Proceedings of the 2nd International conference on Electronics, Communication and Aerospace Technology (ICECA 2018)
IEEE Conference Record # 42487; IEEE Xplore ISBN:978-1-5386-0965-1

IOT Based Smart Electric Pole

Aliya Shaikh
Department of Information Technology Engineering,
Vidyalankar Institute of Technology Mumbai, India
aliya23shaikh@gmail.com

Manasi Thapar
Department of Information Technology Engineering,
Vidyalankar Institute of Technology Mumbai, India,
mansithapar12@gmail.com

Divya Koli
Department of Information Technology Engineering,
Vidyalankar Institute of Technology Mumbai, India,
diyakoli999@gmail.com

Harshali Rambade
Department of Information Technology Engineering
Vidyalankar Institute of Technology
harshali.rambade@vit.edu.in

***Abstract*—The conventional street lighting maintenance and control system still remains ancient in this era of revolution and technological advancement. The evolution of the Internet of Things (IoT) has been a benevolent cornerstone for such revolutionary giants of the web world. Thus we use this highly coveted technology to cater to the maintenance and control processes of street lighting system. The proposed system enables maintenance and control of the street lights and makes it easier to monitor and control its operation. The system will detect faults in the street lights to intimate the control room to take immediate action. This application will have the following features viz. automatic circuit fault detection, pole inclination detection and light sensing. It aims to design a smart electric pole which is free of any human intervention and provides quick maintenance functionality. In the current scenario, the street lights are switched ON at a pre-decided time every evening and is switched OFF the next morning. It also requires regular check-ups for electric pole defect. This project gives a solution for fast repairing and maximizes the ability to control the street lamps remotely and efficiently [2].**

Keywords— automatic circuit fault detection; pole inclination detection; automatic light sensing

I. INTRODUCTION

This project presents an idea of developing an IoT based application to monitor and control streetlights efficiently and improve its maintenance facilities. Now-a-days, street lights are the most important aspect of the city as it leads to most of the accidents due to low light. Lighting creates large amount of load when used in offices and large complexes. The energy saving potential is often ignored. According to a study about 4400MW of power is spent in India on street lightning. Therefore, the street lamps are relatively simple but with the development of urbanization, the number of streets increases rapidly with high traffic density [3]. To detect the faults in the lamps at remote location, the proposed system is very much useful. Based at the aforementioned concerns, innovations in efficient street light control structures is a must. We advise a scalable, holistic and efficient answer that provides lighting only when necessary (consistent with the instant weather conditions) with the goal of lowering the associated cost of the municipalities, supporting the financial restoration. The installation price will be decreased to the minimal with the use of wireless communications and independent performance modes. Most of these enhancements need to be taken into consideration to obtain a sizeable reduction of the energy intake in lights and therefore contribute to the sustainable improvement. It will also make large contributions to the safety and security of the metropolis roads via presenting pole inclination detection where if the pole inclines beyond a fixed threshold value due to any environmental impact or human intervention then it will without delay intimate the concerned officials. Also an over-current situation may cause short circuiting which may lead to fatal accidents. Thus sensors are used to detect the current flow in order to avoid any mishaps.

II. USEFULNESS

The application is extremely useful for serving the purpose of automatic fault detection and generating alert messages which saves as well as optimizes power on a large scale. It can prevent and avoid a number of minor and major accidents which could be fatal as well, due to its powerful sensors that will help to keep the status of the pole updated at the respective control rooms. Also powerful protocols like MQTT are used to establish connections and exchange bulk messages through powerful servers to the user friendly and easily understandable web interface at the admin end. By the use of various sensors, load detection and management, switch mode power supplies, and over current fault protection can be facilitated.

III. RELATED WORK

Previous work has been referred which proposes a lot of challenges related to the street lighting.

In the year 2016, N.Ouerhani, Pazos, Aeberli and Muller [3], have written a paper that provides a working solution for controlling and managing the street lights dynamically which is facilitated by the Internet of Things. An essential contribution is brought at the interoperability level using device connection concept based on model-driven communication agents to accelerate the working of external components to Internet of Things platforms.

In 2017, B. Abinaya, S. Gurupriya, M. Pooja[4], has written a paper that conveys a newly introduced concept which controls the street lights for smart and weather adaptive lighting. It proposed the implementation of smart street light based on use of solar energy where the panels absorbed sunlight during the day when the streetlights remained switched off and automatically illuminated the luminaires during the night. The switching of the street lights can be accessed remotely through the internet.

In 2015, K.Abhishek And K.Srikanth[5], has written a paper that provides an energy efficient solution to control the street lights using LED and ZigBee protocol.

In 2017, J.Arthi, W.Lydiapreethi, B. Gunasundari[6], has written a paper that conveys the elimination of manual operation for controlling the street lights by making it smart using IoT.

In 2016, Ravi Kishore Kodali and Kopulwar Shishir Mahesh[7], has written a paper that proposes a low cost implementation of MQTT using ESP8266. Basically in the outside world scenario the things with sensor capability, sufficient power supply and connectivity to internet makes Internet of things (IoT) possible. For the growing technology, it is the necessary to have a cost effective and low bandwidth protocol like Message Queuing Telemetry Transport (MQTT) Protocol.

In 2016, Peter Horvath, Andras Timar, Andras Poppe[8], has written a paper that suggests the integration of LEDs as a replacement to mercury vapor lamps as light sources revolutionized the paradigm. It facilitates intelligent remote control as well as ability to adapt to the environmental conditions.

IV. AIM AND OBJECTIVE

A. *Aim:*

In the current scenario, the maintenance and fault detection process of streetlights is completely manual. The basic aim of our proposed system is to automate this entire process to save time, energy and resources and also increase the feasibility.

- Overcome the drawbacks of the existing application.
- Alternative to traditional maintenance and control process of streetlights

B. *Objective:*

The following are some more objectives of IoT based smart electric pole:

- The application would be able to detect faults easily and provide required maintenance by generating alert messages to the admin control room.
- Power optimization.
- The application will use cloud services to manage bulk database and providing alerts.
- Also the application will help avoid fatal accidents which can be caused by either tilting of the pole or excess current generation, the sensors will help keep the status of poles updated.
- The use of current sensor facilitates load detection and management, power supply control, and over current fault detection and protection will be intimated.

V. PROBLEM STATEMENT

The street light is one of the most sought after and significant aspect in a city that rules the roads during the dark hours and contributes largely to the safety and well-being of the citizens. The amount spent behind this is often neglected but extremely important, pole is huge due to sodium vapor lamps being utilized as its luminaires that consume high power. The expense spent on the street light can be used for other development of the nation. Currently a manual system is used where the poles are lighted during the dusk and put off when dawn.

In the currently existing system the workers need to manually check for faults in the streetlight or rather be intimated by a worker or a resident of that area for immediate action. This system has a huge drawback as it increases manual effort and the need of manual maintenance [10].

VI. LIMITATIONS OF EXISTING SYSTEM

- It requires manpower to maintain and control the streetlights.
- It is a time consuming process.
- Until and unless there is a complaint or the maintenance personnel goes for a check there is no fault intimation.
- It does not provide the feature of pole inclination detection.
- The staff will not be able to initiate a repair until there is any intimation of fault[11].

VII. PROPOSED SYSTEM

Our proposed system enables maintenance and control of electric poles i.e the streetlights. It will be easier to monitor and control the operation of streetlights. The system will detect faults in the streetlights to intimate the control room to take immediate action.

An overview of the proposed system is stated below:

- The system involves sensing various parameters of the pole in order to take necessary further action.
- The microcontroller Raspberry Pi3 is used in the circuit which will assist in message generation and passing.
- Python programming language will be used to program this.
- A cloud service will be incorporated to store huge database according to specific areas, and will send intimations to the admin.
- The LDR sensor will sense the intensity of light of the pole. The admin will then send for maintenance of the poles.
- The accelerometer sensor will repeat this but will check for threshold value constraint of angle of inclination of pole.
- The current sensor will repeat this process using threshold values for current and power and generate intimations accordingly.
- A web portal at the admin end will be used to receive messages from cloud and will be accessible to the admin and staff.

VIII. SCOPE

This application can help reduce manpower by automating the traditional methods of maintenance and control and also help in detecting any kind of defects with the electric pole. We can extend this project by increasing the no. of poles connected to a circuit. Also, we can integrate solar panels so as to use solar energy in order to light the luminaries in the lamps which will in turn harvest natural resource and save conventional energy.

IX. METHODOLOGY

Methodology implemented for our software development is "Agile"[12]. The system involves sensing various parameters of the pole in order to take necessary further action. The microcontroller Raspberry Pi3 is used in the circuit which consists of an inbuilt WiFi module which will assist in message generation and passing and is based on Raspbian Operating System. Python programming language will be used to program this. A cloud service will be incorporated to store huge database according to specific areas, and will send intimations to the admin.

The LDR sensor will sense the intensity of light of the pole i.e streetlight bulb , if the required threshold value condition is fulfilled , the lamp works fine , else a message will be generated to the control room which admin handles intimating that light intensity condition is not met and that maintenance is required. The admin will then send for maintenance of the poles.

The accelerometer sensor will repeat this but will check for threshold value constraint of angle of inclination of pole. The current sensor will repeat this process using threshold values for current and power and generate intimations accordingly.

A web portal at the admin end will be used to receive messages from cloud and will be accessible to the admin and staff.

Rapid delivery of software: We would be delivering our software i.e the web portal which will allow the user i.e the admin to get notifications about the streetlights and also we will be creating a model with dummy poles having sensors and Raspberry Pi microcontroller and connect it to cloud infrastructure.

The requirements will keep changing as we modify and build the modules of our project due to its agile nature.

The project can adapt to them and deploy a flexible product.

The project development is able to maintain a constant pace making sure that a technically sound environment is maintained for an excellently designed product.

X. BLOCK DIAGRAM

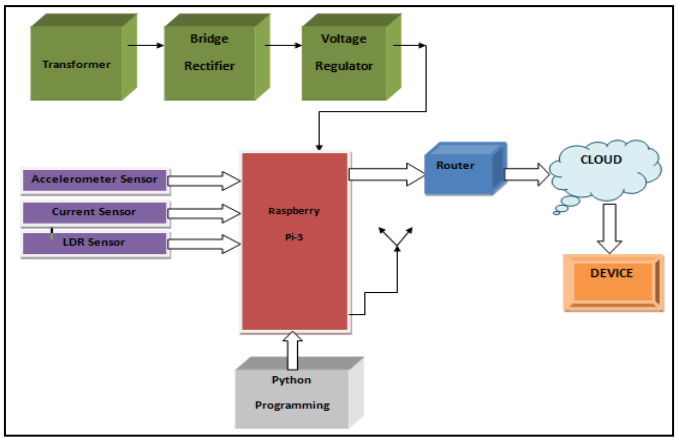

Fig.1 Block Diagram of IoT based Smart Electric Pole

XI. CONCLUSION

The negligence of the streetlights maintenance could have heavily burdened the government to exceeding cost and delay in maintenance. The manual controlling of streetlights can lead to delayed maintenance work.

The proposed project will eliminate this anomaly and improve efficiency and controllability of the city poles that prove to be an essential aspect for the well being and safety of the citizens.

REFERENCES

[1] A. G, Aishwarya N, Anitha J \Intelligent Street Light System, International Journal of Recent Advances in Engineering and Technology, 2015.

[2] Akshay B., M. Siva, V. Parthasarathi, Surya and Shriram K. V. "An Innovation in the Field of Street Lighting System with Cost and Energy Efficiency", Indian Journal of Science and Technology, 2015.

[3] http://redcircuits.com

[4] IoT Based Dynamic Street Light Control for Smart Cities :

http://ieeexplore.ieee.org
[5] Iot Based Smart And Adaptive Lighting In Street Lights : http://ieeexplore.ieee.org/document/7489455/
[6] Design Of Smart Street Lighting System : http://www.ijae.in/pastjan/paper205/
[7] Iot Based Smart Led Street Lighting System : http://ieeexplore.ieee.org/abstract/document/7972267/24
[8] A low cost implementation of MQTT using ESP8266 : http://ieeexplore.ieee.org/document/7917998/
[9] SmartSSL: application of IoT,CPS design platforms in LED based street lighting luminaires : http://ieeexplore.ieee.org
[10] D. Bijo M .T., K. Mehndiratta, Kumar, “Sensor Based Automatic Street Lighting system", International Journal of Education and Science Research Review.
[11] https://www.mapsoindia.com/my-india/government/ : street lighting in india and need for energy efficient solutions.
[12] http://istqbexamcertification.com/ : what is agile model advantages disadvantages and when to use it/