Global Algorithm Applied on Single Photon Detection

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Abstract. There are three major contributions. Firstly, applied study on the theory and experiment of single photon detection, including the project and experiment of quantum key distribution. Secondly, based on methods of the selection of detector, main photo electronic system configuration, design and creation, along with the relationship between these to system characteristics have been studied. Thirdly, based on the considerations on the research of image sensor systems on single photon detection, and the total system characteristics are evaluated and discussed in quantity. The results of simulation experiments and theory analyzing demonstrate that proposed method could advance the system validity effectively, and theory analysis and experiment shows the method is reasonable and efficient.

Keywords: Single photon detection, Imaging sensors, System engineering

1. Introduction
The research on the theory and experiment of single photon detection, including the project and experiment of quantum key distribution, what has become the research direction in these years. Based on the selection of detection methods, the configuration, the reality and the creation of the sensor system, has become an important application direction. The study of the relationship among the components in these systems, which based on the quantum theory and the basic mechanism of single photon detection, have increased as the implementation methodology.

Application and modern imaging sensors need to pay special attentions to the special technology in the development process of photoelectric system, research on single photon detection imaging sensor system is a very active direction based on. In particularly, in many fields, focused mainly on to find the objects description, to increase the detection probability, and to reduce the processing speed. Find by hard and thorough search, detection can be traced to the development of the quantum theory of long rich history.

Quantum theory is one of the two most important cornerstones of modern physics, quantum theory provides the representation methods and ways of thinking about the nature of the novel, reveals the basic rules in the material world, and laid the theoretical foundation for the atomic physics, solid state
physics, and physics and plasma physics. It can well explain the atomic structure, the regularity of the atomic spectrum, the nature of the chemical element, light attraction and radiation and so on.

In classical physics theory of energy is continuously changing, which can take any value. These phenomena should arouse our attentions on that the background and mechanism of quantum cryptography, and the recent research and development. Through analyzing the development of single photon detectors and their respective advantages and disadvantages, especially focus on single photon detection technology and development, and the special principle of core device APD and for the modes of single photon detection, we can recognize the value direction, such as to realize the principle of single photon pulse, and fiber optic coupler to achieve a single photon pulse output. Thus, single photon detection sensor system configuration, comprehensive consideration and system, lead us into the future promising and challenging research.

When the design of the sensor system is beginning, what requires systematic considerations, because the overall system features need to be evaluated and discussed in terms of quantity. The results of simulation and theoretical analysis are need to evaluated and determined by. Therefore, we propose that the global optimization method which establish correlative algorithms can effectively improve the effectiveness of the system. Theoretical analysis and experimental results show that the method is reasonable and effective in these two aspects.

2. Methods

2.1. Detection analysis

Quantum state has its particularity. Based on the special state of the quantum state of the information carrier, we give a global optimization algorithm. From the point of view of quantum mechanics, that quantum state as the information carrier, through the quantum channel transport between the users. The security of quantum cryptography is guaranteed by the principle of quantum mechanics. The so-called absolute safety is that even if the eavesdropper may be smart enough that the most sophisticated eavesdropping measures, may use the most advanced means of measurement, the transfer is still the key security. Usually, the eavesdropper intercepted by key method has two kinds, which means that one kind of method is measured by the quantum state to carry information by which the measurement results will to extract key information. However, the basic principle of quantum mechanics tells us that the measurement of the quantum state will cause the wave function collapse, so that the nature will change quantum state, and the sender and the receiver can be checked by their communications evaluating, because this kind of eavesdropping is bound to stay with obvious features of quantum measurement traces.

The second method is to avoid the direct quantum measurement, which the device with copy function, so that the information transformed by can be intercepted and copied. Then, the evaluator and the quantum state transfer of the original can be use. If a copy of the quantum state for evaluators can be in measurement and analysis, and in order to steal information. So, the evaluator should do not leave any traces. But determined by quantum coherence, quantum no-cloning theorem shows that quantum copying device may allow any physically impossible to clone and the input quantum state exactly.

2.2. Detection options

Base on the Quantum key distribution model and Quantum communication channel model, global algorithm can be applied on single photon detection. Correlation methods applied and analyzed can be demonstrated in Figure1 to Figure 2.
3. Results

Base on the judge by reason that particles in the micro world are strictly abide by the above two kinds of quantum mechanics, so in the quantum secure communication, we use the above characteristics to test the theory and experimentation which we design. According to that quantum communication protocol is based on quantum communication channel, which divided into different approach in communication.
According to the methods discussed above, single quantum state, quantum communication and quantum key distribution simulation analysis have been studied by some experimentation we design, which mainly using the properties of light quantum in the micro world, high-speed transmission through a single photon or entangled photon pairs as the carrier of information to achieve information, can be said that the transmitter large capacity information theoretically, and is capable of generating cannot decipher key, and to encrypted data information communication using the key.

Based on theoretical analysis, principle and process of this protocol, the simulation software simulation model of quantum circuits on agreement and intercept and resend method based on structural reliability and quantitative agreement, effective mutual information analysis model of transmission line, efficacy and safety of different interference model and noise model, quantitative. The experimental results show that. See Figure 3 and 4. And the Results on criterion MTF of sensor system can be evaluated by Figure 5, 6.

![Global algorithm applied on sensor systems A](image-url)
Figure 4. Global algorithm applied on sensor systems B

Figure 5. Results on criterion MTF of sensor system A
4. Conclusions

The results of simulation experiments and theory analyzing demonstrate that proposed method could advance the system validity effectively, and theory analysis and experiment shows the method is reasonable and efficient. Firstly, applied study on the theory and experiment of single photon detection, including the project and experiment of quantum key distribution. Secondly, based on methods of the selection of detector, main photo electronic system configuration, design and creation, along with the relationship between these to system characteristics have been studied. Thirdly, based on the considerations on the research of image sensor systems on single photon detection, and the total system characteristics are evaluated and discussed in quantity.

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