# SMART STREET LIGHT MONITORING SYSTEM

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## ABSTRACT

*This paper describes the smart street lighting system in which the power consumption is minimized using sensors when there is no movement of objects on the road. Automation plays an increasingly important role in the world economy. Smart street light provides a solution for energy saving which is achieved by sensing the movements using the sensors and then increasing the intensity of the street lights. With the advancement of technology, things are becoming simpler and easier for everyone in the world today. In the scope of industrialization, automation is a step beyond mechanization, whereas mechanization provides human operators with machinery to assist the users with the muscular requirements of work. As the objects passes by, the trailing lights will be turned to the bright condition automatically. The fault in the light is detected and it is resolved by adjusting the nearby poles in the street. This system is implemented in the pilot street.*

**Keyword: -** *Power consumption , Street lighting , IR sensor , Dimmer circuit , Stepper motor , LDR sensor*

## 1. INTRODUCTION

In the era of digital India, the street lighting is still controlled and monitored manually by local municipalities, by which the electricity consumption and losses are getting too high. Through the idea of installing the LED lighting system to save electricity combined with automation is the safe way to real savings. If we envisions smart cities initiatives being launched around the globe, smart street lights should be a part. Smart street lights will bring a number of benefits to communities and their governments. They will provide baseline data to help governments make informed policy decisions. This system is beneficial to reduce energy consumption and also eliminate the staff appointed for dedicated street light operation. There are several factors need to be considered in order to design a good street lighting system such as night time safety for community members and road users, provide public lighting at cost effective, the reduction of crime and minimizing its effect on the environment. The use of street lighting was first recorded in the city of Antioch from the 4th century. Later it was recorded in the Arab Empire from the 9th–10th centuries, especially in Cordova.

In the Middle Ages, so-called "link boys" escorted people from one place to another through the murky winding streets of medieval towns. The smart street lighting system is considered to be a smart since based on the information extracted from the sensory data, turning on/off and dimming commands for street lamps are generated automatically. Street lights are ubiquities considering every road and highway is illuminated by the lamps in the night. Wireless communication is among technology's biggest contributions to mankind. Wireless communication involves the transmission of information over a distance without help of wires, cables or any other forms of electrical conductors. The transmitted distance can be anywhere between a few meters (for example, a television's remote control) and thousands of kilometers (for example, radio communication). Some of the devices used for wireless communication are cordless telephones, mobiles, GPS units, wireless computer parts, and satellite

television. The smart street lighting system is considered to be a smart since based on the information extracted from the sensory data, turning on/off and dimming commands for street lamps are generated automatically.

## 2. PROPOSED SYSTEM ARCHITECTURE

There are two nodes in this system, master and slave. The master node acts as the receiver and the slave node acts as the transmitter. Each streetlight will control the lights as they are having circuit board installed in it, which will read the consumption and transmits all the data wirelessly. The intensity of the light will be low when there is no movement on the street and the intensity will be high when the person crosses the pole. If there is any fault in the pole, the nearby poles will adjust according to the person and provides light. With this method we are able to find faulty lights and also track individual light energy consumption. In today's world, we all are well acquainted with our nation's energy scenario.

**Fig -1**: Street light system

Controlling and managing of the system is based on the presence of traffic and the environmental conditions. The system was programmed to automatically turn off during the hours of daylight and only operate during the night. Each pole is working as an independent unit and is robust and efficient. The reduction in power consumption can be achieved through this proposed system. In this system, the street lighting is controlled autonomously with the capability of wireless communication systems. The architecture is shown in Fig 2.

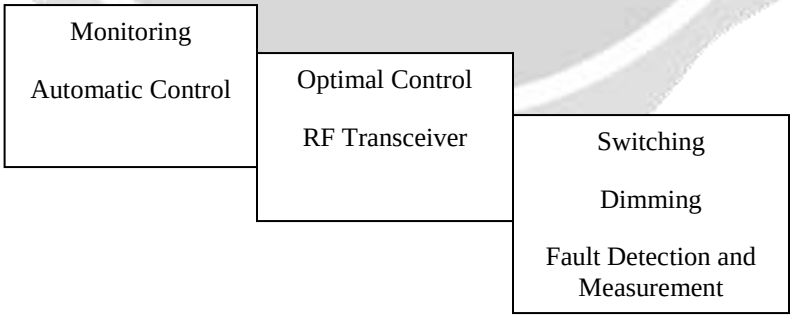


**Fig -2**: Architecture of the proposed system

We are well aware of the fact that not only the available power is less than the demand, but also it is being wasted on a large scale. The wastage is in the form of unnecessary usage of lighting, low power factor and similar other factors. So we need an efficient energy system that has long term advantages. Improved reliability and resiliency, reducing rising energy cost, and environmental issues are the main drives for rapidly extending and adoption of

smart street lighting system. Street lights are ubiquities considering every road and highway is illuminated by the lamps in the night. The main objective of the smart street lighting system is to design energy efficient based controller for controlling Light Emitting Diode (LED) based street lamps via appropriate lighting levels control.

**Table -1:** Dimming level vs Power consumption

| Dimming level (%) | 100 | 90 | 80 | 75 | 70 | 65 |
|---|---|---|---|---|---|---|
| Power consumption (W) | 151 | 132 | 125 | 107 | 96 | *82* |

## 3. CONTROLLER OF THE SYSTEM

One of the most important aspects of fault handling is detecting a fault immediately and isolating it to the appropriate unit as quickly as possible. The fault will be identified by the corresponding port address of the pole and when the fault is detected, it is recognized immediately, hence rotating the adjacent lights and provide light for the person who passes by. The dimming circuit plays a major role in this smart system because the overall circuit is controlled by the dimmer circuit. Initially the sensor gets activated and according to the functioning of the sensors, the dimmer circuit works correspondingly. The LED light are used which reduces more than 50% of the power consumption. By using this, we can conserve power and also reduces the maintenance cost. All the information corresponding to the system is transmitted and received wirelessly and is more efficient. The optimization of this system leads to the greater level of achievements.

## 4. SENSORS

Here we use three different sensors, the Passive Infrared sensor, Infrared sensor and Light Dependent Resistor sensor. IR sensor is used to detect the obstacle. It works by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. This type of sensor can then be used to measure how "bright" the object is. This is useful for tasks like line tracking. This sensor has 3 pins of which the first is the output which is connected to the pin of the arduino board. The second pin is connected to the ground and the third one to the power supply whose operating voltage is 5v. The output of the IR sensor will be in the form of digital either 0 or 1. Here the microcontroller and the IR sensor is initialized and then it is monitored. When the obstacle is detected, the IR sensor reads the digital value 1, otherwise it is not detected and reads the value 0. An LDR sensor is used to vary the intensity of the light. An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. When the LDR value is below the threshold value, the light remains off. When the LDR value goes above the threshold value, the light turns on.

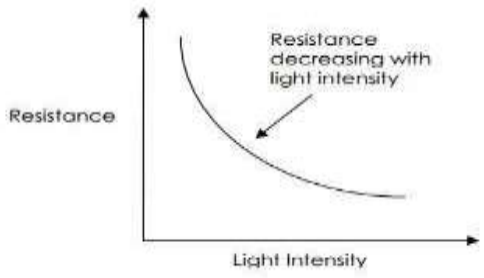


**Fig -3**: Variation graph

The microcontroller and the LDR sensor is initialized and then it is monitored. The LDR sensor monitors the intensity of light in the surrounding. When the intensity value is less than or equal to 800, the light will be switched ON, otherwise the light will be OFF. In the interfacing of LDR sensor, the analog input A0 will be connected to any one pin of the arduino board. The other terminal will be connected to the ground. The LDR sensor gives the analog output which is converted to digital by using ADC which is inbuilt in arduino microcontroller. The bit resolution of ADC is 10 bit and it ranges from 0 to 1023. When the intensity value goes beyond 800, the light will be OFF, otherwise the light will be ON.

A passive infrared (PIR) sensor is an electronic sensor that detects the infrared (IR) light radiating from living beings in its field of view. They are most often used in PIR-based motion detectors. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose. The term passive in this instance refers to the fact that PIR devices do not generate or radiate energy for detection purposes. They work entirely by detecting infrared radiation emitted by or reflected from objects. They do not detect or measure "heat". An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a human, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again.

## 5. CONCLUSIONS

It is a cost effective, eco-friendly and it is the safest way to conserve energy. It clearly tackles the problems that world is facing today, saving of energy and also disposal of incandescent lamps very efficiently. Initial cost and maintenance can be the drawbacks of the method. The cost can be reduced with the advancement in technology and proper planning of the resources. With the periodical checks, the maintenance can be reduced. The LED's have long life and can be used for fast switching. This system is very flexible and scalable, and can accommodate any type of dimmable lamps. The switching and dimming commands are transmitted to each lighting pole wirelessly. This system will be efficient in any type of climatic conditions. This results in maximum energy saving and also acts as an effective system in today's environmental needs.

## 6. REFERENCES

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