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Internet of things based intelligent street lighting system for smart city

A. Siva Puttal Reddy
puttalreddy@gmail.com
Saveetha School of Engineering, Chennai, Tamil Nadu

Dr. J. Mohana
mohanajaishankar1@gmail.com
Saveetha School of Engineering, Chennai, Tamil Nadu

ABSTRACT

This project aims for designing and executing the advanced development in embedded systems for energy saving of street lights. Currently, we have a manual system where the street lights will be switched ON in the evening before the sunsets and they are switched OFF in the next day morning after there is sufficient light on the outside[1]. But the actual timing for these lights to be switched ON is when there is absolute darkness. With this, the power will be wasted up to some extent. This project gives solution for electrical power wastage [2]. Also, the manual operation of the lighting system is completely eliminated. The proposed system provides a solution for energy saving. This is achieved by sensing and approaching a vehicle using an IR transmitter and IR Receiver couple. Upon sensing the movement the sensor transmits the data to the microcontroller which furthermore the Light to switch ON [4]. Similarly, as soon as the vehicle or an obstacle goes away the Light gets switched OFF as the sensor senses an object at the same time the status(ON/OFF) of the street light can be accessed from anywhere and anytime through the internet. This project is implemented with the smart embedded system which controls the street lights based on detection of vehicles or any other obstacles on the street. Whenever the obstacle is detected on the street within the specified time the light will get automatically ON/OFF according to the obstacle detection and the same information can be accessed through the internet. The real-time information of the street light (ON/OFF Status) can be accessed from any time, anywhere through internet.

Keywords: *Arduino, IR Sensor, Current sensor, LDR, LCD display*

1. INTRODUCTION

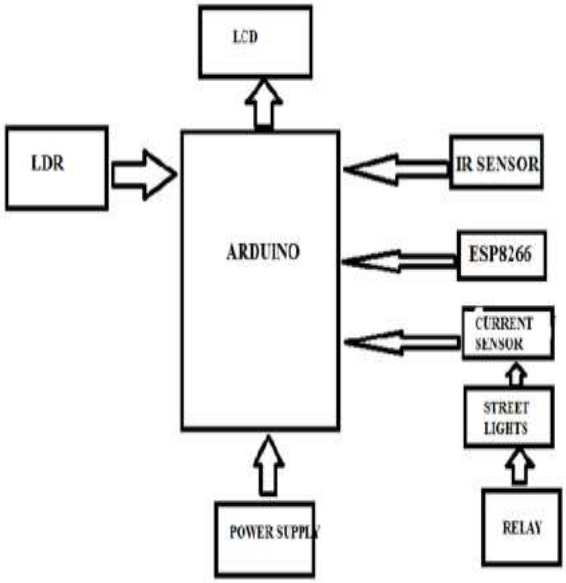
The street lighting is one of the largest energy expenses for a city. An intelligent street lighting system can cut municipal street lighting costs as much as 50% - 70%. An intelligent street lighting system is a system that adjusts light output based on usage and occupancy, i.e., automating classification of pedestrian versus cyclist, versus automotive. An intelligent street light management proposes the installation of the wireless-based system to remotely track and control the actual energy consumption of the street lights and take appropriate energy consumption reduction measures through power conditioning and control [3]. The street light controller should be installed on the pole lights which consist of microcontroller along with various sensor and wireless module. The street light controller installed on the street light pole will control LED Street lighting depending on traffic flow, communicate data between each street light. The data from the street light controller can be transferred to the base station using wireless technology to monitor the system [5]. The mode of operation of the system can be conducted using auto mode and manual mode. The control system will switch on-off the lights at required timings and can also vary the intensity of the streetlight according to requirement.

2. RELATED WORK

The paper describes about the circuit that switches the street light ON detecting the vehicle movement and remains OFF after the fixed time. In this system the street light automatically ON/OFF during the night and the daytime. In this. System the GSM technology has been used in which the manual switching OFF/ON of the street light using GSM. Here the system controls the intensity of the street light by dimming and brightness the intensity on the detection of an object using PIR sensor. In [2] this paper is focused on the necessity of the automated street light system and the peculiar way of implementation with embedded system tools. In this system the Piezoelectric sensor is used to detect the movement of the object on the street instead of using IR sensor. A microcontroller msp430 as a brain to control the process involved. This paper gives a solution to the controlling the intensity of the light considering the movement on the road. In [3] this project is designed to detect the vehicle movement on the highways to switch ON only a block of the street light ahead of it and switch OFF the trailing light to save energy. During the night all the lights on the highways remain ON for the vehicle, but lot of energy is wasted when there is no vehicle movement on the highways. In this paper two kind of sensors has been used

which are light sensor, photoelectric sensor. In [4] Automatic Street Light Control System is not only easiest but also the powerful technique. Relay uses as an automatic switch in this system. It releases the manual work at most up to 100%. As soon as the sunlight goes under the visible region of our eyes this system automatically switches ON lights. Light Dependent Resistor (LDR) is a type of sensor which actually does this work and senses the light as our eyes does. As soon as the sunlight comes, visible to our eyes it automatically switches OFF lights. Such type of system is also useful for reducing energy consumption. In [5] this system the system with LDR sensor, PIR sensor, ZigBee is used to intimate the status of humans use, light intensity and street light ON/OFF status to the EB section to avoid wastage of energy by glowing street lights in unwanted areas. The whole system is operated by using artificial energy source called solar and with battery backup. The PIR and LDR sensors sense the persons and light intensity of a particular place and transmits the data in wireless to the EB section with ZigBee. Depend upon the data received the controller will turn ON/OFF the street light in wireless communication. This system is appropriate for street lighting in remote urban and rural areas where the traffic is low at times.

3. BLOCK DIAGRAM



4. MATERIAL

4.1 Arduino Uno: The Arduino Uno is a microcontroller board in light of the ATmega328 (datasheet). It has 14 automated information/yield pins (of which 6 can be used as PWM yields), 6 basic wellsprings of data, a 16 MHz pearl oscillator, a USB affiliation, a power jack, an ICSP header, and a reset get. It contains everything anticipated that would help the microcontroller; basically interface it to a PC with a USB connection or power it with an aeration and cooling system to-DC connector or battery to start. The Uno fluctuates from each first board in that it doesn't use the FTDI USB-to-serial driver chip. Or maybe, it incorporates the Atmega16U2 (Atmega8U2 up to adjustment R2) tweaked as a USB-to-serial converter.

4.2 LDR: A Light Dependent Resistor (LDR) or a photoresistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photoconductors, photoconductive cells or simply photocells. They are made up of semiconductor materials having high resistance. A light dependent resistor works on the principle of photoconductivity. Photoconductivity is an optical phenomenon in which the conductivity of the material (Hence resistivity) reduces when the light is absorbed by the material.

4.3 IR Sensor: An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. It is also capable of measuring the heat of an object and detecting motion. Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation is the region having wavelengths longer than visible light wavelengths, but shorter than microwaves. The infrared region is approximately demarcated from 0.75 to 1000µm. IR (infrared) sensors detect infrared light. The IR light is transformed into an electric current, and this is detected by a voltage or amperage detector. It is introduced as a segment of an aggregate contraption consistently including gear and mechanical parts. Embedded structures control various contraptions in like way use today. Ninety-eight percent of all chips are delivered as portions of introduced structures.

5. METHODOLOGY

5.1 Arduino IDE: The Arduino Software (IDE) is an open source software and it makes easy to the code and uploads it to the board. It runs on the different plant from Windows, MAC OS, Linux. The environment is written in Java and before running the IDE Java software to be installed on the machine this software can be used with any Arduino board.

5.2 OrCAD: OrCAD is a blessing when it comes to PCB design and the subsequent manufacture. This utility helps from designing the schematic to implementing the routes of the electrical connections and further mounting diagrams of the components. In general, it offers a total solution for core design schematic and PCB layout. The Capture program includes a project wizard that provides an easy method for creating a project, complete with library and simulation resources. Creating a project does not create a design within the project. A new design inherits characteristics from the settings in the design template dialog box, so we should always check those settings before we create a design. After creating a schematic folder we can move existing pages into it and we can create new pages in it.

5.3 Processing software

Processing is a flexible software sketchbook and a language for learning how to code within the context of the visual arts. Since 2001, Processing has promoted software literacy within the visual arts and visual literacy within technology. There are tens of thousands of students, artists, designers, researchers, and hobbyists who use Processing for learning and prototyping.

6. CONCLUSION

This project “IoT Based Smart Intelligent Lighting System for Smart City” is a cost-effective, practical, eco-friendly and the safest way to save energy and this system the light status information can be accessed from any time and anywhere. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of

incandescent lamps, very efficiently. Initial cost and maintenance can be the drawbacks of this project. With the advances in technology and good resource planning, the cost of the project can be cut down and also with the use of good equipment, the maintenance can also be reduced in terms of periodic checks. The LEDs have a long life, emit cool light, the donor has any toxic material and can be used for fast switching. For these reasons, our project presents far more advantages which can overshadow the present limitations. Keeping in view the long-term benefits and the initial cost would never be a problem as the investment return time is very less. The project has scope in various other applications like for providing lighting in industries, campuses and parking lots of huge shopping malls. This can also be used for surveillance in corporate campuses and industries.

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