ZONE LIGHTING SYSTEM

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Flow of Presentation

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Introduction

- A Zone Lighting System is an intelligent zone lighting control system that has to light up at the right time and function seamlessly.

- The aim is to design a system that can be installed along a hallway or corridor which lights up the series of light fixtures as the user passes by.

Motivation

- It is aimed at being used in homes and big institutions where lights are often left turned on when not in use.

- Currently, in the whole world, enormous electric energy is consumed by the street lamps, which are turned on when it becomes dark and turned off when it becomes bright. This is the huge waste of energy in the whole world and should be changed. [1]

Objective

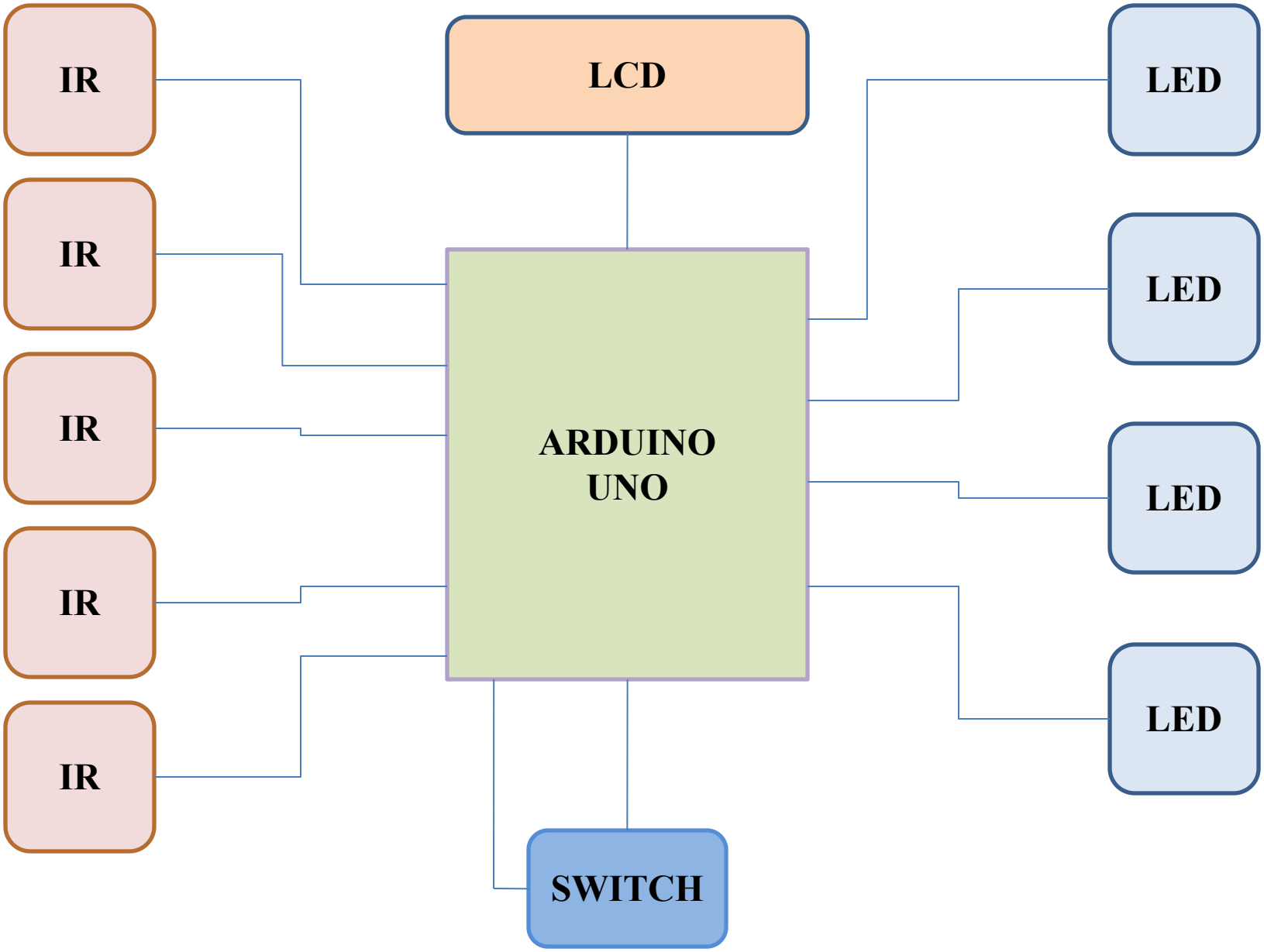
- The project is about making a hallway light control according to the modes mentioned below:

  - Mode 1: Not more than 2 LEDs are ON at a time.
  - Mode 2: All LEDs are ON until the last sensor is triggered and then, all turn OFF one by one.
  - Mode 3: All LEDs are turned ON slowly once the first sensor is triggered and all are turned OFF after last sensor is triggered (PWM dimming).

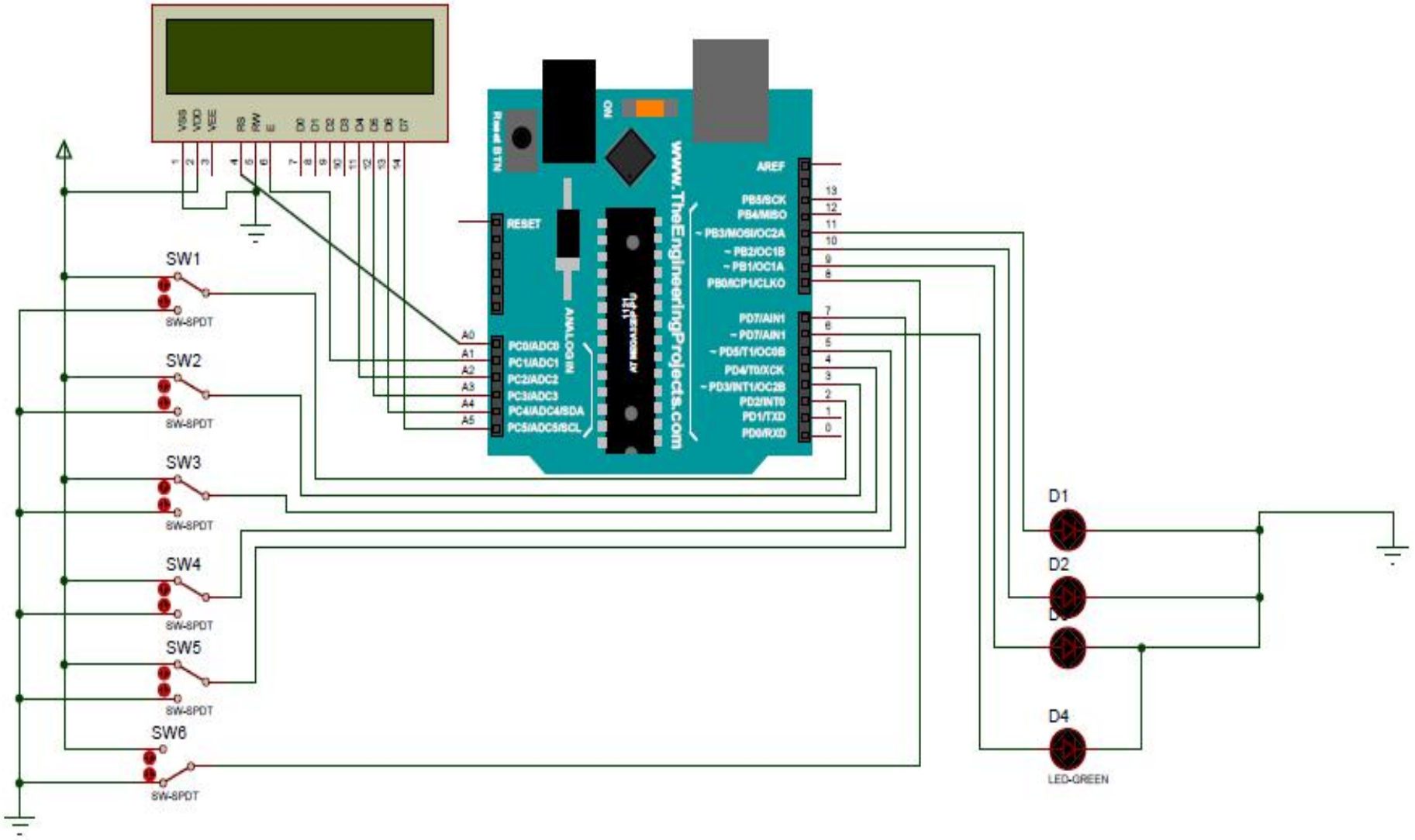
Literature Review

- Shagun Malhotra, Vivek Kumar, describes an energy efficient approach of smart street lighting system, which can automatically control the switching and intensity of street lights based on surrounding light intensity, using Light Dependent Resistor (LDR), Light Emitting Diode (LED), Microcontroller, Passive Infra Red (PIR) sensors. [2]

Block Diagram



Circuit Diagram



Hardware / Software Requirements

Hardware

- Arduino UNO
- LCD
- IR Sensors
- LED
- Potentiometer
- SPDT Switch

Software

- Arduino IDE
- Proteus

Hardware specifications

- Arduino Uno:

Pin Category	Pin Name	Detail
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	RESET	Resets the microcontroller.
Analog pins	A0 - A5	Used to provide analog input in the range of 0-5V.
Input/Output pins	Digital pins 0 - 13	Can be used as input or output pins.
Serial	0 (Rx), 1 (Tx)	Used to receive and transmit TTL serial data.

Pin Category	Pin Name	Detail
External Interrupt	2 , 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

➢ 16x2 LCD:

Pin Number	Pin Name	Detail
1	Ground	Ground (0V)
2	Vcc	Supply voltage; 5V (4.7V – 5.3V)
3	V_{EE}	Contrast adjustment; through a variable resistor.
4	Register select	Selects command register when low; and data register when high..
5	Read/Write	Low to write to the register; High to read from the register.
6	Enable	Sends data to data pins when a high to low pulse is given.
7 - 14	DB0 – DB7	8-bit data pins.
15	Led+	Backlight V_{CC} (5V)
16	Led-	Backlight Ground (0V)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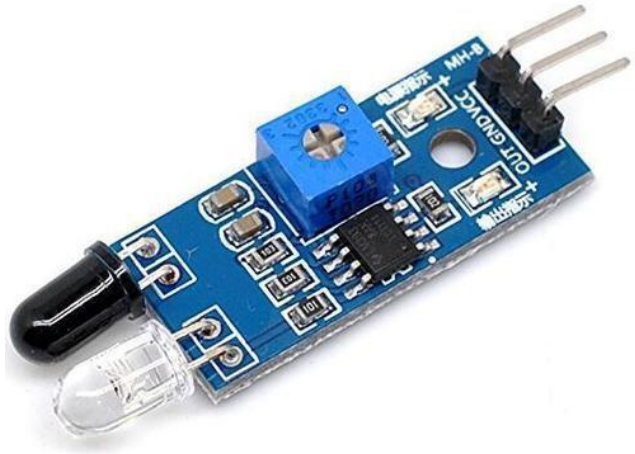
ABCDEFGHIJKLMNOP
abcdefghijklmnop

➢ IR Sensors:

1.	Operating Voltage	3.0V – 5.0V
2.	Detection range	2cm – 30cm (Adjustable using potentiometer)
3.	Current Consumption	At 3.3V : ~23 mA,at 5.0V: ~43 mA
4.	Active output level	Outputs Low logic level when obstacle is detected
5.	Obstacle Detection	On board Obstacle Detection LED indicator



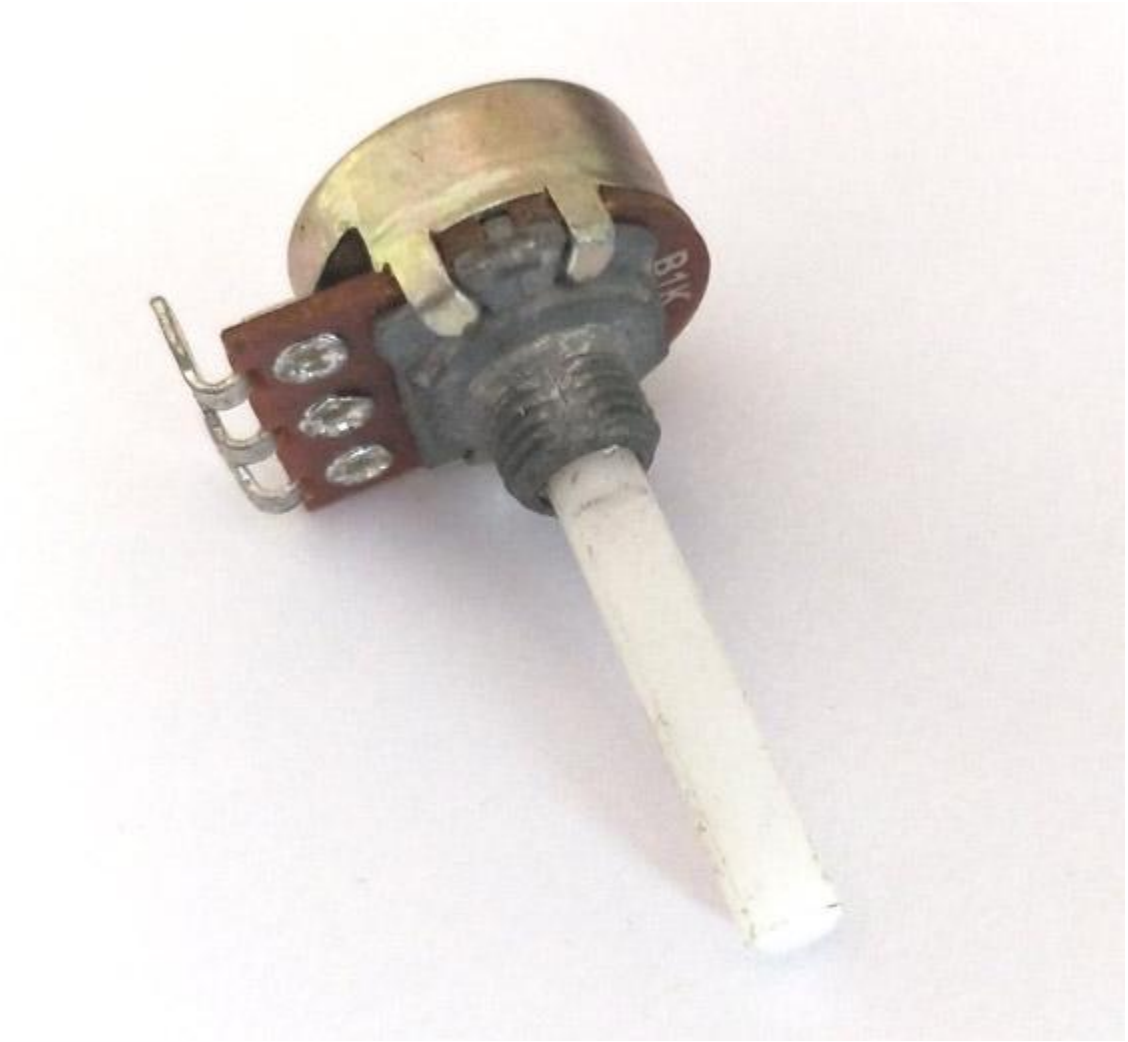
➢ LED:

Intensity	17,000mcd
Colour Frequency	x=31 y=32
Viewing angle	30^{o}
Lens	Water Clear
Voltage	2.9V – 5V
Current	20mA

➢ Potentiometer:

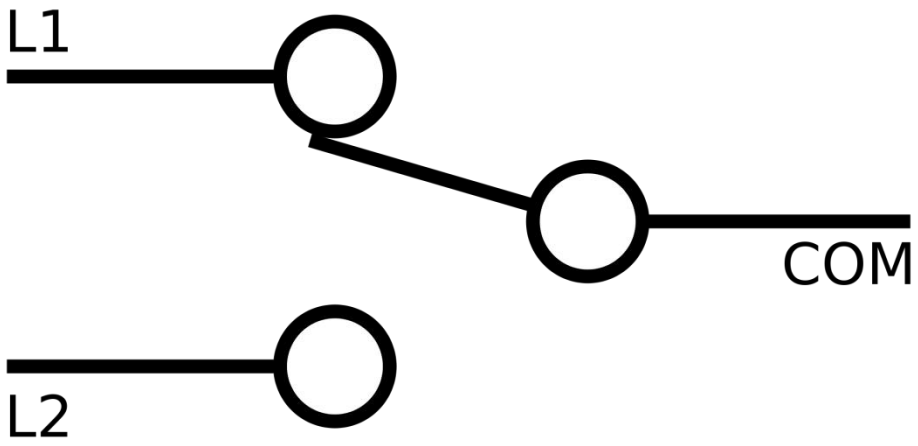
Pin Number	Pin Name	Description
1	Fixed End	This end is connected to one end of the resistive track.
2	Variable End	This end is connected to the wiper, to provide variable voltage.
3	Fixed End	This end is connected to another end of the resistive track

- Type: Rotary a.k.a Radio POT
- Resistance values: 00Ω, 1K, 2K, 5K, 10K, 22K, 47K, 50K, 100K, 220K, 470K, 500K, 1 M.
- Power Rating: 0.3W
- Maximum Input Voltage: 200Vdc
- Rotational Life: 2000K cycles


B1K

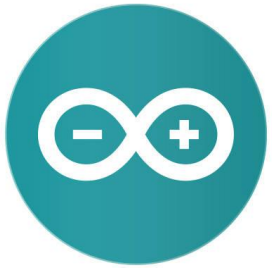
➢ Single Pole Double Throw (SPDT) switch:

Wideband	DC to 1 GHz
Low through loss	1 dB typical at 200 MHz
Unused input	Terminated internally in 50 ohm
Excellent Overload capability	1 dB gain compression point +18 dBm at 300 MHz
Low DC Power	170 uA from 5 V supply
Fast Switching	20 ns typical
Good Isolation	off channel isolation 60 dB at 100 MHz
Low Distortion	IP3 intercept +33 dBm
Directive operation	Bidirectional operation

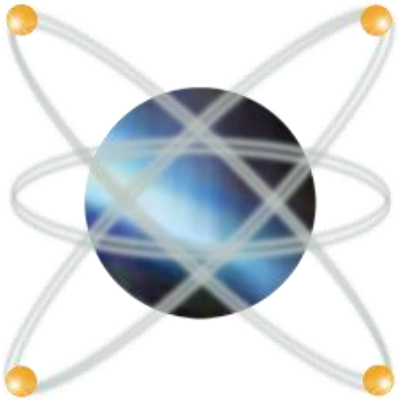

L1
COM
L2

Software Specifications

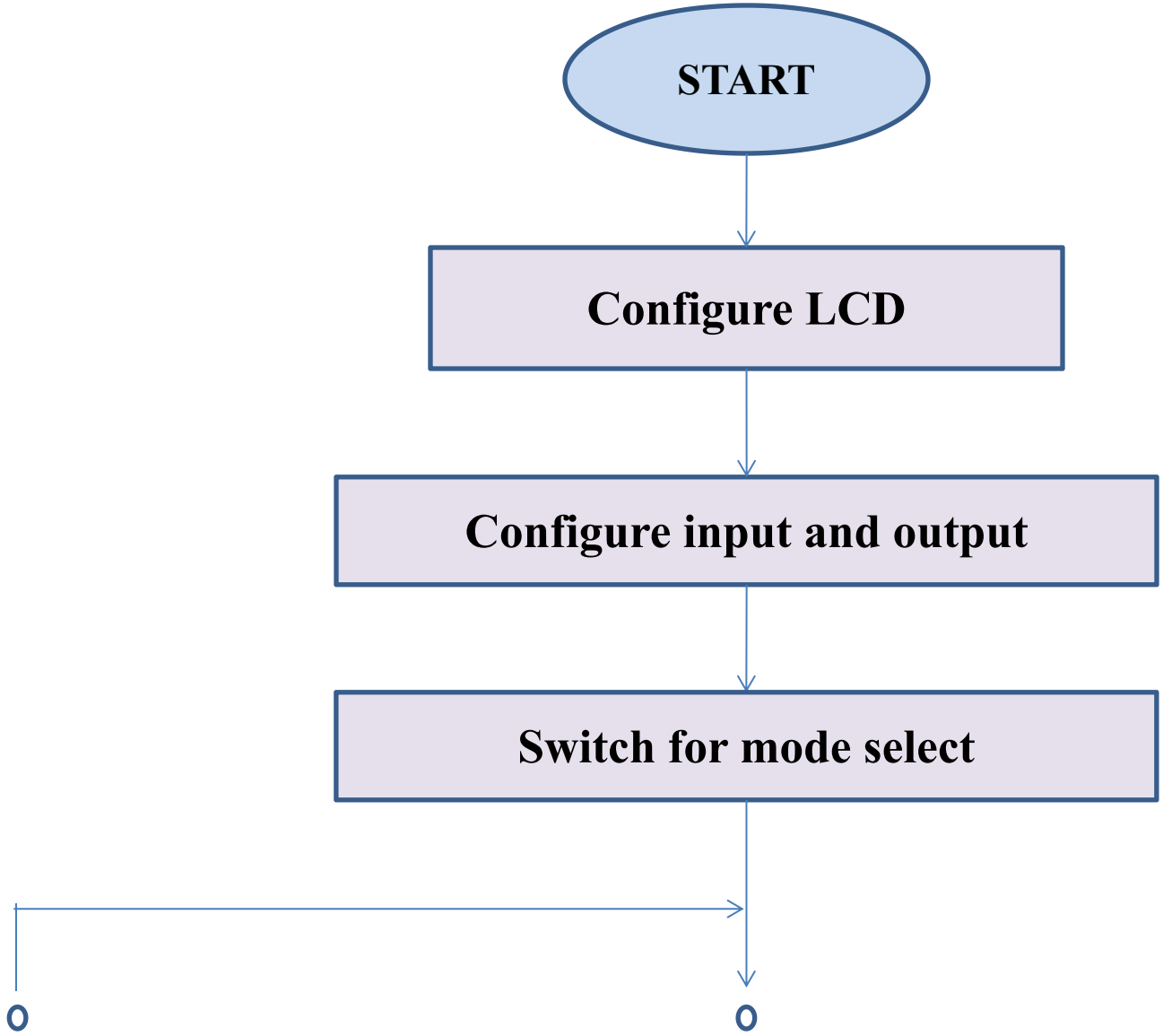
- Arduino IDE 1.8.6

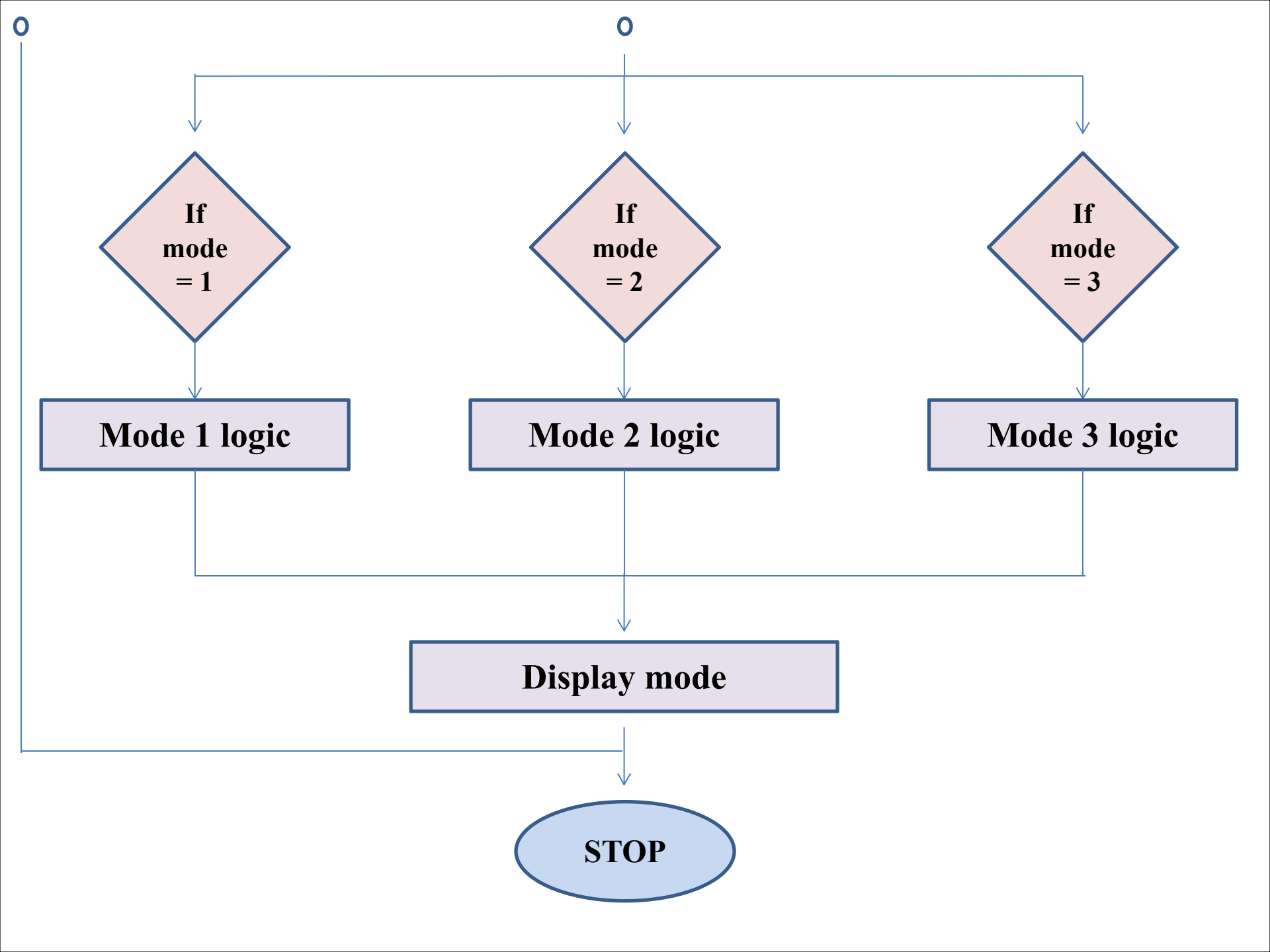


- Proteus Release 8.0 SPO (build 15417)



Flowchart


START
Configure LCD
Configure input and output
Switch for mode select

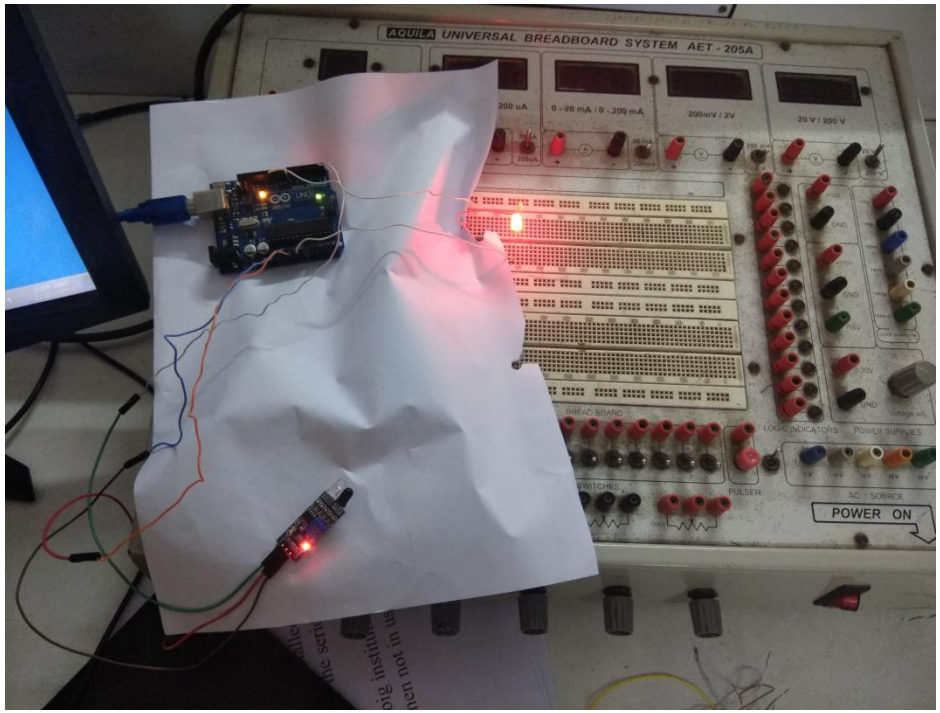

If mode = 1
If mode = 2
If mode = 3
Mode 1 logic
Mode 2 logic
Mode 3 logic
Display mode
STOP

Work Done

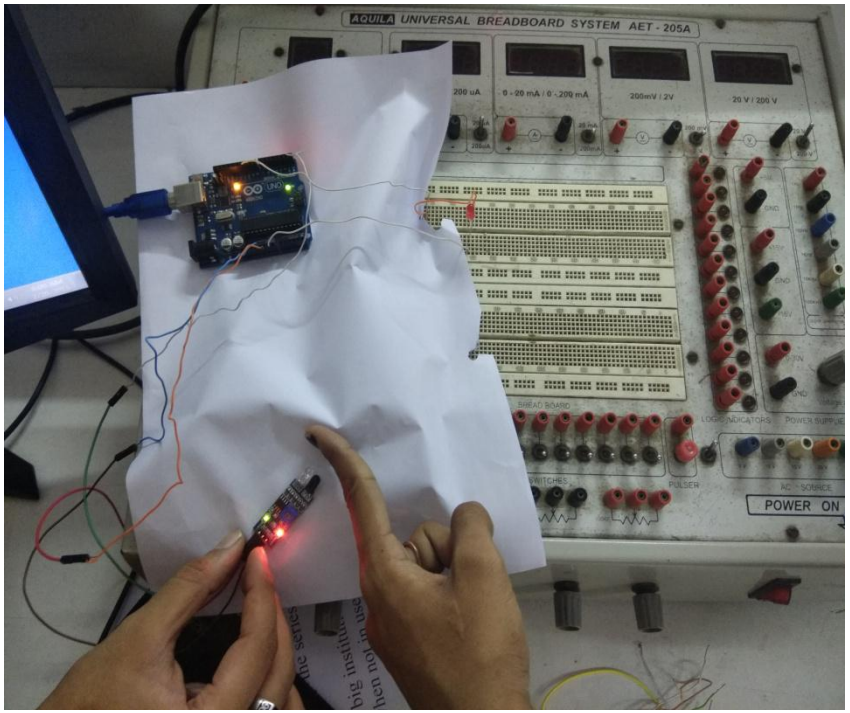
- ✓ Completion of Arduino code. (By Parantap)
- ✓ Implementing circuit on Proteus. (By Riya & Urvashi)
- ✓ Testing of individual components. (By all members)
- ✓ Complete hardware implementation on breadboard. (By Vaidehi & Parantap)
- ✓ Model mounting. (By all members)

Hardware Output

- Testing of an IR sensor: (20 July, 2018)

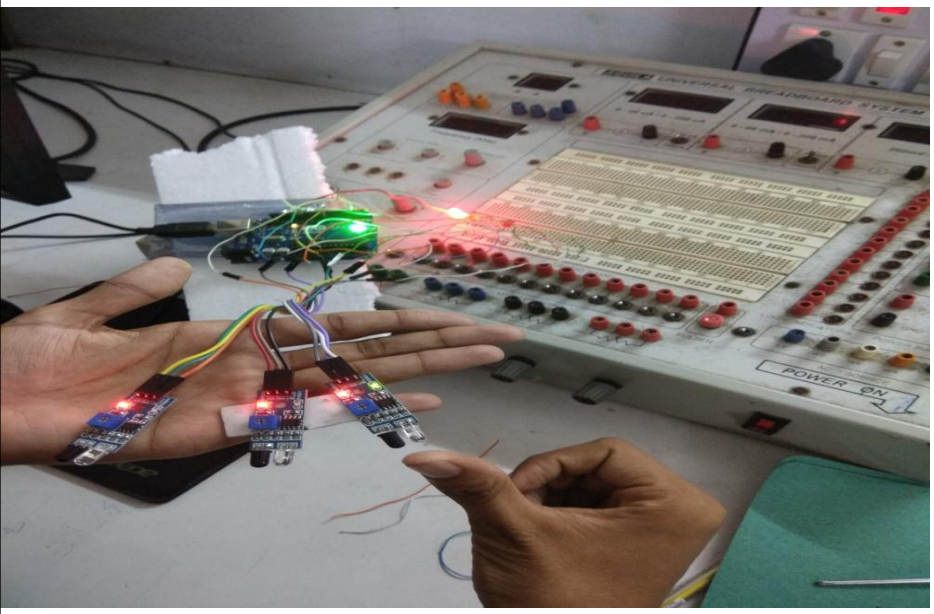


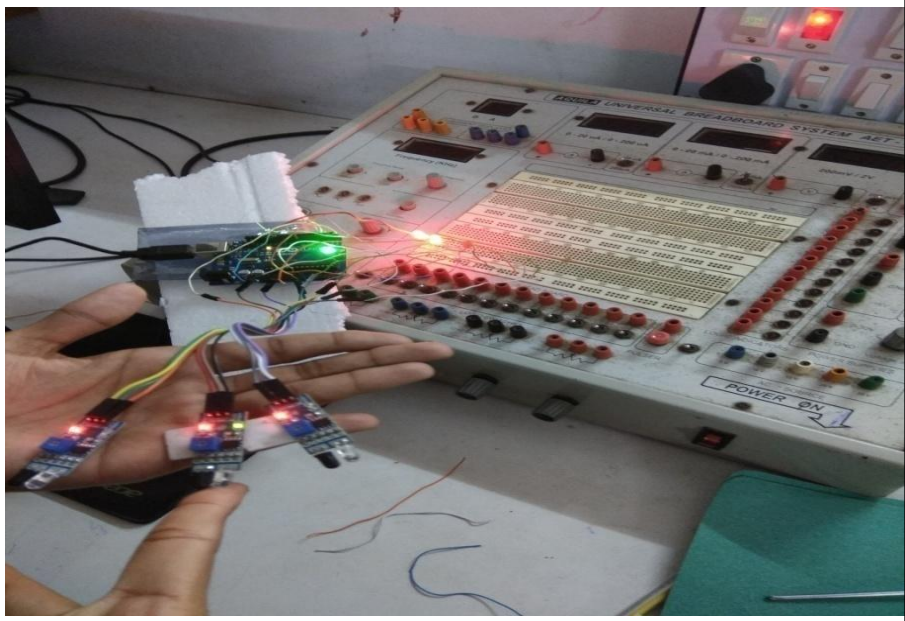
If IR sensor if HIGH, Led is HIGH

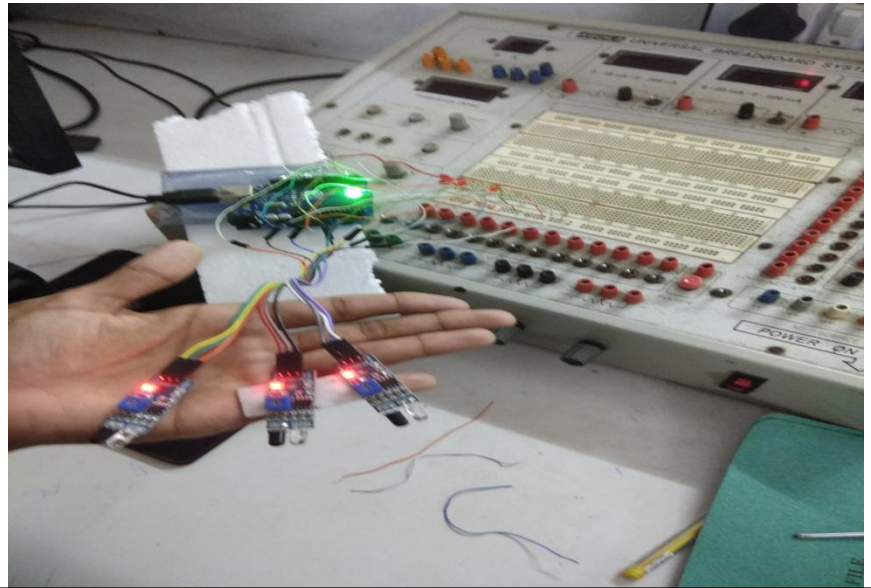


If IR sensor if LOW, Led is LOW

- Testing three IR sensors in series: (27 July, 2018)

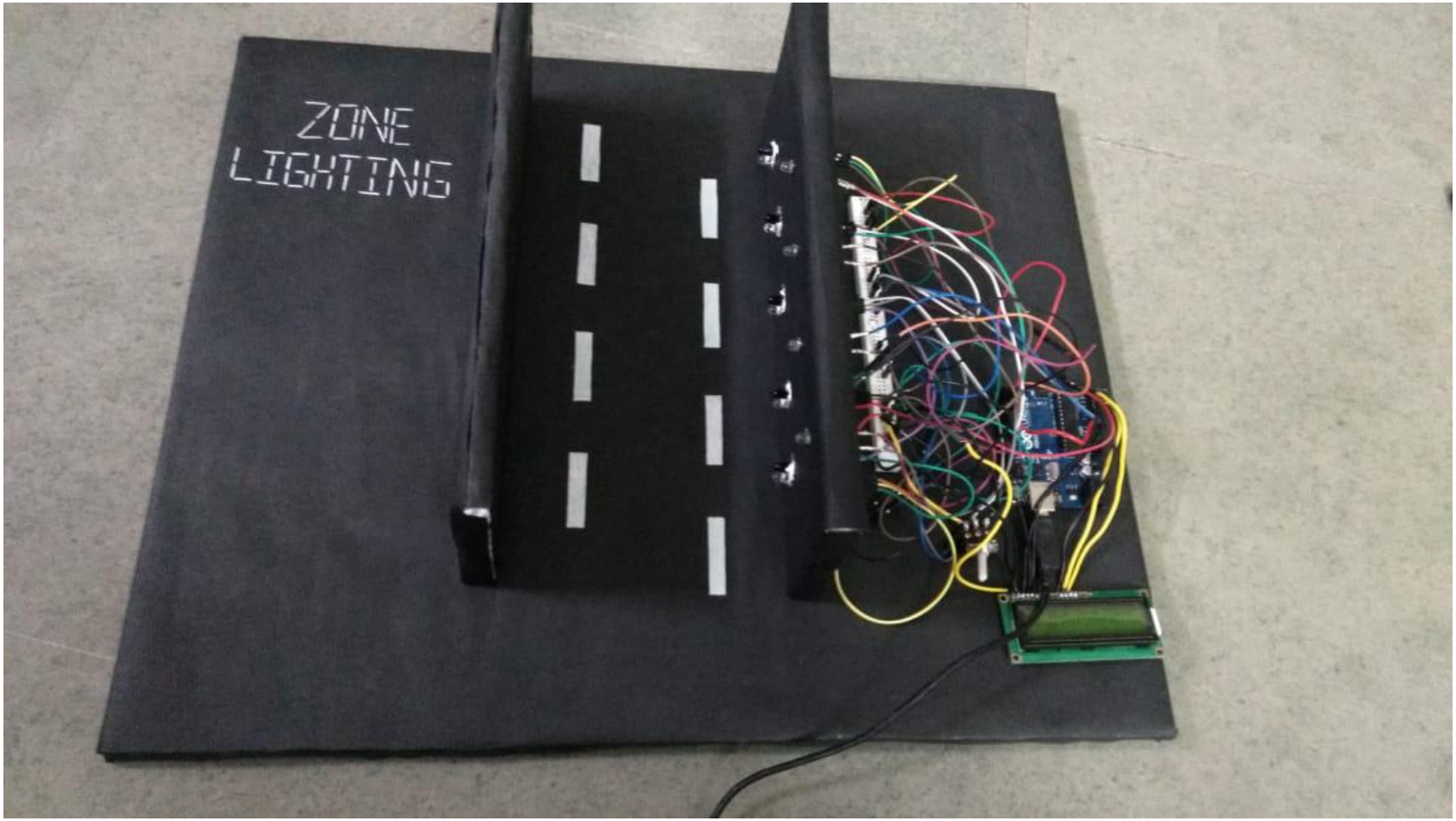






- Testing Mode 1: (10 August, 2018)

Final Model



Future expansions

- Interfacing of new sensors.
- Connecting surveillance camera for the security purpose.
- Visitor counter.
- Threat detection.
- Guide way to nearest exit in emergency.

Summary

- This project of Zone Lighting System is a cost effective, practical, eco-friendly and the safest way to save energy. It efficiently saves the energy by replacing the conventional bulbs by LEDs and by automatic switching/dimming of LEDs as and when required.

References

1. *(PDF) Smart street light system with energy saving function based on the sensor network*. Available from: https://www.researchgate.net/publication/262352965_Smart_street_light_system_with_energy_saving_function_based_on_the_sensor_network [accessed Sep 26 2018].
2. Shagun Malhotra, Vivek Kumar, "Smart Street Lighting System: An Energy Efficient Approach" Volume 5 Issue 2, February 2016, International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611