Traffic Light Controller Using FPGA Board

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Abstract : A design of a modern FPGA based Traffic Light Control (TLC) System to manage the road traffic. The approach is by controlling the access to areas shared among multiple intersections and allocating effective time between various users; during peak and off-peak hours. This method is inefficient and almost always leads to traffic congestion during peak hours while drivers are given unnecessary waiting time during off-peak hours. The proposed design is a more universal and intelligent approach to the situation and has been implemented using FPGA. Theoretically the waiting time for drivers during off-peak hours has been reduced further, therefore making the system better than the one being used at the moment. Future improvements include addition of other functions to the proposed design to suit various traffic conditions at different locations.

I. INTRODUCTION

NEED FOR TRAFFIC LIGHT CONTROLLER TRAFFIC JAMMING IS A CRITICAL PREDICAMENT IN MANY OF THE CITIES AND TOWNS ALL OVER THE WORLD. TRAFFIC CONGESTION HAS BEEN CAUSING MANY SETBACKS AND CHALLENGES IN THE MAJOR AND MOST OCCUPIED CITIES ALL OVER THE GLOBE. TO TRAVEL WITHIN THE CITIES TO THE PLACE OF WORK OR RECREATION HAS BECOME A BIG PROBLEM TO THE COMMUTATES ALL ALONG. DUE TO THESE PROBLEMS PEOPLE LOSE TIME, MONEY AND MOST IMPORTANTLY THE ENERGY RESOURCES WILL BE EXHAUSTED DUE TO THE CONTINUAL USE IN THE AUTOMOBILES. THIS TRAFFIC JAM DIRECTLY IMPACTS THE PRODUCTIVITY OF THE WORKERS, TRADERS, SUPPLIERS AND IN ALL EFFECTING THE MARKET AND RAISING THE PRICES OF THE COMMODITIES IN A WAY. TO SOLVE THESE TRAFFIC RELATED PROBLEMS, WE HAVE TO BUILD NEW CONVENIENCES & INFRASTRUCTURE BUT AT THE SAME TIME MAKE IT SMART. THE ONLY DRAWBACK OF MAKING NEW ROADS ON FACILITIES IS THAT IT MAKES THE SURROUNDINGS MORE CONGESTED, BUT THEN THIS WILL MAKE A WAY TO HAVE NEW WAYS TO EASE THE TRAFFIC. PERHAPS ALL THE COUNTRIES ARE WORKING TO ACCOMMODATE THE TRAFFIC FLOW AND ADVANCE TRANSPORTATION AND REDUCE THE DEMAND OF VEHICLE USE. WE HAVE TO BUILD NEW FACILITIES AND INFRASTRUCTURE MAKING ITS USE SMARTER FOR ITS EFFICIENT USE. FOR THIS MANY IDEAS ABOUT THE TRAFFIC LIGHT SYSTEMS HAVE COME UP IN THE RECENT PAST TO SIMPLIFY THE COMPLEX PROBLEM OF THE TRAFFIC CONGESTION.

II. FPGA

FIELD PROGRAMMABLE GATE ARRAYS (FPGAS) ARE EXPANSIVELY USED IN QUICK PROTOTYPING AND VERIFICATION OF CONCEPTUAL DESIGN AND ALSO USED IN ELECTRONIC SYSTEMS WHERE THE MASK-PRODUCTION OF A CUSTOM BECOMES REALLY EXPENSIVE DUE TO THE SMALL QUANTITY. THE USE OF THE FPGA'S IS INCREASING TO AVOID THE HIGH COSTS FOR A CUSTOM VLSI FOR A SMALL QUANTITY. MANY SYSTEM DESIGNS THAT USED TO BE BUILT IN CUSTOM SILICON VLSI ARE NOW IMPLEMENTED IN FIELD PROGRAMMABLE GATE

III. BLOCK DIAGRAM
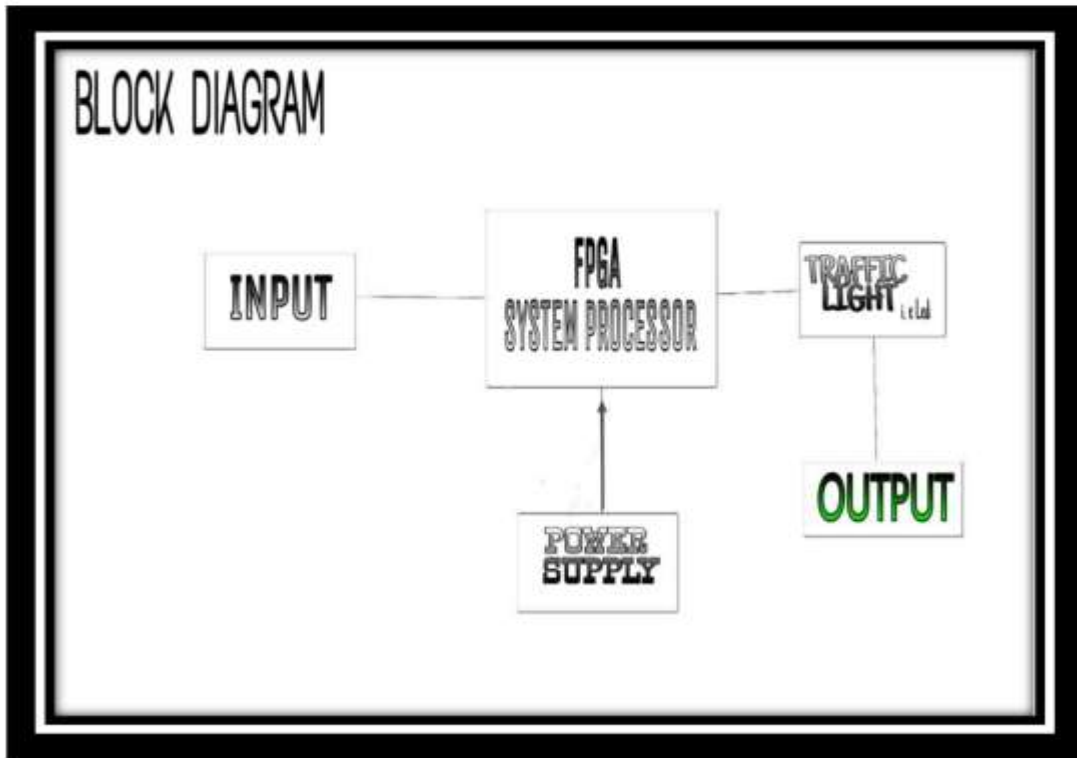
IV. FLOW CHART
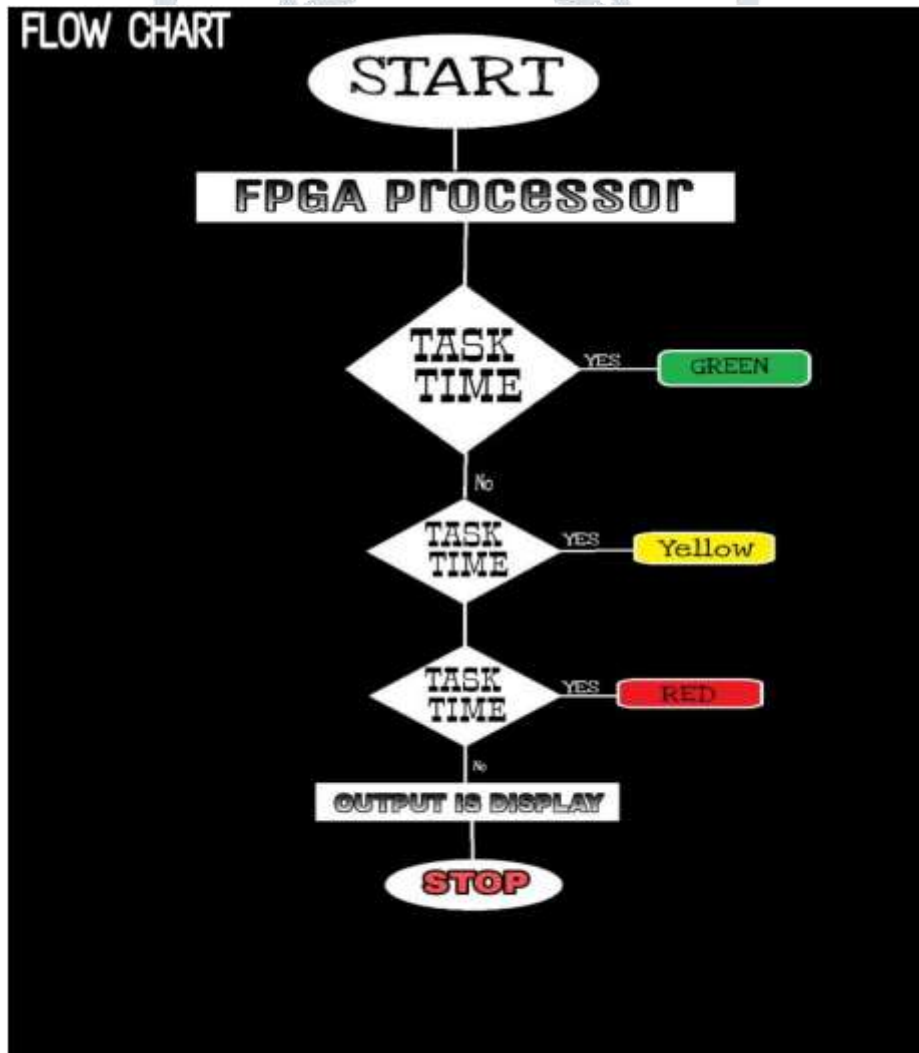
V. A PROJECT IMPLENTATION

1. WORKING

A)Terminologies:
- M1 →
  Refers to the road which moves from left to right.
- Mt ⌐
  Mt is the main turn from the main road.
- M2 ⊤
  Traffic goes from right to left and also turns from top to bottom.
- S ⌐
  S is the side turn which merges with the main road
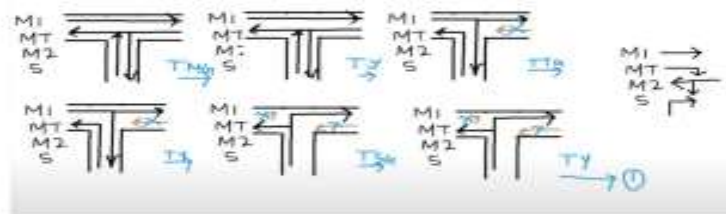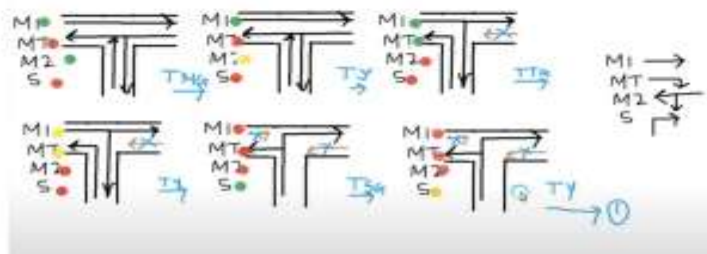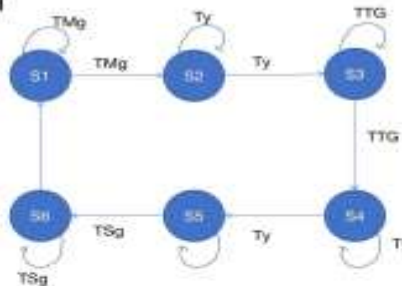
B)System Design:Diagram 1

Diagram 2

C)State Diagram

- TMg – 7 sec
- Ty – 2 sec
- TTg – 5 sec
- TSg – 3 sec

D) State Table

Present State	Input	NS	ST	M1	M2	T	S
A B C		A B C		R Y G	R Y G	R Y G	R Y G
0 0 0		0 0 1	1	0 0 0	0 0 0	0 0 0	0 0 0
0 0 1	TMG	0 0 1		0 0 0 1	0 0 1	1 0 0	1 0 0
	TMG	0 1 0	1				
0 1 0	Ty	0 1 0		0 0 0 1	0 1 0	1 0 0	1 0 0
	Ty	0 1 1	1				
0 1 1	TTg	0 1 1		0 0 0 1	1 0 0	0 0 1	1 0 0
	TTg	1 0 0	1				
1 0 0	Ty	1 0 0		0 0 1 0	1 0 0	0 1 0	1 0 0
	Ty	1 0 1	1				
1 0 1	TSg	1 0 1		0 1 0 0	1 0 0	1 0 0	0 0 1
	TSg	1 1 0	1				
1 1 0	Ty	1 1 0		0 1 0 0	1 0 0	1 0 0	0 1 0
	Ty	0 0 1	1				
1 1 1		0 0 0		0 0 0 0	0 0 0	0 0 0	0 0 0

2. A RESULT

Simulation Results: Wave Forms

The below figure shows the Wave form of the Traffic Light Controller when the test bench.
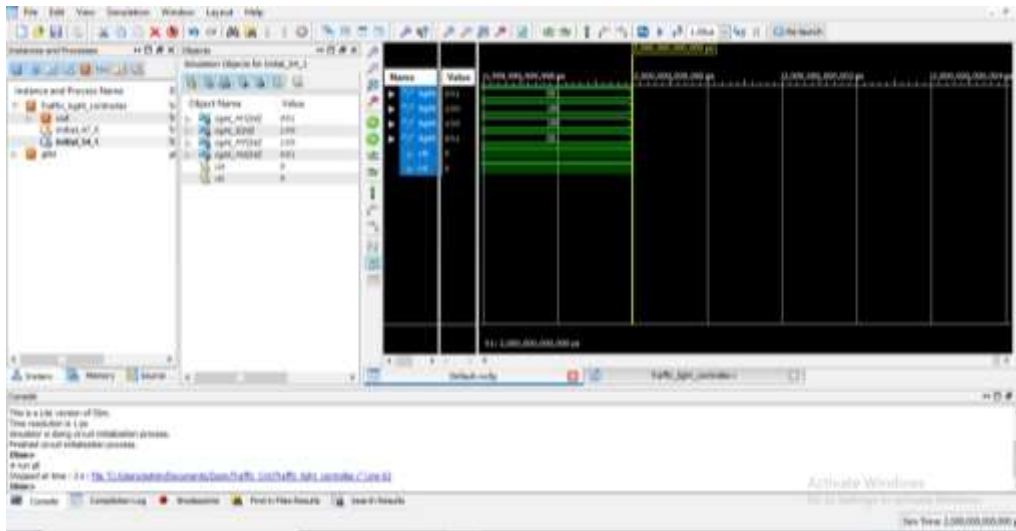
3.1 ADVANTAGES

- o Traffic control signals provide for an orderly movement of traffic.
- o They help in reducing the frequency of an accident of some special nature i.e. of right angles accidents.
- o They intercept heavy traffic to allow other traffic to cross the road intersection safety.
- o They provide authority to the drivers to move with confidence.

3.2 DISADVANTAGES

- o Traffic control signals may result in a re-entrant collision of vehicles.
- o They may cause a delay in the quick movement of traffic.

3.3 APPLICATION

- o Optimum control of fluctuating traffic volumes such as over saturated or unusual load conditions.
- o Improve the vehicular throughput.
- o Maximizes the traffic flow.
- o Control the time intervals of the traffic light. o Reduces the number of accidents.
- o Reduces the average waiting time at red lights o Better traffic flow leading to greener environment

4. CONCLUSION

The modern ways of four -way junction traffic light controller can improves the traffic condition up to a large extent. Advanced signaling controllers contribute to the improvement in the traffic condition; and also the prevention of the road accidents. This implementation of four junction traffic light controller can challenge any complexity in the traffic. The future scope of this project is it can be directly applied in real time by employing more number of such circuits

5. REFRENCES

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