



# STREET LIGHT CONTROL AND AIR QUALITY MONITORING SYSTEM

1Udhaya M, 2Susmitha K, 3Padmavathi V

1Scholar

1Anna University

## ABSTRACT

The proposed work is designed and executed the IoT systems for energy saving of street lights and Air quality monitoring. The present system is like, the street 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 roads, this paper gives the best solution for electrical power wastage. Also, the manual operation of the lighting system is completely eliminated. In this paper the two sensors are used which are Light Dependent Resistor LDR sensor to indicate a day/night time and the photoelectric sensors to detect the movement on the street. This movement helps the vehicle to alert in advance through indication, before it reaches near the crossing. Here Air Quality is been also monitored. This proposed model will monitor the air quality and display the real-time level of the air. The air ppm values will be divided into certain parameters threshold levels through which system can decide the quality of air. Above model also include live dashboard where user can view the status of air online in cloud. The live data is been generated and communicated with Arduino.io cloud to store the data for further analysis. This model will help in maintaining the air quality around street. Additionally, it also checks for fault among the street lights where it's shown in the dashboard. The Microcontroller is used as brain to control the street light system, where the programming language used for developing the software to the microcontroller is C-language. Finally, the system is using MQTT protocol for the communication purpose which ensures the data reliability and instant actuations between controller and cloud.

**Keywords:** Iot(Internet of Things), LDR, Arduino.io

## Introduction:

IoT is the network of physical devices that allows the devices to communicate with each other. IoT allows remote sensing and control over the devices. It is an advanced automation and analytics system which uses artificial intelligence technology to deliver advanced and automated products and services. These systems allow greater transparency, control, and good performance [1,2]. IoT has several automation applications like smart home, smart parking, smart roads, smart lighting etc. The current manual streetlight system has several problems like maintenance issues, timing problem, and connectivity issues. These problems can be resolved by IoT technology [5]. The system is based on smart and weather adaptive automatic street lighting and management [6].

Automation simplifies various problems in the world economy as well as in daily life [8]. It uses the latest technology in LED as the light source to restore conventional street lamps such as HID lamps or High-Pressure Sodium Lamps etc...The LED lights are adopted because of its various advantages over existing technologies like power saving due to increased current luminous efficiency, reduced maintenance cost, high color rendering index, accelerated start-up, and durability [10]. Nowadays flexibility of streetlight system is being highly challenged. Majority of the control runs in a manual setup whereas some are automated based on their surrounding parameters. Handling remote area location is the greatest dilemma. Manual mistakes can lead to energy wastage and lower the performance of the system [1]. The aim of this paper is to automate the streetlights to increase the productivity and accuracy of the system in a cost-effective manner and also permits wireless accessibility and control over the system [3].

The main motive of the system is the energy conservation because the resources like hydro, thermal, coal that we rely upon are not easily replenished, so introducing power saving elements like LDR Relays and LEDs can light up a large area with high-intensity light whenever needed [4]. The relay is used as an automatic switch and reduces almost 100 percent of the manual work [11]. The main issue of existing electric system is the connectivity problem as most of the connections handled by different contractors are done manually. Timer settings are performed manually. Timer often requires twelve hours continuous power supply and the further timer settings may be disrupted in the absence of continuous power supply [5]. It supports client-server mechanism where a single user can control the overall system [1]. It reduces heat and carbon dioxide emissions [2]. IOT based street light automation is a cost-effective and eco-friendly method which also eliminate the problems in disposal of incandescent lamps and power saving [9]. The view of the proposed system is been shown in the below figure 1.1. The smart street light controller must be installed on the light pole which consist of microcontroller along with various sensor and wireless module. The smart street light controller installed on the street light pole will control LED street lighting depending on movements of the object in the street. The captured data cane transferred to base station where the energy gets stored using wireless technology to monitor the smart system. The smart system can be operated either manually or automatically. The control system will switch ON and OFF the street lights at needed timings and can also vary the intensity of the street light according to the necessity. As there is another major issue in streets that is air pollution through vehicles. The motor vehicle engine emits many types of pollutants including nitrogen oxides (NOx), volatile organic compounds (VOCs), carbon monoxide (CO),

carbon dioxide (CO<sub>2</sub>), particulates, Sulphur dioxide (SO<sub>2</sub>) and lead. Emissions are related to use of the engine, mainly the fuel type and the temperature of combustion. If the engine is 100% efficient, then the products of combustion will be CO<sub>2</sub> and water (H<sub>2</sub>O). However, at low loads engines are inefficient and therefore the products of incomplete combustion dominate, for example CO and VOCs in petrol engines and carbon monoxide, VOCs and smoke in diesels. Air Pollution Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there are number of harmful gases present in the air like CO<sub>2</sub>, smoke, alcohol, benzene. The system will show the air quality in PPM on the dashboard so that it can be monitored very easily. In this IOT project, it can monitor the pollution level from anywhere using computer. This system can be installed anywhere and can also trigger some device when pollution goes beyond some level, like we can send alert in cloud.



Figure 1.1 Prototype view of the proposed model

#### AIM AND OBJECTIVES:

- To develop an IoT based Safety light control and air quality monitoring.
- To develop a model for identifying the presence human movements and light and to alert the driver in advance to slowdown.
- To develop a system that can be monitored online in the Blynk app where the status can be live with fault identification status.

## 1.2 PROBLEM STATEMENT

In the recent years, many efforts have been taken to automate the existing streetlight system. For any intelligent streetlight system, it should operate in a systematic way to maximize the quality and productivity. So, by implementing a more reliable system can cut off a major street lighting expenses and reduce human effort as well. But many methods are still operating with traditional light sources, therefore, it may reduce the human effort but the energy wastage and light pollution still exist. In most of the cities, the street lights are ON when it is not need and It is OFF when is not needed. Because of these situation the huge energy expenses for a city gets wasted. Usually, the lights are ON in the evening after the sunset, it continuous to be ON till the sun rises in the next day morning. Due to the increase of Air pollution it has to also monitored on the regular basis. The fault can occur at any time on the street lights, which has to be monitored on the instant and real-time basis.

## 1.3 EXISTING SYSTEM

The existing system the street light systems are automatically ON and OFF according to the situation. This smart light system automatically detects the movements of the object on the street. In the traditional system IR sensor is used to detect the object. The microcontroller is used to control the process involve the net. This paper is focused on the controlling intensity of the light considering the object movement near the light. Two different sensors named light sensor and photo electric sensor are used. Once if the sun light goes under the visible region then this system automatically switches ON light. As soon as the sun light is visible then automatically switches OFF lights. This Smart light system is used to reduce energy consumption. In this smart system the system uses some of the sensors. This smart system is used to avoid unnecessary usage of electricity. The entire smart system is designed to operate using artificial energy source. The PIR sensor and LDR sensors are used to sense the human being and light intensity of a particular area and transmits the data in wireless to the EB section. This smart system is best suited for street lighting in remote urban and rural areas where the traffic is very low.

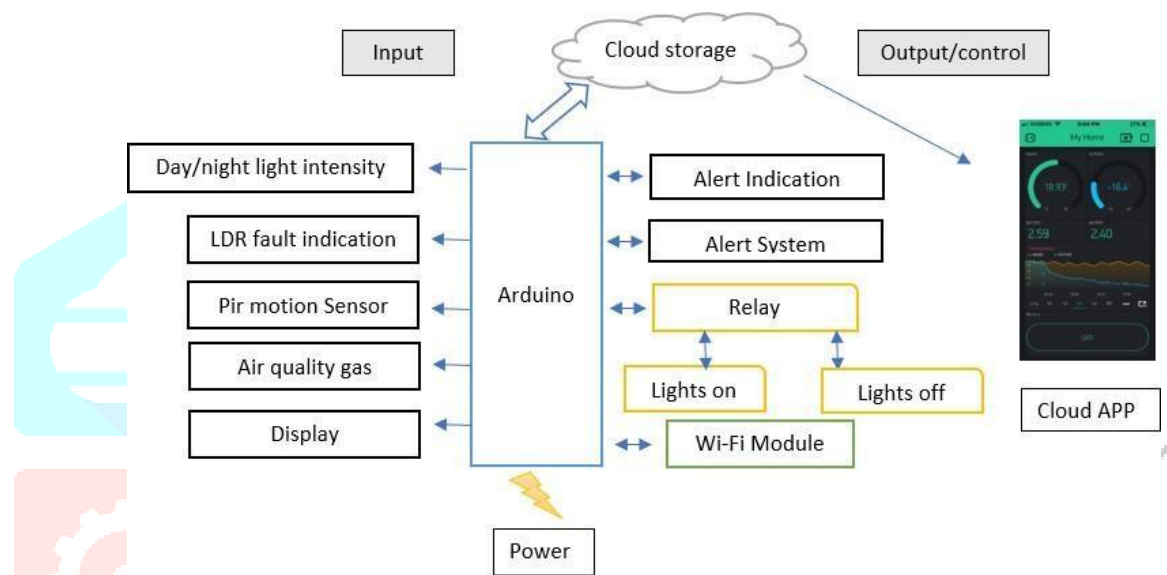
## 1.4 PROPOSED SYSTEM

The street light controller should be installed on the pole lights which consist of microcontroller along with various sensor and wireless module. The street light controller installed on the street light pole will control LED street lighting depending on traffic flow, communicate data between each street light. The data from the street light controller can be transferred to base station using wireless technology to monitor the system. The mode of operation of the system can be conducted using auto mode and manual mode. The control system will switch on-off the lights at required timings and can also vary the intensity of the street light according to requirement. Here we propose a system to detect day or night at any particular area in the street which will allow to monitor and check live light switches on as well as automatic alert with actuation. Controls will be handled through IoT Wi-Fi MQTT protocols with an alert system. System will detect the presence of light also and surrounding working environment for appliance to find the fault with switching on the light when necessary. Air quality is

been also monitored and displayed in the dash board. It will also be monitored through cloud online. Active status will be alerted through mobile application named Blynk app. Through this app notification is been sent to the user on the instant basis.

#### 4.1 PROPOSED ARCHITECTURE

In this chapter, an IoT based street control system that identifies the presence of day, night to switch on the light. It also works by monitoring light fault occurring on the regular basis. Movements is been also monitored to check the walkers to cross the road and avoid accidents. Air quality is been also monitored and shown in the dashboard.



**Figure 4.1 Proposed Architecture**

Figure 4.1 shows the safety system which is used to identify all faults actuation using Arduino of IoT. The proposed system consists of sensing of parameters, storage of data in cloud, display in dashboard with executing actuation control among the electrical appliances to avoid any sort of accidents or power switching

The proposed system is divided into four modules namely

1. Sensing of parameters (intensity, gas, light, motion)
2. Display of data in Mobile application
3. Execution of the remedy actuation after sensing
4. Monitor and control in the Blynk Application

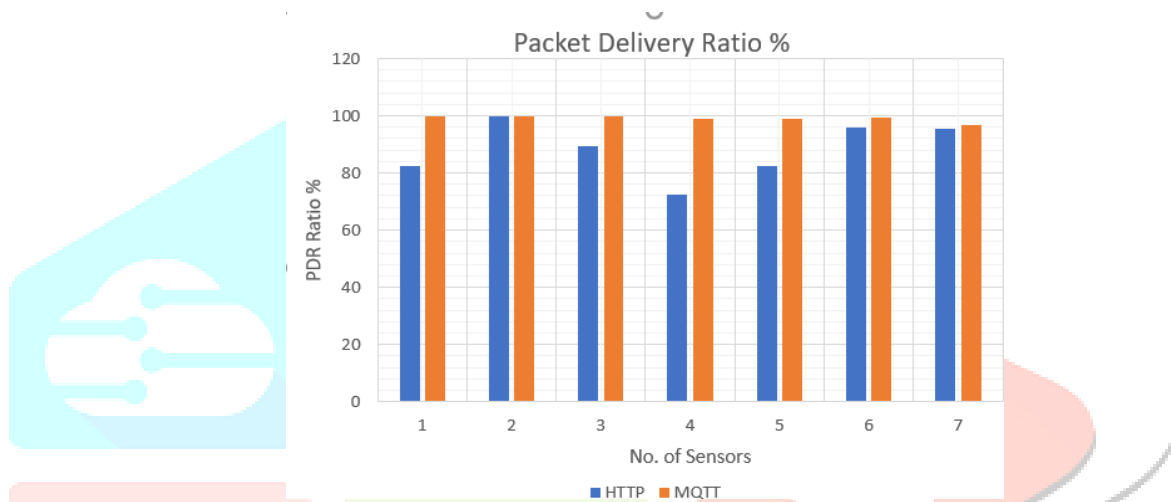


Fig Packet delivery ratio comparison b/w HTTP and MQTT **CONCLUSION**

In this project system makes use of motion sensing along with light and air quality sensing to detect movements, Air ppm level as well as low lighting to avoid any accidents and prevent losses. The sensor data is constantly scanned to record values and check for fault or low light and then this data is transmitted online. The Wi- Fi module is used to achieve the internet functionality. In this research work it is proposed to develop a monitoring system to take care of safety level around street roads. This proposed model will monitor and alert the user through instant alert on harsh conditions. This prototype is divided into two parts one for sensing actively and sending it to cloud named Blynk App and the other one to actuate according to the threshold values assigned through cloud values, it would receive the values from cloud. This communication is been done between the Arduino and cloud through MQTT protocol integrated with the prototype. In this system pedestrians and drivers can be safeguarded by any emergency occurrence like accidents between them through signal alert notification to the nearby proposed architecture. In future scope the data stored in the cloud can be analyzed further for controlling the street light in predictive manner.so the predicted data can be used for handling the power usage through this system.

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