Micro Processors and Computer Architecture Lab

Project Report on

"Street light Automation with Energy Saving and GPS based Automatic Notification System"

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November 26, 2019

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Acknowledgement

We would like to express our heartfelt gratitude to our supervisor, Dr.PandiyarasanVeluswamy, Assistant Professor of department of electronics and communication engineering, IIITDM-Chennai, for laying the foundation for our thesis concept and providing his valuable insight and guidance at each and every step of the development process.

Additionally, we would like to thank Dr. Md. Khalilur Rahman, Arafa. Mohd. Anis, Hamidur Rahman, Jennifer Sherry Alam, Sohel Islam Nabil and Syed Mahmud Hasan for their work on Electronic Voting Machines, which served as a starting point and major reference source for our thesis. We extend this appreciation towards authors from various other sources who have provided all the relevant information in their work that has made the completion of this thesis possible.

Furthermore, we would like to thank our family and friends for their continued support and encouragement throughout. Without them, this would not have been made possible, as they have helped push us further and further to reach our desired destination.

Last, but not least, we would like to thank our peers who have lent their support, advice and much appreciated words of encouragement. Their valuable input and suggestions with respect to our thesis is thoroughly appreciated.

BONAFIDE CERTIFICATE

Certified that this project report ***"Street light Automation with Energy Saving and GPS based Automatic Notification System"*** is the bonafide work of "Ashwin Anjan, DVS Srikar, Ranjan Yadav" who carried out the project work under my supervision, guided under mentorship of Mr. Srinivasulu Jogi (PH.D. scholar).

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Content

BACKGROUND/ORIGIN/ROADMAP:

Due to the increase of environmental concerns, lighting control systems will play an important role in the reduction of energy consumption of the lighting without impeding comfort goals. As mentioned the energy is the singlemost important parameter toconsider when assessing the impacts of technical systems on the environment. Energy relatedemissions are responsiblefor approximately 80% of air emissionsand central to the most serious global environmental impacts and hazards, including climate change, acid deposition, smog and particulates. Lighting is often the largest electrical load in offices, but the cost of lighting energy consumption is low when compared to the personnel costs. Thus, its energy saving potential is often neglected. According to study global grid-based electricity consumption for lighting was about 2650 TW in 2005, which was an equivalent of 19% of total global electricity consumption. European office buildings dedicate about 50% of their electricity for lighting, whereas the share of electricity for lighting is around 20-30% in hospitals, 15% in factories, 10-15% in schools and 10% in residential buildings. Intelligent lighting control and energy management system is a perfect solution for energy saving, especially in public lighting management. It realizes remote on/off and dimming of lights, which can save energy by 40%, save lights maintenance costs by 50%, and prolong lamp life by 25%. The system application in streetlight control for each lamp will reduce in streetlight electricity and maintenance cost, and increase availability of street light.

- The current trend in engineering is to shift towards green engineering, ie products which are power efficient and are smart.
- Streetlights are one of the most common public usage lights, these are operated on a daily basis. This causes a lot of power wastage when they are used in places where no one is travelling.
- To address this issue, we first need to take into consideration when a street light is required to be turned on.
- The obvious answer is whenever a vehicle passes through that road. So we need a system set in place that identifies a moving object and responds by turning on the street lights around it.

- A good by product of this system is the fact that we now can easily track vehicular density around a particular area and can use this data to give notifications to users about traffic in an area.
- Another use of this notification system is that users can send emergency broadcasts in case of accidents.

ABSTRACT / INTRODUCTION:

The project is to designed detect vehicle movement on highways to switch ON only a block of street lights ahead of the vehicle, and to switch OFF the behind lights to save energy. During night all the lights on the highway remain ON for the vehicles, but lots of energy is wasted when there is no vehicle movement.

Smart Street light is an automated system which automates the street. The main aim of Smart Street light is to reduce the power consumption when there are no vehicle movements on the road. The Smart street light will glow with high intensity when there are vehicles on the road otherwise the lights will remain dim. With advancement of technology, things are becoming simpler and easier for everyone in the world today. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization, whereas mechanization provided human operators with machinery to assist the users with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Automation plays an increasingly important role in the world economy and in daily experience. Automatic systems are being preferred over manual system. The research work shows automatic control of streetlights as a result of which power is saved to an extent. The Smart street light provides a solution for energy saving which is achieved by sensing an approaching vehicle using the IR sensors and then switching ON a block of street lights ahead of the vehicle with high intensity. As the vehicle passes by, the trailing lights turn dim automatically. Thus, we save a lot of energy. So when there are no vehicles on the highway, then all the lights will remain dim.

Smart Street Lighting

Street lights are doing more than ever in today's smart cities. With digital networks and embedded sensors, they collect and transmit information that help cities monitor and respond to any circumstance, from traffic and air quality to crowds and noise. They can detect traffic congestion and track available parking spaces. Those very same networks can remotely control LED lights to turn on and off, flash, dim and more, offering cities a chance to

maximize low-energy lighting benefits while also improving pedestrian and bicyclist safety. With street lights creating a network canopy, those networks of data can be used by more than just lighting departments, empowering even schools and businesses via a lighting infrastructure that brightens the future of the digital city.

Smart lighting helps cities save energy, lower costs, reduce maintenance—all while better serving citizens and reducing energy use and CO2 emissions. Automation and networked control can further increase your energy savings and reduce maintenance spending. Networked street lighting built on a scalable platform can reduce crime up to 10% and make roadways safer through improved visibility. Leveraging intelligent control systems can rapidly increase lighting efficiencies and traffic management

The aim of our project is to create a power efficient solution to the problem of power wastage by street lighting.

- Street lights use up to 38% of the energy of a city, this mean inefficient street lighting results in a large amount of power being wasted. Our product will be able to save up to 70% of the power consumed.
- The tasks our product does are:
    - Turns the street lights ON around a moving object, it uses IR sensors to detect movements and responds accordingly. By turning on the closest street light in front of the vehicle.
    - It tracks the number of street lights turned ON in an area and uses this data to get information about traffic in that area. We can send this information to public display systems which are around the jammed area so that people can alter their routes accordingly.
    - In the case of an accident, the BLINK app can be used to generate an SOS signal which will be sent to the corresponding authorities in that area. This leads to early response from the concerned authorities.

LITERATURE SURVEYS:

S.Suganya et al [1] have proposed about Street Light Glow on detecting vehicle movement using sensor is a system that utilizes the latest technology for sources of light as LED lamps. It is also used to control the switching of street light automatically according to the light intensity to develop flow based dynamic control statistics using infrared detection technology and maintain wireless communication among lamppost and control terminal using ZigBee Wireless protocol. It also combines various technologies: a timer, a statistics of traffic flow magnitude, photodiodes, LED, power transistors.

K.Santha et al [2] have surveyed on Street Lighting System Based on Vehicle Movements. The system operates in the automatic mode which regulates the streetlight according to brightness and dimness algorithm and light intensity. The control can be made according to the seasonal variation. It includes a time cut-out function and an automatic control pattern for conserving more electricity. The whole project was implemented using a PIC microcontroller.

Srikanth et al [3] proposed a ZigBee based Remote Control Automatic Street Light System. The system is designed with the help of ZigBee modules that helps in detecting the faulty lights and control the light. It also discusses about an intelligent system that takes automatic decisions for ON/OFF/DIMMING considering the vehicle movement or pedestrian and also the surrounding environment. PIR motion sensor is used to detect movement of both living and non-living things.

M.Abhishek et al [4] have implemented design of traffic flow based street light control system with effective utilization of solar energy in the year 2015. They used the renewable source of energy i.e. the solar power for street lighting. They have also used 8052 series microcontroller and is developed by replacing the normal bulbs with the LEDs due to which the power consumption is reduced by 3 times. Sensors are placed on either side of the road which senses the vehicle movement and sends the commands to the microcontroller to switch ON and OFF the lights. Here all the street lights remain switched off and it glows only when it senses the vehicle movement. Hence, because of the microcontroller, even when its night the lights are switched off.

C.Bhuvaneshwari et al [5] have analysed the street light with auto tracking system by which one can increase the conversion efficiency of the solar power generation. Here, the sun tracking sensor is the sensing device which senses

the position of the sun time to time and gives the output to the amplifier based on light density of the sun. Sun tracking sensor is LDR, amplifier unit is used to amplify the LDR signals which converts low level signals to high level signals and the output is given to comparator. The LM324 IC is used as an amplifier. Comparator compares the signals and gives the command to AT89C51 microcontroller.

Steve Chadwick [6] reports on the two-installation case studied in Scotland and Wales and explains the details and benefits of the technology. The system was called as MINOS that had a track record of over 100,000 units installed and working successfully.

SomchaiHiranvarodom [7] describes a comparative analysis of photovoltaic (PV) street lighting system in three different lamps. Namely, a low-pressure sodium lamp, a high-pressure sodium lamp and a fluorescent lamp have been used for installation in each mast to determine the suitable system to install in a typical rural area of Thailand. All three systems have been mounted with the same module type and wattage in different places within the Rajamangala Institute of Technology, Thanyaburi district, Pathumthani province of Thailand. An operation of solar street lighting system can be divided into 2 period of time, namely, at 18.00-22.00 hours and 05.00-06.00 hours. The design of a control circuit was experimentally done in this work. The aim of this work is to determine the appropriate system to install in a typical rural area or a typical rural village of Thailand.

RadhiPriyasree [8] explains a system to reduce the power consumption of street lights by avoiding inefficient lighting which wastes significant financial resources each year. This is done by dimming the lights during less traffic hours. For this purpose, PIR sensor is used which detects any movement. This work also aims at reducing the fatal crashes and road accidents caused due to alcohol consumption. This is done using skin sensors placed in vehicle doors and also using breadth sensors inside the vehicle. By implementing this death rates due to drunk driving can be reduced to a great extent. The prototype has been implemented and works as expected and will prove to be very useful and will fulfil all the present constraints if implemented on a large scale. It also aims at detecting consumption of alcohol by the driver and if it exceeds certain level it impairs the driver from entering into the Vehicle. This prevents occurrence of accidents or any fatal crashes. This initiative will help the government to save this energy and meet the domestic and industrial needs.

From this literature survey, the methods each one has implemented and used is simple and easy to understand. These papers and journals has given many

ideas to further implement a much efficient system and make things automated. The presentations are simple and clean with all the necessary information needed for a basic learner or reader.

REFERENCES FOR EACH SURVEYS:

[1]S. Suganya, R. Sinduja, T. Sowmiya& S. Senthilkumar, Street light glow on detecting vehicle movement using sensor

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[3]. Srikanth M, Sudhakar K N,ZigBee Based Remote Control Automatic Street Light System

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[5]. C.Bhuvaneshwari, R.Rajeswari, C.Kalaiarasan, Analysis of Solar energy based street light with auto tracking system, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol 2, Issue 7, July 2013

[6]. Steve Chadwick, "Street Light Monitoring – a Practical Solution magazine" November/December 2002

[7]. "Intelligent Street Lighting System Using Gsm" International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726Volume 2 Issue 3 March. 2013

[8]. "Wireless internet lighting control system", Budike, E.S. Lothar (Power web Technologies), US patent 7,167,777, Jan 23, 2007.

CURRENT SCENARIO:

In recent days due to the fast development of industries and urban communities' connectivity, the road lighting frameworks are also developing quickly. The mechanization of effective utilization of power and cost reduction is important factor in the present day to day life. The different types of road light control frameworks are implemented to control and keep up complex road lighting systems. For controlling and diminishing energy utilization of a town's open lighting system, the effective systems are created. The current work is shows utilizing High intensity discharge (HID) lights. As of now, the HID is utilized for urban road light where power is not managed by any of the methods to reduced or switch off the lights during less density or unmanned areas. High intensity discharge lights are a kind of electrical gas release light which delivers light by methods for an electric circular segment between tungsten terminals fixed inside glassy or simple combined quartz (colourless glass made of almost pure silica or melded alumina curve tube). The gas and metal salts are loaded in tube. The gas excites the circular segment's underlying it. Once the circular segment is beginning, it warms and evaporates the metal salts forming plasma which enormously builds the force of light delivered by the curve and decreases its energy utilization. High force release lights are a sort of circular segment light.

FEW POINTS:

- **There have been a few cases of automated streetlights being implemented all around the world, primarily due to the fact that they lessen the power consumed.**
- **A good example of this is the city of San Diego where the government has installed smart street lights that monitor temperature, light and movement in order to light up only selective places and thus reducing the amount of electricity being used.**
- **Another example of why we need smart lights is our college, even though there are no people roaming around at night, all the streetlights are active. This causes a lot of power wastage that can be avoided.**

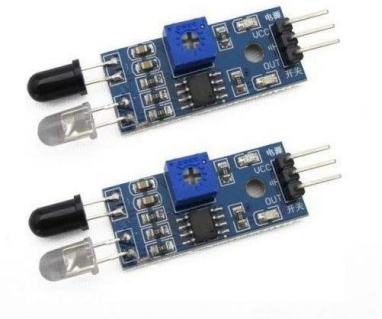
SAN-DIEGO'S EXAMPLE ON AUTOMATION IN STREET LIGHT USING SENSORS:

The city of San Diego, CA is currently deploying what is arguably the largest smart city and Internet of Things (IoT) project yet to be

undertaken globally by a municipality. Already the city has deployed 2000 smart nodes based on technology from Current, powered by GE and Intel, and the size of the network should double by mid-2019. Some of the software and applications might still be described as trials or prototypes, but the project is a full-fledged, city-wide deployment with the nodes mounted on selected LED street light poles upon which the city had previously installed solid-state lighting (SSL) with integrated wireless connectivity. The new smart nodes include cameras and other sensors, connected via high-speed cellular technology, that are capturing anonymized data which the city will use to better serve citizens and visitors. That data will also be available to organizations and businesses located in San Diego.

SENSORS & MICROCONTROLLERS:

1. Passive IR Sensor



A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

Operation:
A PIR sensor can detect changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a person, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection. Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well.

Features of IR Sensor Module: -

- When the module detects obstacles in front of the signal, the circuit board green indicator light level, while the OUT port continuous output low-level signals, the module detects a distance of 2 ~ 10cm, detection angle 35 °, the detection distance can be potential adjustment with adjustment potentiometer clockwise, the increase in detection distance; counter clockwise adjustment potentiometer, the detection distance decreased.

- The sensor active infrared reflection detection, target reflectivity and shape of the detection distance of the key. The black minimum detection range, white maximum; small area object distance is small, a

large area from the large.

- The sensor module output port OUT can be directly connected with the microcontroller IO port can also be driven directly to a 5V relay; Connection: VCC-VCC; GND-GND; OUT-IO.

- The comparator using LM393, stable.

- 3-5V DC power supply module can be used. When the power is turned on, the red power LED is lit.

- With the screw holes of 3mm, easy to install.

- Board size: 3.1CM * 1.5CM.

- Each module in the delivery has threshold comparator voltage adjustable via potentiometer, special circumstances, please do not adjust the potentiometer.

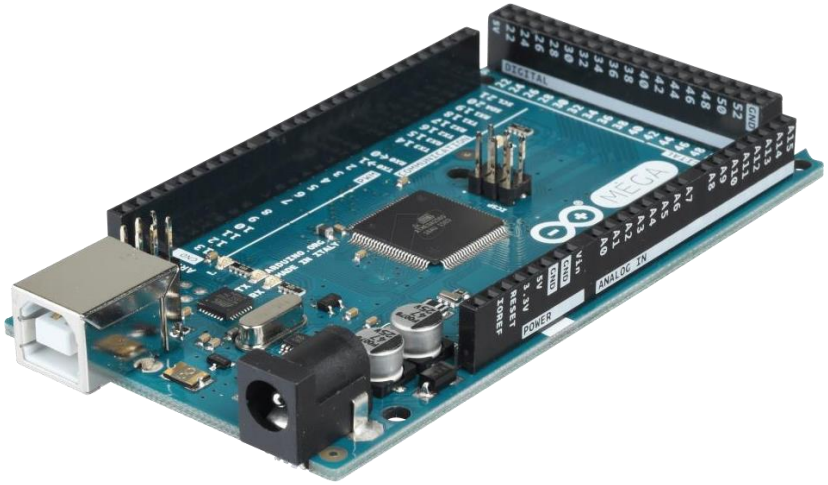
Interface(3-wire): -

- VCC external 3.3V-5V voltage (can be directly connected with the a 5v microcontroller and 3.3v microcontroller).

- GND external GND.

- OUT board digital output interface (0 and 1).

2. Arduino *Mega*



The Arduino Mega 2560 R3 is an open source precise microcontroller board Successor to the Arduino Mega based on the ATmega2560 SMD chip. The Mega 2560 R3 also adds SDA and SCL pins next to the AREF. In addition, there are two new pins placed near the RESET pin. One is the IOREF that allow the shields to adapt to the voltage provided from the board. The other is a not connected and is reserved for future purposes. The Mega 2560 R3 works with all existing shields but can adapt to new shields which use these additional pins.

This Board has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller. Using the board is also very easy, simply connect it to a computer with a USB cable or power it with DC adapter or battery to get started.

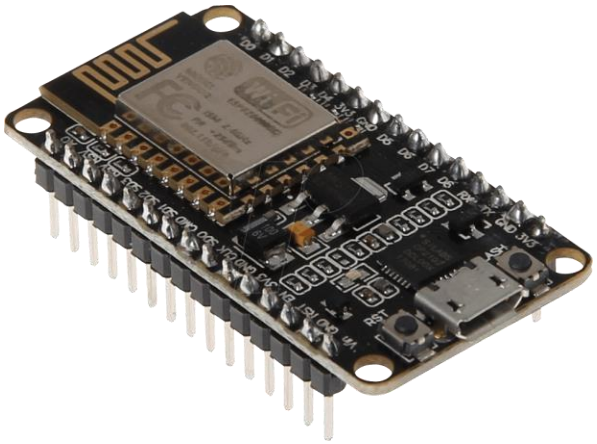
Specifications: -

- Microcontroller: ATmega2560
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 54 (of which 15 provide PWM output)
- Analog Input Pins: 16
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 256 KB of which 8 KB used by bootloader\
- SRAM: 8 KB
- EEPROM: 4 KB
- Clock Speed: 16 MHz

- USB Host Chip: MAX3421E
- Length:101.98mm/4.01in
- Width:53.63mm/2.11in
- Height:15.29mm/0.60in

3. ESP 8266 WIFI Module

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espressif system. It is mostly used for development of IoT (Internet of Things) embedded applications.



ESP8266-01 WIFI Module specifications: -

ESP8266 comes with capabilities of

- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2),
- general-purpose input/output (16 GPIO),
- Inter-Integrated Circuit (I^2C) serial communication protocol,
- analog-to-digital conversion (10-bit ADC)
- Serial Peripheral Interface (SPI) serial communication protocol,
- I^2S (Inter-IC Sound) interfaces with DMA (Direct Memory Access) (sharing pins with GPIO),

- UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and
- pulse-width modulation (PWM).

It employs a 32-bit RISC CPU based on the TensilicaXtensa L106 running at 80 MHz (or overclocked to 160 MHz). It has a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External flash memory can be accessed through SPI.

ESP8266 module is low cost standalone wireless transceiver that can be used for end-point IoT developments.

To communicate with the ESP8266 module, microcontroller needs to use set of AT commands. Microcontroller communicates with ESP8266-01 module using UART having specified Baud rate.

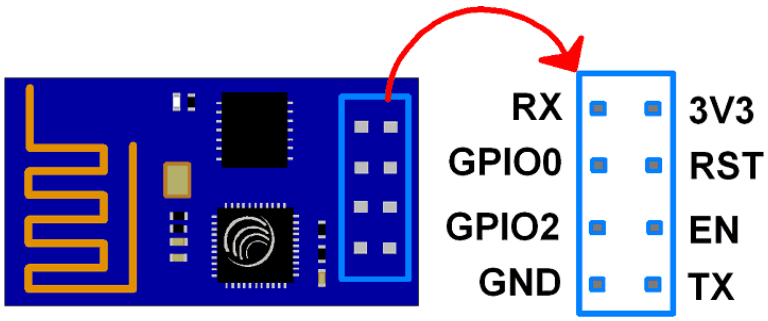
There are many third-party manufacturers that produce different modules based on this chip. So, the module comes with different pin availability options like,

- ESP-01 comes with 8 pins (2 GPIO pins) – PCB trace antenna. (shown in above figure)
- ESP-02 comes with 8 pins, (3 GPIO pins) – U-FL antenna connector.
- ESP-03 comes with 14 pins, (7 GPIO pins) – Ceramic antenna.
- ESP-04 comes with 14 pins, (7 GPIO pins) – No ant.

etc.

For example, below figure shows ESP-01 module pins

ESP8266-01 Module Pin Description



ESP8266-01 Module Pins

3V3: - 3.3 V Power Pin.

GND: - Ground Pin.

RST: - Active Low Reset Pin.

EN: - Active High Enable Pin.

TX: - Serial Transmit Pin of UART.

RX: - Serial Receive Pin of UART.

GPIO0 & GPIO2: - General Purpose I/O Pins. These pins decide what mode (boot or normal) the module starts up in. It also decides whether the TX/RX pins are used for Programming the module or for serial I/O purpose.

To program the module using UART, Connect GPIO0 to ground and GPIO2 to VCC or leave it open. To use UART for normal Serial I/O leave both the pins open (neither VCC nor Ground).

4. Light Emitting Diode

A light-emitting diode (LED) is a two-lead semiconductor light source. It is p-n junction diode that emits light when activated. The long terminal is positive and the short terminal is negative. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm2) and integrated optical components may be used to shape the radiation pattern.

LEDs are versatile semiconductor with a number of attributes which make them perfect for most applications. Their features include:

Long Life: LEDs can last over 100,000 hours (10+ years) if used at rated current No annoying flicker as we experience with fluorescent lamps. LEDs are impervious to heat, cold, shock and vibration.LEDs do not contain breakable glass. Solid-State, high shock and vibration resistant.Extremely fast turn on/off times low power consumption puts less load on the electrical systems increasing battery life. Here we have used the most common 5mm white light.

White LEDs are perfect for replacing inefficient incandescent bulbs in night lights and path lights.

SPECIFICATION:

Intensity: 28,500mcd ,ColourFreq: x=31 y=32 ,Viewing Angle: 48º ,Lens: Water Clear ,Voltage: 3.0v-3.3v ,Typical: 3.1v , Current: 20mA.

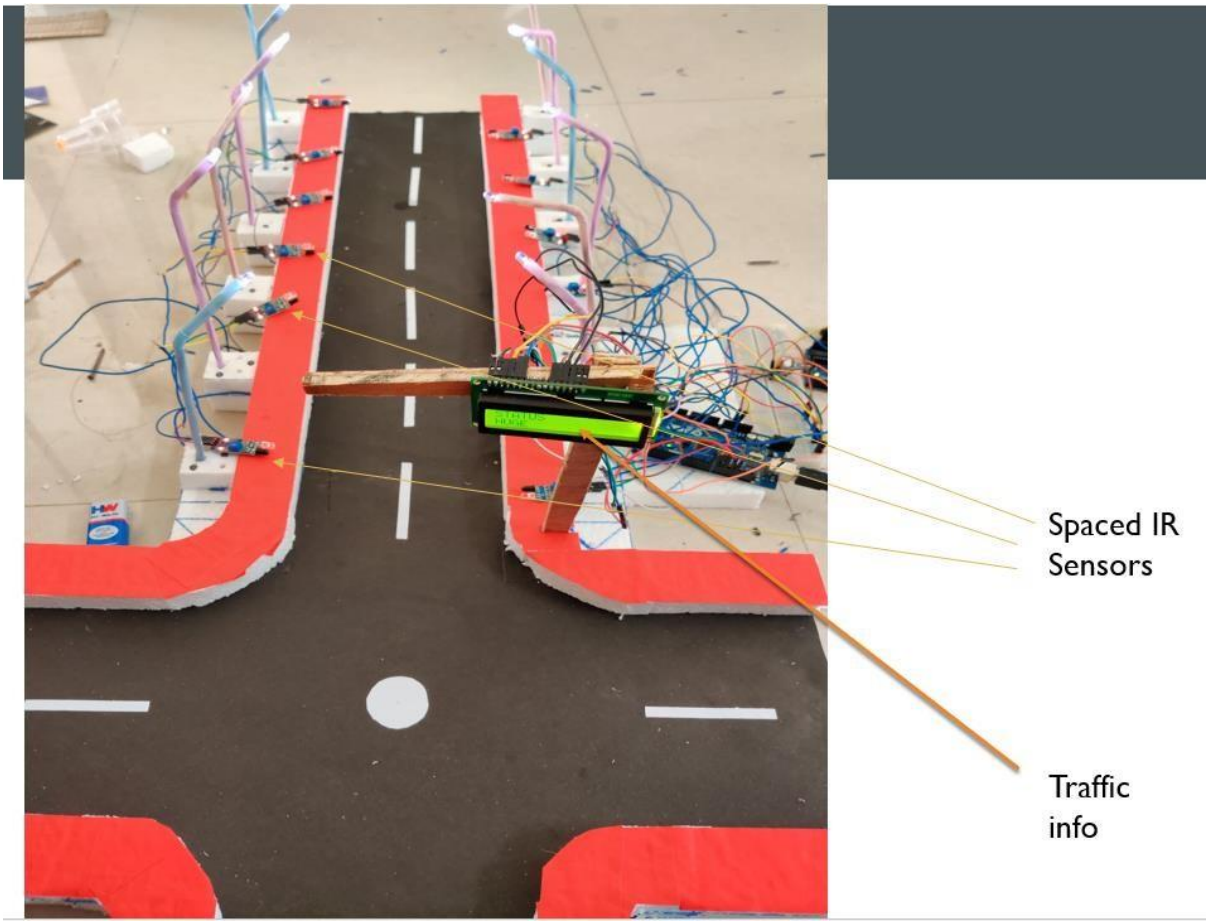
METHODOLOGY, WORKING PRINCIPLE, SCIENTIFIC REASONS:

- The system is largely based upon detection of moving obstacles by using IR sensors and then changing which lights are active based upon which sensor was tripped.
- The response times of IR sensors are very small, this makes the system near instantaneous in detecting a and responding.
- The streets will have IR sensors placed at distances, and each sensor will turn on the streetlights between itself and the next IR sensor and this process will continue.
- Depending upon how many sensors are active in a continuous line, simultaneously, we can judge the traffic conditions of that area. This information can be used to notify traffic at nearby junctions.
- An SOS system that uses the blynk app. This is used to notify the authorities that an accident has occurred.

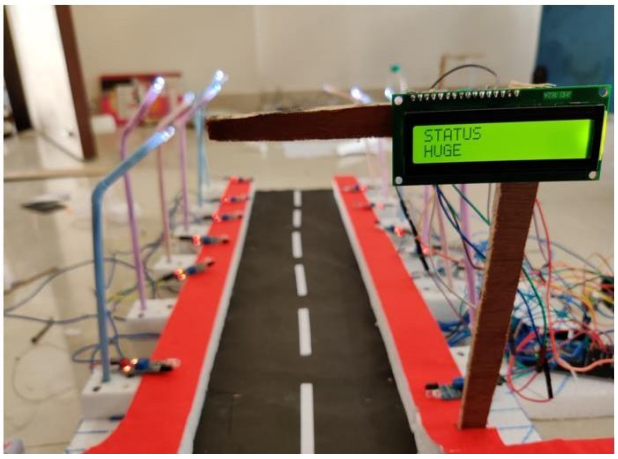
WORKING:

The highway model consists of LED's as street lights and pairs of photodiodes-IR diodes used as sensors. The IR diodes are placed on one side of the road and photodiodes are placed on the other side of the road, directly facing the IR diodes. Consider, when there is no vehicle on the highway. In this case, the IR radiation emitted from the IR diode directly falls on the photodiode which is exactly opposite to it. This causes the photodiode to fall in conduction state. This implies that photodiode conducts and current passes through it. The current passes through the photodiode and goes through the variable resistor. So, to summarize we can say that, when there is no vehicle on the highway, then all the inputs to the microcontroller port 1 is ZERO. Consider the case when a vehicle obstructs the IR radiation path. In this case, IR radiation is

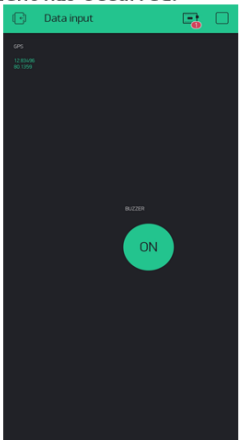
blocked and hence it does not fall on the photodiode. This in turn implies that photodiode doesn't conduct.



- Depending upon how many sensors are active in a continuous line, simultaneously, we can judge the traffic conditions of that area. This information can be used to notify traffic at nearby junctions.



- An SOS system that uses the blynk app. This is used to notify the authorities that an accident has occurred.
- There is a buzzer that indicates the emergency, and also sends out the gps location of the crash.



Code:

```
// include the library code:
#include <LiquidCrystal.h>

//const int rs = 48, en = 49, d4 = 50, d5 = 51, d6 = 52, d7 = 53;
LiquidCrystal lcd(13, 12, 10, 9, 8, 7);

//PIN DECLARATION IR SENSOR ON LEFT SIDE
int ir11=22;
int ir12=24;
int ir13=26;
int ir14=28;
int ir15=30;
int ir16=32;

//PIN DECLARATION OF IR SENSORS ON RIGHT SIDE
int ir21=23;
int ir22=25;
int ir23=27;
int ir24=29;
int ir25=31;
int ir26=33;

//PIN DECLARATION OF LEDs ON LEFT SIDE
int led11=34;
int led12=36;
int led13=38;
int led14=40;
int led15=42;
int led16=44;

//PIN DECLARATION OF LEDs ON RIGHT SIDE
int led21=35;
int led22=37;
int led23=39;
int led24=41;
int led25=43;
int led26=45;

//PIN DECLARATION OF SWITCHES
int sw11=6;
int sw21=6;


int traffic=0; //DECLARATION OF VARIABLE

void setup()
  {
//PIN MODE DECLARATION OF IR SENSORS ON LEFT SIDE
  pinMode(ir11,INPUT);
  pinMode(ir12,INPUT);
  pinMode(ir13,INPUT);
  pinMode(ir14,INPUT);
  pinMode(ir15,INPUT);
  pinMode(ir16,INPUT);

```

```
56: //PIN MODE DECLARATION OF IR SENSORS ON RIGHT SIDE
57:   pinMode(ir21,INPUT);
58:   pinMode(ir22,INPUT);
59:   pinMode(ir23,INPUT);
60:   pinMode(ir24,INPUT);
61:   pinMode(ir25,INPUT);
62:   pinMode(ir26,INPUT);
63:
64:  //PIN MODE DECLARATION OF SWITCHES
65:   pinMode(sw11,INPUT);
66:   pinMode(sw21,INPUT);
67:
68:  //PIN MODE DECLARATION OF LEDs ON LEFT SIDE
69:   pinMode(led11,OUTPUT);
70:   pinMode(led12,OUTPUT);
71:   pinMode(led13,OUTPUT);
72:   pinMode(led14,OUTPUT);
73:   pinMode(led15,OUTPUT);
74:   pinMode(led16,OUTPUT);
75:
76: //PIN MODE DECLARATION OF LEDs ON RIGHT SIDE
77:   pinMode(led21,OUTPUT);
78:   pinMode(led22,OUTPUT);
79:   pinMode(led23,OUTPUT);
80:   pinMode(led24,OUTPUT);
81:   pinMode(led25,OUTPUT);
82:   pinMode(led26,OUTPUT);
83:
84:   //initial state start
85:     digitalWrite(led11,0);
86:     digitalWrite(led12,0);
87:     digitalWrite(led13,0);
88:     digitalWrite(led14,0);
89:     digitalWrite(led15,0);
90:     digitalWrite(led16,0);
91:
92:     digitalWrite(led21,0);
93:     digitalWrite(led22,0);
94:     digitalWrite(led23,0);
95:     digitalWrite(led24,0);
96:     digitalWrite(led25,0);
97:     digitalWrite(led26,0);
98:   //intitial state end
99:
100:
101:  // set up the LCD's number of columns and rows:
102:  delay(3000);
103:   lcd.begin(16,2);
104:   // Print a message to the LCD.
105:   lcd.print
106:   ("STATUS");
107:   }
108:
109: void loop()
110: {
```

```
166:       if(digitalRead(ir15)==0)
167:         {
168:             if(digitalRead(ir14)==1)
169:             {
170:               digitalWrite(led14,0);
171:               digitalWrite(led15,1);
172:               digitalWrite(led16,1);
173:             }
174:             else if(digitalRead(ir14)==0)
175:             {
176:               digitalWrite(led14,1);
177:               digitalWrite(led15,1);
178:               digitalWrite(led16,1);
179:             }
180:         }
181:
182:       if(digitalRead(ir16)==0)
183:         {
184:              if(digitalRead(ir15) == 1)
185:             {
186:               digitalWrite(led15,0);
187:               digitalWrite(led16,1);
188:             }
189:             else if(digitalRead(ir15) == 0)
190:             {
191:               digitalWrite(led15,1);
192:               digitalWrite(led16,1);
193:             }
194:         }
195:
196:     ////street lignt code for left side end
197:
198:     //street lignt code for right side start
199:
200:       if(digitalRead(ir21)==0)
201:         {
202:           digitalWrite(led21,1);
203:           digitalWrite(led22,1);
204:         }
205:
206:       if(digitalRead(ir22)==0)
207:         {
208:               if(digitalRead(ir21)==0)
209:             {
210:               digitalWrite(led21,1);
211:               digitalWrite(led22,1);
212:               digitalWrite(led23,1);
213:             }
214:             else if(digitalRead(ir21) == 1)
215:             {
216:               digitalWrite(led21,0);
217:               digitalWrite(led22,1);
218:               digitalWrite(led23,1);
219:             }
220:         }
```

```
221:
222:       if(digitalRead(ir23)==0)
223:         {
224:               if(digitalRead(ir22) == 1)
225:               {
226:               digitalWrite(led22,0);
227:               digitalWrite(led23,1);
228:               digitalWrite(led24,1);
229:             }
230:             else if(digitalRead(ir22) == 0)
231:             {
232:               digitalWrite(led22,1);
233:               digitalWrite(led23,1);
234:               digitalWrite(led24,1);
235:               }
236:         }
237:
238:       if(digitalRead(ir24)==0)
239:         {
240:               if(digitalRead(ir23) == 1)
241:               {
242:               digitalWrite(led23,0);
243:               digitalWrite(led24,1);
244:               digitalWrite(led25,1);
245:               }
246:               else if(digitalRead(ir23) == 0)
247:               {
248:               digitalWrite(led23,1);
249:               digitalWrite(led24,1);
250:               digitalWrite(led25,1);
251:               }
252:         }
253:       if(digitalRead(ir25)==0)
254:         {
255:             if(digitalRead(ir24)==1)
256:             {
257:               digitalWrite(led24,0);
258:               digitalWrite(led25,1);
259:               digitalWrite(led26,1);
260:             }
261:             else if(digitalRead(ir24)==0)
262:             {
263:               digitalWrite(led24,1);
264:               digitalWrite(led25,1);
265:               digitalWrite(led26,1);
266:             }
267:         }
268:
269:       if(digitalRead(ir26)==0)
270:         {
271:              if(digitalRead(ir25) == 1)
272:              {
273:               digitalWrite(led25,0);
274:               digitalWrite(led26,1);
275:             }
```

```
276:            else if(digitalRead(ir25) == 0)
277:            {
278:              digitalWrite(led25,1);
279:              digitalWrite(led26,1);
280:            }
281:        }
282:
283:    //street lignt code for right side end
284:
285:    // individual light control start
286:    //at ir sensor positon 4
287:      if(digitalRead(sw11)==1)
288:        {
289:          digitalWrite(led14,0);
290:          delay(1000);
291:        }
292:
293:
294:      if(digitalRead(sw21)==1)
295:        {
296:          digitalWrite(led24,0);
297:          delay(1000);
298:        }
299:    //// individual light control start
300:
301:
302:      //trafic jam status code start
303:      if(digitalRead(ir11)==0)
304:        {
305:          traffic=traffic+1;
306:        }
307:      if(digitalRead(ir12)==0)
308:        {
309:          traffic=traffic+1;
310:        }
311:      if(digitalRead(ir13)==0)
312:        {
313:          traffic=traffic+1;
314:        }
315:      if(digitalRead(ir14)==0)
316:        {
317:          traffic=traffic+1;
318:        }
319:        if(digitalRead(ir15)==0)
320:        {
321:          traffic=traffic+1;
322:        }
323:      if(digitalRead(ir16)==0)
324:        {
325:          traffic=traffic+1;
326:        }
327:
328:      //notification code end
329:      if(traffic==1 || traffic==2)
330:      {
```

```
331:        lcd.setCursor(0, 1);
332:        delay(1000);
333:        lcd.print("LOW JAM");
334:        }
335:        if(traffic==3 || traffic==4)
336:        {
337:          lcd.setCursor(0, 1);
338:        delay(1000);
339:          lcd.print("MED JAM");
340:
341:        }
342:        if(traffic==5 || traffic==6)
343:        {
344:        lcd.setCursor(0, 1);
345:        delay(1000);
346:        lcd.print("BIG JAM");
347:        }
348:        traffic=0;
349:        //trafic jam status code end
350: }
351:
352:
353:
```

RESULT:

- It is quite clear in the context of today's world that reducing power emissions is the way to go. This helps to cut down the cost of running a product and also makes the environment cleaner.
- The output of our product would be a lighting system that would ensure no additional power is used. The only lights active would be where there is traffic. The traffic notification system would help people avoid potential jams.
- The GPS location system would help people in distress, as the notified authorities would be able to quickly identify the location of the distress signal.
- In practical implementation we can expect to see a large reduction in power used, especially in India as we are a country with a very large road and highways system.

Application and Advantages:

- The street light control circuit can be used in normal roads, highways, express ways etc.
- The project can also be used in parking areas of malls, hotels, industrial lighting, etc.
- If the lighting system implements all LED lights, the cost of the maintenance can be reduced as the life span and durability of LEDs is higher than Neon based lights which are normally used as street lights.
- As the lights are automatically turned ON or OFF, huge amount of energy can be saved.
- This system less costly, less installation and maintenance cost and more efficient as compared to the others system.

CONCLUSION:

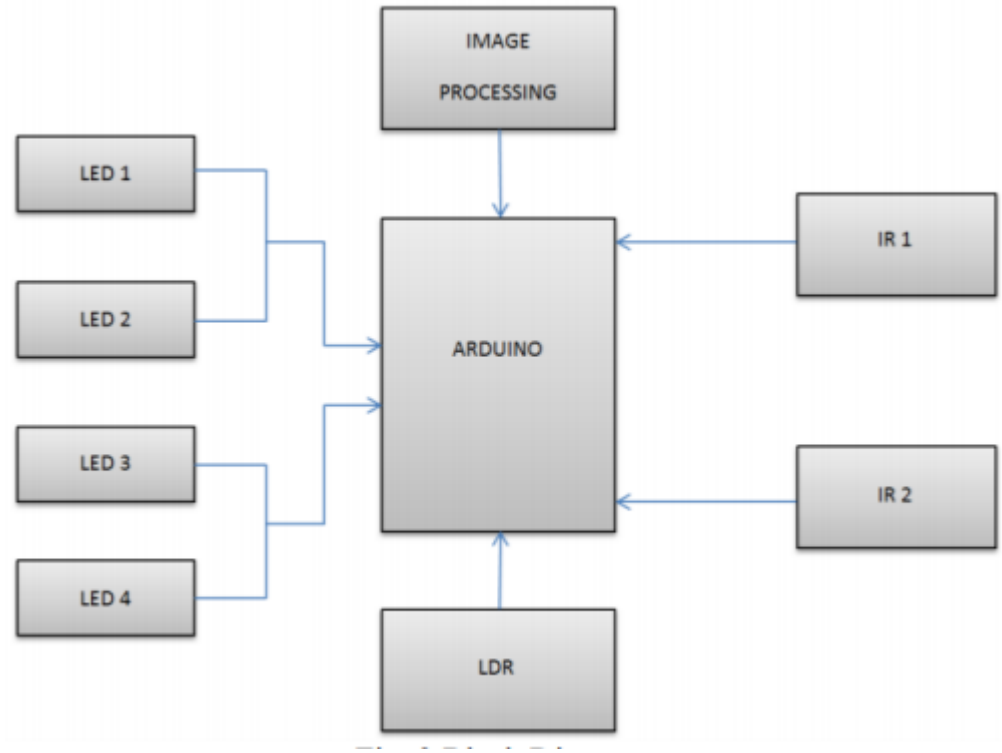
The street light has been successfully controlled by microcontroller. With commands from the controller the lights will be ON in the places of the movement when it's dark. The system automates the street light, helps to save a significant amount of power. This helps the organisations to save resources and money. This can be utilized in other areas for improvement and development. This control circuit can be used in long roadways between the cities. In future this system can be used for security and traffic monitoring purpose as it takes input from a camera. This system can also report street light failure, which make the repair of street light easier and less effort is required.

FUTURE ENHANCEMENT:

- There are several prospective technologies that can be used to improve and build upon on the basic design offered by this product.
- Improvements in solar panel efficiency, low-power high-capacity sensors, and improvement in image processing and detection will help us make the system even more efficient. These improvements will help us identify humans and animals separately from cars and vehicles and use this to make cases of when to turn the street lights ON or OFF.

- Traffic detection algorithms can be improved further to pre-emptively detect traffic jams based upon previous data and then reroute traffic accordingly.
- The SOS feature can be further improved to automatically detect crashes based upon impact or velocity changes and react automatically and inform the nearest hospital.

BLOCK DIAGRAM FOR IMAGE PROCESSING:



The above disadvantages can be overcome by using other sensor which can differentiate between objects and animals. Pole damage detection with the addition of suitable sensor. If the system has traffic speed sensors then this information could be used to manage traffic speed via dimming of the street lights. If the average traffic speed is too fast during evening and night hours, this could be used trigger slight dimming of the street lights. The level of dimming would be imperceptible to motorists but they would slow down, regardless, in response to the slightly diminished lighting. With the added intelligence in the lamp, you can add further feature to increase HID lamp life, such as softer start-up and protection against reigniting an already hot HID lamp, since this shortens the lamp life.

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