Smart City Street Light System using Internet of Things

R. Nandha Gopal[#1], R.Sankar[*2]

[1]*Scholar, Master of Computer Application, S.A Engineering College, Chennai-77*
RVN.nandha@gmail.com
[2]*Asst. Prof., Department of Computer Applications, S.A. Engineering College, Chennai-77*

Abstract — Internet of things is a developing technology that makes use of internet to control and monitor electronic, mechanical and other physical devices connected to internet. In today's world, IoT is used in various fields. Globally, 7.5 billion peoples are using 12.5 billion internet devices. Smart city is a developed urban area that excels in economy, people and life which is very important for the development of our nation. The need for public sector is increasing day by day to explore IoT technologies to improve traffic flow, reduce pollution and energy consumption. Android mobile phones are used in this paper for street light control. The main objective of street light system is that lights turn on when it is required and light turn off when not required by an authorized user with the help of Wi-Fi module through which we can get access to the street light system from the remote location.

Keywords — *Internet of Things; Smart Cities; Street Light System; Android Mobile Phone; Wi-Fi; Arduino Board.*

1. Introduction

The Internet of Things (IoT) is a concept in which nearby objects are connected throughout wired and wireless networks. In IoT, the objects communicate and exchange information which provides advanced intelligent services for users. The term IoT was initially introduced by Kevin Ashton- the director of the Auto-ID Centre of MIT in 1999. [1]. The IoT will be faster in the development of many applications. Numerous governments turned to adopt ICT solution in the management of public affairs to understand the concept of smart city[2]. The aim of smart city is to make a better use of the public administrator. This goal can be accomplished by the deployment of an urban IoT. Street light system plays a very important role in development of cities. So, here we particularly focus on the street light system for the development of the smart city with the help of Internet of Things. In the year 2020, the number of Internet connected devices will be increased from 26 billion to 50 billion. In India, central government offers financial support of INR 48,000 cores in 5 years and plans to setup 100 smart cities throughout the nation. [3].

2. Existing System

In the existing street light system, the street light operator has to control the functioning of switch board for each light; it is done manually by switch ON/OFF button of street light [4]. In some of the cities, the street light control is normally done using general switch which is activated manually on a time based system or through automatically based on the timer settings (i.e. the street light is switched on at the evening time before the sunset and it is switched off in the next day morning after there is enough light outside) [5][6]. Hence, the flexibility of the existing street light system is very limited and there is no much security as well.

2.1.Disadvantages of Street Light System

- Manual switching ON/OFF of street lights are not practical.
- It consumes more energy.
- More manpower is needed here.

3. Proposed System

In the proposed system, the street light operator can control the street light with the help of an android phones using Wi-Fi connection and Arduino board. Here, the Arduino board is connected to the relay through which an operator can control the street light function from the remote area.

3.1 Advantages of Proposed Street Light

- Here the street lights can be automatically ON/OFF when required. It does not need the help of manual operation.
- It is helpful to reduce the energy consumption.
- The need for manpower is reduced here.
- With the usage of Wi-Fi, our proposed system provides the benefit of wireless communication.

4. Methodology

In our street light system, an operator can operate the system from the remote location with the help of android phone, Wi-Fi module, Arduino board and relay. All Wi-Fi modules have a separate Internet Protocol (IP) address which gives more security to the system, and therefore only authorized user will be allowed to control the street light system. This help to make our street light system more secured. By connecting our android mobile with the Wi-Fi

module, a user can get access to the android app design for this street light system [7]. Here, we are using the Wi-Fi module to establish a connection between android phone and arduino board. The Wi-Fi module will pass the request to the arduino board and it will be activated. It passes the signal to the relay and relay will be activated. As a result light will ON/OFF as seen in figure 1.
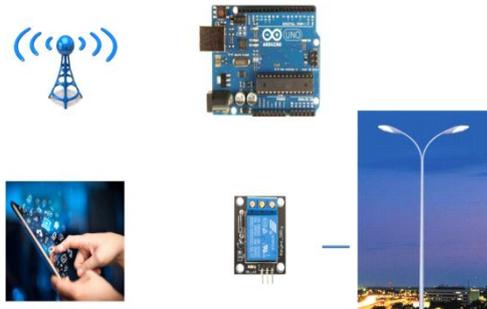

Fig.1: Smart Street Light System Architecture

5. Implementation

5.1 Android

Fig.2: Android Mobile

Android is a well known mobile operating system developed recently by Google based on Linux kernel. It primarily developed with the new feature of touch screen system [8]. For example smart phones, smart watches and tablets. Android is a user friendly system.

5.2 Wi-Fi

Fig.2: Wi-Fi

Wi-Fi allows the users of computers, smart-phones, or other devices to connect to the Internet and communicate with one another via wireless connection within a particular locality.

5.3 Arduino

Fig.3: Arduino

Arduino is an open source platform used to build electronics projects. It consists of both physical programmable circuit board and small part of a software or IDE that run on our computer used to write and transfer computer code to the physical board. Arduino board can interact with buttons, Light Emitting Diodes (LEDs), motors, Global Positioning System (GPS) units, cameras, internet, and even with smart phones [9].
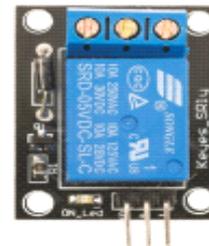
5.4 Relay

Fig.4: Relay

Relay is an electromagnetic device which is used to insulate two circuits electrically and connect them magnetically. They are convenient devices and allow one circuit to switch another one. A relay switch can be separated into two parts: input and output [10]. The input section has a coil which produce magnetic field, when a minuscule voltage from an electronic circuit is applied to it. This voltage is known as the operating voltage. Commonly used relays are available in distinct configuration of running voltages like 6V, 9V, 12V, 24V and many more. The output section consists of connectors which connect or disconnect mechanically [11].

6. Conclusion

IoT plays a major role in bringing up our nation a smart city. With the help of IoT our existing street light system becomes a smart street light system which benefits in automatic ON/OFF of street lights from the remote location. This reduces the man power, energy consumption and save people from light pollution and provides wireless communication with the effective use of arduino, WI-Fi, relay and android phone. The street light will be controlled

by the operator from the remote location. The initial cost for setting up this smart street light system is high but this is for the long term usage and the drawback will not be a big issue.

7. Future Enhancement

The IoT is here to change our world. The access of internet in this real time is very large. Every corner of the city is covered by IoT. IoT is interconnecting people in many ways. Humans are constantly evolving new technology; IoT will have a large impact in our day to day life. In this technology we can also use Raspberry PI which works like an arduino board for more ease of use. The Future of IoT is undoubtedly bright.

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