Automatic Street Lighting System Using Solar Energy

1. Abhinav Ankur, Electronics & Telecommunication, DIT, Pimpri
2. Deepraj Ambure, Electronics & Telecommunication, DIT, Pimpri
3. Ratnadeep Wankhede, Electronics & Telecommunication, DIT, Pimpri
4. Asst. Prof. Sarika A. Patil, Electronics & Telecommunication, DIT, Pimpri

Abstract

Our manuscript aims 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 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 etc.

Keywords—*Atmega, Object detection, IoT(Internet of Things)*

I. INTRODUCTION

Automation systems [1] are being preferred over the manual mode because it reduces the use of energy to save 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 [2]. Among all exciting applications, street lights play a vital role in our environment and also 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 also the most significant energy expenses for a city. In this regard, an intelligent lighting control system can decrease street lighting costs up to 70% [3] and increase the durability of the equipment.

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) [4], IR obstacle detector sensor [5] and Arduino [6] together is proposed in the past [7-10]. In the meanwhile, the importance of smart light system has motivated a lot of studies and the series of research work has been done [7-20]. In previous works, the street light systems are based on LDR [8-13], and most of them are passive infrared receiver based systems that are controlled with timers and analog circuits. Sun tracking sensors [21] 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 [11], and ZigBee based system to control street light [22] have also been implemented. Distinguished from turning ON/OFF the electricity, another approach is introduced to dim the light [10] 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.

II. LITERATURE SURVEY

Duc Doan et al[1] has discussed about solar powered LED street lamp with automatic light control includes a Solar photovoltaic board, a brightness/darkness detection sensor, a lamp pole, an LED lamp, an LED direction board, billboard or light box, a base, a storage battery, a central controller and an infrared motion sensor. The Solar photovoltaic board is mounted on the top end of the lamp pole, the LED direction board, billboard or light box is mounted on the lamp pole, the storage battery and the central controller are situated in the base, the motion sensor and the LED lamp are mounted on the transverse bar of the lamp pole, and a plurality of LEDs are arrayed so as to constitute the characters or text on the LED direction board, billboard or light box.

Sze Keun Chan et.al [2] solar powered street lighting system that is totally independent of any external power sly. Solar panels are connected in such a manner to charge a maintenance-free storage battery with sufficient capacity to light street lights and/or traffic signals. An auxiliary generator may also be provided having a wind driven vane for also charging the battery if sufficient sun light is not available.

Light control system using LDR and Arduino is a whole new idea in the world of street lights. In the wake of experiencing numerous exploration papers which were found on the lighting system were only based on their working and not on the consumption of energy or electricity the main thought process of doing this extend make another diagram system for the road lights that don't eat up massive measure of energy and light up tremendous zone with high force.

III. HARDWARE COMPONENTS

1) Atmega Microcontroller:-

Atmegam328 has 1KB Electrically Erasable Programmable Read Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). Other characteristics will be explained later. ATmega 328 has several different features which make it the most popular device in today's market. These features consist of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins, programmable Serial USART, programming lock for software security, throughput up to 20 MIPS etc. ATmega-328 is mostly used in Arduino..

Figure :- Atmega Microcontroller

2) IR Obstacle Avoidance Sensor

An obstacle avoidance sensor consists of an infrared-transmitter, an infrared-receiver and a potentiometer for adjusting the distance, shown in Fig. 5a. 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 (as shown in Fig. 5b). It is a heat sensitive sensor and used for detection of motion.

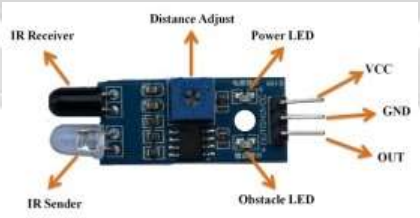

Figure :- IR Sensor Board

3) Solar Panel

It is a kind of a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A solar panel is a collection of solar cells. Lots of small solar cells spread over a large area can work together to provide enough power to be useful. The more light that hits a cell, the more electricity it produces.

4) Wi-Fi Module

The Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. This module is capable of either hosting an application or offloading all Wi-Fi networking functions from another

application processor. Each Wi-Fi module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

Figure :- Wi-Fi Module

IV.WORKING

For the simplicity of discussion, Fig. 1 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 day-time 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 night-time with the help of IR obstacle detection sensor and will demonstrate it to the serial monitor.

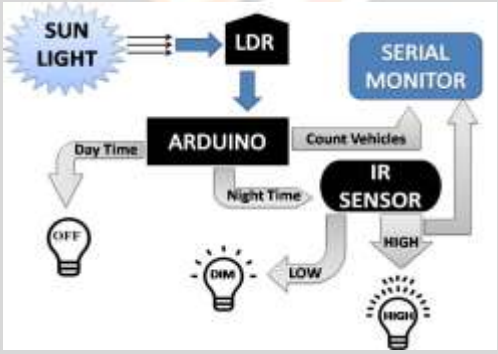

Figure :- Flowchart of Project

Solar panel is connected to NC pin of relay,while dynamo is connected to NO pin of relay and battery is a connected to Common pin of relay.

V. Conclusion And Future Scope

In this paper Intelligent street lighting system is described that integrates new technologies offering ease of maintenance and energy savings.The proposed system is appropriate for street lighting in remote as well as urban areas where traffic is low at times. It is capable of taking corrective actions in case of unprecedented events of climatic change.

We can further control the operation of LED lights manually by applying various IOT techniques. We will able be control the exact intensity of lights and will be able remotely switch the bulbs on or off. It can also be implemented in smart home which has huge scope in the coming generation. The main aim is change the way we use the electricity and conserve it as much as possible because energy is limited to us.

References

[1] Reza Mohamaddoust, Abolfazl Toroghi Haghighat, Mohamad Javad Motahari Sharif and Niccolo Capanni, "A Novel Design of an Automatic Lighting Control System for a Wireless Sensor Network with Increased Sensor Lifetime and Reduced Sensor Numbers", Sensors (2011) ,Volume No.11(9), pp. 8933-8952.

[2] De Dominicis, C.M.; Flammini, A.; Sisinni, E.; Fasanotti, L.; Floreani, F.; "On the development of a wireless self localizing streetlight monitoring system ", Sensors Applications Symposium IEEE, pp. 233 -238 ,2011.

[3].Gustavo W. Denardin, Carlos H. Barriquello, Alexandre Campos "Control Network for Modern Street Lighting Systems"IEEEsymposium on Industrial Electronics (ISIE), (2011), pp. 1282 –1289.

[4].Jing Chunguo, Wang Yan Sun, Wenyi Song, "Design of Street Light Pole Controller Based on WSN", The Tenth International Conference on Electronic Measurement & Instruments, ICEMI (2011), pp. 147 –150.

[5] Shentu, Xudan; Li, Wenjun; Sun, Lingling; Gong, Siliang, "A new streetlight monitoring system based on wireless sensor networks", International Conference on Information Science and Engineering, pp. 6394 –6397.

[6] Wu Yue; Shi Changhong; Zhang Xianghong; Yang Wei; "Design of new intelligent street light control system ",, 8th IEEE international Conferences on Control and Automation (ICCA), (2010) , Page(s): 1423