IoT Based Smart Street Light

Name: Himanshu Shekhar Das
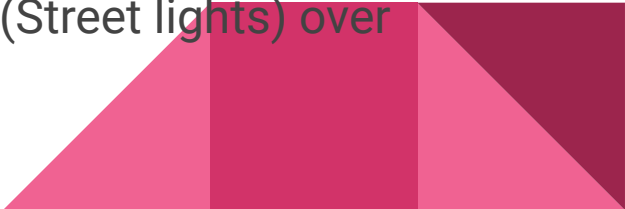Btech 3rd year ECE
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Introduction

Most of the places have automatic street light which can sense the daytime and nighttime, and automatically turns on and off according the night and day. Here we are extending this project by adding one more constraint to turn on the light that is Street light will only glow if there is darkness and someone is passing through the street. The main objective of this project is to reduce the power consumption by glowing the Street light only when it is needed. In this project we are demonstrating the prototype of the Smart Street Light with 3 IR sensors, 1 LDR sensor and 3 LEDs - each representing one street light. We will also update the LDR sensor data to the ThingSpeak and control the LEDs (Street lights) over internet from anywhere in the world.

Components Required

- ESP8266 NodeMCU

- Micro USB cable

- LEDs

- Jumper wires

- IR sensors

- LDR sensors

ESP8266 NodeMCU

ESP8266 NodeMCU is an open source IoT platform. It includes firmware which runs on the low cost Wi-Fi enabled ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. It has GPIO, SPI, I2C, ADC, PWM AND UART pins for communication and controlling other peripherals attached to it. On board NodeMCU has CP2102 IC which provides USB to TTL functionality.

Thingspeak

ThingSpeak™ is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.
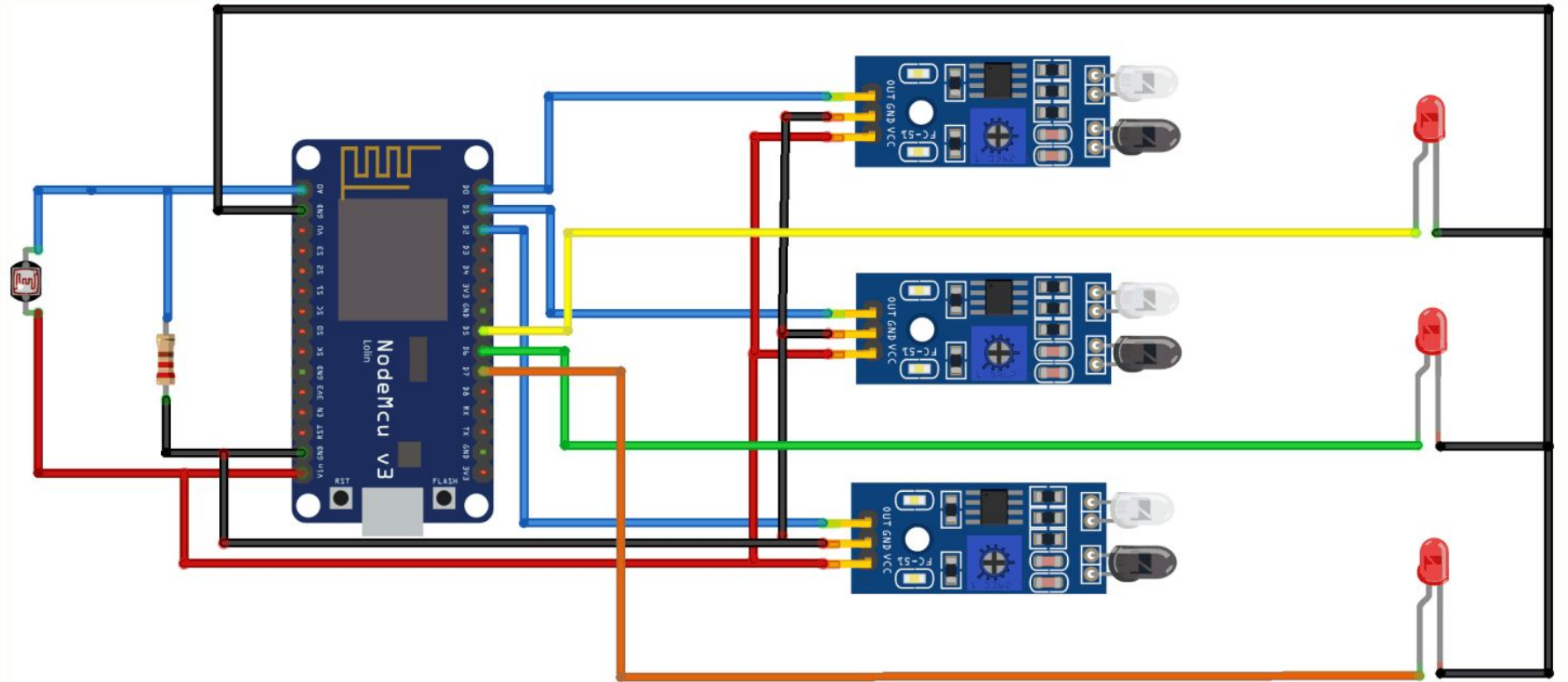
IR Sensor

IR sensor is an electronic device which is used to detect objects by sensing infrared radiations reflected from the objects. It mainly consists of a transmitter IR LED and a receiver photodiode. It detects infrared radiations which have wavelength from 700nm to 1mm. When a specific positive voltage is applied across the transmitter LED it transmits the IR rays. If these rays fall on some object then that object reflects back the IR rays which are received by the receiver photodiode. The receiver diode generates a voltage across its terminals which depend on the intensity of light reflected by the object. Generally IR receiver LED is darker (black) whereas transmitter is transparent in color.
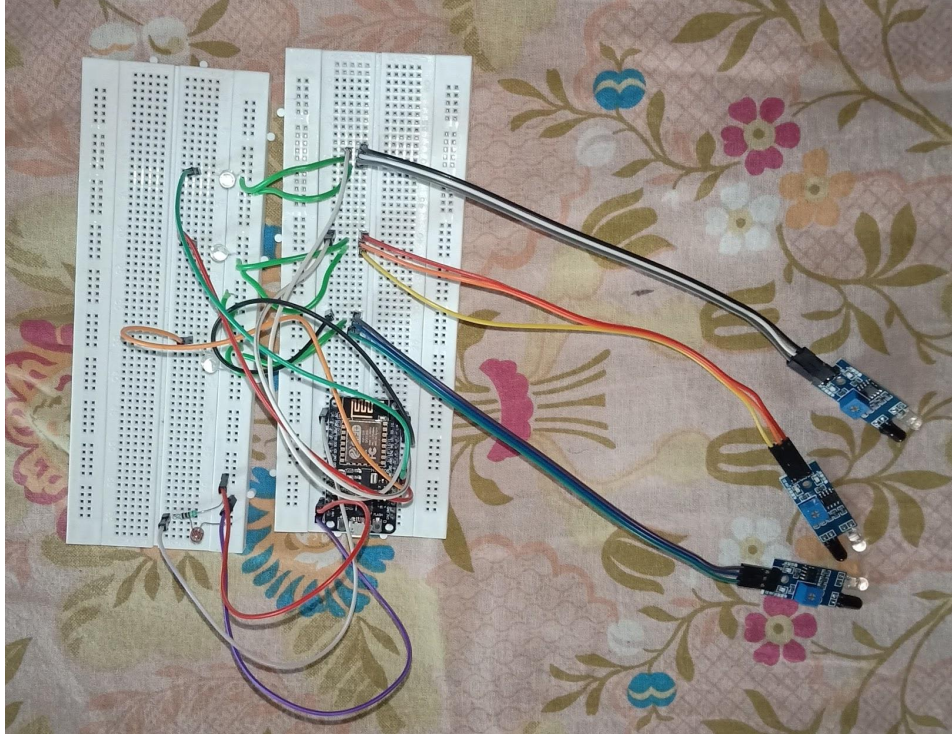
LDR Sensor

LDR stands for Light Dependent Resistor also known as photo-resistor. LDR is sensitive to light and its resistance changes according to the intensity of light falling on it. It is made up of high resistance semiconductor and its resistance increases in darkness and decreases in light. When light incident on the LDR exceeds some threshold, it absorbs the photons and allows electrons to jump into the conduction band. LDR generates a variable resistance which depends on the intensity of light falling on it. It is mainly used in electric circuits like street light, alarm clock, automatic brightness and contrast control etc.
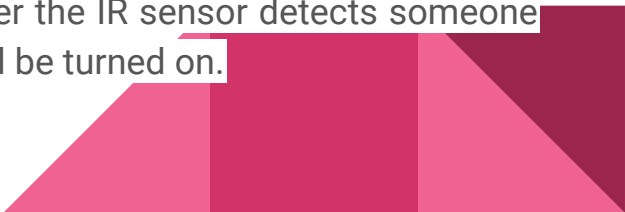
Circuit Diagram

Real Circuit on Breadboard

Working

Here the LDR sensor is used to detect whether it is daytime or night time. Since LDR sensor generates variable resistance based on the amount of light falling on it, it has to be connected like a potentiometer. One end of the LDR sensor is connected to 5V and other end is connected to fixed resistance which is further connected to ground. NodeMCU has one ADC pin (A0) which is connected to point between fixed resistance and one end of the LDR sensor as shown in the circuit diagram. Since the LDR sensor gives variable resistance therefore variable voltage will be generated at A0 according to the amount of light falling on LDR.

IR sensors are used to detect if someone is crossing the street or not. It detects the obstacle or motion in the surrounding. The transmitter will transmit IR rays which will be reflected back if it falls on some object like person, animal, vehicles, etc. The reflected ray will be received by receiver diode and hence will confirm the presence of object and the corresponding LED will be glowed. This method will save significant amount of electricity as the street light will only turns on if there is someone present in the Street. IR sensor has 3 pins, two of which are VCC and ground and one is output pin. The output of IR sensor gets high if detects presence of some object. This pin is connected to GPIO pin of NodeMCU so whenever the IR sensor detects someone passing through the street it triggers the Street light. In our case one LED will be turned on.

Monitoring from ThingSpeak server

References

https://iotdesignpro.com/projects/iot-based-smart-street-light-using-esp8266-and-thingspeak

https://thingspeak.com/channels/1256374

https://en.wikipedia.org/wiki/ESP8266

https://robu.in/ir-sensor-working/

https://en.wikipedia.org/wiki/Intelligent_street_lighting#:~:text=Intelligent%20street%20lighting%20refers%20to,brightens%20when%20movement%20is%20detected.