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RESEARCH ARTICLE

Prototype Implementation of Power Saver Street Lighting and Automatic Traffic Management System

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Abstract- In India most of the power generation takes place from hydraulic power stations. In the present decade, cost of the power generation is very much expensive and we have very less water resources for hydraulic power generation i.e., 33 percent. Day by day cost per unit rises and it is unbearable for a common man and hence it is always better to depend on renewable sources. Therefore the use of with embedded system technology, the goal of the present study is to save energy in Street lighting and traffic system.

In the existing system, power consumption takes place due to continuous lighting throughout the night by street lights. Hence an idea is implemented in such a way that the lights will be switching ON only in the presence of traffic on the roads at night times. Therefore, maximum power will be saved and the saved power can be used for some other useful purposes like agriculture, industries and domestic purposes.

In present days, we are facing the traffic problem in the rural as well as urban areas. It is essential to control the traffic density in an efficient manner in such a way that it can control according to the priority of the more traffic density present in the street by using sensor network. The proposed idea was implemented by FPGA and sensor network on VHDL platform.

Keywords- field Programmable gate array (FPGA); Infrared Sensor (IRS); Very High Speed Integrated Circuit Hardware Description language (VHDL); Light Dependent Resistors (LDR)

I. INTRODUCTION

Street lighting provides a safe nighttime environment for all road users including pedestrians. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10–38% of the total energy bill in typical cities worldwide. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically.

The implementation of street light intensity control using LUX meter, traffic sensor and complex sub control machines are in process in the Norway. (Oslo street light control)[6]. But the power consumption is

reduced only by nearly 30%. There also exists a project in progress where in the street light power consumption is reduced using a remote controlled system, but the disadvantage is that it is not cost effective and that the initial investment is not economical.

The main objective of the present study is to reduce the power consumption and efficient utilization of renewable sources for the application of street lightening and traffic signaling. Hence, this paper is aimed at design and implementation of an automatic system to control the traffic and reduce energy consumption of streets public lighting system up to the maximum possible extent. The density of traffic is sensed by using an array of Infrared Sensors (IR), which senses the traffic movement. LDR is used to detect the presence of day light. The proposed system is able to control the traffic during the day as well as night. In this system, the streetlights are switched ON/OFF automatically during the presence of the traffic only during the nights.

II. IMPLEMENTATION OF AUTOMATIC STREET LIGHT AND TRAFFIC CONTROL UNIT

The block diagram of proposed automatic street lightening and traffic control system corresponding to road safety is as shown in Fig.1. In this system, light presence will be detected by the Light Dependent Resistor (LDR). LDR is used to switch ON and OFF the street lights based on detecting the light ambiance. Depending upon the illumination level the resistance of the sensing element varies, which varies the voltage at its output.

It requires analog to digital converter which converts the sensor output voltage into digital form and that is proportional to the intensity of the sun light present in the atmosphere. In the proposed system this job is done by the “Op amp/Schmitt Trigger.” The digitized signal is connected to the processing unit FPGA (Field Programmable Gate Array).

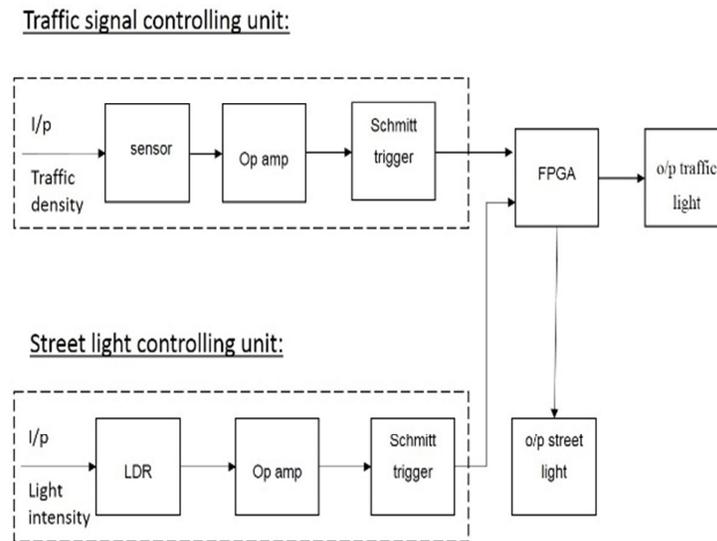


Fig.1: Block diagram of Street light and Traffic controller

In the proposed system, traffic control unit is used, in which traffic will be controlled in four way junction by lightning the signal lights (Green, Yellow and Red) depending on the density of the traffic with the help of the infrared sensors. Apparent motion is detected using the variation in the IR rays emitted by the vehicles and this information is given to the FPGA.

III. WORKING OF STREET LIGHT AND TRAFFIC CONTROLLER

The working of Street light and Traffic controller is explained with the help of flow chart as shown Fig.2.

The proposed system is designed to implement the power saver street lighting as well as automatic traffic controlling mechanisms.

Here, the street lights are powered through USB. Switching ON or OFF of the street lights depends on the sensing output of LDR. If there is a sun light then the street lights are in OFF position, and the control is directly passed on to the traffic system. Otherwise, if there is no sun light then the street lights are to be switch ON and then the control is transferred to traffic system. However, if there is no traffic at the absence of sunlight, then also the street lights are remain in OFF position.

Traffic signal controlling unit:

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. At this moment the sensor output is logic low which is in the low voltage range. Hence, this small voltage is to be amplified by using an op amp. This analog signal is converted into digital signal by using op amp/Schmitt trigger. The digitized signal is connected to the processing unit (FPGA).

Here with the help of power supply, LDR and IR Sensors, the processing unit makes the street lights to glow only at the absence of sun light and that to in the presence of traffic only. 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.

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

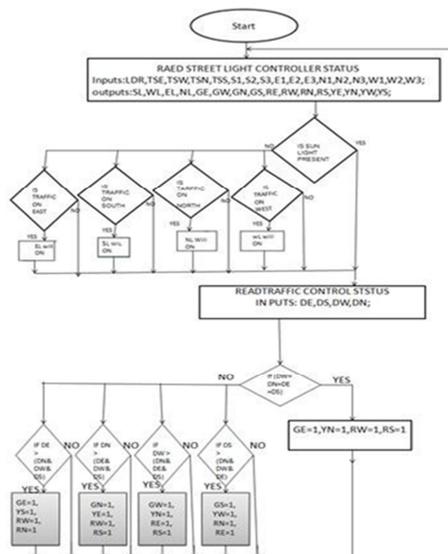
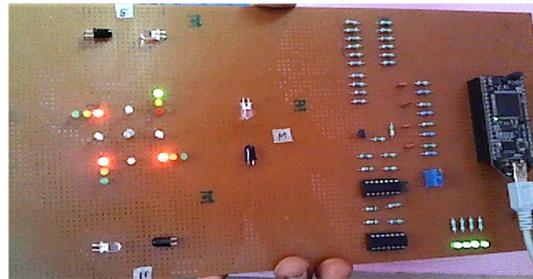
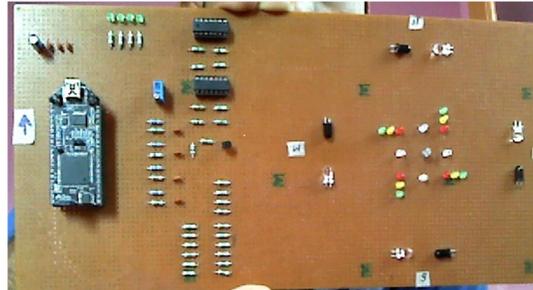


Fig.2: Flow chart of traffic and street light control

If sun light is absence the street light will glow in night time it will check the vehicle when enter in the road the LDR can automatically it will glow IR sensor can break the signal analog signal is connected to op amp/schmitt trigger connected to FPGA then the FPGA can convert the signal in digital then through transmitter traffic is done by FSM state machine.

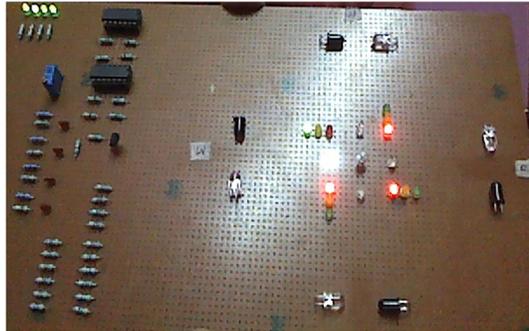


RESULTS:

1. If Sunlight is absence the LDR will glow in south side is greater traffic is heavy then green light will glow in south side.



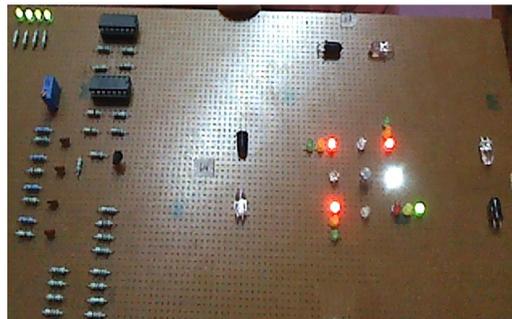
2.If sun light is absence the LDR will glow in west side is greater traffic is heavy then green light will glow in west side.



3. If sun light is absence the LDR will glow in north side is greater traffic is heavy then green light will glow in north side.



4. If sun light is absence the LDR will glow in east side is greater traffic is heavy then green light will glow in east side.



IV. CONCLUSION

The design and verification of Automatic Street light and traffic control system is done successfully by using FPGA based system. The advantage of the present system is the utilization of op amp and schmitt trigger in an efficient manner. It requires the initial cost only 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 (generated by hydraulic power stations).Therefore, such systems are once implemented on a large scale can bring significant reduction of the power consumption caused by street lights and traffic control lights. This initiative will help the government to save this energy and meet the domestic and industrial needs. It 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.

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