Efficient Street Lighting

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Abstract— *Now days it seems that street lamp wastes a lot of power. Street lamps are needed for visibility in dark mainly during the night hours. The street lamps remain in on state even in off peak hours i.e. from 10 pm to 6 am. During these hours the lamp is in on state and power wastage occurs as there is less usage of lamps during these hours. This condition can be avoided by bringing the street lamp in dim mode and brought back to bright mode when human passes by using a sensor. This greatly helps in advancement of economy and efficiency. Design of new street light control system does not only achieve energy-saving power but also extend the service life of lighting equipment. Moreover, it is controllable, ease of maintenance. This circuit consists of dark activated sensor and connected to the Arduino UNO microcontroller. The output of microcontroller is given to relay switch where PIR sensor the brightness of the switch can be controlled. When the sunlight goes down the LDR sensor detect the presents of light then LDR send message to microcontroller rand lit up the light. Then the light will be in bright mode until the 10 pm, after 10pm the bulb changes to dim mode. Here the interrupts are working. If a human interruption occurs in this mode the interrupt is enabled and it goes to bright mode and remains for some time. When the sun rises then the LDR sense that and all the lights will be turned off automatically*

Keywords –**PIR sensor, Arduino UNO**

I. INTRODUCTION

Street lights are used to light up the roads or walkways when enough natural lighting is not present. The traditional street lights have to be manually turned on by evening and manually turned off in the morning. The lights remain lit up till next day morning. During midnight hours, the traffic is very less or no traffic at all. So keeping the lights lit up till morning during the night hours. This wastes electrical energy and reduces the life of the light bulbs. Streets lights are usually lit up at 06:00 PM , but due to climatic changes or whether changes, the sun rise or sun set will change which means that some days, there will be enough sunlight for more time than usual and vice versa. But it is not taken in to consideration in the current street lighting systems. Our new idea of street lighting has automatic functionalities for turning on and off and the wastage of energy during midnight hours are also overcome here in our project titled **"Efficient Street Lighting"** The main objective of the project is to develop a simple, low-cost, real time, smart and efficient street lighting system that aims to overcome many defects and is operated by its own. Intelligent street lighting, also the lights enter in to a dim state after 10 PM, assuming that by that time, the number of road users will be very less. Known as adaptive street lighting, dims when no activity is detected but brightens whenever movements are detected. The lights will remain in this state till and morning and by sunrise; all the lights will turn off.

II. LITERATURE SURVEY

It has some advancement than our traditional systems. Street lighting consists of many poles and lights. Each pole has individual sensors that sense motion continuously. And a light sensor too is present for each pole. The data from these sensors are then processed and the street light intensity is adjusted accordingly. Also the power on and off functions are controlled using these sensors. All the poles have individual sensors and they are not inter connected by any means, and which means that each pole needs costly hardware and complicated software to operate them. The poles or the sensors are not interconnected and each pole and the light fixed to it will work independently. The main advantage is that it doesn't need specialized software or complicated physical or wireless interconnections [1]. This adds much to the portability and adaptability of the individual light poles. But, the main disadvantage is that moving vehicles will have less advantage of this system or sometimes they get no use of it at all. Also, stray dogs or any unwanted motions can trigger the light and light may be wasted.

A. Demerits of the Existing Systems

- ✓ Costly hardware and complicated software is needed for each pole.
- ✓ The entire light pole fails if any sensors in it fails.
- ✓ Lighting up light bulbs for moving vehicles in their direction of travel is almost impossible.
- ✓ It Efficiency of a decentralized system is always compromised and has high implementation costs .

III.PROPOSED SYSTEM

The new system is being developed making use of all the advantages of the old system and adding new technologies to it to make it efficient and better. Here all the sensors are connected together to a microcontroller[2]. So, the detected motion can help to trigger nearby lights (lights ahead of the moving object in the direction of motion) too based on the motion. Any moving vehicle or even a walking person needs light around him, as well as in front of him. If the lights ahead are not lit up for a speeding vehicle, then the system is useless at that point. This is the main reason to inter connect all the lights as well as sensors. Also, adding a light sensor can help to turn on or off the lights based on the present light conditions[3]. Normally the lights are kept on from 6 PM till 6 AM and this timing can be varied according to the light conditions of each day with the use of light sensor[9]s. The sun sets early and rises late during rainy and winter seasons and vice versa, the light sensor is made use of during such situations to control the On and Off times of the lights[4]. Also, manual switching on and off of the street light is no more required, but the automated system can be overridden and be controlled manually during special or emergency situations.

A. Advantages of proposed system

- ✓ The having a centralized controller will help the entire system to work more efficiently and effectively.
- ✓ Adding an LDR (Light Dependent Resistor) will help to determine the atmospheric light conditions to power on and power off the lights
- ✓ Even if any sensors fail, the data from the nearby sensors can be taken in to account and the lights can function.

IV.MODULE DESCRIPTION

The project “Efficient Street Lighting”, consists of following modules

A. Light Dependent Resistor (LDR)

A Light Dependent Resistor or photodiode is a variable resistor controlled by the light intensity. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

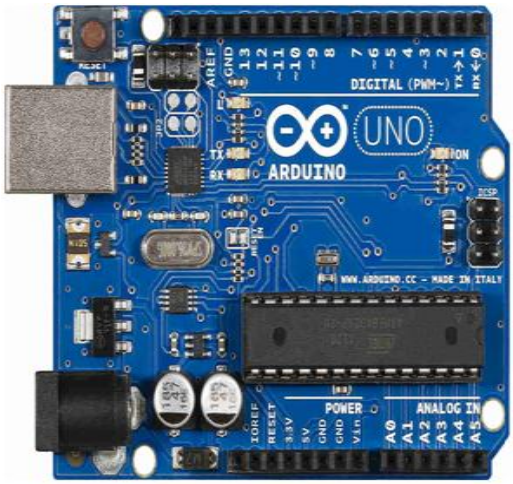
A light dependent resistor is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high a few mega ohms (MΩ), while in the light, it can have a resistance as low as a few hundred ohms. If incident light on a photo resistor exceeds certain intensity, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons conduct electricity, thereby lowering resistance. A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor. Extrinsic devices have impurities, also called dopants, and added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons are sufficient to trigger the device. The resistance value from the LDR is to be analysed to know the atmospheric light conditions.

B. Passive Infrared (PIR) Sensor

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. All objects with a temperature above absolute zero emit heat energy in the form of radiation and the PIR sensor makes use of this to detect motion. Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths and human eye cannot see infrared radiations, but it can be detected by electronic devices designed for such a purpose. The term passive in this instance refers to the fact that PIR devices do not generate or radiate any energy for detection purposes. They work entirely by detecting the energy given off by other objects. It is to be noted that PIR sensors do not detect or measure heat, but detects the infrared radiation emitted from any object and this radiation is usually associated with the temperature of the object. Infrared radiation enters through the front of the sensor, known as the 'sensor face'. At the core of a PIR sensor there are sensors, made from pyroelectric materials—materials which generate energy when exposed to heat. The PIR sensor has 3 pins and they are for VCC, GND and Output. It is a digital sensor and outputs a high value if any motion is detected. The sensitivity can be varied accordingly using the two screws on the side of the sensor.

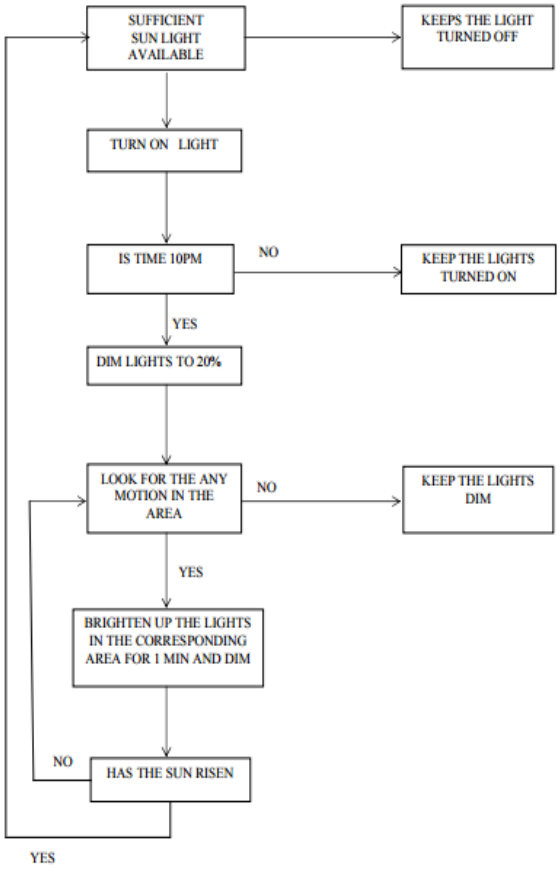
C. *Arduino UNO*

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins of which 6 can be used as PWM (Pulse Width Modulation) outputs, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, and a reset button. It contains everything needed to support the microcontroller. The Arduino Uno can be programmed with the Arduino software (IDE). The Arduino Uno comes pre-programmed with a boot loader that helps to upload new code to it without the use of an external hardware programmer. The program can be copied and burned to the board with the help of a USB cable. The ATmega328 has 32 KB of with 0.5 KB occupied by the boot loader. It also has 2 KB of SRAM and 1 KB of EEPROM.TheArduino Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically. The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.
Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalwrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor of 20-50k ohm to limit the current to the pins to 40 mA to protect the board. The Arduino Uno has 6 analog inputs, labelled A0 through A5, and each of these pins are able to give 1024 different values my PWM method



V.WORK FLOW DIAGRAM

The entire design and idea of the proposed system is illustrated here. Following are the figure givinga clear picture of the system.



VI. CONCLUSION

The project work has been studied and implemented a complete working model using an Arduino UNO board. The programming and interfacing of the microcontroller has been mastered during the implementation. This work includes the study of energy saving system in many applications. The main advantage of the newly developed system is power savings and longevity of the electrical components. Only the initial cost is a little more than conventional systems, but when compared with the efficiency, power saving and longevity of components, this can be helpful to attain low operational and maintenance costs. This helps government agencies and individuals for better lighting needs. This design is very simple and can be adapted almost anywhere due to the flexibility of the design. After having implemented this system, still there are room for improvements. Solar panels and batteries can be as a part of sustainability or small windmills can be added to harvest more energy from the atmosphere rather than sunlight. In addition to that, controlling the Traffic Signal lights would be

another feature that we could look into after successful implementation of our system. Depending on the traffic in a particular direction, necessary controlling actions can be taken. We hope that these advancements can make the system completely robust and totally reliable in all respect.

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