Smart Street Light System for Energy Conservation and Emergency Rescue

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Abstract - *The proposed Internet of Things based Street Light System is designed to prevent wastage of power and provides emergency help and security. Implementation of proposed idea is through smart embedded system along with programming that allows street light to be used in the right capacity according to the requirement. Street lights glow with different intensity based on sunlight's detection and object's movement. For emergency rescue two buttons (red and green) and two displays are placed at reachable height. A wireless camera is embedded along with the system that stores footages on cloud maintained by the base station. When one of this button is pressed then notification is sent to the area's police station or hospital and immediate action is taken. This prototype helps the police as criminal's picture is captured and proof against him is recorded in the camera. When ambulance is reaching the spot then display of all connected street lights turn green indicating ambulance is approaching and traffic has to be avoided. Hence system ensures security and cuts down power wastage.*

Key Words: **Internet of Things, Smart street light system, Energy conservation, Emergency Buttons, Displays.**

1. INTRODUCTION

With the growing economy, street lighting system is one of the major concerns of the government. Therefore, efficient management and energy saving control of the lighting system is very important. In the traditional system, lights are ON for the entire night leading to about 50-70% of municipal waste. Instead this amount can be spent on the proposed idea that aims at installation of the wireless based system to remotely track and control the actual energy consumption of the street lights and take appropriate energy consumption reduction measures [2].

The system includes a street light controller that is installed on the poles along with a microcontroller, photo resistor, object detecting sensor and communication between the street lights is based on the controller installed on the pole. The Light Emitting Diode (LED) is controlled by the controller. The sensor senses the sunlight and sends the information to the microcontroller which acts upon, based on the given condition [1].

With the escalating crime rate and accidents increasing exponentially, there must be an assisting system available. Street poles serve as these helping hands as they are installed in every part of the city. For this purpose the system also includes camera, buttons and displays. When emergency situations such as accident, theft or harassment is found to happen then one of these buttons can be pressed and immediate action is taken.

2. PROBLEM STATEMENT

The existing system of street light is one of the huge expense of the city and even then it is not efficient. Hence this proposed idea can be implemented to overcome the drawbacks.

2.1 Disadvantages of existing system

1. High power consumption: Street lights are ON for the entire night that counts many hours of wastage of power as they are continuously working on maximum voltage.
2. Usage of sodium vapour lamps: High watt, high pressure sodium vapour lamps are responsible for high power consumption, emission of carbon dioxide in the environment and moreover shelf life of sodium lamps is less.
3. Wired connection: In this type of connection even if a component fails it is not known.
4. Man power: Man power is required for switching ON and OFF of street lights and periodic checking.

2.2 Advantages of proposed system

1. Low power consumption: In the smart street light system, LED's turn automatically ON during the night and automatically OFF during the day. Even during the night time, it's ON only when the object is detected.
2. Usage of Light Emitting Diode (LED): Low watt LED's replace sodium lamps since they are able to

control their light, consume less power and have long shelf life.

3. Wireless connection: Base station remotely controls the street light and keeps track of power consumed by every lamp that has a unique id maintained in the database. It also monitors lamp status to check if it breaks, falls or malfunction.

4. Protection: At present there is no system to safeguard the people but our system forges a step for it [1].

3. MATERIALS AND FUNCTIONING

1. MICROCONTROLLER

- Arduino Uno based on ATMega328 series controllers is heart of the system that connects all other components and entire controlling takes place on this board.
- The board is programmable with Arduino IDE (Integrated development environment) via Universal Serial Bus (USB).

Fig-1: Arduino board

2. LIGHT DEPENDENT RESISTOR (LDR)

- It is a photo resistor radiation.
- The working principle is whose resistivity factor is function of electromagnetic photo conductivity in which materials conductivity reduces when light is absorbed by the material.
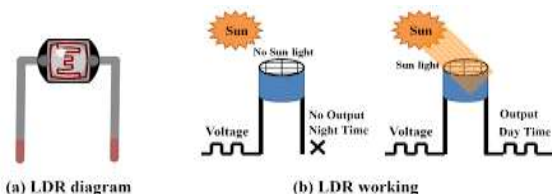- The above principle is used to check whether its day time or night time.

Fig-2: LDR diagarm and working[3]

3. INFRARED SENSOR (IR SENSOR)

- It is an electronic sensor that detects obstacle movement either by emitting or detecting infrared radiation through a transmitter-receiver pair.

- Transmitter emits rays in infrared spectrum and if object passes by then the emitted rays hit the surface and reflect back to the receiver, hence motion is detected.
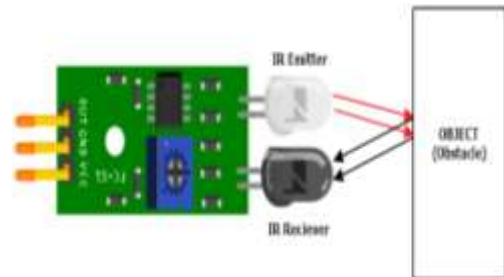

Fig-3: Working of IR Sensor

4. LIGHT EMITTING DIODE (LED)

- It is a PN junction diode used to emit visible light when activated.
- When the voltage is applied over its elements, electrons regroup with holes within the LED, releasing energy in the form of photons which gives the visible light. LEDs may have the Dim/full capability [3].
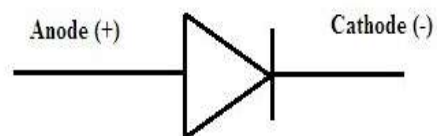

Fig-4: Circuit diagarm of LED

5. BUTTONS

- It's an electronic device designed to assist in alerting people during emergency situations where threat to a person or property exists [1].
- These are connected to base stations to request emergency assistance from local security, police or emergency services [1].

Fig-5: Emergency buttons

4. PROPOSED APPROACH

Arduino Uno connects the IR sensor and LDR to the analog pins. LED and buttons are connected to the general purpose input output pins (GPIO). Arduino sends all the sensor data to the cloud.

During the day time when LDR is exposed to sunlight its resistance is low. The change in resistance of LDR can be

noticed by the change in output voltage. Therefore LED turns off automatically as the output voltage is low.

When LDR does not detect light, LED's glow but brightness of depends on whether vehicle is detected or not.

The cases below describe:

Case 1:
When an object is not detected by the IR sensor then maximum light is not required. Hence to avoid wastage in these situations, LED glows only with 30% brightness (dim).

Case 2:
When vehicles or pedestrians movement is detected by the sensor then LED glows high. Street lights communicate to each other through a zigbee network. Therefore to ensure safety, four poles ahead of it also glow high.
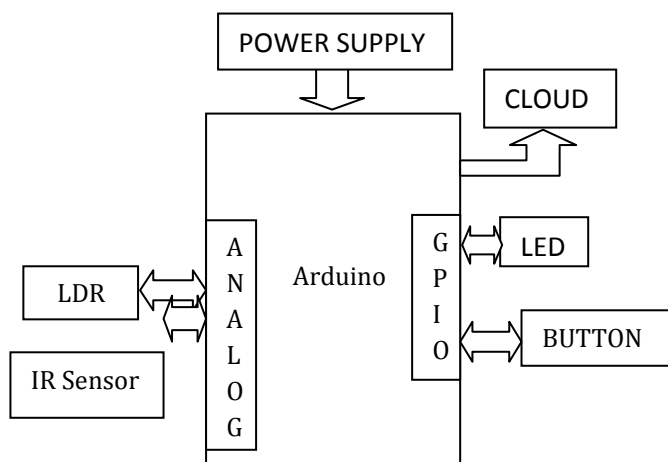
Along with the above system, architecture also includes a CCTV camera, buttons and display.

Base station assigns unique identification number to every street pole. The database of base station stores poles address and its connected police station and hospital.

The buttons on the street poles can be of great help to citizens in emergency situations. Green button is used in cases such as an accident or a pregnant women requires immediate doctor's help. In case of theft, robbery or harassment victim can use the red button.

Steps that take place when buttons are used:

I) Trigger: When green or red button is clicked on the light pole, programmer program's this as a trigger which sends notification to its connected hospital or police station respectively.

II) Notification: It includes the light pole address. In addition, a picture is sent to the police station that was captured at instance when button was clicked.

III) Action:

- If a pole's green button is pressed then immediately the display of all poles that are connected this pole turn green.
- Main purpose of display is to inform citizens that traffic should be avoided.
- Citizens viewing the green display can also reach the spot and help the person.
- Green display is shown until ambulance reaches back the hospital.
- If pole's red button is pressed then the police could arrive at the place and take action against the criminal.
- Even if criminal escapes his image can be used.
- After the notification is sent, red display turns off to avoid panic among the citizens.
- During night time, when pictured has to be captured then two closest street pole LED's also glows high so that image captured is clear.

5. CONCLUSION AND FUTURE WORK

Street lights being one of the highest expenses of the city are not efficient.

The proposed system ensures

- Electricity is not wasted.
- Appropriate equipment's are used.
- Maintenance cost is low as components function only when required.
- It helps the police to gather evidence against the criminal through the image and footages.
- System provides immediate help

The project can be implemented in places where continuous surveillance is required such as industries, parking lots of shopping malls and campuses.

REFERENCES

[1] B. Abinaya, S. Gurupriya, M. Pooja, "Iot based smart and adaptive lighting in street lights", Department of Information Technology, Sri Sairam Engineering College

[2] Parkash, Prabhu V, Dandu Rajendra , "Internet of Things Based Intelligent Street Lighting System for Smart City", in International Journal of Innovative Research in Science, Engineering and Technology, Volume 5, Issue 5, May 2016

[3] Zain Mumtaz , Saleem Ullah , Zeeshan Ilyas , Shuo Liu , Naila Aslam , Jehangir Arshad Meo , Hamza Ahmad Madni,, "Automatic Streetlights that Glow on Detecting Night and Object using Arduino"

[4] Aziera Abdullah, Siti Hajar Yusoff, Syasya Azra Zaini, Nur Shahida Midi, Sarah Yasmin Mohamad, "Energy efficient smart street light for smart city using sensors and controllers", in Bulletin of Electrical Engineering and Informatics, Volume 8, No 2,June 2019