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Automation of Street Lighting

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Abstract: ***In every place, prominent amount of electricity is being used for street lighting. Some streets of the city may have less regularity of vehicles, but the amount of energy consumed is equal at every place. Due to this a large amount of energy is wasted. So in our proposed system we will replace the high intensity discharge lamps with LEDs. These LEDs can change its intensity based upon the requirement. LDR (Light Dependent Register) are used to sense the vehicle's movement and if there is a decrease in passers-by then automatically the intensity of light will be reduced. Hence, our proposed street lighting system can also stabilize the lighting conditions according to the weather environment.***

Index Terms: LDR, LED, Microcontroller, Arduino UNO, Street Lighting Automation, Solar Panel.

I. INTRODUCTION

Street lighting is one of the considerable parts of a city's infrastructure and it also plays an important role in contributing to our traffic and pedestrian safety. Street light are used to irradiate at night or at dark environmental conditions. It allows a clear vision of roadway and stimulates the traffic smoothly. Thus, the existing system has a lot of flaws such as sodium vapor lamps, unsustainable supply of electricity, needs a lot of man power, which gradually increases the maintenance costs up to a significance level and it makes hard to detect the errors and solve them. Sodium vapor lamp release a huge amount of heat and gases into the atmosphere. As our proposed system is going to change this Sodium vapor lamps into LED lamps whose life span is almost fifty times better than all other conventional lamps. LED avoids greenhouse effect and it is both cost and energy efficient. In conventional system the major problem is due to the wire system that puts a halt to the ongoing services each and every time. The services are ceased due to bad weather or any technical problems in wire. So far the street lighting system is controlled manually where we need to deploy the officers to check the condition and damage to lights that cannot be detected automatically. These problems resulted in very high maintenance cost. Hence, our proposed system will resolve all of these problems including an embedded weather monitoring system.

II. RELATED WORKS

In (1), the system solar panels act as a source of battery. According to the density of the pedestrians and vehicles the intensity of street lights can be varied. The use of LDR sensor makes the system intensity efficient. It senses the intensity of light in the environment and vary the strength of street light. The IR sensor are also used to detect the unfortunate movement crossing the street but it is less efficient.

In (2), the design of public street lighting system is based on IOT (Internet of Things). The system works well according to the telecommunication system which includes control zone and device zone. In control zone we can control minimum of four lamps to turn on or off automatically or manually through internet. The information sent over to the cloud server from the micro controller via internet has avg delay time of 1 second.

In (3), this paper elaborates the design and construction of automatic street control system circuit by using arduino and NI Lab view. NI Lab view is used for real time controlling, and we use ultrasonic sensors for sensing vehicles. Thus, this paper point out towards saving electrical energy.

In (4), this project is for the betterment and development of embedded system. This paper detect the motion of object as it can control vehicle speed and intensity of street light automatically. This paper uses self responsive cars for smart transportation. This self responsive cars helps the driver to understand the benefit of street light automation. Many smart cities will adapt these techniques in future as it has great scope like it is energy efficient and it has fast response. But we have to make this technique more reliable. In (5), this study is concentrating about saving potential energy of two Lane Street including pedestrian paths. It can be enabled by using emergence of LEDs which has luminaire technology; it is capable of being deemed frequently and faster. The results of the chosen luminaire are presented in kWh.

In (6), this paper it majorly focuses on conserving energy and monitoring street light by using power line communication. This system uses LDR (Light Dependent Register) sensors and LED (Light Emitting Diode) luminaire which make it an intelligent control system. Frequency shift keying (FSK) modulation help the power line to communicate. In the future, this system can be practically implemented.

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III. SYSTEM DESIGN AND ARCHITECTURE

We have proposed a working model that consists of various hardware components used for development of this system as shown in figure. 1.

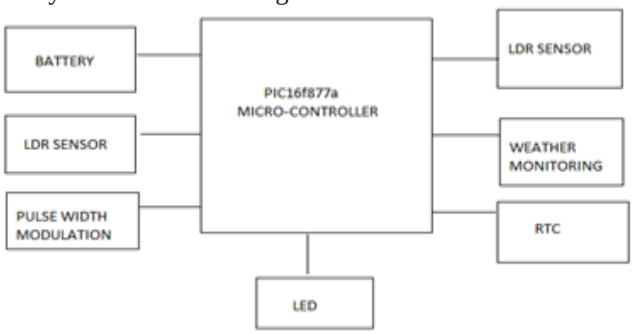

Figure 1. Architecture of Street Light

Weather monitoring system in the proposed paper mainly works upon the basis of arduino sensing and then sends the data received to the LCD display as shown in the figure. 2. Four sensors are being used such as Temperature sensor, Light sensor, Humidity sensor and Rain level sensor. Temperature sensor works on the basis of change in Resistance. The resistance change is sensed by the circuit and then it calculates the temperature. As temperature vary on the basis of increase or decrease in voltage. Light sensor work is to convert the light energy of various wavelengths from infrared to UV and after that these data are shown in electrical signal. Humidity sensor work is to senses two reports moisture and air temperature. The detection is done here when there is a change in electrical current or temperature in the air. These changes or variation create a data for Humidity sensor. Now at last Rain level sensor are used which work on some basic principle of Total internal reflection. All of these data are combined together and one single report is forecast on the LCD Display.

Figure 2 Working of Weather Monitoring Sensor

Figure 3 shows different PWM signals. First we can see a PWM output at a 10% of duty cycle where the signal is on for the period of 10% and on the other side 90% is off. In second one we can see PWM output at a 50% of duty cycle which means the signal is on and off for the period of 50% duty cycle. In last one 90% is the on period of signal and 10% is the off period of duty cycle. All of these four PWM outputs conceal four different analog signal values, at 10%, 30%, 50% and 90%.

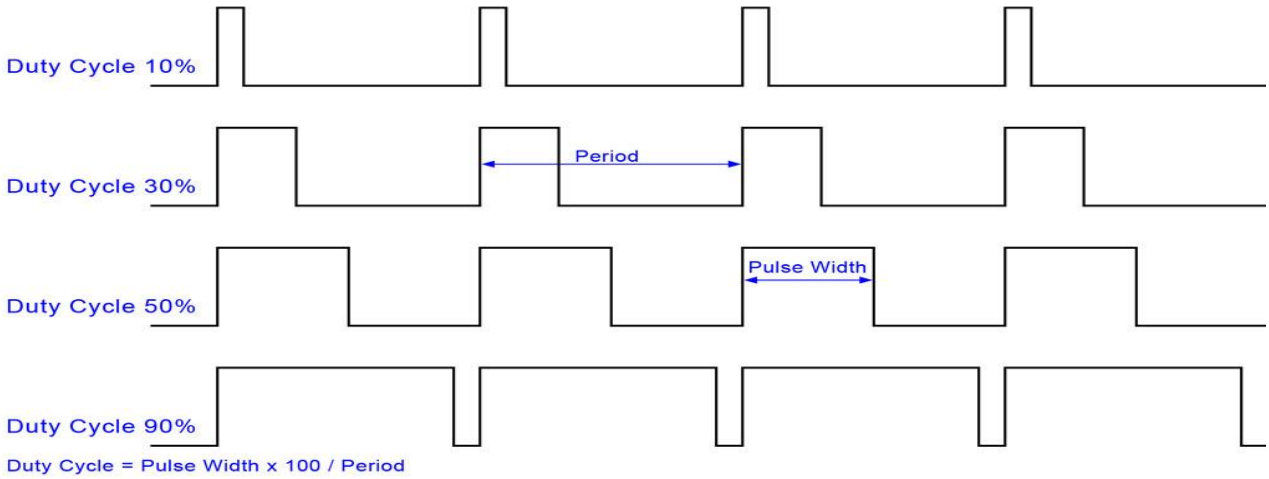

Figure 3. PWM Signals of Varying Duty Cycle

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This block diagram shows us the components linked with arduino UNO. The major components linked are the temperature, light, humidity, and rain level sensor. The database components include Wi-Fi model for connectivity and online cloud storage for data analyzing. For output an LCD screen has been attached to the system.

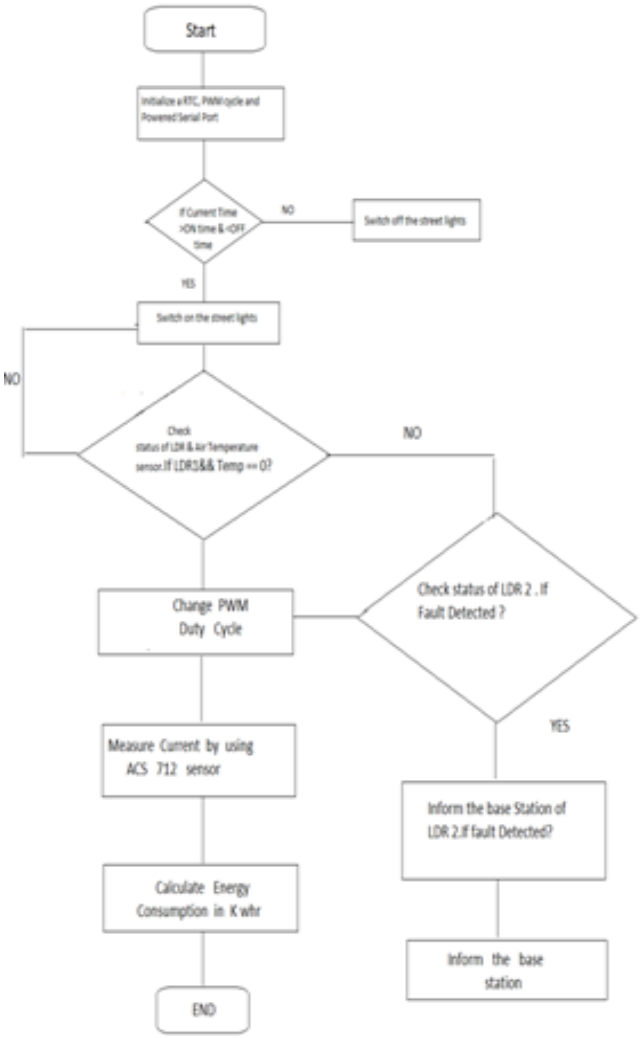

Figure 4. Workflow of the Proposed System

IV. IMPLEMENTATION

Street lights can now be transformed into intelligent machines that adapt to movement and weather conditions. In this system there is use of solar panels integrated with LEDs in the street lights to save the energy. There is a difference in wattage between traditional and LED bulbs. The large variance between an LED bulb and, say, halogen bulb wattage is the reason LEDs are so much cheaper to run. This means that the LED spot uses 90% less electricity to run and therefore it costs 90% less. LDR sensor is used to sense the intensity of light falling on to the system which helps the light to vary the intensity accordingly. Here the street lights are completely used during the peak hours say from 6PM to 12AM and after that they are dimmed which saves up to 40W power supply. Each street light consists of two LDR in it, named as LDR-1 and LDR-2. LDR-1 checks the vehicle's movement in the street and changes the intensity of the light accordingly. LDR-2 is used to detect the faults in the system and it works similar to the IR sensors. The major implementation of this paper includes weather monitoring which senses the environment on the basis of temperature, humidity, light and rain level sensor. These four sensors are directly connected to Arduino UNO which acts as an in-built analog to digital converter. Arduino also calculates the weather parameters and display it on LCD. These parameters are sent to internet using IOT technique. This process uses Wi-Fi repeatedly to send the data on the internet at a constant interval of time. Then the user has to visit that particular website to get the data. It is estimated that the bills could be slashed by up to 70% saving 5.3 billion per year if local authorities were to invest in energy efficient smart lighting. Accelerated savings-Intelligent street lights, connected by a network, can cost up to 8,000 each, an outlay that authorities have been able to recover over a period of around five years through energy savings. TCS has developed a digital software, that period can be cut back to two years through the use of machine learning and predictive analysis. The LED lights can change their intensity based upon the weather conditions. Arduino senses the bad weather or fog and in react of that it changes the intensity accordingly. This makes the system more reliable and efficient.

V. RESULT AND DISCUSSION

The working model produced from our work is shown as a result in Fig 5, Fig 6, Fig 7, Fig 8. At initial stage the intensity of street Lamps are low (i.e 25%) and we can also observe that all the street lamps are at same intensity(Fig 5). As soon as vehicles come near to the street lamp poles then the intensity of that particular lamp post will be increased to maximum (i.e 100%). Related to the pedestrian point of view the intensity of the street light will be low (i.e 25%), but if any vehicle will be detected then the intensity will increase. The weather monitoring system is an extension for this project which leads it for the betterment and advancement of technology. As a future scenario it will help every single country to handle the street lights with efficient weather monitoring. It will reduce the number of accidents, it will help the drivers and it also gives weather related data according to which the light intensity will also change. Thus, street light automation help us to eases the fault detection and manage of street lights. The installation of this system is also very efficient. This system proves itself very useful by changing the infrastructure of the city.

However, Since LDR sensor are used, it can detect the headlight of the vehicles and change the intensity. Weather monitoring sensor also senses the atmosphere and change the intensity of lights. The main motive to use weather monitoring system is that sometime the atmosphere get foggy and it makes everything nearly invisible in the roads so it will detect it and lights will be ON.

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The smart cities are going to adapt this technique in future only because of its advantages such as easy fault detection, fast retaliation and energy efficient.

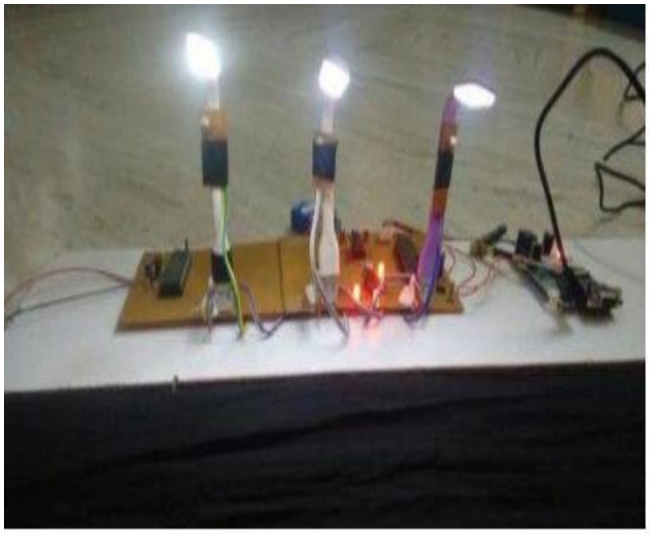

Figure 5. Street Lights Glimmering at its Initial Intensity of 25%.

Figure 6. Lamp Post 1 Glimmering at its Maximum Intensity (i.e100%).

Figure 7. Lamp Post 2 Glimmering at its Maximum Intensity (i.e100%)

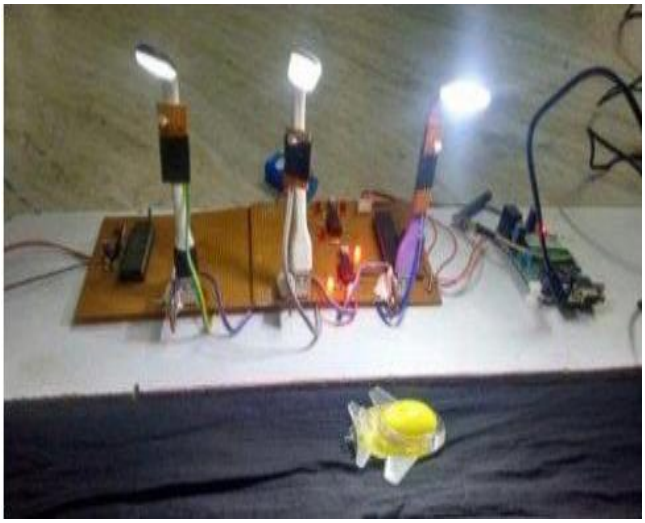

Figure 8. Lamp Post 3 Glimmering at its Maximum Intensity (i.e100%)

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