# Smart Street Light Using IOT

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**ABSTRACT:** This paper is about automation, Power optimization and cost effectiveness that can be done in the present street light systems. Automation is done with the help of IoT (Internet of Things) by using sensors connected to an Arduino board which will keep track of the working of the whole system. With the implementation of right sensors in the system we can save almost 25% of the energy consumption that is being used in the present system and also in this system we use renewable energy sources like sunlight using solar panels. Which further decrease the dependency on non- renewable energy. Unnecessary wastage of power is being eliminated in this system by controlling the intensity of the lights when there is no movement or less movement on the roads and thus saving more money.

**KEYWORDS:** *IOT, LDR, Sensors, Solar Panel*

## I. INTRODUCTION

A street lighting system is the basic electrical system implemented on the roads for the safety of the people. Street lights are integral part of the society which need to be developed for better efficiency to save power. It is estimated that 20% of the world electric power is consumed by the lighting, of which 5% is used in the public areas as street lights. Only in India the street lights consume about 4400MW of power per year. But with further development the consumption will increase. At present we have automatic ON or OFF of street lights at a particular time(time-based), which is still insufficient to save power. The proposed project is one step ahead of it. Instead of the fluorescent bulbs which consume more power we will use LED's. The LED's life span is more compared to fluorescent bulbs. Here we develop a prototype of the electric pole which detects the faults and sends the information to the worker. It also helps in detecting the inclination of the pole where if the pole inclines beyond a threshold value due to natural

calamities or human intervention it will automatically intimate to the concern authorities. We will use the LDR and IR sensors. LDR helps in detecting the intensity of the sunlight to turn ON or OFF of the lights. If there is no movement at night times, with the help of IR sensor, the intensity of the light decreases to a particular pre-selected level. Whenever motion is detected depending on speed of motion, we will increase the intensity of the light. This way we can save up to 40% of power. The street lights are the most essential electrical system that is implemented on the roads for a smooth travel from one place to another. These street lights use most of the electrical energy that is needed to be reduced. In the present System in most of the towns and cities the street lights are manually turned ON in the evenings when sun lights start to reduce and they are turned OFF only in the mornings when there is adequate amount of sunlight. This requires human interaction and consumes lot of energy and sometimes the person may forget to turn off the lights and there by unnecessary wastage of electrical energy. There are some places in India where the street lights gets turned ON and OFF at particular time interval this saves some energy but not much effectively. There is still some wastage of energy in this system. Internet of Things helps to automate the system with the help of sensors. This is an effective way to reduce human interaction.

The paper aims at harvesting the energy from renewable energy sources like sun and to effectively use the harvested energy for the good thing about mainly the remote villages (villagers) facing the intense power problems. The most aim of the paper is to supply a "IoT based Automatic Street Lightning System" powered with alternative energy during dark. We use the word "smart" because the system not only provide power to the road lights but also helps in detecting the direction of movement of the pedestrian and helps him by means of illuminating the trail of movement till the near next

street light. By integrating the whole street lights with Smart street light system it's possible to systematically help the pedestrian to realize the destination within the remote rural areas which face serious voltage supply problem. The identical system also can be employed in metropolitan cities in addition. A simple and effective solution to the current would be dimming the lights during off peak hours. Whenever presence is detected, the lights around it'll glow at the traditional (bright) mode. This might save plenty of energy and also reduce cost of operation of the streetlights. We'll check the status of street light on internet using IOT (Internet of things) from anywhere in real time and solve the issues if happen during the processing. Additionally, a table top model has been developed to show the idea's working.

This paper implements IoT based smart Street Lightning System. As the traffic decreases slowly during late-night hours, the intensity gets reduced progressively till morning to avoid wasting energy and thus, the road lights start at the dusk so switch at the dawn, automatically. The strategy repeats on a routine. While Light Emitting Diodes (LED) replaces conventional HID lamps in street lighting system to incorporate dimming feature. The intensity isn't possible to be controlled by the high intensity discharge (HID) lamp which is mostly employed in urban street lights. LED lights are the longer term of lighting thanks to their low energy consumption and long life. LED lights are fast replacing conventional lights because intensity control is feasible by the heart beat width modulation. The application would be able to detect faults easily and provide required maintenance by generating alert messages to the admin control room. System makes use of solar panels mounted on the lighting structure or integrated into the pole itself. The solar panels charge a rechargeable battery, which powers LED lamp during the night.

This proposed framework utilizes an Arduino board. Strings of LED are interfaced to the Arduino board. A modified Arduino load up is locked in to give various powers at various times.

This project is improved by coordinating the LDR to follow the exchanging activity definitely and IOT to show the status of road on internet browser and help in controlling it.

The main objectives are as follows:
• To avoid unnecessary Waste of street light.
• Provide efficient, smart lightning system.
• It is based on Renewable energy sources.
• Detection of the faults and alarming them.
• More life expectancy.
• Energy Saving.

## II. RELATED WORK

In order to make this paper happen there was a lot of pre learning has been done in order to know about the present technology that is being implemented in street light system and the energy that is being consumed by the street lights with the present technology per day, per month and per year. Various power saving techniques has been studied and how can that be implemented is also known. In order to gain this knowledge, we have referred a lot of IEEE papers that we mentioned in the References section. In each paper a wide variety of techniques have been used ton make street lights smarter, different papers used different sensors to implement a function in street light system also used different kind of approaches to solve the problems that is being faced in the present system. By reading all those papers we came to a simple solution where automation, power saving and reducing human interaction can be implemented on a single system easily. Finally, we came to a conclusion that using LED's LDR sensors and solar panels we can reduce the power consumption and also varying the intensity of the LED's when there is motion with the help of IR sensors. By using accelerometer we can know the faults in the pole whether the pole is about to fall or not due to heavy rains or winds. And also, we make use of the renewable energy by using solar panels. This total system is automated by using Node MCU which is a Wi-Fi module to send alert messages to the concerned authorities whose phone numbers can be stored in a cloud.

## III. PROPOSED SYSTEM

The current system utilizes power conveyance through a single stage line to the streetlight. The proposed framework includes five additional parts to manage the force conveyance. An Infra- Red Proximity Sensor at the base of the road light distinguishes nearness in a little zone around the road light. The information from the sensor is sent to the Arduino which structures brain of the circuit. The Arduino then commands to switch between dim and bright modes depending upon the requirement and thus controls the brightness of the street light. A battery eliminator, also powered by the single-phase line, is used to supply 5V inputs to the sensors and Arduino.

The design basically includes three working modes: -

**OFF mode:** When there is sufficient common light in the encompassing for example during the daytime, the whole system is turned off and the batteries are charging.

**Active mode:** When the natural light drops below a certain level the system automatically turns on and

the motion sensors are powered.

**ON mode:** On the nearness of people on foot, the sensors turn on which thus turns on the LED lights. These lights turn off after a certain timeframe.

- Solar cells are used to power the street light which charges during the day time and stores the energy in the battery
- We use IR sensor to detect the object which is necessary to increase the intensity of the light
- Node MCU ESP8266 WIFI module is used in

order to connect the model to the Telegram app which is used to send the intimation to the user when any fault in the street light is detected

- There are various way to detect the fault in the light and the pole. We make use of LDR sensor to detect the fault in the light
- We make use of Accelerometer meter sensor to detect the fault in the pole where we set some threshold angle below which it detects as the fault in the pole.
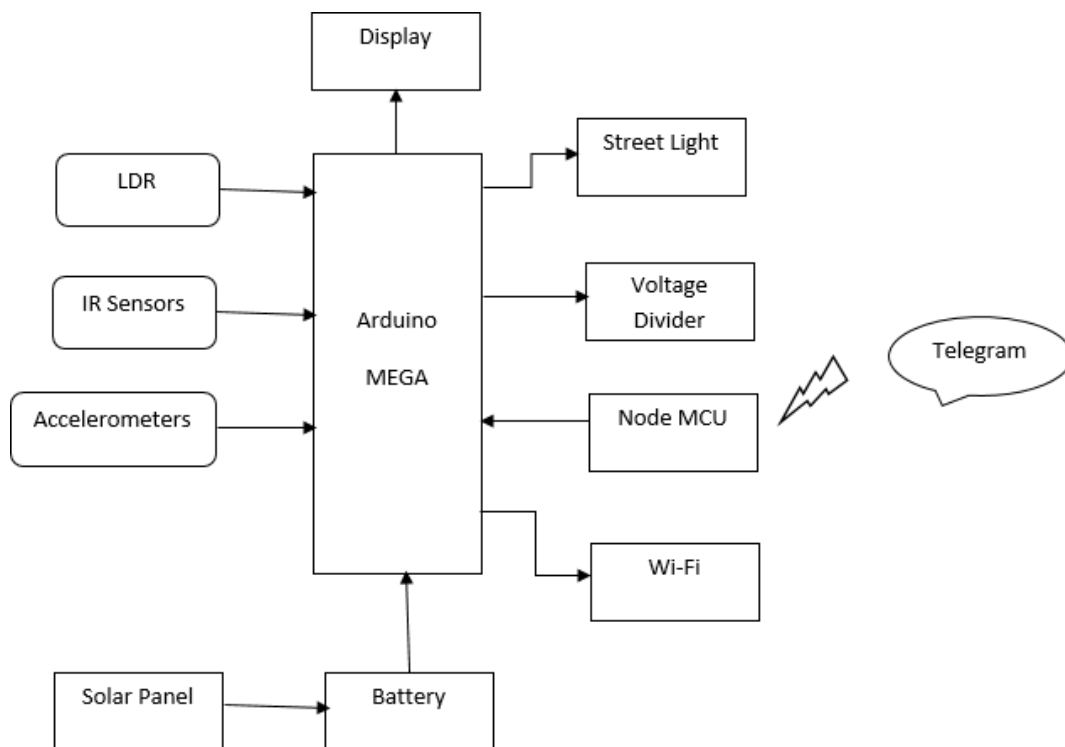
## IV. SYSTEM ARCHITECTURE



**Fig 1: -** Block Diagram

## V. WORKING

The flow chart indicates the work flow of the project "Smart Street Lights using IOT". All the required hardware is pre- installed on the poles after verification. When we turn on the hardware after sometime all the components get started to work. The IR Sensor helps in the detection of the vehicles passing through the pole. When a vehicle approaches the pole the IR sensor detects the movement and sends the signal to the Arduino

Mega board. With the help of LDR sensor we will get to know what time it is, whether day time or night time.

If it is night time, the IR sensor will respond and the Intensity of the light of that pole increases and becomes maximum. After sometime the 32rduino again checks for the status of the IR sensor and the LDR sensor and repeats the process depending on their status.
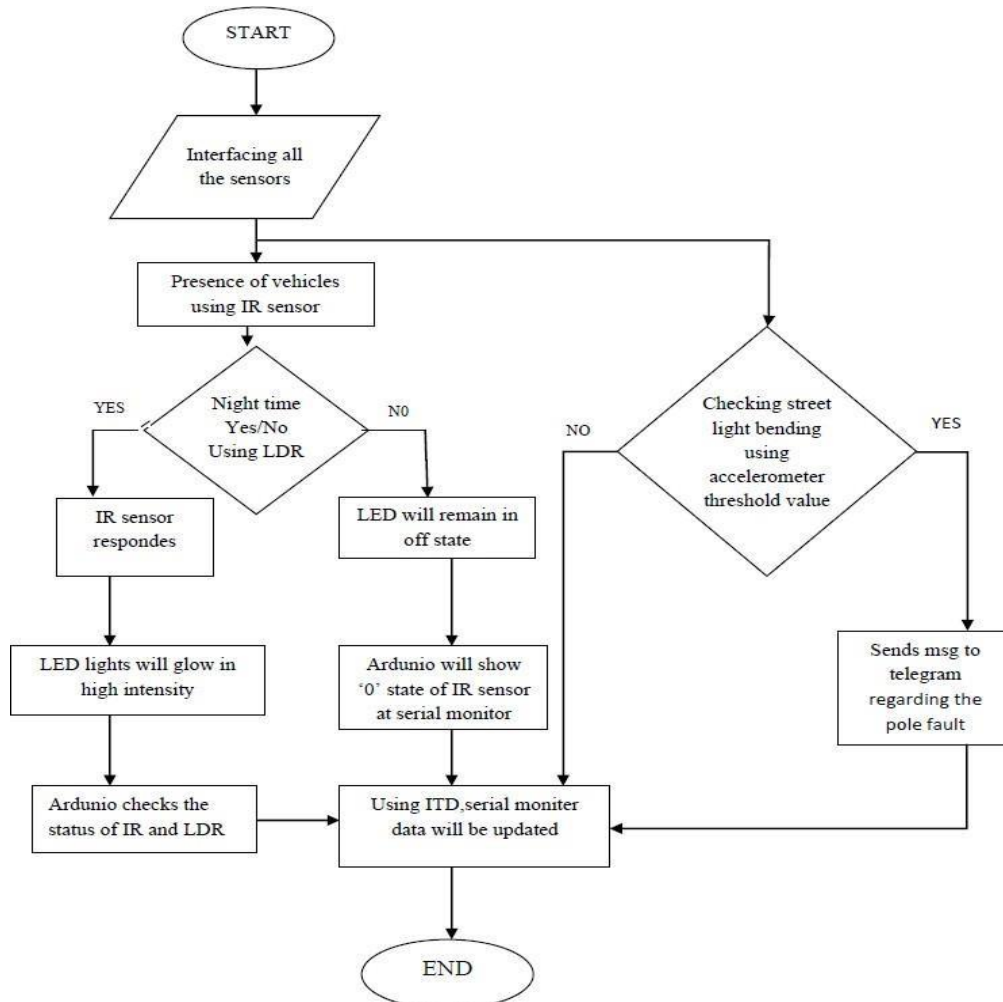
**Fig 2: -** Flow Chart

If it is day time, IR sensor will respond and the Arduino checks the LDR status as day time and the bulb will remain in OFF state and waits for other detections. In this case the Arduino shows '0' state of the IR sensor at the serial monitor. The same applies for the day time.

The accelerometer helps in the detection of the pole inclination due to harsh weather, if the inclination is more than the threshold value given then an alert message will be sent to the telegram number registered along with the details of the pole having fault.

This entire process is stored in the cloud with the help of Wi-Fi module(esp8266). And this process gets repeated.

## VI. RESULTS

- In this project we aim to achieve an energy efficient street light using the modern Technology like IOT. We were able to succeed in implementing using the cloud-based apps like Telegram which provides an online open platform for various projects.
- Here Solar panels which are renewable energy source and we make use of LED which consumes less power compare to that of the normal bulbs which are used in the street lights. IR sensor is used to detect the objects during the night time and increase the intensity of the light. Whenever there is no detection, we are able to reduce the intensity.
- As we all known most of the street lights which are used in cities as well as villages are timer based which will turn on and off every 12hrs. We make use of relay which is connected to LDR sensor which is connected to the whole system so when the sensor detects no sunlight it turns on the street light and vice versa. During night when the IR sensor detects the vehicles the intensity of the light is increases.
- We also make use of the accelerometer sensor

which detects the fault in the pole (i.e. when it detects any inclination in the pole).

- LDR sensor again are used to detect the fault in the street light during night time when light doesn't fall on the LDR it detects that as the

fault in the light and sends the intuition.

The consumption of electricity of present system and the proposed system is shown in below tabular column,

**TABLE I.** Electricity consumption of different systems

| SYSTEM | Time (hrs) | Energy Consumed per month(W) | Percentage of energy saved by system |
|---|---|---|---|
| Existing System | 12 | 18,662.4 | 0 % |
| Proposed System | 12 | 13,230 | 29 % |

## VII. FUTURE WORK

The above project i.e. Solar Smart Street Light System with IoT is powered from A battery, which might be charged during day time by harvesting the solar power through a photovoltaic cell. The solar power harvested from sunlight is stored, inverted from DC voltages to AC voltage using sun tie converter.

The AC voltage is stepped up and given to the electrical grid. The AC voltage from the electrical grid is stepped down, rectified and used for powering the circuit. Meanwhile, the road light also can be powered by the A.C. voltage, which is controlled by a relay switch connected to the switching a part of the circuit. The above-mentioned strategy will enable us to reap solar power in an efficient way for the operation of the circuit and for powering the road light also.

Using this smart project, we will also estimate the speed of the vehicle, recognizing the amount plate, recognizing the accidents transpire on roads etc.

This Smart Street light project not only helps in rural areas but also beneficial in urban areas too. As we are moving towards more advancement, we require more power so use of renewable resources is helpful and advantageous. With this project, we will even add smart parking of auto and it's even useful for driverless cars. This project features a bright future not only to save lots of power but also reduced the calamities and even reduced the rate.

## VIII. CONCLUSION

The utilization of intensity gadgets is expanding exponentially across different divisions of human life. The segments utilized in the undertaking, as Arduino and sensors are gradually turning into a crucial piece of our day by day schedules. In this way, it is just fitting that we use them to improve effectiveness in different social statuses. Remembering the earnest requirement for vitality preservation, Solar Smart Street Light System with IoT is an incredible and powerful arrangement. It combines safe lighting conventions with utilization of minimum use of power. The energy saving, as discussed before are phenomenal. The future extent of this project's ventures into speed detection and adjustable region of light.

An extra part which would prompt better working of the idea would be the utilization of LED bulbs. In spite of their high initial costs, they are a reasonable choice as they radically decrease the power consumption. They will help in further saving the energy and decrease in operational expenses.

There are various fault detection method which are being implemented using sensors and whenever any fault in the street light necessary intuition is send using apps like Telegram which make it user friendly. This is one way to use current IoT technology in our day today life which makes human life much simpler and easier.

The proposed system is suitable for street lighting in remote likewise as urban areas where traffic is low every now and then.

Along with energy saving it also tackles with the matter of power theft .It is capable of taking corrective actions just in case of unprecedented events of climatic changes.

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