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A Review Research Paper On Design And Implementation of Reversible Gates Using Quantum Gates

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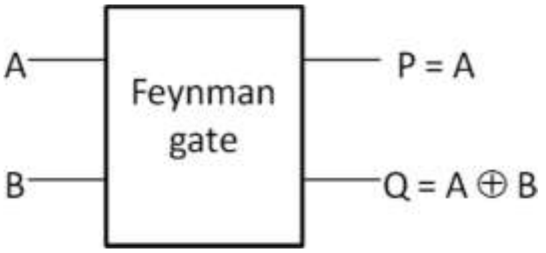
***Abstract*: -** One of the most recent reversible logic technologies has been identified as quantum computing. It has been noted that as transistor density increases, power consumption will eventually approach its maximum in conventional technologies. In traditional circuits, bits of information are erased during logic operations, causing a sizable amount of energy to be lost. It follows that power consumption can be decreased if circuits are designed to retain information bits. The bits of information are not lost in reversible logic computation. Reversible logic technology can be used to increase speed, reduce heat generation, and minimize power usage. In this study, different reversible logic-based logic gates, such as Toffoli, Peres, Fredkin, and Feynman, are described. Quantum and classical logic gates are contrasted

***Introduction* :-** Conventional computation's primary objective is irreversible by design. It is impossible to reconstruct input from its output. Reversible bits are problematic in high-speed computation because they prevent all input lines from propagating to the output. The issues that could occur in a traditional computing system could be either of the physical, computational, or economic types as specified later in this work. Reversible logic is crucial and highly effective in the construction of low power circuits. Reduced power dissipation is the goal of low power VLSI circuits. It is referred to as reversible if it translates each output assignment to a different input assignment and vice versa and is a fully stated N-output, n-input Boolean function. Information cannot be deleted by reversible logic operations, anddissipate zero heat. The circuit actually operates in a backward operation, allows reproducing the inputs from the outputs and consumes zero power. [I]

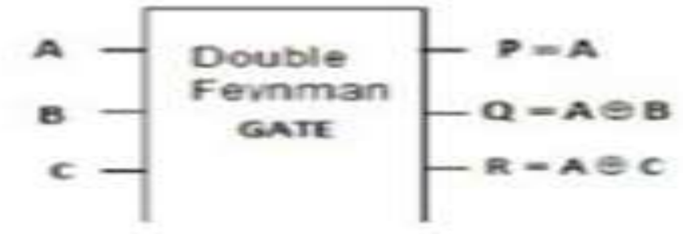
According to launder's research "the amount of energy dissipated by every irreversible bit operation is at least KTln2 joules, where k=1.3806505*IO-23 23m2kg-2K-I
(joule/Kelvin-I) is the Boltzmann's constant and T is the temperature at which operation is performed".

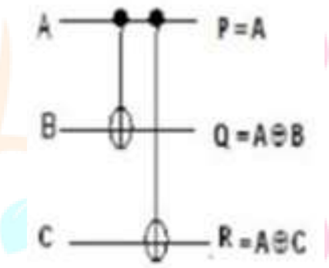
BASIC QUANTUM GATES The circuits of the quantum computer are implemented using reversible quantum gates . Information are measured in the form of electron-spin qubits in a quantum computer. Qubits differ from classical bits in that a classical bit can only be either 1 *or 0 at a any given* time, whereas a qubits either in both states simultaneously.

Feynman Gate, a 2x2 one-through reversible gate, is shown in Figure 1. The input vector is I(A, B), while the output vector is O(P, Q).P=A, Q=A, and B are the outputs' definitions. [U+F0C5] The quantum cost of a Feynman gate is 1. The Feynman Gate (FG) can be used to build a copying gate. These gates are useful for replicating the required outputs because reversible logic does not allow a fan-out.



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





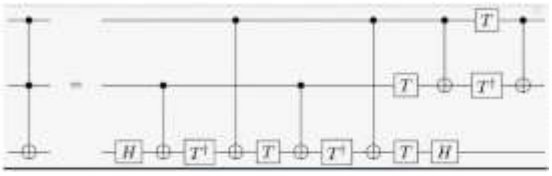
Taking input vector Inpt(A,B) output vector OUT(P,Q)

Code:

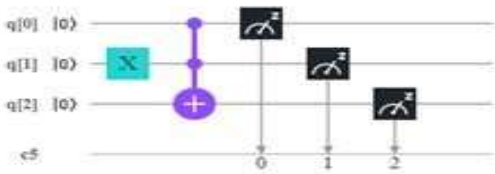

```
module fmdesign(A,B,P,Q);
input A,B;
output P,Q;
assign P=A;
assign Q=A^B;
endmodule;

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;
```

1.Unable to meet size requirement

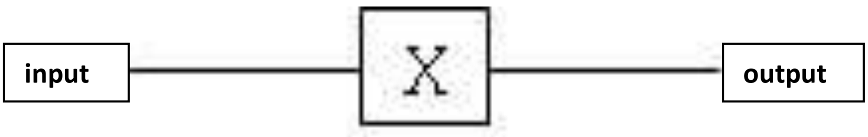
although there are limitations to conventional computing approaches in terms of heat dissipation and size requirements, ongoing research and development are focused on alternative solutions. The future of computing involves exploring new technologies and continuously improving existing methods to meet the demands of tomorrow's computing **systems.**

2.**Computational problem**.

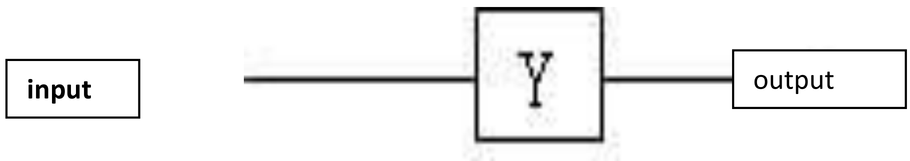
NP-complete type problem required high computational speed and have not been solved by classical computers. During cryptography operation heat dissipation is a crypto analysis method.

C.Pauli Gate:

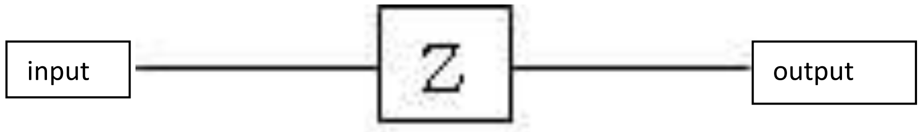
C1. The Pauli X Gate only uses one qubit. It operates in the same way as a traditional computer's NOT gate. It converts the states |0 to |1 and |1 to |0. The following is its graphical representation:



C2. Y Gate in Pauli One Pauli The Y gate (20) uses just one qubit. Changes are made to the states of |0 to i|1 and |1 to -i|0. The following shows it in graphic form.



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.



1. Conclusion

This article provides an overview of several studies on reversible logic gates, which are crucial building blocks of quantum computers and the subject of reversible circuits. This study presents the reversible gates that have been collated from the literature up to this point. The discussion of reversible logic gate circuit development that is relevant to fields like quantum computing, low power CMOS, computer graphics design, nanotechnology, optical computing, DNA computing, digital signal processing(DSP), quantum dot cellular automata, communication area, cryptography, and so on can be added to the paper.

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