International Journal of Engineering Research and Development
e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 8, Issue 4 (August 2013), PP.33-36

Quantum Computers-A Revolution InComputing

Dr.R.Udayakumar[1], Dr.V.Khanaa[2]
[1,2]Bharath University

Abstract:- Ever since the first computer was constructed more than fifty years ago, the general trend has been towards smaller and smaller computers. the trend is in line with moore‘s law that states that the number of transistors on a semiconductor doubles roughly every 18months with a 50% reduction in area. Within the next twenty years a truly amazing milestone would be reached, transistors would have become the size of a few aggregates of atoms. Going smaller requires manipulating rules of quantum mechanics where the laws of classical physics breaks down. Not only do the laws of quantum mechanics allow us to build smaller computer but they also let usincreasethecomputational power exponentially. such a computer based on quantum mechanics is known as the quantum computer. In a quantum computer there would be no wires, no plugs and no transistors. Quantum computers which harness the power of atoms and molecules to perform memory and processing tasks have The potential to perform certain calculations billions of times faster than any silicon-based computer. This paper gives into insight into the quantum mechanics involved in designing quantum computers and various issues relating to quantum computers such as quantum entanglement and de-coherence. in this paper we discuss how non magnetic resonance (nmr) is used to detect qu-bits State in a quantum computer. a large number of quantum algorithms have been discovered and the Field of quantum cryptology is also budding. there is even a proposal to build a quantum neural network. neural networks are based on the same principle as a human mind. a sizable quantum neural network, if built, would behave just like the human mind but exponentially faster. the principle of quantum entanglement can form the basis for high-speed networking in the future. Quantum computers are surely going to revolutionize the field of computing.

I. INTRODUCTION

The State Of Atom In Quantum Computers Is Designated As Qubit (Quantum Bits). Each Qubit Can Represent Our States. So A Quantum Computer Has Exponentially More Memory When Compared To Classical Computers. In Other Words A Quantum Computer Offers An Enormous Gain In The Use Of Computational Resources Such As Time And Memory. Quantum Computers Have The Property Of Inherent Parallelism I.E To Process Number Of Computational Tasks In Parallel.

II. CLASSICALCOMPUTERS VS QUANTUM COMPUTERS

The Classical Computers That We Use Today Stores Information In The Form Of 0‘S And 1‘S Called Bits. A Quantum Computer On The Other Hand Stores Information In The Form Of Qubits (Quantum Bits). Whereas A Bit Is

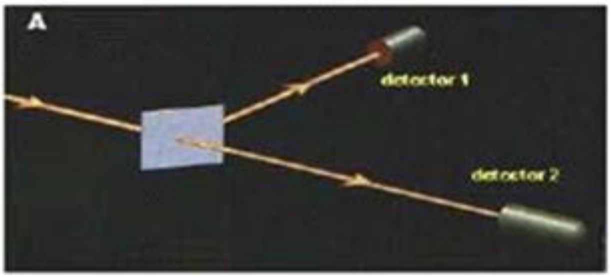
Either A 1or A 0, A Qubit Is 1 And 0 At The Same Time! This Means Hat The Qubit Can Be Either 0 Or 1 Or A Superposition Of 0 And 1.Hence Two Qubits Can Store Four Bits, Three Qubits Can Store Eight Bits Of Information And A Collection Of L Bits Can Store 2L Bits Of Information. This Empowers Quantum Computers With Parallelism. This Means That A Quantum Computer in Only One

Computational Step Can Perform The Same Mathematical Operation On 2L Different Input Numbers Encoded In Coherent Superposition Of L Qubits. In Order To Accomplish The Same Task Any Classical Computer Has To Repeat The Same Computation 2L Times Or One Has To Use 2L Different Processors Working In Parallel. For Example, A Classical Computer Takes 10 Million Billion Billion Years To Factor A 1000 Digit Number, Whereas A Quantum Computer Would Take Around 20 Minutes.

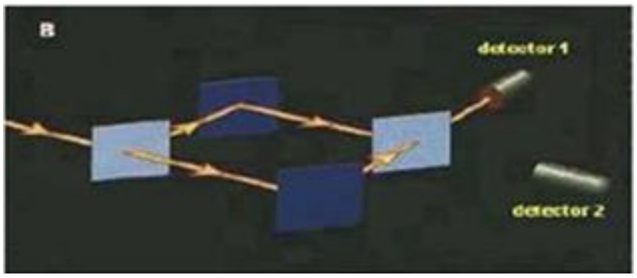
III. QUANTUM ENTANGLEMENT

Superposition Of States In Quantum Theory Can Be Explained By A Phenomenon Called Quantum Entanglement. This Can Be Explained Clearly Using The Following Experiments:- Let Us Try To Reflect A Single Photon Off A Half-Silvered Mirror I.E. A Mirror Which Reflects Exactly Half Of The Light Which Impinges Upon It, While The Remaining Half Is Transmitted Directly Through It (Fig. A). It Seems That The Photon Is Either In The Transmitted Or The Reflected Beam With The Same Probability. That Is One Might Expect The Photon To Take One Of The Two Paths Choosing Randomly Which Way To Go. Indeed, If We Place Two Photo Detectors Behind The Half-Silvered Mirror In Direct Lines Of The

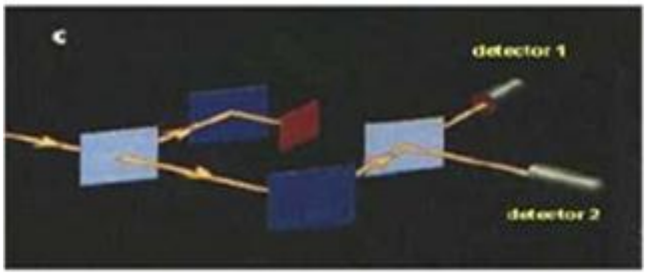
Two Beams, The Photon Will Be Registered With The Same Probability Either In The Detector 1 Or In The Detector 2. Does It Really Mean That After The Half-Silvered Mirror The Photon Travels In Either Reflected Or Transmitted Beam With The Same Probability 50%? No, It Does Not! In Fact The Photon Takes `Two Paths At Once'.



This Can Be Demonstrated By Recombining The Two Beams With The Help Of Two Fully Silvered Mirrors And Placing Another Half-Silvered Mirror At Their Meeting Point, With Two Photo Detectors In Direct Lines Of The Two Beams (Fig. B). With This Set Up We Can Observe A Truly Amazing Quantum Interference Phenomenon. If It Were Merely The Case That There Were A 50% Chance That The Photon Followed One Path And A 50% Chance That It Followed The Other, Then We Should Find A 50% Probability That One Of The Detectors Registers The Photon And A 50%Probability That The Other One Does. However, That Is Not What Happens If The Two Possible Paths Are Exactly Equal In Length, Then It Turns Out That There Is A 100% Probability That The Photon Reaches The Detector 1 And0% Probability That It Reaches The Other Detector 2.



Thus The Photon Is Certain To Strike The Detector 1! It Seems Inescapable That The Photon Must, In Some Sense, Have Actually Traveled Both Routes At Once For If An Absorbing Screen Is Placed In The Way Of Either Of The Two Routes, Then It Becomes Equally Probable That Detector 1 Or 2 Is Reached (Fig. 1c).



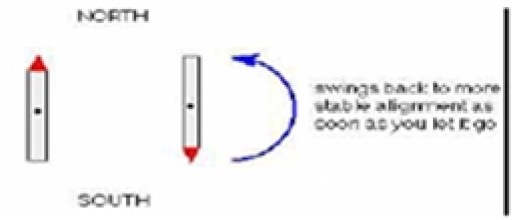
Blocking Off The Of The Paths Actually Allows Detector To Be Reached; With Both RoutesOpen, The Photon Somehow Knows That It Is Not Permitted To Reach Detector2, So It Must Have Actually Felt Out Both Routes. It Is Therefore Perfectly Legitimate To Say That Between E Two Half-Silvered Mirrors The Photon Took Both The Ansmitted And The Reflected Paths Or, Using More Technical Language, We Can Say That The Photon Is In A Coherent Superposition Of Being In The Same
Token An Atom Can Be Prepared In A Superposition Of Two Different Electronic States, And In General A Quantum Two State System, Called A Quantum Bit Or A Qubit, Can Be Prepared In A Superposition Ofits Two Logical States 0 And 1. Thus One Qubit Can Encode At A Given Moment Of Time Both 0 And 1.

IV. QUANTUM DECOHERENCE

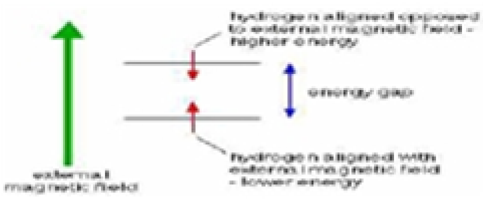
Potentially Large Obstacle Preventing From Building Quantum Computer That Can Rival Today's Modern Digital Computer Is QuantumDecoherence. Decoherence Is The Tendency Of A Quantum Computer To Decay From A Given Quantum State Into Incoherent State As It Interacts, Or Entangles,With The State Of Environment.These Interaction Between The Environment And Quibts Arre Unavoidable And Include The Break Down Of Information Sored In The Quantum Computer And Thus Errors In Computation.Quantum Decoherence Can Be Avoided By Using NMR Technique In Detecting States Of Quabits.

NON- MAGNATI RESONANACE

The Quntum Compuetr Uses NMR To Maniplate Particulars In The Atomi Nuclei Of The Moloculars The NMR Is Used To Apply Electro Magnetic Pulses.Which Force The Partiulars To Line Up. These Particulars In Postion Parallel Are Ounter To The Magnetic Field Allow The Quantum Computer To Mimic The Information Encoding Of Bits In Didgital Computers.



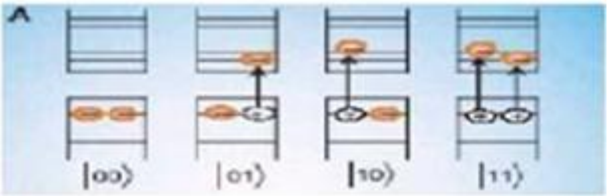
If You Have Compass Needle Normally Lines Up With Earth Magnetic Filed With The North Seeking End Ponits North.Provided It Isn`T Scaled In Some Sort Of Container, You Could Twist The Needed Around With The Fingers So That It Point South -Lining It Up Opposed To The Earth`S Field And As Soon As You Let It Go Again, It Will Flip Back To Its More Stable State.Atom Nuclei An Also Be Aligned With An External Magnetic Field Or Opposed To The Field Is Less Stable (At A Higher Energy). It Is Possile To Make It Flip From The More Stable Alignment To The Less Stable One By Supplying Exactly The Right Amount Of Eneregy.



The Energy Needed To Make This Flip Depends On The Strength Of The External Magnetic Field Used But It Usually In The Range Of Energies Found In The Ratio Waves-At The Frenquenies Of About 60-100Mhz.It Is Possible To Detect The Interaction Between The Radio Waves Of
Just The High Frenquency And The Proton As It
Flips From One Orientation To Other As A Peak On A Graph.This Flipping Of The Proton From One Magnetic Alignment To The Other By The Radio Waves Is Known As The Resonance Condition.This Condition Is Used To Detect State Quabit Indriectly.

Quantum Gates

They Can Be Realized By Using Exction Transtitions And Tarpped Ion Method. Excition Transtition: IN This Method Gallium Arsenide Layer 4.2 Nm Thick Is Grown Between Two 25 NmAluminum Gallium Arsenide Barriers To Make A Quantum Dot.Eletrons Are Trapped In The Dot Beause The Gallium Arsenide Layer Has A Smaller Energy Band-Gap Than The Surrounding Material.When Excited By Light,Electrons From The Valence Band In The Dot Move To Higher Energy Levels. The Excited Electron And The Hole It Leaves Behind Combine To From An Exction The System Has Four States: A Ground State Containing Two Unexctied Electrons: TwoStstes Containing One Exaction.The Two Single Exctions Can Be Distinguish Form The Each Other Because The Exctions Have Different Polarization.This System Bahaves Like A Controlled -NOT Gate In Which The Valve Of Qubit Is Reserved (The NOT
Operation)If -And Only If -The Valve Of The Other Quabitis 1.



Trapped Ion Method

One Of The New Two Quabit Logic Gates Was Made Using Apair Of Trapped Beryllium Ions The Hyperfine Structure Of Their Spin-Up And Spin Down Electronic Energy States Allows Them To The Store Extremely Stable Qubits.An Oscillating Froce That Only Acts When The Ions Are Ina Mixture Of Spin-Up And Spin-Down.The Forces On The Ions Oscillate Slightly Towards And Away From Each Other. The Changes Of Coulomb Forces Between The Charged Ions And While, The Force Is Acting Makes The Energy Of The Mixed State S Diferent From That Of Half The Energy Of A Completely Spin-Up Or Spin-Down State.This Is Called A Pharse Gate And Is The Logic Equivalent To The Controlled NOT Operation In Conventional Electronics.

V. CONCLUSION

Quantum Computers Are The Final Frontiers Of Computing With The Transistors Size Shrinking To Atomic Size In The Next Decade ,Quantum Computing Will Become The Future The Computers.Quantum Computers Are Billion TimesFasterThanClassical Computers.QuantumComputersWill Revolutionize The Field Of Computing In The Next Decade.

REFERENCES

[1]. Richard Feynman, ―Introduction To Quantum Computing‖, 1992
[2]. Peter Shor, ―The Power Of Quantum Computing‖, Springer Publications, 1995
[3]. Www.Vector.Cshl.Org/Quantum And Some Websites And Journals.