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Darwinism of Quantum Computing

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***Abstract*—With rapid development in modern science the traditional computers can't cope up with modern problems so there is a immense need of a powerful computer which can handle enormous number of problems.**

So after years of research we have finally come to the pinnacle of Computing called Quantum Computing which uses the laws of Quantum Physics such as superposition, entanglement, tunneling and annealing to solve problems that can't be solved in life span of human beings. Quantum Computing and AI is the future that we need.

Keywords— Quantum Computing, Quantum Bits, Quantum Information Theory, Quantum Computers, Quantum-Inspired Evolutionary Algorithm, Quantum Entanglement and Quantum Superposition.

I. INTRODUCTION

Even though power offered by todays computers are colossal still there are infinite problems which are needed to be solved or which can take years to be solved. With rapid increase in population there is a rapid growth in data.

The traditional computers are good for now but will suffer in future as demand in science will increase exponentially. So there is need for a Quantum Computer. "The Quantum Computers will revolutionize in the same way as the bulb did by replacing candles". Bulbs and candles have the same functionality but have different physical forms. In the same way Quantum Computers will not match the physicality of traditional computers but will do the same functions with more efficiency.

The Quantum Circuits are based on Quantum bits or Qubits, which is parallel to the bit in traditional computers. Qubits can be 1 or 0 Quantum state or they can be superposition of both states (1 and 0). When qubits are studied the result is always either a 0 or 1. Computation is performed by manipulating qubits with quantum logic gates, which are somewhat analogous to classical logic gates[10]. The number of atoms needed to represent a bit of memory has been decreasing exponentially since 1950. An observation by Gordon Moore in 1965 laid the foundations for what came to be known as "Moore's Law" – that computer processing power doubles every eighteen months.[8]

Recent researches in Quantum Computing have resulted in two 53 qubit processors one from IBM and one from Google as published in the paper *journal Nature* in the paper is argued that a normal supercomputer would require approximately 10,000 years to perform equivalent task which is performed in 2.5 days by a Quantum Computer. We think it will give overall information about Quantum Computer.

II. LITERATURE SURVEY

A literature survey is the summary of the various previous research done on a particular topic in the past. The idea of computational device based on quantum mechanics was first explored in the 1970's and early 1980's by physicists and computer scientists such as Charles H. Bennet of the IBM Thomas J. Watson Research Centre, Paul A. Beniof of Arogonne National Laboratory in Illinois, David Deustch of the University of Oxford and Richard P. Feynman of Caltech[8].

Edwin Pednault, John Gunnels, Dmitri Maslov and Jay - Gambetta [2] When the Quantum computers were compared with traditional computers the relied on an advanced simulation that leverages parallelism, fast and error free computation, and large aggregate RAM, but failed to fully account for plentiful disk storage.

Martin Giles [3] The research explains the superiority of Quantum Computers and the way they have almost replaced the normal computers. The machines are notoriously prone to errors, because even the slightest change in temperature, or a tiny vibration, can destroy the delicate state of qubits [3].

Das, A.; Chakrabarti, B. K. [4] Proposed about the recent success in Quantum Computing. Utilization of Quantum fluctuations for the optimization of the cost and energy is reviewed here.

Ying, M. [7] Quantum computation research hopes to find more quantum algorithms demonstrating significant boost up on the other hand the AI community believes that Quantum computation shows significant potential for solutions to currently intractable problems

III. PROPOSED METHODOLOGY

Given below is the timeline of Quantum Computing

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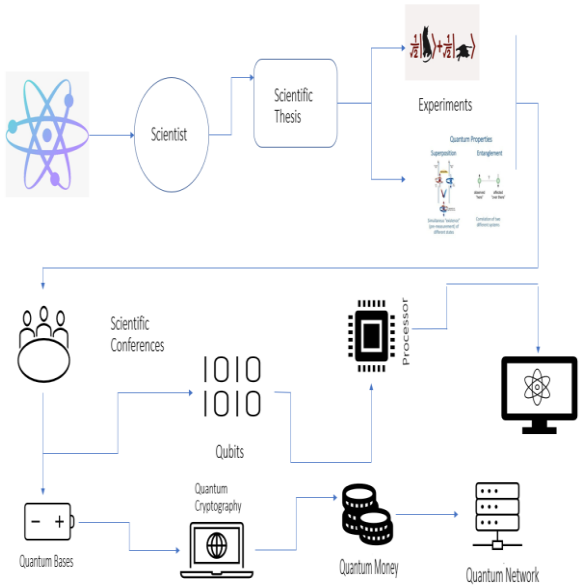

Fig name: Timeline of Quantum Computing

Timeline 1: Quantum physics theory provided by scientists like Niels Bohr, Max Planck. Various thesis were written down for the future.

Timeline 2: Evolutionary experiments like Schrodinger's cat, Quantum entanglement, Parallelism etc. which heavily contributed in the field of Quantum Computing.

Timeline 3: Conferences held by companies like IBM and Google brought light to the realm of Quantum Computing. This led to the extensive work on Qubits and Quantum bases which further powered the age of Quantum Computing.

Timeline 4(A): In quantum computing, operations instead use the quantum state of an object to produce what is known as a qubit [13]. The states are not defined before they have been figured out, it can be spin of an electron or photon polarization. Qubits are neither 1 or 0 it is a superposition of both and make decisions based on the situation.
Processor: This list contains quantum processors, also known as quantum processing units (QPUs).
1)Google- Bristlecone (2018), Sycamore (2016).
2)IBM- IBM Q 5 Tenerife (2016), IBM Q 53(2019).
These processors started the initial building of quantum computers.

Timeline 4(B): The Quantum state is nothing but a mathematical property that gives idea about probability distribution for each possible probability. The Quantum states which are not the mixtures of any other states are called as pure states, whereas others are called mixed states.
Applications:

1. Cryptography: Quantum computing with the help of ML can help in improving cybersecurity, additionally it can help in creating encryption method known as Quantum cryptography.
2. Quantum Money: Quantum money can help us build Bank note which are impossible to forge.
3. Quantum Network: It is way of transmitting information from 1 qubit to another qubit.
4. Machine learning and Artificial intelligence: ML and AI can help us accelerate the process of learning of computers at a far better pace than the current one available.

IV. CONCLUSION

The main goal of the Quantum Computing is to revolutionize computation wholly by solving problems which are not possible for traditional computers as they can take thousands of years to solve those problems. As every coin has two faces in the same way Quantum Computing has some technical risk too but that is only until it is fully evolved. With the proper use of Quantum Computation, AI, ML or medical sectors will reach new heights which we cannot even imagine as of now. Quantum is the future that we are approaching to, IBM and Google are taking serious efforts to make this possible. They have already developed Quantum Computers which do require more research to be made open for the public. This would surely make this world a better place to live.

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