Light Intensity Monitoring and Automation of Street Light Control

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ABSTRACT

Metropolitan cities and villages of all kinds require streetlights that help their busy lifestyle. But as the human lifestyle gets busy they tend to forget to turn off these streetlights when its dawn. Technology is being improved at the speed of light; the use of timer-based streetlights does not always solve the problem of electricity being wasted. Automation plays a wonderful role in solving this problem. Using the web app and an Android app the control of the streetlights can be monitored. The intensity control feature helps in saving energy during late nights while traffic density on the streets is low.

Keywords – Street light automation**,** Light Dependent Resistor (LDR), IR sensor, Raspberry pi, ESP8266, Firebase.

1. INTRODUCTION

The Street lights are the major requirements now-a-days for safety purposes and avoiding accidents during night.Lighting can account for 10-38% of the total energy bill in typical cities world-wide.The features of street lights indirectly have assisted
the public and government in reduction of crime rate and accidents in the area.Poor lighting creates unsafe conditions. The main consideration in the present field technologies are :
Automation, Power consumption and cost effectiveness. Automation is intended to reduce man power with the help of intelligent systems. Power saving is the main consideration always as the sources of the power are diminishing due to various reasons. Designing a cost-efficient system is very important as the requirement is more. In order to overcome this problem, an automatic street light control method is introduced. The main
objective of our project is to provide a better solution to minimize the electrical power wastage in operating street lights, in this era of automation humans are restless and are not in a position to regulate the manual operations in. The street lights are switched ON when the sunlight goes below the visible region of our eyes. It switches OFF the street lights under illumination by sunlight. This system operates in accordance with varying sunlight, whenever there is sufficient light falling on the LDR, the streetlights turns OFF and when the intensity of light reducesthe street lights automatically turns ON with the detection of motion.

2. EASE OF USE

We have seen in the number of cities where the street lights is the one of the huge energy expense for a city. Currently we have manual system where the light will be switched ON in the evening before the sunset and they are switched OFF next day morning after there is sufficient light outside. So, there is lot of energy waste between ON and OFF timing.

- Manual Switching off/on of Street Lights
- More Energy Consumption.
- High expense.
- More manpower.

Advantages of the Proposed System:

- Automatic Switching of Street lights
- Maintenance Cost Reduction

- Energy Saving
- Reduction of manpower
- Safety and Security
- Longer life and reliability
- Works based on intensity control

Disadvantages of the proposed system:

- It has limitation of power
- Light turns on when shadow falls on LDR
- Led is a low voltage device

Opportunities:

- Every housing colony or township
- Highways
- Private sectors
- Government sectors

Threats:

- Nature can damage sensors
- Hacking of accounts

3. ALGORITHM

- Implementing the project by placing all the required components in it.
- The ESP8266 or Raspberry Pi are programmed using software (Arduino or Raspberry pi).
- ESP8266 is programmed by initializing some variables and serial begin communication.
- Set the Analog A0 pin and digital pins D1, D7 as input port, digital pinsD2,D3,D6 as output ports.
- Consider two functions street1() and street2() which represents each lane of street light.
- Call the street1() function and read the analog input into a variable(s) and print the same with delay of 1ms.

- Intensity of the light that falls on LDR Sensor is set by the threshold values of 300.
- If the analog input value is greater than or equal to 300 and digital input pin D7 is high(1) then digital pins D0,D6 are made high by writing 1 to output ports and introduce some delay (1ms).
- Else write digital pins D0,D6 low(0) .
- Call street2() function ,read the analog input into a variable(s) and print the same with delay of 1ms.
- If the analog input value is greater than or equal to 300 and digital input pin D1 is high(1) then digital pins D2,D3 are made high by writing 1 to output ports and introduce some delay (1ms).

- Else write digital pins D2, D3 as low(0) .
- Consider a loop if the digital pin D7 is high(1) the street1() function is called or D1is high(2) then street2() function is called.
- The changes in the value can be observed in the Firebase, which in turn is also reflected in MOBILE APP.

4. PROJECT IMPLEMENTATION

A photoelectric sensor has been used to detect the movement of humans and vehicles on the streets. Automatic street light controlling can be achieved using ESP8266 and light dependent resistors. Again, the LDRs are used to differentiate between day and night light. The discrete analog signals sensed by LDR due to variation in its resistance are converted to digital signals. The ESP 8266 is programmed in such a way that during morning and evening as the intensity changes according to which street light intensity is programmed with five intensity levels. This system is basically street light intensity control as well as switching control.

As the intensity of Light fall below 300 lux during night time open circuit voltage reaches a certain value and the ESP8266 senses the voltage value and the switching operation is carried out and the streetlight glows.

The street lights switch on automatically when the light intensity goes below a certain threshold value and switch off as soon as the light intensity goes above the set threshold value. Additionally, the streetlights operate based on movement detection. During the night, the streetlights switch on only with the detection of movement, for example, when a car startes to travel on a particular road, the streetlights on that road switch on and switch off only when the car has exited the road. It is a simple and powerful concept, to switch ON/OFF the street light system automatically. It automatically switches ON the streetlight when the sunlight goes below the visible region of our eyes and switches OFF the streetlight when ample amount of sunlight is available. The component used for light sensing is a Light Dependent Resistor. By using the LDR we can operate the streetlight automatically, when ample amount of light is available the streetlight will be in the OFF state and when it is dark the light will be in ON state, it means LDR

resistance is inversely proportional to light falling on it. When the light falls on the LDR it sends the commands to the control circuit that it should be in the OFF state and the streetlight turns OFF. This project exploits the working of a transistor in saturation region and cut-off region to switch ON and switch OFF the lights at appropriate time with the help of an electromagnetically operated switch LDR resistance is inversely proportional to light falling on it.

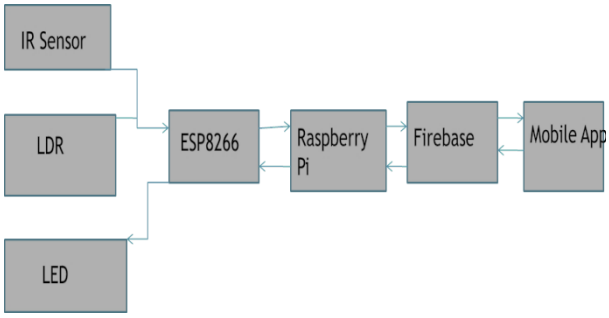

Fig 1: Block Diagram

The Fig 1 shown above is the block diagram of the designed circuit. Here, IR sensor and LDR are the input ,LED is the output, ESP8266 isthe input node , RaspberryPi is used as a gateway, firebase is used as online server and we have created an app interface for the same for monitoring and controlling.

Through the app we can switch over automatic and manual mode and vary the intensity of light through which it also shows the status of lights.

5. EXPERIMENTAL WORK

The light dependent resistor used as a light sensing device senses light intensity and sends analog signals to the microcontroller. A certain delay after the passing of the object (for example: person or vehicle) along a particular streetlight is provided for the efficient operation of the streetlight.

In order to turn ON/OFF the streetlight, two conditions have to be satisfied. One of the condition is light intensity sensing of the light dependent resistor and the other being the manual or automatic operation of the streetlight in a particular area controlled manually by the people residing in that area. Once either of these conditions are satisfied the streetlights can be switched ON/OFF.

By trial and error we have chosen the optimum threshold value.

6. RESULTS

The circuit was constructed as planned using the block diagram as well as using the hardware and software components needed. It was observed that the circuit worked as required. The LED's (which acted as the streetlights in this project turned on automatically whenever the intensity of the light in the surroundings were less than a particular value which was sensed by the LDR and also when there was presence of motion which might be due to the movement of vehicles or people which was sensed by the IR sensor. Also, during the daytime, the lights did not turn on irrespective of the intensity of light and motion. There was also an option to exercise the choices of manual control as well as automatic control which turned out to work perfectly.

The connection of the circuit on the breadboard is shown in the below Fig.2: Circuit connection.

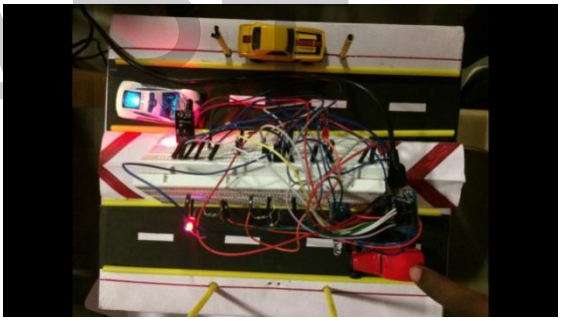

Fig 2: Circuit Connection

7. CONCLUSION

Automatic control using LDR helps to save a large amount of electric power which is wasted in conventional street lighting system. The automatic switching operation observed using the developed control circuit is found to be very efficient and the maintenance cost is very less. The circuit controls the turning ON or OFF the street light. The use of Raspberry Pi as a server has been successfully implemented to monitor the light intensity based on the amount the light incident on the light dependent resistor (LDR).

Further the project can be enhanced by using time programmed dusk to dawn switching based on latitude and longitude of a specific place.

8. REFERENCES

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