Applications of FPGA in Quantum Key Distribution
– Project & Thesis Topics for Students

Quantum Key Distribution (QKD) is a secure communication technology based on the principles of quantum mechanics, enabling theoretically unconditionally secure key distribution. Field-Programmable Gate Arrays (FPGAs), with their high parallel processing capabilities and reconfigurability, have broad application prospects in QKD systems. This project aims to explore specific application examples of FPGAs in QKD to enhance the performance and security of QKD systems.

Research Objectives

- Investigate the application of FPGAs in real-time data processing in QKD systems.
- Design and implement QKD protocols based on FPGAs.
- Optimize the performance of FPGAs in QKD systems to improve real-time processing and security.
- Explore the application of FPGAs in QKD network integration and experimental research.
- Further objectives.

Research Content

Several of the following should be fulfilled:

- Real-Time Data Processing: Study high-speed signal processing and time-stamping techniques using FPGAs in QKD systems.
- Key Extraction: Implement error rate calculation and error correction coding based on FPGAs.
- Protocol Implementation: Implement QKD protocols.
- System Control: Investigate hardware control and synchronization techniques using FPGAs in QKD systems.
- Network Integration: Study the application of FPGAs in QKD network nodes and integration with traditional communication systems.
- Experimental Research: Conduct prototype verification and algorithm optimization for FPGA-based QKD systems.

Requirements for Applicants

- Academic Background: Major in electronic engineering, computer science, physics, or related fields.
- Attitude: Proactive, with strong learning ability and willingness.
- Technical Skills:
  - Familiarity with FPGA design and development tools (e.g., Vivado).
  - Proficiency in digital circuit design and Verilog programming.
  - Strong mathematical and algorithmic foundation.

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*Outstanding research results may be published in relevant academic journals or conferences.