A Quantum Circuit Design for Grover's Algorithm

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We present a circuit design realizing Grover's algorithm based on 1-bit unitary gates and 2-bit quantum phase gates implementable with cavity QED techniques. In the first step, we express the circuit block which performs a key unitary transformation that flips only the sign of the state $|11 \cdots 11\rangle$ using 1-bit and 2-bit gates. The Grover's iteration operator can then be constructed using this key unitary transformation twice, plus other operations involving only 1-bit unitary gates on each qubit. Mathematical proofs are given to justify that the criuciting satisfies the desired operator properties.

Key words: Quantum Search; Grover's Algorithm.