Arduino Based Smart Street Light System

Shweta D[1], Shruthi M[2], Shreya A[3], Shwetha B[4], Sujay M[5], Asst. Prof. Chaitanya K J[2]
[1,2,3,4,5] *4th SEM Student in Department of Electrical and Electronics Engineering, K.L.E.I.T, Hubli, Karnataka, India.*
[2]*Assistant Professor in Department of Electrical and Electronics Engineering, K.L.E.I.T, Hubli, Karnataka, India*

***Abstract*- In the recent years the demand is increasing day to day. It is found that large quantity of electricity in many countries is consumed in lighting the streets. Most of basic street lighting systems are switched ON/OFF at regular intervals of time. In this project the system is to develop a street light energy saving control system to reduce energy if no vehicles pass through certain roads. The proposed system saves a large amount of the electrical power. In addition, it may increase the lifetime of the lamps. Operation of this system is to maintain the intensity of street lighting to 40% of the maximum intensity if no vehicles passing through the road. When the IR sensor detects movement of the vehicle, the street lights will be switched to 100% intensity. LDR is used in the system to detect day/night. Once day is detected all the street lights will be in the OFF state. Arduino microcontroller is used to control the system. IR sensor functions as a vehicle detector will be send a signal to the Arduino will be control the intensity of the LED while the current sensor is used as the current detector LED lamp. The prototype for the street lighting energy saving control system is also has safety usage that is the light will not turn OFF completely but only dimming and the user can easily see from far away and the light will full turn ON if it detecting movement. As it is observed that, if any of the street light has been damaged then unless it is been complained manually it will never come to operation state. So to detect the proper operation of the street light an LDR sensor is placed below the street light once its night and as all the lights should glow at 40% of maximum intensity if the value of LDR is not changing then it implies that the street light is not working properly the same is displayed on LCD. The system has shown a great energy savings and if the system can be upgrade with many functions and user friendly the system can be commercialize and the cost for retrofitting the street lighting energy saving control system can be lowered.**

Index Terms- Street light, Smart control, LDR, light intensity.

I. INTRODUCTION

In present scenario, continuously electricity supply to the consumers is not possible because of production of electricity is less than the utility of electric energy. The solution can be save the electrical energy rather than production of the energy. Saving the energy is more economical than the produce the electrical energy. Street light monitoring is the perfect solution for saving energy, the aim of street light monitoring system using wireless sensor network is to control use of electricity via remote ON/OFF/DIM of lights which can save energy costs and maintenance costs and increases the life of lamp. We all know that, street lighting is one of the important parts of a city's infrastructure where the main function is to lightning the streets of area if cities during the night.

The demand of electricity increases day by day. So, energy saving plays a vital role in present scenario. As energy is generated at huge amount, the energy consumed also is at the same rate. And the electrical energy is generated mostly due to non-conventional energy which is depleting day by day. In present scenario the energy consumption is increasing as per the demand, either the same amount of power is to be generated or the power consumption should be reduced. On the national highway there are approximately 500 street lights and each street light consume approx. 150W. During night the street light continuously glows till day or sometimes even day time. So when 500 street lights are considered the energy consumption will increase up to75000W. This power consumption is huge, this can be minimized by the following methodologies illustrated below. First technique is by using the IR Sensors, the vehicle navigation on the National Highways can be sensed and accordingly the street light glows Thus, the power consumption reduces considerably up

to30%.and the second technique is by using LDR'S this detects the light and the light doesn't glow during the day time. This reduces power consumption by 20%. Thus, by these techniques 50% of power consumption is reduced.

II.MOTIVATION

Smart cities and green technology are becoming one of the world agenda in preparing for a better future. The smart street lighting system is one of the technologies that support green environmental related work. The technology that evolves with the advance in wireless communication and low energy street light has become the foundation in the development of smart cities [1].

Apart from supporting works toward better future, smart city technologies allow improvement in the area of response and maintenance where failures or breakdowns within the deployment area is almost real time detectable, allowing immediate response from the respective person.

Street lighting is one of the important parts of a city's infrastructure where the main function is to illuminate the city's street during the dark hours of the day. There are several factors that should be considered for the design of road lighting systems, such as a safety night for members of the public and other road users, provide public lighting at a cost effective, reduce crime and reduce its impact on the environment.

Generally, street light is switched on for the whole night and during the day the street light is switched off but during the night time, street light are not necessary if there is no traffic user. Saving of this energy consumption is a very important factor these days as energy resources get reduced day by day. Alternatives for natural resources are very less and our next generations may face lots of problems because of lack of these natural resources [2].

The Arduino microcontroller system has some advantages such as inexpensive, easy to run the programming, simple and clear programming environment, have open source and extensible software and also have extensible hardware. This is the reason why Arduino microcontroller has been chosen as the controller for the system. Arduino microcontroller system is the device that can very fast and capable of running thousands of lines of code each seconds [3].

III.PROBLEM STATEMENT

It is very common to see the street light alight all night, which is a great waste of energy. The power consumption is relatively high day by day. Some streets are not fully occupied like the main city streets; sometimes they are empty for a certain period time.

Based on the problem, the observation of street lighting was done to improve the street lighting control system to make sure the street light can operate properly. By applying this system, it can reduce energy consumption and also can reduce electricity wastage. Therefore it is important to know the ways how to minimize the power consumption of the street light.

IV.LITERATURE SURVEY

[1] In this paper, Street Light Glow on detecting vehicle movement using sensor is a system that utilizes the latest technology for sources of light as LED lamps. It is also used to control the switching of street light automatically according to the light intensity to develop flow based dynamic control statistics using infrared detection technology and maintain wireless communication among lamppost and control terminal using ZigBee Wireless protocol. It also combines various technologies: a timer, a statistics of traffic flow magnitude, photodiodes, LED, power transistors.

[2] In this paper, the system operates in the automatic mode which regulates the streetlight according to brightness and dimness algorithm and light intensity. The control can be made according to the seasonal variation. It includes a time cut-out function and an automatic control pattern for conserving more electricity. The whole project was implemented using a PIC microcontroller.

[3] In this paper, they have implemented design of traffic flow based street light control system with effective utilization of solar energy in the year 2015. They used the renewable source of energy i.e. the solar power for street lighting. They have also used 8052 series microcontroller and is developed by replacing the normal bulbs with the LEDs due to

which the power consumption is reduced by 3 times. Sensors are placed on either side of the road which senses the vehicle movement and sends the commands to the microcontroller to switch ON and OFF the lights. Here all the street lights remain switched off and it glows only when it senses the vehicle movement. Hence, because of the microcontroller, even when its night the lights are switched off.

V.OBJECTIVE

To develop an intelligent street lighting system equipped with vehicle detection sensors which provide a better solution to reduce electricity wastage.

VI. METHODOLOGY

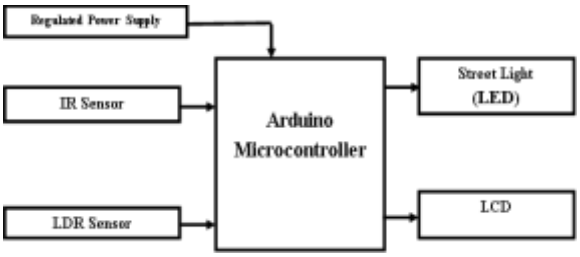


Fig 1 Block diagram of the proposed concept

The above fig.1 represents block diagram of the project carried out . The main aim is to reduce the power consumption by the street lights, the present situation is like the street lights on the national highway will be switched ON in the evening and OFF in the morning. But the actual timing of these street lights to be switched ON is when there is absolute darkness. With this the power will be wasted to some extent. This project gives the best possible solutions for the power wastage. In our project we are using LDR, whose resistance varies according to the amount of light falling on its surface, this gives the indication whether it is day/night time. The IR sensors have been placed on both the sides of the road which are monitored by microcontroller. The IR'S will be activated only during the night times. If any obstacle that is vehicle or a person crosses IR automatically the light gets brighter till the obstacle crosses to certain distance and then the street light gets dimmer (less brightness). So as mentioned 50% of the power consumption is reduced. In this project we use microcontroller(ATMELGA328P) and a regulated voltage supply of 5V to the Arduino.

VII. HARDWARE IMPLEMENTATION

The hardware design of the overall system has been implemented in the same form as it was designed. The subsystems implemented are illustrated in a sequence.

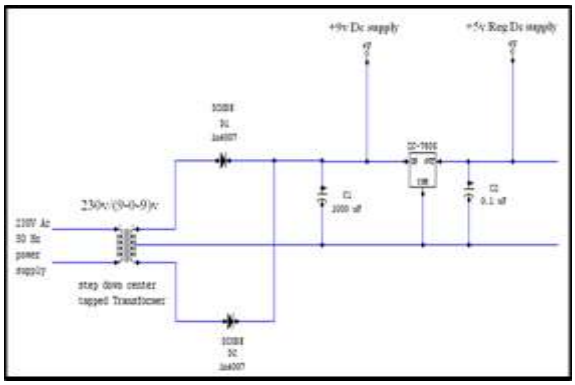


Fig 2 Regulated Power Supply Circuit

As shown in the above Fig 2, The 230V AC 50 Hz supply is given to step down center tapped transformer (9-0-9) V, 500mA. Here the voltage is stepped down from 230V to (9-0-9) V then by using two diode full wave rectification circuit the voltage is rectified and converted into pulsating dc that is fed to capacitive filter to remove the ripple content from the voltage and then it is fed to 7805 regulator IC to get a regulated power supply of 5V DC, 500mA. Appropriate heat sink is included to dissipate the heat developed during the operation.

B. LCD Interface to Arduino

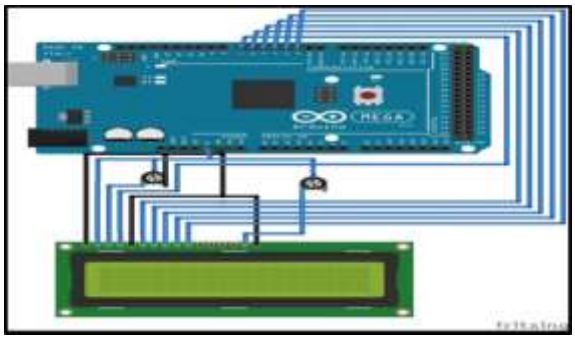


Fig. 3 Interface circuit of LCD with Arduino

The fig. 3 represents circuit of LCD (20x4) interfaced with Arduino MEGA. The two potentiometer are used in order to control the contrast and brightness of the LCD. The LCD is used to display alphanumeric character. Four bit of data transmission is used to interface between the Arduino and LCD. Only write operation is used by sending a low signal to read/write terminal of the LCD.

C. Implemented Circuit

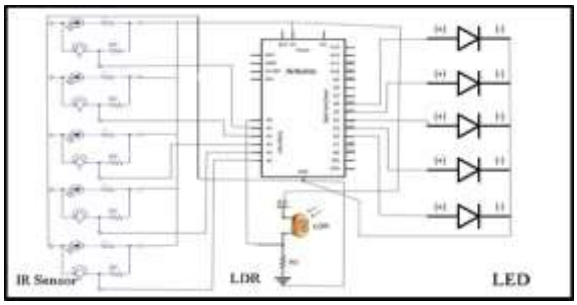


Fig. 4 Implemented circuit

The aim of the project is to design a street light control system which automatically turns ON or OFF the street lights by detecting the movement of vehicles and depending on the intensity of sunlight. In dark, resistance of LDR is high. So the voltage drop across the LDR is also high. The IR sensor is placed directly in line of sight with IR receiver, so that the IR sensor receiver continuously receives the infrared rays. Once the receiver receives the infrared rays the microcontroller will ON or OFF depending on the instruction dumped in the program.

In dark, when a car or any other vehicle blocks any of the IR sensor, the microcontroller will immediately increase the intensity of the first LED.As the vehicle moves forward and blocks the second IR sensor, the corresponding next LED's will be turned ON and the first LED of the previous set is turned OFF. The process continues this way for all sensors and LED's .As the resistance value is maximum in the midnights, the controller checks peak time during which there is no traffic and switch OFF the lights.

D. Experimental Setup

The following depicts the experimental setup of the proposed concept.

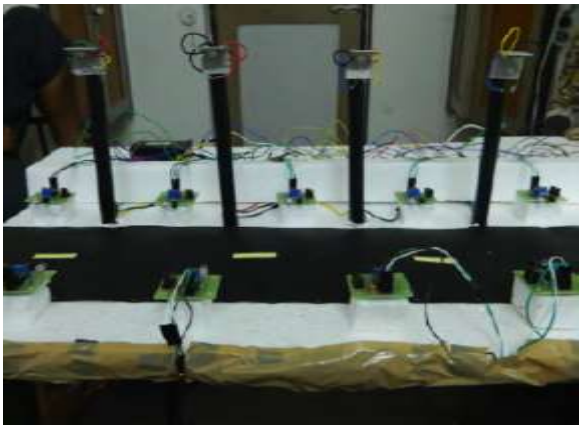
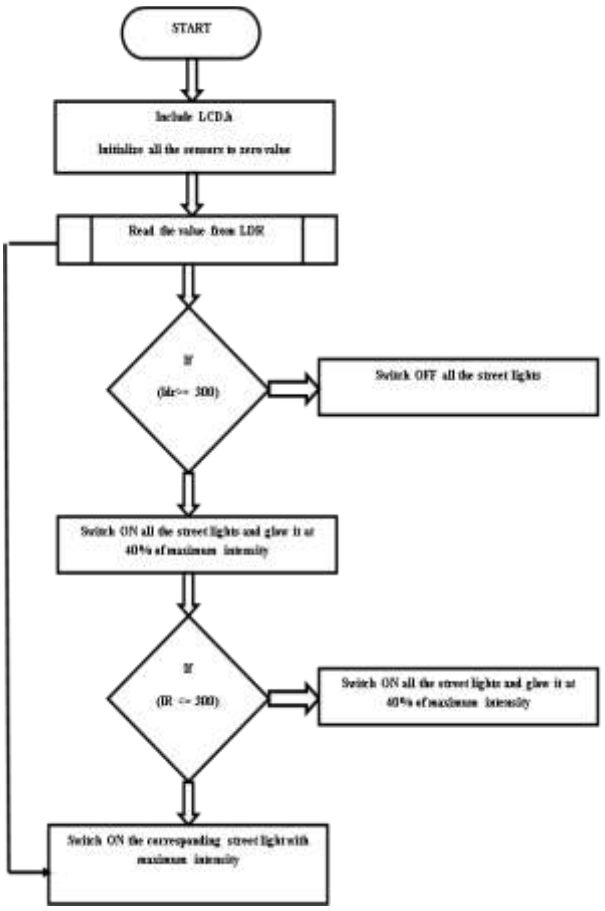


Fig. 5 Experimental setup

Fig. 6 Experimental setup in operating state

VIII. SOFTWARE IMPLEMENTATION



IX. RESULTS

The following tabulated data represents results of activation of street lights.

Table 1 Result of implemented system

SI.No.	LDR 1	LDR 2	Street Light State
1.	Low light	Low light	ON
2.	Low light	Dense light	OFF

3.	High light	Low light	OFF
4.	High light	High light	OFF

The following tabulated data represents results of results of activation of lights because of availability of vehicle

Table 2 Result of activation of light because of availability of vehicle

SI.NO	LDR 1	LDR 2	IR Sensor 1	Street Lights 100% ON	Street Lights 75% ON
1.	Low light	Low light	ON	Street light 2	Street light 1,3,4,5,6

Table 3 Result of activation of light because of availability of vehicle

SI.NO	LDR 1	LDR 2	IR Sensor 2	Street Lights 100% ON	Street Lights 75% ON
1.	Low light	Low light	ON	Street light 5	Street light 1,2,3,4,6

CONCLUSION

This implemented concept expounds the configuration and development of Smart Street lighting control framework circuit. Circuit meets expectations appropriately to turn road light ON/OFF. In the wake of planning the circuit which controls the light of the road as delineated in the past segments. LDR sensor and the IR sensors are the two fundamental conditions in living up to expectations the circuit. On the off chance that the two conditions have been fulfilled the circuit will do the required work as indicated by the particular system. Every sensor controls the killing ON or the lighting segment. The road lights have been effectively controlled by Arduino UNO. With orders from the controller, the lights will be ON in the spots of the movements. Besides the downside of the road light framework utilizing timer controller has been succeeded, where the framework relies on upon photoelectric sensor. At long last this control circuit can be utilized as a part of a long roadway between the urban areas as well as the rural areas. The venture points were to lessen the reactions of the present street lighting framework and discover an answer for power loss. In this venture, the first thing to do is to set up the inputs and yields of the framework to control the lights of the street. The model acts not surprisingly and will turn out to be exceptionally valuable and will satisfy all the present limitations if actualized on a vast scale.

REFERENCES

[1] S. Suganya, R. Sinduja, T. Sowmiya & S. Senthilkumar, "Street Light Glow On Detecting Vechile Movement Using Sensor", International Journal For Advance Research In Engineering And Technology, 2015, Volume 1, PP.No 114-116.

[2] K.Santha Sheela, S.Padmadevi, "Survey on Street Lighting System Based On Vehicle Movements", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 3, Issue 2, February 2014, PP.No. 9220-9225.

[3] M.Abhishek, Syed ajram shah, K.Chetan, K,Arun Kumar, Design and implementation of traffic flow based street light control system with effective utilization of solar energy, International journal of Science Engineering and Advance Technology, IJSEAT, Vol 3, Issue 9, September -2015

[4] C.Bhuvaneshwari, R.Rajeswari, C.Kalaiarasan, Analysis of Solar energy based street light with auto tracking system, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol 2, Issue 7, July 2013.