Modeling of Quantum Grover's Algorithm on a Classical Computer

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***Abstract*—The idea of quantum computer exists more than forty years but has not advanced very far as classic informatics. It's due to the fact that the classical algorithms can be implemented in the classical computer and quantum algorithms need a computer architecture which is fundamentally different from the classical one.**

However, the current lack of opportunities for physical implementation of a quantum computer does not mean the inability to simulate a quantum algorithms on a classical computer with some assumptions. Nowadays there are several programming languages which can model necessary calculations for quantum computing algorithms.

Quantum algorithms on graphs have a special interests for informatics. Dijkstra's algorithm is the one of this. Often the work of Dijkstra's algorithm can help to find the selection of the optimal packet's path when it is transmitted over the Internet. One of the feature using quantum version of this algorithm is its acceleration by the use of the following selection step, the minimum weight vertices, Grover algorithm instead classical means (priority queue and etc.).

In this report it is searching the possibility of modeling the operation of Grover's algorithm.

The algorithm searches in the disordered database but needs fewer operations in $\sqrt{N}$ in comparison with classical linear search algorithm. This is a promising growth rate, however, the work of the algorithm shouldn't be demonstrated in the algorithm's model, but it is quite simple to check the correct work of the algorithm.

Model is made with a help of packages QCL and Quipper, which is implemented in C ++ and Haskell, respectively. The constrict model is planned to compare the classical(linear) and binary search in the database and to draw the conclusions about its correctness.

In the future, the algorithm's implementation will be collected in the optical circuit and the circuit will be implemented in an integrated optical chip. This allows to obtain finished optical implementation of the algorithm and the ability to embed it in a more general Dijkstra's algorithm, which can also be implemented in an integrated chip. When the problem of data on inputs and outputs of the chip will be solved you can use it to solve the problem of finding the shortest path in the network. The implementation of the algorithm in optics will provide the increase in speed and the implementation on a classical computer needs only to check the circuit and of the algorithm correctness.

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