A

PROJECT REPORT

ON

"AUTOMATIC STEERT LIGHT USING SENSOR"

Submitted in partial fulfillment of the requirements for the award of a degree of

BACHELOR OF TECHNOLOGY

in

ELECTRICAL AND ELECTRONICS

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CERTIFICATE

I hereby submit the project entitled **"AUTOMATIC STREET LIGHT USING SENSOR"** in the **School of Automation** of the Banasthali Vidyapith, under the supervision of **"Dr. JYOTSNA SINGH"**, School of Automation, Banasthali Vidyapith, Rajasthan, India.

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Date: 26/04/2023

ABSTRACT

Smart Street light is an automated system that automates the street. The main aim of Smart Street light is to reduce power consumption when there are no vehicle movements on the road. The Smart streetlight will glow with high intensity when there are vehicles on the road otherwise the lights will remain off. The Smart streetlight provides a solution for energy saving which is achieved by sensing an approaching vehicle using the IR sensor and then switching ON a block of streetlights ahead of the vehicle with high intensity. As the vehicle passes by the trailing lights turn off automatically. Thus, we save a lot of energy. So, when there are no vehicles on the highway, then all the lights will remain off. Using solar energy for charging batteries to glow the streetlights also helps to save energy. The solar plate will help to charge the battery that is connected to the streetlights in the daytime and the stored energy will be utilized in the night-time to glow the light. Laser light will help the driver to know that someone is crossing the road so that he can be alert and slow down the speed of the vehicle. A buzzer is used to produce the sound to alert the driver if anyone crosses the road, it will reduce the rate of accidents.

Thus, this project will help to save energy using smart streetlights and solar energy and reduce the rate of accidents using a buzzer to alert the driver.

ACKNOWLEDGEMENT

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Special gratitude we gave to my supervisor. **Dr. Jyotsna Singh,** whose contribution in stimulating suggestions and encouragement, helped me to coordinate our project for this session.

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My thanks and appreciation also go to my friends who helped me in my work on the project and people who have willingly helped me out with their abilities.

Diya Upadhyay

Prerna Singh

Anchal Bhardwaj

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CHAPTER - 1

INTRODUCTION

1.1- BACKGROUND

In today's modern world, the development of transportation systems plays a vital role. It consists of roads, streets, highways, etc. These pathways must be illuminated brightly with the help of several types of glowing bulbs or LEDs. The main purpose of providing light to these highways, roads, or streets is to provide safety to the vehicle and the number of persons crossing these paths and protect them from any mishappening or accidents. Another purpose of providing lighting to these places is that during the night times when a smaller number of vehicles pass the road, the pedestrian can easily cross the roads without feeling any darkness on the road. But, for providing a large amount of illumination, a huge amount of electricity is required which causes high cost.[1] In the past, halogen light was used in streetlights whose element heating time is high to glow and it takes much power these lights harm the environment such as the emission of carbon dioxide (CO 2). [2] After this, halogen lights were replaced with LED lights which glow up in a millisecond as well as consume less power.[3] Nowadays, street lighting accounts for about 13–14% of the world's electricity annual production, and the market is continuously growing. It is expected that by 2027, there will be about 363 million streetlights around the world. Consequently, enormous energy is consumed by streetlights, which makes it imperative to work on solutions to reduce streetlight consumption.[4] The main reason behind the high cost is the continuous glowing of lightning for more than 12 hours a day. So, to reduce the electricity cost and prevent the high cost there is a need to develop a system that is autonomous. For automatization, LDR interfaces with streetlights which automatically start and stop the lights after sunset and before sunrise. But this is not sufficient for reducing power consumption.

Then, an IR sensor was introduced which senses the motion of living beings near the IR sensor; if the sensor does not detect any motion, then, the controller dims/toggles the light. This reduces the power consumption upon a certain mark. As much as solar energy is a cost-effective option for lighting, using LEDs with solar light becomes a super saver combo. Therefore, this project deals with a system that is autonomous which consists of SOLAR, LDR, and LASER which reduce power consumption and accident rate.

1.2- MOTIVATION

This project focuses on the limitation of using streetlights based on the weather and especially at night. As we know, the street was crowded with cars in the morning who are going to work or citizens who are shopping at the mall and hanging out with members at night. Usually, after midnight, the street is not busy. The streetlamp will continue until the morning, and it will cause a waste of electricity. To achieve our objective, we decided to use an IR sensor that controls the streetlight. It will reduce the use of streetlights. And several accidents are increasing day by day here we are using a laser.

The Laser Light Alarm is a device that provides a warning when there is unauthorized presence or intrusion within the premises. Intelligent Street lights change the way municipalities manage cities while delivering exceptional energy savers. Furthermore, electricity usage is expected to grow by 50 percent in the next two decades as more and more people will be shifting to urban areas**.** [5]

The lighting operator or the municipality often does not have a good overview of the working status of the traditional non-connected streetlights. It is difficult to collect data on the actual power consumption lamp failure status. Adjusting lighting levels when the road situation changes is also unfortunately not feasible. By switching from halogen to LED, municipalities can achieve up to a 50 percent reduction in energy usage. Adding smart street light controllers, which help adjust luminaire brightness based on predefined schedules, and calendar events of ambient light levels can yield an additional 20 to 30 percent energy savings. A total of up to 80 percent energy savings can also be achieved if municipalities opt for motion sensor smart streetlights, which trigger luminaires' output based on movement. Traditional streetlights often burn all night at full intensity – even when there is no one around. In turn, generating significant light pollution with intelligent street lighting, or in other words, network-connected street lighting, the operator (or municipality) has complete control.

Light pollution is detrimental to humans and animals as well. It can disrupt the circadian rhythm, in other words, the sleep-wake cycle. Some of the other consequences of light pollution include:

- For humans – increased headache incidents, fatigue, stress, increase in anxiety, and hypertension, can lead to aggravation of the cardiovascular disease.
- For ecology (organisms and ecosystems) – confuse animal navigation/ migration, change predator-prey relations, and psychological harm.
- The disappearance of the night sky

  Turning lights off when there is no one is one of the easiest ways to lower light pollution. Reducing the road lighting levels during the off-peak hours with low or no traffic significantly lowers sky glow as well as light pollution – without compromising road safety.

Generally, we can see streetlights are ON even after sunrise, and no presence of humans thus by having an automatic street light control system, which turns the ON and OFF the streetlights when ambient light falls below a specific intensity, for this, we can use an LDR sensor. In this system, we are also using an IR sensor that detects the motion of the object such as humans and animals passing through it, using this motion of the object LEDs are turned ON. The manpower required for controlling the light cuts a huge cost, so using this system we can also reduce the cost of manpower and reduce unnecessary power consumption. We also know that during the daytime there is no essence of streetlights, this problem is solved by the LDR sensor. (1) LDR sensor keeps the streetlight OFF in the daytime. When the light intensity is low then the LDR starts working and the light is switched on. The main aims of this project are to implement auto-intensity control of LED-based LDR and IR motion sensors. IR motion sensor detects the human presence and turns the ON/OFF LED light. LDR and IR motion sensor interface with a microcontroller, as the surrounding light decreases LDR sensor turns on the LED light, and when the IR sensor detects motion, it turns ON lights.[6]

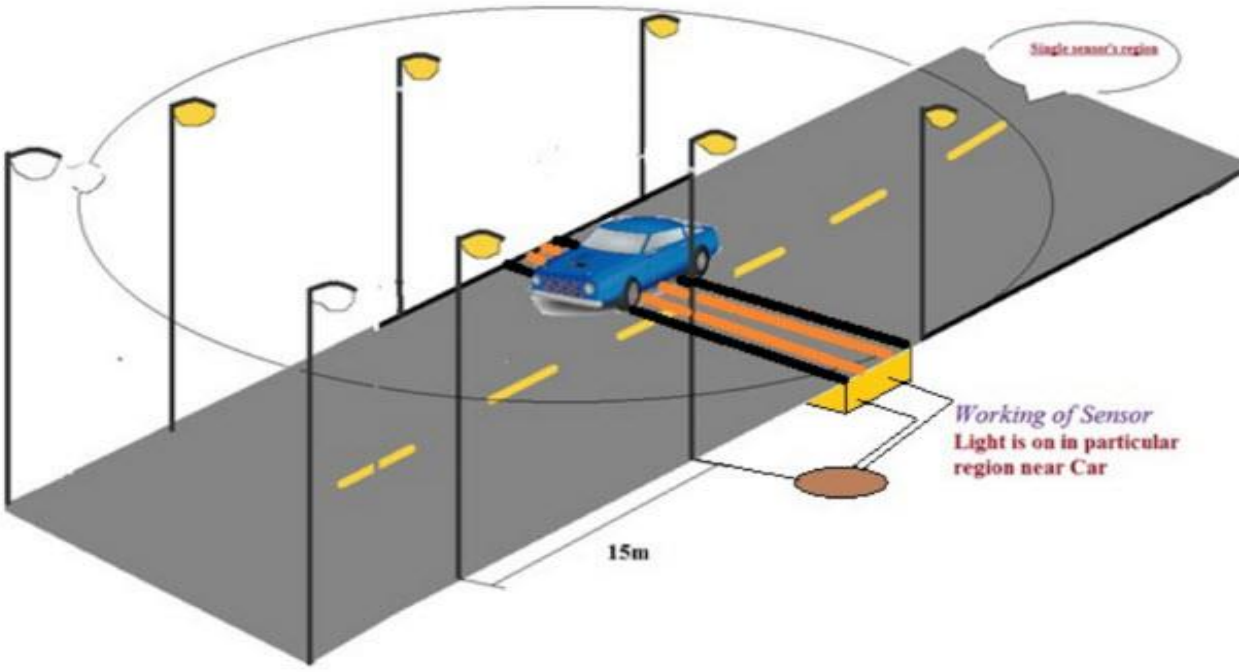

FIGURE 1: The architecture design of the automatic street light control system

Technology is enhancing day by day and thereby helping us to globalize the world more and more. So, our project is one the best example as it shows the conservation of energy, reduction in carbon emission during the production of electricity (reducing environmental pollution), reduction in manual work, etc.
Now let's move further to the applications of our project. The automatic streetlight can be used in various places. [7]

1.3-WORK

The main objective of our project is as follows:

- Provide efficient, automatic, and smart lighting systems.
- Totally based on renewable energy sources.
- Longer life expectancy.
- Energy saving.

So, concluding the above points we can use the automatic street light system to its greatest advantage.[8]

Automatic streetlights using an Infra-Red (IR) motion sensor and Light Dependent Resistor (LDR) sensor, where the streetlights will **automatically turn ON and OFF by detecting the presence of humans and the amount of luminous energy in the environment at that moment.**

This project can be used in various places. Application of such a system can be implemented in park lights, streetlights, room lights, smoke detectors, and the presence of any object or living being.

CHAPTER-02

PROBLEM FORMULATION

2.1 PURPOSE

The main problem faced by today's world is the problem of electricity as we are utilizing electricity in doing our household work, industrial work, office work, transportation, and many other uses as well. As we are utilizing electricity at a large, we also need to generate that much electricity and it's not easy to generate electricity as it requires so many types of equipment, experts, and money to generate electricity. There are two main ways by which electricity is generated:(i) hydroelectricity running is generated by water which drives hydro turbines. India has several multi-purpose projects like the Bhakra Nagal, Damodar valley corporation, etc.(ii) thermal electricity is generated by burning non-renewable fossil fuels like coal, petroleum, and natural gas. There are over 310 thermal power plants in India. On a global scale, millions of dollars are spent each day on these streetlights to provide the required electrical energy. The maintenance and replacement costs of conventional incandescent bulbs are immense. They consume a lot of electric power to function, and their heat emission is also very high. All of this contributes to greater demand for electricity production and consequently, more carbon dioxide emission from powerhouses. The main aim of the project is to provide an "AUTOMATIC STREET LIGHT USING SENSOR" powered with solar energy during nighttime. We use the phrase "smart" due to the fact the machine no longer solely grants strength to the streetlights however additionally helps in detecting the route of motion of the pedestrian and helps him by the capability of illuminating the route of motion until the close to subsequent avenue light. By integrating the entire road lights with Smart Road mild machine, it is

viable to systematically assist the pedestrian to attain the vacation spot in faraway rural areas which are going through serious electric powered electricity supply problems. The identical gadget can additionally be used in metropolitan cities as well. An easy and effective solution to this would be dimming the lights all through off-top hours. Whenever presence is detected, the lights around it will glow in the ordinary (bright) mode. This would stop a lot of strength and reduce the fee for the operation of the streetlights.[8]

Road accidents are increasing day by day as stray animals cross the road and get hit by vehicles. To reduce it to some extent we can give the driver some kind of signal that someone is crossing the road so they can reduce the speed of the vehicle and maintain the speed so that both can pass without hitting each other. We have used a laser and LDR circuit to provide the solution. The light of the laser directly falls on the LDR and the buzzer makes no sound, as soon as some obstacle is there in the path the light beam gets interrupted and the buzzer beeps and this indicates the driver presence of some kind of animal of any other object on the road.

2.2 CIRCUIT COMPONENTS

1. IR SENSOR

An infrared sensor is an electronic device that emits a sense of some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detect motion. These types of radiation are invisible to our eyes and can be detected by an infrared sensor. The emitter is simply an IR LED, and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

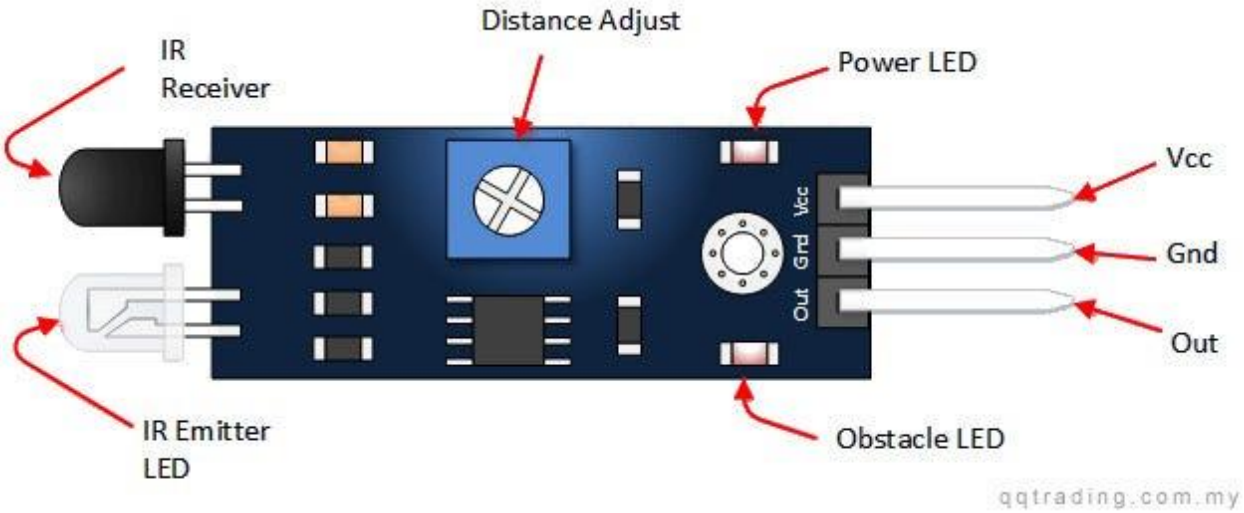

FIGURE 2: IR SENSOR

WORKING PRINCIPLE OF IR SENSOR: The working principle of an infrared sensor is like the object detection sensor. This sensor includes an IR LED & an IR Photodiode, so combining these two can be formed as a photo-coupler otherwise optocoupler. The physics laws used in this sensor are planks radiation, Stephan Boltzmann & Weins displacement. IR LED is one kind of transmitter that emits IR radiation. This LED looks like a standard LED and the radiation which is generated by this is not visible to the human eye. Infrared receivers mainly detect radiation using an infrared transmitter. These infrared receivers are available in photodiode form. IR Photodiodes are dissimilar as compared with usual photodiodes because they simply detect IR radiation. Different kinds of infrared receivers mainly exist depending on the voltage, wavelength, package, etc. Once it is used as the combination of an IR transmitter & receiver, then the receiver's

wavelength must equal the transmitter. Here, the transmitter is IR LED whereas the receiver is an IR photodiode. The infrared photodiode is responsive to the infrared light that is generated through an infrared LED. The resistance of the photodiode & the change in output voltage is in proportion to the infrared light obtained. This is the IR sensor's fundamental working principle. Once the infrared transmitter generates emission, then it arrives at the object & some of the emission will reflect toward the infrared receiver. The sensor output can be decided by the IR receiver depending on the intensity of the response.[9]

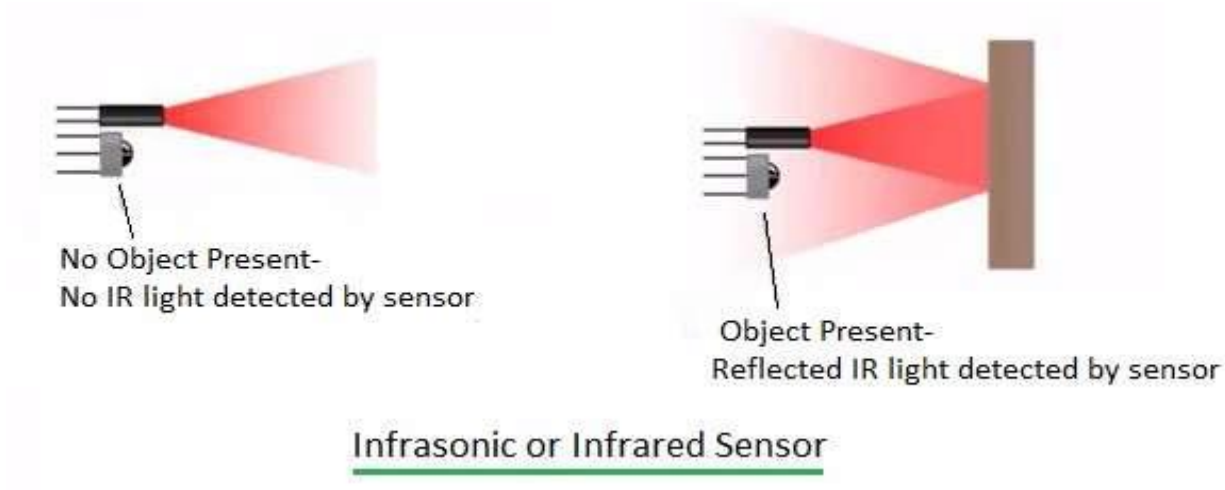

FIGURE 3: IR SENSOR DETECTION MECHANISM

2. LIGHT-DEPENDENT RESISTOR

LDRs or Light Dependent Resistors are very useful in sensor circuits that use light and darkness. Normally, an LDR has a high resistance, but when it is illuminated with light the resistance drops dramatically. These electronic components change their electrical characteristics depending on the presence of visible or invisible light. The best-known devices of this type are the Light Dependent resistor (LDR), the Photodiode, and phototransistors. LDRs are made by depositing a film of cadmium sulphide or cadmium selenide on a substrate of ceramic containing little to no free electrons. Resistance decreases with longer strips and when light is applied, it falls in value dependent on the exposure amount. Typical ratings for LDRs range from 50-500 ohms but can be much higher depending on how sensitive they are to light; switching time is high so these aren't good for applying high frequencies. Dependent resistors are typically found in amplifiers and choppers. They have a variety of sizes, including discs from 0.5 cm to 2.5 cm,

depending on the application. The resistance increases as the device becomes dark; this is due to light-dependent resistors being made up of two metal contacts separated by a cadmium sulphide film track that provides maximum contact area with the two metals. These devices can come in various shapes and sizes, but most popularly feature a diameter of 10 mm or greater for ease of use. When a linear Dynamic resistor is brought from light to dark, the resistance does not increase immediately. The recovery rate is set according to k ohm/second and for certain types of LDR, it can be more than 200k ohm/second. Going from darkness to light takes less than 10ms and the resistance matches the brightness accordingly.

Darkness: Maximum resistance, about 1 Mega Ohm.

Very bright light: Minimum resistance, about 100 ohms. The LDR is a variable resistor whose resistance decreases with the increase in light intensity. Two cadmium photoconductive cells with spectral response are very similar to that of the human eye. The cell resistance falls with increasing light intensity. Some of its features: 1) High reliability. 2)Lightweight. 3) Wide spectral response. 4) Wide ambient temperature range.

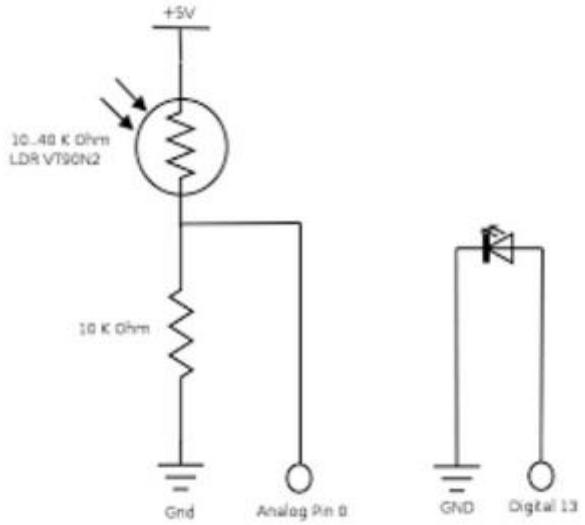

FIGURE 4: LDR CIRCUIT

FIGURE 5: LDR

3. LIGHT-EMITTING DIODE: A light-emitting diode, or LED, is a two-lead semiconductor light source. It is a p-n junction diode that emits light when activated. The long term is positive, and the short term is negative. When a suitable current is applied to the leads, electrons can recombine with electron holes within the device, releasing energy in the form of photons. LEDs are versatile

semiconductors with several attributes that 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.

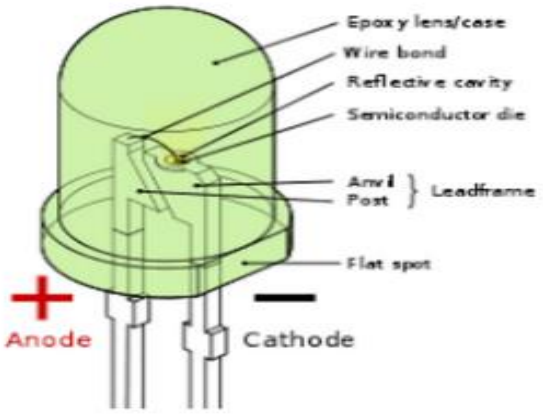

FIGURE 6: LED STRUCTURE

FIGURE 7: LED

2.3 CIRCUIT DIAGRAM

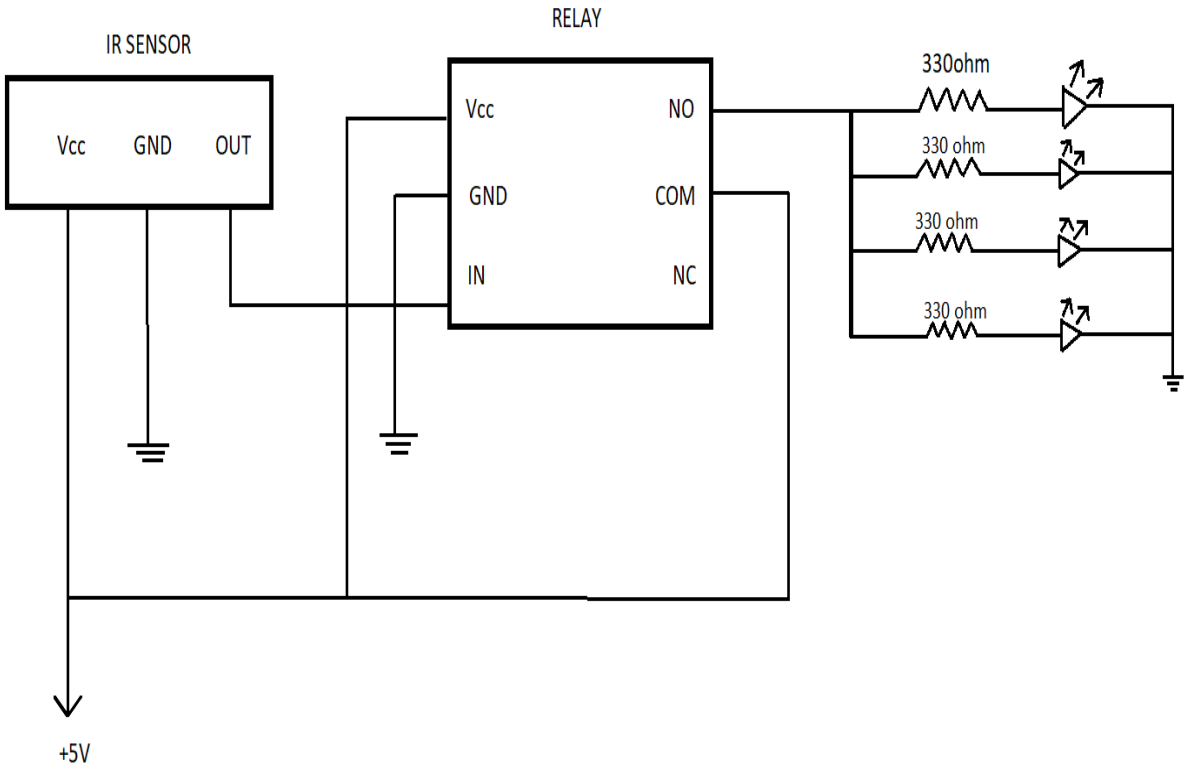

FIGURE 8: CIRCUIT DIAGRAM OF DETECTING OBJECT

The following are the different steps included in building a smart streetlight.

1. All the VCC and common terminals of the relay and IR sensor are connected to the 5V power supply.

2. Output of the IR sensor is given to the relay.

3. NO terminal of the relay is connected to the LED through 330-ohm resistors while the cathode sides of the LEDS are grounded.

4. When the IR sensor detects any motion, the relay is turned on and the common pin of the relay gets connected to the normally open pin which connects 5V to the anode terminal of LEDS, so it turns on.

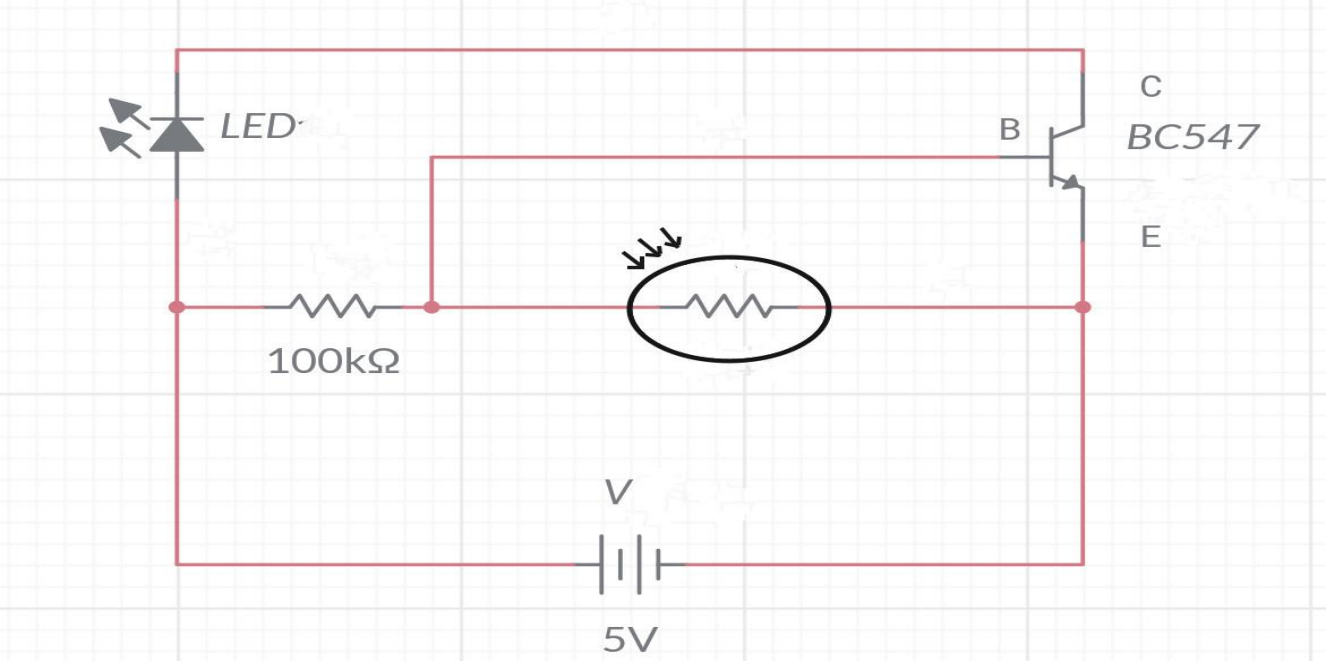

FIGURE 9: CIRCUIT DIAGRAM OF LDR CONNECTION WITH LED

The following are the different steps included.

1. LDR relates to the base and emitter of BC547

2. LED is connected between the collector and LDR through a 100k ohm resistor

3. Voltage supply of 5V is provided.

4. When lights fall on the LDR its resistance decreases and does not conduct.

5. In the darkness resistance increases and conducts and it turns on the LED.

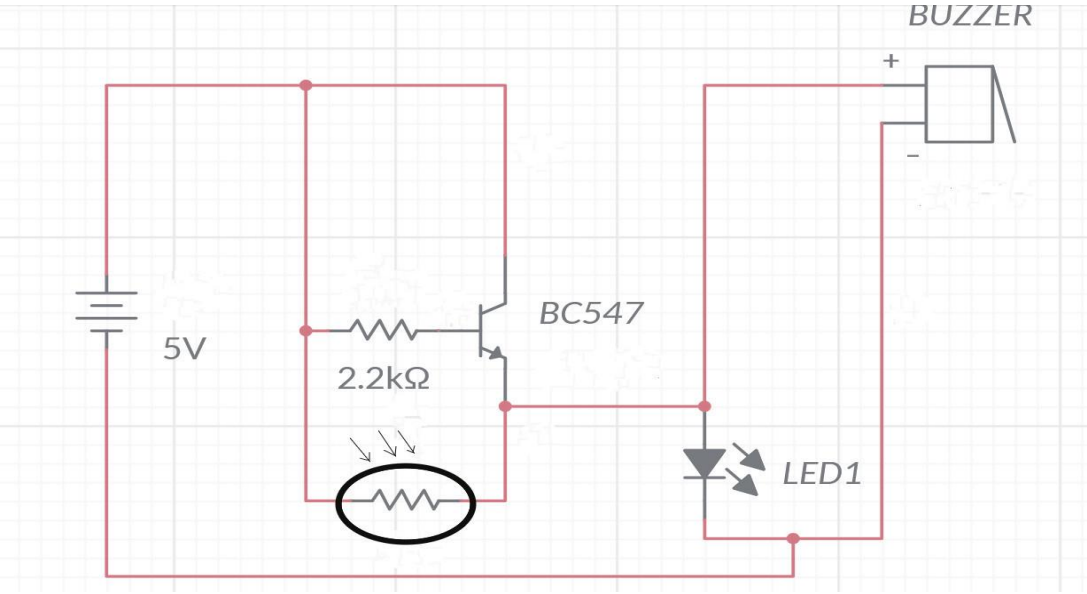

FIGURE 10: CIRCUIT DIAGRAM FOR LASER

CHAPTER-3
RESULTS AND DISCUSSION

In this section, the setup of the whole research work is depicted in a step-by-step manner. Sample screenshots are displayed once the components are fixed and connected to each other. All the components are connected to each other and thus complete the system setup which helps one to understand the steps in a simple and easy way. With these steps, even when a person is trying to implement the same, it makes it simple, clear, and easy. The following are the screenshots in an orderly way:

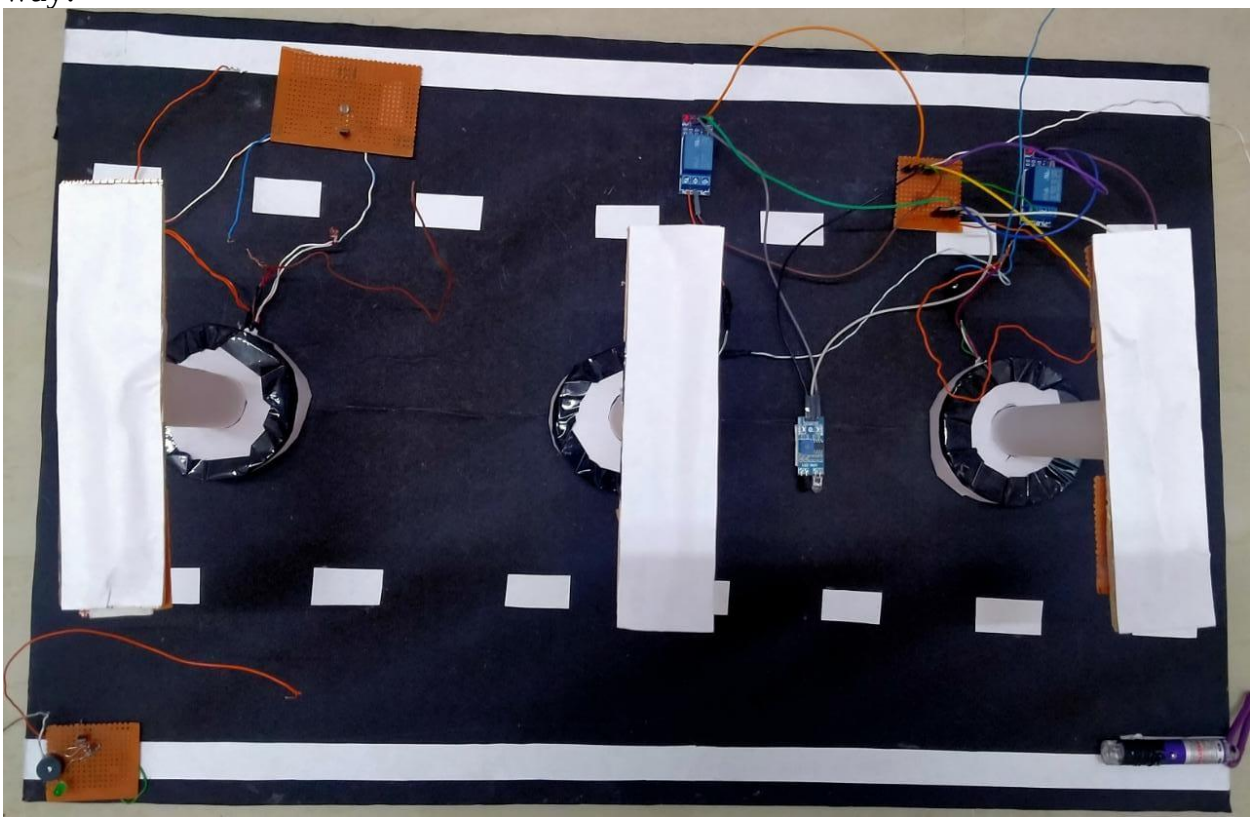

FIGURE 11: INITIAL SETUP

Fig 11 depicts the initial setup of the hardware. All the components are in accordance with every other component. The two IR sensors are placed next to each other to sense the motion. LEDs are connected to the relay and the relay is connected to the power supply and IR sensor.

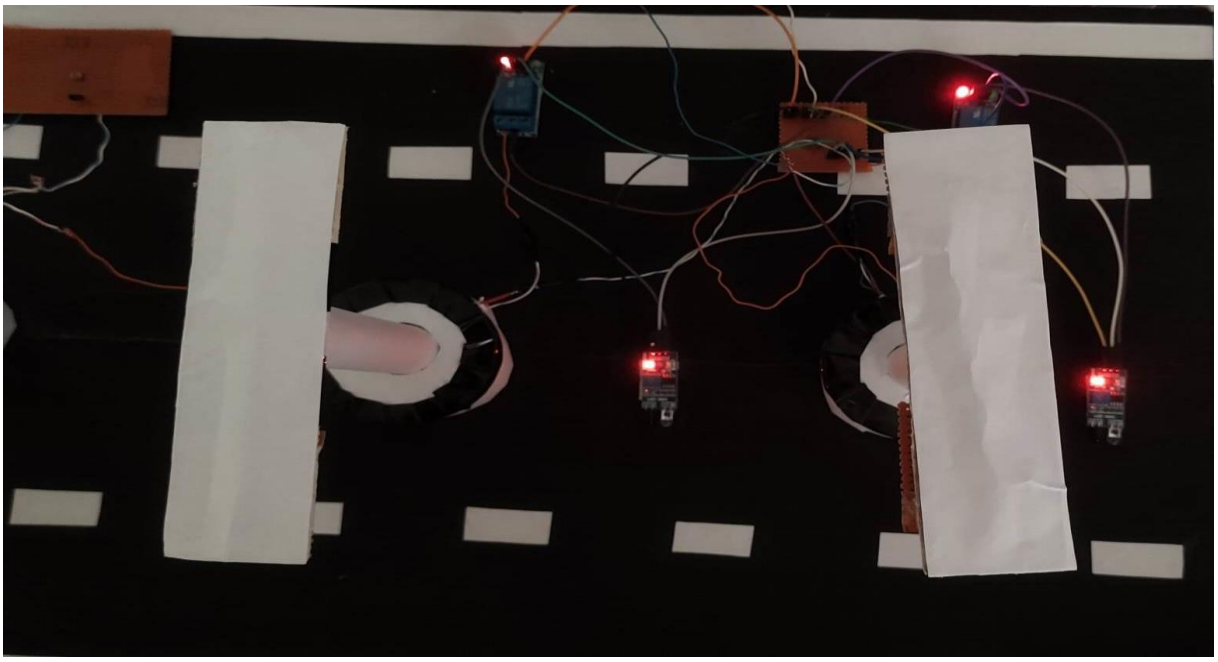

FIGURE 12: OPERATION PHASE 1

Fig 12 shows the initial operation when power is supplied, and the relay and IR are ON.

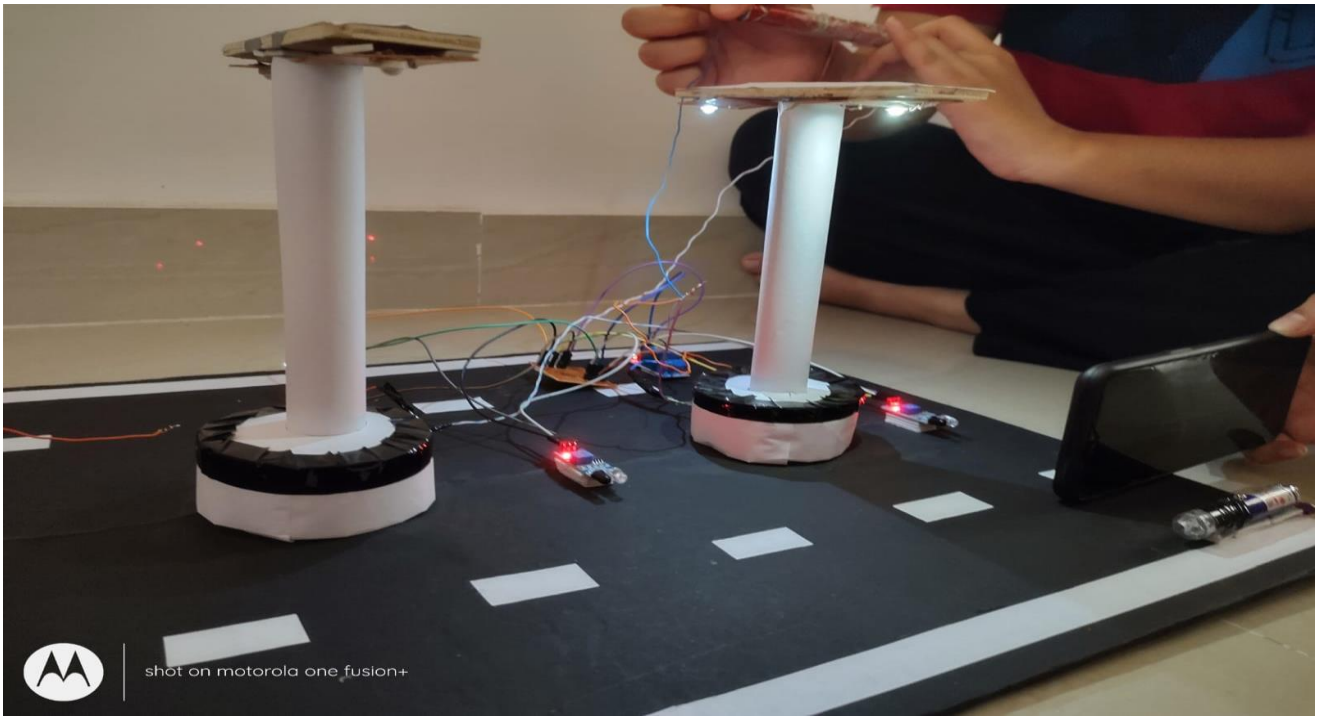

FIGURE 13: OPERATION PHASE 2

Fig 13 depicts that when any object is detected by the first sensor first LED glows with its full intensity keeping the other LED off.

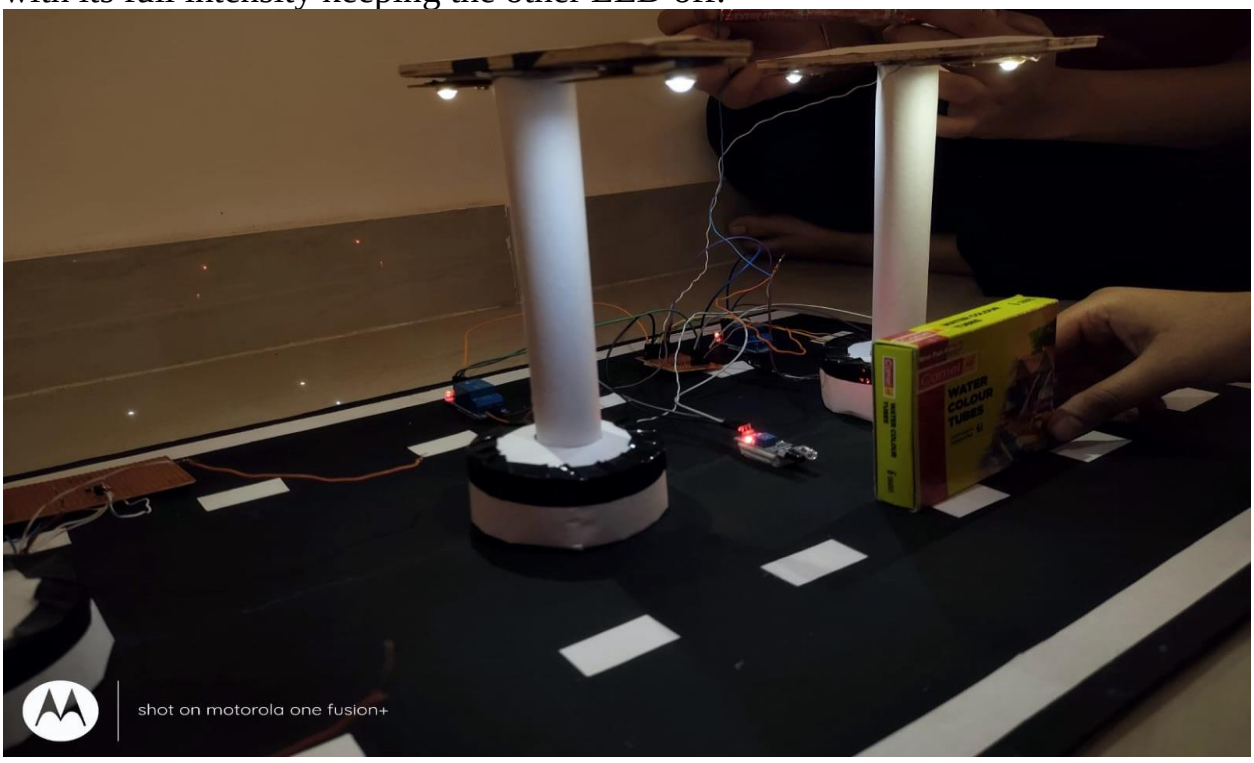

FIGURE 14: OPERATION PHASE 3

Fig 14 depicts that when the object is between both the sensors both the LEDs glow with their full intensity.

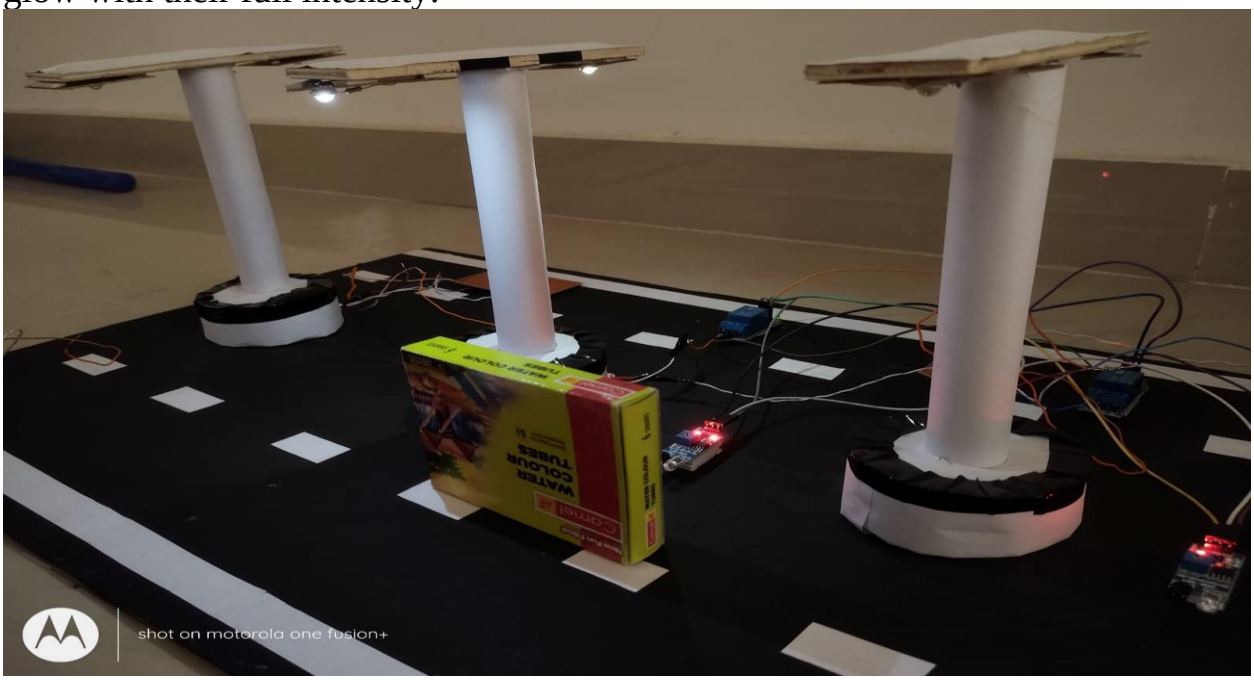

FIGURE 15: OPERATION PHASE 4

Fig 15 depicts that when any object is detected by the second sensor the second LED glows with its full intensity keeping the other LED off.

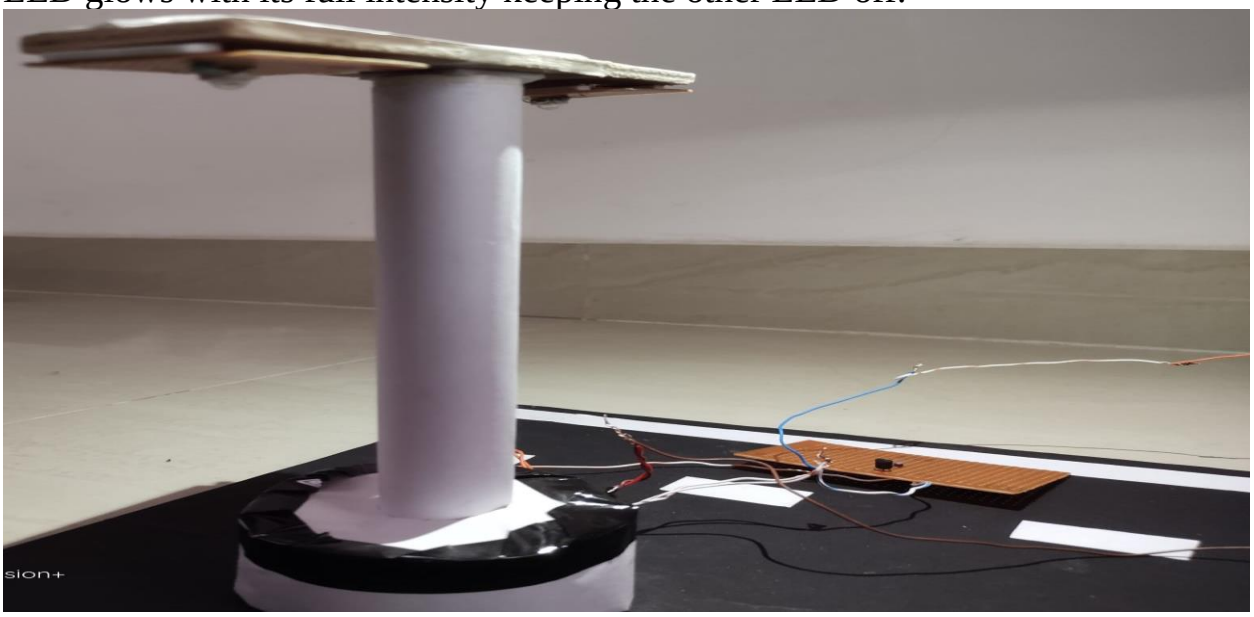

FIGURE 16: OPERATION PHASE 5

Fig 16 shows that in natural lighting conditions, LDR works as an insulator, and does not allow current to pass through the circuit. Hence, the LED is off.

FIGURE 17: OPERATION PHASE 6

In Fig 17, LDR is hidden by fingertip, to create natural dark conditions. Due to no light, the resistance of LDR becomes very low, allowing current to pass through the LDR circuit. Thus, the LED glows dimly.

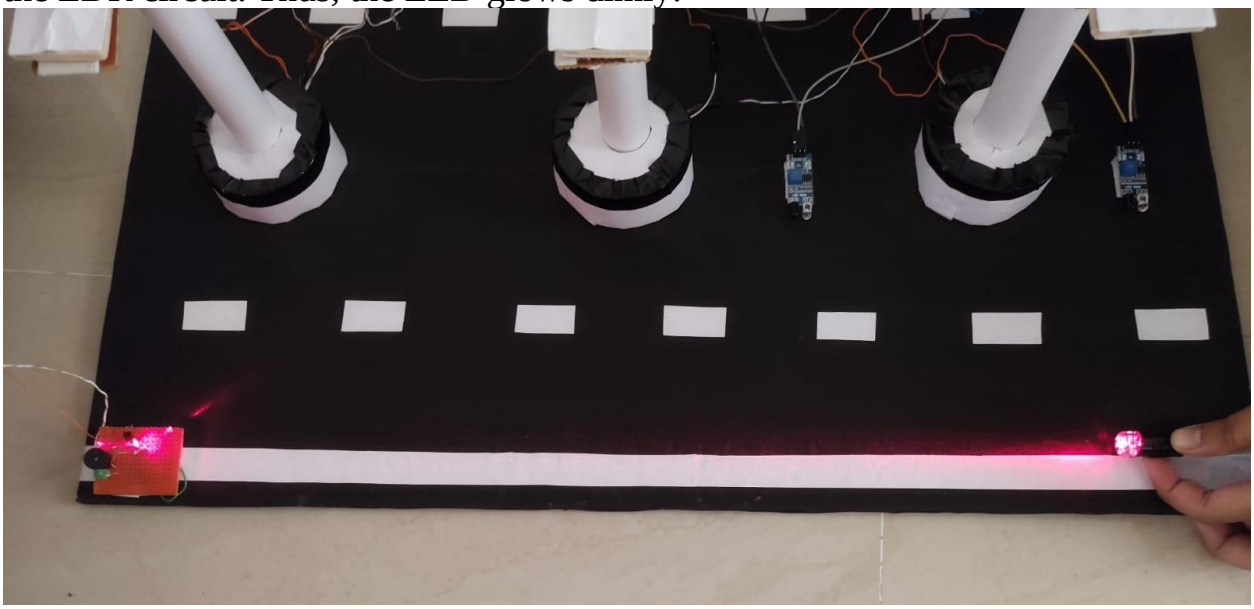

FIGURE 18: OPERATION PHASE 7

Fig 18 shows that when there is no obstacle between the LDR and the laser, the light of the laser directly falls on the LDR, LED does not glow, and no beep sound is produced by the buzzer.

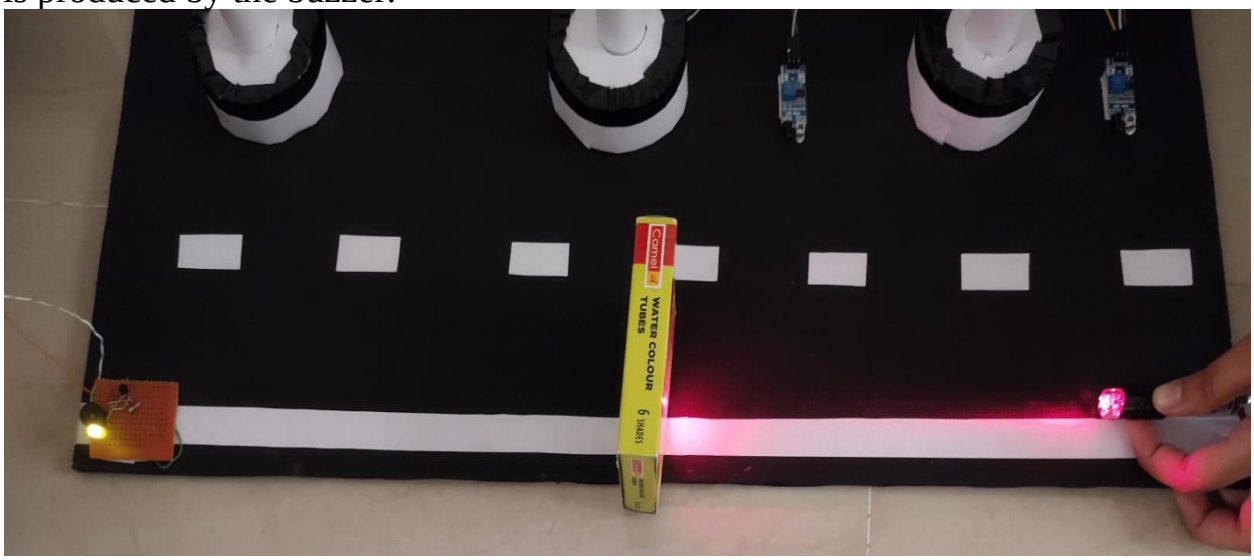

FIGURE 19: OPERATION PHASE 8

In Fig 19, when there is an obstacle in the light path LED glows, and the buzzer beeps.

CHAPTER-04
CONCLUSIONS AND FUTURE SCOPE

4.1 CONCLUSION:

By using Smart Street light, one can save a surplus amount of energy which is done by replacing sodium vapor lamps with LED and adding an additional feature for security purposes. It prevents unnecessary wastage of electricity, caused due to manual switching of streetlights when it's not required. It provides an efficient and smart automatic streetlight control system with the help of IR sensors. It can reduce energy consumption and

maintains cost. The system is versatile, extendable, and totally adjustable to the user's needs.

- The system is now used only for the way traffic on highways.
- Continuous use of LDR and IR sensors even in the daytime.
- Not switched on before sunset.

The Smart light system can be further extended to make the current system in two-way traffic, making the system more flexible in case of rainy days, and introducing ways to control the lights through GSM-based service.

4.2 FUTURE SCOPES:

- This system can be used for only one-way traffic. A highway might be covered by this system on dual system installation on both sides.
- The system does not have an automatic fault detector.
- Pole damage detection with the addition of a suitable sensor can be implemented.

REFERENCES

1. https://www.ijitee.org/wp-content/uploads/papers/v8i12S/L104110812S19.pdf
2. Yusoff, Y. M., Rosli, R., Karnaluddin, M. U., & Samad, M. (2013, September). Towards smart street lighting system in Malaysia. In *2013 IEEE Symposium on Wireless Technology & Applications (ISWTA)* (pp. 301–305). IEEE
3. Nuttall, D. R., Shuttleworth, R., & Routledge, G. (2008). Design of a LED street lighting system (pp. 436–440).
4. https://downloads.hindawi.com/journals/js/2022/5249187.pdf
5. https://www.electronicshub.org/laser-security-system/
6. https://www.academia.edu/7935630/Automatic_Street_Light_with_Motion_Sensor
7. https://www.elprocus.com/street-light-glows-on-detecting-vehicle-movement-circuit/
8. https://www.researchgate.net/publication/348096383_Smart_Street_Lighting_System
9. https://www.elprocus.com/infrared-ir-sensor-circuit-and-working/