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A Review Research Paper on Design and Implementation of Reversible Gates Using Quantum Gates

Vivek Kumar Singh, Md Sartazul, Harishankar , Narayan Dey, Kamal Bhatia
Electronics And Communication , Noida Institute Of Engg .And Technology/AKTU , INDIA

Abstract: *Future computers will use a new technology called quantum. The main benefit of quantum computers is reversibility. There are many applications for reversible logic, including low power consumption such as CMOS, quantum computing, nanotechnology, cryptography, optical computing, DNA computing, digital signal processing (DSP), quantum Dot automata f mobile, communication, and computer graphics. Reversible logic is one of the most important issues at the moment. Without the use of a postponed brain action, quantum computing cannot be detected. Design's primary goals are to rationally reduce waste disposal costs, circuit depths, and quantum costs. The basic logical retrospective gates are presented in this study. Reversible computing can therefore be used to lower the complexity of digital circuits. We must use quantum gates to construct reversible gates in order for a quantum computer to conduct reversible operations.*

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I. INTRODUCTION

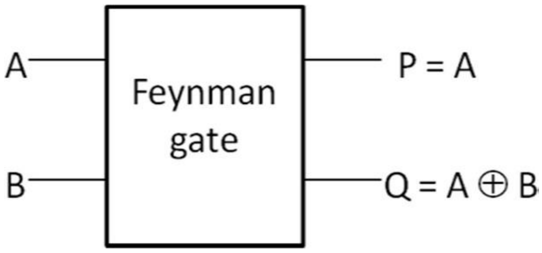
The main goal of VLSI circuit design is to reduce the power consumption or energy consumption .Now a days a famous type of gate is developed to achieve this. R. Landauer ,in the early 1960s that irreversible hardware computing leads to electrical dissipation due to statistics loss, regardless of awareness technique. Each lost data bit has been shown to consume approx. KTln2 joules of energy (heat), where okay is the Boltzmann constant (H) and at operating temperature(T). Reversible good judgement circuits may have zero internal energy excess. if they don't lose data. Bennett asserted that in order for preventing KTln2 joules of power excess, reversible common sense gates must be utilised while building a circuit. Bennett affirmed that reversible common sense gates must be used in the construction of a circuit in order to prevent KTln2 joules of power dissipation. The records loss was caused by a reduction in power supply due to the range of bits decreasing while the virtual system was operating. Due to low density of the gate's result traces in compared to its input traces, the full entropy of the virtual device reduce after the operations i.e (statistics loss = power loss).

Reversible gates like Fredkin, Feynman, Peres and Toffoli gates are used to build reversible circuits. Similar in operation to a operates-NOT gate is the 2x2 Feynman gate, it also known as a "CNOT gate". If the input is set to be 0, it acts as a buffer; otherwise, it acts as NOT gate. The Feynman gates are used to repeat the sign. Pere, Toffoli, and Fredkin gates are reversible gates having three inputs and three outputs. Because they may be used to build any kind of digital circuit, including flip-flops, comparators, adders, multipliers, and more, all of these gates are collectively referred to as universal gates. However, reversible computing is widely used in advanced systems if the system has reversible g.

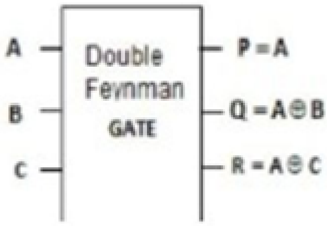
II. BASIC QUANTUM GATES

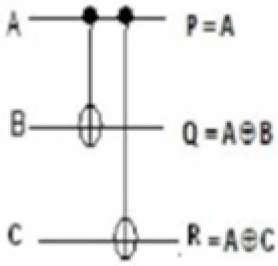
The circuits of the quantum computer are implemented using reversible quantum gates . Information are measured in the form of electron-spin qubits in a quantum computer. Qubits differ from classical bits in that a classical bit can only be either 1 or 0 at a any given time, whereas a qubits either in both states simultaneously. The states in quantum mechanics is shown as
$X = MAJ(A,B, C) = A\cdot B + B\cdot C+ C$

A. Feynman Gate :
Figure 1 depicts the Feynman gate, a 2x2 one through reversible gate. I(A, B) be the input vector, while O be the output vector (P,Q).P=A, Q=A, and B is define the outputs. [U+F0C5] A Feynman gate has a quantum costs of 1. A copying gate can be created using the Feynman Gate (FG). Because reversible logic does not permit a fan-out, this gates are helpful for duplicating the necessary outputs.



B	A	P	Q
0	0	0	0
1	0	0	1
0	1	1	1
1	1	1	0

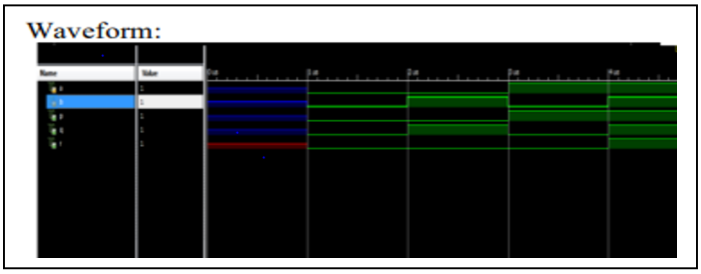




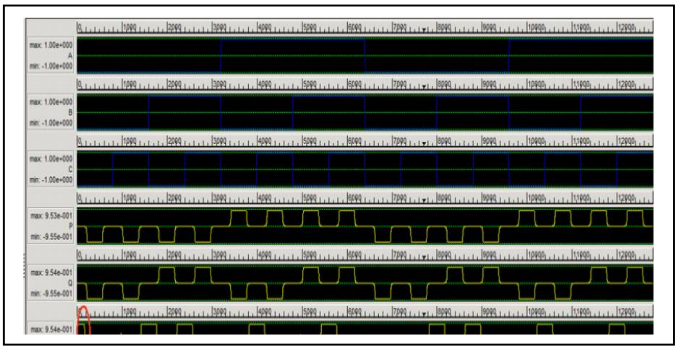
Taking input vector Inpt(A,B) output vector OUT(P,Q)

Code:

```
module fmdesign(A,B,P,Q);
input A,B;
output P,Q;
assign P=A;
assign Q=A^B;
endmodule;
```

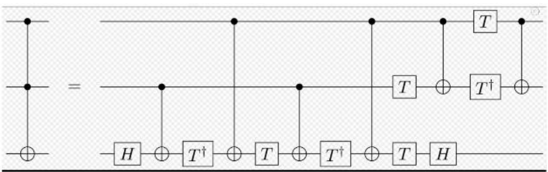



```
module tbnh();
reg A,B;
wire P,Q;
design dut (.A(A), .B(B), .P(P), Q(Q));
initial
begin
A = 0; B = 0 #10
A = 0; B = 1 #10
A = 1; B = 0 #10
A = 1; B = 1 #10
end;
endmodule;
```

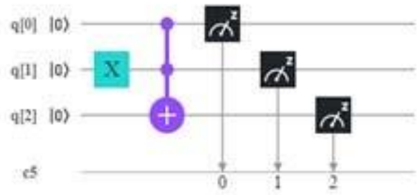


B.Toffli Gate:

The Toffoli gate, also referred to as the CCNOT gate and used as a universal reversible logic gate in logic circuits, was developed by Tommaso Toffoli. This mean that anyof conventional reversible circuits can be created by using Toffoli gates. The term "controlled-controlled-not" gate alludes to the operation of this gate. It has 3-bit as inputs and three for outputs, and if the first two bits are set as 1.

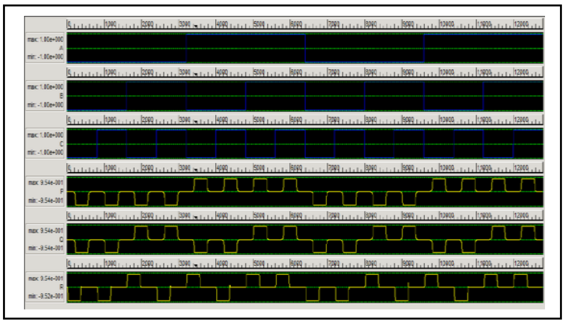


C	B	A	P	Q	R
0	1	0	0	1	0
0	1	1	1	1	0
1	0	0	0	0	1
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	1	1	1



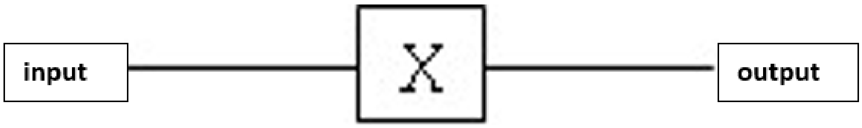
Code:

```
module Tfdesign( input A,B,C, output P,Q,R );
assign P = C;
assign Q = B;
assign R = (C&B)^A;
endmodule;
```

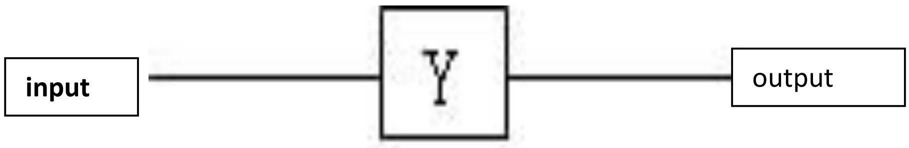


C.Pauli Gate:

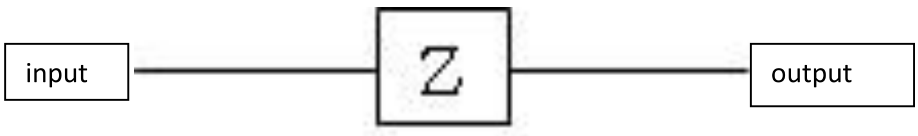
C1. The Pauli X Gate only uses one qubit. It operates in the same way as a traditional computer's NOT gate. It converts the states |0 to |1 and |1 to |0. The following is its graphical representation:



C2. Pauli's Y Gate A Pauli Only one qubit is used by the Y gate (20). The states of |0 to i|1 and |1 to -i|0 are changed. The following is a graphic representation of it.



C3.Z Gate in Pauli The Pauli Z gate is uses a unique qubit as its input. Because thir state will not change if its basis state as |0 and it will change to -|1 if the basis state is |1, the phase shift gates are also known as a phase flip gates. The following fig is graphic representation of it.



III. CONCLUSION

This study conducts an overview of numerous research in the area of reversible logic gates with regard to be reversible circuits and the fundamental component of quantum computers. The reversible gates that have been compiled from the literature up to this point are presented in this study. The paper can be expanded further to discuss the development of digital designs using reversible logic gates circuits that are useful at areas such as quantum computing, low power consumption CMOS, Computer graphics design ,Nanotechnology, optical computing, DNA computing, digital signal processing(DSP), quantum dot cellular automata, communication area, cryptography and so on.

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