SMART AND ADAPTIVE STREET LIGHTING SYSTEM USING IoT

Dr. A. Radhika*, R. Keerthana**, B. Magila***, R. Vaishnavi****

*1Professor, Department of Electrical and Electronics Engineering, Velammal College of Engineering and Technology, Madurai - 625009, Tamil Nadu.  
**2,3,4UG Students, Department of Electrical and Electronics Engineering, Velammal College of Engineering and Technology, Madurai - 625009, Tamil Nadu.

ABSTRACT

Nowadays, the technology has grown at a high speed. This project proposes the design of an IoT based street light automation system using Wi-Fi. It is a Wi-Fi based system and uses wireless technology (Wi-Fi). The system has three main components: An Arduino, a Wi-Fi adapter for signal transfer and a smartphone for controlling web page servers. The design is based on a standalone Arduino Wi-Fi board and the components are connected to these boards using a relay, the smartphone interacts with the Arduino through Wi-Fi. The motive of the IoT based street light automation system is controlling the street light from the place with the help of Wi-Fi modules.

Keywords: IoT, Street Light, Wi-Fi, Arduino

I. INTRODUCTION

Smart street light controls take the priority in the transportation aspect. Nowadays the smart and adaptive street lighting system is developed with automatic switching of street lights with reduction of manpower. The proposed work has a scope of developing a smart street light automation system using IoT by integrating sensors and actuators through Wi-Fi to control and monitor from a central location and also from remote locations. LDRs (Light Dependent Resistors) which enables the intensity variation of the street lights.

II. METHODOLOGY

Proposed System

The proposed work explains the IoT based street light automation system using Wi-Fi. In this system the Wi-Fi module is connected with the arduino based IoT system. It is a Wi-Fi based system and uses wireless technology. The system has three major components namely an Arduino, a Wi-Fi adapter for transferring the signals and smartphone for controlling the web page server. The design is based on a standalone Arduino Wi-Fi board and the components are connected to this board using a relay, the smartphone interacts with the Arduino through Wi-Fi. This is constructed and the work is achieved by using a smartphone application. The proposed system is developed for automatic switching of street lights using wireless communication with reduction of manpower.

Analysis

The system verifies the capability of the smart street lighting automation system based on IoT technology, which gives the reference for the promotion and application. It is constructed to provide intelligent, diversified, efficient and economical resources for the smart cities. The system can optimize the energy consumption by the street lights. It operated the street lights in a smart and capable way to increase its efficiency.

III. MODELLING AND ANALYSIS

Block Diagram
Description Of Block Diagram

The ESP8266 is Wi-Fi enabled system on chip module developed by express if system. It is a Wi-Fi adapter which gives wireless internet connection to the microcontroller. Here we use PIC16F877 microcontroller. It is an 8 bit controller made by microchip technology, used in a wide variety of embedded systems. The driver circuit is generally used to regulate current flowing through a circuit and it usually drives higher current devices. The driver circuit is connected with the relay. A relay is also a switch which can turn ON or OFF any external circuit.

Hardware

1. Driver Circuit:

A transistor circuit usually used to regulate current flowing through a circuit. It is used as a current amplifying device and so the input of the device is usually from a low current source such as a logic gate or a sensor. It drives higher current devices such as bulbs and motors.

2. Relay:

Relays are switching devices which can turn ON or OFF any external circuit. It is an electrically operated switch and consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. They are used to reduce the current that flows through the circuit. It works on the principle of electromagnetic induction. It is also used as a protective device.

3. ESP8266:

The ESP8266 is a low-cost microchip and it is a 32-bit microcontroller. This small module allows microcontroller to connect to a Wi-Fi network. On the GISMO board, the ESP-01 Wi-Fi module is used to get connected to a Wi-Fi network for internet access. The ESP-01 is based on the ESP8266 chip. The hardware interaction between the microcontroller and the ESP-01 is a serial interface.
4. Microcontroller:

The PIC16F877 microcontroller is an 8-bit microcontroller made by microchip technology and it is used in a wide variety of embedded systems. The performance of PIC16F877 microcontroller is very fast because of using RISC architecture. Power conception is also very less when compared to other microcontrollers. It also have much application in digital electronics circuits.

![PIC16F877 Microcontroller](image1)

**Figure 4**: PIC16F877 Microcontroller

5. LCD Display:

Liquid crystal displays (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.

![LCD Display](image2)

**Figure 5**: LCD Display

**Hardware Model:**

The proposed system represents the stand alone Wi-Fi board and the components are connected to this board using relays and smartphone interacts with the Arduino through Wi-Fi. This can be attained by using a smartphone application by which we can turn ON or OFF the street lights from the place. It operates both in AC and DC sources. The PIC16F877 microcontroller is used to control the process. Each street light pole is installed with the LDR sensor, Wi-Fi module and the lamp or light. Whenever a signal is received the bulb turns ON or OFF. The overall process of the system is maintained by the smartphone application through a Wi-Fi connection from the place.

![Hardware Model](image3)
IV. RESULT AND DISCUSSION

OFF STATE:

When the Wi-Fi module connected to the smartphone application is in OFF condition, the LCD display will show that the lights are in OFF condition and the light does not glow.

ON STATE:

When the Wi-Fi module connected to the smartphone application is in ON state, the LCD display will show that the lights are in ON condition and the lamp will glow.

V. CONCLUSION

The proposed system is energy saving and highly efficient. Already established street light controlling system use conventional, line communication, Bluetooth etc. A cost effective technique was to utilize ESP8266 Wi-Fi modules to create a network and get connected to a LAN or router to reach the concept of IoT. The challenge of a street light system is long range communication. Range extension from Wi-Fi modules has been attained in the proposed system. The future scope of this system expands into speed detection and customizable areas of illumination and so the power consumption is drastically reduced.

VI. REFERENCE


Shicao, chen & Xiong, Gang & Xu, Jia & Han, Shuangshuang & Wang, Fei-Yue & Wang, Kun (2018). The Smart Street Lighting System Based on NB-IoT. 1196-1200.10.1109/CAC.2018.8623281

M. Durugan and L.Gokrem, "Cloud-Based Adjustable and Section LED Pattern Controlled Street Light", 2019 3rd International Conference on Advanced Information and Communication Technology (AICT), Lviv, Ukraine, 2019, pp.308-310.
