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# FPGA IMPLEMENTATION OF AUTOMATIC TRAFFIC CONTROL SYSTEM

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**ABSTRACT**

*The traffic in road crossings /junctions is controlled by switching ON/OFF Red, Green & Amber lights in a particular sequence. The Traffic Light Controller is designed to generate a sequence of digital data called switching sequences that can be used to control the traffic lights of a typical four roads junction in a fixed sequence. It is also proposed to implement the day mode and night mode operations. It plays more and more important role in modern management and control of urban traffic to reduce the accident and traffic jam in road. It is a sequential machine to be analyzed and programmed through a multistep process. The device that involves an analysis of existing sequential machines in traffic lights controllers, timing and synchronization and introduction of operation and flashing light synthesis sequence. The methods that are used in this project are design the circuit, write a coding, simulation, synthesis and implement in hardware. In this project, XILINX Software was chosen to design a schematic using schematic edit, writes a coding using Verilog HDL (Hardware Description Language) text editor and implements the circuit on Programmable Logic Device [PLD].*

## I INTRODUCTION

Traffic congestion is a severe problem in many modern cities around the world. Traffic congestion has been causing many critical problems and challenges in the major and most populated cities. To travel to different places within the city is becoming more difficult for the travelers in traffic. Due to these congestion problems, people lose time, miss opportunities, and get frustrated. Traffic congestion directly impacts the companies. Due to traffic congestions there is a loss in productivity from workers, trade opportunities are lost, delivery gets delayed, and thereby the costs goes on increasing. To solve these congestion problems, we have to build new facilities & infrastructure but at the same time make it smart. The only disadvantage of making new roads on facilities is that it makes the surroundings more congested. So for that reason we need to change the system rather than making new infrastructure twice. Therefore many countries are working to manage their existing transportation systems to improve mobility, safety and traffic flows in order to reduce the demand of vehicle use. Therefore, many researches about traffic light system have been done in order to overcome some complicated traffic phenomenon but existent research had been limited about present traffic system in well-travelled traffic scenarios. The time of allocation is fixed from east to west or opposite way and from north to south way in crossroads. Field Programmable Gate Arrays (FPGAs) are extensively used in rapid

prototyping and verification of a conceptual design and also used in electronic systems when the mask-production of a custom IC becomes prohibitively expensive due to the small quantity. Many system designs that used to be built in custom silicon VLSI are now implemented in Field Programmable Gate Arrays. This is because of the high cost of building a mask production of a custom VLSI especially for small quantity.

## II LITERATURE REVIEW

There have been many studies done in the area of smart street light systems to provide an easy and efficient method to control street lights and automate their process. The following are a few studies that we have referred to. Intelligent Street- Light System using Arduino UNO. The purpose of this workis to describe the Intelligent Street Lighting (ISL) system, an approach to accomplish the demand for flexible public lighting systems. The present system is like this, the streetlights will be switched on in the evening before the sun sets and they are switched off the next day morning after thereis sufficient light on the roads. This project gives the best solution for electrical power wastage. Also, the manual operation of the lighting system is eliminated. In this project, sensors used are Light Dependent Resistor (LDR) to indicate aday/night time and Infrared (IR) sensors to detect the movement on the street. The Arduino Uno is used as a brain to control the street light system. In their system, they use LASER and photoelectric sensors for the detection and movement of vehicles whereas in our system we are using Infrared Ray senor for motion detection as well as density measurement.

## III EXISTING METHOD

The existing traffic light controller is a basic fixed-time method. 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 by using Verilog coding.

## LIMITATIONS OF EXISTING METHOD

- They may cause a delay in the quick movement oftraffic.
- Manual Control interface.
- High power consumption.
- Relatively high maintenance cost.

## IV PROBLEM STATEMENT

In many of the cities and towns all over the globe, traffic congestion is a serious predicament. It has been causing many challenges and setbacks in most major capitals all over the world. Moreover, due to traffic jams, the productivity of traders, suppliers and workers are all affected thus raising the prices of goods. Heavy congestion occurs because of the lack of organization on each road. Another problem appears when there is no congestion, but the waiting still goes on. Thesolution is to regulate the delay time of the traffic lights and detect

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the level of congestion. This problem requires an evaluation of the situation and switching to manual control of the traffic. This work aims to suggest that a traffic light system will provide a solution at a low cost. A traffic light controller (TLC) can be made using an FPGA.

**OBJECTIVE**

Our goal is to design an Automatic Traffic Control System using FPGA by using Verilog coding. For this we have collected information about the FPGA and its working. We also learned about Xilinx software in order to test our code.

**SYSTEM REQUIREMENTS:**

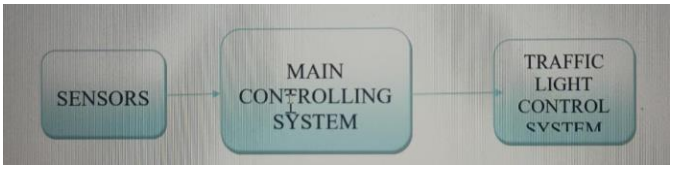
**1. HARDWARE (For Simulation):**

1. FPGA Board
2. IR sensor module
3. LDR sensor module
4. LED

**2. SOFTWARE:**

1. Windows OS
2. Xilinx Vivado

**BLOCK DIAGRAM**




To control the traffic, IR sensors are connected on either side of the road. When vehicle passes on the road, the signal between IR sensors breaks and this condition is treated as presence of traffic. Automatically the system provides a control which will switch ON the street lights. At this momentthe sensor output is logic low which is in the low voltage range. Hence, this analog signal is converted into digital signal by using digitization and signal conditioning unit. The digitized signal is connected to the processing unit (FPGA). If density of traffic is equal on four ways then priority is given to South side and the control signal generates to switch ON the green light on the East for prescribed time. If density of traffic is not equal on four sides then chooses any one of the following four conditions depending on traffic density.

a) If traffic on South side is more then, it switches ON the green light on South side and yellow light on West side and red light on North and East side for the prescribed time and then again check the traffic density.

b) If traffic on west side is more then, it switches ON the green light on West side and yellow light on North side and red light on East and South side for the prescribed time and then again check the traffic density.

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c) If traffic on North side is more then, it switches ON the green light on North side and yellow light on East side and redlight on South and West side for the prescribed time and then again check the traffic density.

d) If traffic on East side is more then, it switches ON the green light on East side and yellow light on South side and red light on West and North side for the prescribed time and then again check the traffic density.

**WORKING:**

Traffic is the movement from one location to another. The number of motor vehicles and correspondent travel demand is continuously increasing with economic and social development. Traffic control is one of the most important technical means to regulate traffic flow, improve congestion, and even reduce emissions. One of the principal challenges in traffic control is to accommodate traffic safely and efficiently.The current traffic systems are efficient in a way but relatively take high maintenance costs and thus result in poor maintenance of it. This cost is due to the high power consumption of the system. It is the same in the case of street light systems that are turned on even when there is no traffic. The street light system should be able to provide enough light for the vehicles to pass but should also minimize power consumption. For both the automated Traffic light system and street light system, the required can be achieved by automating the system and the power consumption can bereduced by using the FPGA (Field Programmable Gate Array) which results in faster operation.

**RESULTS:**

- For the condition where there is equal traffic density in four directions

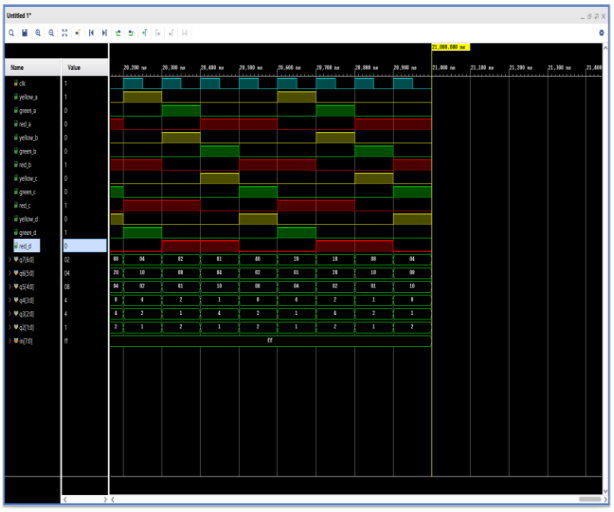

Fig : Equal Traffic In All Directions.

- For the condition where there is no traffic in anydirection.

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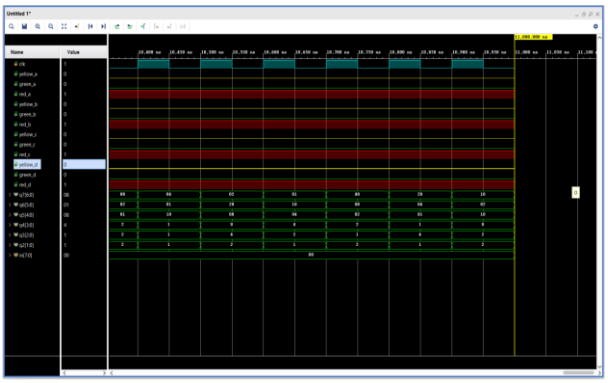

Fig : No traffic in any direction.

## V CONCLUSIONS

The modern ways of multi-way traffic management improve the traffic condition up to a large extent. Advanced signaling controllers contribute to the improvement of the urban traffic; which is proportional to the complexity of the controller. These more complex controllers can be well handled using Counters. Usage of counters also help in reducing the required hardware thus leading to low power and area efficient design. The design implementation and prototype verification of Automatic Traffic Control System is done successfully by using FPGA based system. It requires the only initial cost for designing and installation and not for utilization. Hence, such systems are very much useful for the government to reduce the utilization of conventional power. Therefore, such systems are once implemented on a large scale can bring significant reduction of the power consumption caused by traffic control lights. This initiative will help us to save the energy and meet the domestic and industrial needs. This idea can overcome the drawback of conventional traffic controllers where, the traffic signaling is done in equal intervals of time. But in the proposed system, with the capability of providing varying green cycle interval based on dynamic traffic load changes at every lane in a 4-way junction control. In the proposed system, only power saving technique is implemented. In the place of conventional power, we can use solar power as a source to the proposed system.so that renewable source also used. The future scope of this project is it can be directly applied in real time by employing a greater number of such circuits.

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