

**SMART STREET LIGHT MANAGEMENT USING IBM WATSON**

TEAM PHOENIX



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**PROBLEM STATEMENT:**

Manual and Automatic switching of street lights considering the intensity of sunlight, brightness control of light on detecting movement using LDR, Ultrasonic sensor, NodeRed and MIT app inventor.

**INTRODUCTION:**

Nowadays, street lighting systems in industries or cities are growing rapidly. The important considerations in the field of different technologies like electrical and electronics are cost effective, automation and power consumption. There are different street lighting systems are developed to maintain and control the lighting systems. These lighting systems are used to control and decrease energy consumption. This article illustrates the street light that glows on detecting vehicle movement. Street light controlling is one of the most developing system in India to conserve the energy.

Generally, street light controlling system is a simple concept which is used to turn lights ON in the night time and turn OFF during the day time. The entire process can be done by a using a sensor namely LDR (light dependent resistor). Nowadays conserving the energy is an essential part and day by day energy resources are getting decreased. So our next generations may face a lot of problems due to this lack of resources. This system doesn’t need a manual operation to turn ON/OFF the street lights. The street light system detects whether there is need of light or not.

**IMPLEMENTATION IDEA:**

Based on the intensity levels of sunlight we can change the intensity of the street lights from the User interface which is created in Node Red platform of IBM Watson services.

**Hardware used:**

Node MCU

LDR

LED

**Software used:**

Arduino IDE

Android Studio

IBM Watson Cloud Services

MIT App Inventor

**Highlights:**

Individual Control

Area Control

Dimming function

**What is ARDUINO IDE?**

The Arduino ecosystem is comprised of a diverse combination of hardware and software. The versatility of Arduino and its simple interface makes it a leading choice for a wide range of users around the world from hobbyists, designers, and artists to product prototypes.

The Arduino board is connected to a computer via USB, where it connects with the Arduino development environment (IDE). The user writes the Arduino code in the IDE, then uploads it to the microcontroller which executes the code, interacting with inputs and outputs such as sensors, motors, and lights.

The Arduino Integrated Development Environment (IDE) is the main text editing program used for Arduino programming. It is where you’ll be typing up your code before uploading it to the board you want to program.

**A screenshot of a social media post

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**ESP8266 NodeMCU :**

NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT product. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. It is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266.

A circuit board

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A screenshot of a cell phone

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**What is a Light Dependent Resistor (LDR) or a Photo Resistor?**

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photoconductive cells or simply photocells.

They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a LDR, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.

**Applications of LDR:**

LDR’s have low cost and simple structure. They are often used as light sensors. They are used when there is a need to detect absences or presences of light like in a camera light meter. Used in street lamps, alarm clock, burglar alarm circuits, light intensity meters, for counting the packages moving on a conveyor belt, etc.

A picture containing athletic game, sport, furniture

Description automatically generated

**What is an Ultrasonic Sensor?**

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves.

The sensor head emits an ultrasonic wave and receives the wave reflected from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternately. This enables miniaturization of the sensor head.

Distance L = 1/2 × T × C where L is the distance, T is the time between the emission and reception, and C is the sonic speed. (The value is multiplied by 1/2 because T is the time for go-and-return distance.)

A picture containing coffee, cup

Description automatically generatedA picture containing knife, weapon

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**IBM WATSON**

Watson is a question answering (QA) computing system that IBM built to apply advanced natural language processing, information retrieval, knowledge representation, automated reasoning, and machine learning technologies to the field of open domain question answering.

Watson uses IBM's DeepQA software and the Apache UIMA (Unstructured Information Management Architecture) framework implementation.

**NODE-RED**

Node-RED is a flow-based development tool for visual programming developed originally by IBM for wiring together hardware devices, APIs and online services as part of the Internet of Things.

Node-RED provides a web browser-based flow editor, which can be used to create JavaScript functions. Elements of applications can be saved or shared for re-use. The runtime is built on Node.js. The flows created in Node-RED are stored using JSON

A screenshot of a social media post

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**MIT APP INVENTOR**

App Inventor for Android is an open-source web application originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT), which allows newcomers to computer programming to create software applications for the Android operating system (OS).

It uses a graphical interface very similar to Scratch and the StarLogo TNG user interface, which allows users to drag-and-drop visual objects to create an application that can run on Android devices. In creating App Inventor, Google drew upon significant prior research in educational computing, as well as work done within Google on online development environments.

A screenshot of a cell phone

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As of May 2014, there were 87,000 weekly active users of the service and 1.9 million registered users in 195 countries for a total of 4.7 million apps built.

As December 2015, there were 140,000 weekly active users and 4 million registered users in 195 countries, run total of 12 million built applications.

**PROJECT APPROACH**

This project is used to detect the movement of a vehicle on highways or roads to turn ON the lights when the vehicle is ahead of the lights, and to turn OFF (reduce the intensity) of the glowing light when the vehicle passes away from the lights.

**WORKING**

In the beginning, the LDR sensor will sense the light intensity in the atmosphere at that time and consequently sends the data to Arduino. After receiving the data, Arduino will convert it into different discrete values from 0 to 1023 (In which 0 represents maximum darkness and 1023 represents maximum brightness) and then it will adjust the output voltage accordingly from 0 to 2.5v/5v (Dim/High) depending upon the received value (0-2023) by comparing with threshold value. So, the output will be 2.5v in the complete darkness (night time) if the received value is less than the threshold value. As a result, Dim LEDs will glow that is the half of maximum brightness and when there is completely shine (daytime), the received value will be higher than the threshold value, and the output voltage would be 0v resulting the LEDs to be entirely switched OFF.

Initially, the ultrasonic obstacle detection sensor will be HIGH. So, when there is no vehicle/obstacle in-front of the sensor, ultrasonic Transmitter does continuously transmit the EM rays. Whenever, a car or any other object blocks any of the ultrasonic sensors, then the emitted rays will reflect the echo after hitting the object, then microcontroller will sense it as a motion. In simple words, when any object passed in front of the first sensor ( trigger) , the corresponding LEDs will be turned from DIM to HIGH (5v) by the microcontroller. As the object moves forward and blocks the next sensor, the next LEDs will be turned to HIGH from DIM, and the LEDs from the previous set is switched to DIM from HIGH. The process continues this way for the entire obstacle detector sensors and LEDs. These kinds of application can be implemented in the headlights of vehicles, street lights, parking lights of hotels, malls and homes, and it can be very beneficial.

A close up of text on a white background

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**SCOPE OF THE PROJECT:**

Moving with the new & renewable energy sources, this system can be upgraded by replacing ordinary LED modules with the solar based LED modules. With utilizing the latest technology and advance sensors, we could serve the same purpose of automatically controlling the street lights much more effectively both by cost and manpower. The main objective of the project is to save the energy, and by doing so we would be able to lighten few more houses. This model could be implemented with few modifications as a source of revenue; as charging station for battery operated vehicles.