



# PROJECT REPORT

ECECC09 : Electronic Design and Workshop  
Department of Electronics

## LUXMETER

Authors:-

Prashasti Jain - 2021UEC2646

Anirban De - 2021UEC2650

Shruti Arya - 2021UEC2652

# Contents

1 Synopsis	3
2 List of Components	4
3 Operational Flowchart	10
4 Block Diagram	11
5 The Timeline	12
6 The PILOT	13
7 Circuit Schematic	15
8 Code	16
9 Applications	18
10 Gantt Chart	20
11 References	21

# SYNOPSIS

A luxmeter is a device that measures illuminance and luminous emittance using the SI unit of lux. It effectively measures the amount of power from the light falling on a given unit of area, except that the power measurement is weighted to reflect the sensitivity of the human eye to varying wavelengths of light. A simpler way to describe a lux meter is to say that it measures how bright the light falling on the sensor is.

The light sensor for a lux meter can be one of several different types of sensors, including photodiodes and phototransistors, but the easiest to use and often the most readily available type of sensor is a photoresistor or light dependent resistor (LDR). As you would expect, the resistance of an LDR changes as the amount of light falling on it changes. If you can measure the resistance of the LDR and you know the characteristics of your particular LDR, you can quantify the amount of lux falling on the LDR. In general, the brighter the light, the lower the resistance, but unfortunately, the relationship between resistance and lux for an LDR is not a nice linear relationship. It is instead an exponential relationship which is a little trickier to deal with. With a little bit of time though, you can take a few measurements to determine the mathematical relationship between resistance and lux and program the relationship into a microcontroller to create a simple and reasonably effective lux meter.

In this project, we are going to take you through the process of characterizing an LDR, writing software that can calculate illuminance and then building an LDR and Arduino based luxmeter.

# LIST OF COMPONENTS :

## 1)Solderless Breadboard

A breadboard is used to build and test circuits quickly before finalizing any circuit design. The breadboard has many holes into which circuit components like ICs and resistors can be inserted. The holes are most commonly spaced 0.1" apart to accommodate standard DIP components. A typical breadboard that includes top and bottom power distribution rails is shown below:



The breadboard has strips of metal sockets which run underneath the board, yellow rectangles in figure 2, and connect the groups of five holes on the board. The metal strips are arranged as shown below. Note that the top and bottom rows of holes are connected horizontally while the holes in the center sections are connected vertically.

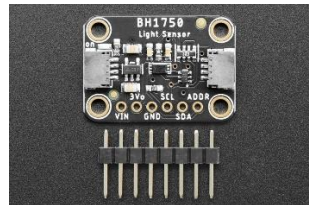
## 2)Arduino Uno

The Arduino UNO is categorized as a microcontroller that uses the ATmega328 as a controller in it. The Arduino UNO board is used for an electronics project and mostly preferred by the beginners. The Arduino UNO board is the most used board of all Arduino boards. The board contains 14 digital input/ output pins in which 6 are analog input pin, one power jack, USB connector, one reset button, ICSP header, and other components. All these components are attached in the Arduino UNO board to make it functioning and can be used in the project. The board is charged by USB port or can be directly charged by the DC supply to the board.



### 3)BH1750 Ambient Light Sensor :

This is the BH1750 16-bit Ambient Light sensor from Rohm. Because of how important it is to humans and most other living things, sensing the amount of light in an environment is a common place to get started when learning to work with microcontrollers and sensors. Should we turn up the brightness of our display or dim it to save power? Which direction should your robot move to stay in an area with the most light? Is it day or night? All of these questions can be answered with the help of the [BH1750](#). It's a small, capable and inexpensive light sensor that you can include into your next project to add the detection and measurement of light.



### 4)16x2 LCD Display :

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

Display is made up of millions of pixels. The quality of a display commonly refers to the number of pixels.

A pixel is made up of three subpixels; a red, blue and green—commonly called RGB. When the subpixels in a pixel change color combinations, a different color can be produced. With all the pixels on a display working together, the display can make millions of different colors. When the pixels are rapidly switched on and off, a picture is created.



### 5)100R Resistor, 4.7K Resistor, 1k Resistor :

These components are used to protect the luxmeter device from getting burnt as it could undergo the condition of over voltage which could cause harm to the device.



### 6)Male to Male jumper wires :

They are simple wires that have connector pins at each end allowing them to be used to connect two points to each other. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

40 strip Male to Male jumper wire each cable length about 20cm or 8-inch.

This has two ends where both male ends have a pin protruding and can plug into things. Male-to-male jumper wires are the most common and what you likely will use most often. When connecting two ports on a breadboard, a male-to-male wire is used.



### 7)Normal jumper wires :

Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering.

You can use jumper wires to modify a circuit or diagnose problems in a circuit. Further, they are best used to bypass a part of the circuit that does not contain a resistor and is suspected to be bad.

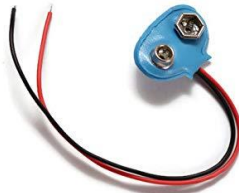
This includes a stretch of wire or a switch. Suppose all the fuses are good and the component is not receiving power; find the circuit switch. Then, bypass the switch with the jumper wire.





### 8)Battery clip :

A terminal of a connecting wire having spring jaws that can be quickly snapped on a terminal of a device, such as a battery, to which a temporary wire connection is desired.



### 9)Battery 9V :

9V batteries are extremely common and popular. This means that a wide variety of manufacturers make these batteries and a wide variety of retailers sell the battery.

The 9V battery is an extremely common battery that was first used in transistor radios. It features a rectangular prism shape that utilizes a pair of snap connectors which are located at the top of the battery. A wide array of both large and small battery manufacturers produce versions of the 9V battery.



### 10)Solder Wire :

Solder wires are wires with a low melting point which can melt along with the soldering iron. Depending on the application and soldering temperature, many different types of soldering wires are available.



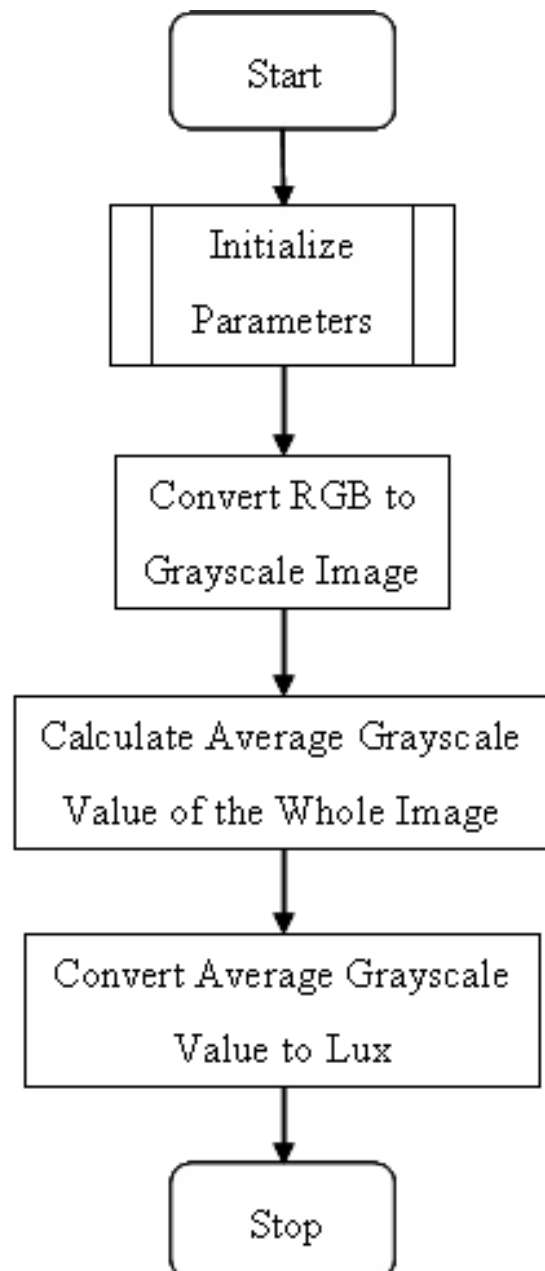


## 11)Zero PCB Board :

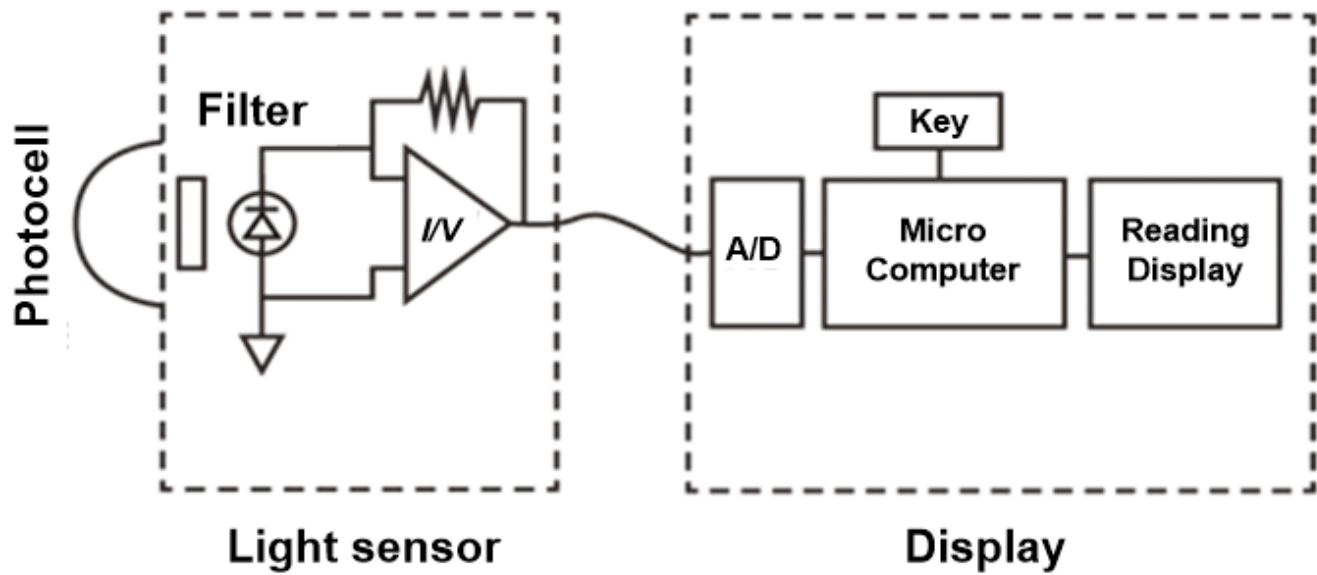
Zero Printed Circuit Board refers to an all-purpose & conventional PCB that embeds the circuits arbitrarily to ensure the continuous functioning of the hardware. The layers of general purpose circuit board are coated with copper as to allow appropriate soldering of the components of PCB. Thus, it reduces the chances of any short circuit.



## OPERATIONAL FLOWCHART :



## BLOCK DIAGRAM :



# **The Timeline -**

## **The Initiation Phase :**

The initiation phase involved framing out the block diagrams and charting out the optimal strategy with the brutes framework in mind. Following which, the scope of the project was identified and the clarification of resources was carried out involving gathering required components for the same.

## **The Planning Phase :**

The planning phase involved preparing the Gantt chart and brainstorming on the optimal milestones and the documentation resources for the project.

## **The Execution Phase :**

Putting the plan into action, the execution phase, being the primary focus, involved majorly the hands-on stuff.

## **The Interfacing :**

The individual sensors and modules were interfaced with the Arduino separately on the breadboard in various stages, starting with configuring the Arduino uno and writing the code.

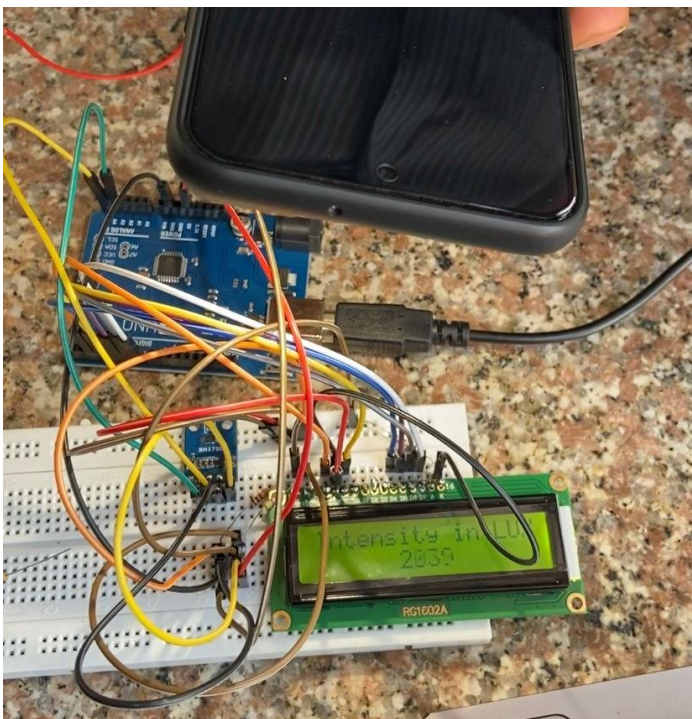
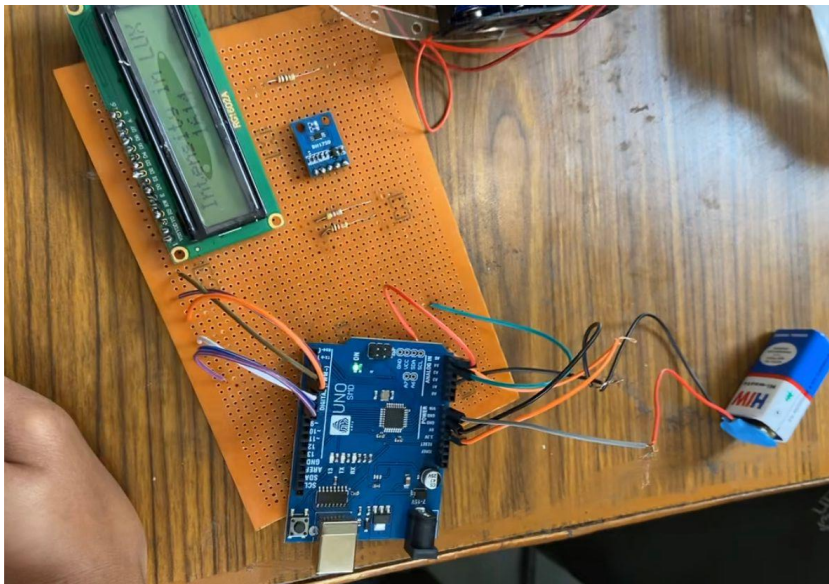
## **The Prototyping :**

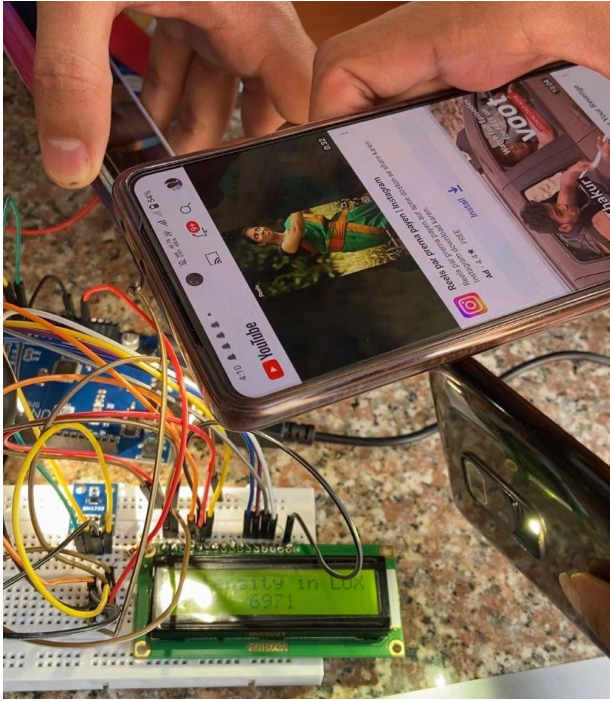
The prototyping phase involved assembling the initial integrated sketch of the circuit as shown on the breadboard and interfacing it with the Arduino micro-controller, accompanied by an exhaustive set of dry runs of the former. Interfacing the circuit with the Arduino micro-controller board required programming using the Arduino IDE Software and debugging to tune the circuit to the circuit to tailor our requirements.

## THE PILOT :

The beta prototype was prepared by soldering the circuitual components onto the perfboard as per the final schematic given, accompanied by the subsequent dry run of the project, before designing of the enclosure and making concluding adjustments.

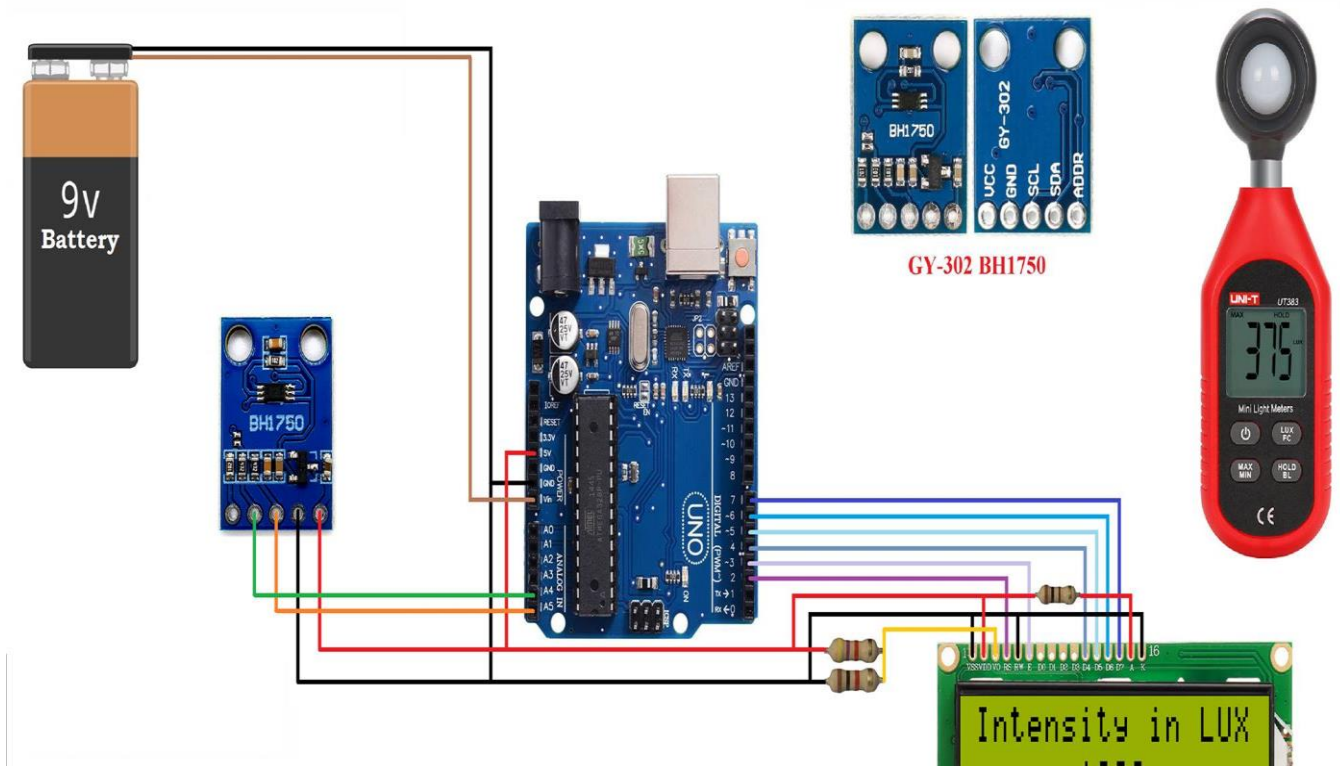
Some pictures showing the execution stage :







# CIRCUIT SCHEMATIC :





## CODE:

```
#include<LiquidCrystal.h>
#include<Wire.h>

LiquidCrystal lcd (2, 3, 4, 5, 6, 7);

int BH1750address = 0x23;
byte buff[2];

void setup(){
  Wire.begin();
  lcd.begin(16,2);
  lcd.print(" BH1750 Light ");
  lcd.setCursor(0,1);
  lcd.print("Intensity Sensor");
  delay(2000);
  lcd.clear();
}

void loop(){
  int i;
  uint16_t value=0;
  BH1750_Init(BH1750address);
  delay(200);

  if(2==BH1750_Read(BH1750address)){
    value=((buff[0]<<8)|buff[1])/1.2;
```

```
    lcd.setCursor(0,0);  
    lcd.print("Intensity in LUX");  
    lcd.setCursor(6,1);  
    lcd.print(value);  
    lcd.print("  ");  
}  
delay(150);  
}
```

```
int BH1750_Read(int address) {  
    int i=0;  
    Wire.beginTransmission(address);  
    Wire.requestFrom(address, 2);  
    while(Wire.available())  
    {  
        buff[i] = Wire.read();  
        i++;  
    }  
    Wire.endTransmission();  
    return i;  
}
```

```
void BH1750_Init(int address) {  
    Wire.beginTransmission(address);  
    Wire.write(0x10);  
    Wire.endTransmission();  
}
```

# APPLICATIONS:

It has several applications:

- Sensitive medical equipment

- 1) Medical monitor light meter : It is a precision measuring instrument for the measurement of luminance with a measuring angle of  $1^\circ$ . Luminance measurements at distances of 1 meter to infinity, taking ambient light into account, can be performed with this device.



- 2) Medical monitor light meter :

The luminance of monitor screens can be precisely measured and documented with the help of this device precision measuring instrument. The device is designed for class B contact measurements. It's suitable for the performance of measurements at transilluminated and self-luminous surfaces.

The silicon sensor included with this device is color corrected – its spectral sensitivity is precisely matched to that of the human eye. This instrument fulfills all requirements for luminance meters specified in DIN 5031-7 and DIN EN 13032-1 class B.



- 3) Illuminance tester : It is a high precision luxmeter for use in hospitals and medical practices. It reliably measures the illuminance of daylight, as well as all types of artificial light sources, and is ideal for quality

assurance: precision in accordance with class C makes it suitable for a broad range of measuring tasks.

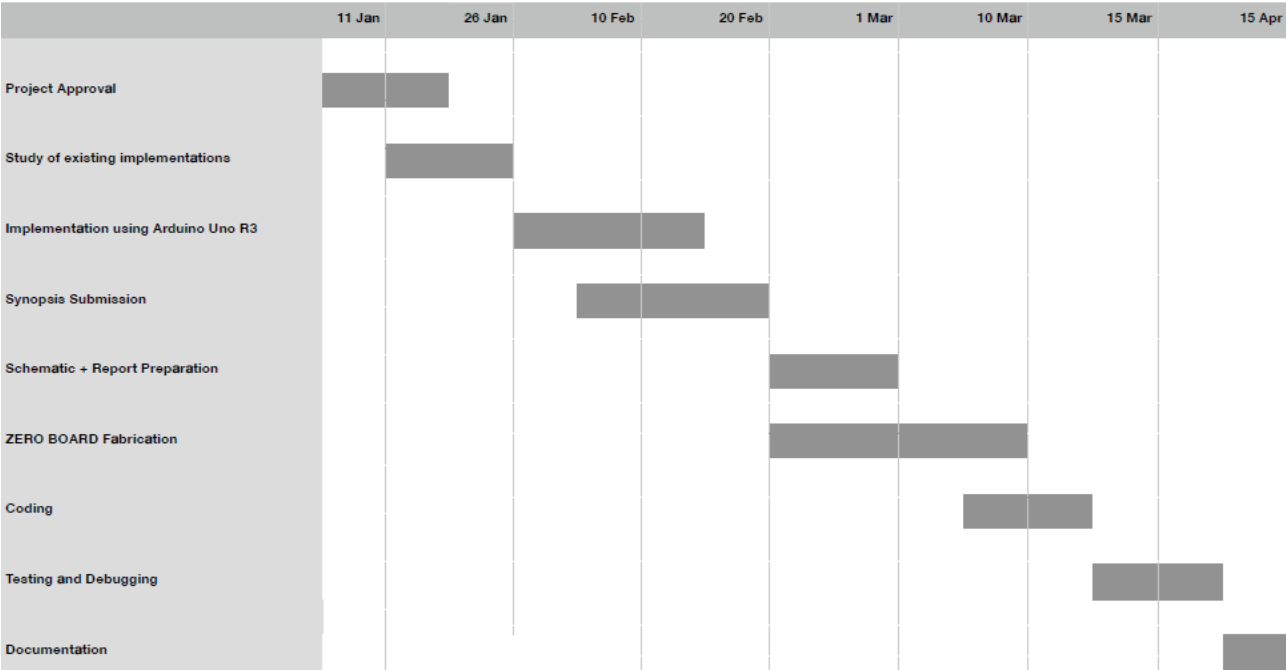
- Light sampling : Sample light is defined as “the type of light used to illuminate the samples under observation.” There are different types of sample lights depending on the space in which the sample light is being used. Sample lights also vary in intensity and localization.

Usage-

Sample lights are utilized in the fields of biology, chemistry, and research. Scientists and researchers used different types of lights to illuminate the specimens under study. Simply lights play a very important role in all aspects of life if you want to look or observe anything you want a light to be shined on that to view its details. Light rays fall on the objects and reflect, the reflected rays then enter our eyes and create an image in our brains.

- Automatic streetlights intensity controlled : The street lights take up a lot of electricity consumption which is incurred by the government. Mostly, the street lights have Mercury or Halogen bulbs so their electricity consumption is quite higher. The street lights are already automated and start glowing only after the sunset. This project is an improvement to the existing automatic street light system. The project controls the voltage supply to the street lights based on the intensity of sunlight. Therefore, when there is not completely dark, the project supplies lower voltage to the lights and as the darkness increases with the sunset, the voltage supplied to the lights is gradually increased to full.
- Auto Brightness in Phones : Adaptive Brightness is a feature on both old and new Android phones that automatically adjusts your screen's brightness based on the ambient lighting conditions. It makes it easier to read your phone in different lighting environments with the added advantage of conserving battery life.

# GANTT CHART :



# REFERENCE:

- 1) <https://www.hackster.io/embeddedlab786/diy-light-lux-meter-ad3a81>
- 2) <https://youtu.be/TRZ8WyEKDAk>
- 3) <https://www.allaboutcircuits.com/projects/design-a-luxmeter-using-a-light-dependent-resistor/>
- 4) [https://www.hioki.com/in-en/learning/usage/field-measuring\\_1.html](https://www.hioki.com/in-en/learning/usage/field-measuring_1.html)
- 5) <https://www.digikey.in/en/maker/projects/design-a-luxmeter-with-an-ldr-and-an-arduino/623ae0f93e427bb57e02c4592567d1>
- 6) <https://www.medicalexpo.com/medical-manufacturer/light-meter-12187.html>

