THE SUPERPOSITION AND INTERFERENCE MANAGEMENT MODEL BASED ON QUBITS IN TRADITIONAL QUANTUM COMPUTING

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Abstract

Quantum computers use the properties of quantum physics to store data and perform calculations. They can perform better than the fastest computers we use. Classical computers, including smart phones and laptops, encode information in binary "bits." They can be either 0 or 1. In a quantum computer, the basic unit of memory is the quantum bit or qubit. Qubits are made using physical systems such as the spin of an electron or the orientation of a photon. These systems can be found in multiple orders simultaneously. This property is called quantum superposition. In this paper the superposition and interface management model based on the qubits was proposed to enhance the computational operations. The qubits can be inextricably linked using a phenomenon called quantum entanglement. As a result, successive qubits can represent different data simultaneously. According to traditional mechanistic theory, to understand a mechanical system as a whole, one must understand the properties of its parts. Its idea is that the mechanics of the whole can be devised by knowing the basic properties of the parts, the mechanisms by which they operate.

Keywords:

Quantum, Computers, Physics, Data, Binary, Qubits, Photon, Operations, Mechanistic

1. INTRODUCTION

Quantum theory describes matter as light, wavelike particles. According to the quantum principle, the smallest particles are not solids [1]. Microscopic units of matter are very finely structured and dual in nature. Sometimes they appear as particles and sometimes as waves, depending on how we look at them [2]. This same duality is manifested by light in the form of electromagnetic waves and particles. It must be said that this dual nature of matter has not yet been known to physics [3].

So to be something that manifests itself as both particles and waves at the same time was a novelty for the field of physics. These inconsistencies led to the emergence of conundrums like Cowan's [5]. Finally, the formulation of the quantum principle was completed. This was made possible by the invention of a scientist named Max Planck. He discovered that thermal energy is not emitted continuously but in bursts of energy. Such packets of energy are called quanta [6].

Matter alternates between particles and waves at the same time. Here the traditional belief that matter has a finite set of properties is called into question [7] [8]. It showed an uncertainty. Thus, matter had only the possibilities of being particles and waves. That is why they are waves and particles at the same time [9].

These were perceived to occur based on the law of mathematical probability. According to the new theory, it is through the dynamics of the whole that the properties of the parts can be understood as a whole [10]. Once the mechanics of the whole are understood, then the properties and functional forms of its parts can be deduced [11]. A change in this scientific relationship between the whole and the parts occurred when the quantum principle was developed in physics [12].

The problem is also the problem behind creating computer simulations of quantum systems. This discovery shows that a large class of quantum systems (those with exponential decay of interactions) has only finite complexity and can be easily simulated. The relationship between area and entanglement has been questioned by researchers in the field, based on the intuitive argument that if the interaction between particles in a system decreases rapidly with distance, only nearby particles will become entangled with each other.

Therefore, particles far from the boundary do not participate in the problem and only the boundary region is relevant. However, this attractive idea is undermined by the presence of a counterexample. This shows that even if the two regions are separated by a layer wide enough to cut off all communication between them, observers cannot learn about each region if they are truly isolated. This 'data masking' phenomenon is a key characteristic of entangled states, in which one partner's lack of knowledge affects the other measurable. This work solves the apparent difficulty by combining recent discoveries in quantum information theory, originally developed to analyze quantum communication protocols, to show that data hiding cannot be prevented if exponential decay interactions are detected in all the different parts of the system.

2. RELATED WORKS

Quantum computers are said to be able to solve calculations that cannot be solved by conventional computers and are capable of completing very complex calculations very quickly [1]. Computers that we usually use in homes and offices work through a unit called 'bit' which has a binary numerical value of zero or one. But quantum computers work in terms of units called qubits. A qubit unit represents the possible combinations of digits 0 and 1 [2]. This ability to exist in multiple states simultaneously is called superposition. Through this process, quantum computers can combine binary digits and do things that conventional computer cannot [3].

To harness the power of quantum computers, many qubits must be mixed together. This process is called entanglement. Also, the calculation doubles as each qubit is added. This allows quantum computers to solve problems in minutes that have been unsolvable for years by conventional computers [5]. Quantum computing technology is complex to understand. Not just a laptop or a cell phone, they work in a completely different way than supercomputers, which operate at astonishing speeds [8]. The underlying project is to use quantum computers to combat climate change, develop new medicines, and improve artificial intelligence technology. But solving practical problems with quantum computers is yet to materialize [12]

3. PROPOSED MODEL

A classical computer requires eight bits to represent any number between 0 and 255. But eight qubits are enough for a quantum computer to represent every number between 0 and 255 simultaneously. A few hundred qubits would be enough to represent more numbers than there are atoms in the universe. This is where quantum computers become more important than classical computers. Quantum computers must protect qubits from external interference. They can be preserved by isolating and keeping them cold or moving them with a carefully controlled electronic pulse shown in Fig.1.

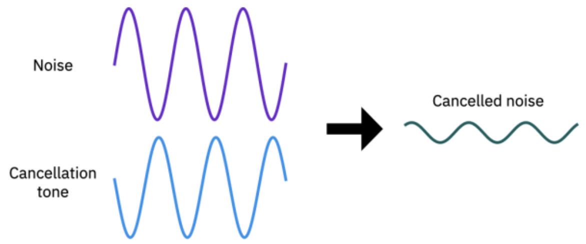

Fig.1. Superposition and interference

In situations where there are a large number of combinations, quantum computers can consider them simultaneously. Examples are finding the common factor of a very large number or trying to find the best way between two places. However, there may be situations where classical computers outperform quantum computers. So, future computers may be a combination of these two types. For now, quantum computers are more sensitive. Therefore, qubits lose their properties due to heat, electromagnetic fields and collisions with air molecules. This process, known as quantum decoherence, causes quantum computers to malfunction.

Quantum circuits enable a quantum computer to take in classical information and output a classical solution. It improves quantum principles by helping to account for interference and entanglement. A typical quantum model workflow is as follows:

- A classical method for constructing a description of a quantum circuit,
- A quantum circuit to be operated in quantum hardware,
- A classical solution to the problem it creates.

Quantum gates form the primitive operations of quantum data. Quantum gates represent information security, reversible changes of quantum data stored in qubits. Quantum computing is defined as an area of computing that uses the principles of "quantum mechanics" to perform calculations. Devices used to make quantum computers are called quantum computers. The "quantum" nature of a quantum computer allows it to perform operations in a different way than classical computers. The fundamental quantum mechanical principles that allow such great advantages are: superposition, entanglement, and interference. The principle of superposition explains the ability of a quantum bit (qubit) to exist in a mixture of multiple states simultaneously until a measurement is made. This allows two qubits to change states if one of the qubits can be entangled. Interference is a relatively easier concept to understand than the previous two. Different qubits interfere with each other and can strengthen or weaken each of their states. Think of each quantum particle as a wave function that interferes with each other constructively or destructively. This is a more condensed version of these principles that aims to provide an overview as opposed to a conceptual understanding.

4. RESULTS AND DISCUSSION

The proposed superposition and interference management model (SIMM) was compared with the existing Emerging quantum computing algorithms (EQCA), Multi-qubit entanglement and algorithms (MQEA), variational quantum algorithms (VQA) and quantum deep learning model (QDLM)

4.1 QUANTUM CRYPTOGRAPHY MANAGEMENT

This addresses this threat and develops cryptographic protocols suitable for a post-quantum world. One such notable protocol is quantum key distribution (QKD). QKD allows two users to exchange keys over a quantum channel, meaning that a third party can discard intercepted keys and start the process over. Modern cryptosystems rely on the inefficiency of classical computers, and while we're a long way from building a large-scale quantum computer capable of running, it's still a problem that needs to be solved before we are anywhere close. The assessment of Quantum cryptography management was demonstrated the following Table.1.

Table.1. Assessment of Quantum cryptography management

Inputs	EQCA	MQEA	VQA	QDLM	SIMM
100	81.02	66.25	61.98	87.54	99.83
200	80.69	64.75	61.39	85.67	98.82
300	79.35	63.64	60.41	84.84	98.66
400	78.21	63.26	59.20	83.93	97.70
500	77.16	62.25	58.06	83.01	98.13
600	76.45	61.32	56.95	81.68	96.93
700	75.15	60.32	56.25	80.60	96.77

4.2 ARTIFICIAL INTELLIGENCE MANAGEMENT

Quantum Machine Learning (QML) will revolutionize the field of Artificial Intelligence. AI needs some heavy numbers to learn models and make good predictions. Quantum computers can do this in less time than a classical computer. QML is an emerging field of research aimed at developing various "quantum" algorithms to efficiently implement an AI model. The assessment of Artificial Intelligence management was demonstrated the following Table.2:

Table.2. Assessment of Artificial Intelligence management

Inputs	EQCA	MQEA	VQA	QDLM	SIMM
100	83.32	68.55	58.58	84.80	95.74
200	82.99	67.05	57.99	82.93	94.70

300	81.65	65.94	57.01	82.10	94.57
400	80.51	65.56	55.80	81.19	93.61
500	79.46	64.55	54.66	80.27	94.04
600	78.75	63.62	53.55	78.94	92.80
700	77.45	62.62	52.85	78.07	92.69

4.3 STRUCTURAL DEVELOPMENT

Drug development involves analyzing the structure and properties of various chemical compounds and molecules to develop better drugs. These compounds are made up of molecules. Molecules are composed of atoms, which are subatomic particles of quantum mechanical nature. As we discussed earlier, quantum computers can be simulated more efficiently in a quantum computer than in a classical one. Quantum computers have already successfully simulated simple molecules and are predicted to simulate more complex chemicals in time. Hence, a collection of better, more efficient drugs against known and unknown diseases is promising. The assessment of Structural Development was demonstrated the following Table.3.

Table.3. Assessment of Structural Development

Inputs	**EQCA**	**MQEA**	**VQA**	**QDLM**	**SIMM**
100	82.06	76.29	66.14	93.24	95.00
200	80.43	74.55	64.56	91.82	93.71
300	79.95	72.21	62.36	90.56	92.70
400	78.66	71.40	60.73	88.57	91.81
500	76.55	69.11	59.59	86.10	91.44
600	75.06	67.18	57.39	84.66	90.40
700	73.25	65.45	56.24	82.94	89.63

4.4 PROBLEM OPTIMIZATION

Optimizing means that we want to find the state that solves the problem out of all possible combinations of states. As we have already discussed, optimization problems are difficult to solve on a classical computer. However, that doesn't mean they can't be solved. Computer scientists have developed algorithms to solve these types of problems. But that doesn't mean we can't do better. It has been theoretically proven that quantum computers can solve certain problems more efficiently than classical computers. The assessment of Problem optimization was demonstrated the following Table.4.

Table.4. Assessment of Problem optimization

No of Inputs	EQCA	MQEA	VQA	QDLM	SIMM
100	91.95	72.19	65.98	92.23	95.00
200	90.46	70.22	63.56	90.03	95.01
300	89.66	69.09	63.15	89.23	93.81
400	87.33	67.90	61.55	88.56	93.33
500	86.32	67.51	59.23	87.13	91.90
600	85.68	65.99	57.98	86.04	90.74
700	85.02	65.75	55.25	85.56	89.97

4.5 QUANTUM MECHANICS MANAGEMENT

The quantum mechanical simulations to be precise. The theory of quantum mechanics proves that the world is quantum mechanical in nature. To make reasonable predictions about any natural phenomena, we can simulate those phenomena in a machine. Simulating quantum mechanical systems is again very difficult in terms of both time and space in a classical machine. The assessment of Quantum mechanics Management was demonstrated the following Table.5.

Table.5. Assessment of Quantum mechanics management

Inputs	**EQCA**	**MQEA**	**VQA**	**QDLM**	**SIMM**
100	83.44	75.82	68.49	96.43	94.84
200	83.55	75.80	68.66	96.70	95.34
300	83.57	74.92	67.93	96.40	95.22
400	80.47	72.09	64.59	92.89	91.99
500	79.27	70.77	63.86	91.57	91.61
600	78.66	69.94	62.97	91.03	91.04
700	78.25	69.54	62.89	90.73	91.34

5. CONCLUSION

Modern computing devices come in many shapes and forms. From smart-watches to GPS systems, mobile phones to supercomputers, space probes to drones, these devices all run on the same basic engine as a classical computer. The basic operation of a classical computer relies on encoding information as a string of binary characters. A single character—the smallest piece of information—is called a bit, which can be either a 0 or a 1. Since modern computers are digital, 0 represents low voltage and 1 represents high voltage. This information is stored in the millions of transistors in your processor that perform operations on this information. The reason we are talking about modern computers and their working principles is because we want to highlight that all modern computing devices work on the same basic principle. Quantum computers on the other hand do not operate on these principles. They are fundamentally different from their classical counterparts. The way information is represented and processed in a quantum computer relies heavily on the application of quantum mechanics principles.

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