International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

WEAPON DETECTION USING SMART STREET LIGHTS

Kishanth U[1], Koushik S[2], Mohammed Rizwan Z[3], Sriram S R[4]

[1-4]*Department of Electronics and Communication Engineering, Easwari Engineering College, Chennai, India*

Abstract - *Street lights are an important part of the city for comfort and security. Street light improves the road safety, make the travel comfort, and reduces the possibility of any suspicious activity. Street lights also provide safety for drivers and pedestrians. Driving outside of daylight is more dangerous and usually not preferred. However, the energy cost to street lighting in urban areas is high. Various efforts were made to cut costs and enhance maintenance services. This includes integrated lighting control system that enables street lights to be monitored remotely. There occurs increased number of suspicious activity day-by-day life in urban and remote area. The proposed module involves a fully integrated street lighting system that turns the street light on and off instantly, based on the natural intensity of sunlight. This also includes weapon activity monitoring using image sensor. If a weapon is exposed to the image sensor, it will be detected, and notified to the control room with the location and respective camera number. Further, if there is any external damage in the lamps or fault in the electrical supply it will be intimated to the control room to provide necessary action and service for the breakdown. The amount of current supplied to each lamp in the network can also be monitored.*

***Key Words*: Smart street lights, Automation, LoRa, Weapon monitoring, Image processing**

1. INTRODUCTION

Street lights are important mainly for safety or for the feeling of safety. Street lights must satisfy a different variety of national traffic safety regulations based on wider or narrower road lanes. It should provide minimum specified light intensity to allow all road users to see each other, identify the potential unsafe traffic conditions and accident proneness. These also provide optimum levels of brightness to ensure that people are not affected by the artificial lighting.

It is believed to be that about 18-38 percent of the total electricity bill is due to street lighting and this therefore needs considerable attention. Many research activities are being carried out to enhance the efficient use of energy consumption. The universal remedy for this is to get rid of certain loads in order to maintain its stability [1]. Street lighting was one of the earliest applications for electric lighting technologies. Street lighting provides many advantages and helps the various drivers and pedestrians from accidents. Currently, the energy conservation technique for street lighting has increased in many countries due to the high electricity demand [2]. Works in this area cover automatic lighting systems, lighting technologies assisted by artificial intelligence approaches. Smart Street light is said to be an automatic lighting system. The major objective of smart street light is to reduce power consumption when it is not needed [3]. Nowadays, having control over the various sources of energy is challenging and involves huge cost. In both urban and rural areas, enormous amount of energy is being consumed by street lighting [4]-[5]. Efficient management of street lighting can help saving a lot of energy. At the same time, street lighting plays a major role in public safety, crime prevention and protection against violent activity in general.

The main objective of our paper is to design energy efficient smart street light system implemented using ESP8266. This system is proposed to have a highly automated and low energy consuming street light. This framework also provides weapon monitoring. In addition to this, the electrical faults in the streetlights are also detected. The communication mechanism in this framework is carried out using LoRa technology [6].

2. EXISTING SYSTEM

In the existing methodology, the street lights consist of photocells. Photocells are sensors which are light sensitive and respond to the amount of light detected. When the natural intensity of the sunlight is too low, the sensor detects and activates the flow of current.

The sensor deactivates the street light when the photocell detects too much sunlight. The disadvantage of the existing framework is that it does not have any data regarding how much energy has been consumed and because of this there is an enormous amount of wastage in energy. Also, the streetlights are generally prone to faults and damages. These faults or damages in the street lights are recognized only through manual inspection or noticed by surrounding people.

3. PROPOSED SYSTEM

In our proposed module using LDR sensor the streetlight is turned on and off and with the help of current sensor the amount of energy absorbed or consumed can be tracked. This module also includes weapon activity monitoring. In case, if a person with a weapon is identified, then the weapon is detected by the image sensors and the corresponding camera number will be intimated to the control room. In case of any damage in any particular lamp, the control room will be intimated and service for the breakdown can be provided immediately. The overall system can be monitored from the main control station.

3.1 Block Diagram

The block diagram of the proposed module is shown in Fig-1. In our system architecture, Arduino nano, USB camera, LDR sensor, LoRa, node (MCU), current sensor are used. Arduino nano is used as a microcontroller. Current sensor displays the measured current that has been consumed. LDR sensor detects the intensity of the light and activates street lights accordingly. With the help of LoRa technology, the interaction between the street lights and the control room is implemented wirelessly in this system. With the help of node MCU, all the data are transferred to the cloud and this can be accessed by the personnel in the control room. In addition to this, our proposed system also checks if there are any weapon activities in the surrounding area. If by chance a person with a weapon is detected, the corresponding location and camera number will be intimated to the control room. Also when there is any damage or electrical faults that have been identified in the lights, it will be immediately intimated to the control room for resolving the problem. The output of each module and sensors are given in Table-1.

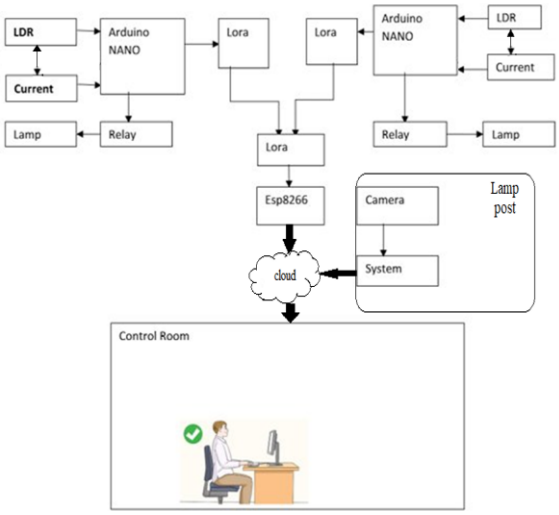

Fig-1: Block diagram

3.2 LDR based street light activation

An LDR (Light based resistor) provides resistance in accordance to the surrounding natural light. If there is an increase in intensity of the incident light, the resistance tends to decreases, and vice versa. In the absence of light, the LDR displays a resistance of the order of mega ohms and this reduces to a few hundred ohms in the presence of light. It can act as a sensor. By using this principle the LDR detects the light intensity of the surrounding and switches on the street light if the intensity is below a particular value and switches off when the intensity high.

Table -1: Module Description

MODULE	OUTPUT
Current sensor	Amount of current consumed for energy calculation.
LDR sensor	Activates the street light based on the intensity of the natural light.
ESP 8266	Generation of the camera number where the weapon is detected to the control room.

3.3 Detection of faults in street lights

It is obvious that the street lamps are prone to electrical faults and damages. This issue is left

unnoticed most of the times. With the use of current sensor, this issue can be resolved. The basic purpose of current sensor is to measure and display the amount of current supplied to the lamps. When the light intensity is more, the LDR sensor reads high value and hence the street lights are turned off which in turn has the current sensor reading lesser value. When the light intensity is less, the street lights are turned on and in turn the current sensor reads higher value. When there is a fault in particular lamp, then when the light intensity is less, the street lights should supposed to be turned on and current sensor should read a high value but since the lamps are damaged no current is supplied and hence the current sensor reads low value. Hence when this condition occurs, that is when both LDR and current sensor readings are low, it indicates a fault in the lamp and the control room will immediately be intimated about the same. The following Fig-2 shows the fault detection in streetlights.

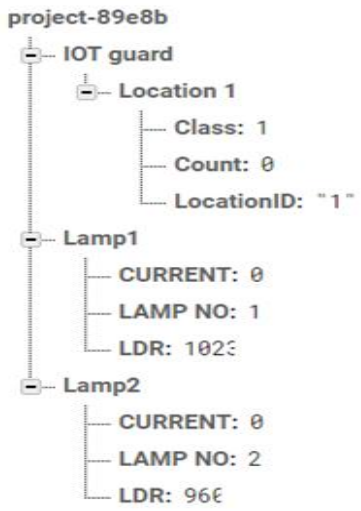

Fig-2: Detection of fault

3.4 Process of weapon detection

When a person carrying a weapon is captured by the camera, the image sensor separates the image captured into individual pixels and then transforms those pixels into a string of numbers. This process is performed with the help of CCDs (charged coupling device) and CMOS (complementary metal oxide semiconductor) chips. Now, the amount of light that each pixel received is determined by the image sensor. The amount of light that the each pixel received is converted into a string of numbers and this information is stored in a memory chip. Using this technique, the images being captured by the camera is converted into a string of digits. Every digit corresponds to the brightness or darkness of one pixel in the image, and what color it is. Now the image has been converted to the digital form. The converted image is compared with the originally stored image of weapons like guns, knives etc and when there is a considerable amount of match between these two images, the weapon is detected and the corresponding camera number is intimated to the control room immediately. Fig-3 shows an appropriate and matching portion of digital value of converted image that corresponds to weapon held.

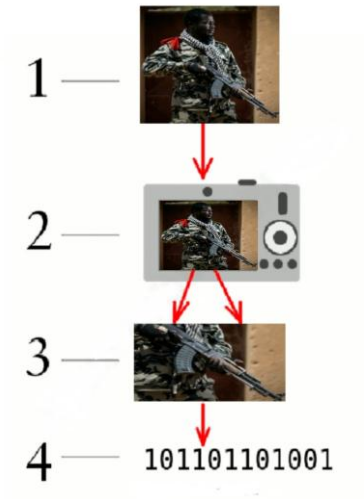

Fig-3: Conversion of an image into digital form

4. CONCLUSIONS

A smart street lighting is a solution to ensure control over the energy consumption in a daily basis. A new approach based on Lora technology to control the consumption of energy is proposed. Under ideal conditions, our device can be efficiently utilized for conserving energy. It is quite cheap and compact compared to the existing systems. The solution provides automatic on and off of the street lights, detection of faults in the street lamps. Moreover, the weapon detection used in this system will be helpful in reducing the crime rates to a large extent.

REFERENCES

[1] Ali, Mokhtar and Orabi, Mohamed and Abdelkarim, Emad and Qahouq, Jaber A Abu and El Aroudi, Abdelali, "Design and development of energy-free solar street LED light system", 2011 IEEE PES Conference on Innovative Smart Grid Technologies-Middle East, 2011, pp. 1-7.

[2] Yoomak, Suntiti and Jettanasen, Chaiyan and Ngaopitakkul, Atthapol and Bunjongjit, Sulee and Leelajindakrairerk, Monthol, "Comparative study of lighting quality and power quality for LED and HPS luminaires in a roadway lighting system", Energy and Buildings, vol. 159, Jan 2018, pp. 542-557.

[3] Sindhu, AM and George, Jerin and Roy, Sumit and Chandra, J, "Smart Streetlight using IR sensors", IOSR Journal of Mobile Computing & Application (IOSR-JMCA), vol. 3, no. 2, Mar 2016, pp. 39-44.

[4] Kivrak, Sinan and Gunduzalp, Mustafa and Kesler, Selami and Beklergul, Mehmet," A novel approach to astronomical time relays in point of energy saving in street lighting of the big cities: The selected plot area Denizli in Turkey," Int. Rev. Electr. Eng, vol. 4, no.3, Sep 2009, pp. 1061-1068.

[5] Bellido-Outeirino, Francisco Jose and Quiles-Latorre, Francisco Javier and Moreno-Moreno, Carlos Diego and Flores-Arias, Jose Maria and Moreno-Garcia, Isabel and Ortiz-Lopez, Manuel," Streetlight control system based on wireless communication over DALI protocol," Sensors, vol. 16, no. 5, May 2016, pp. 597.

[6] Bingol, Ezgi and Kuzlu, Murat and Pipattanasompom, Manisa , "A LoRa-based Smart Streetlighting System for Smart Cities," 2019 7th International Istanbul Smart Grids and Cities Congress and Fair (ICSG), Apr 2019, pp. 66-70.