Mini Project:

Implementation of Discrete Time Quantum Walks on Quantum Computer using Qiskit

Week 2

By Abhay Suresh, CS20B1018

This Weeks Agenda

These are the main points on which the weekly agenda of the project is to be updated to the professor

- The need for Quantum walk.
- Differences between Random walk and Quantum walk.
- Why is Quantum walk preferred over Random walk?
- Progress on Qiskit so far...

The need for Quantum Walk

- Is a building block for Quantum Algorithms.
- Used to develop new forms of quantum repeaters and quantum networks for quantum communication.
- Helps in simulating the behaviour of quantum systems in complex environments.
- Used to simulate behaviour of quantum systems in relation to chemistry and biology.

Differences between Random walk and Quantum walk

RANDOM WALK

1. Is a classical mathematical model, which represents the walker using classical states.
2. Described by a definite position in space
3. State is updated using a transition matrix
4. Walker exists only in one position at a time

QUANTUM WALK

1. Is a quantum mathematical model, which represents the walker using quantum states.
2. Described by a wave function of the states.
3. State is updated using a unitary operator
4. Walker exists in multiple positions at the same time

Why is Quantum walk preferred over Random walk?

1. Higher efficiency
2. Power to explore multiple paths simultaneously
3. Robust quantum algorithms
4. The walker produces complex and interesting behaviours, due to quantum interference.
5. New forms of quantum correlation and quantum information processing can be produced.

Progress on Qiskit so far...

- Basics of qiskit on IBM Quantum lab and Google colab
- NOT, CNOT and CCNOT gates
- Bit representation of numbers
- Implementation of half adder

All of these have been implemented on google colab and IBM quantum lab and the same has been uploaded in the GitHub repository for the mini project at ***https://github.com/Abhay-Suresh/Discrete-Time-Quantum-Walks-on-Quantum-Computer/tree/main/Codes/Qiskit%20Tutorials***

Thankyou