Problem Statement

Quantum random walk is one of the research cores in current Quantum algorithms.

Different from the normal distribution of classic random walk, the distribution of random quantum should be symmetric distribution expanding to two sides. The   
feature of quantum can make the quantum random walk become more competitive in search algorithms operation.

This research mainly discuss the difference between quantum walk and classic quantum walk, proposing the answer of “++” may cause constructive interference because of the phase, and the answer of “+ - “ may cause destructive interference

in the quantum circuit.

The first part of this research discuss the impact of the different coins to the system, and design a quantum gate.

The second part is based on the first part, promoting the walking space to multidimensional space by using the quantum gate, and observe the tendency and difference of classical multidimensional random walking.

Eventually, we designed a one-dimensional quantum walking with great symmetry successfully, and it still keep this symmetry after we promoting it to two-dimensional space, expecting that this experiment could have a further contribution to future search algorithm; therefore, we also propose a quantum random walk which could search specific target.

As for the future prospect:

1. Mapping of enzyme, and to comprehend the evolution of enzyme when it contacts the mutagen.

2. Understand the situation of electron transmission of graphene by applying quantum walk.

3. Simulate Brownian motion by using three-dimensional quantum random walk.

4. Design new quantum walk circuit to run quantum walk of different graphs.