

# Design, Fabricate & Program an ESP8266 Microcontroller Board

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# **DOCUMENTATION ON PCB WORKSHOP**

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**Submitted to**  
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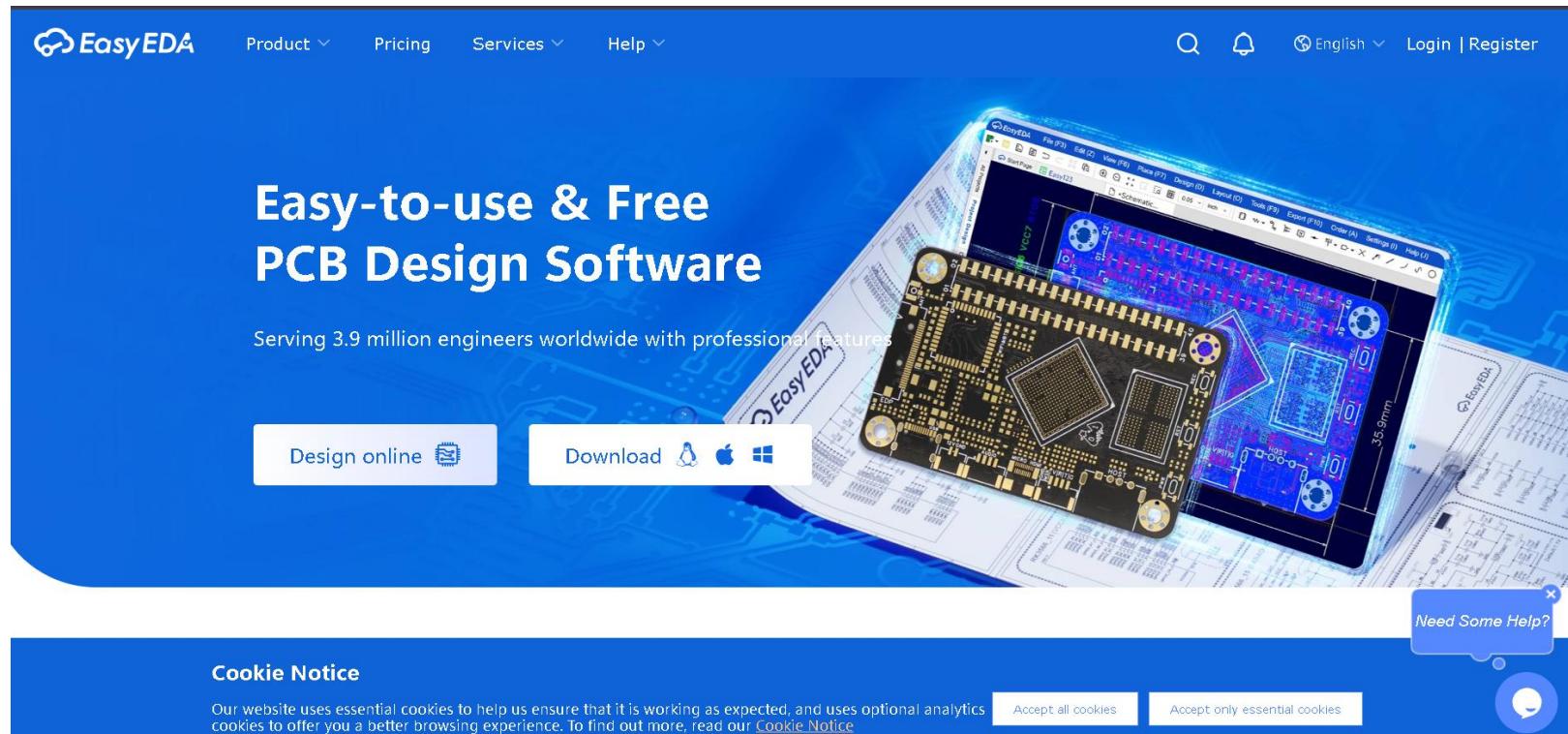
## Day Four:

- Implementation of Project
- Evaluation of Project

# DAY ONE

## GETTING STARTED WITH EASYEDA

EasyEDA is a powerful, web-based EDA (Electronic Design Automation) tool suite that simplifies hardware development



# • CREATE ACCOUNT

## To sign in to EasyEDA:

1. Go to [easyeda.com](https://easyeda.com).
2. Click "Sign in."
3. Enter your email/password or use a third-party account (like Google).
4. Follow any prompts.
5. Access your account.

## Sign in to EasyEDA

Need new account? [Sign up now](#)

The screenshot shows the 'Sign in to EasyEDA' page. At the top, there is a message 'Need new account? [Sign up now](#)'. Below it is a form field for 'srushtigadakh' with the placeholder 'Please enter your username'. Below that is a password field with a redacted value and an eye icon. A 'reCAPTCHA' section follows, featuring a green checkmark and the text 'I'm not a robot'. To its right is the 'reCAPTCHA' logo and links for 'Privacy - Terms'. A large blue 'Sign In' button is centered below these fields. At the bottom left is a 'Remember me' checkbox, and at the bottom right is a 'Forgot password?' link. A 'Sign in with Google' button with the Google 'G' logo is also present.

# What is PCB:

A PCB (Printed Circuit Board) is the foundation of most electronic devices. In short:

- **Purpose:** It's a board that mechanically supports and electrically connects electronic components.
- **Structure:** It consists of conductive tracks, pads, and other features etched from copper sheets laminated onto a non-conductive substrate.
- **Function:** It replaces complex wiring, making electronics smaller, more reliable, and easier to manufacture.
- **Use:** Essential in everything from simple gadgets to complex computers.

## **Types of PCB:**

- **Single-Sided PCBs:** These have a single layer of conductive material (usually copper) on one side of the board .They are the simplest and most cost-effective type. Used in basic electronics like calculators and LED lighting.
- **Double-Sided PCBs:** These have conductive layers on both sides of the board. Holes allow connections between the layers . They offer increased complexity and are used in devices like amplifiers and power supplies.
- **Multi-Layer PCBs:** These consist of three or more conductive layers sandwiched together . They enable highly complex circuitry in a compact space. Used in advanced electronics like computers and medical equipment

## **SINGLE SIDED PCB:**

A single-sided PCB is the most basic type of printed circuit board. Here's a concise explanation:

- **Simple Structure:**

- It features a conductive layer (typically copper) on only one side of the insulating substrate.
- Components are mounted on one side, and the circuitry is on the other.

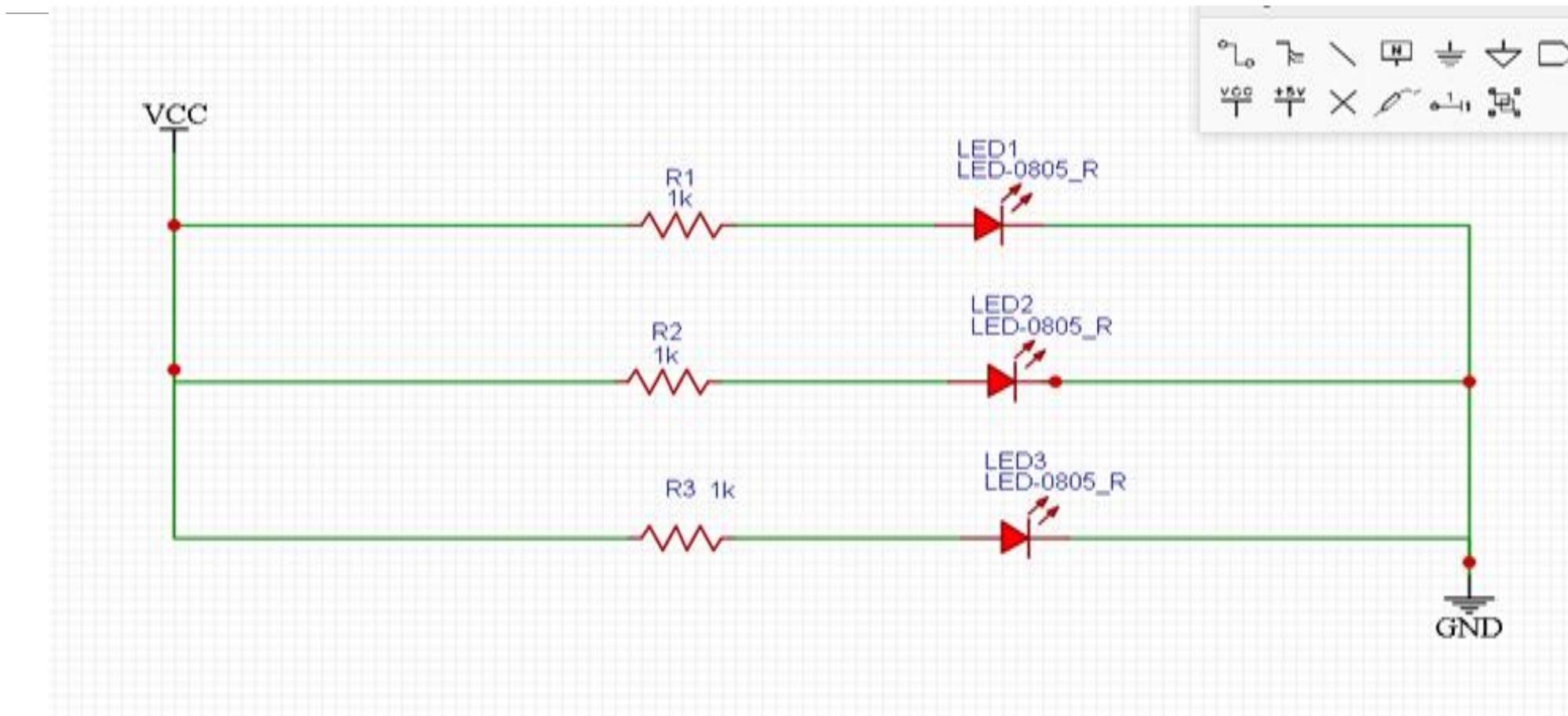
- **Key Characteristics:**

- Cost-effective: Simpler manufacturing leads to lower production costs.
- Simple design: Suitable for less complex electronic circuits.
- Lower density: Limited space for complex wiring.

- **Common Applications:**

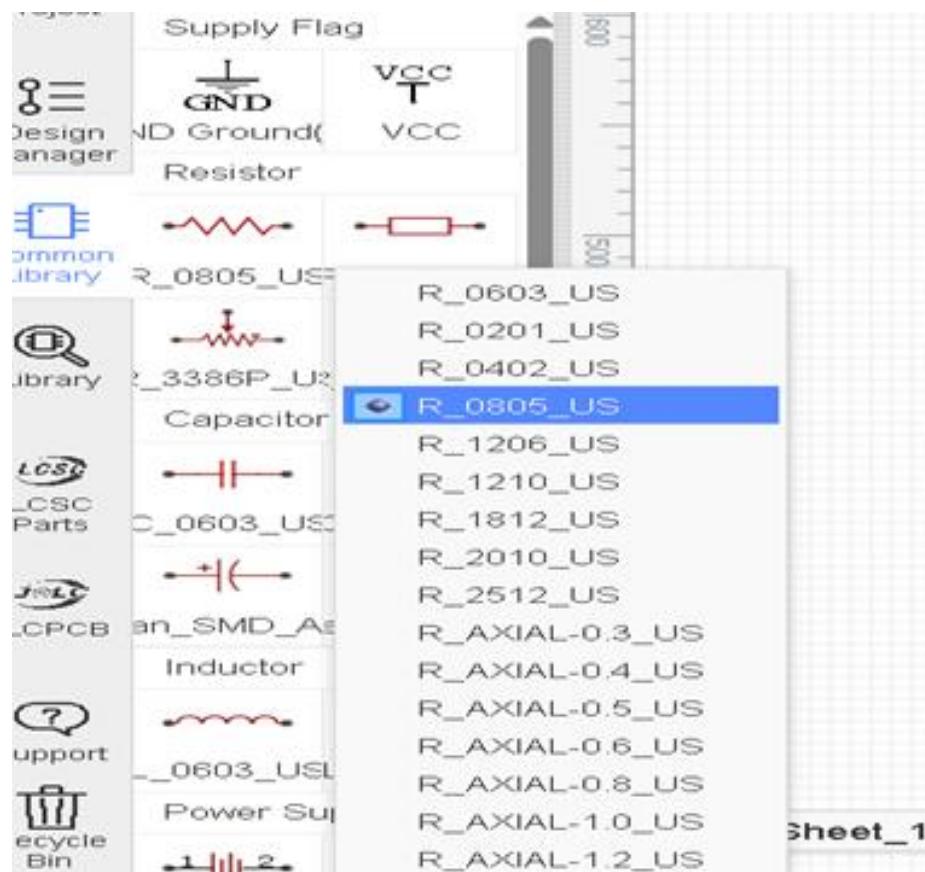
- Used in basic electronic devices like:
  - LED lighting.
  - Calculators.
  - Power supplies.
  - consumer electronics.

# Schematic Diagram of Single Sided PCB

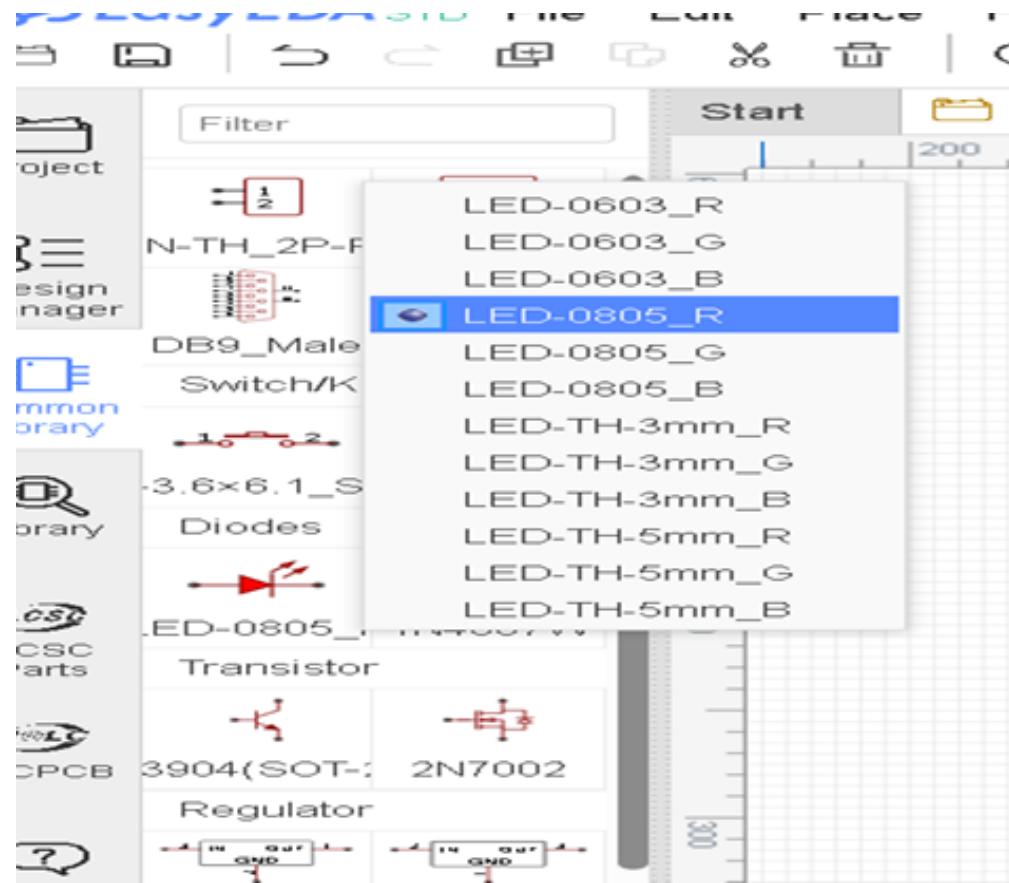


# Components Used:

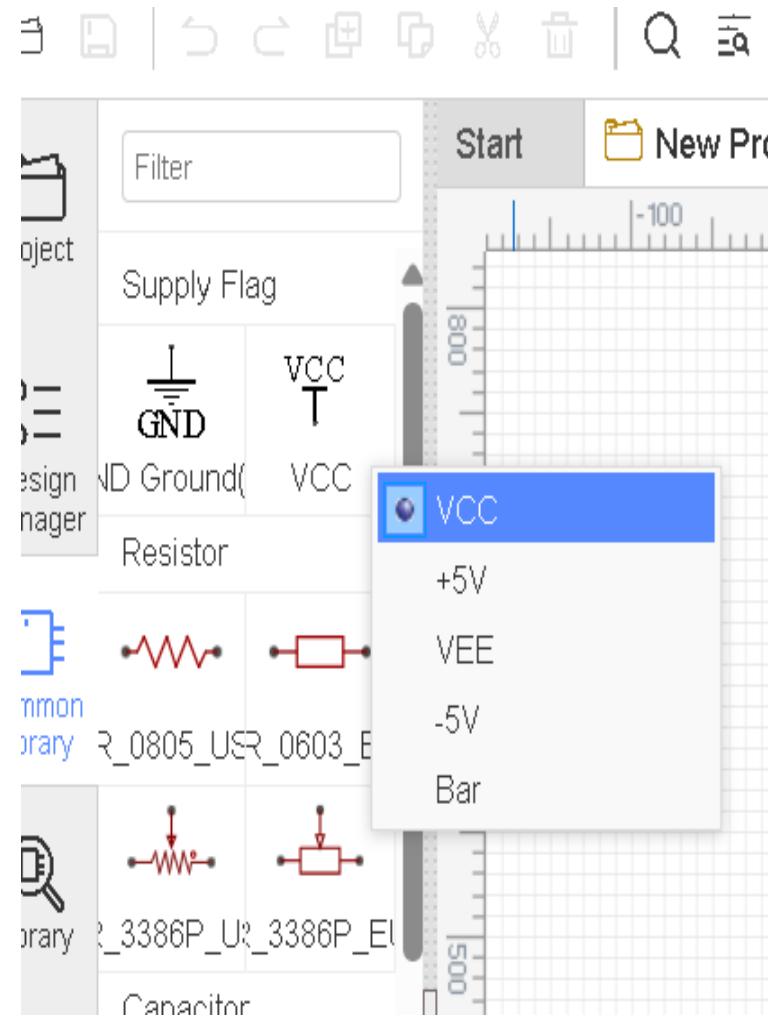
## 1. RESISTOR



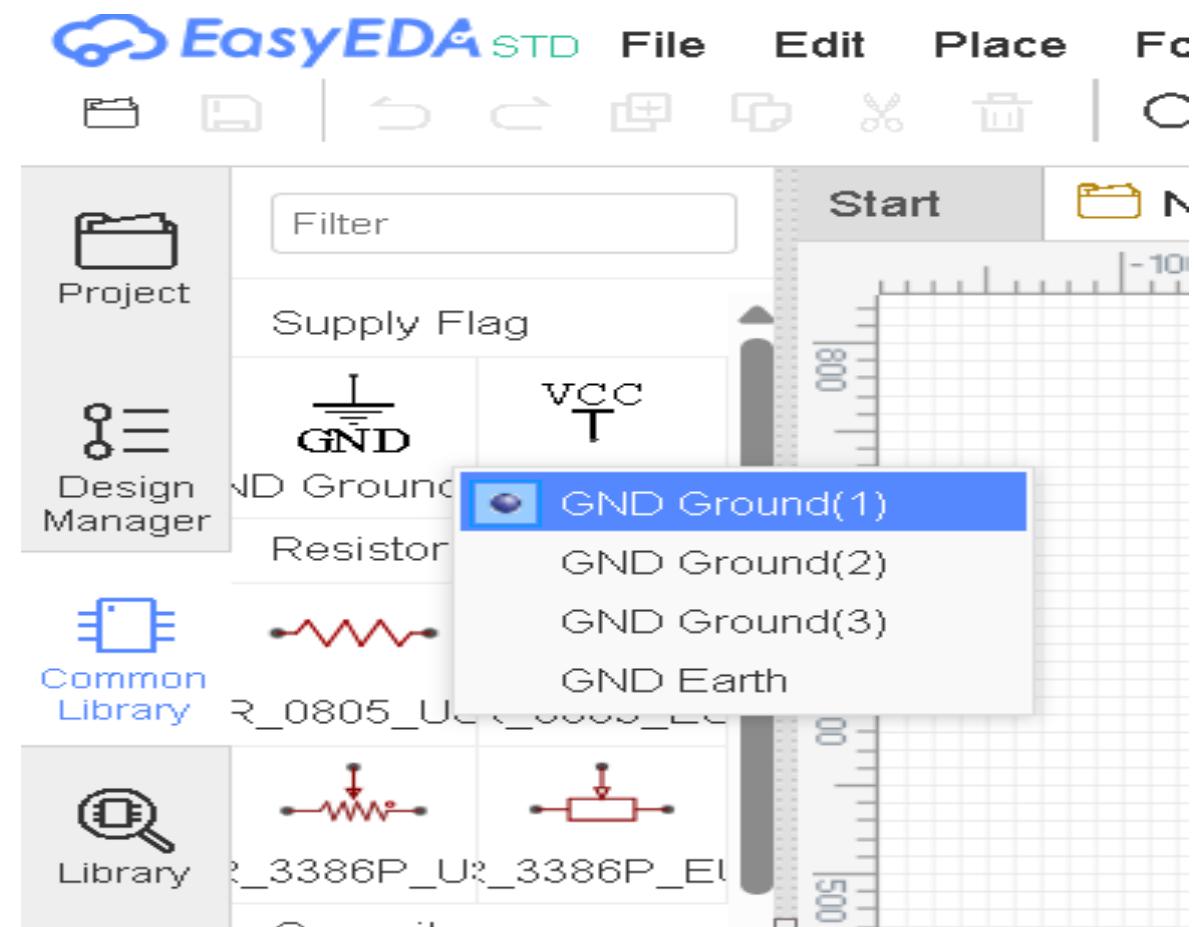
## 2. LED



### 3.VCC



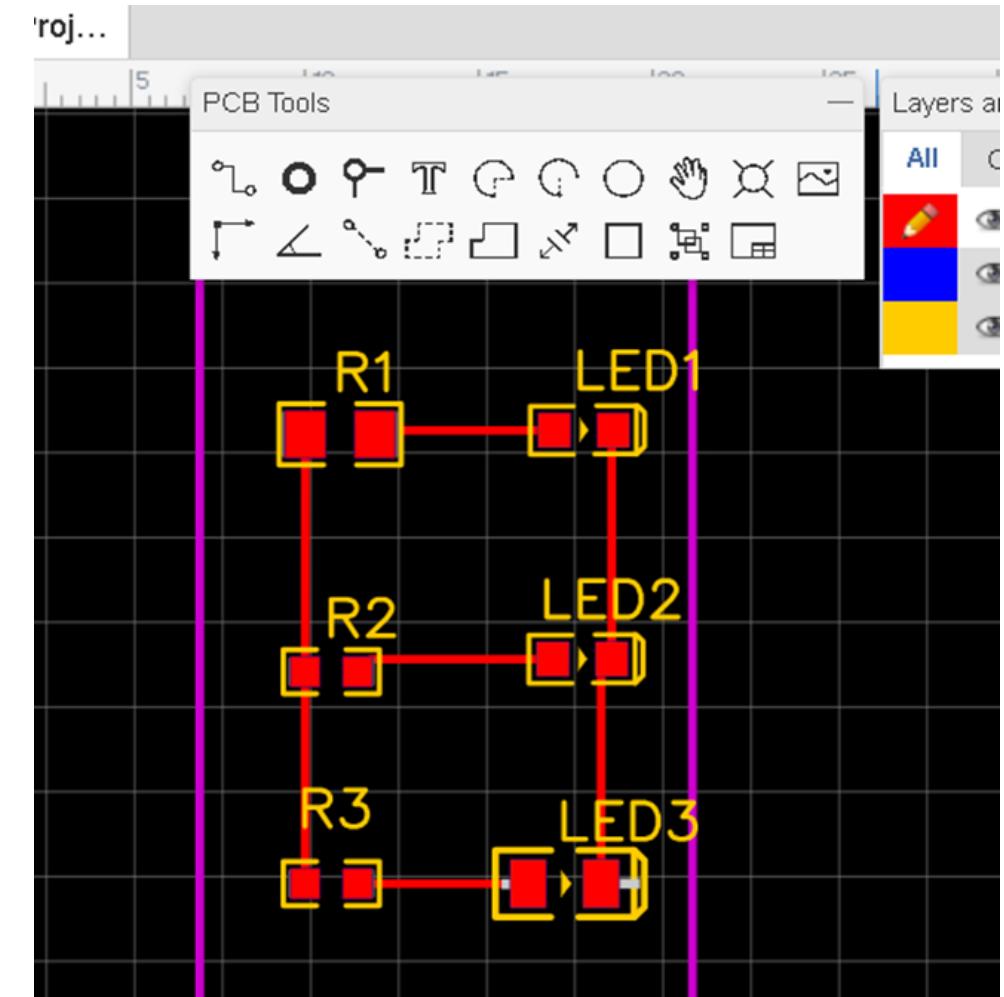
### 4.GROUND



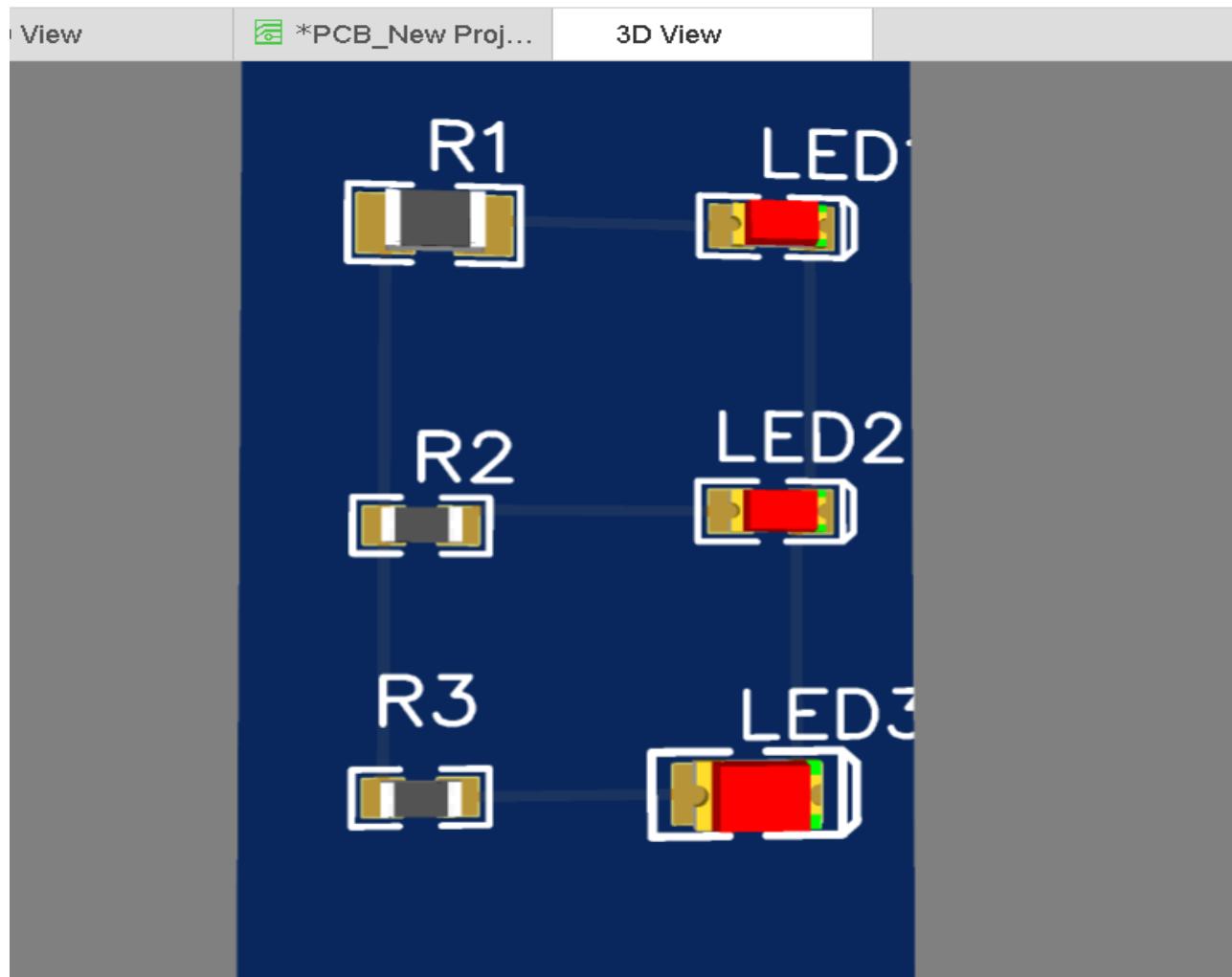
# Schematic Diagram Convert to PCB Layout

Steps for converting Schematic to PCB layout:

- 1.Schematic:** Draw the circuit.
- 2.Netlist:** Export connections.
- 3.Footprints:** Assign component shapes.
- 4.Placement:** Arrange components on the board.
- 5.Routing:** Draw the wires (traces).
- 6.DRC:** Check for errors.
- 7.Gerbers:** Export files for manufacturing.



# 3D VIEW OF PCB LAYOUT:



# Double Sided PCB:

A double-sided PCB, in essence, is a printed circuit board that:

- **Has conductive layers on both sides:**

- This means copper traces and components can be placed on both the top and bottom surfaces of the board.

- **Uses vias to connect layers:**

- Vias are small holes drilled through the board that are then plated with metal, allowing electrical connections between the two sides.

- **Offers increased complexity:**

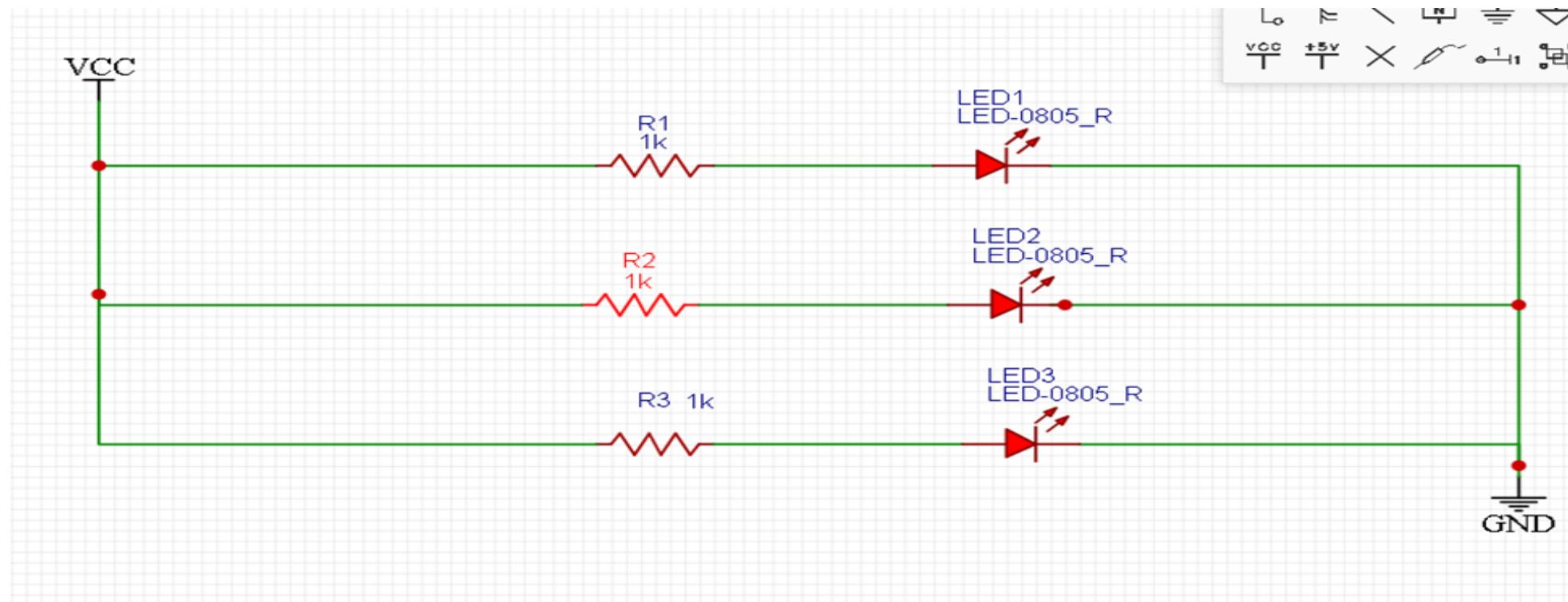
- Compared to single-sided PCBs, double-sided boards allow for more complex circuitry and higher component density.

- **Is widely used:**

- They are common in many electronic devices, offering a balance between complexity and cost.

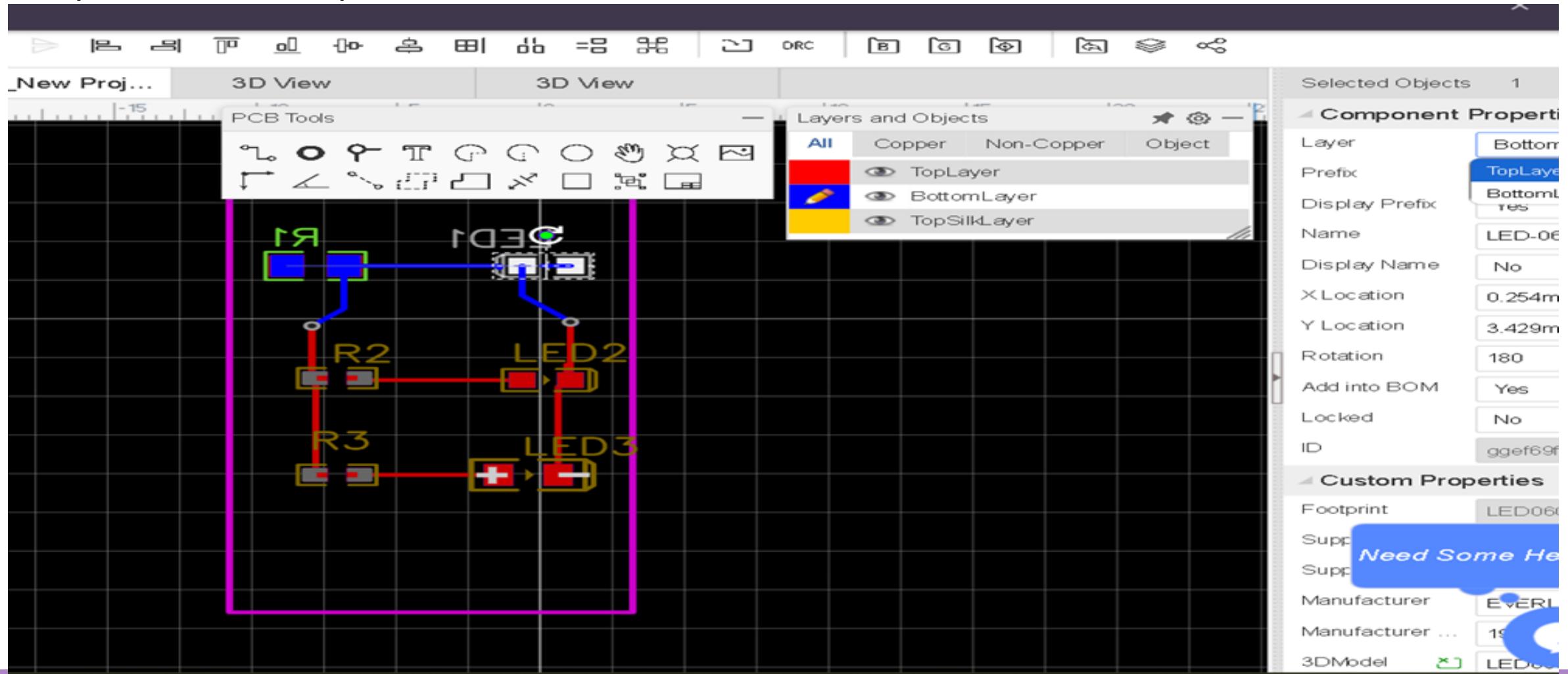
In short, it's a PCB with circuitry on both sides, connected by vias, allowing for more complex designs.

# Schematic Diagram of Double Sided PCB:

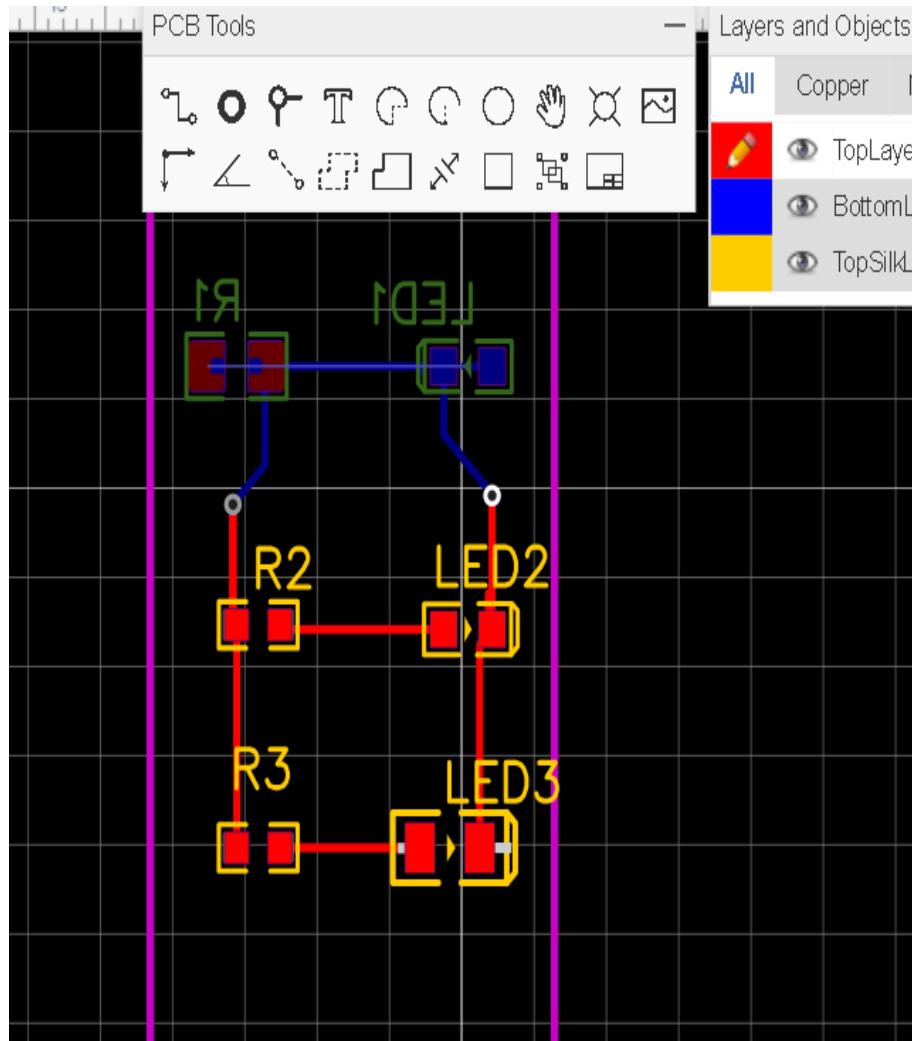


# Converting Schematic Diagram to PCB Layout:

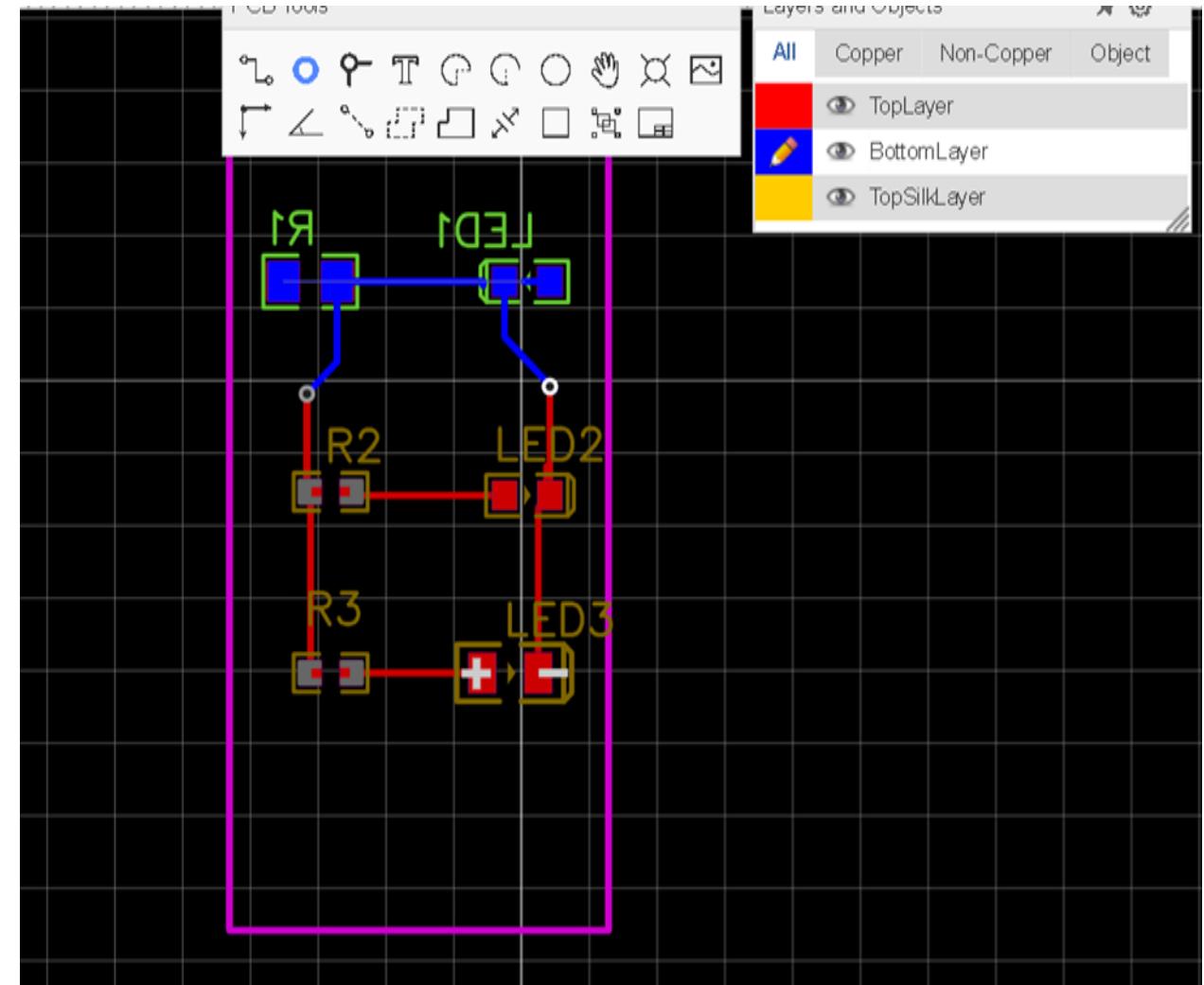
**Placement:** Place components, optimizing for both sides. Here we convert the layer of component from Top to Bottom.



## Top Layer

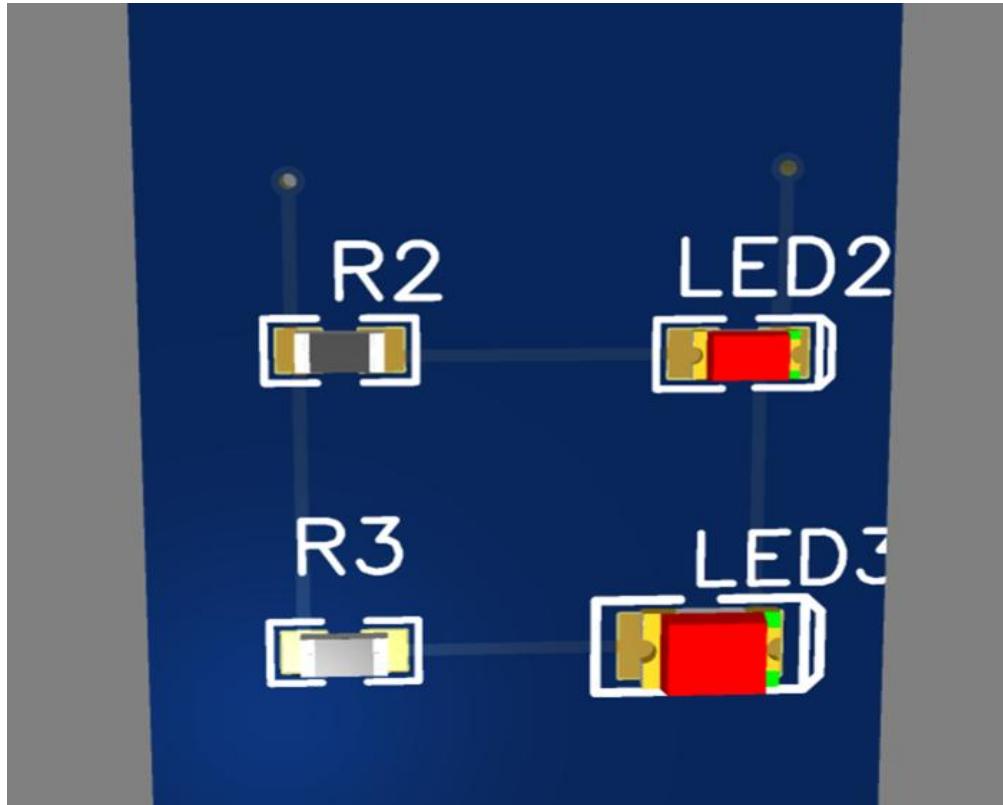


## Bottom Layer

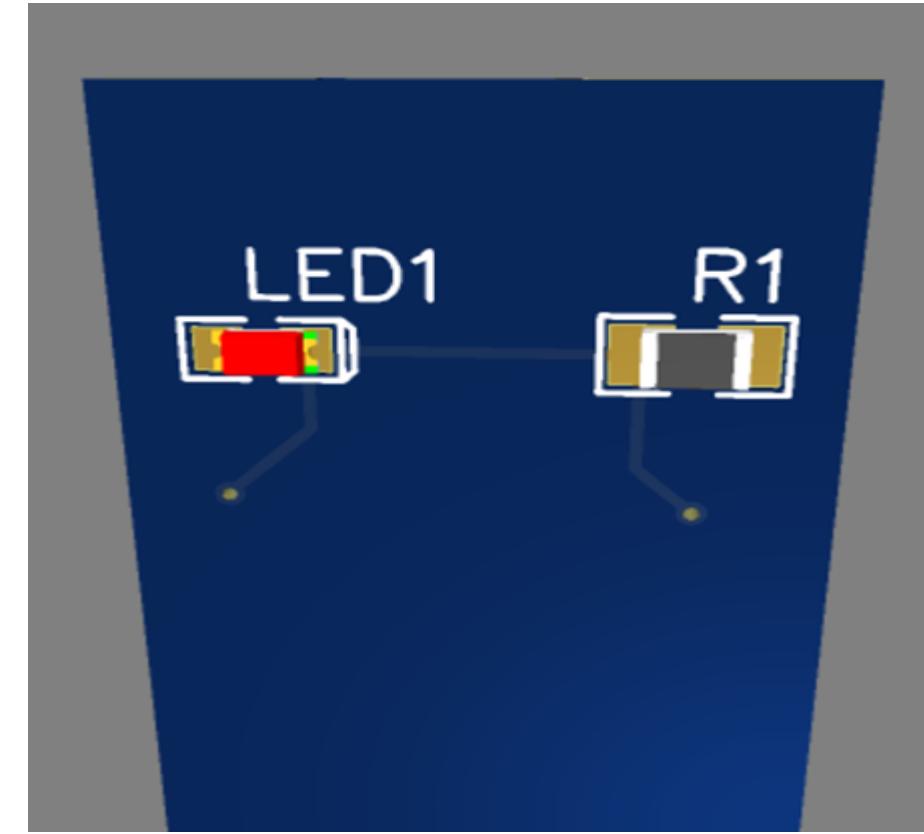


# 3D VIEW:

TOP LAYER



BOTTOM LAYER



# CUSTOM SHAPE PCB:

Custom-shaped PCBs are printed circuit boards that deviate from the standard rectangular or square form. In short:

- **Non-standard outlines:**

- They are designed with unique shapes to fit specific enclosures or product designs.

- **Application-driven:**

- Used when space constraints or aesthetic requirements demand a non-traditional shape.

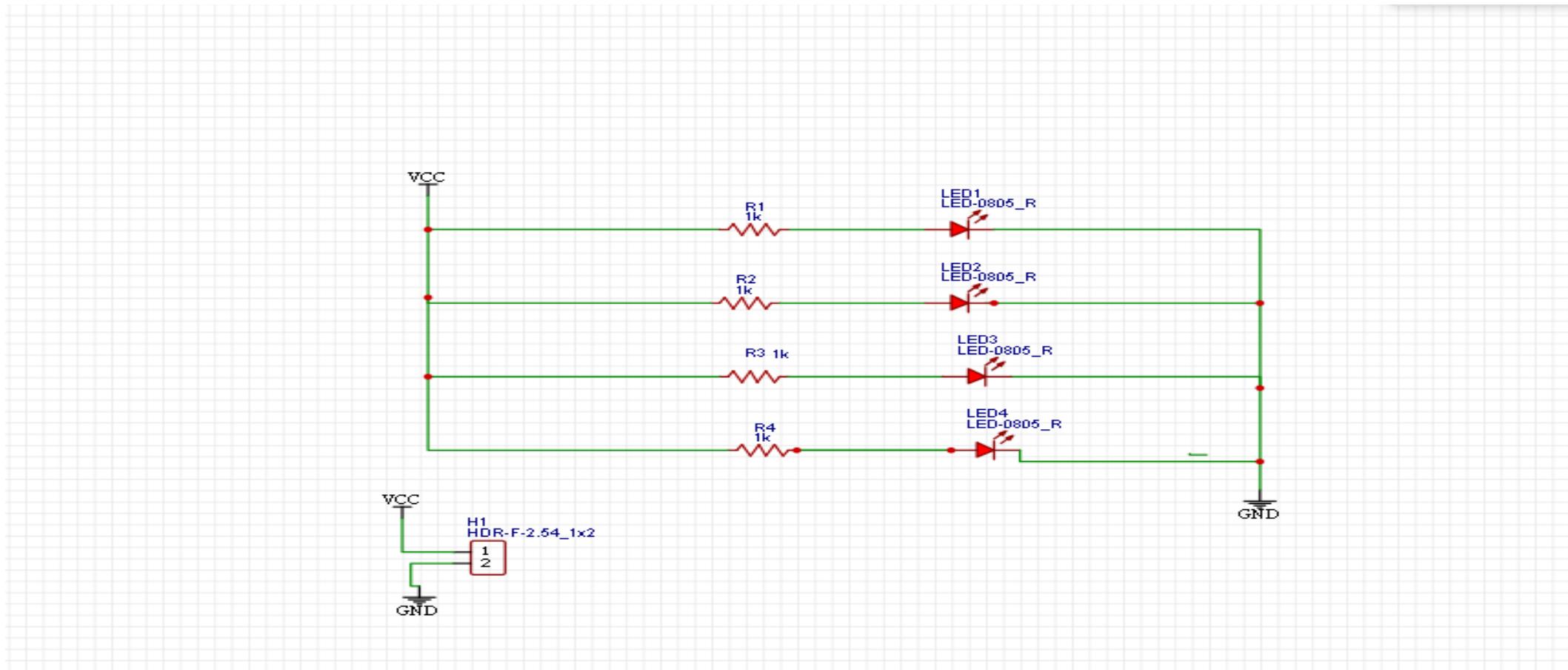
- **Manufacturing:**

- Requires precise cutting or routing during fabrication to achieve the desired shape.

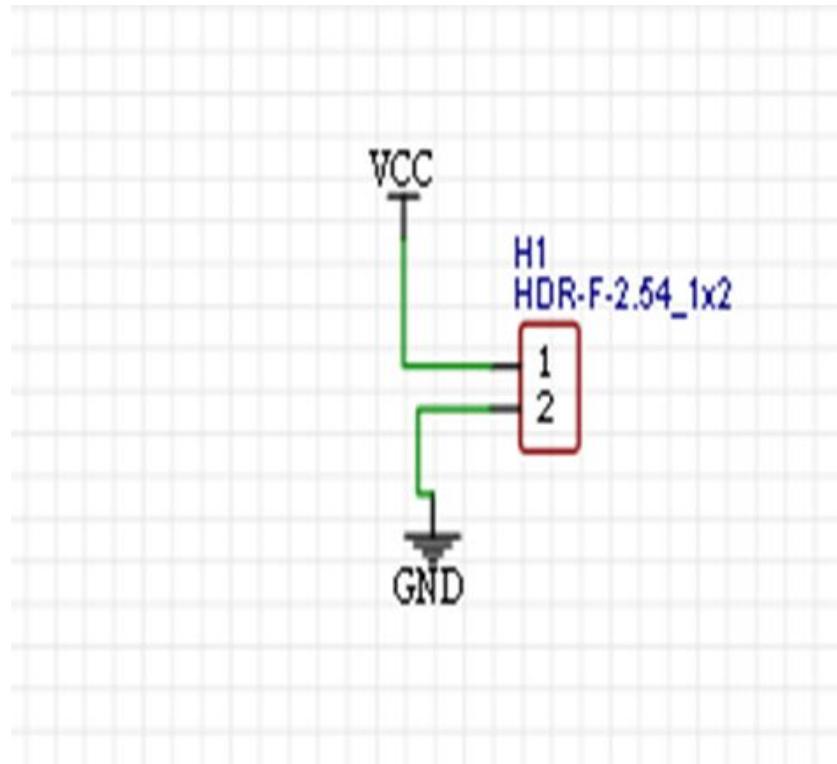
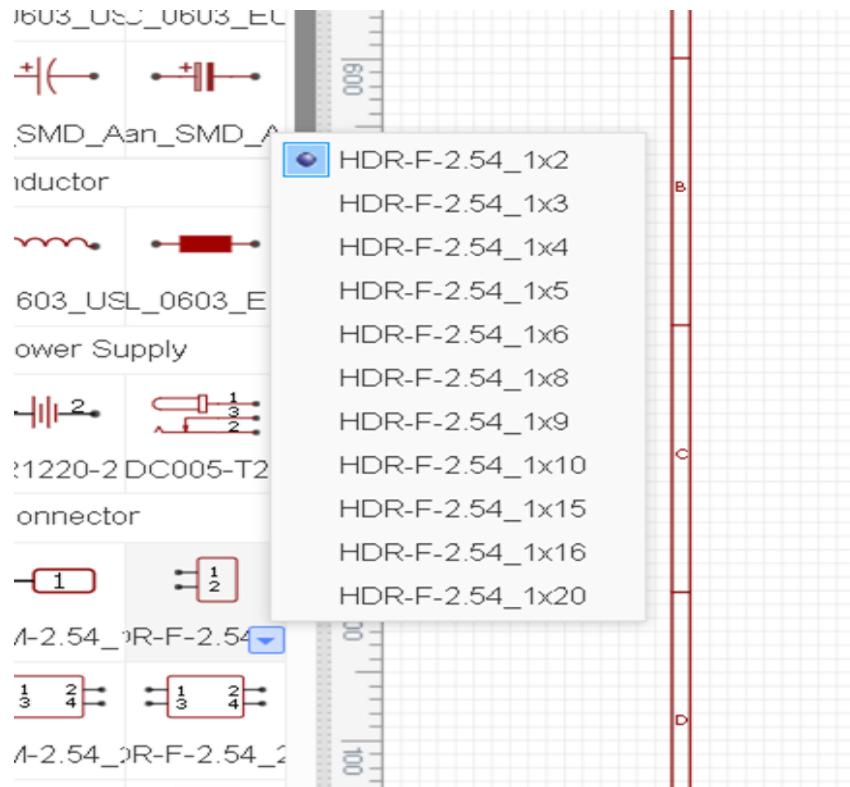
- **Flexibility:**

- Allows for better integration of electronics into complex or irregular product designs.

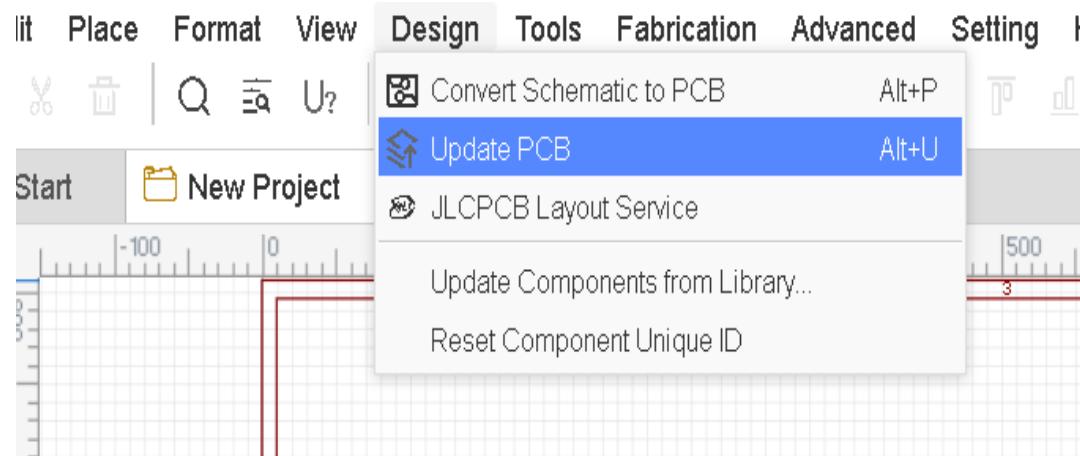
# CUSTOM SCHEMATIC DIAGRAM:



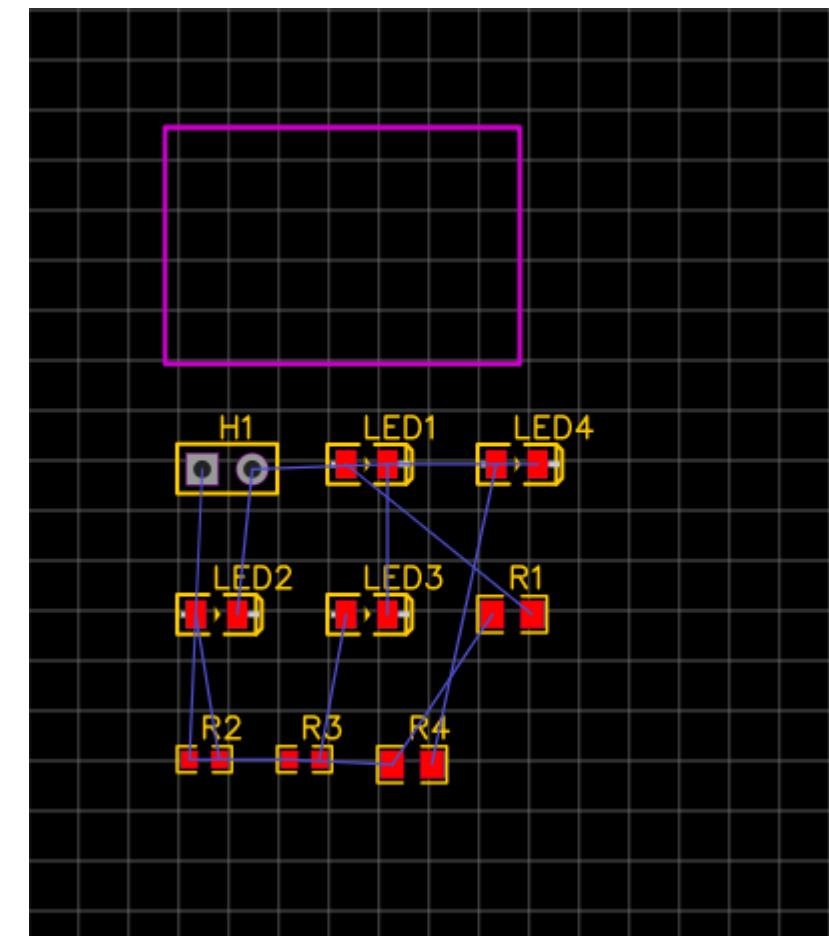
## STEP1: SELECT CONVERTER AND ADD TO SCHEMATIC DIAGRAM



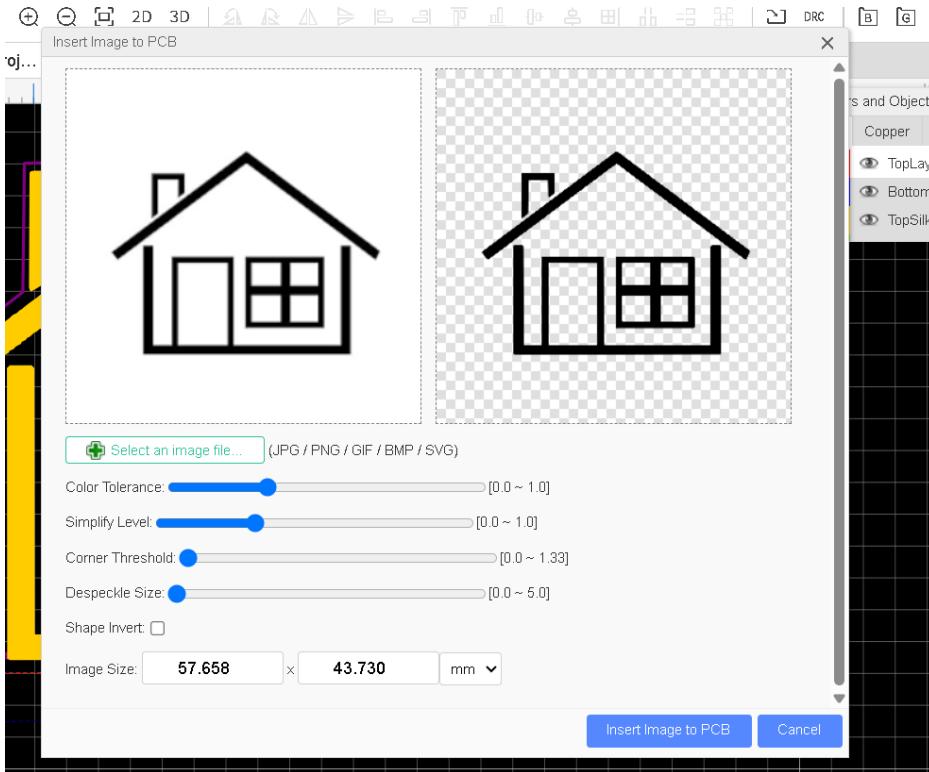
## STEP2:UPDATE PCB



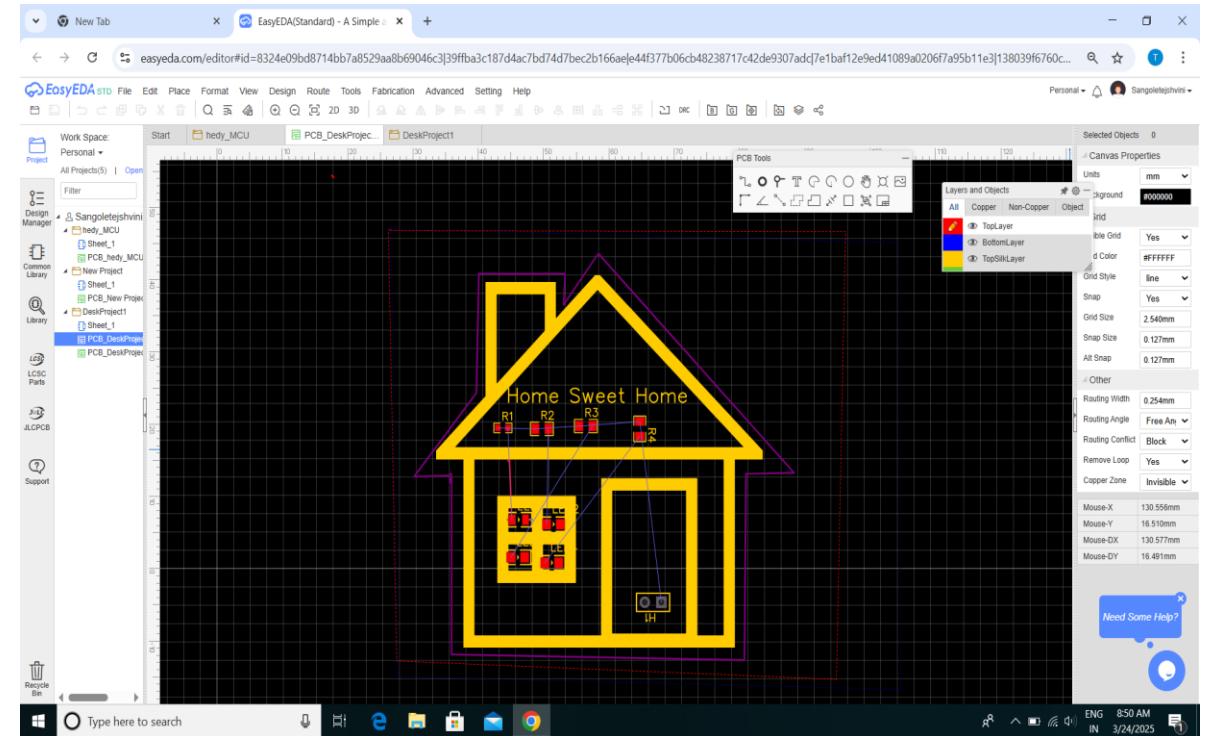
## STEP 3: CONVERT SCHEMATIC TO PCB LAYOUT



## Step 3: Insert home.png image on PCB



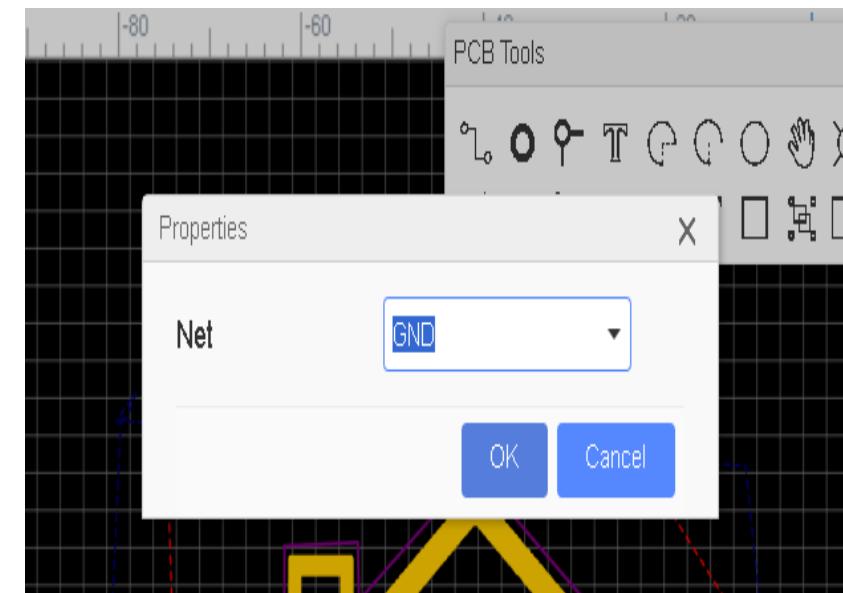
## Step 4: place components



Step 5: place resistors at bottom layer



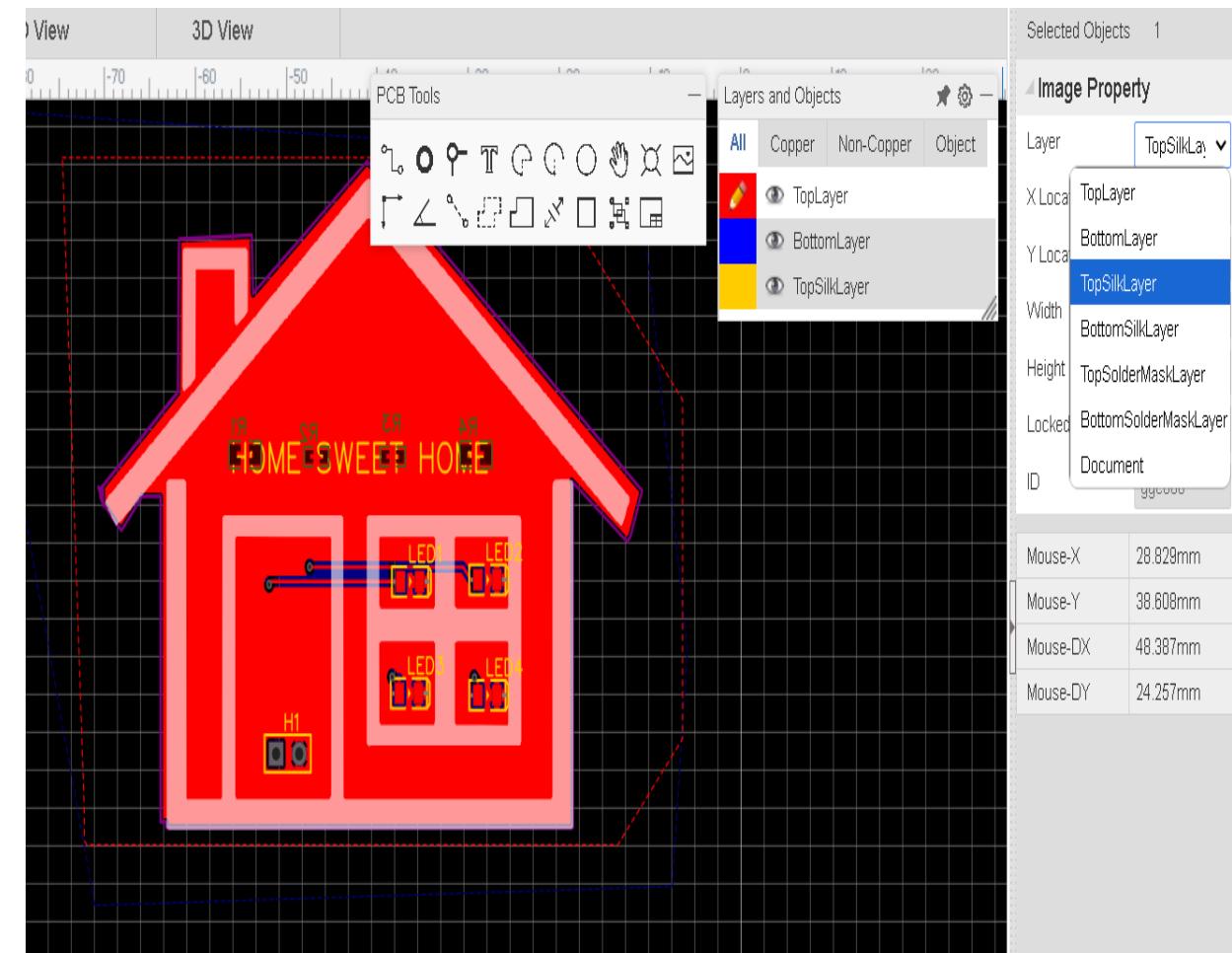
Step 6: Select copper core as ground



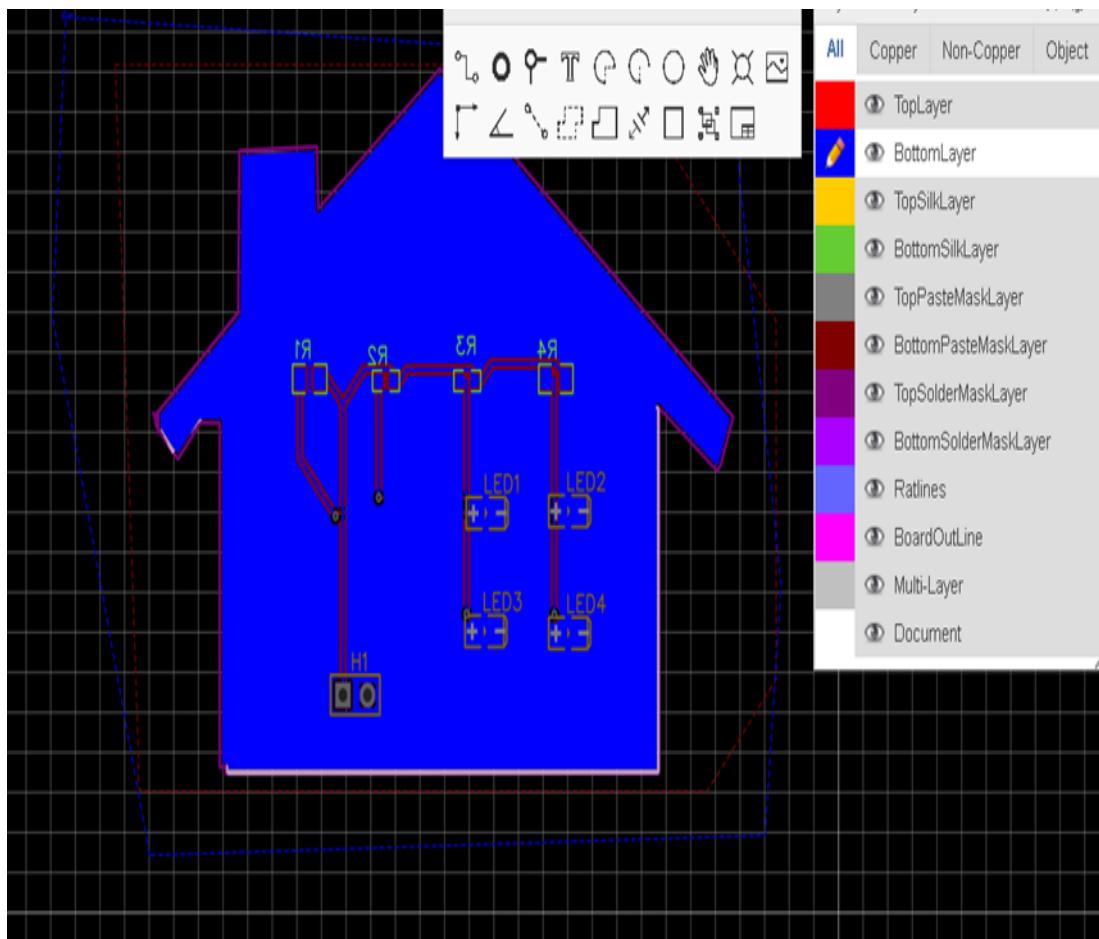
# Copper core Applications and uses

- 1.Electricity's Backbone:** Copper's high conductivity powers homes and industries through wiring.
- 2.Heat's Efficient Carrier:** It cools engines in radiators and transfers warmth in plumbing.
- 3.Construction's Durable Choice:** Copper pipes and roofing resist corrosion and stand the test of time.
- 4.Transportation's Vital Component:** It's the wiring in cars and the windings in motors.
- 5.Electronics' Essential Element:** Copper enables circuit boards and device connections.
- 6.Industry's Versatile Material:** It forms alloys and shapes machinery parts.
- 7.Antimicrobial Protection:** Copper surfaces fight bacteria, promoting hygiene.
- 8.Artistic Expression:** Its malleability makes it ideal for sculptures and jewelry.
- 9.Telcommunications Foundation:** Copper wires, though superseded by fiber, carried signals.
- 10.Everyday Reliability:** From appliances to infrastructure, copper is a dependable material

## Step 7: draw copper core (ground) outline    Step 8:top layer



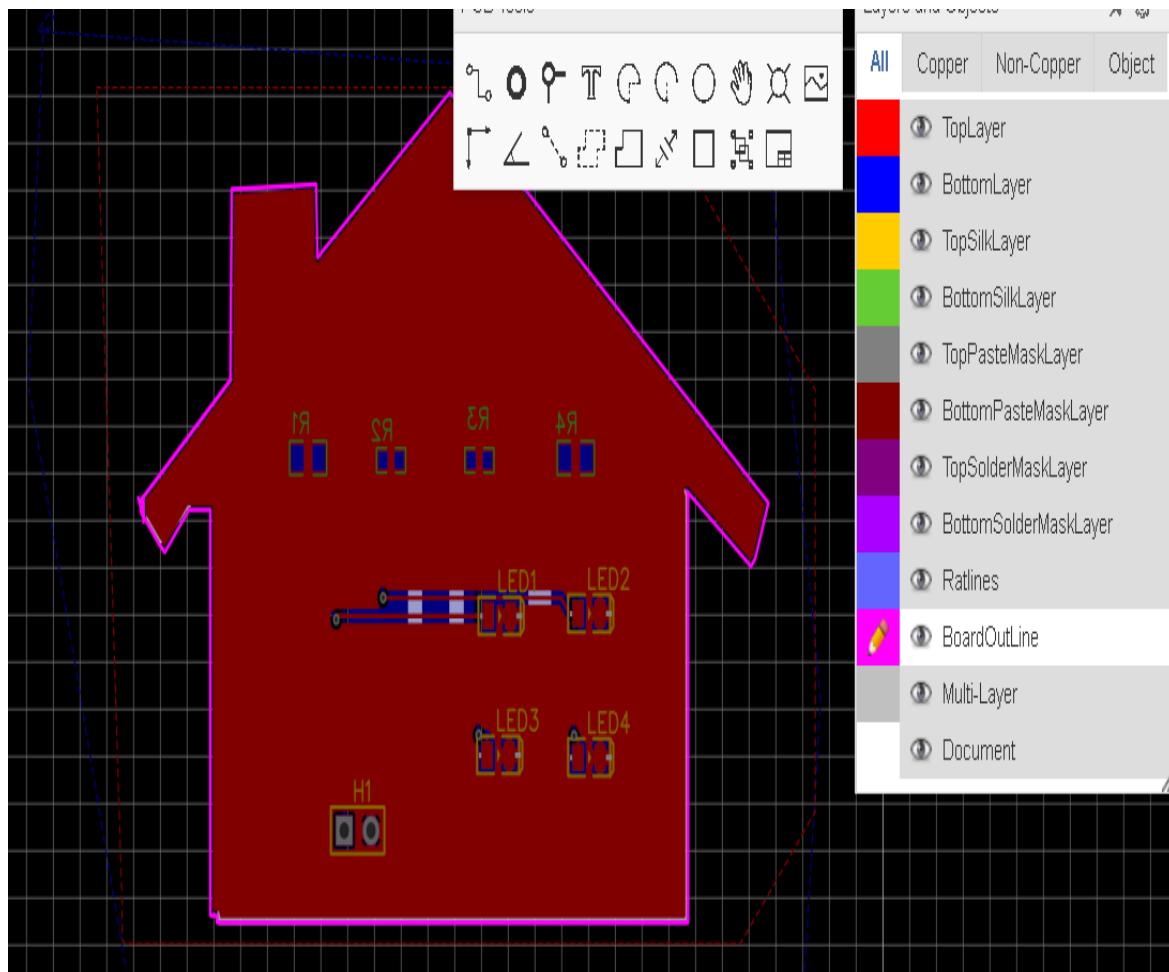
## Step 9:Bottom layer



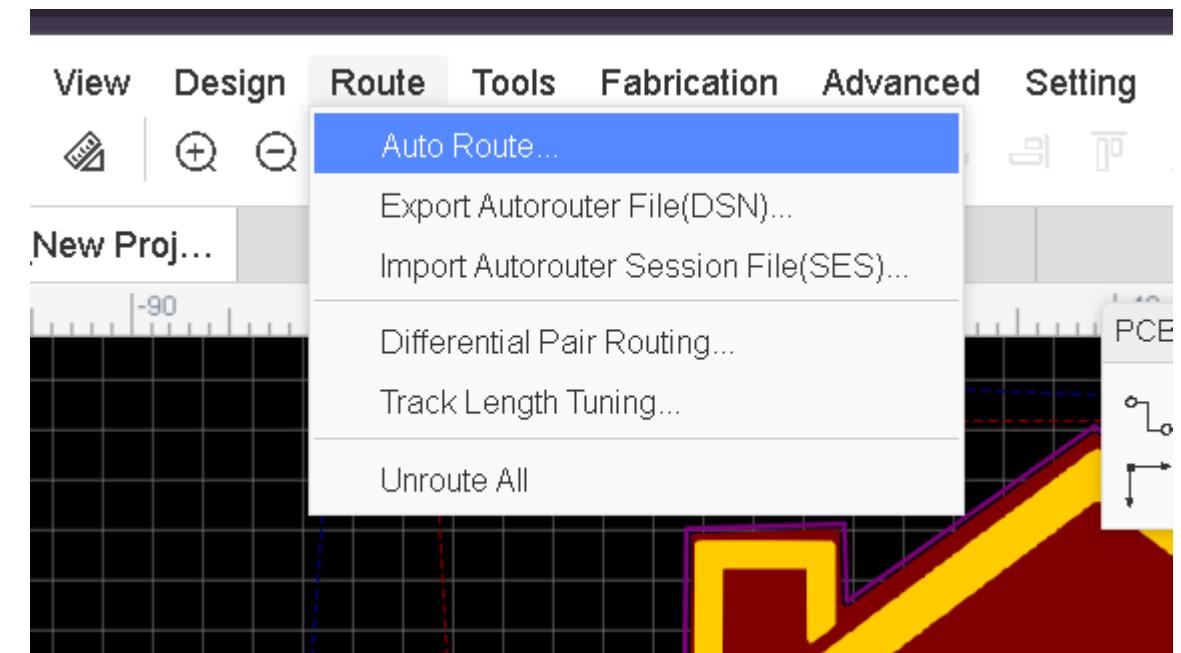
## Step 10:Topsilk Layer



## Step 11:Board Outline



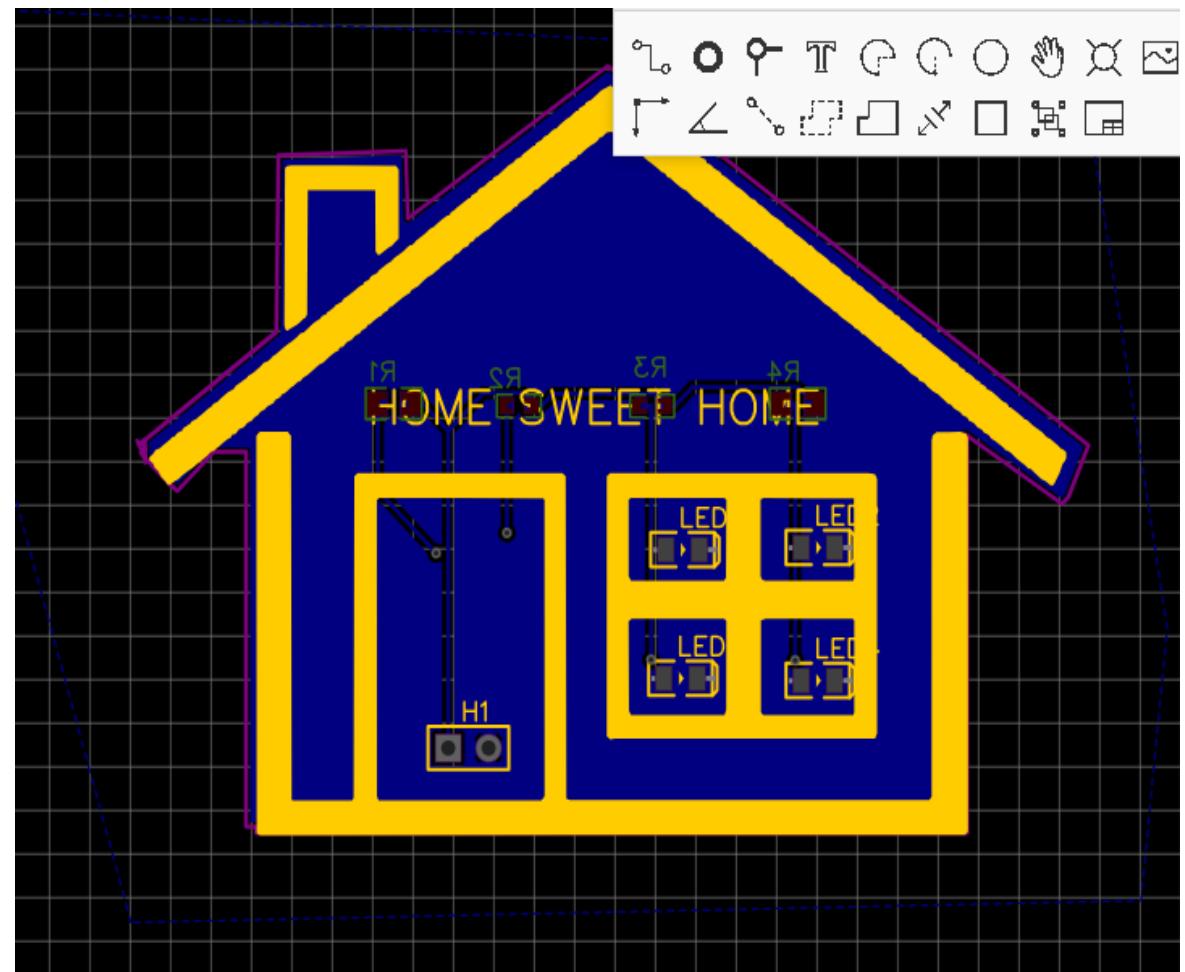
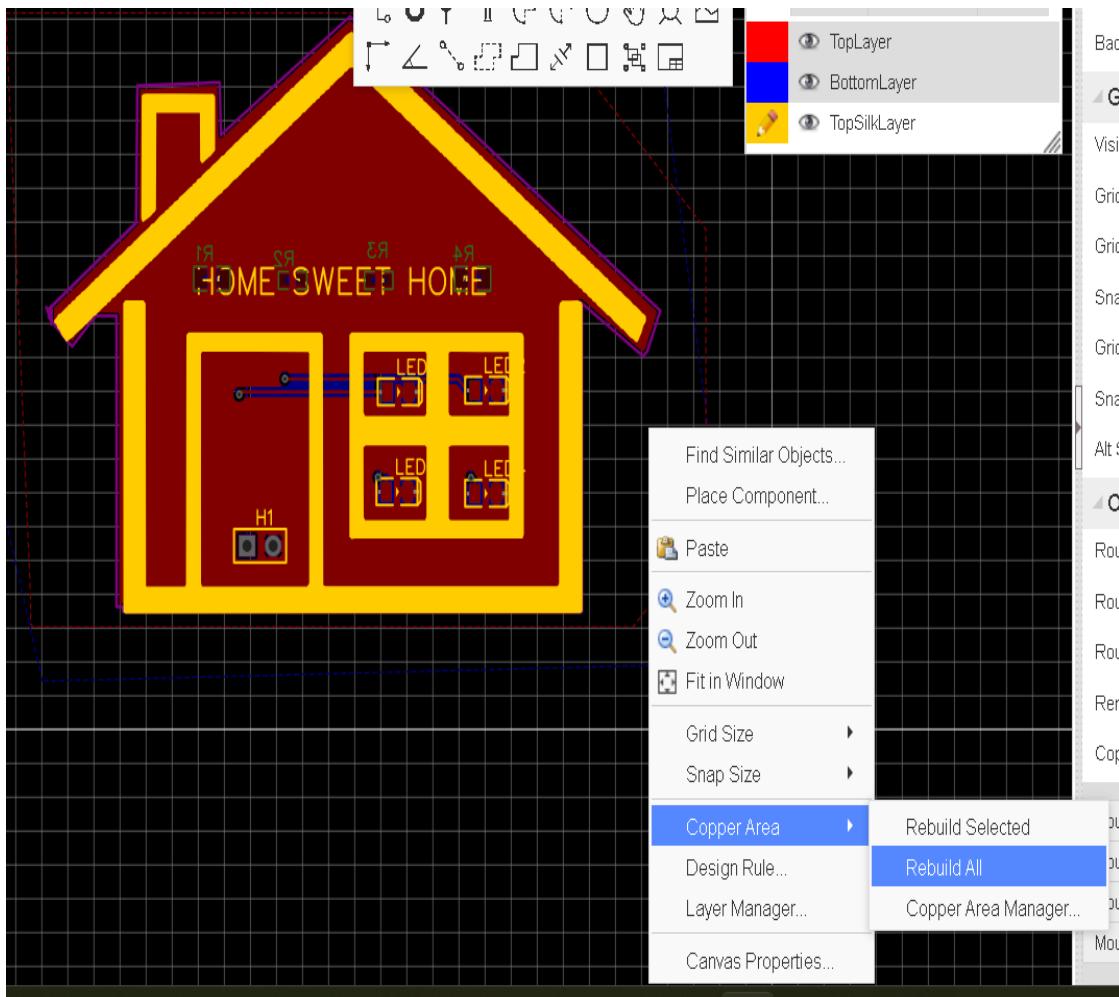
## Step 12:Auto Route



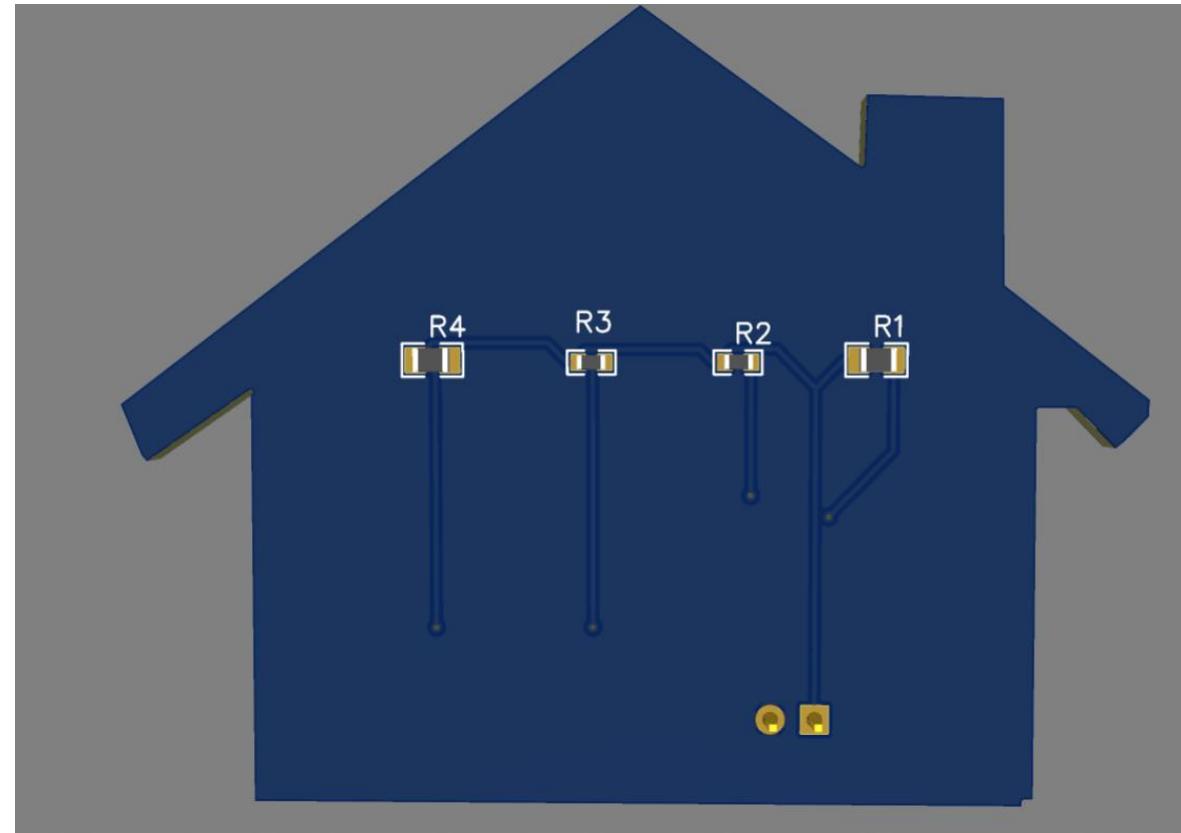
# Auto Routing

- **Placement matters:** Good layout is key.
- **Set design rules:** Guide the autorouter.
- **Plan layers:** Distribute traces wisely.
- **Prioritize nets:** Handle critical connections first.
- **Manage vias:** Control hole usage.
- **Avoid congestion:** Pre-route if needed.
- **Iterate:** Expect multiple runs.
- **Check DRC:** Verify for errors.
- **Know limits:** It's not perfect.
- **Refine manually:** Fine-tune the result.

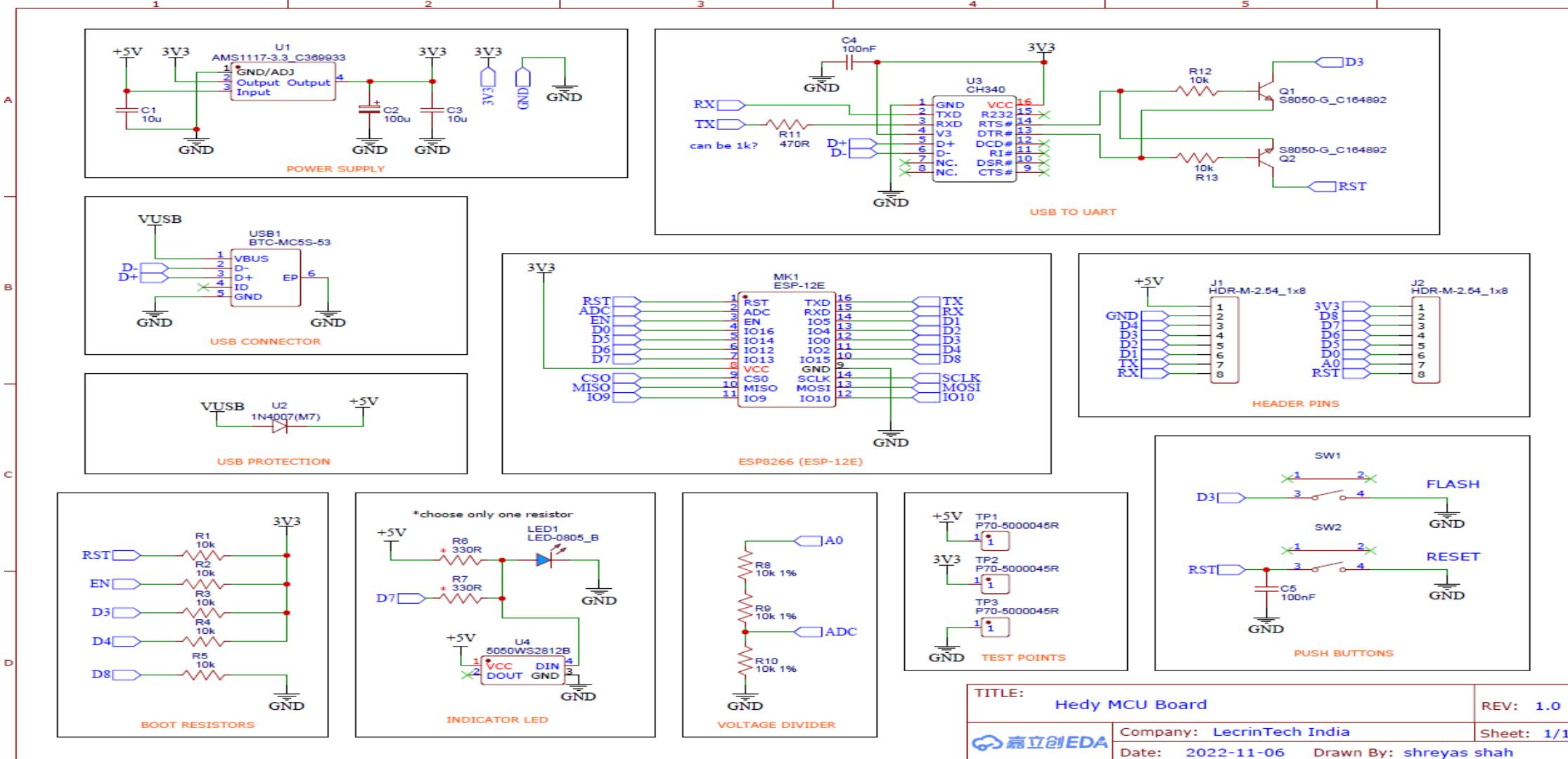
# Auto Route



# 3D VIEW



# Study of Hedy MCU schematic



# POWER SUPPLY

Function: Converts AC to DC, regulates voltage and current.

Key Components: Transformers, rectifiers, filters, regulators.

Types: Linear, switching, AC-DC, DC-DC, etc .

Applications: Computers, electronics, industries, and more.

# USB CONNECTOR

Electricity: Wires for power.

Heat: Pipes, radiators.

Construction: Roofing, plumbing.

Transportation: Car wiring, motors.

Electronics: Circuit boards.

Industry: Machinery, alloys.

# USB TO UART

- **Purpose:**

- Allows communication between a computer's USB port and a device's UART serial interface.

- **Function:**

- Converts USB data signals to UART (serial) signals, and vice versa.

- **Use:**

- Programming microcontrollers, debugging embedded systems, serial communication with devices.

- **Common Chips:**

- FTDI, CP2102, CH340 are popular converter chips.

- **Practicality:**

- Makes it very easy to communicate with devices that use a serial port, using a modern computer.

# USB PROTECTION

- **Overcurrent Protection:** Limits excessive current flow.
- **Overvoltage Protection:** Prevents damage from voltage spikes.
- **ESD Protection:** Protects against electrostatic discharge.
- **Data Line Protection:** Shields data signals from corruption.
- **Circuit Protection:** Fuses and other components to prevent short circuits.

# ESP 8266

- **Wi-Fi Enabled:** It has built-in Wi-Fi capabilities, allowing devices to connect to the internet.
- **Microcontroller:** It functions as a microcontroller, meaning it can process data and control other electronic components.
- **Low Cost:** Its affordability has made it popular among hobbyists and developers.
- **Versatile:** It's used in a wide range of IoT projects, including home automation, sensor networks, and remote control applications.
- **Easy to Use:** With readily available development tools and libraries, it's relatively easy to program and integrate into projects

## **Header pins:**

- Connect wires/components easily.
- Male or female types.
- Used for prototyping & connections.

## **A boot resistor:**

- **Limit inrush current:** When a device is powered on, it can draw a surge of current. The boot resistor restricts this initial surge.
- **Provide a pull-up or pull-down function:** It can set a pin to a defined logic state (high or low) during the boot process.
- **Enable or disable a circuit:** In some cases, it can be used to control the activation of a circuit during startup

## **Indicator LED:**

- Small light showing device status.
- Uses little power.
- Comes in many colors.
- Signals power, errors, etc.

## **A voltage divider :**

- **Reduces voltage:** It takes a larger voltage and produces a smaller, proportional voltage.
- **Uses resistors:** It typically consists of two resistors connected in series.
- **Calculated output:** The output voltage depends on the ratio of the resistor values.
- **Common in electronics:** Used for sensing, biasing, and creating reference voltages.

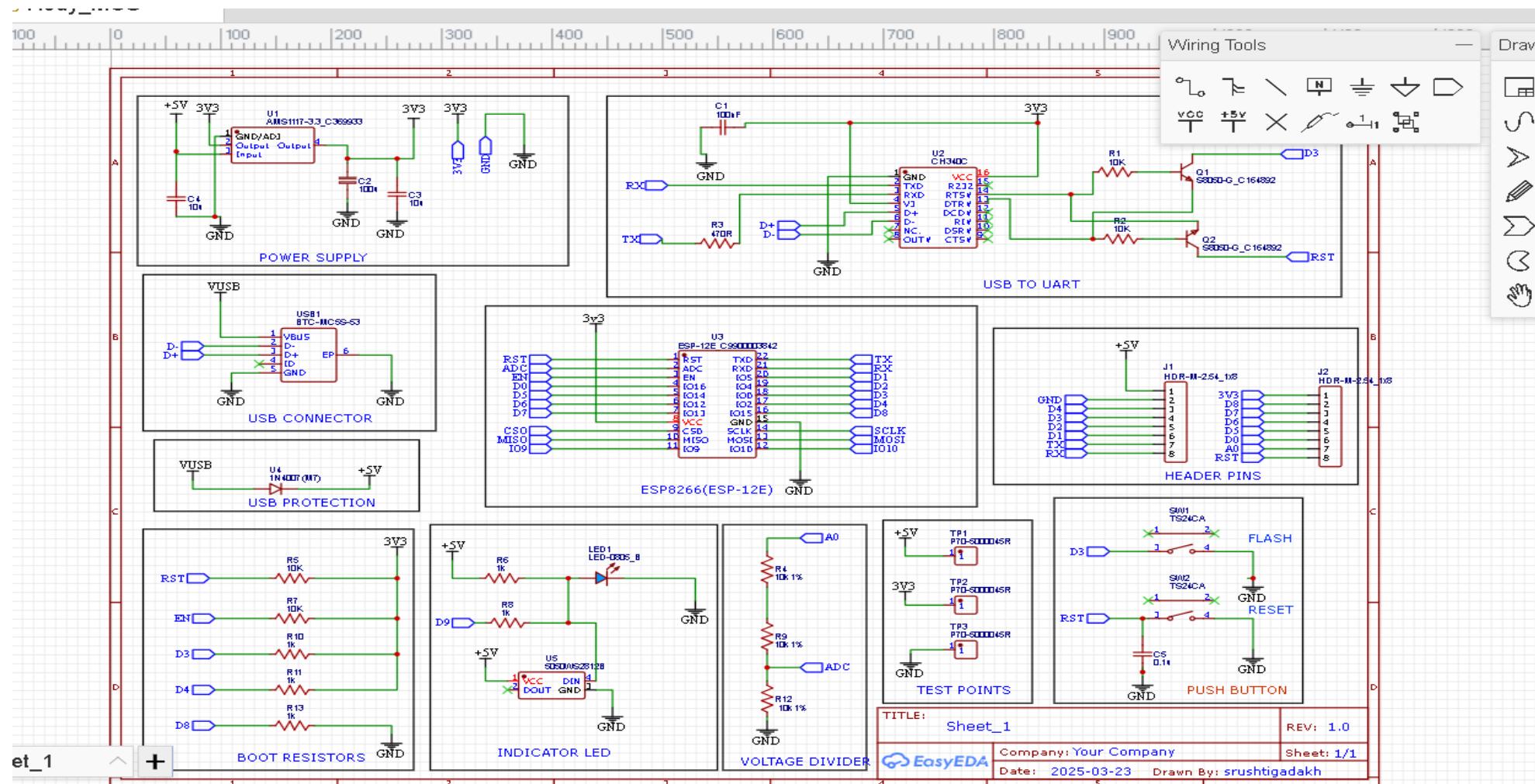
## **TEST POINTS:**

- **Measuring signals:** Allows easy probing with test equipment.
- **Troubleshooting:** Helps diagnose issues during development or repair.
- **Verification:** Confirms circuit functionality and performance.
- **Manufacturing testing:** Speeds up production line checks.

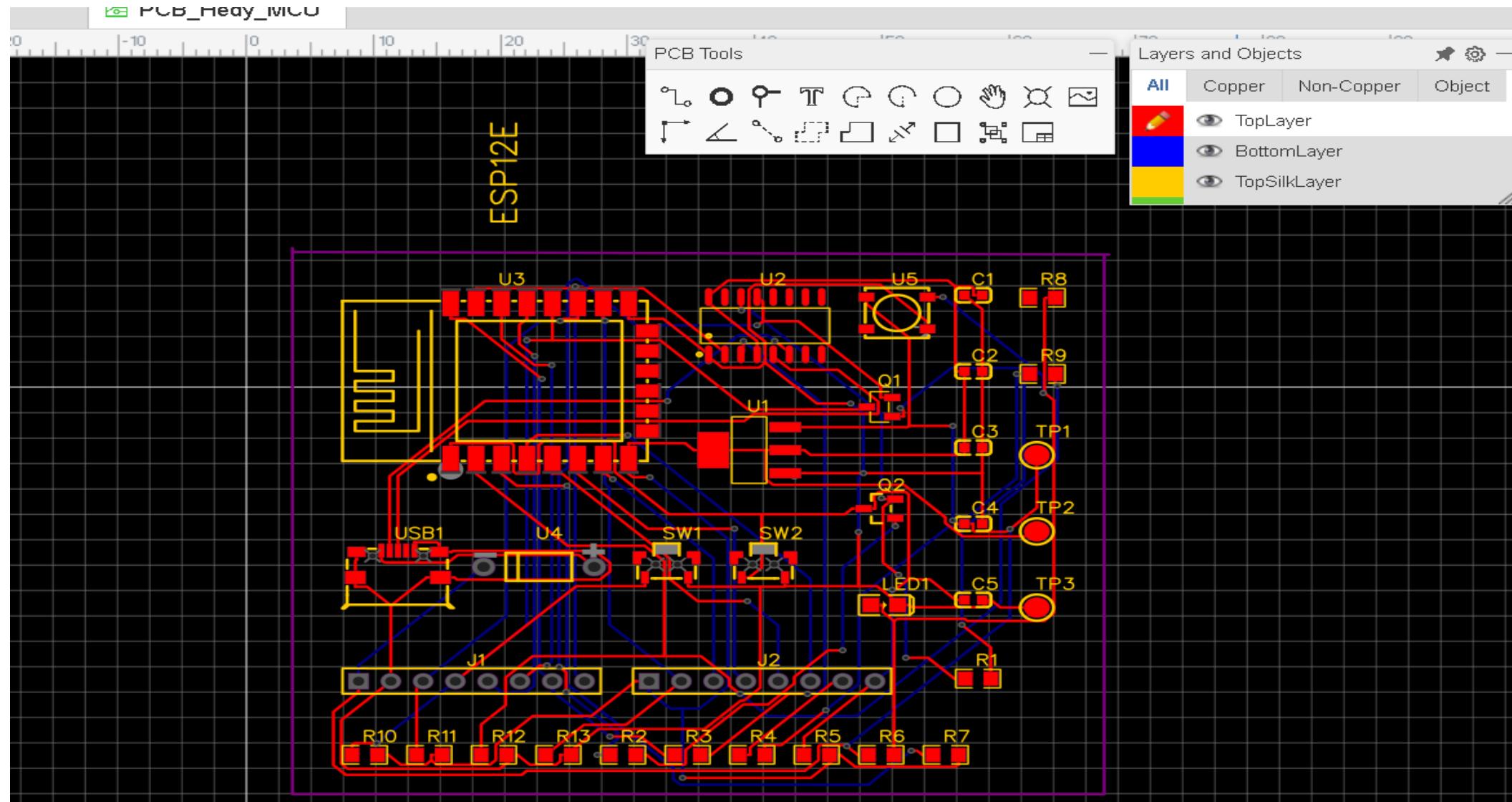
## **A push button**

- **Momentary contact:** It closes a circuit only while being pressed.
- **User input:** Allows for manual activation of a function.
- **Various sizes & types:** Available in many forms for different applications.
- **Common in electronics:** Used for power on/off, resets, and menu selection.

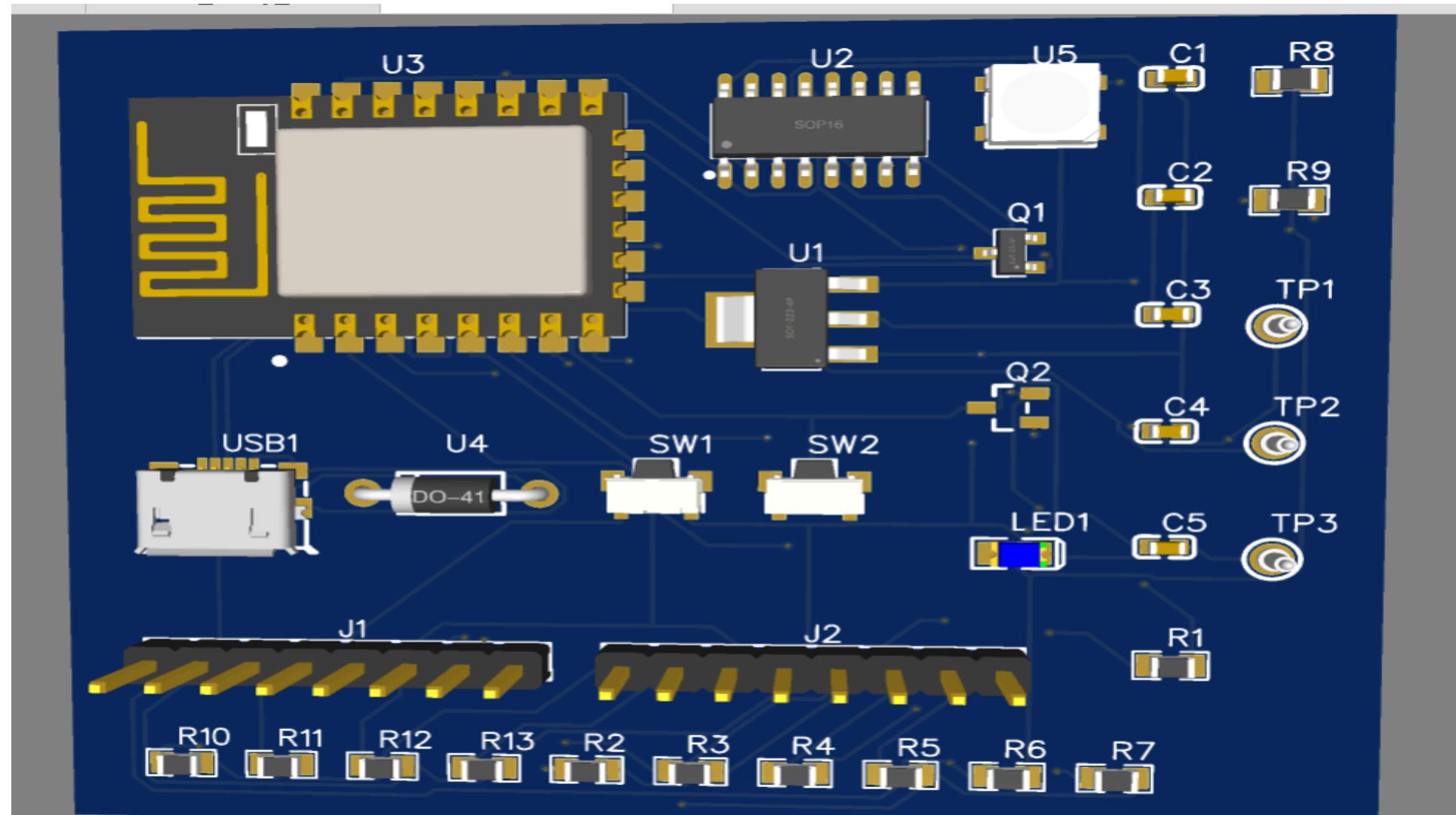
# Design of Hedy MCU



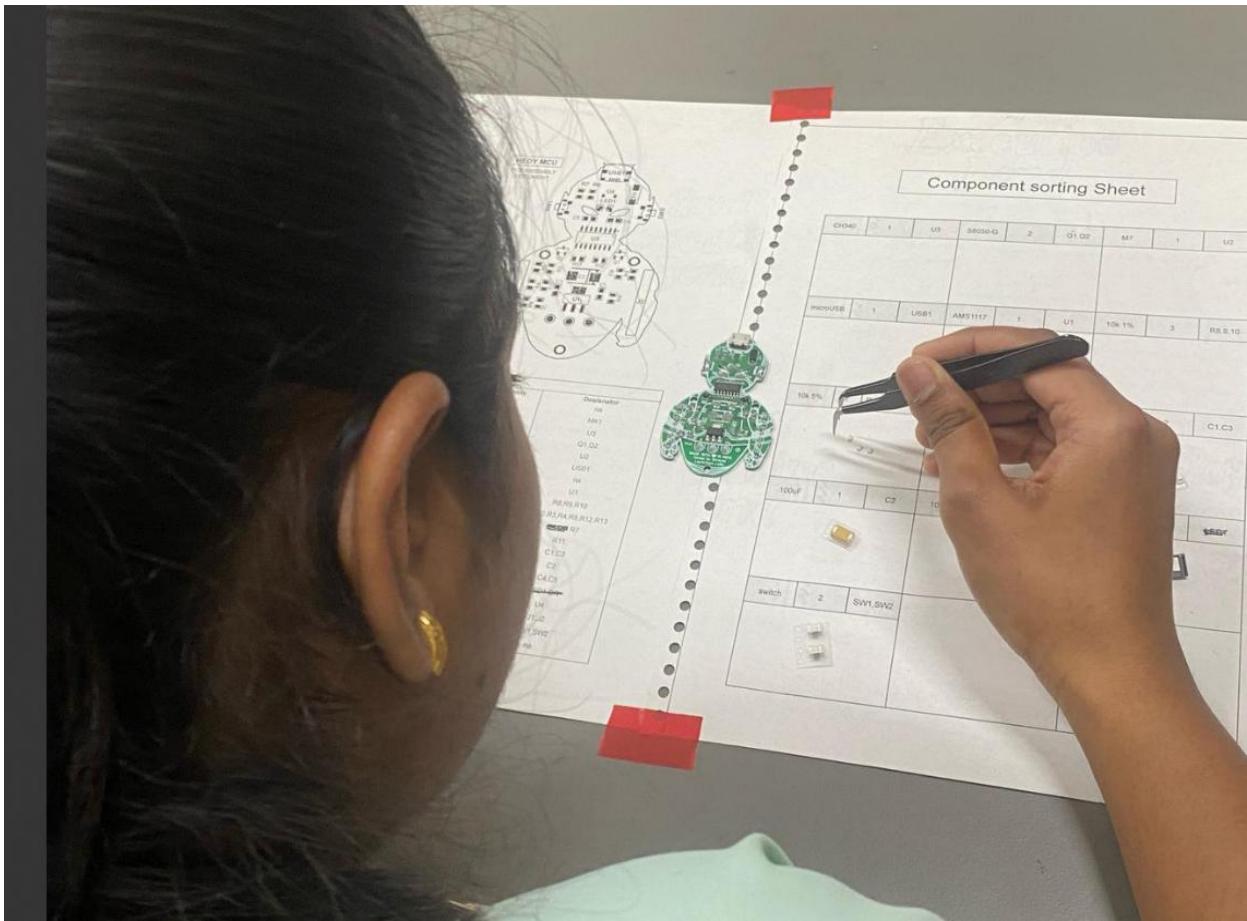
# LAYOUT OF HEDY MCU



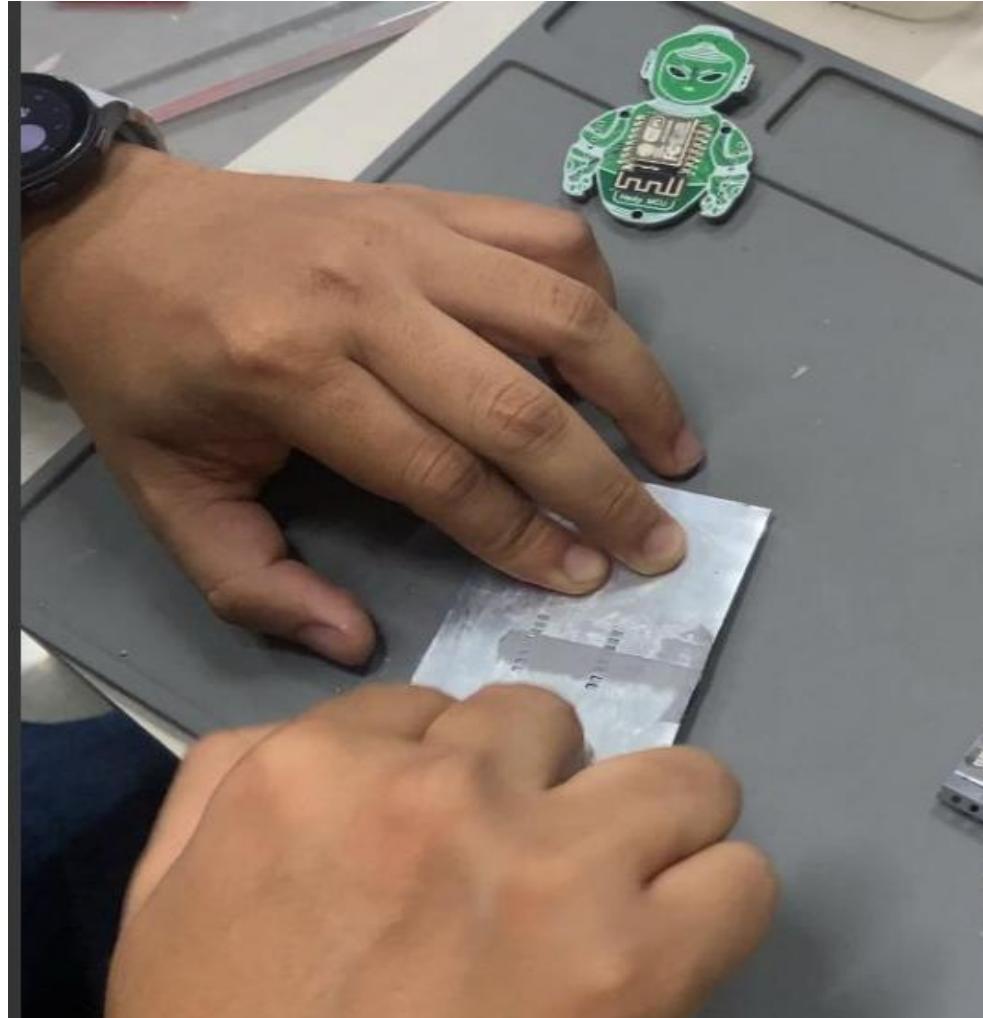
# 3D VIEW



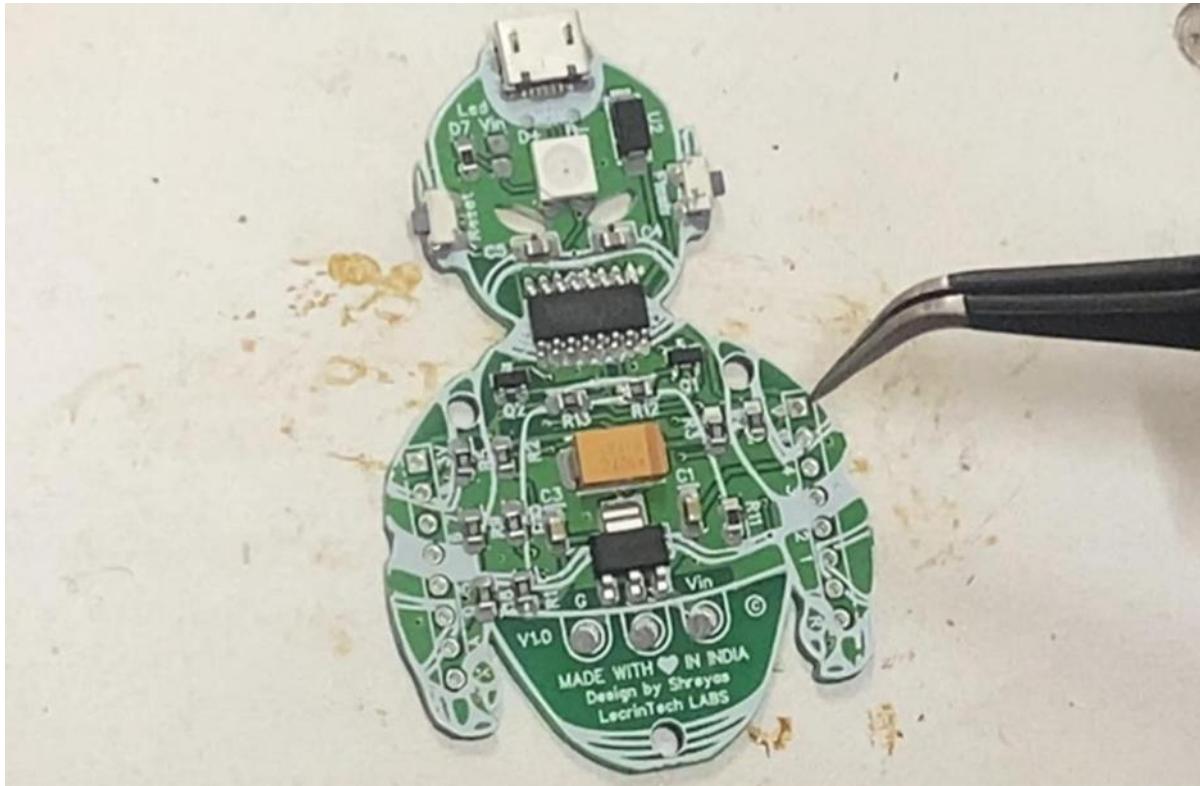
## COMPONENT IDENTIFICATION AND SORTING



**Solder pasting on board and sort the components(from bottom side)**



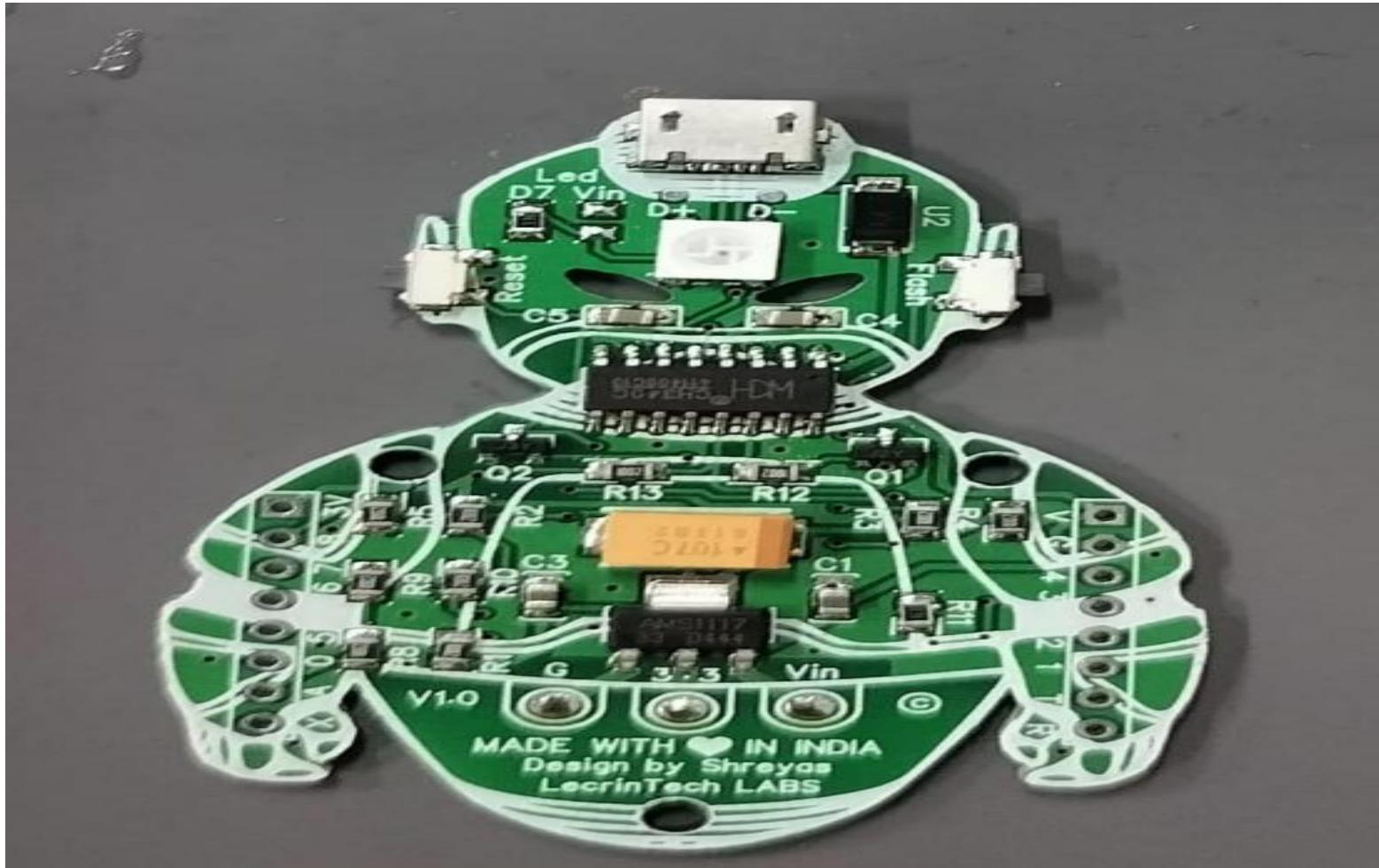
- Place PCB on hot plate and solder it



- Applied soldering paste on top side and place the component and solder with soldering gun



# Solder the male header with soldering iron



# DAY 3

## •Install Arduino 2.3.4

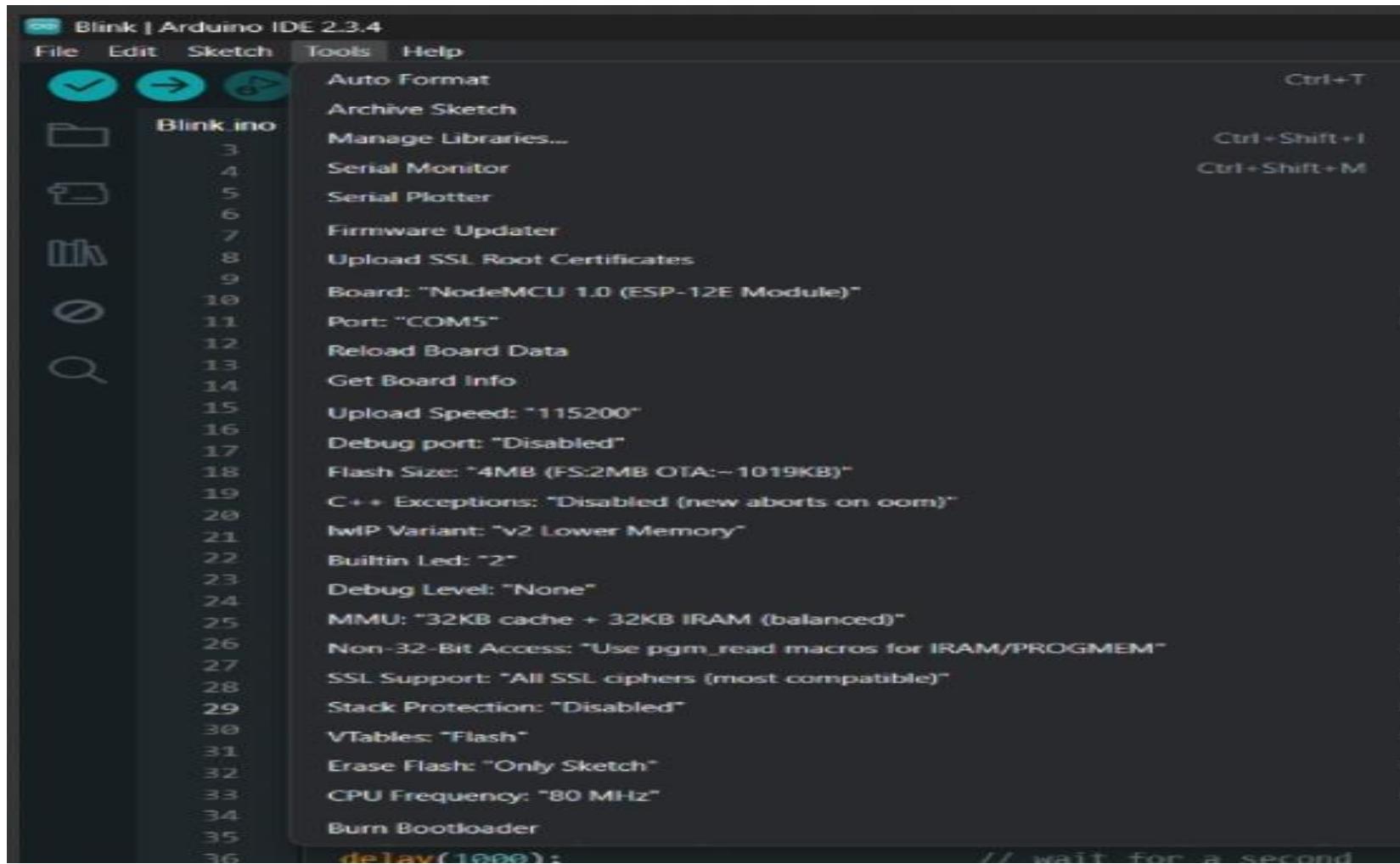
The screenshot shows a browser window with multiple tabs open, including various EDA projects and the Arduino software page. The main content area displays the Arduino Cloud Editor and the Downloads section for the Arduino IDE 2.3.4.

**Cloud Editor:** A section titled "Arduino Cloud Editor" featuring a hand interacting with a digital interface. It describes the service as allowing users to code, upload, and access projects from anywhere. Buttons for "GO TO CLOUD EDITOR" and "LEARN MORE" are present.

**Downloads:** A large section for downloading the Arduino IDE. It includes a thumbnail of the IDE icon, the title "Arduino IDE 2.3.4", and a brief description of the new features. A link to the "Arduino IDE 2.0 documentation" is provided. To the right, a "DOWNLOAD OPTIONS" panel lists download links for Windows, Linux, and macOS, along with their respective system requirements. A "Release Notes" link is also available.

**System Tray:** At the bottom, the Windows taskbar shows various pinned icons and the date/time: 24-03-2025, 22:51.

- Include board in port



Blink | Arduino IDE 2.3.4

File Edit Sketch Tools Help

Auto Format Ctrl+T

Archive Sketch

Manage Libraries... Ctrl+Shift+I

Serial Monitor Ctrl+Shift+M

Serial Plotter

Firmware Updater

Upload SSL Root Certificates

Board: "NodeMCU 1.0 (ESP-12E Module)"

Port: "COM5"

Reload Board Data

Get Board Info

Upload Speed: "115200"

Debug port: "Disabled"

Flash Size: "4MB (FS:2MB OTA:~1019KB)"

C++ Exceptions: "Disabled (new aborts on oom)"

lwIP Variant: "v2 Lower Memory"

Builtin Led: "2"

Debug Level: "None"

MMU: "32KB cache + 32KB IRAM (balanced)"

Non-32-Bit Access: "Use pgm\_read macros for IRAM/PROGMEM"

SSL Support: "All SSL ciphers (most compatible)"

Stack Protection: "Disabled"

VTables: "Flash"

Erase Flash: "Only Sketch"

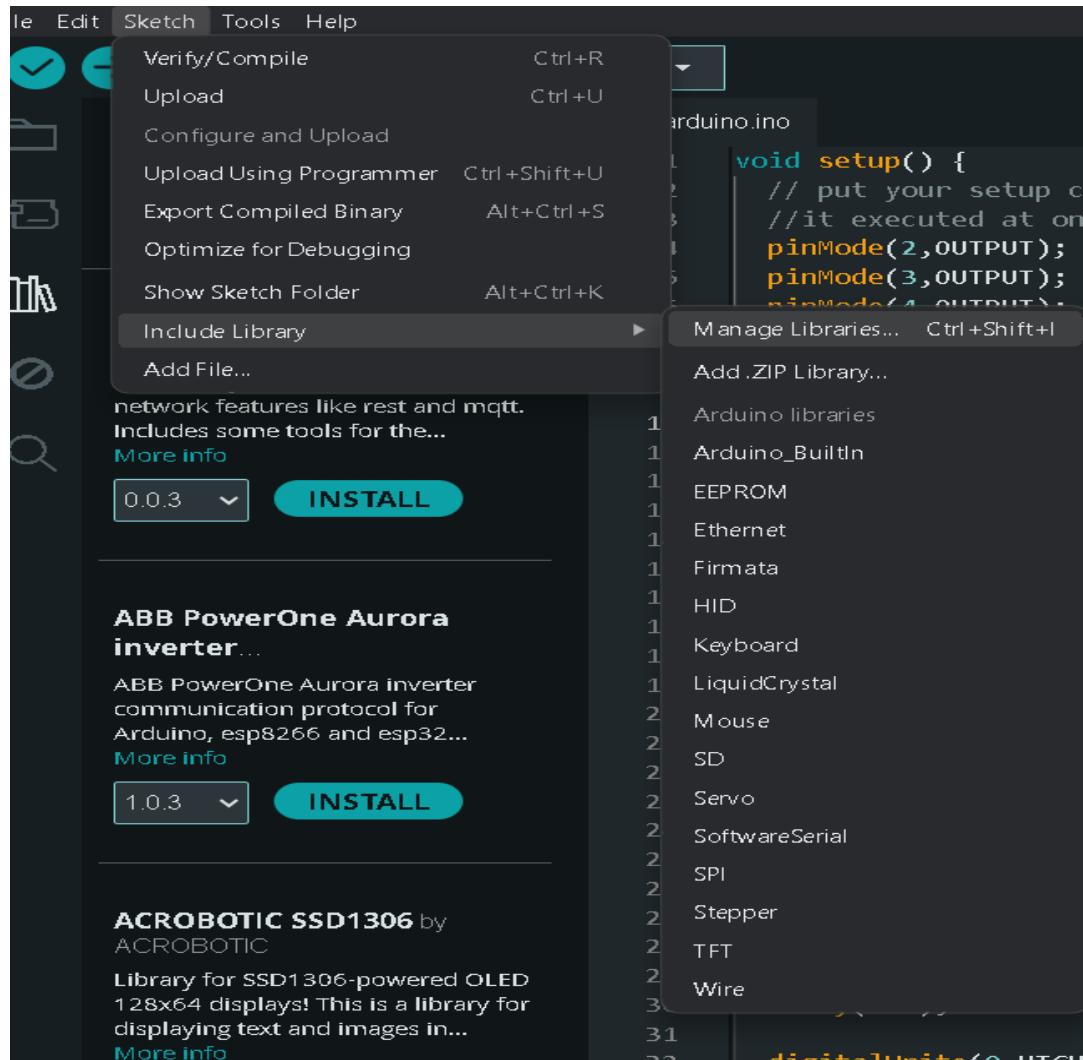
CPU Frequency: "80 MHz"

Burn Bootloader

delay(1000); // wait for a second

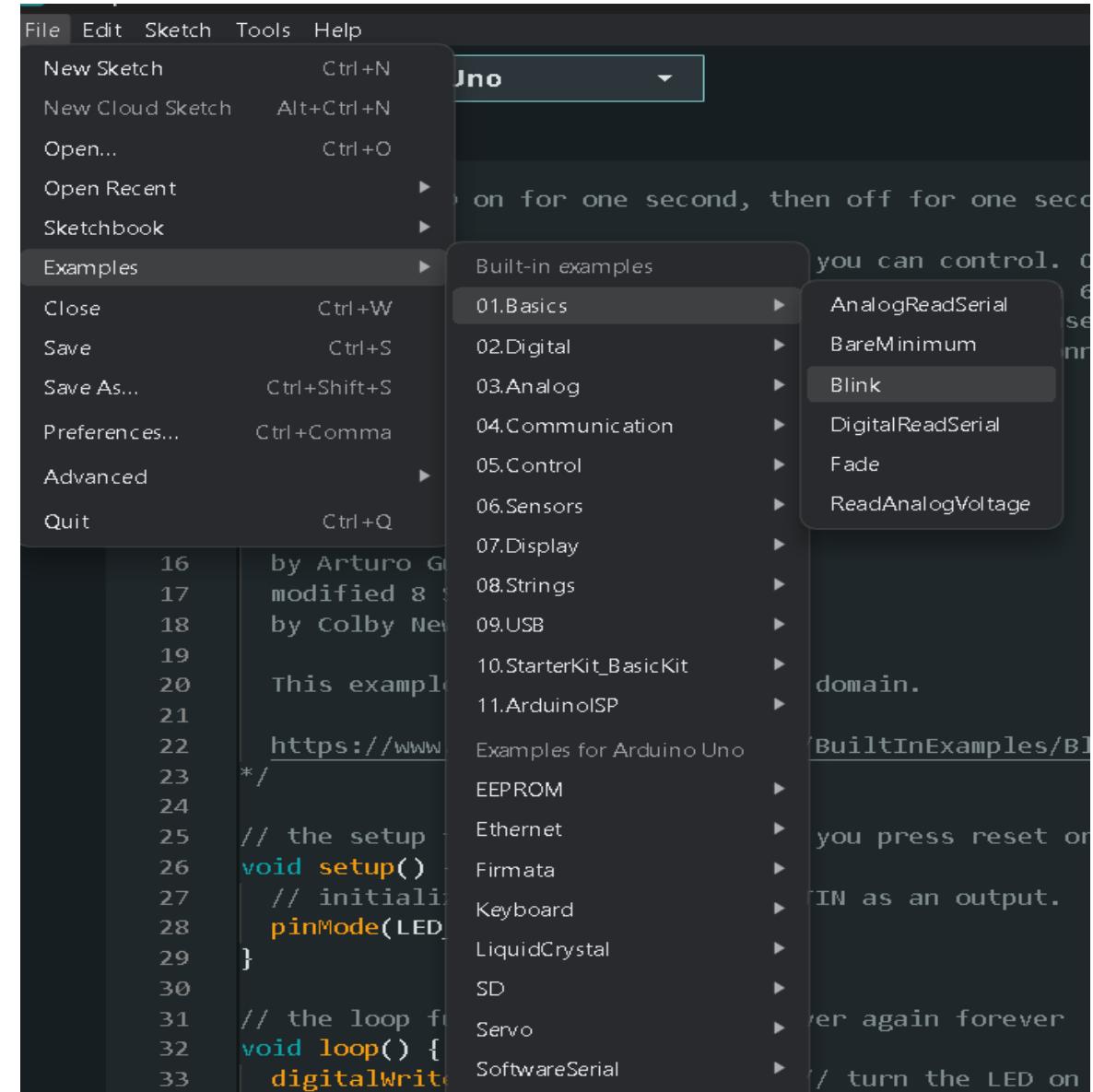
36

# •Install necessary library



# Led blink program

```
23 //  
24 // the setup function runs once when you press reset or power  
25 void setup() {  
26     // initialize digital pin LED_BUILTIN as an output.  
27     pinMode(LED_BUILTIN, OUTPUT);  
28 }  
29 // the loop function runs over and over again forever  
30 void loop() {  
31     digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is  
32     // wait for a second  
33     delay(1000);  
34     // turn the LED off by making  
35     digitalWrite(LED_BUILTIN, LOW); // wait for a second  
36     delay(1000);  
37 }
```



# Install app on android phone



# •Insert code

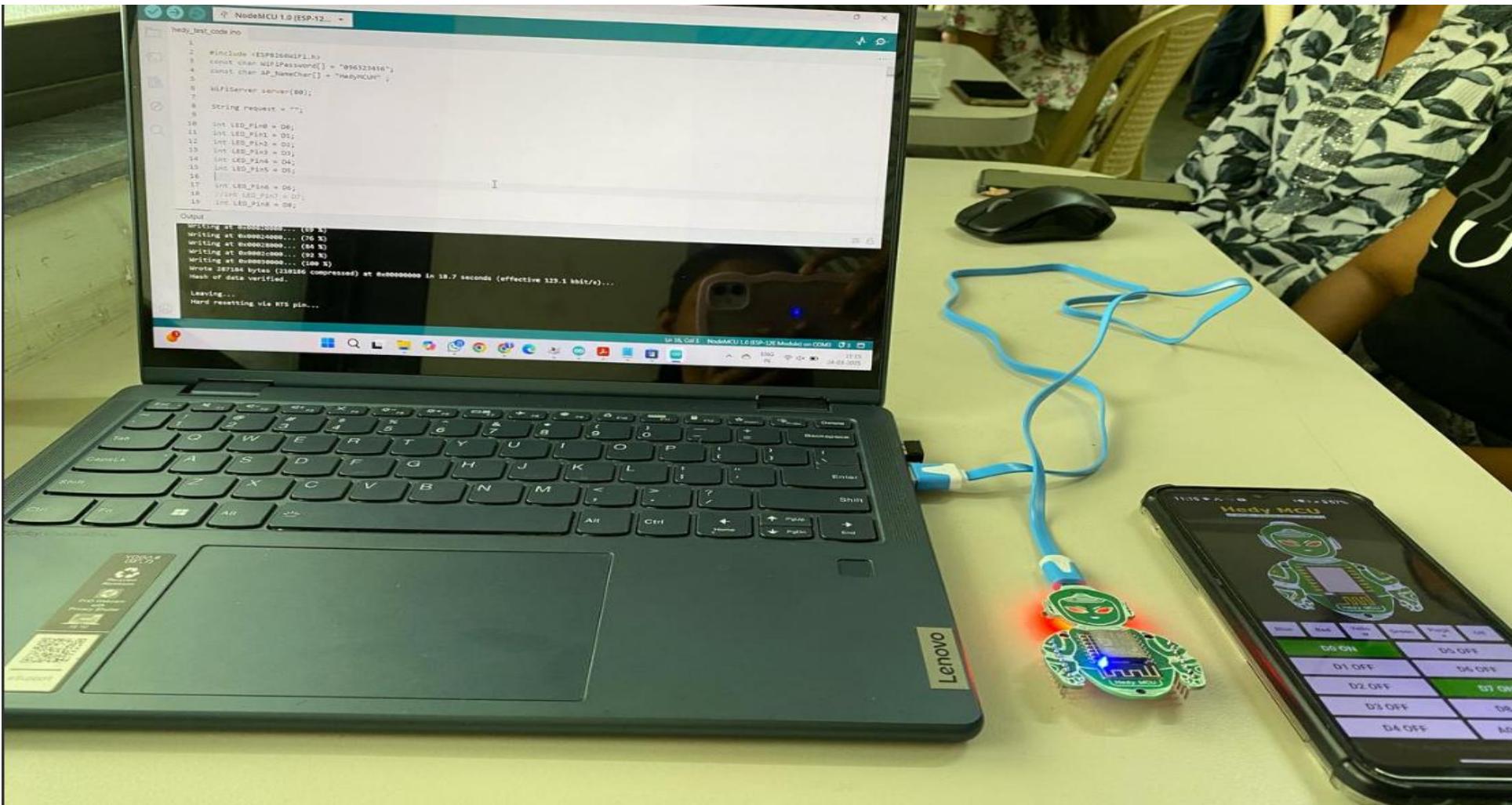
```
2 #include <ESP8266WiFi.h>
3 const char WiFiPassword[] = "123123123";
4 const char AP_NameChar[] = "HedyMCU1" ;
5
6 WiFiServer server(80);
7
8 String request = "";
9
10 int LED_Pin0 = D0;
11 int LED_Pin1 = D1;
12 int LED_Pin2 = D2;
13 int LED_Pin3 = D3;
14 int LED_Pin4 = D4;
15 int LED_Pin5 = D5;
16 int LED_Pin6 = D6;
17 //int LED_Pin7 = D7;
18 int LED_Pin8 = D8;
19
20 int flag = 0;
21
22 const int analogPin = A0; // ESP8266 Analog Pin ADC0 = A0
23 int sensornewValue = 0; // value read from the pot
24 int sensoroldValue = 0;
25
26 #include <FastLED.h>
27 #define LED_PIN      D7
28 #define NUM_LEDS    6 //1
29 #define BRIGHTNESS  200
30 #define LED_TYPE    WS2812B
31 #define COLOR_ORDER GRB
32 CRGB leds[NUM_LEDS];
33
34
35 void setup()
36 {
```

```
        client.println("HTTP/1.1 200 OK\r\n");
        client.flush();
    }
    if ( request.indexOf("PURPLE") > 0 )
    {
        leds[0] =CRGB::Purple;
        FastLED.show();
        client.println("HTTP/1.1 200 OK\r\n");
        client.flush();
    }
    if ( request.indexOf("OFF") > 0 )
    {
        leds[0] =CRGB::Black;
        FastLED.show();
        client.println("HTTP/1.1 200 OK\r\n");
        client.flush();
    }

    delay(5);
}

void readA0()
{
    sensoroldValue = sensornewValue;
    sensornewValue = analogRead(A0); // read the analog in value
    if(sensoroldValue != sensornewValue)
    {
        serial.println(sensornewValue);
        //client.println(sensornewValue);
        //client.flush();
        delay(200);
    }
}
```

- Tested the circuit on test board





# **Project Title:-**

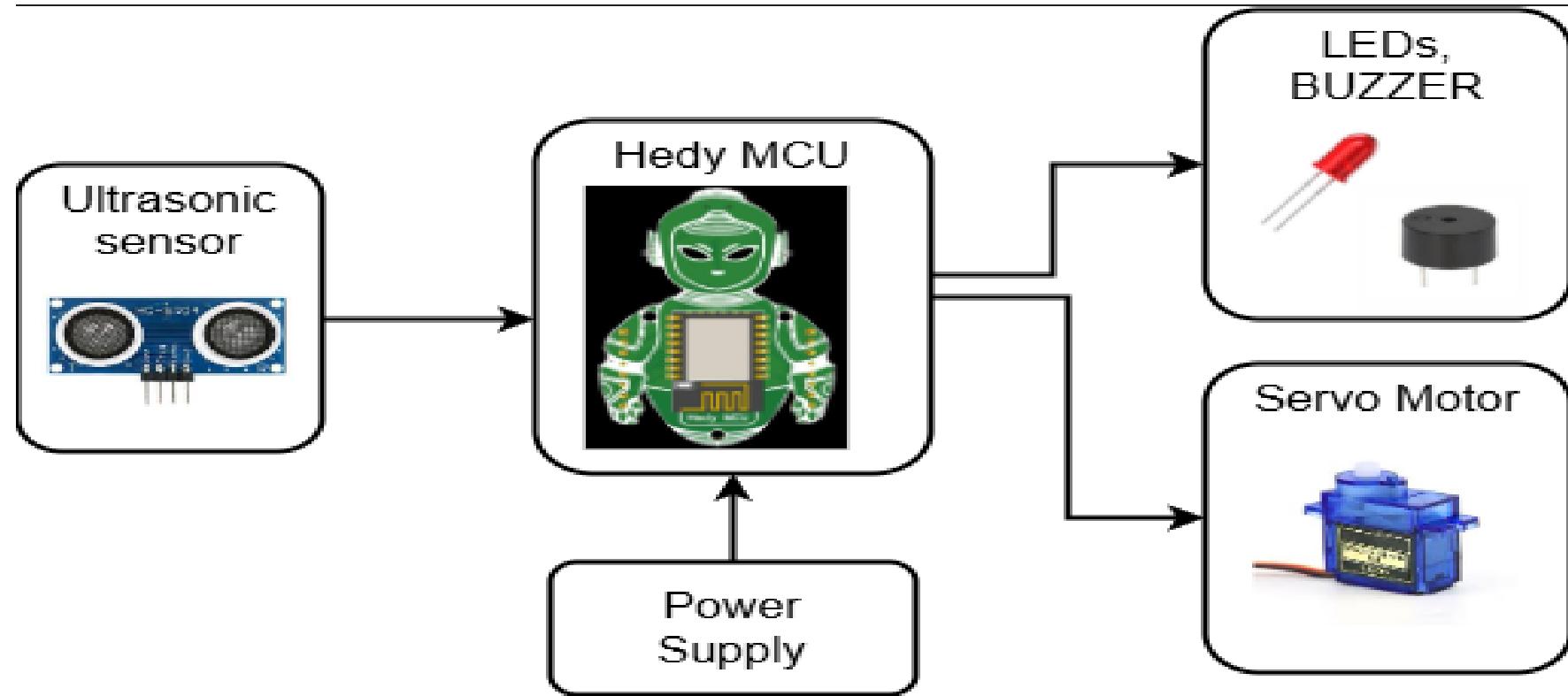
## **Collision Avoiding System**

- Detecting obstacles:** Using sensors (ultrasonic).
- Assessing risk:** Determining potential collisions.
- Alerting the user:** Providing warnings.
- Taking corrective action:** Automatically braking or steering.
- Improving safety:** Reducing accidents in vehicles, robots, and other systems.

### **Components used:**

- Ultrasonic Sensors
- Hedy MCU
- Power Supply
- LED's Buzzer
- Servo motor

- **BLOCK DIAGRAM :**



Block Diagram : Collision Avoiding System

# **THANK YOU!**