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SMART ADAPTIVE ILLUMINATION CONTROL FOR STREET LIGHTS

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Abstract

The main aim of Smart Street light is to reduce the power consumption when there are no movement on the road. The purpose of this project “SMART ADAPTIVE ILLUMINATION FOR STREET LIGHTS” is to minimize the cost & loss of electricity and also reduce the man power to manually on-off the street light. The solar street lights comprise of, which absorb the solar energy during daytime. The photovoltaic cells convert solar energy into electrical energy, which is stored in the battery. The piezoelectric plate are used to produce energy from the pressure and vibration given upon it. LED comprises of the chemical compound when direct current is passes from the battery through it produce light energy. These solar street lights are able to automatically sense outdoor light with the help of a sensor. This way smartly they can save power & give light on successive nights even when sunlight is unavailable for a couple of days. This is the reason many users nowadays are switching over to solar street lights. The Smart street light will glow with high intensity when there is motion is detected on the road otherwise the lights will remain dim. With advancement of technology, things are becoming simpler and easier for everyone in the world today. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. Automatic systems are being preferred over manual system. The research work shows automatic control of streetlights as a result of which power is saved to an extent. The Smart street light provides a solution for energy saving which is achieved by sensing an approaching human movement using the PIR sensors and then switching ON a block of street lights ahead of the motion with high intensity . As the person passes by, the trailing lights turn

dim automatically. Thus, we save a lot of energy. So when there are no movements on the road, then all the lights will remain dim.

Keywords: Energy Saving, Smart Devices, PIR Sensor, Illumination Control.

1. Introduction

1.1 PREAMBLE

Automation plays an increasingly very important role in the world economy and in daily life. Automatic systems are being preferred over any kind of manual system. We can also call it an “SMART ADAPTIVE ILLUMINATION FOR STREET LIGHTS”. Intelligent light sensing refers to public street lighting that adapts to movement by pedestrians, cyclists and cars. Intelligent street lighting, also referred to as adaptive street lighting, dims when no activity is detected, but brightens when movement is detected. This type of lighting is different from traditional, stationary and illumination, or dimmable street lighting that dims at pre-determined times. The research work shows automatic control of streetlights as a result of which power is saved to some extent.

In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist the users with muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Basically, street lighting is one of the important parts. Therefore, the street lamps are relatively simple but with the development of urbanization, the number of streets increases rapidly with high traffic density. There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and road users, provide public lighting at cost effective, the reduction of crime and minimizing its effect on the environment.

At the beginning, street lamps were controlled by manual control where a control switch is set in each of the street lamps which is called the first generation of the original street light. After that, another method that has been used was optical control method done using high pressure sodium lamp in their system. Nowadays, it is seen that the method is widely used in the country. The method operates by set up an optical control circuit, change the resistance by using of light sensitive device to control street lamps light up automatically at 9 dusk and turn off automatically after dawn in the morning. Due to the technological development nowadays,

road lighting can be categorized according to the installation area and performance, for an example, lighting for traffic routes, lighting for subsidiary roads and lighting for urban center and public amenity areas.

The WSN helps in improving the network sensing for street lighting. Meanwhile, street light system can be classified according to the type of lamps used such as incandescent light, mercury vapor light, metal halide light, high pressure sodium light, low pressure sodium light, fluorescent light, compact fluorescent light, induction light and LED light. Different type of light technology used in lighting design with their luminous efficiency, lamp service life and their considerations. The LED is considered a promising solution to modern street lighting system due to its behavior and advantages. Apart from that, the advantages of LED are likely to replace the traditional street lamps such as the incandescent lamp, fluorescent lamp and high-pressure Sodium Lamp in future but LED technology is an extremely difficult process that requires a combination of advanced production lines, top quality materials and high precision manufacturing process.

Therefore, the research work highlights the energy efficient system of the street lights system using LED lamps with PIR sensor interface for controlling and managing.

2. Problem Statement

Human operators with machinery to assist the users with muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Basically, street lighting is one of the important parts. Therefore, the street lamps are relatively simple but with the development of urbanization, the number of streets increases rapidly with high traffic density.

There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and road users, provide public lighting at cost effective, the reduction of crime and minimizing its effect on the environment. At the beginning, street lamps were controlled by manual control where a control switch is set in each of the street lamps which is called the first generation of the original street light.

2.1 Proposed Methodology

The Passive Infrared sensor is used to detect the motion when there is any activity created by pedestrians, cyclists and cars. The Led lights gets brightens if there is no movement across the sensor Led dims automatically. This procedure is followed by every sensor present in the system. This system is known as adaptive street lighting.

2.2 Block Diagram

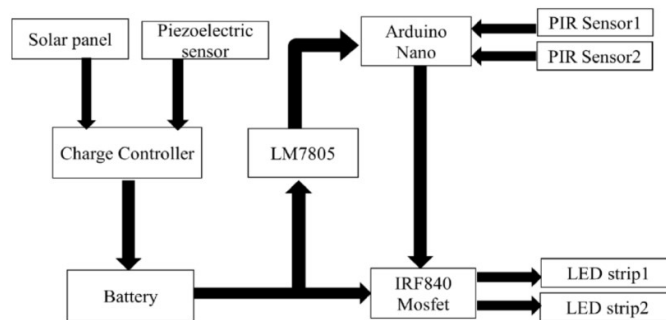


Figure. 1. Functional Block diagram

The above block diagram represents the SMART ADAPTIVE ILLUMINATION CONTROL FOR STREET LIGHTS using PIR (i.e, motion sensor).

3. Expiremental Setup Or Hardware Prototype



Figure.2. Hardware Setup or Prototype

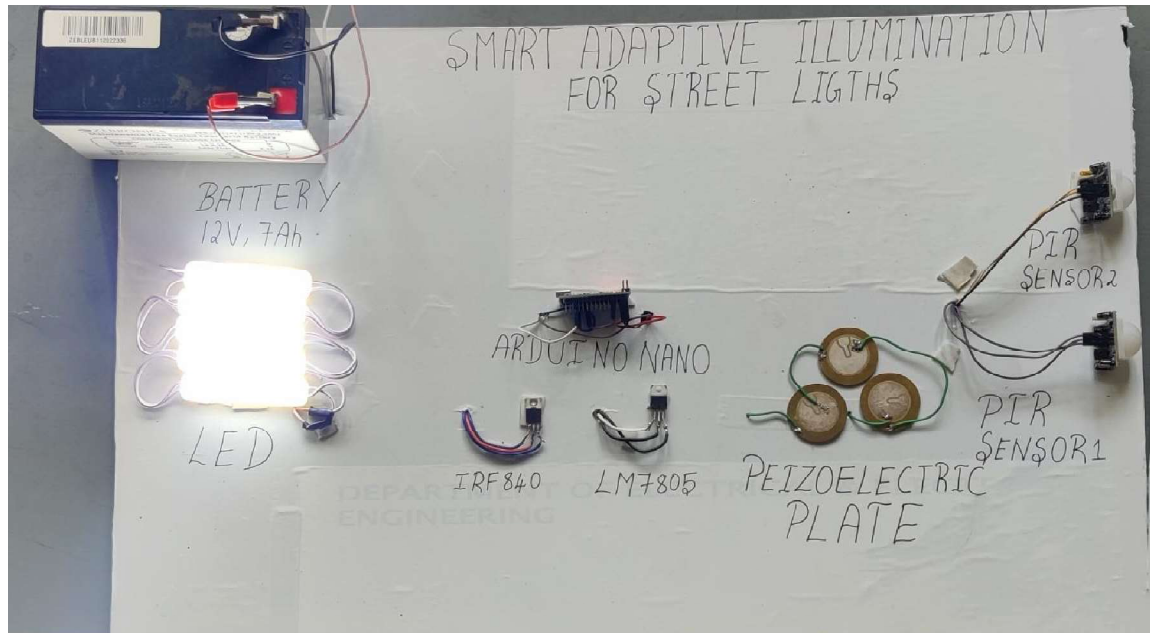


Figure.3. Light Glows With Full Brightness

The solar street lights comprise of, which absorb the solar energy during daytime. The photovoltaic cells convert solar energy into electrical energy, which will given to the solar charge controller manages the power going into the lead Acid battery 12V 7Ah and also it prevent from the overcharging and runback to solar panel 40Watts. Additionally, the piezoelectric sensors produce the voltage when there is a pressure and vibration upon it. The power supply from the battery given to LM7805 voltage regulator, which reduce the voltage from 12V to 5V for the Arduino Nano which requires 3.3V to 5V. The Arduino Nano is programmed for the required operation of dim and bright light system using the Passive Infrared Sensor. The Sensor is connected to the Arduino Nano, when sensor pedestrians, cyclists and cars , gives signal to the microcontroller and it goes through the conditions in the program and it provide signal to the IRF840 mosfet from the pulse width modulation pins. With the help of this N-channel mosfet can work upto 500v load. The Mosfet supply power to Led strips from the command received from the micro controller. If there is no movement across the Passive Infrared Sensor the Led strips goes to dim illumination after some delay.

4. Conclusion and Future Scope

We have implemented Smart Adaptive Illumination For Street Lights using Motion Sensor of parameters using ARDUINO NANO, whenever the motion sensor detects the motion or movement the illumination of the light will be increased otherwise the illumination of light will be low. Also we added automatic ON and OFF control of light on the time basis for example 6.00 PM to 6.00 AM.

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This will reduce the power consumption and saves electric energy. We installed solar panel for the supply and battery of store the power from the solar panel. Additionally, the piezoelectric plates are implemented to produce the energy from the pressure and vibration from the movement of the vehicle. We also try to use the piezoelectric energy producing plate as a sensor to detect the vehicles for the betterment of this system. The extended version of this project will be the fault diagnosis and sun tracking system to make the system efficient.

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