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ijirset@gmail.com



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Automated Street Light System Using IOT

Prof. Shrisha HS¹, Pratheeksha Shenoy², Vaishnavi V Bhat³

Professor, Department of Computer Science and Engineering, Canara Engineering College Mangalore,
Karnataka, India¹

Student, Department of Computer Science and Engineering, Canara Engineering College Mangalore, Karnataka, India²

Student, Department of Computer Science and Engineering, Canara Engineering College Mangalore, Karnataka, India³

ABSTRACT: In this modern era where energy is a major concern worldwide, it is a prior responsibility to save energy effectively. With the development of technology, automation system plays a vital role in daily life experience and it is being preferred over the traditional manual system today. So the proposed system is an IoT based which is a simple and a powerful concept, uses relay as a switch to switch ON and OFF the street light automatically. By using this system manual works are removed. It automatically switches ON lights when the sunlight goes below the visible region of our eyes and automatically switches OFF lights under illumination by sunlight. This is done by a sensor called Light Dependent Resistor (LDR) which senses the light actually like our eyes and Infrared Sensor (IR) that detects presence of an object. By using this system energy consumption is also reduced because now-a-days the manually operated street lights may not be switched OFF even after sunrise and also not switched ON after sunset.

KEYWORDS: IOT, Sensors, Smart city, Automated street light.

I. INTRODUCTION

The main aim of the system is to reduce the power consumption when there are no vehicle movements on the road. The Smart street light will glow with high intensity when there are vehicles on the road otherwise the lights will remain off. With advancement of technology, things are becoming simpler and easier for everyone in the world today. Automation is the use of control systems and information technologies to reduce the need for human work. In the scope of industrialization, automation is a step beyond mechanization. The Automation plays an increasingly important role in the world of the economy. Automatic systems are being preferred over manual systems. The research work shows automatic control of streetlights as a result of which power is saved to an extent. The smart street light provides a solution for energy saving which is achieved by sensing an approaching vehicle using the IR sensors and then switching ON a block of street lights ahead of the vehicle with high intensity. As the vehicle passes by, the trailing lights turn off automatically. Thus, we save a lot of energy. So when there are no vehicles on the highway, then all the lights will remain off during night time. Internet of Things (IOT) is a technology is transforming slowly for the city administration. It refers to a system of interrelated, internet-connected objects that are able to collect and transfer data over a wireless network without human intervention. So the proposed system uses IoT to transfer the data collected from IR sensor and LDR sensor. The data collected can be stored in the cloud for further analysis and visualization of statistical data. The system infrastructure includes Internet Protocol connectivity via gateways, which enables remote management of individual lights. By means of monitoring each and every street light, power failure, bulb damage can be detected by monitoring whether the light is working or not and check the status of the sunlight and the artificial lamp (street lamp) by using LDR as light sensor. More than 50 percentages of energy and maintenance cost can save by adding some intelligence to lights. Relays are used to connect with the street lights which enables the street lights for switching ON/OFF according to presence or absence of human or vehicles. The instructions are sent to relay from Microcontroller which receives the data from LDR and IR sensors connected to it. The data of the specific area or street is sent to the cloud using the ESP8266 Wi-Fi module which is connected to internet.

II. RELATED WORK

[1]H. A. Madni, States that to develop a system which will lead to energy conservation and by doing so, we would be able to lighten few more homes. The proposed work is accomplished by using Arduino microcontroller and sensors that will control the electricity usage based on night and object's detection. Meanwhile, a counter is set that

will count the number of objects passed through the road. The beauty of the proposed work is that the wastage of unused electricity can be reduced, lifetime of the streetlights gets enhance because the lights do not stay ON during the whole night, and also helps to increase safety measurements. We are confident that the proposed idea will be beneficial in the future applications of microcontrollers and sensors.

[2] GulShahzad, have implemented street light system for energy conservation. This was implemented with a wireless network from which we can remotely read conditions of the street lights. However, the energy conservation efficiency can be improved by implementing street light control with an android or web browser for immediate rectification

[3] K.Y.Rajput have elaborated on implementing and connecting the streetlights over a network along with a focus on energy consumption. However it does not implement renewable energy which has become essential these days as energy conservation is crucial

[4] S.H Jeong, describes the Development of Street Light Control System which control and monitor status of street lights. Lights are switched to ON/OFF by this system's control command. Its local status information is also monitored by control system via communication channel. Status information monitored is on/off status information, control group status information and safety related information energy saving mode status, etc. To transfer control command and status information between street control terminals, various communication media and communication protocols are used. As communication media, wireless or power lines are used generally. Various frequency bands from tens of MHz to Rebrands are used for wireless case. This Street light control system can save maintenance time, costs and can improve safety level.

III. METHODOLOGY

- In streets the light is needed all the time due to continuous human or vehicles presence. So instead of making lights OFF when no motion is detected the light becomes off. These off light become ON whenever the motion is detected by our system.

Block Diagram of Automated Street Light

Relays are used to connect with the street lights which enable for switching ON/OFF according to presence or absence of human or vehicles. The instructions are sent to relay from Microcontroller which receives the data from LDR and IR sensors connected to it. The data of the specific area or street is sent to the cloud using the ESP8266 Wi-Fi module which is connected to internet.

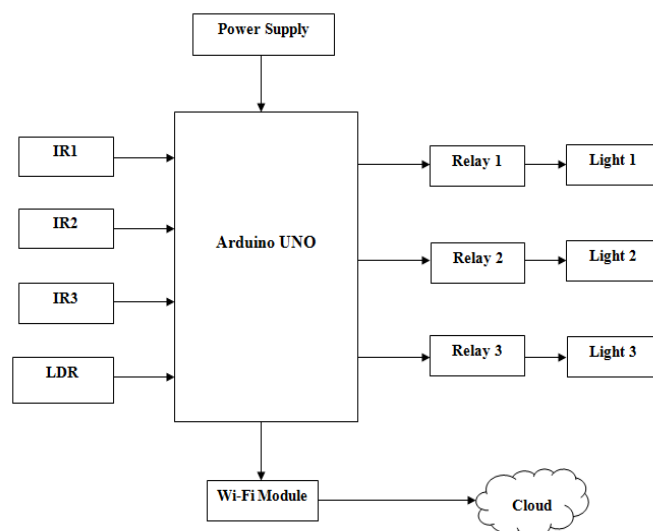


Figure 1. Architecture of street light

3.2 Hardware requirements

IR Sensor

An infrared (IR) sensor is an electronic device and detects an object in its surrounding environment by emitting infrared radiation. When an object comes close to the sensor, the infrared radiation from the sensor reflects off the object and is detected by the receiver. It is used to sense the presence of light.

LDR Sensor

Light Dependent Resistors are light sensitive devices. They are made up of semiconducting materials with high resistance. LDR works under the principle of photoconductivity in which conductivity of the material gets reduced by the absorption of light.

Arduino Uno

The microcontroller board on Arduino UNO is based on the ATmega328 series controllers, and has an integrated development environment (IDE) for writing, compiling, and uploading codes to the microcontroller. It has 14 digital input and output pins (of which six are pulse width modulation (PWM)) and six analog inputs for communication with the electronic components such as sensors, switches, motors, and so on. It also has 16 MHz ceramic resonators, a USB connection jack, an external power supply jack, an ICSP (in-circuit serial programmer) header, a reset button, GND pins (for grounding), and 5 V pin (for supplying 5 volts). Its operating voltage is 5 V, with an input voltage 7 to 12 V (limit up to 20 V).

ESP8266EX Wi-Fi Module

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system. It serves as a WiFi adapter; wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface.

Relay

Relay is one of the most important electromechanical devices highly used industrial applications especially in automation. It is like remote control switches. A relay is used for electronic to electrical interfacing i.e. it is used to switch on or off electrical circuits operating at high AC voltage using a low DC control voltage.

3.3 Smart controller schematic diagram

Schematic shows the schematic diagram of the smart controller system. The street light system used Arduino Mega 2560 as a microcontroller. In this system, the infrared sensor and voltage sensor will be the input to the microcontroller and the relay module will be the output of the system. The ESP-01 module will act as the bridge between Arduino microcontroller and application. The infrared sensor will detect the movement in the street light area. The relay module is used to manage the light on or off based on the movement in the street.

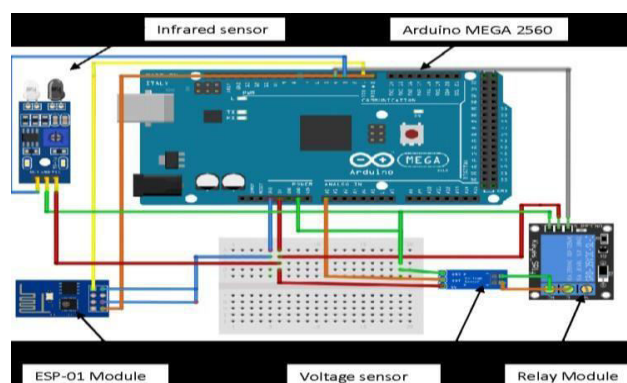


Figure 2. IOT-based smart street light controller schematic diagram

3.4 Data storing on cloud



Figure 3. Data storing on cloud

The system updates the data to ThingSpeak cloud using the ESP8266 Wi-Fi module which is connected to internet. ThingSpeak provides instant visualizations of data posted by devices or equipment through GUI. All the information are sent to central location in the cloud, so user can easily access data for online or offline analysis.

IV. RESULT

- 1.To put discipline in the execution of the street lighting operation which will essentially introduce a saving in the power consumption of the utility.
- 2.Scheduling for ON / OFF automatically.
- 3.Uploading the data to the cloud.

IV. CONCLUSION

In general, the IOT-based Smart Street Light System has been successfully modelled and controlled using Arduino MEGA 2560 microcontroller. Based on the prototype design and experiment, this IOT-based Smart Street. Light System prototype has saved the energy consumption by 45.48% on weekdays and 32.22% on weekends, thus this system maintained the wasted energy below 100% usage. This system also successfully implemented the infrared sensor to detect movement on the street light as the input for the Arduino microcontroller. It was found that the IOT system perform very well and gave an accurate display of the street light system. The IOT-based smart street light system also controlled the street light and shows that the system successfully saved the energy depletion of a street light system by almost half of the original value. Hence, with a proper system and monitoring, the energy depletion of the street light system can be managed.

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