Smart street light -IoT Based

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ABSTRACT: Street lights in India consume 20-40% of the electrical energy produced in the entire nation and the demand for electricity in recent years has increased day by day. Most of the lights are still halogens which are regularly switched on and off at a particular time irrespective of the need in that particular surrounding. In this project, smart street light is introduced which is IoT based, it aims to automate the process of turning the street lights on when required, also, LED bulbs are used to assures low power consumption. The operation of this system is to maintain the intensity of street lights to 40% of the maximum intensity if no vehicles passing through the road. When the IR sensor detects the movement of the vehicle, the street lights will be switched to 100% intensity. Phototransistor is used in the system to detect day/night. Once the sun is out all the street lights will be in the OFF state. The intensity and switching On/Off of lights are all controlled by the Arduino microcontroller which receives the signal from IR sensors and phototransistor. Electricity theft is also a major problem in many big cities. People tend to connect another phase with a street light pole and connect that phase to their home. To avoid this problem this project uses a sudden signal of power drop or phase drop to detect the exact pole at which electricity theft is happening or if that particular street light is faulty, all this is possible as the data is shared through IoT about each phase and each light and all this can be controlled and monitored by a mobile application.
Keywords: Smart Street Light, LED bulb, IoT, Arduino Microcontroller, Electricity theft**.**

I. INTRODUCTION

Street lights are a major concept of today's urbanization, about 60% of India's population uses the vehicle and hence street lights are a necessity of developed or developing society. Existing street lights have been seen as a major power consumption unit. This generation struggles very much to save electrical energy. And Street lights are exceedingly important but costly [6], hence there is a demand for computing the system in a way that is economical and efficient. Many street lights still require manual monitoring, which can be a tedious task [4]. In addition to being concerned about electricity, many street lights are experiencing power outages. Technically speaking, power losses are divided into two categories: technical losses and non-technical losses. Power quality issues, such as too long network cables, sloppy wire connections, worn-out cubicles, and the use of worn-out wires, all contribute to technical losses.Non-technical factors include electricity theft, which causes load fluctuations if electricity usage is increased. The transformer suffers losses as a result of this. Thus to observe this problem the identification can be done either physically, or to keep the track on the consumption of customer. Losses involving electricity theft are a major concern in our country and many others. In past few years IoT [1] has become a rising technology to share and control data over the internet and that is how these street lights can be controlled from just a button on a mobile application. Therefore, it has become important to overcome the existing system problems and design a new system that saves the maximum amount of electricity and is easy to control without any manual help.

II. EXISTING SYSTEM DRAWBACK

- In existing street light halogen bulbs or HID bulbs are used which are not very eco-friendly and consume lot of power.
- Some existing system require manual monitoring of streetlights. Which can be a tedious task as well.

- Lights turn on/off at a clock cycle which leads to electricity wastage when the sun rises early and sets late during summers.
- Lights are on even at the places where there is no need, leading to electricity wastage.
- There is no easy and fast way to detect faulty lights or to detect electricity theft besides physical inception.

III.   PROPOSEDSYSTEM

This paper is based on street light development which will help to develop a smart street light.

This proposed system does not consist of any expensive hardware and is easier to replace in case of failure. The light will sense the brightness, also detect any moment in the environment and adjust the intensity as per the same, Sensors are affixed to sense the luminosity and moment detection. The data of street lights i.e. its power consumption will be monitored by IoT which helps in detecting power loss and all this can be controlled by a mobile application just at the tip of your hand. The proposed system will reduce most drawbacks of the existing system. The proposed system aims to use LEDs in place of conventionally used halogen bulbs or HID bulbs. This ensures 100% automation (in exception to periodic maintenance).

IV.   SYSTEMARCHITECTURE
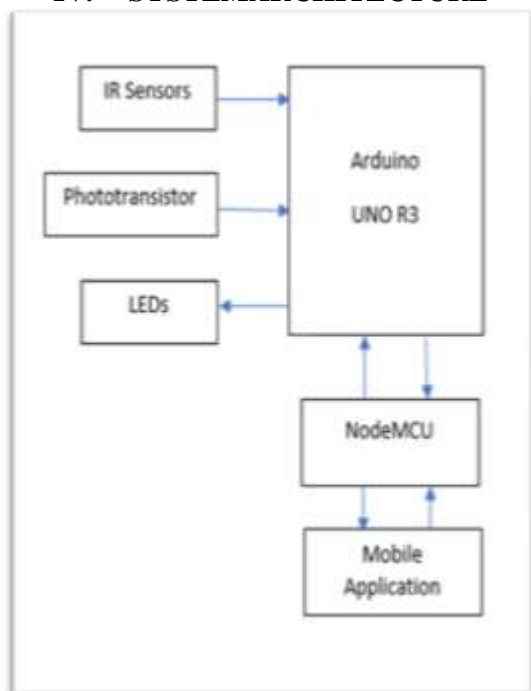
System architecture

V.   REVIEW OF RELATED LITERATURE

Many papers with similar topics are taken as a suggestions and used for understanding smart street light, indicating that everything has its advantages and disadvantages and its own concepts and theories to make a street light smart by using different microcontroller, sensors and software:

- Based on paper Smart Street Light System using IoT[1] automation can save a huge amount of energy, energy conservation is made easy with the use of sensors, The Internet of Things (IoT) is an assortment of interrelated preparing devices, mechanical or virtual machines, articles, animals and individuals that have fascinating identifiers (UIDs) and the ability to move information over a framework without expecting of human-to-human. IoT is used to gather an accurate real time field data which can be used for future references.
- Based on IoT Based Smart Street Lightning System [2] Data from street lights are stored by IoT hence they can be used as a multi-functional element, intensity of the road light can be controlled, accident prevention, smoke detection, over speeding can be kept in check through sensors.
- Based on A Study on IoT based Smart Street Light Systems [3] Smart Street Lighting System faces the major problems like Crime detection, Energy wastage, disposal of incandescent lamps, maintenance cost etc., This system ensures traffic safety and the security of the people and can stop burglaries and further intimidations by sharing the data through IoT and using sensors.
- Based on A Survey on Automatic Street Lightning [4] Light dependent resistors are used with the micro controller Arduino UNO to operate the lights automatically during rain, day and night to avoid manual labour leading to energy conservation and saving cost on manual labour.
- Based on Intelligent Street-Light System using Arduino UNO [5] Arduino microcontroller is used along with light dependent resistor to control the lights according to the natural light present in the surrounding. This technology can also be directed towards other things like head lights, street light, park lights, industrial lights etc.
- Based on Smart street light using Arduino [6] The LEDs adjust to the surrounding's natural light and is fully turned on when it's completely dark, the street lights also have

LED displays which gives the current weather report .

VI. CIRCUIT COMPONENTS

1. ARDUINO UNO R3

The Arduino UNO is the project's brain. It has 14 digital input/output pins, 6 analogue inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header, and a reset button. It comes with everything you need to support the microcontroller; all you have to do is connect the computer to the controller using a USB cable or power it with a AC-to-DC adapter or battery to get it running.

2. IR SENSORS

IR Sensor is a electronic component which is used to sense some characteristics from its surrounding by either emitting infrared radiations or detecting them. It can also measure heat and detect motion. Infrared radiations are invisible to human eyes.

3. Phototransistor

The phototransistor is a semiconductor device that changes the current flow between emitter and collector according to the light levels. The phototransistor is more sensitive in view of the gain provided by the fact that it is a bipolar transistor.

4. LED

When current flows through a light-emitting diode, it produces light. Electrons recombine with electron holes in the semiconductor, releasing energy in the form of photons. The energy required for electrons to cross the semiconductor's band gap determines the color of light (corresponding to the energy of photons). The use of white light is obtained. Multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device are used to produce white light.

5. NodeMCU

The NodeMCU platform is a low-cost open source IoT platform. It originally included firmware that ran on Espressif Systems- ESP8266 Wi-Fi SoC and hardware that was based on the ESP-12 module.

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VII. IMPLEMENTATION AND OBSERVATION

Fig.1 IR sensor (amazon.in)

Fig.2 Arduino UNO (indiamart.com)
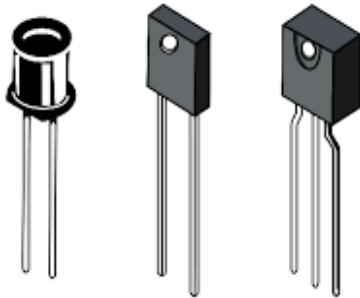

Fig.3 LED light [6]

Fig.4 Phototransistor
(https://instrumentationtools.com/)

Fig.5 NodeMCU (amazon.in)

The basic model of the Smart Street Light consist of an Arduino UNO R3 which is a microcontroller board established on the ATmega328P. It has 14 digital input/output pins, 6 analogue inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header, and a reset button. It comes with everything you need to support the microcontroller; all you have to do is connect the computer to the controller using a USB cable or power it with a AC-to-DC adapter or battery to get it runningand IR Sensor is an electronic component which is used to sense some characteristics from its surrounding by either emitting infrared radiations or detecting them. It can also measure heat and detect motion. Infrared radiations are invisible to human eyes.IR Sensors areconnected to breadboard according to the circuit diagram along with the LED Lights.

The IR Sensor along with LED are connected to Arduino where the input from the IR sensor is given to the analog input of the Arduino pin(A0-A5) and the output is given to the LED from Arduino pin(D0-D15).
The NodeMCU platform is a low-cost open source IoT platform. It originally included firmware that ran on Espressif Systems- ESP8266 Wi-Fi SoC and hardware that was based on the ESP-12 module.
Blynk Software is platform that help us to connect our model with IoT and Mobile App. The Blynk

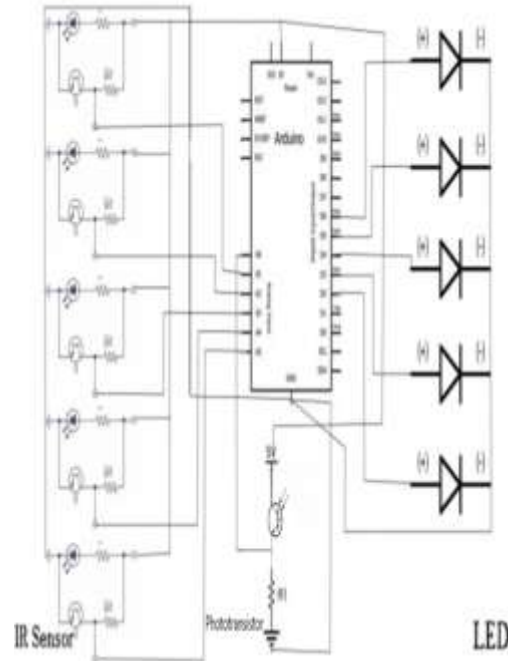App will control the Smart Street Light model through NodeMCU.

Fig. Circuit Diagram

VIII. FUTURE ENHANCEMENTS
Smart street lights can be used for surveillance purpose. i.e. the lights can be installed with cameras with inbuilt AI function which can identify car crash or any unethical activities happening in the surroundings.
Solar panels can be installed to power the street lights.
Piezoelectricity can be used to power the street lights on a foot path or running/jogging area (Piezoelectricity is the electric charge that acquire in certain solid materials in response to applied mechanical stress. So, when a person is walking or running on any piezoelectric generating surface then electrical energy can be produced).

IX. CONCLUSION
The existing system use halogen bulb which are not very eco-friendly and consume lot of power. The solution to energy conservation is to introduce a system that could sense brightness levels and moment in the environment and act accordingly, so that the intensity of street lights is not affected by seasonal changes. LEDs can also be used instead of HID lamps because they can be dimmed.Electricity theft and power loss is a major concern hence its detection is required in an easier and faster way.

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