Implementation of IoT based Automatic Street light illumination by using IR sensor

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Abstract: Smart led street lighting system aims for designing and executing the advanced development in IOT for energy saving of street light, the best solution for electrical power wastage is automation of street light, the manual operation of the lighting system is completely eliminate. A method for modifying street light illumination by using sensor at minimum electrical energy consumption ,when object presence is detected, street lights glow at their brightest mode, else they stay in the dim mode during night time Internet of things (IOT) is used to visualize the real time updates of street processing and notifying the changes occur. This shall reduce heat emissions, power consumption, maintenance and replacement costs and carbon dioxide emissions.

Keywords: Internet of things , Arduino , LDR , IR sensor.

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%. The existing system is like the lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the outside . But the actual timing for these lights to be switched on are when there is absolute darkness. With this, "IOT based Automatic Street lightning system", the power that is wasted will be saved up to some extent. In sunny and rainy days, ON and OFF time differ which is one of the significant hindrances of the existing street lights systems. Also, the manual operation of the lighting system will be completely eliminated. The energy consumption in entire world is rapidly increasing due to population growth and economic development and the availability of energy sources remains woefully constrained. Resource augmentation and growth in energy supply has not kept pace with increasing demand and, therefore, continues to face serious energy shortages. Street lights are an integral part of any locality. They are present on all major roadways and in the suburbs too. Every day, street lights are powered from sunset to sunrise at full strength, even when there is no one around. On a global scale, millions of dollars are spent each day on street lights to provide the required electrical energy. The maintenance and replacement costs of conventional incandescent bulbs are immense. They consume a lot of electric power to function and their heat emissions are also quite high. All of this contributes to greater demand of electricity production and consequently, more carbon dioxide emissions from powerhouses.

It also causes unnecessary light pollution. The main aim of the project is to provide an "IoT based Automatic Street Lightning System" powered with solar energy during night time. We use the word "smart" because the system not only to provide power to the street lights but also to helps in detecting the direction of movement of the pedestrian and helps him by means of illuminating the path of movement till the near next street light. By integrating the entire street lights with Smart Street light system, it is possible to systematically help the pedestrian to reach the destination in the remote rural areas which are facing serious electric power supply problem. The same system can also be used in metropolitan cities as well. A simple and effective solution to this would be dimming the lights during off peak hours. Whenever presence is detected, the lights around it will glow at the normal (bright) mode. This would save a lot of energy and also reduce cost of operation of the streetlights. We can check the status of street light on internet using IOT (Internet of things) from anywhere in real time and solve the issues if happen during the processing [1].

2. BACKGROUND

S.Suganya et al have proposed about Street Light Glow on detecting vehicle movement using sensor isa system that utilizes the latest technology for sources of light as LED lamps. It is also used to control the switching of street light automatically according to the light intensity to develop flow based dynamic control statistics using infrared detection technology and maintain wireless communication among lamppost and control terminal using ZigBee Wireless protocol. It also

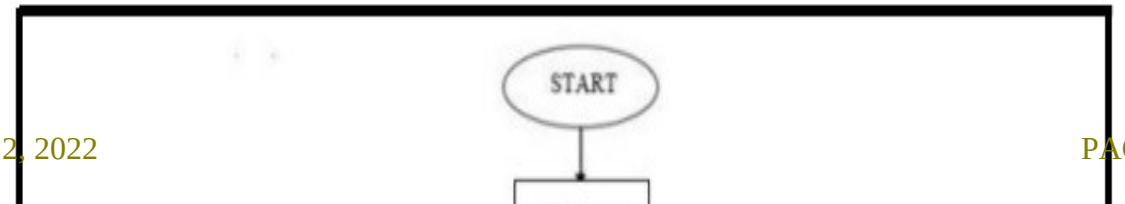
combines various technologies: a timer, a statistics of traffic flow magnitude, photodiodes, LED, power transistors [2]. C.Bhuvaneshwari et al (2013) have analysed the street light with auto tracking system by which one can increase the conversion efficiency of the solar power generation. Here, the sun tracking sensor is the sensing device which senses the position of the sun time to time and gives the output to the amplifier based on light density of the sun. Sun tracking sensor is LDR, amplifier unit is used to amplify the LDR signals which converts low level signals to high level signals and the output is given to comparator. The LM324 IC is used as an amplifier. Comparator compares the signals and gives the command to AT89C51 microcontroller [3]. K.Santha et al (2014) have surveyed on Street Lighting System Based on Vehicle Movements. The system operates in the automatic mode which regulates the streetlight according to brightness and dimness algorithm and light intensity. The control can be made according to the seasonal variation. It includes a time cut-out function and an automatic control pattern for conserving more electricity. The whole project was implemented using a PIC microcontroller [4]. Srikanth M et al (2014) Proposed a ZigBee based Remote Control Automatic Street Light System. The system is designed with the help of ZigBee modules that helps in detecting the faulty lights and control the light. It also discusses about an intelligent system that takes automatic decisions for ON/OFF/DIMMING considering the vehicle movement or pedestrian and also the surrounding environment. PIR motion sensor is used to detect movement of both living and non-living things [5]. M.Abhishek et al (2015) have implemented design of traffic flow based street light control system with effective utilization of solar energy in the year 2015. They used the renewable source of energy i.e. the solar power for street lighting. They have also used 8052 series microcontroller and is developed by replacing the normal bulbs with the LEDs due to which the power consumption is reduced by 3 times. Sensors are placed on either side of the road which senses the vehicle movement and sends the commands to the microcontroller to switch ON and OFF the lights. Here all the street lights remain switched off and it glows only when it senses the vehicle movement. Hence, because of the microcontroller, even when its night the lights are switched off [6].

3. PROPOSED SYSTEM

In our proposed system, we use the property of LDR, in which its resistance varies with respective to the intensity of light [7] , in our proposed system the night and day is identified using LDR, during the day time the street light will be switched off and during the night time street light will be switched on automatically, IR sensor is used to detect the presence of vehicle and pedestrian on the Road, and the intensity of the LED light will be based on the darkness of surroundings [7]. If there is no movement on the road light will be switched off and if any movement is detected by IR sensor , then light will automatically switch on. Also we will adjust the brightness level of light. Adjusting the brightness level of lights provides a solution for problem of uneven power consumption. This is required in order to provide right amount of power such to avoid overproduction or shortages & the wastage of power can be minimized.

This proposed system basically includes four working modes:-

- **OFF mode:** When there is enough natural light in the surrounding i.e. during the daytime, the entire system will be switched off.
- **Active mode:** When the natural light drops below a certain level then the system automatically turns on and the motion sensors will be powered.
- **ON mode:** On the presence of pedestrians and vehicles, the sensors turn on which in turn switches on the LED lights. These lights turn off after a period of time.
- **Brightness Level Control:** The brightness level of the LED light will be adjustable based on the intensity of darkness on the road.



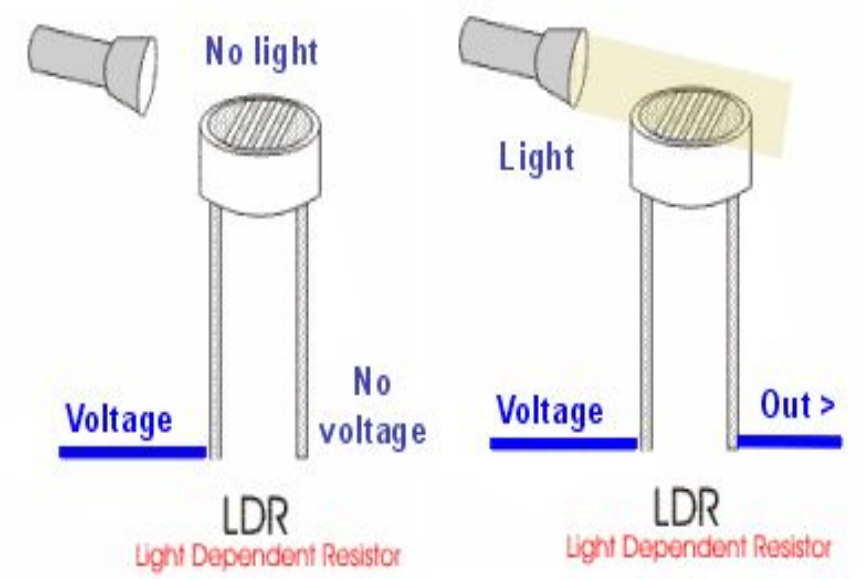


Figure 2. Working Principle of street light

The following tools are used for above proposed system:

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

2. **Wi-Fi module :**The Arduino Uno Wi-Fi is an Arduino Uno with an integrated Wi-Fi module. The board is based on the ATmega328P with an ESP8266WiFi Module integrated. The ESP8266WiFi Module is a self-contained SoC with integrated TCP/IP protocol stack that can give access to your Wi-Fi network.

3. **LIGHT EMITTING DIODE (LED):** A Light Emitting Diode is a light source that releases light when current drifts through it. It recombines an electron in semiconductor with electron holes, liberating power in the mode of photons.

4. **LDR:**An LDR (Light Dependent Resistor) is also called a photo resistor. These devices are light dependent. The resistance will be decreases, when the light drops on the LDR, now the resistance level is low. If LDR is placed in the dark region, then the resistance increases here its resistance level is high.

5. **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 heat of an object and detecting motion. Infrared waves are not visible to the human eye.

6. **RESISTORS:** A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor. All other factors being equal, in a direct-current (DC) circuit, the current through a resistor is inversely proportional to its resistance and directly proportional to the voltage across it. This is the well-known Ohm's Law [8].

4. BENEFITS OF PROPOSED SYSTEM

- Automatic Switching of Street lights.
- Maintenance Cost Reduction.
- Reduction in CO_2 emission.
- Reduction of light pollution.
- Energy Saving.
- Reduction of manpower.

5. SIGNIFICANT RESULT

The proposed system aims to reduce the side effects of the current street lighting system, and find a solution to save power. In this system street light will be automatically switched off during day time and light will be switched on night time. During night time light will be switched on when on night time. During night time light will be switched on when there is any pedestrian passing by there or any vehicle basically when there is any motion detected by IR sensor and the brightness of LED light will be based on the darkness of surrounding.

6. CONCLUSION & FUTURE SCOPE

IoT Based Automatic Smart Intelligent Lighting System is a cost effective, practical, eco-friendly and the safest way to save energy. The system can now be operated remotely from any location instead of being present in the location of the switch and operate it manually. With the help of this system the light status information can be accessed from anytime and anywhere. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently. The Energy crises occur in the cities may be reduced because 50 to 60 percent of electricity is saved and these energies were used in other important purposes. The proposed system 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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