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Advance Street Lighting System for Smart City

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Abstract: ***Recently, in the whole world, enormous electric energy is consumed by the street lights. These lights are automatically turn on when it becomes dark and automatically turn off when it becomes bright. This is the huge waste of energy in the whole world and should be controlled. Street lights in India consume approximately 20-40% of the electrical energy produced in the entirenation and the demand for electricity in recent years has increased day by day. In this paper, smart street light is introduced which is IoT based, it aims to automate the light system, also, LEDs are used to assures the low power consumption. The operation of this system is to maintain the intensity of streetlights to 40% of the maximum intensity if no vehicles passing through the road. Electricity theft problem is also address in this paper 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. Moreover, all these data are shared through IoT about and can be controlled and monitored by a mobile application.***

Keywords –Smart Street Light , IoT, Arduino Microcontroller, sensors.

1. INTRODUCTION

Street light systems are a major part of today's urbanization, about 80% of India's population uses the vehicle and hence streetlights area necessity of smart city. Existing streetlights have been seen as a major power consumption unit. So, to save electrical energy, smart street lights are exceedingly important. Many street lights still require manual monitoring, which can be a tedious task [1]. 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 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 [2]. 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.

2. BACKGROUND STUDY

Many papers with similar topics are taken as a suggestions and used for understanding smart streetlight, indicating that everything has its advantages and disadvantages and its own concepts and b the ories to make a streetlight smart by using different micro controller, 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,animalsandindividualsthathavefascinatingidentifiers(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

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detection, Energy wastage, disposal of in can descent 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 areusedwiththemicrocontrollerArduinoUNOtooperatethelightsautomaticallyduring rain, day and night to avoid manual labor leading to energy conservation and saving cost on manual labor.BasedonIntelligentStreet-LightSystemusingArduinoUNO[5]Arduinomicrocontrollerisusedalongwithlightdependentresistortocontrolthelight saccording 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.

3. EXISTING SYSTEM DRAWBACK

- In existing street light halogen 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 at edious task as well.
- Lightsturnon/offataclockcyclewhichleadstoelectricitywastagewhenthesunrisesearlyandsetslateduring summers.
- Lights are on even at the places where there is no need, leading to electricity wastage.
- Thereisnoeasyandfastwaytodetectfaultylightsortodetectelectricitytheftbesidesphysicalinception.

4. PROPOSED SYSTEM

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 proposedsystemaimstouseLEDsinplaceofconventionallyusedhalogenbulbsorHIDbulbs.Thisensures100%Automaton (inexceptiontoperiodic maintenance).

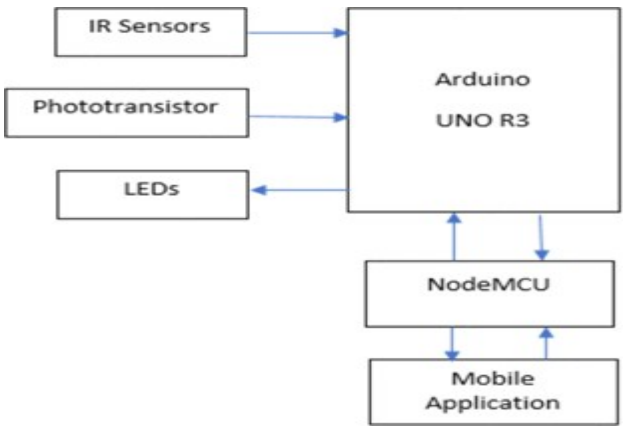

Figure-1: System Architecture

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5. PROPOSED CIRCUITCOMPONENTS AND ITS CIRCUIT

5.1 ARDUINOUNOR3:

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 are set button.It comes witheverythingyouneedtosupportthemicrocontroller;allyouhavetodoisconnectthecomputertothecontrollerusingaUSBcableorpoweritwitha AC-to-DC adapter or battery to get It running.

5.2 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.

5.3 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.

5.4 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 these miconductor's band gap determines the color of light(corresponding to the energy of photons).The use of white light is obtained .Multiples emiconductors or a layer of light-emitting phosphor on the semiconductor device are used to produce white light.

5.5 Node MCU:

TheNodeMCUplatformisalow-costopensourceIoTplatform.Itoriginallyincludedfirmware that ran on Espressif Systems- ESP8266 Wi-Fi SoC and hardware that was based ontheESP-12 module.
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Fig.2 IR sensor (amazon. In) **Fig.3** LED light

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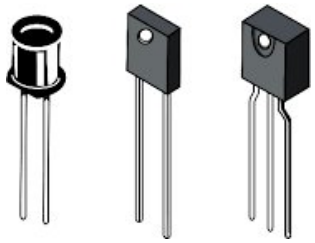


Fig.4 Photo transistor

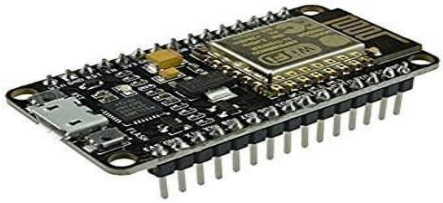
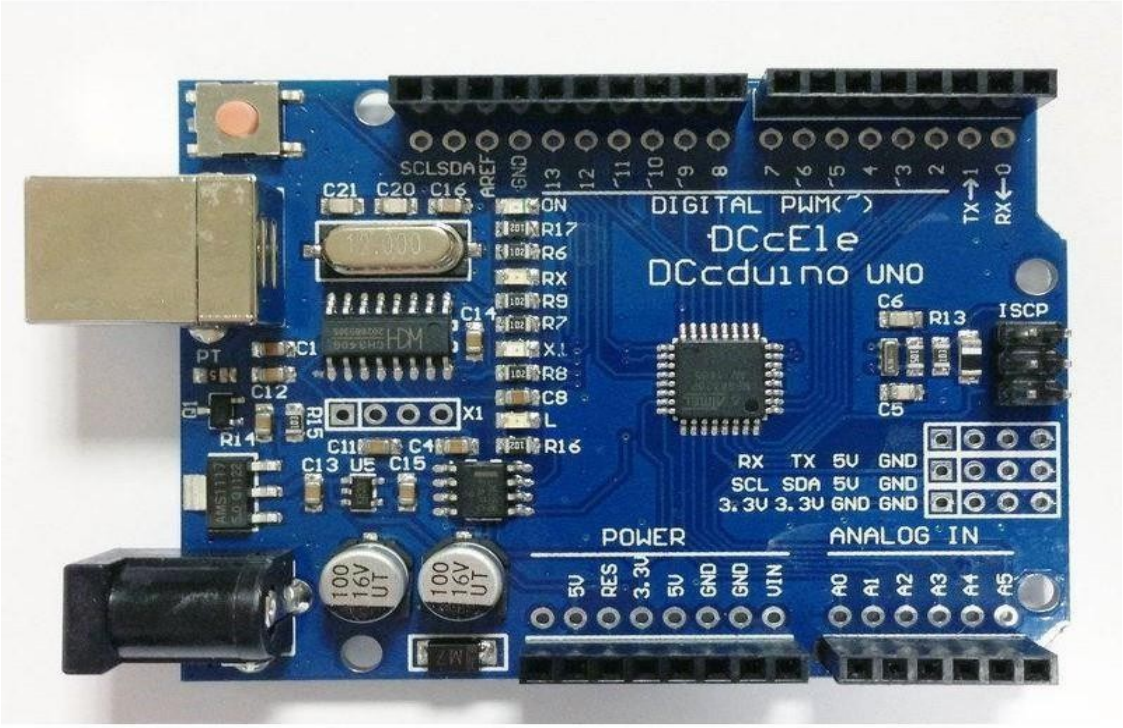


Fig.5 Node MCU



The basic model of the Smart Street Light consists of an Arduino UNO R3 which is a micro controller board established on the ATmega328P. It has 14 digital input/output pins, 6 analogue inputs, a 16 MH zceramic resonator(CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header, and are set button. It comes with everything you need to support the microcontroller; all you have to do is connect the computer to the controller

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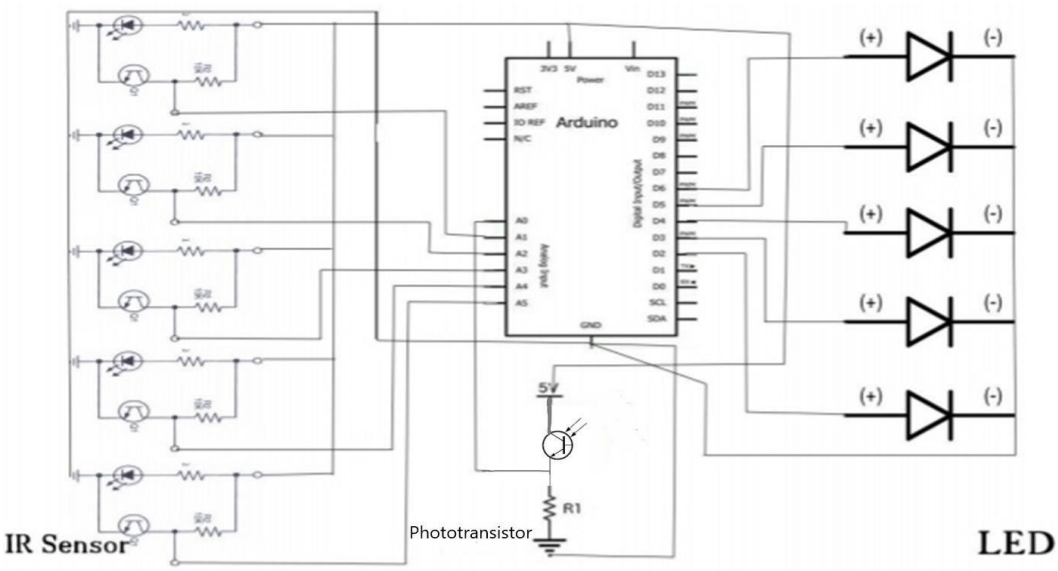
using a USB cable or power it with a AC-to-DC adapter or battery to get it running and IR Sensor is an electronic component which is used to sense some characteristics from its surrounding by either emitting infrared radiations or detecting them. It can also measure heat and detect motion. Infrared radiations are invisible to human eyes. IR Sensors are connected to breadboard according to the circuit diagram along with the LED Lights.

TheIRSensoralongwithLEDareconnectedtoArduinowheretheinputfromtheIRsensorisgivento the analog input of the Arduino pin(A0-A5) and the output is given to the LED from Arduino pin(D0-D15).

The Node MCU platform is a low-cost open source IoT platform. It originally included firmware thatranonEspressifSystems-ESP8266 Wi-Fi So C and hardware that was based ontheESP-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 Node MCU.



6. FUTURE ENHANCEMENTS

Smart street lights can be used for surveillance purpose. i.e. the lights can be installed with cameras with inbuilt AIfunctionwhichcanidentifycarcrashoranyunethicalactivitieshappeningInthesurroundings.Solarpanelscanbeinstalle dtopowerthestreet lights.
Piezoelectricitycanbeusedtopowerthestreetlightsonafootpathorrunning/joggingarea(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).

7. 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. LED scan also be used instead of HID lamps be cause they can be dimmed. Electricity the ft and power loss is a major concern hence its detection is required in an easier and faster way.

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