EE/ CprE/ SE 491 - sddec23-17

Simulated Design of Quantum Networks

Week 2 Report

Feb 6 - Feb 12
Client: Dr. Durga Paudyal
Faculty Advisor: Dr. Durga Paudyal

Team Members:

Benjamin Amick - Network security engineer
Derrick Wright - System integration engineer
Ohik Kwon- System component designer
Steven Tompary- Network engineer

Past Week Accomplishments

- Set environment for our simulation - Everyone

  Our design project cleared from “Quantum Computing” to “Simulated Design of Quantum Networks.”

  It picked Qiskit, which is an SDK for quantum computation as our tool for simulating our quantum networks.

- Revised direction from a quantum machine learning to quantum key distribution and researched - Benjamin

  Benjamin changed his direction in the project from a quantum machine learning to quantum key distribution(QKD) which is more related to his skills and interests.

  He also researched QKD using bell states. He will keep his research for implementing QKD in our simulation

- Researching about quantum information - Derrick

  Derrick studied quantum information systems and basic quantum computation. He studied quantum states, why it is impossible to copy quantum states, and basic components of quantum computing which are CNOT and qubit gates which are quite different from classical computers.

- Researching about quantum hardware - Ohik

Ohik researched hardware implementation of quantum gates such as ion trap gate and photonic crystal which are promising components for quantum networks. He also researched simulation tools that he might use for this project.

During the meeting this week, he finalized his role in this project and changed direction from hardware implementation for q gates to design and simulate q gates for quantum networks.

He will focus on implementing quantum gates components to our simulations work collaboratively with Derrick

- Researching about quantum networks - Steven

Steven researched quantum networks and studied what are required for quantum networks systems such as quantum entanglement, super position, teleportation, and quantum repeaters.

He brought a lot of questions about quantum network system for example, whether our system will be quantum to quantum communication or quantum to classical computers (hybrid) communication systems which were helpful to clarify our project direction

Resources

Slides we used during a meeting

https://drive.google.com/drive/folders/14SBQ7WX_hiMyA4cD8afOY_JiGtXTvxmE?usp=sharing

Books we are reading

- Introduction to quantum information, Stephen M. Barnett
- Quantum Computation and Quantum Information, Michael A. Nielson

Articles we found this week and reading

- Perspective on quantum transduction
- Local quantum dot tuning on photonic crystal chips
- A high-fidelity quantum matter-link between ion-trap microchip modules

Pending Issues

- Study more about quantum networks and information technology - everyone
- Start to publish our Senior project web page and devise a method for tracking hours of contribution
- Set a virtual problematic environment which quantum networks we will make can solve it (e.g. transmitting healthcare information …)

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Benjamin Amick	Researched about QKD	3	5
Derrick Wright	Researched Quantum Information	3	5
Ohik Kwon	Research quantum gates	3	5
Steven Tompary	Researched quantum networks	3	5

Plans for Coming Week

- Share individual research about quantum networks and set our virtual environment for our project - everyone
- Research about quantum information and networks, understand theoretical base for quantum gates - ohik
- Research about quantum key distribution algorithm on Qiskit platform - Benjamin
- Research about quantum-quantum network - Steven
- Research about Qiskit platform and quantum information system - Derrick
- Investigate potential applicable problems relevant to Iowa State.