Smart Street Light System using IOT

Sumaya Goodwala[1] G. R. Meghana[2]
[1,2]Department of Computer Science & Engineering
[1,2]VDIT Haliyal, India

Abstract— The internet of things (IoT) can implement transparently a very large amount of heterogeneous end systems, while digital service provides open access to sub set of data. This paper focuses on smart street light system. In this system the street light systems are automatically ON, DIM and OFF according to the situation. This smart light system automatically detects the movements of the object on the street. In the traditional system IR sensor is used to detect the object. The microcontroller is used to control the process. This paper is focused on the controlling intensity of the light considering the object movement near the light. Once if the sun light goes under the visible region then this system automatically switches ON light. As soon as the sun light is visible then automatically switches OFF lights. This Smart light system is used to reduce energy consumption. In this smart system the system uses some of the sensors. This smart system is used to avoid unnecessary usage of electricity. The entire smart system is designed to operate using artificial energy source. The IR sensor and LDR sensors are used to sense the human being and light intensity of a particular area and transmits the data in wireless to the EB section. This smart system is best suited for street lighting in remote urban and rural areas where the traffic is very low.

Keywords: Automation, Switching, Energy conservation, Arduino, Sensors

I. INTRODUCTION

Automation systems are being preferred over the manual mode because it reduces the use of energy to saves energy. These automation systems play an essential role in making our daily life more comfortable and facilitate users from ceiling fans to washing machines and in other applications. Among all exciting applications, street lights play a vital role in our environment and plays a critical role in providing light for safety during night-time travel. In this scenario, when the street lights are in working functionality over the whole night that consumes a lot of energy and reduces the lifetime of the electrical equipment such as electric bulb etc. Especially in cities streetlights, it is a severe power consuming factor and the most significant energy expenses for a city. An intelligent lighting control system can decrease street lighting costs up to 70% and increase the durability of the equipment.

The smart street light controller must be installed on the light pole which consists of microcontroller along with various sensor and wireless module. The smart street light controller installed on the street light pole will control LED street lighting depending on movements of the object in the street. The captured data cane transferred to base station where the energy gets stored using wireless technology to monitor the smart system. The smart system can be operated either manually or automatically. The control system will switch ON ,DIM and OFF the street lights at needed timings and can also vary the intensity of the street light according to the necessity.

II. RELATED WORK

The traditional lighting system has been limited to two options ON and OFF only, and it is not efficient because this kind of operations meant power loss due to continuing working on maximum voltage. Hence, wastage of power from street lights is one of the noticeable power loss, but with the use of automation, it leads to many new methods of energy and money saving. In this regard, controlling lighting system using Light Dependent Resistor (LDR) [1], IR obstacle detector sensor [2] and Arduino [3] together is proposed in the past. In the meanwhile, the importance of smart light system has motivated a lot of studies and the series of research work has been done. In previous works, the street light systems are based on LDR, and most of them are passive infrared receiver-based systems that are controlled with timers and analog circuits. Sun tracking sensors [6] are also utilized to power OFF the street lights by the detection of the sunlight luminance. Furthermore, street light control with the use of solar energy [5], and ZigBee based system to control street light [7] have also been implemented. Distinguished from turning ON/OFF the electricity, another approach is introduced to dim the light [4] in fewer traffic hours that might be useful to reduce the power consumption, but the electric bulbs are in continuous usage condition. To the best of our knowledge, a need is still existed to design a system that controls the dim light, connect the power ON/OFF with the vehicle's motion detection, calculate the total number of vehicles passed through the road, and control the entrance gate at night to reduce criminal activities.
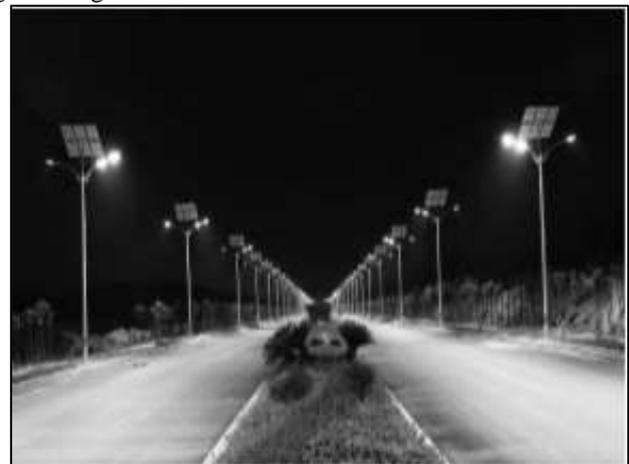

Fig. 1: Smart Street Light System

III. PROBLEM DEFINITION

In most of the cities, the street lights are ON when it is not need and It is OFF when is not needed. Because of these situation the huge energy expenses for a city gets wasted. Usually the lights are ON in the evening after the sunset, it continuous to be ON till the sun rises in the next day morning.

This paper focuses on reducing the energy by automatically switching ON, OFF and DIM street lights. When vehicles come to the street/road the sensor will capture the movements of the vehicles then lights automatically ON. Otherwise automatically DIM the lights.
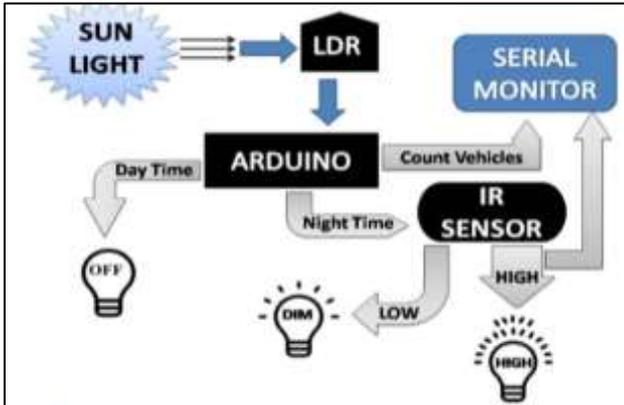
IV. ARCHITECTURE

Fig. 2: The architecture design of automatic street light control system.

For the simplicity of discussion, Fig. 2 illustrates the overall working mechanism and the features of the proposed lighting concept. Firstly, LDR will sense the intensity value of sunlight and send it to Arduino. Arduino will judge if the received value is above the threshold level (which is set independently by the user from the discrete value: 0-2023), then it will consider it as daytime and LEDs will remain OFF, or if the received value below the threshold level, Arduino will consider it as a night-time. In the night-time, if the value of IR obstacle detector sensor is LOW and detects no object, then DIM LEDs (half of its maximum voltage) will glow, or if IR obstacle detector value is HIGH and detects any object, then HIGH LEDs (full of its maximum voltage) will glow. Arduino will also count the total number of vehicles that crossed the street in the nighttime with the help of IR obstacle detection sensor and will demonstrate it to the serial monitor.

V. METHODOLOGY

Recent days, Smart Street Light System is major component of a smart city Infrastructure. The important function is to light the city streets using Sensor's to save the current or power energy. In existing system using normal street lamps. It takes more current and costs too. So, use LED lamps to save the current in low amount of power. Using IoT type system is all over the world. It is used to watch all kind of areas in the cities.

A. Light Dependent Resistor (LDR)

LDR is a Light Dependent Resistor (Fig. 3a) whose resistance is dependent on the light impinging on it. The resistance offered by the sensor decreases with the increase in light strength and increases with the decrease in light strength. This device is used for detection of day-time and night-time because when sunlight falls on it, it will consider as day-time, and when there is no sunlight falls on it, it will be regarded as a night, as shown in Fig. 3b. These are very beneficial, especially in light/dark sensor circuits and help in automatically switching ON /OFF the street lights.
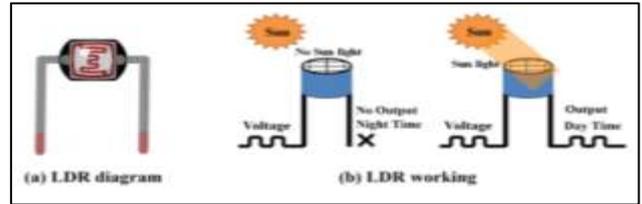

Fig. 3: LDR symbol and its working phenomenon

B. Arduino Uno

As shown in Fig. 4, the Arduino Uno is a microcontroller board which is based on the ATmega328 series controllers and has an IDE (Integrated Development Environment) for writing, compiling and uploading codes to the microcontroller. It has 14 digital input and output pins (of which 6 are PWM) and 6 analogue 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, and a reset button. Its operating voltage is 5v, input voltage 7 to 12v (limit up to 20v).
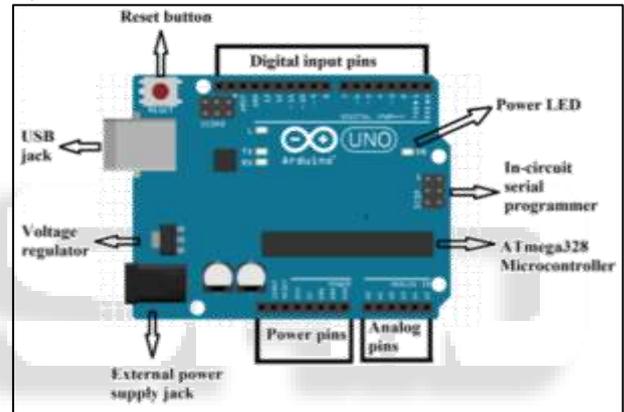

Fig. 4: Arduino Uno board description

C. LEDs

A LED (light-emitting diode) is a PN junction diode which is used for emitting visible light when it is activated, as presented in Fig. 5. When the voltage is applied over its elements, electrons regroup with holes within the LED, releasing energy in the form of photons which gives the visible light. LEDs may have the Dim/full capability.
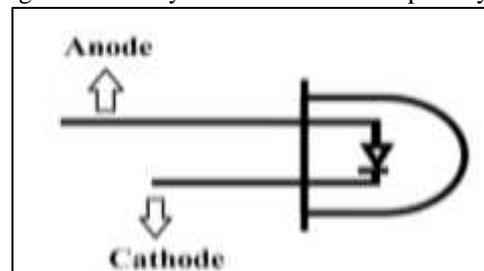

Fig. 5: LED circuit diagram

D. IR Obstacle Avoidance Sensor

An obstacle avoidance sensor consists of an infrared-transmitter, an infrared-receiver and a potentiometer for adjusting the distance, whenever an object passes in front of a sensor, the emitted rays hit the surface of an object and reflect to the receiver of the sensor, so it will consider this as

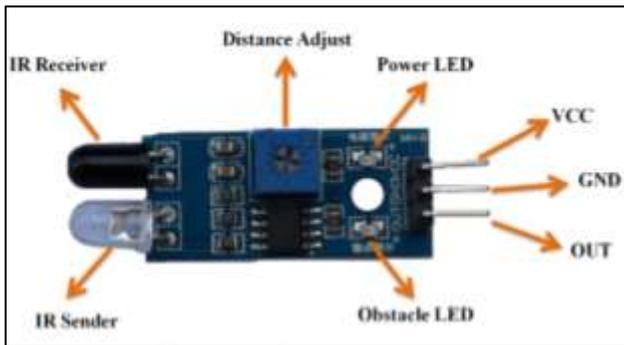a motion It is a heat sensitive sensor and used for detection of motion.

Fig. 6: IR obstacle detector sensor

VI. CONCLUSION

The proposed streetlight automation system is a cost effective and the safest way to reduce power consumption. It helps us to get rid of today's world problems of manual switching and most importantly, primary cost and maintenance can be decreased easily. The LED consumes less energy with cool-white light emission and has a better life than high energy consuming lamps. Moving to the new & renewable energy sources, this system can be upgraded by replacing conventional LED modules with the solar-based LED modules. With these efficient reasons, this presented work has more advantages which can overcome the present limitations. Keep in mind that these long-term benefits; the starting cost would never be a problem because the return time of investment is very less. This system can be easily implemented in street lights, smart cities, home automation, agriculture field monitoring, timely automated lights, parking lights of hospitals, malls, airport, universities and industries etc.

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