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Quantum Computer: Why should we use it over classical computer

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ABSTRACT

As we all know our world is getting advance day by day in technology if its mobile phone or any tech. So why we are using classical computer if we have quantum computer . The goal of quantum computing is to find algorithm that are considerably faster than classical computer . The quantum computer seems to be no longer just for physicists and computer scientists , but also for information system researchers .In this paper we will study about the advantages of quantum computer over classical computer , why it is better and also problems which we face while operating quantum computer.

Keywords: *Quantum Computer, Qubits, Superposition, Entangle, Classical Computer.*

1. INTRODUCTION

Classical Computers are those which we use in our day to day life and we know that they are mainly based on transistors .They work on binary digits which are either 0 or 1. Classical computers are develop in early 19th century . Our first generation was mainly based on vacuum tube and second generation is was on transistor From third generation it was based on IC chip .As the size of electronic components is decrease the size of the system is also get decrease. The chip technology is not get cheaper and better. Fig. 1 is the image of your PC.

Fig. 1: Classical Computer

But when it comes to quantum computers technology, it is different from classical computers. These computers are based on physics quantum theory .The computing in quantum computer transform the memory into quantum superposition. Bits of quantum computer are in state of 0 , 1 as well as both(superposition state). These bits are known as Qubits. Here is a fact that many scientist has said that the power of Forty qubits is equivalent to the modern super computers i.e it can search a phone no.in 25 to 30 secs from worlds phone book . Fig. 2 is the image of your quantum computer.

Fig.2 Quantum computer

2. COMPARISON

2.1. By Graph

In classical computers ,Power increases in a 1:1 relation with the number of transistors (represents 0 or 1). They have low error rates and can operate at room temp because of this transistors.Fig.3 is the relationship graph of power and transistor .

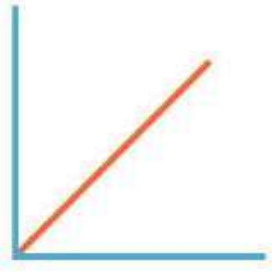

Fig.3: Classical computer graph

In quantum computers , Power increases exponentially in

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proportion to the number of qubits(represent 0 and 1 at the same time) . They have high error rates and need to be kept cold because of this qubits.Fig.4 is the relationship graph of power and qubits .

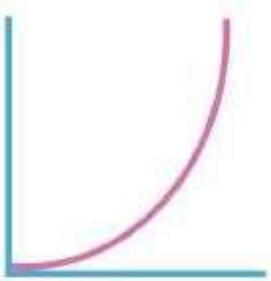

Fig.4: Quantum computer graph

2.2. By Experiment

We all know the game which we play in our computeri.e, the coin game. It starts with the coin showing head and the computer will play first,it can choose to flip thecoin or not but you don't see the outcome. Next is yourturn You can also choose to flip the coin or not andyour move will not be revealed to the computer. Finallythe computer plays again, and can flip the coin or not,and after these three round ,the coin is revealed and if it is tail you win and if it is head then computer wins.Fig.5 is the image of your experiment how it works.

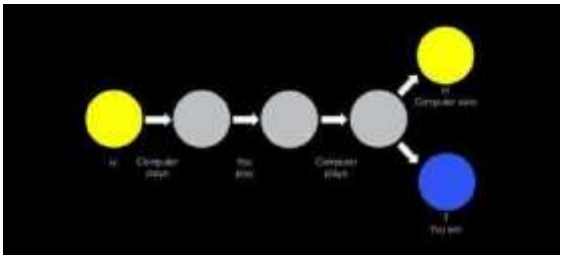

Fig.5. Experiment structure

If everything is working fine and the coin is fair the you have a chance of winning the game is 5 percent , or close to 50 percent which is expected.Fig.6 is the imageof the result of the game played in classical computer.

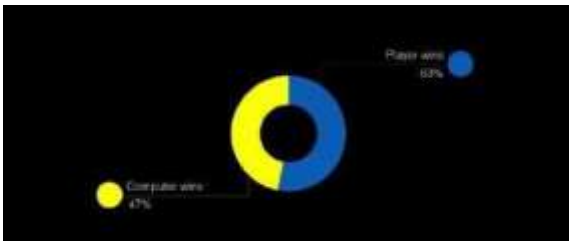

Fig.6: Classical computer result

Now ,when you play this game in quantum computer ,your chance of winning is get reduce.Fig.7 is the imageof the result of the game played in quantum computer.

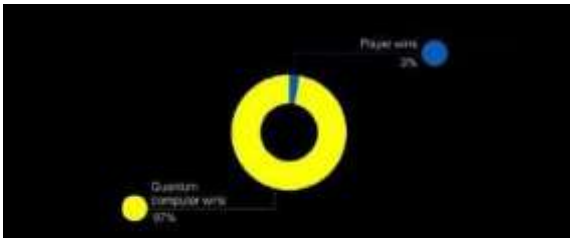

Fig.7: Quantum computer result

How did quantum computer achieve this amazing win streak? It is because of quantum physics is in actions. A regular computer simulates heads or tails of a coin asA bit, zero or one or a current flipping on and off insideyour computer chip. Quantum computer is completely different .It can exist in a combination of 0 and 1 both ,with some probability of being 0 and 1 respectively. In other words ,its identity is on a spectrum. So during thegame, the quantum computers creates this fluid mix ofheads and tails, so that no matter what the player doesflip or no flip, the superposition remain intact ,but in itsfinal move the quantum computer can unmix the 0 and 1,perfectly recover heads so that you lose every time.Fig.8. is the image shows that how it work.

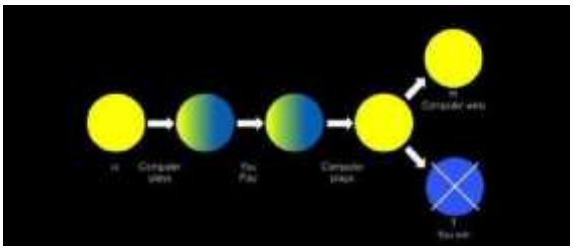

Fig.8: Quantum computer working

From this experiment we can conclude that by having the quantum computers we can tests problems which we cannot implement in classical computers. As we cansee here heads and tails exist in combination of head and tails which we cannot see in our daily life.

3. APPLICATION OF QUANTUM COMPUTER

1. Quantum uncertainty could be used to create private keys for encrypting messages sent from one location to another, so that hackers could not secretly copy the keys perfectly, because of quantum uncertainty
2. Quantum technology could also transform healthcare and medicines. For example , the design and analysisof molecules for drug development is a challenging problem today, and that's because exactly describing and calculating all of the quantum properties of all the atoms in the molecule is a computationally hard task, even for our supercomputers. But if we use our quantum computer we can do it because it operates using the same quantum properties as the molecule its trying to simulate.
3. Quantum computers can be used for teleportation of Information from one location to another without Physically transmitting the information. It is possible Because of these fluid identities of the quantum particles can get entangled across space and time in such a way that when you change something about one particle, it can impact the other and that createsa channel for teleportation.

4. PROBLEMS

1. We use superconductive materials to create and materials for maintaining this qubits. Any heat in this system can introduce error, and therefore quantum computers operates at low temperature close to zeroA huge infrastructure is required in order to maintainthis very low temperature.
2. Because of decoherence ,we can only keep the info in the quantum state for a particular time period. Thisputs a limit on the number of operations we do in a row before you lose your information.

5. CONCLUSION

Quantum computing programming method is different from classical computers. Many large companies like IBM , Google etc are working on non error corrected quantum

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computers and it is very expensive for their development purpose . But we have also seen that by using quantum computers we can resolve many– many problems that cant be done using our today computers. Although the future of quantum computing looks very promising, so we have to realize on quantum computer

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