do you believe to be fashionable? *Apa yang Anda percaya untuk menjadi modis?*

What media do you use, (television show/computer programs/radioprograms/magazines)? Which?Why? *Media apa yang Anda gunakan?* (acara televisi / komputer program / program radio / majalah)? *Mengapa?*

What games did you play when you where you or do you still play? *Apa permainan yang Anda bermain ketika Anda di mana Anda atau apakah Anda masih bermain?*

Economical/Economis

Do people in Jayapura talk about money? If so, what do they talk about? *Apakah orang-orang di Jayapura berbicara tentang uang? Jika demikian, apa yang mereka bicarakan?*

Why do you work? *Mengapa Anda bekerja?*

Are you saving your money? Where for? *Apakah Anda menghemat uang Anda? Dimana untuk?*

Do you have bank account? Do you use it? *Apakah Anda memiliki rekening bank? Apakah Anda menggunakannya?*

Do you have a credit card? Do you use it? Apakah Anda memiliki kartu kredit? *Apakah Anda menggunakannya?*

Do you have a lone? *Apakah Anda memiliki tunggal?*

Do you invest money on something? In what? *Apakah Anda menginvestasikan uang pada sesuatu? Dalam apa?*

Do you believe most people from Jayapura see money like you do? *Apakah Anda percaya kebanyakan orang dari Jayapura melihat uang seperti yang Anda lakukan?*

Environmental/Lingkungan

Do people in Jayapura talk about the environment, if so what do they talk about? *Apakah orang di Jayapura bicara tentang lingkungan, jika demikian apa yang mereka bicarakan?*

What do you believe to be environment problem of the world as well as in Papua? *Apa yang Anda yakini sebagai masalah lingkungan dunia serta di Papua?*

Why do you think using benzene generators are bad for the environment? *Menurut Anda, mengapa menggunakan generator benzena yang buruk bagi lingkungan?*

What do you to believe to be natural energy sources? *Apa yang Anda percaya untuk menjadi sumber energi alam?*

Do you believe the people of Papua are aware of the environmental problems? Why? *Apakah Anda percaya rakyat Papua sadar akan masalah lingkungan? Mengapa?*

Daftar pertanyaan walikota Jayapura

Untuk merancang produk informasi, informasi dasar tentang walikota diperlukan. Informasi ini meliputi: informasi tentang distrik dari walikota, informasi tentang orang-orang hidup ini distrik dan informasi tentang walikota diri. Utuk mengumpulkan ini informasi, jawaban atas setelah pertanyaan diperlukan. Tapi juga menemukan orang yang tepat akan membantu. Partanyaan daftar pada setelah halaman:

Lokasi Walikota Jayapura

Mana di Jayapura Walikota terletak?
Apa bangunan sekitarnya?
Apa lain aktivitas di dalam dan sekitar bangunan?
Menggambarkan lingkungan sekitarnya?
Apakah Anda pernah melihat sesuatu dari lingkungan sekitarnya atau orang-orang?
Apa situasi yang ekstrim terjadi pada 5/10 tahun terakhir?
Apakah ada entitas sekitarnya gedung, selain pengunjung dan karyawan?
Bagaimana iklim berubah dari tahun?

Distrik pengguna Walikota Jayapura

Apa daerah Papua merupakan bagian dari distrik Walikota?
berapa banyak orang tinggal di sana?
Apa yang telah kebangsaan masyarakat yang tinggal di kabupaten ini?
Apa tingkat pendidikan telah orang-orang yang tinggal di sana?
Berapa rasio orang buta huruf?
Berapa rasio manusia dan perempuan?
Berapa rasio orang yang kristen, beragama Islam, Hindu dan orang-orang dengan agama lain?
Bagaimana tingkat kemiskinan rakyat di daerah ini?
Apakah orang-orang yang aman, menginvestasikan uang atau memiliki tunggal?
Bagaimana perubahan kota selama 60 tahun terakhir?
Berapa persentase penduduk Jayapura memiliki usia berapa?
Berapa banyak energi yang digunakan sehari-hari di distrik?
Apa yang terjadi jika listrik dimatikan?
Apakah peraturan sehubungan dengan masalah lingkungan?
Apa saja peraturan tentang imigrasi?
Apakah ada peraturan tentang energi surya, lingkungan atau media?

Struktur Wallikota Jayapura

Menjelaskan struktur walikota Jayapura?
Apa departemen terletak di bangunan pertama?
Apa departemen terletak di bangunan kedua?
Bagaimana departemen yang berbeda mempengaruhi satu sama lain?

Karyawan Walikota Jayapura

Siapa karyawan di departemen?
Terendah Pendidikan:
Tertinggi pendidikan:
Rasio dua kelamin:
tugas per deparmen:
Jam kerja:
Istirahat jam:
Jumlah karyawan:

rasio dari berbagai usia:
terendah usia:
tertinggi usia:

jawab pihak Walikota Jayapura

Siapa yang akan bertanggung jawab untuk sistem surya setelah menginstal? Mengapa?
Siapa yang akan bertanggung jawab atas informasi produk setelah menginstal? Mengapa?
apa pekerjaan mereka?
Apakah tingkat pendidikan mereka?
Apa yang mereka tahu tentang energi surya?
Apa yang mereka tahu tentang komputer?
Apa yang mereka tahu tentang instalasi teknis?

Pengunjung walikota Jayapura

Siapa saja pengunjung Gedung walikota kedua?
Berapa banyak pengunjung yang ada setiap minggu?
Apa jam tim tamu?
Apakah agama mereka?
Jenis kelamin mereka?
Berapa usia mereka?
Apa pekerjaan mereka?
Apa tujuan mereka?
Bagaimana mereka menghabiskan waktu mereka di sana?
Apakah mereka perlu kembali ke walikota Jaypara?
Seberapa sering orang perlu pergi ke sana?

Daftar pertanyaan walikota Jayapura

Untuk merancang produk informasi, informasi dasar tentang walikota diperlukan. Informasi ini meliputi: informasi tentang distrik yang ada di wilayah Kota Jayapura, informasi tentang orang-orang hidup ini distrik dan informasi tentang Walikota. Untuk mengumpulkan informasi tersebut , jawaban atas pertanyaan – pertanyaan berikut sangat diperlukan dari sumber (orang) yang tepat yang nantinya akan membantu maksud tersebut. Daftar Partanyaan yang dimaksud dapat dijumpai pada halaman berikut :

Lokasi Walikota Jayapura

Dimana Kota Jayapura terletak?

Berapa banyak orang yang datang ke kantor Walikota Jayapura?

Apa saja aktivitas yang di lakukan di lingkungan Kantor Walikota?

Aktifitas apa saja yang berlangsung di sekitar Kantor Walikota?

Apakah anda pernah mendata aktifitas di sekitar Kantor Walikota?

Situasi ekstrim(mencolok) apa yang terjadi dalam kurun waktu 5/10 tahun terakhir?

Apakah ada pengunjung yang tidak lasim selain tamu dan karyawan (misal : binatang atau orang mabuk)?

Bagaimana perubahan iklim setiap tahun?

Pengguna Kantor Walikota Jayapura

Apakah setiap penduduk di wilayah kota Jayapura berurusan ke kantorWalikota?

Berapa jumlah penduduk yang ada di wilayah Kota Jayapura?

Suku apa saja yang tinggal di kota Jayapura?

Bagaimana tingkat pendidikan penduduk di Kota Jayapura?

Berapa orang buta huruf?

Berapa rasio laki-laki dan perempuan?

Berapa rasio pemeluk agama kristen, Islam, Hindu dan agama lainnya di Kota Jayapura?

Bagaimana tingkat kemiskinan masyarakat di daerah ini?

Bagaimana tingkat kesadaran masyarakat untuk menggunakan uang mereka demi masa ?

Bagaimana perubahan kota selama 60 tahun terakhir?

Berapa persentase jumlah penduduk di kota Jayapura berdasarkan usia?

Berapa banyak energi yang digunakan sehari-haridi tiap distrik yang ada di kota Jayapura?

Apa yang terjadi jika listrik dimatikan?

Peraturan apa saja yang berhubungan dengan masalah lingkungan? (baik perda maupun peraturan perundang-undangan lainnya)

Peraturan apa saja yang berhubungan dengan imigrasi? (baik perda maupun peraturan perundang-undangan lainnya)

Apakah ada peraturan tentang energi surya, lingkungan atau media? (baik perda maupun peraturan perundang-undangan lainnya)

Struktur Wallikota Jayapura

Jelaskan struktur Pemerintahan Walikota Jayapura
SKPD atau satuan unit kerja apa saja yang terletak pada kantor pusat?
SKPD atau satuan unit kerja apa saja yang terletak pada kantor otonom?
Berapa Jumlah SKPD yang ada diluar kedua kantor tersebut diatas?
Bagaimana SKPD atau satuan unit kerja yang berbeda mempengaruhi satu sama lain?

Karyawan Walikota Jayapura

1. Siapa saja yang bekerja di SKPD atau satuan unit kerja di lingkungan Pemda Kota Jayapura? (latar belakang ilmu)
2. Pendidikan terendah karyawan:
3. Pendidikan tertinggi karyawan:
4. Rasio karyawan wanita dan pria:
5. tugas setiap SKPD dan unit kerja yang ada di Lingkungan Kota Jayapura:
6. Jam kerja:
7. Istirahat jam:
8. Jumlah karyawan:
9. Rasio dari berbagai usia:
10. Usia termuda:
11. Usia tertua :

Respon Kantor Otonom

Siapa yang akan bertanggung jawab untuk sistem surya setelah menginstal? Mengapa?
Siapa yang akan bertanggung jawab atas informasi produk setelah menginstal? Mengapa?
Apa pekerjaan mereka?
Apakah tingkat pendidikan mereka?
Apa yang mereka tahu tentang energi surya?
Apa yang mereka tahu tentang komputer?
Apa yang mereka tahu tentang instalasi teknis?

Pengunjung Walikota Jayapura

Siapa saja pengunjung kantor Otonom?
Siapa saja pengunjung Kantor pusat?
Berapa banyak pengunjung yang ada setiap minggu pada kedua kantor tersebut?
Apa jam untuk bertamu ?
Apakah agama mereka?
Jenis kelamin mereka?
Berapa usia mereka?
Apa pekerjaan mereka?
Apa tujuan mereka?
Bagaimana mereka menghabiskan waktu mereka disekitar kantor otonom dan kantor pusat saat menunggu?
Apakah mereka perlu kembali berulang – ulang untuk hal yang mereka perlukan di Kantor tersebut?
Seberapa sering orang setiap warga Kota datang ke Kantor Walikota?

D. USER TEST

FRAMING USER TEST:

For this part of the user test, a model of part of the installation is placed in the hall of a university building between lunch hours. This location is more lighted than the hall of the governmental building. It is larger and filled with more and different kind of striking objects. It is visited by people with different culture, background, education, and interest. All these differences have to be taken into account when drawing conclusion out of these user tests.
The installation existed of one pillar the model of the solar panel and a computer screen showing the images of the bar and the city. On the top of the pillar, the information about direct consequences is showed.

FIRST PART:

In the first part of the user test the reactions of the passengers in the hall has been observed. Because the installation was placed in hall around break hours, a lot of people passed the installation and so the reaction of many people can be investigated. Because this location is a lot more crowded during this time than the governmental building in general, this difference has to be taken into account. Because the product was located in the hall of a technical university, the majority of the people surrounding the installation are highly educated and interested in more technical information. Moreover the age of the people varies between 18 and 65 and the majority of the people have Dutch nationalities.

SECOND PART:

In the second part of the user test the same set-up is used; the product is still at the same place, and a large amount of people are still moving around the product. This time people are asked to first observe the installation and answer some questions based on these observations, followed by interacting with the product and answering a second pair of questions based on this experience. In total nine people are asked to do so, varying in gender and age (between 20 years old up to 60 years old), and all having Dutch nationalities and backgrounds. All of the participants were studying at university or have finished high level educations.

GEBRUIKERS TEST

OVER EEN AANTAL MINUTEN GAAT U BEGINNEN MET HET ONTDEKKEN VAN HET GEBRUIK VAN EEN INTERACTIEVE INSTALLATIE DIE IN EEN GEMEENTEHUIS VAN DE HOOFDSTAD VAN PAPUA KOMT TE STAAN. VOORDAT U GAAT BEGINNEN MET DE DAADWERKELIJKE INTERACTIE ZIJN ER EEN AANTAL VRAGEN DIE U GAAT BEANTWOORDEN. HIERNA ZAL HET TESTEN

VAN HET GEBRUIK BEGINNEN. DE VRAGEN DIE HIEROP VOLGEN STAAN OP DE VOLGENDE BLADZIJDE. DEZE VRAGEN MOGEN PAS BEKEKEN WORDEN NA HET DAADWERKELIJKE GEBRUIK.

- HOE VERWACHT U DAT HET PRODUCT GEBRUIKT GAAT WORDEN?
- WAT VERTELT HET PRODUCT OVER DE INHOUD?
- HOE VERWACHT U DAT U OP ZOU REAGEREN ALS DEZE INSTALLATIE IN DE HAL VAN HET GEMEENTEHUIS ZOU STAAN?
- VINDT U HET PRODUCT UITNODIGEN OM TE BENADEREN?
- VINDT U HET PRODUCT UITNODIGING OM TE GEBRUIKEN?

U MAG NU HET PRODUCT MAG GAAN GEBRUIKEN

U KUNT NU DE VOLGENDE VRAGEN BEANTWOORDEN

- WAT TROK UW AANDACHT IN HET PRODUCT?
- WAT VINDT U VAN HET GEBRUIK VAN HET PRODUCT
- WAT VINDT U VAN HET UITERLIJK VAN HET PRODUCT?
- WAT HIELD U BETROKKEN BIJ HET GEBRUIK VAN HET PRODUCT?
- WAT HEBT U ALS IRRITANT ERVAREN BIJ HET GEBRUIK VAN HET PRODUCT?
- WAT HEBT U ALS POSITIEF ERVAREN BIJ HET GEBRUIK VAN HET PRODUCT?
- ZOU U HET PRODUCT BENADERD HEBBEN IN UW VOORBIJGANG? ZO JA, WAAROM?
- WAT VERTELT HET PLAATJE OP HET SCHERM?
- WAT VERTELT DE INFORMATIE OP DE PILAAR?
- WAT HEBT U NAAR UW IDEE NIET GOED BEGREPEN?
- WAT HEBT U ALS OVERBODIGE INFORMATIE ERVAREN?
- VINDT U DE INFORMATIE DIE HET PRODUCT VERTELT GELOOFWAARDIG? GEEF DIT AAN OP EEN SCHAAL VAN 1 TOT 5? WAAROM?
- VINDT U DE INFORMATIE DIE HET PRODUCT VERTELT INTERESSANT? GEEF DIT AAN OP EEN SCHAAL VAN 1 TOT 5? WAAROM?
- KUNT U HET GEBRUIK VAN HET PRODUCT UITLEGGEN?
- HOE HEBT U DIT ONTDENKT?
- HOE IS DE RELATIE TUSSEN DE ACTIE VAN INTERACTIE EN DE CONTENT?
- WAT ZIJN VOLGENS HET PRODUCT DIRECTE CONSEQUENTIES VAN ZONNE-ENERGIE IN VERGELIJKING MET EEN DIESEL GENERATOR?
- WAT ZIJN VOLGENS HET PRODUCT LANGE TERMIJN GEVOLGEN VAN HET GEBRUIK VAN ZONNEPANELEN IN VERGELIJKING MET DE DIESEL GENERATOR?
- WAT KAN MEN VOLGENS HET PRODUCT DOEN OM BIJ TE DRAGEN AAN EEN GROTERE BETROKKENHEID (INVOLVEMENT) IN HET MILIEU?

- Hoe was de interactie tussen u en andere personen?
- Hoe zou u meer mensen bij de interactie willen betrekken?
- Heb t u geprobeerd de gehele interactie tot een einde te brengen? (uit te spelen?) Hoe?
- Hebt u nog aanbevelingen of verbeteringen?

Dit is het einde van de gebruikers test. Bedankt voor uw tijd.

Results User Test:

The first part of the results is based on observations done. The Second part exists of summaries of the answers the nine people gave on the questions mentioned in the previous paragraph.

First Part:

Generally people that came within 10 meters of the installation did notice the object. All people that passed it from a further distance got interrupted by all other things that were going in this hall. The majority of the people stared at the installation while passing by. Only few did really stop. People, who did stop, observed the top plane and moved on. People only start interacting with the installation if the person was waiting on something or when he had seen something else do it. Larger groups of people were more likely to do so.
Once someone started 'playing' with the installation, the product got more attention; more people stopped to take a look. Although this is a way of passive involvement of other people within the interaction, actively involve others was not as likely to happen. People did ask other people place a third hand, only if that person was familiar and in the neighborhood. If this was not the case, they walked away or used their elbows.

Second Part:

Participant one:

The participant expected the interface to give information about the procedure taking place in the governmental building. Because of this, she felt the necessity to take a look at the installation. When taking a closer look she noticed the installation communicating solar energy. Still although she knew what it was about, she couldn't figure out the goal of the installation. Up to the end she tried to figure this out. She even mentioned this to be a reason for keeping attached to the interaction.
The fact than the installation was something new and interactive made her curious about the product. She understood all the information all the information told en mentioned this to be nothing new from what she knew already.
The part she didn't understand about the installation was the fact that covering the hand attached to the information about diesel contributed to a better and cleaner Papua. She discussed that covering this hand should result in a worsening of the environment.

Participant two:

The participant expected the installation to inform about solar energy and the environment, especially because of the model of the solar panel. Touching the information was expected because of the hands shown on the top plane of the installation. The experiences this use to be easy, though mentioned the low speed of the deflation of the bar as being annoying. She understood the content of the installation and the information mentioned on the screen. She didn't relate working together with other people on the installation with the need to do so for creating a better environment. She did involve other people in the installation. This person was a friend of her tough.
As well as the previous participant this participant didn't understand the coherence between the hand related to diesel and the positive impact on the environment.

Participant three:

This person mentioned the same expectation as the previous participant: The content of the installation being about the environment and the interaction being done by touching. He also mentioned this being a reason to approach the product in case it would be standing in the hall of the governmental building
The participant mentioned the information being obvious and not very interesting. The latter had more to do with his general interest in the subject, than the difficulty of the information.
Involving more people is also done by this person. The people were acquaintances of the participant though and already involved by observing this person. Although this team work had taken place, the participant mentioned 'not able to cover all hand by yourself 'as being annoying. When she found out, the goal of the interaction was to involve others in the interaction, she discussed that intergrading more hands, or even feed, to make this more self explanatory.

Participant four:

This was the only participant that expected to respond more cautious in case he was placed in the hall of the governmental building. He also mentioned the interaction as being unclear, though said this was the positive part of the installation. The slow respond time when a hand is moved was mentioned as being annoying.
This person did seem to understand what the information on the screen as well as on the top plane was trying to tell him. As well as the previous participants he mentioned contradiction in the fact that the hand connected to diesel information positively influencing the environment on the screen.
Also this participant mentioned the functioning and the goal of the installation being unclear. He advises to explain this more somewhere on the installation.
This person didn't interact with other people in any way.

PARTICIPANT FIVE:

The participant did understand all information mentioned on the top plane. He has been one of the two people who did understand the relation between the interaction of more people in the installation and the need of working together in real life. He did only start noticing this after actively thinking about the functioning of the installation though. Still he mentioned the lack of coherence between the three parts: the hands on the top plane, the solar panels and the screen.
This person mentioned the interactive character of the installation as being a positive characteristic. He understood the functioning of the installation rather fast. He even said that the fact that people can 'play' with the product is expected to be rather inviting. He recommends a larger screen though, to emphasize the small details in the animation.

PARTICIPANT SIX:

The sixth participants says he would start using the installation, but only if he has to wait for something or someone. The solar panel would be the reason for him to take a look, while the animation and the interaction would stimulate him to stay involved. This person also missed the coherence in the different parts and it took him a while to understand how all parts where related to each other. Probably for this reason he called the interaction confusing.
The participant did understand all information told on the screen and top plan though as well as the need for more people to reach a goal.

PARTICIPANT SEVEN:

The participant mentioned the hand on the top plane as being inviting. He did recommend emphasizing and clarifying this use even more by using these symbols on the floor and walls. He also recommended a larger screen to clarify details and be more inviting.
This person did understand all information told as well as the functioning. He had a hard time figuring out what was meant with the symbol indicating a diesel generator. He mentioned clarifying the connection with the sun and the solar panels, because people in Papua don't know what solar panel is.
As well as the previous participant, he was annoyed by the disability of not being able to cover all hands on the top plane. Covering the third feels like cheating while if not doing so the interaction can't be 'finished'

PARTICIPANT EIGHT:

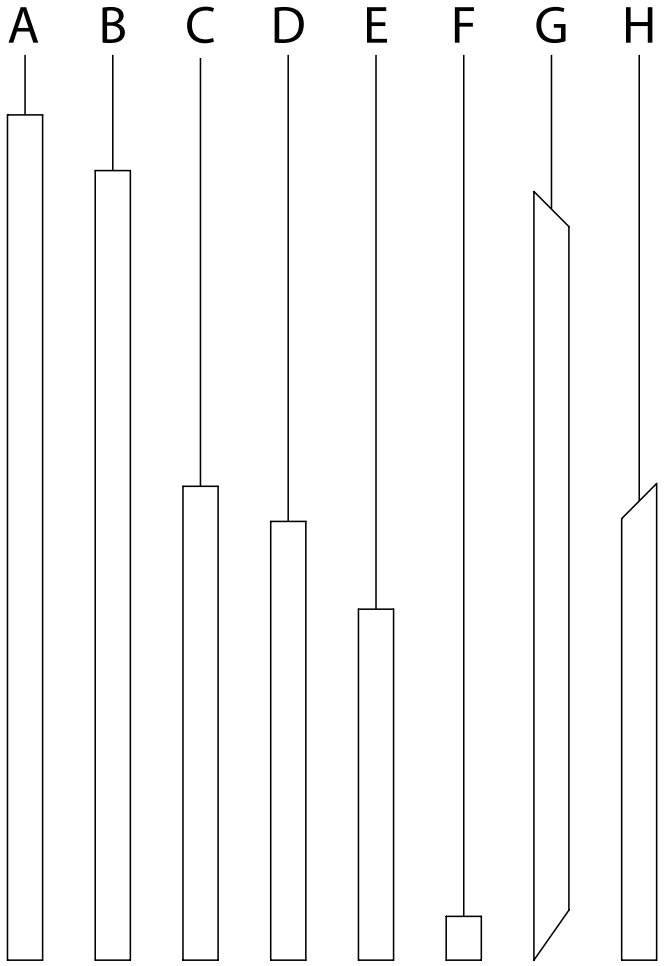
This participant had already seen other people interact with the system and mentioned this being the reason for expecting the installation being interactive. She didn't know how this interaction would take place, though said this would be a reason for her to take a look, as well as the moving images on the screen. This person was the only one who mentioned the lights on the top plane. According to her this motivated her to keep involved. She also, was annoyed by the fact that she was not able to enlighten all three lights by self. This did motivate her to ask someone to help her. Again this person asked, was an acquaintance of the participant of the participant.
The participant did understand what was told on the top plane, but didn't understand what was meant with the image of the screen. She couldn't see the difference between short and long time consequences of using solar energy.

PARTICIPANT NINE:

The final participant had the expectation of the solar panel being authentic and therefore expects not to have an impact on the installation. For this reason she would take a look but then walk around the installation in case the installation would be located at the governmental building. Moreover she does mention the subject being interesting but also says that she had heard too much about it stay inviting. The basic level of information does emphasize this feeling disinterest.
The participant did understand all information told on the screen and top plane, but mentioned the goal of the installation being unclear. Moreover she said she would have never figured out to use a third hand to complete the interaction, if not helped with a second participant. Also this person noticed the lack of coherence between the hand related to diesel energy and the positive influence on the city on the screen.
For this person, the hands have been the signs that invited to interact with the product. The fact there were three did annoy also this person. Still she did invite an acquaintance to help her solve this problem.

Pillar

Materials



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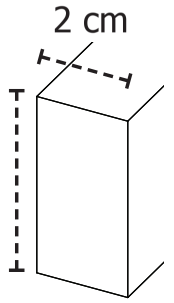
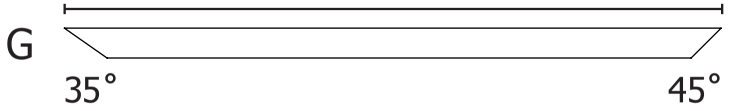
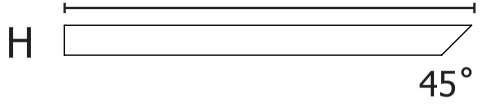
A, B, C, D, E, F, G, H → 4 cm



		#
A	96,4 cm	2x
B	90 cm	2x
C	54 cm	1x
D	50 cm	3x
E	40 cm	2x
F	5 cm	2x
G	87,6 cm	2x
H	54,3 cm	2x





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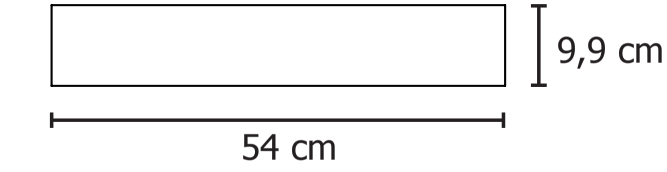

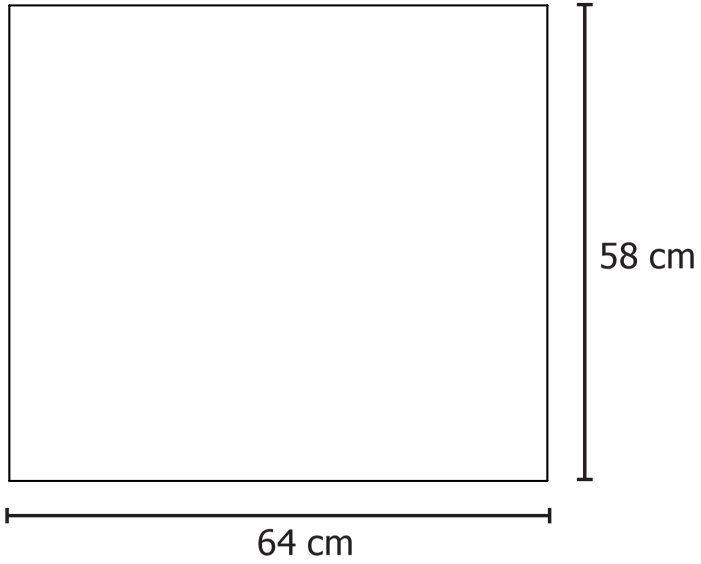

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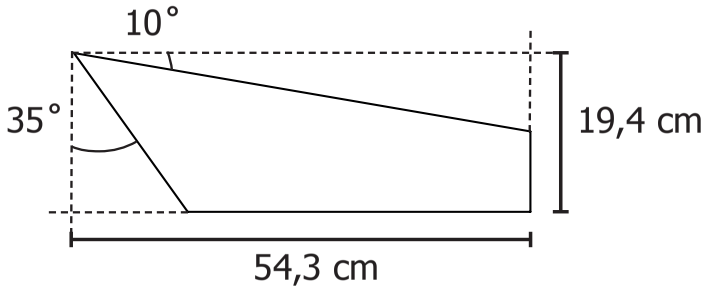

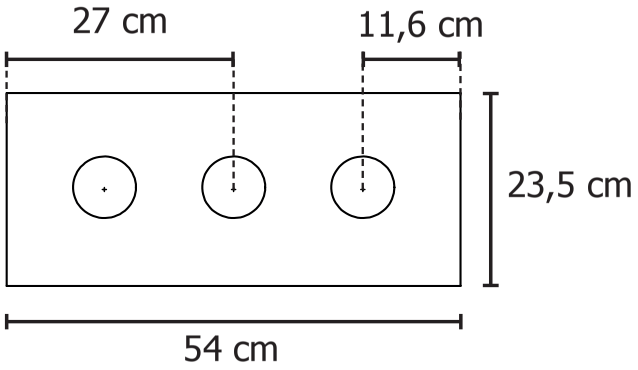

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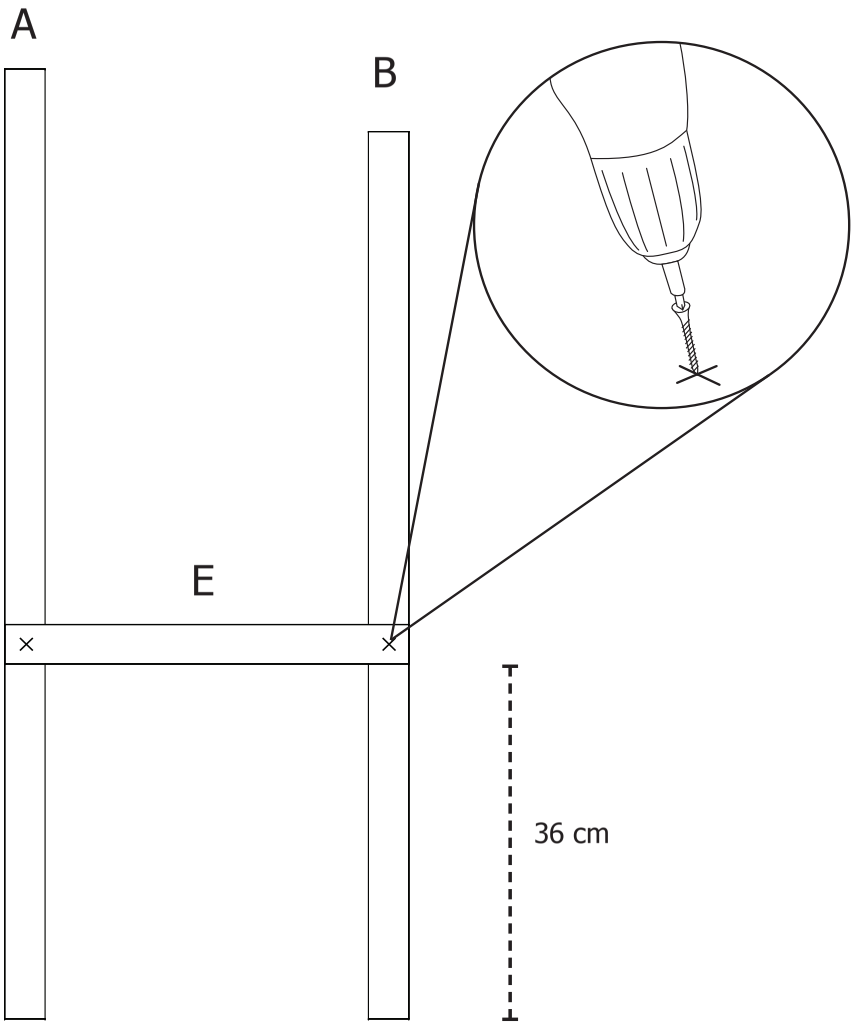

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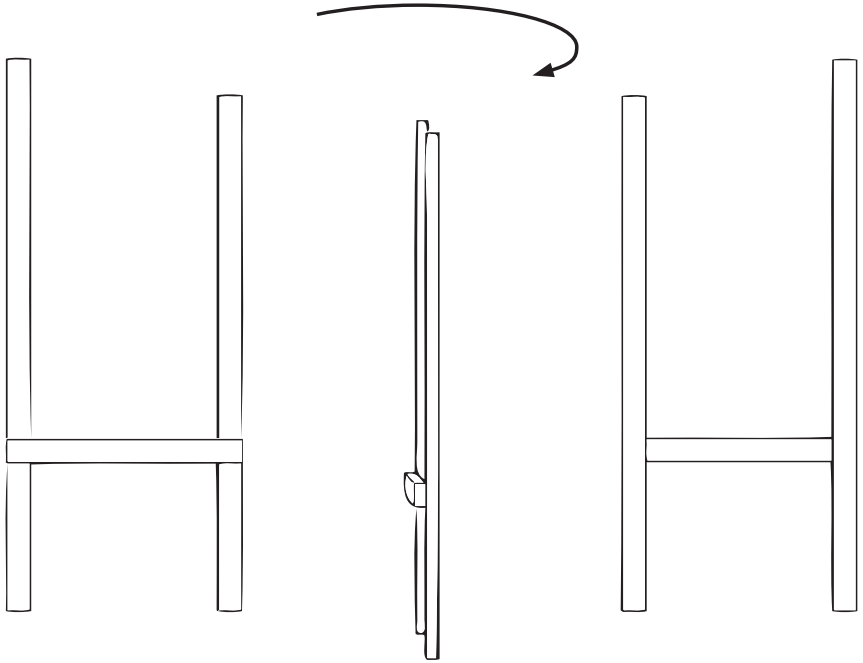

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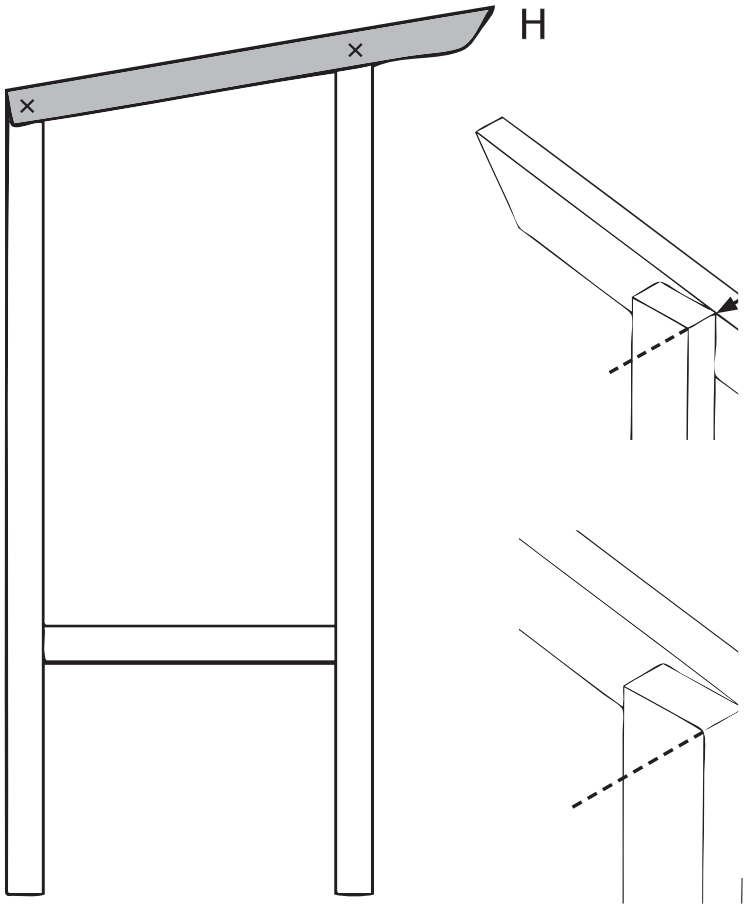

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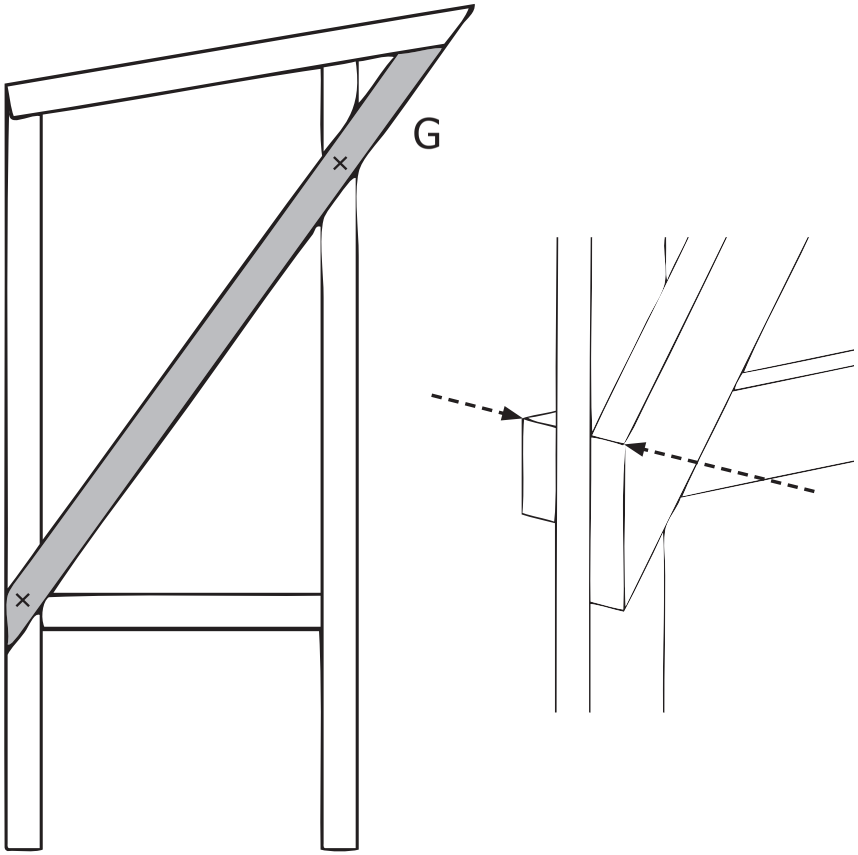

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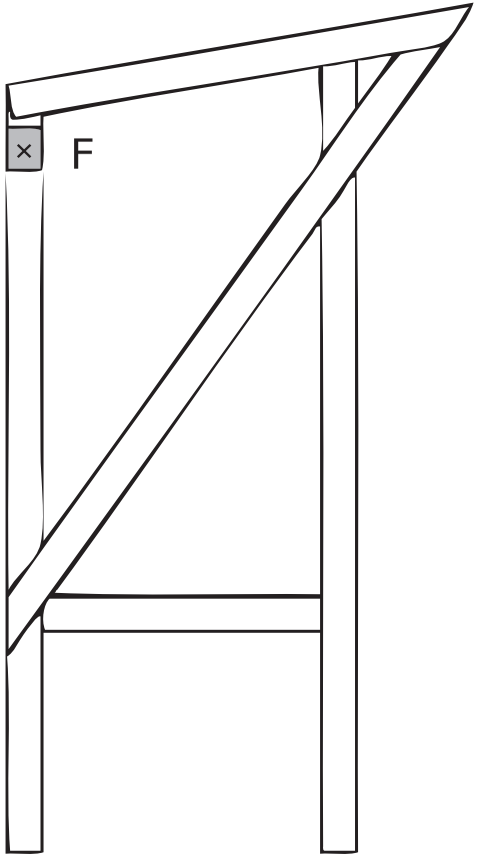

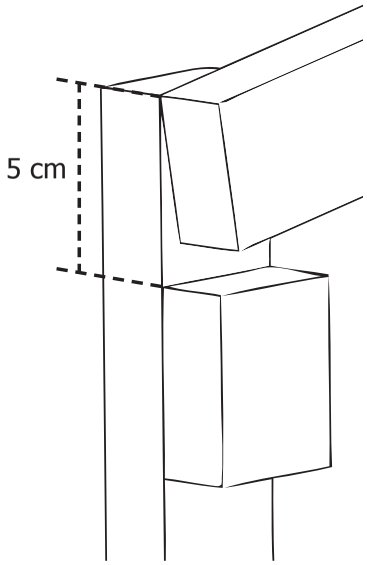

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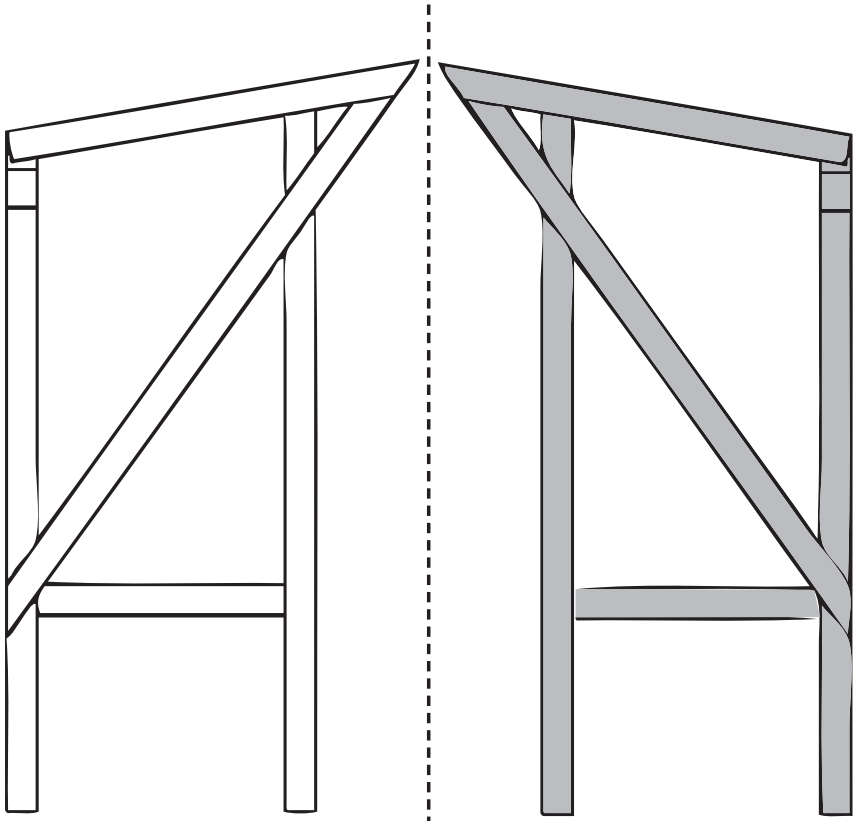
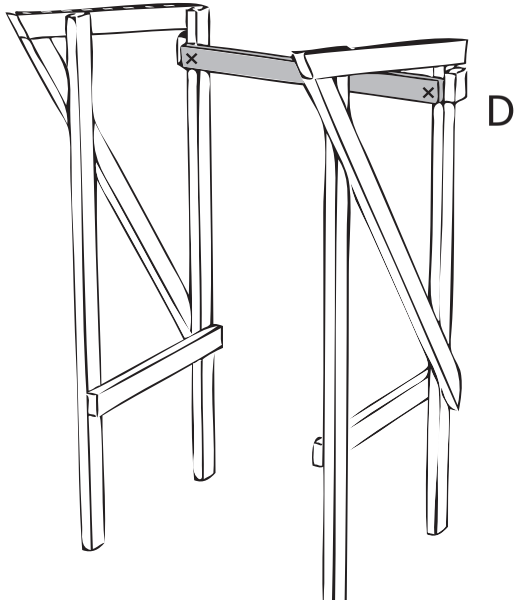
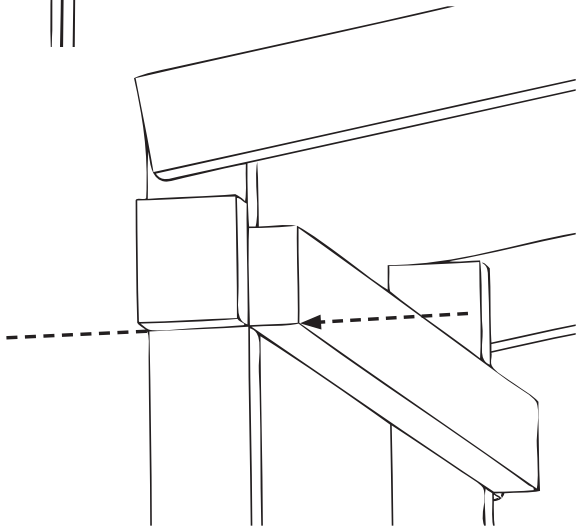


Step
1., 2., 3., 4., 5.

7.





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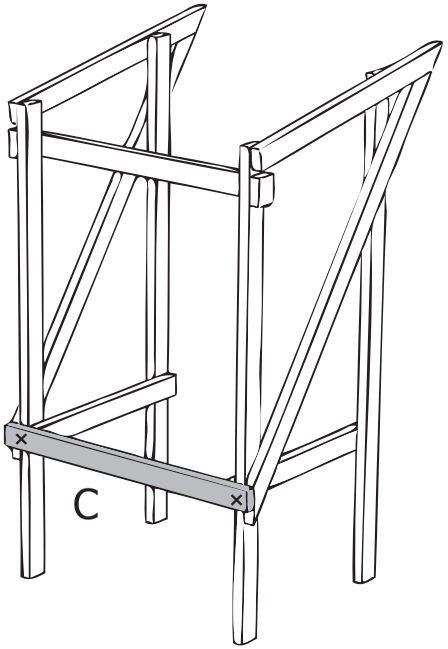

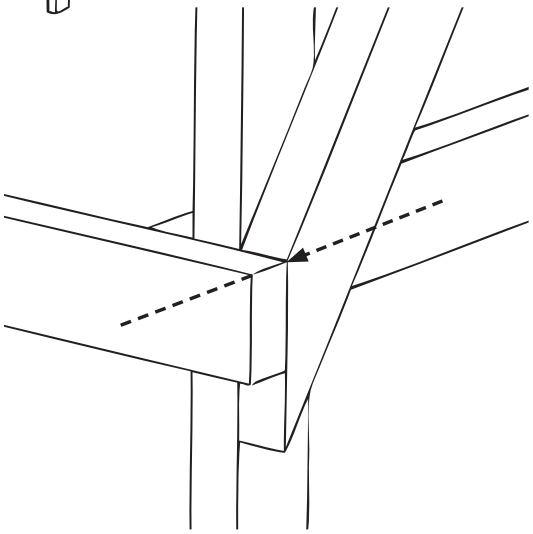

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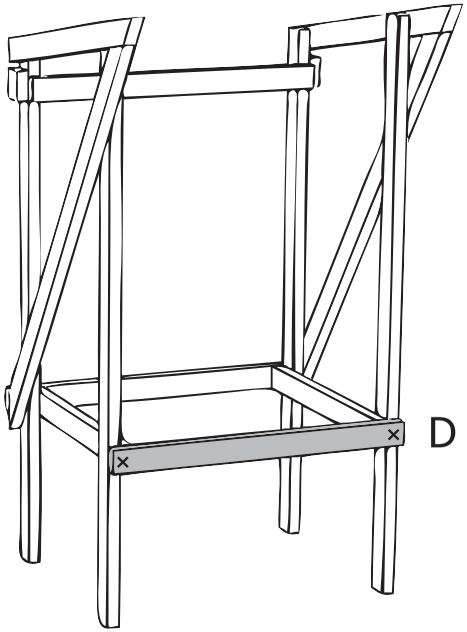

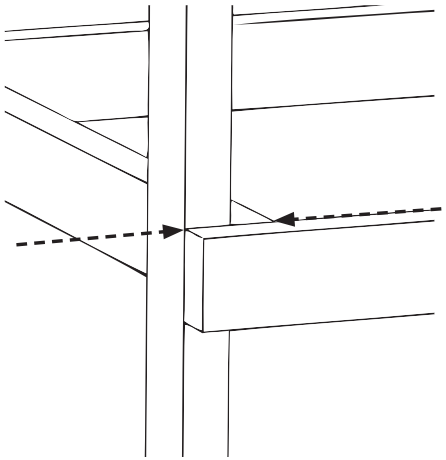

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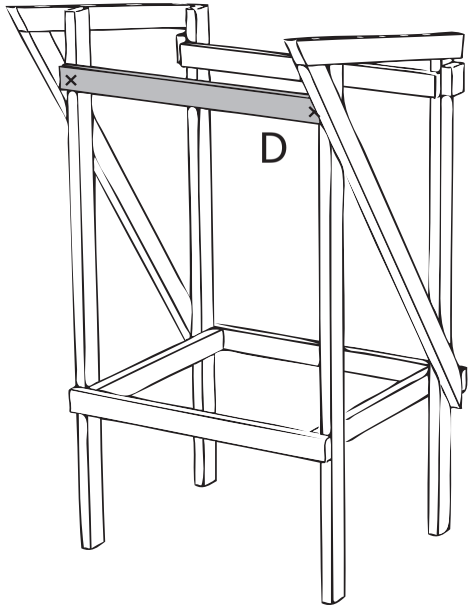

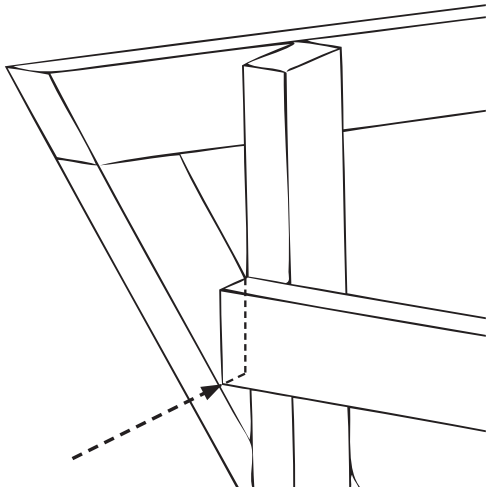

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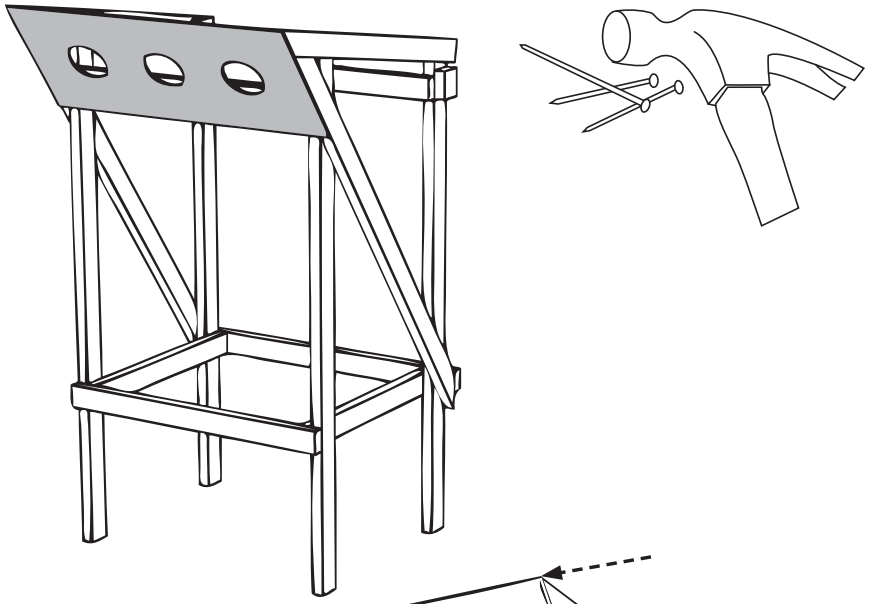

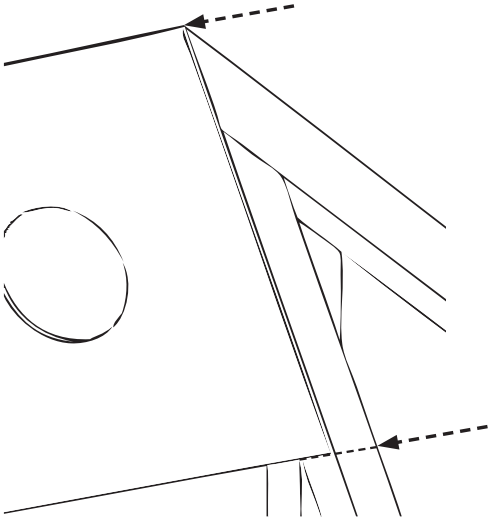

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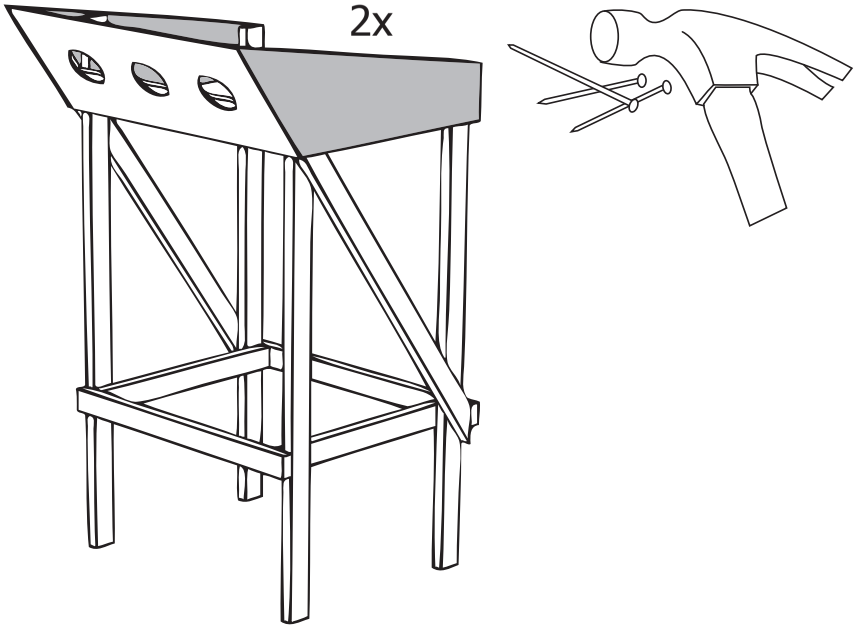

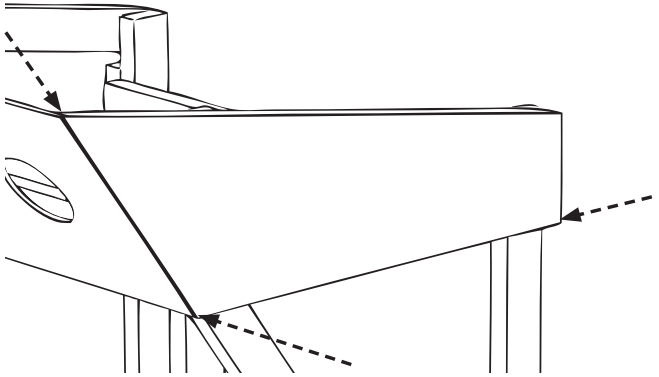

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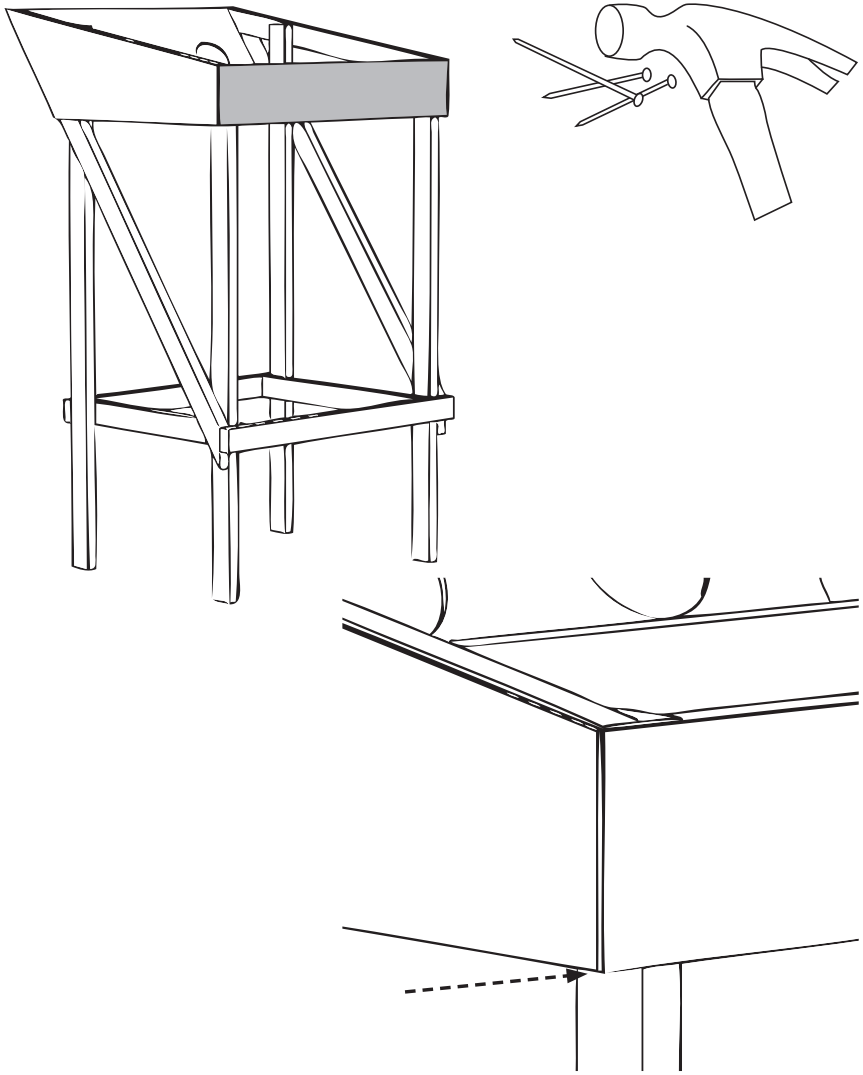

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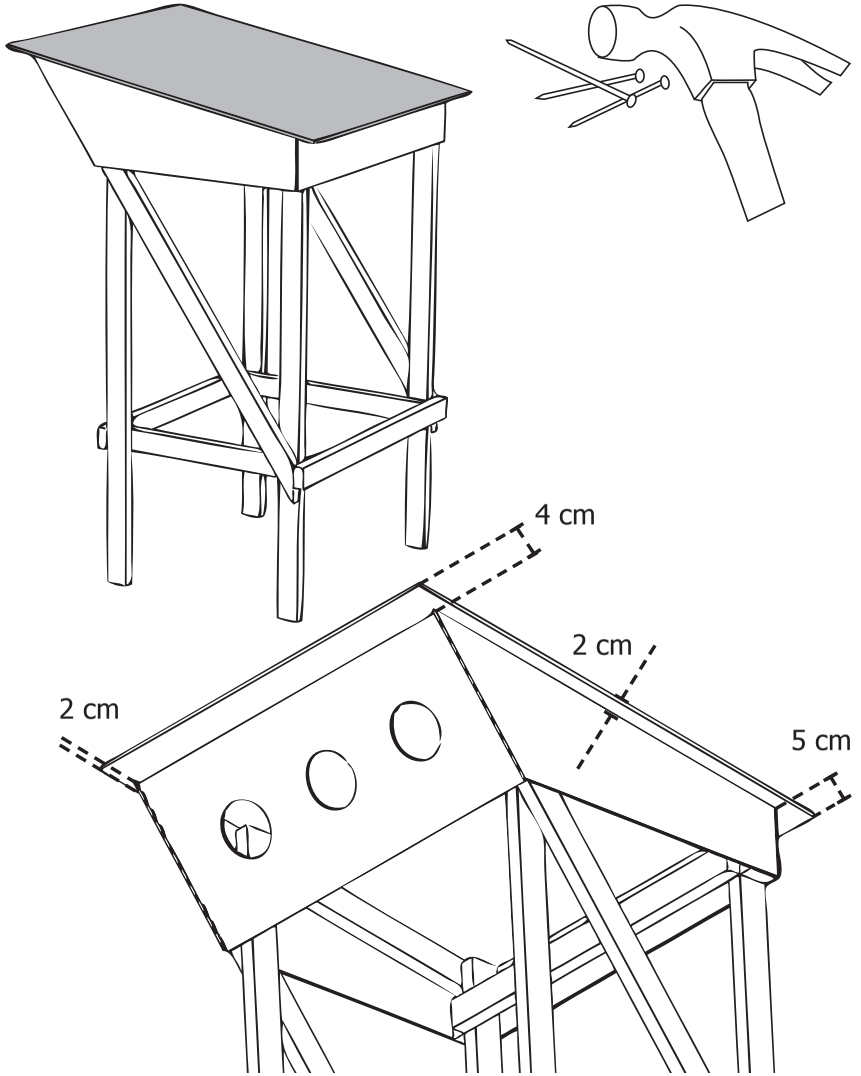

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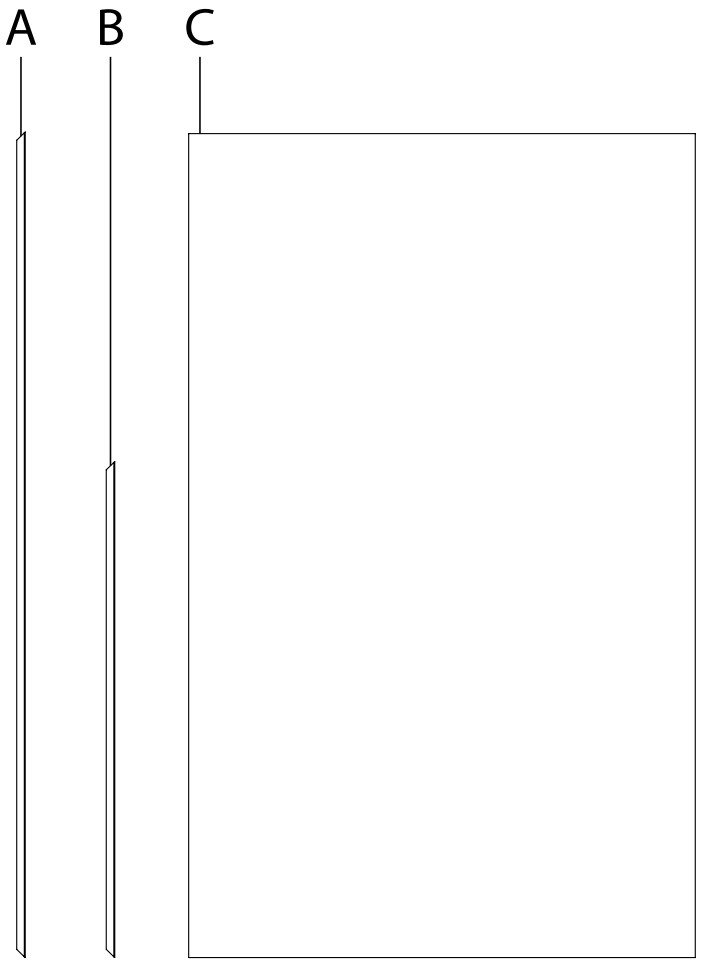
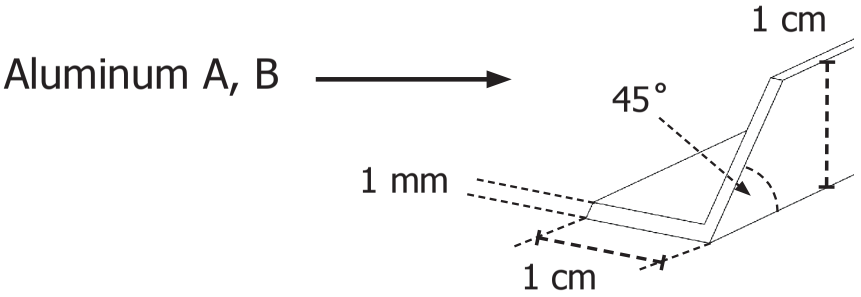
Solar panel

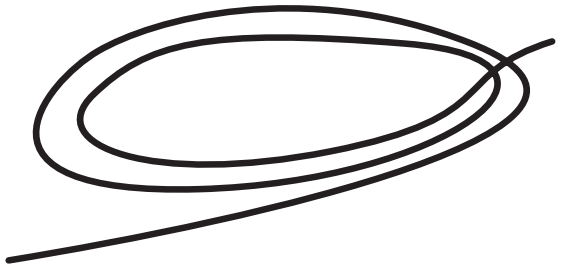
Materials





		#
A	100,2 cm	2x
B	60,2 cm	2x
C	100x60	1x

Wire 1x 2m



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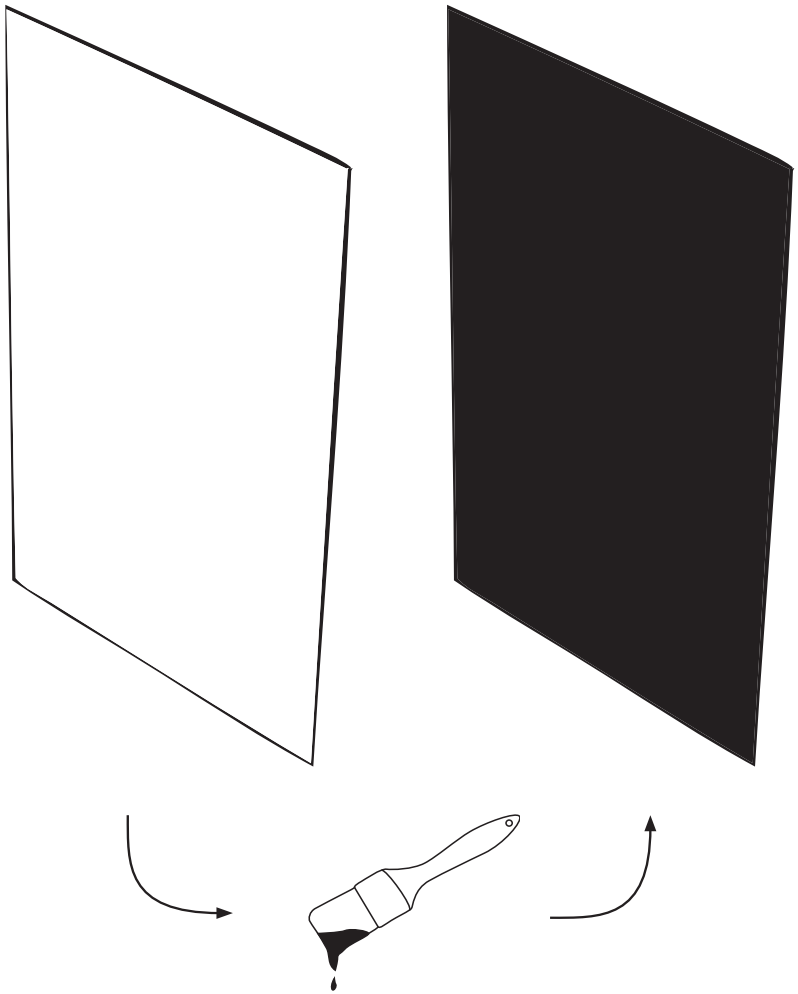

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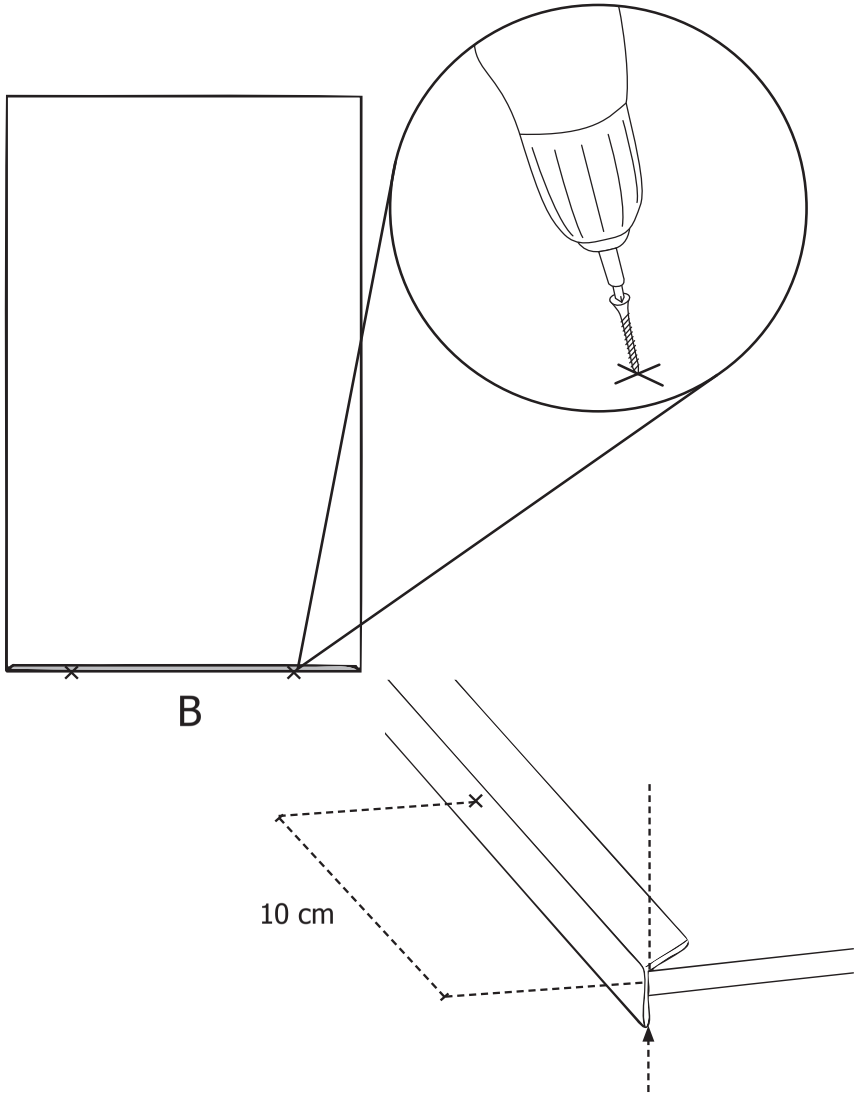

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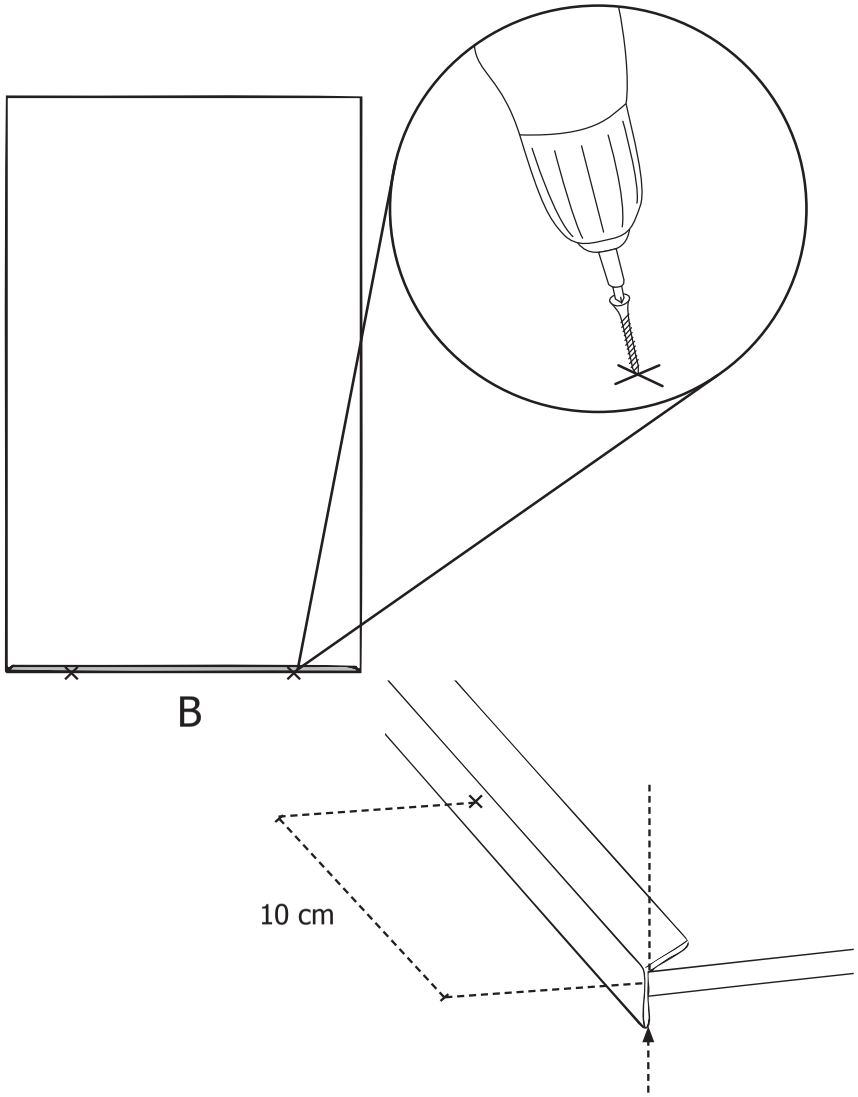

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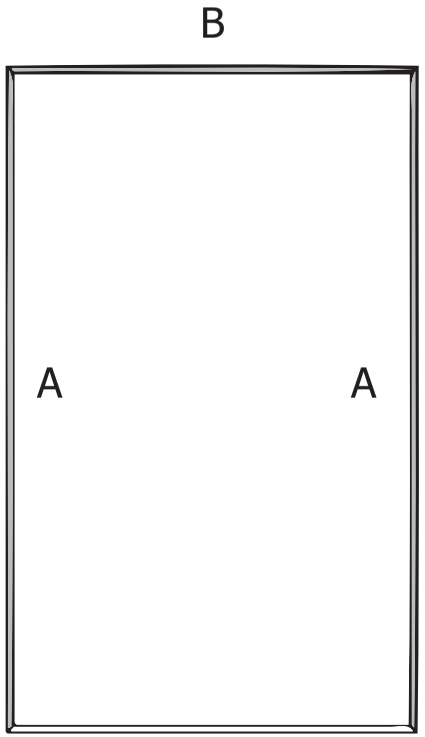
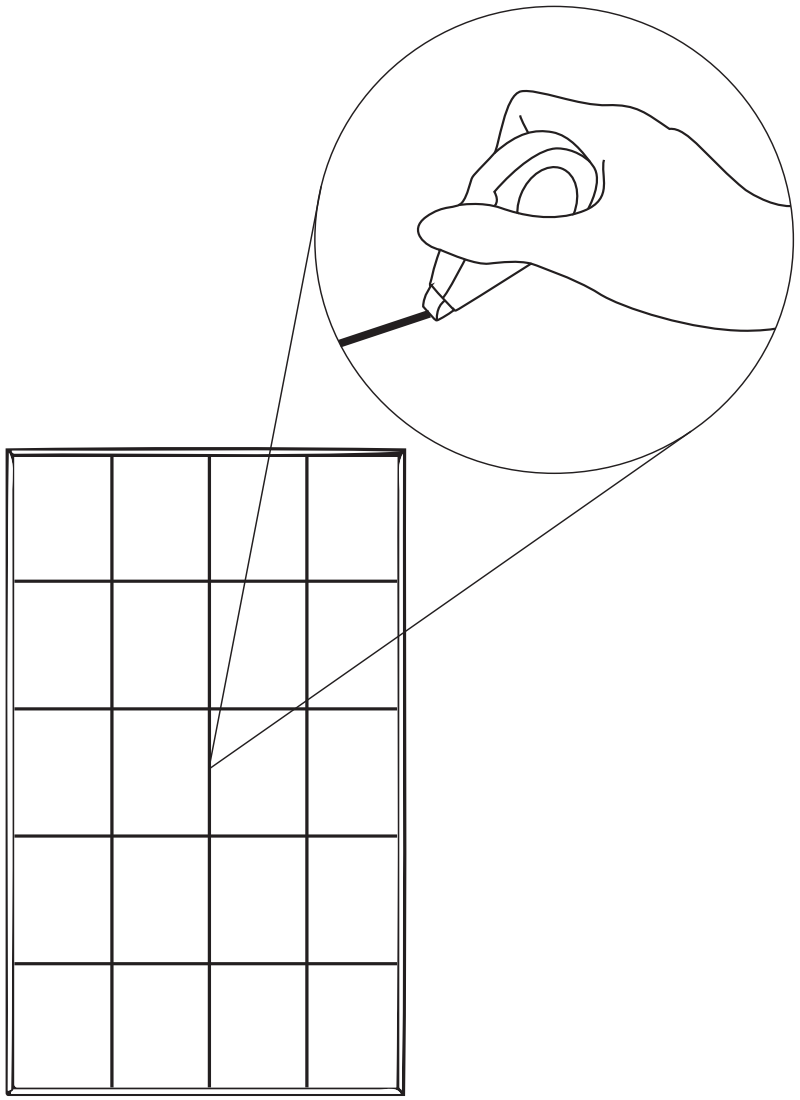


3x

Step 1.

6.



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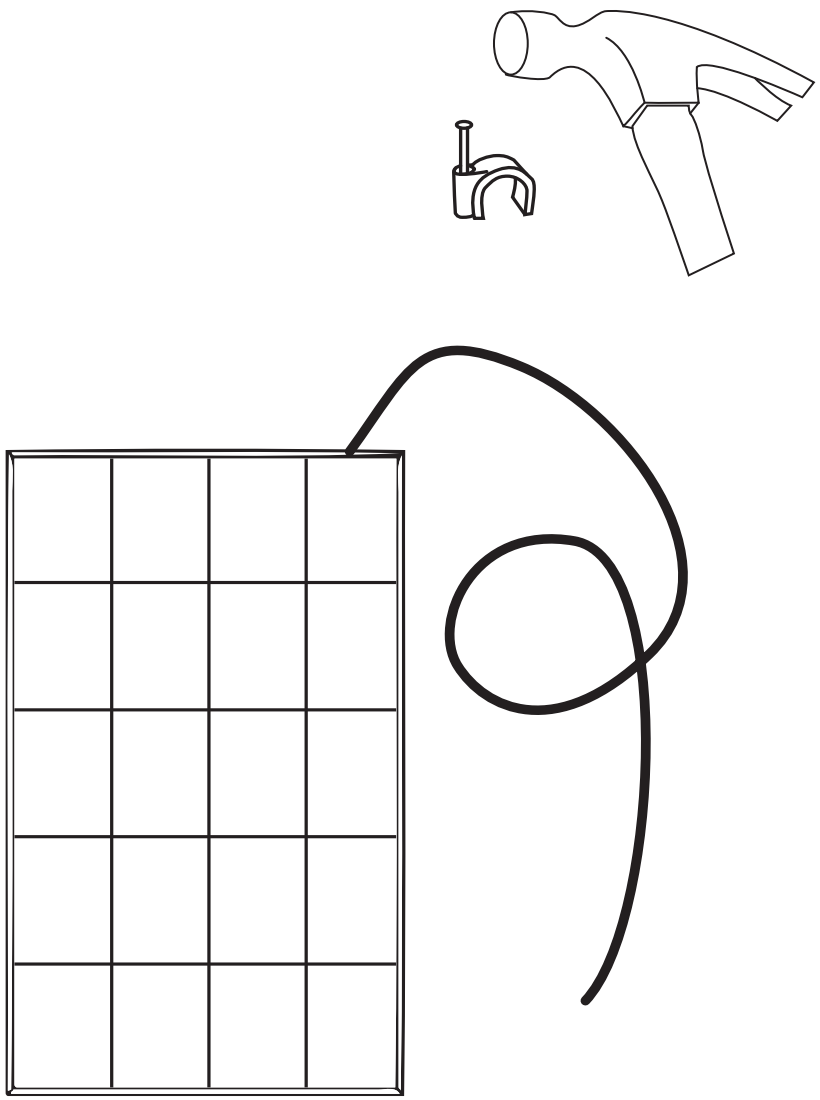

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F. INTERVIEW HANS VELDHUIS

INTERVIEW MET HANS

WELKE INFORMATIE WORDT ER GEREGISTREERD?
De huidige opbrengst van de panelen. (aanvullen/verbeteren)

Onder verschillende panelen zijn in het systeem in totaal drie temperatuursensoren monteert, waarmee de huidige temperatuur van het paneeloppervlak wordt gemeten. Verder is er op het dak een weerstation geïnstalleerd. Deze meet onder andere de lichtinval, de windsnelheid en windrichting.

HOE WORDT DEZE INFORMATIE GEREGISTREERD?
Voor het registreren van de data wordt er gebruik gemaakt van een datalogger. Dit is een kastje beschikkende over vele inputs waarvan de data wordt opgeslagen. Vervolgens is het mogelijk om via een seriële output de data uit te lezen met de computer. Wanneer Hans terug is in Nederland heeft hij deze informatie periodiek nodig van de datalogger, hoe hij dit dan precies gaat verkrijgen weet hij nog niet.
De opbrengst van de panelen wordt echter op een andere manier geregistreerd. Hiervoor wordt gebruik gemaakt van een 'webbox' die de informatie registreert en daaruit vervolgens een internetpagina genereert met weergave van de data.

WAT IS HET TYPE WEERSTATION/WEBBOX?
Het weerstation betreft een WeatherHawk RS232. De webbox is de SMA Sunny Webbox.

ALS JE GEREEDSCHAP OF MATERIAAL NODIG HEBT, HOE VERKRIJG JE DAT?
De stad beschikt over verschillende winkels voor gereedschap en onderdelen. Een dichtbij liggende plek hiervoor is tegenover het hotel waar Hans verblijft en waar wij onze eerste dagen ook hebben doorgebracht.
Voor materialen als plaatmateriaal zal even verder gekeken moeten worden. Waarschijnlijk wil men voor een klein bedrag de spullen wel komen brengen naar het Walikota.

IS HET OOK MOGELIJK OM IN JAYAPURA AAN ELEKTRONICAONDERDELEN TE KOMEN?
Die mogelijkheid zou er wel moeten zijn, maar Hans heeft voor de zekerheid meegenomen waarvan hij dacht dat nodig zou zijn. Voor het verkrijgen van een specifieke kabel heeft Hans wel een groot deel van de stad afgezocht.

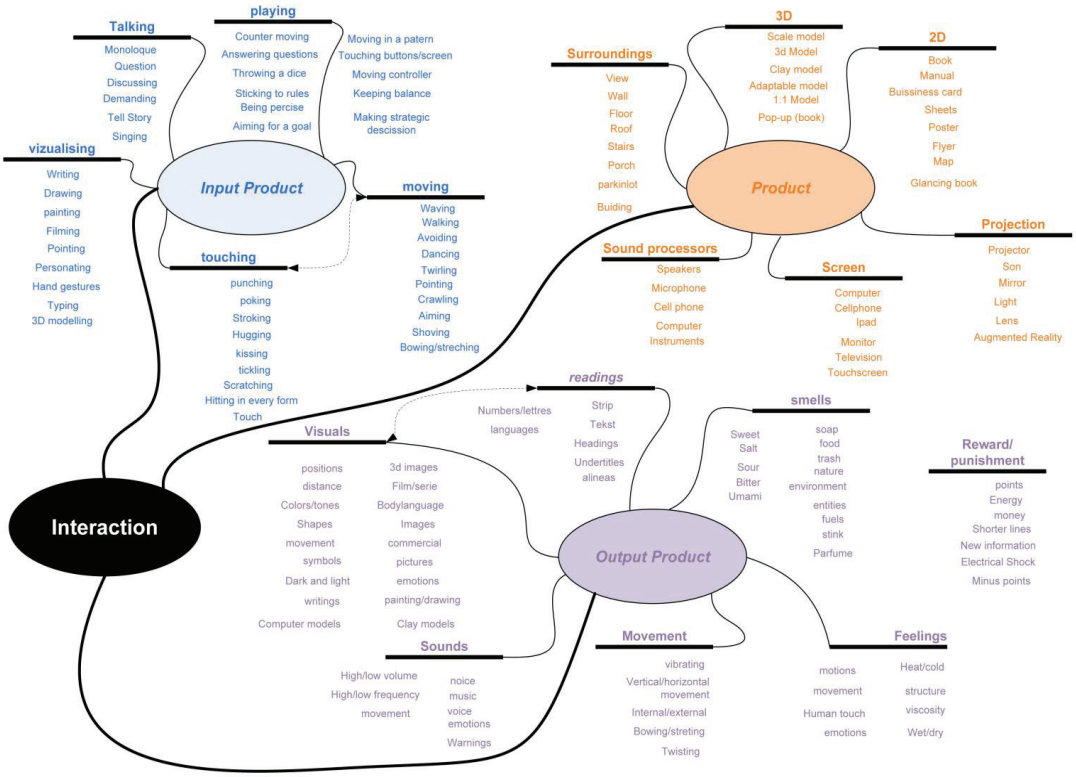
WAT IS JE ERVARING MET HET BESTELLEN VAN ONDERDELEN?
Er moest wel een specifiek onderdeel worden besteld, maar dat ging via het installatiebedrijf. Hier weet hij dus niet veel van af. Laten bezorgen bij de afdeling van Walikota zou in principe moeten kunnen, maar zal even nagevraagd moeten worden bij de betreffende persoon.

IS DE INTERNETVERBINDING IN HET WALIKOTA STABIEL?
Hans heeft geen ervaring met een onstabiele internetverbinding. Zodra de stroom niet uitvalt, is er over het algemeen ook internet.

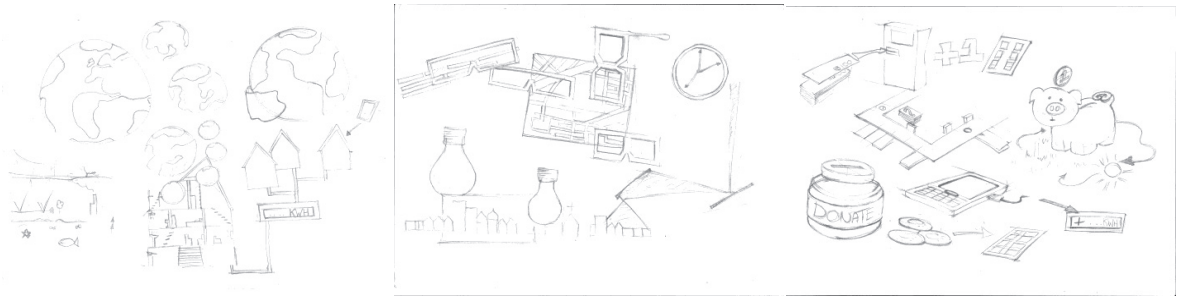
Inspirations

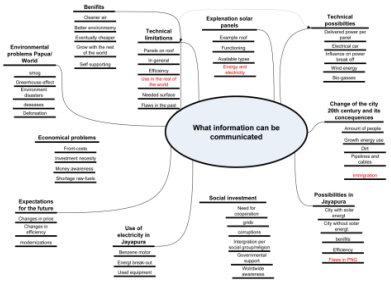
These images are translations of knowledge about interactions, information and technique. They are the step between the analyses and the concrete ideas. The Interactive inspirations show different ways in which the installation can interact with its user. The informative interactions are visualization associations on the information that has to be told according to this same analysis. The technical inspirations show possibilities of technique which can contribute to the functioning of the installation.

Interactive Inspirations

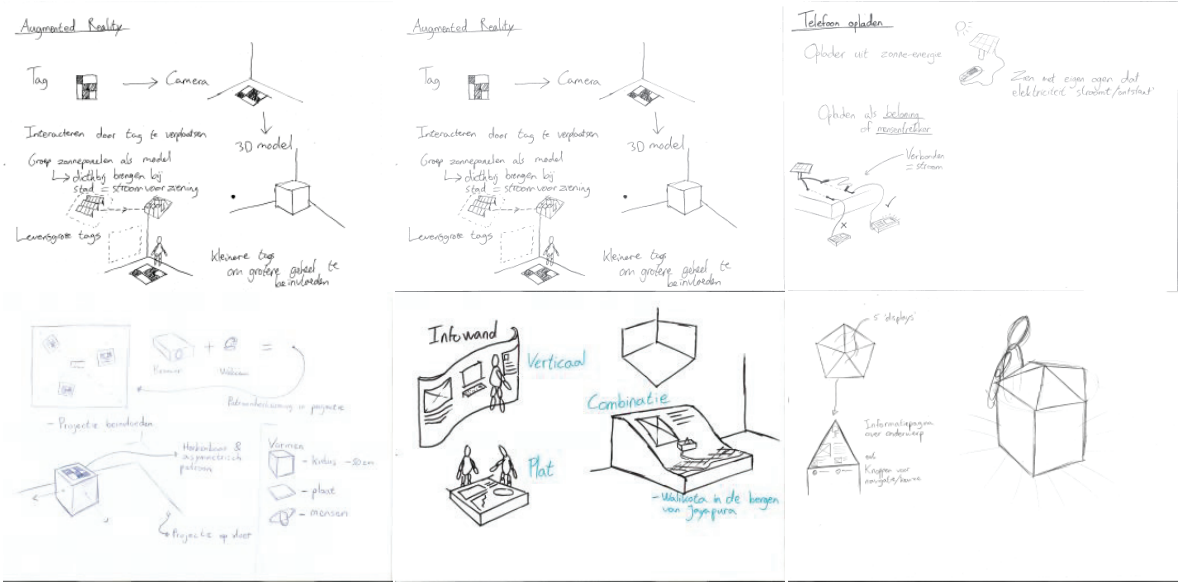


INFORMATIVE INTERACTIONS





TECHNICAL INSPIRATIONS



H. QUESTIONNAIRE VISITORS WALIKOTA

Questionnaire Visitors Walikota

Name/nama:
Age/usia:
Religion/agama:
occupation/pendudukan:
Education/pendidikan:
Level of reading/tingkat membaca: *bad/mediocre/ good/ perfect buruk/sedang saja/baik/sempurna*

Use of interfaces

What ways of communication tools do you use? Apa cara alat komunikasi yang anda gunakan?

- *Computer/komputer*
- *Laptop/laptop*
- *Cell phone/ponsel*
- *Smartphone, type/jenis:.....*
- *Television/televisi*
- *Radio/radio*
- *Walky-Talky*
- *Books/buku*
- *Letters/surat*
- *Other/lain, viz./yaitu: .....*

What computer programs/applications do you use? Apa program computer yang anda gunakan?

- *Facebook*
- *Twitter*
- *MSN-Messenger*
- *What's-app*
- *Skype*
- *Paint*
- *E-Mail, viz. /yaitu: Hotmail/Gmail/Outlook/……*
- *Adobe premiere, viz. /yaitu: Photoshop/Flash/Illustrator/……*
- *Modeling program, viz. /yaitu: Solid Works/Rhinoceros/Maya/……*
- *Microsoft Office, viz. /yaitu: word/Excel/Visio/……..*
- *Games, viz. /yaitu: .....*
- *Internet, viz. /yaitu Internet explorer/ Google Chrome/……*

What is so your favorite program to work with and why? Apa anda program favorit untuk bekerja dengan

Use of Electricity

What electrical machinery do you use while ……and for how long a day?
Apa mesin listrik yang anda gunakan sementara……..dan untuk berapa lama satiap hari?
Cooking/memesak:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Washing/pencucian:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Sleeping/sedang tidur:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Eating/makanan:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Cleaning/pembersihan:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Reparations/memperbaiki:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Doing odd jobs/pekerjaan:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Working/kerja:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Other/lain, viz./yaitu:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

Other/lain, viz./yaitu:

O less than 15 min O 15min O 30 min O 45 min O 1 hour O 2 hours O more than 2 hours
O Kurang dari 15 menit O15 menit O30 menit 45 menit O 1 jam O 2 jam O Lebih dari 2 jam

What kind of wall plugs do you use?/Apa macam steker anda pengganaan?

How many do you have at home?/ Berapa kaya dan di tempat diam?

What do you do when the electricity turns off?/ Apa yang Anda lakukan ketika listrik mati?

Would you call yourself depended of electricity? Why (not)?/ Apakah Anda menyebut diri Anda tergantung dari listrik? Mengapa (tidak)?

Do generate your own energy? In what situation? How often does this happen?/ Untuk menghasilkan energi Anda sendiri? Dalam situasi apa? Seberapa sering hal ini terjadi?

Electricity

How would you explain electricity?

How would you explain energy?/ Bagaimana bisa dijelaskan listrik?

What happens when the electricity is off?/ Bagaimana bisa dijelaskan listrik?

Where does your electricity generally come from?/ bagaimana anda menjelaskan energi?

How is this electricity generated?/ Bagaimana listrik ini dihasilkan?

What is necessary for this generation?/ What is necessary for this generation?

What are the raw materials for generation of electricity you use today?/ Apa bahan baku untuk pembangkit listrik yang Anda gunakan saat ini?

Alternative ways of generating energy/ Alternatif cara untuk menghasilkan energi

What are different ways of generating energy?/ Apa saja cara untuk menghasilkan energi?

Could you explain what you believe solar energy to be?/ Bisakah Anda menjelaskan apa yang Anda yakini energi matahari untuk menjadi?

What are the pros of solar energy?/ Apa pro energi matahari?

What are the cons of solar energy?/ Apakah kontra dari energi matahari?

Would you like to know more about solar energy?/ Apakah Anda ingin tahu lebih banyak tentang energi matahari?

Would you like to have/use solar energy for yourself? Why/Why not?/ Apakah Anda ingin menggunakan energi matahari untuk diri sendiri? Mengapa Mengapa tidak??

What would your environment/family think about it?/ Apa yang akan keluarga dan teman-teman berpikir tentang hal ini?

How would they respond to it? Bagaimana mereka menanggapinya?

What is your opinion about projects from Europe/America trying to convince you to use other kinds of energy? Apa pendapat anda tentang proyek-proyek dari Eropa / Amerika berusaha meyakinkan Anda untuk menggunakan jenis energi lainnya?

What is your opinion about solar energy in general?/ Apa pendapat Anda tentang energi surya secara umum?

Environment/ lingkungan

What do you believe to be the environmental problems of Papau?/ Apa yang Anda yakini sebagai masalah lingkungan Papau?

What do you believe to be the environmental problem of the world?/ Apa yang Anda yakini sebagai masalah lingkungan dunia?

What do you do to help the environment?/ Apa yang Anda lakukan untuk membantu lingkungan?

What does the government do help the environment?/ Apa yang pemerintah lakukan membantu lingkungan?

What is your opinion about this?/ Apa pendapat Anda tentang ini?

I. SCENARIO TEST CHERLEY GOUY

FRAMING SECOND USER TEST

For this test Cherley Gouy, who is known with and experienced in living and working in the Papuan culture to is evaluates the information told by and interaction of the installation. She is asked to answer some question after reading about the explanation of the project. This explanation is supported by an image of the installation, a scenario of a general situation, an example of how the image on one of the top planes would look like and the animation of the image on the screen. Based on this information an interview is done.. The conclusion of this interview in summarized in the following chapter.

SCENARIO TEST

Een aantal verschillende belangenpartijen zijn het afgelopen jaar bezig geweest met een zonne-energie project in Jayapura, de hoofdstad van de provincie Papua in Indonesië. De universiteit Twente, de overheid van Indonesie/Jayapura, het WWF, Solinvest (een producent van PV- zonnepanelen) en twee universiteiten in Indonesie hebben ervoor gezorgd dat op het dak van het gemeentehuis (Walikota Builiding) zonnepanelen worden geplaatst die dit gebouw van een grote hoeveelheid elektriciteit kan voorzien. Hiermee zijn zij een voorbeeld voor de rest van de bevolking om deze te stimuleren meer bij te dragen aan een vergroting van het gebruik van zonne-energie. Om ook duidelijk te maken aan de bevolking dat de overheid de eerste stap in de goeie richting zet is gevraagd naar een interactieve en educatieve installatie die zowel dit project laat zien als extra informatie geeft over zonne-energie en de populariteit van zonnepanelen vergroot. Een overzicht van de installatie is op dit plaatje te zien.

UITLEG INSTALLATIE

De tafels rondom het scherm bevatten sensoren. Deze sensoren kunnen worden bedekt door een oplegging van een hand. Op het scherm op de achterwand wordt een animatie van de doorsnede van de stad Jayapura worden weergegeven. Op het moment dat niemand zijn hand op een sensor heeft zal de stad er vies en bruin uitzien. Wanneer iemand zijn hand op de sensor legt gaat er een lamp schijnen op het zonnepaneel. Dit zorgt ervoor dat de stad op het scherm er groener en schoner uit komt te zien. Naarmate meer handen op de tafels gelegd zal deze stad blijven bloeien tot dat het maximale aantal zonne-energie ie bereikt en mensen zullen juichen en het 'spelletje' afgelopen is.

Op de verschillende tafels zal informatie worden weergegeven die meer ingaat op het project en het gebruik en de gevolgen van zonne-energie en diesel generatoren.

.

Bijgevoegd is een scenario geschetst van een persoon in Jayapura die tijdens zijn bezoek aan het walikota gebouw in aanraking komt met deze installatie. Wij willen u vragen om dit scenario te bekijken en vervolgende de vragen te beantwoorden**. (scenario_text.jpg)**

- WAT KLOPT ER NIET AAN DIT PLAATJE, ALS DIT VERGELIJKT MET DE WERKELIJKE SITUATIE IN PAPUA?
- HOE DENKT U DAT MENSEN ZULLEN REAGEREN OP DE INSTALLATIE WANNEER ZE BINNEN KOMEN?
- HOE DENKT U DAT DE INTERACTIE TUSSEN MENSEN ZAL PLAATSVINDEN TIJDENS EN VOOR HET GEBRUIK?
- DENKT U DAT MENSEN DE TIJD NEMEN OM MET DE INTERACTIE UIT TE VOEREN?
- IN HOEVERRE DENKT U DAT MENSEN GEÏNTERESSEERD ZIJN OM DE TEKST DOOR TE LEZEN?

- Wat zijn situaties die mensen kunnen onderbreken in hun gebruik?
- Denkt u dat mensen begrijpen wat er verwacht wordt bij het zien van de installatie?
- Hoe nieuwsgierig is men in Papua in vergelijking met hier in Nederland? En waarom?
- Hoe initiatiefnemend in men in Papua in vergelijking met hier in Nederland? En waarom?
- In hoeverre is men in staat om zaken te ondernemen zonder dat daar aansturing bij is?
- Hoe is de interactie tussen mensen in het algemeen in Papua in vergelijking met Nederland?

Behalve het scenario is ook de animatie bijgevoegd die tijdens het gebruik zal worden getoond. Ook hier zijn wat vragen aan verbonden. **(animation.exe)**

- Wat wordt hier weergegeven?
- Wat is de boodschap die u hieruit kan opmaken?
- Wat denkt u dat mensen uit Papua hieruit concluderen?
- Denkt u dat deze informatie invloed zal hebben op de bevolking? Wat voor invloed denkt dat dit is?
- Denkt u dat deze informatie interessant is voor bevolking van Papua?
- Denkt u dat deze animatie aantrekkelijk is voor de bevolking van Papua?
- Denkt u dat de opmaak van de animatie aansluit bij de smaak van de bevolking van Papua?
- Wat mist u in deze animatie?
- Wat vindt u van de animatie?

Als laatste wat vragen over de informatie die op één van de blokken komt te staan**.(aangepast.pdf)**

- Kunt u recapituleren wat er beschreven is?
- Denkt u dat de bevolking van Jayapura begrijpt wat hier beschreven is?
- Denkt u dat de inhoud van de informatie interessant is voor de bevolking van Papua?
- Wat is de mening over zonne-energie in papua volgens u?
- Hoe denkt u dat men op deze informatie reageerd?
- Denkt u dat de informatie invloed zal hebben om de bevolking van Papua? Wat zal dit kunnen zijn?
- Denkt u dat deze installatie men enthousiast kan maken over zonne-energie?
- Denkt u dat men deze informatie zal lezen wanneer dit in uw gezichtsveld is?
- Denkt u dat deze informatie aantrekkelijk is voor de bevolking van papua?
- Wat mist u aan deze informatie?
- Denkt u dat de opnaak van de informatie aansluit bij de smaak van de bevolking van Papua?

RESULTS SECOND USER TEST

Cherley Gout is about 65 years old and has lived in Indonesia until her 13th. The last few years of her stay, she lived in Santani, Papua and went to school in Jayapura (40 km from Santani). She left Indonesia in 1961 after Papua got in hands of Indonesia. Her dad has been working for the Dutch government so they had to flee. She never has been able to go back to this part of Indonesia since and never mentioned not being completely up to date about the culture nowadays. Still because of traveling through other part of Indonesia as well as other Asian countries, she did see the cultures that has been influencing Papua over the last few years and had the possibility to compare this to the Papuan Culture.
After showing the scenario and pictures of the installation as well as the project and why it is important, the previous questions are asked and answered. The answered are summarized here here.

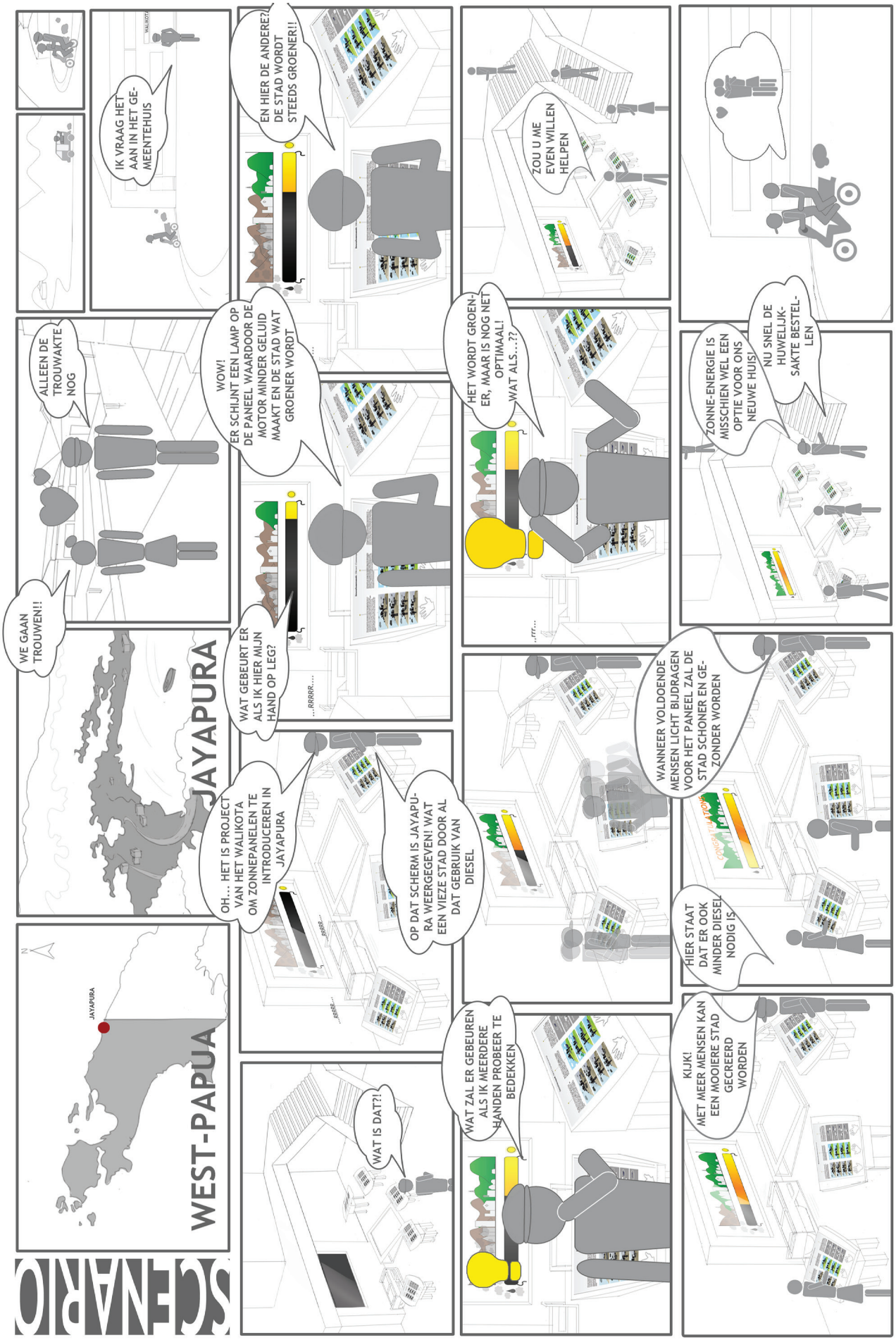
SCENARIO/ANIMATIE (INTERACTIVE):

Because Cherelely hasn't been in Jayapure for a very long time she had no insight in political and environmental issues. Therefore she hasn't always been able to judge the expected reaction and opinion of the visitors on the installation. General knowledge people have on solar energy as well as to what rate people are aware of the environmental situation and if they are interested in improving it, she was not able to asses. Therefore it was hard to answer questions that asked about in attractiveness and understandability of the information and installation. She did mention the simplicity of the information and how she was easily able to understand it. She recommended asking children or foreign people with a language barrier to test the product, to emphasize the parts that are apparently different in different cultures.
Cherley did know a lot about the general mentality people have, and could give an insight on how she expected people to act on the functioning of the installations. In general, she said, people from Indonesia are very interested in and curious about western people and things. They want to know who you are, what you do, and a lot more. Cherley relates this behavior to curiosity and the eager people feel to learn new things. For this reason she does think people will be curious enough about what that 'flashy western installation' is and would approach it if they can.
On the other side she mentioned the authoritative and militarized society in which people might be afraid of doing thing they are not expected to do. Placing the installation in a governmental building might emphasize this atmosphere. People could be scared of doing something they are not supposed to. Moreover Chereley remembered her father talking about tribes living in other parts of Papua believing in different gods and therefore easily being afraid of new technologies and lights. This might also oppose people from interacting with the installation.
Cherley also discussed the way she expected people to respond to each other while interacting with the product. She mentioned people being expectative and cautious. People generally don't speak with each other in public spaces if they are not familiar. She doesn't remember people interacting in buses or other common rooms, besides if something or someone different and obvious occurs. An example she mentioned was white people entering the bus and asking a weird question. After that people did start talking and joking. Because the installation will be different for the people Cherely does expect people to talk about the object bit is not sure about this happening in the way mentioned in the scenario.
She had doubts about the impact that the installation will have on the mentality of the people. She mentioned people not being willing enough to take a second step; if things take too much effort and money people will not do it. Moreover she discussed the small amount of people that will be confronted with the information. She expected television commercials being more effective because all though people are poor, most do have television.
Finally she mentioned remembering the Papuan society as being 'pedang pedang', the Indonesian word for saying relaxed. People take their time for things. Still she doesn't know if this changed by the introduction of the Indonesian culture.

TOP PLANE:

Although Cherely had no idea about the educational level of the population of Jayapura, she did have some comments about the design of the top plane based on her own perceptions. First of all, Cherely doubted about clarity of the affordance. She recommended drawing a small manual sign to explain where and how to hold the hand s.
Secondly she mentioned some images not being self explaining. She recognized industry instead of buildings in the background of the images. She doubted the maintenance picture not being exaggerated enough to understand the difference between low and high maintenance. Finally she didn't understand how supporting could be interpreted; the house could have been a governmental institution to stimulate people to take solar panels. The 'thumbs up' she could recognize.

J. SCENARIO


SCENARIO
WEST-PAPUA
JAYAPURA
JAYAPURA
WE GAAN TROUWEN!!
ALLEEN DE TROUWAKTE NOG
IK VRAAG HET AAN IN HET GEMEENTEHUIS
WOW! ER SCHIJNT EEN LAMP OP DE PANEEL WAARDOOR DE MOTOR MINDER GELUID MAAKT EN DE STAD WAT GROENER WORDT
EN HIER DE ANDERE? DE STAD WORDT STEEDS GROENER!!
WAT GEBEURT ER ALS IK HIER MIJN HAND OP LEG?
....RRRRR....
ZOU U ME EVEN WILLEN HELPEN
HET WORDT GROENER, MAAR IS NOG NET OPTIMAAL! WAT ALS...??
...rrr...
ZONNE-ENERGIE IS MISSCHIEN WEL EEN OPTIE VOOR ONS NEUWE HUIS!
NU SNEL DE HUWELIJKSAKTE BESTELLEN
OH... HET IS PROJECT VAN HET WALIKOTA OM ZONNEPANELEN TE INTRODUCEREN IN JAYAPURA
OP DAT SCHERM IS JAYAPURA WEERGEGEVEN! WAT EEN VIEZE STAD DOOR AL DAT GEBRUIK VAN DIESEL
WANNEER VOLDOENDE MENSEN LICHT BIJDRAGEN VOOR HET PANEEL ZAL DE STAD SCHONER EN GEZONDER WORDEN
HIER STAAT DAT ER OOK MINDER DIESEL NODIG IS
WAT IS DAT?!
WAT ZAL ER GEBEUREN ALS IK MEERDERE HANDEN PROBEER TE BEDEKKEN
KIJK! MET MEER MENSEN KAN EEN MOOIERE STAD GECREEERD WORDEN