Occupancy counter

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Project idea

- **That the system will use a microcontroller and 2 IR sensors to detect directional movement through a door and updates an on-screen counter accordingly.**

- **The counter, displayed on an LCD display will provide a real-time count on occupancy making it easy to check room usage.**

- **It will provide, knowing the occupancy would help in managing the space efficiently.**

Description of the project

Room management: Provides real-time data on room occupancy for efficient usage.

Status LEDs:

- **Red LED: Lights up when no spots are available.**
- **Green LED (optional): Lights up when one spot is available.**
- **Yellow LED: Lights up when the room reaches full capacity.**

Safety: Ensures compliance with occupancy limits in small or regulated spaces.

Energy efficient: Tracks room usage to enable automated lighting, reducing energy waste.

Battery: Operates on a 9V lithium battery for extended usage.

IR proximity sensor: Detects entries/exits using two sensors for reliable directional movement tracking.

LCD display: Shows real-time occupancy for user convenience.

Buzzer: Alerts when the room is full and entry is restricted.

Cost effective: Built using readily available components.

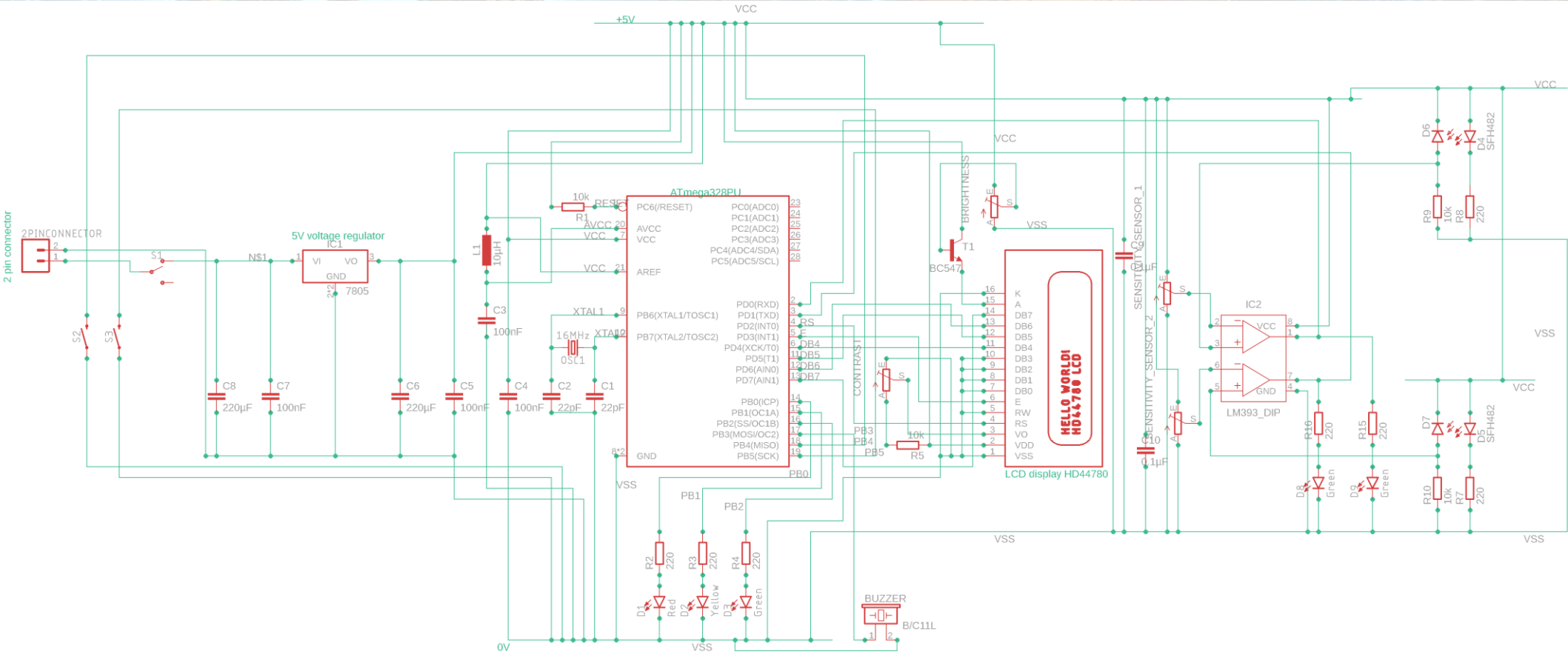
Bill of material

Components	Price
Atmega328P	€2,51
Oscillator – 16MHz	€0,43
16 x 2 LCD - HD44780	€4,65
Battery – 6V	€2,00
3 pin Switch	€1,35
Buzzer	€1,40
LEDs	€0,36
28-pin socket	€0,21
Push buttons	€0,40
Voltage regulator – 5V	€0,13

Bill of material - continued

Components	Price
Inductor - 10	€0,47
2 pin connector	€0,06
Dual comparator - LM393	€0,21
Potentiometer – 10k	€0,84
Infra red LED	€0,30
Photodiode	€0,70
Transistor - BC547	€0,36
Resistors (220Ω and 10kΩ)	€3,99
Capacitors (100nF and 22pF)	€0,34
Headers	€1,00
Total:	**€21,71**

PCB schematic



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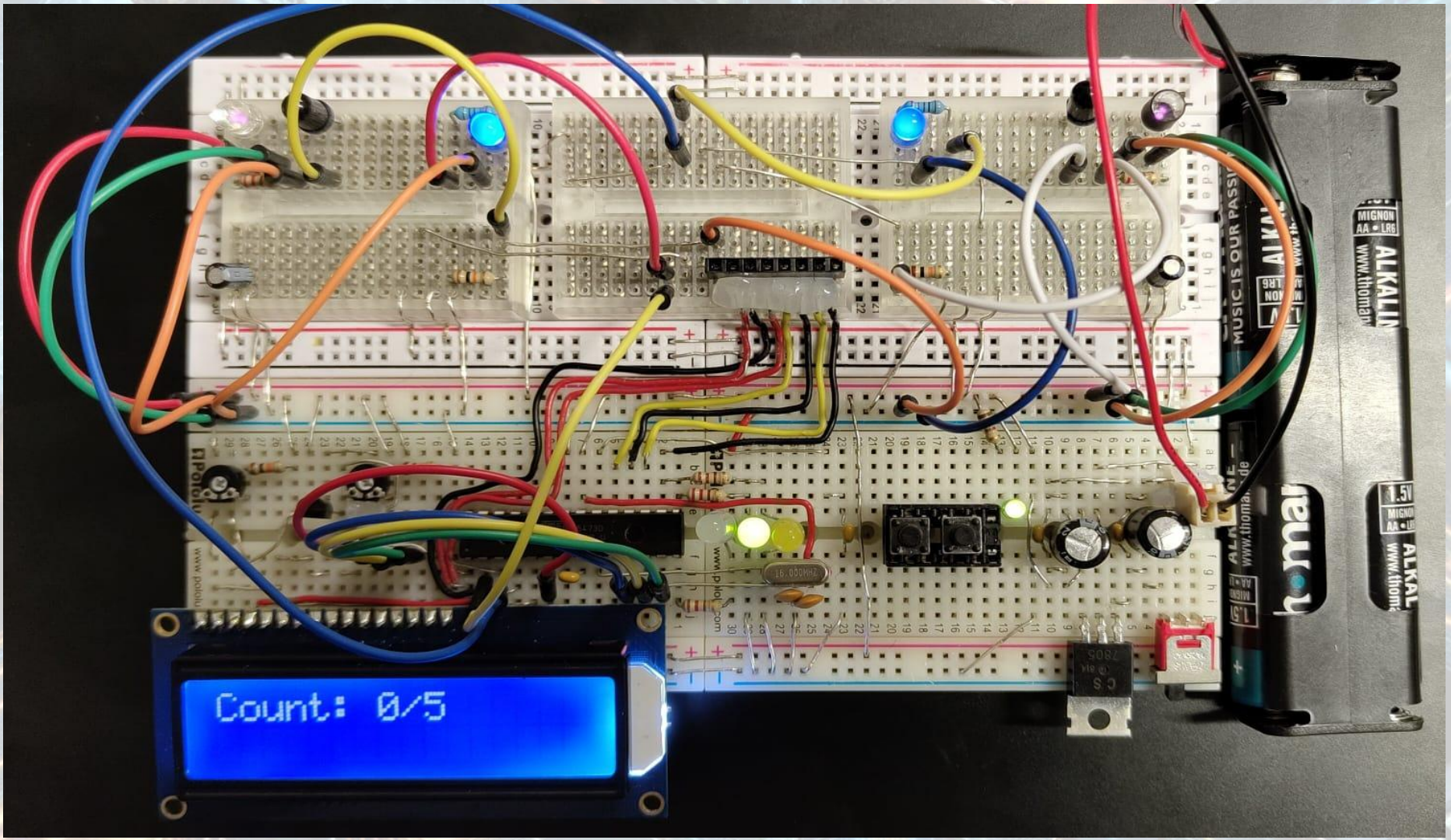
Prototyping and testing



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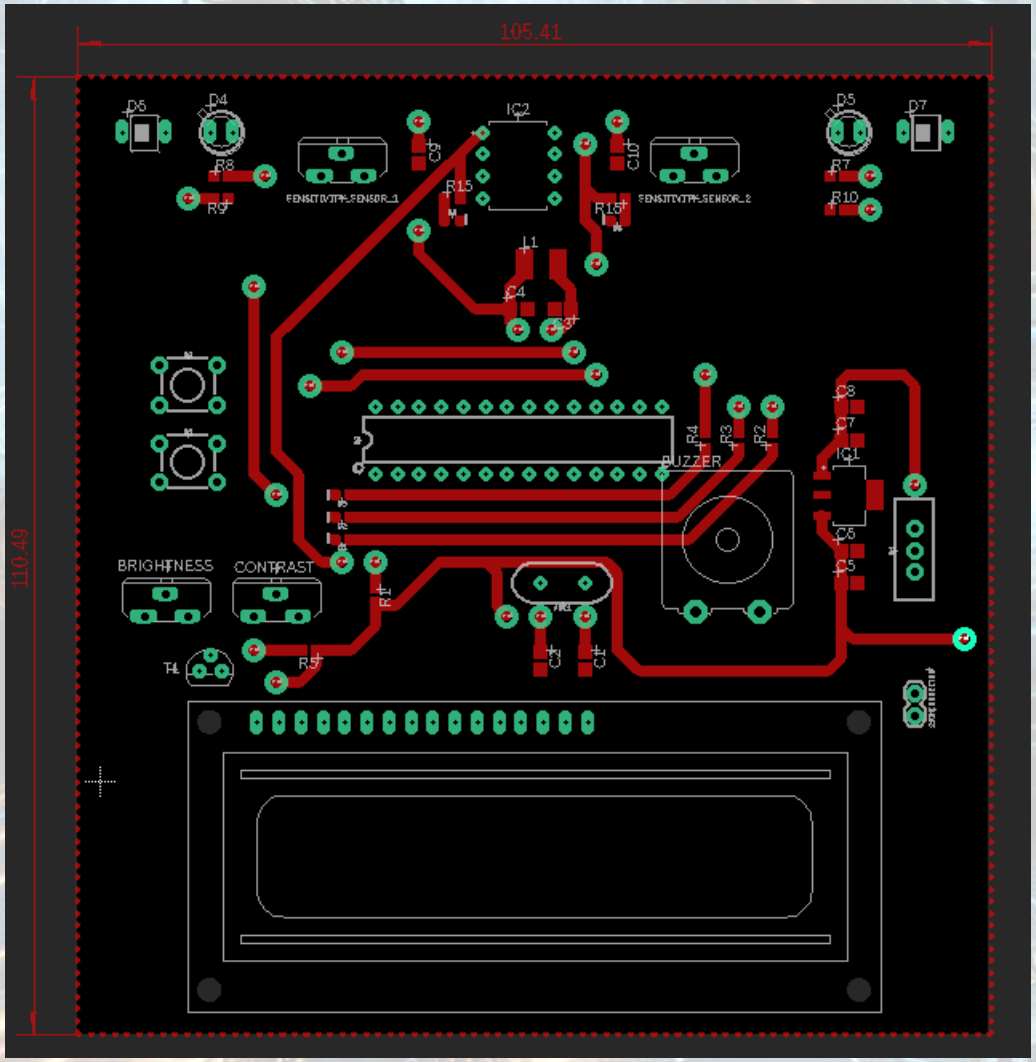
Coding - snippets

```
//Reset lock for sensor 1 when signal goes HIGH
      if (sensor1_state && sensor1_locked) {
          sensor1_locked = 0; //Reset lock
}

//Reset lock for sensor 2 when signal goes HIGH
      if (sensor2_state && sensor2_locked) {
          sensor2_locked = 0;  // Reset lock
}
```

PCB design

PCB design – top



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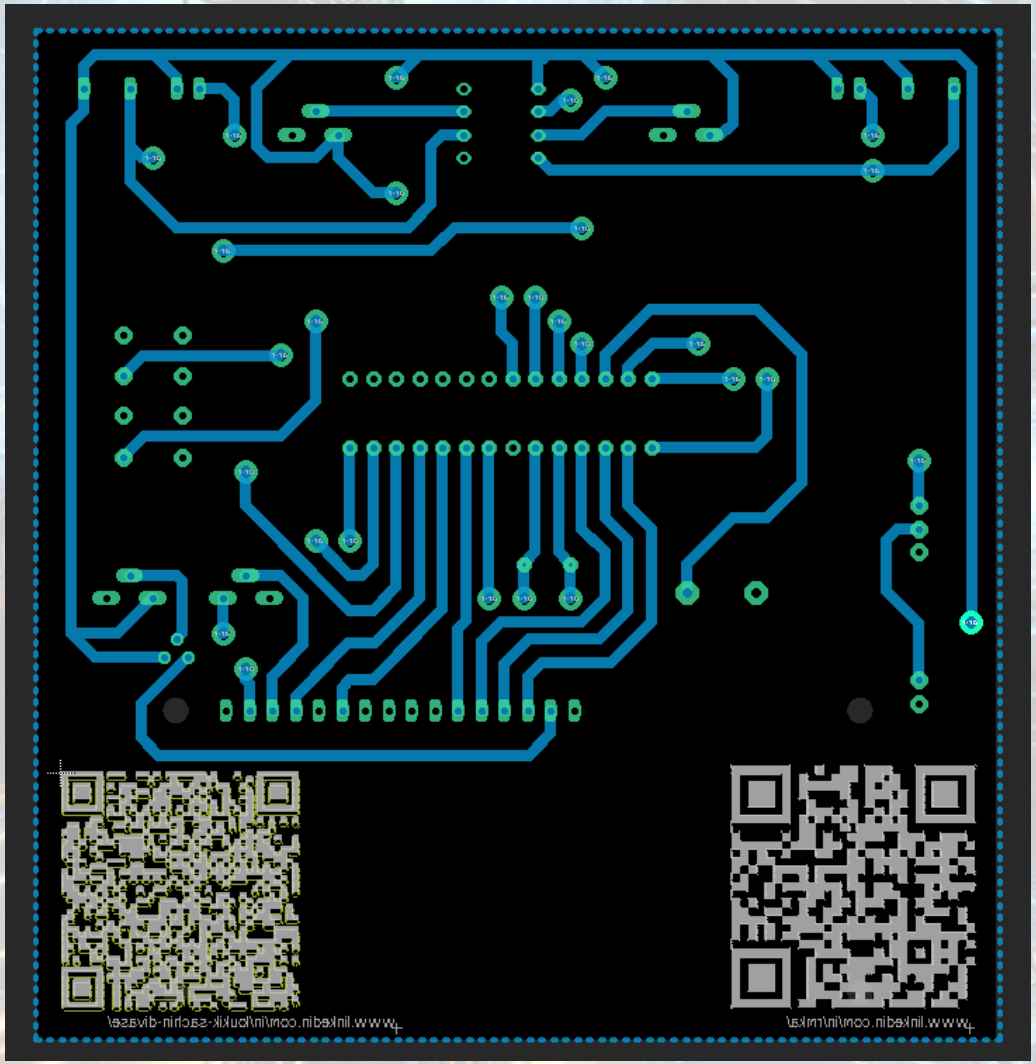
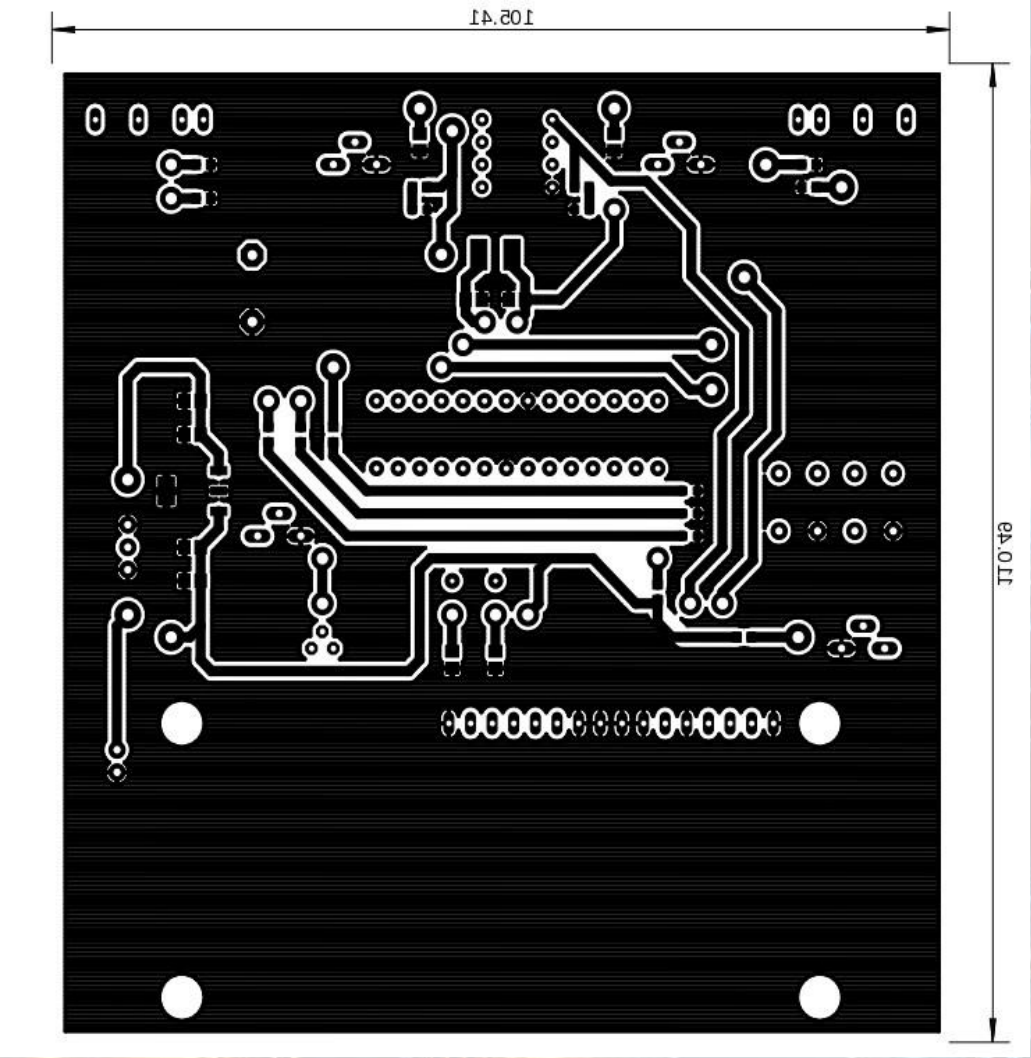
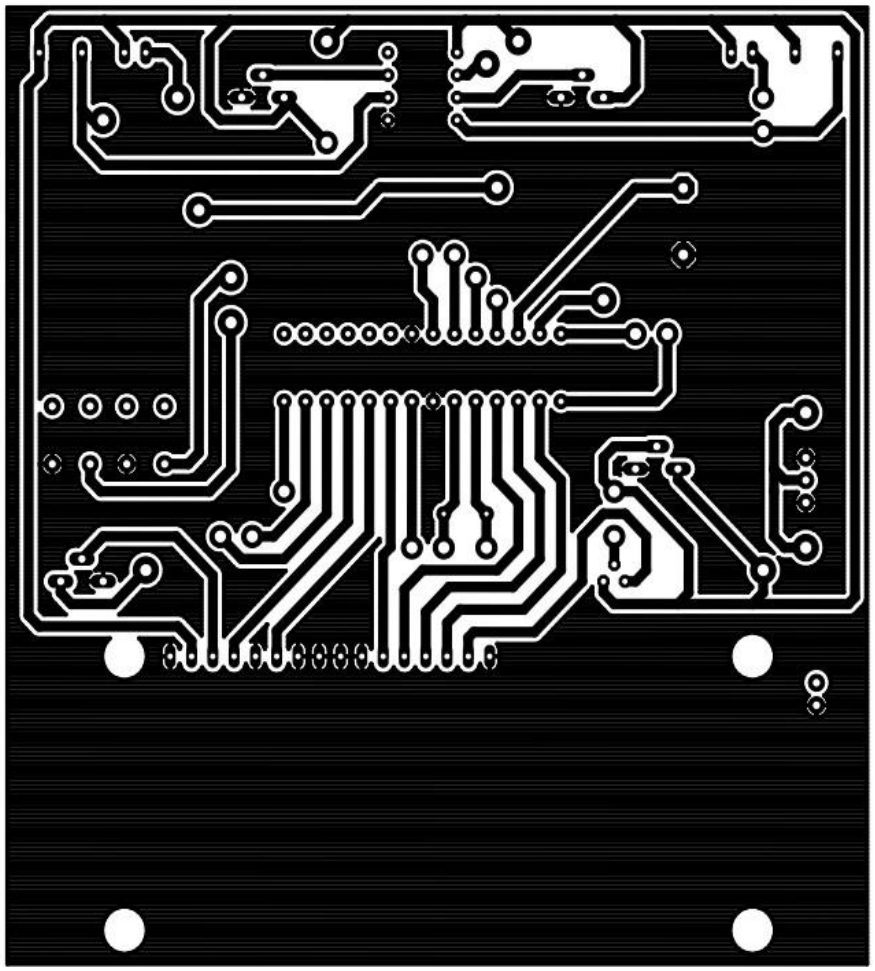
PCB design - bottom



PCB UV masking - top

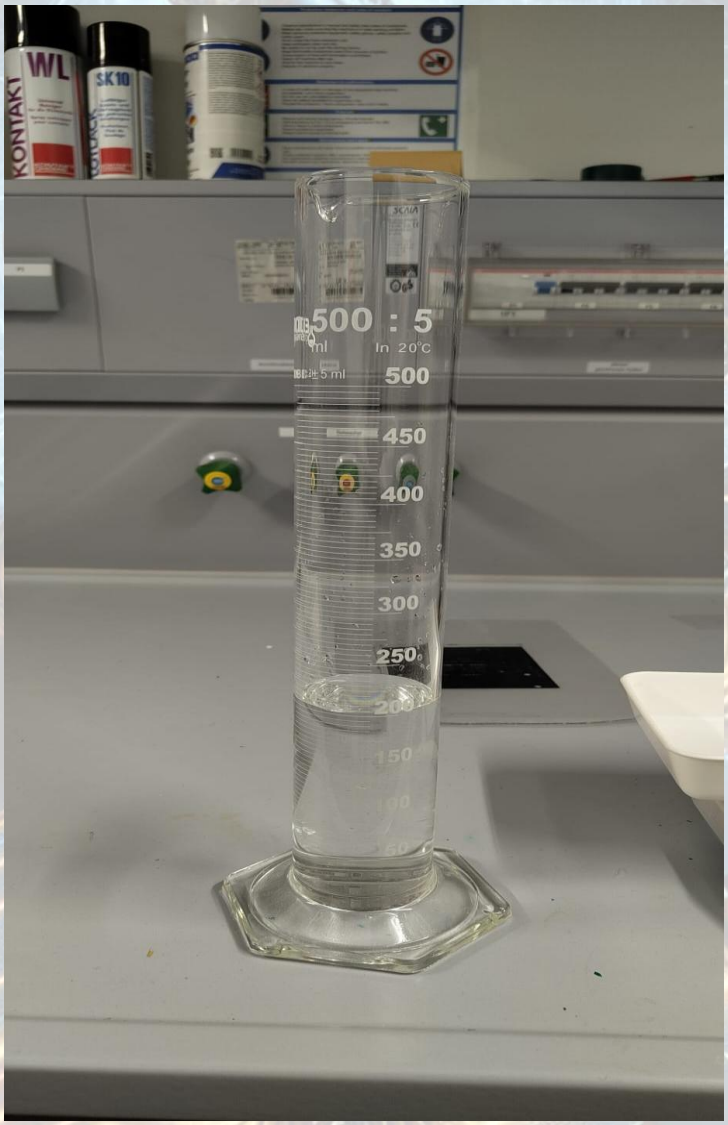


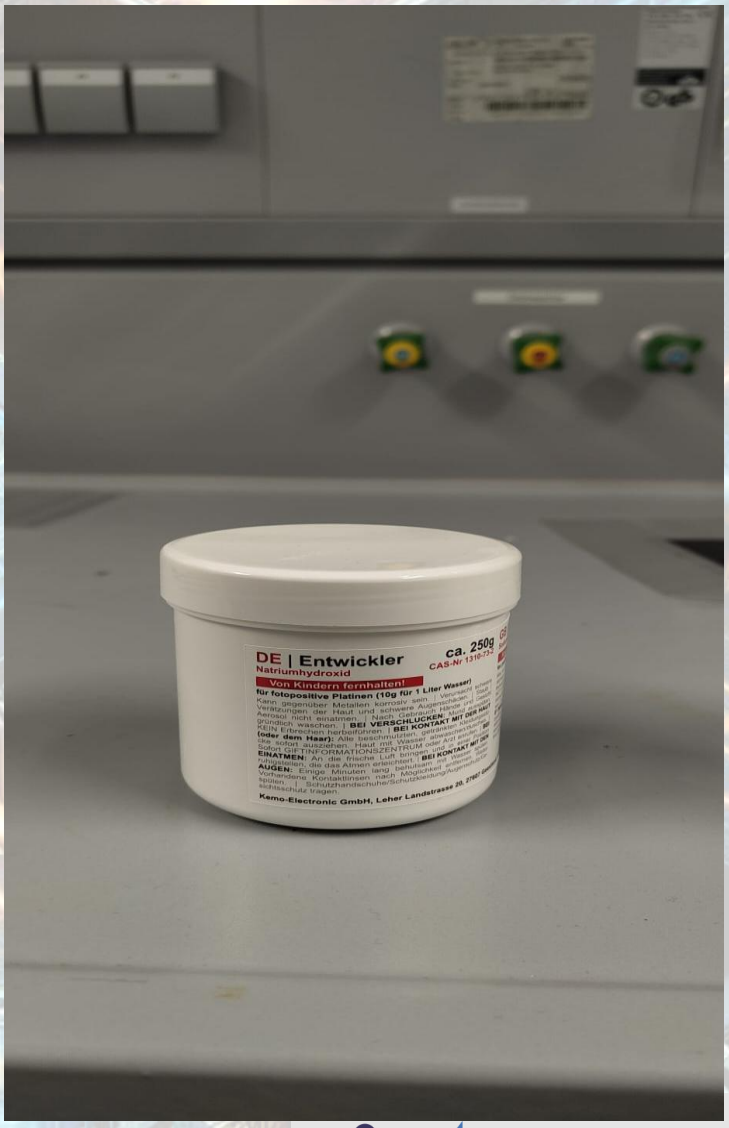
PCB UV masking - bottom



PCB manufacturing

PCB etching - 200mL water, 2g of NaOH





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PCB etching – Diluting 2g of NaOH in 200mL H2O and preparing the PCB for UV light

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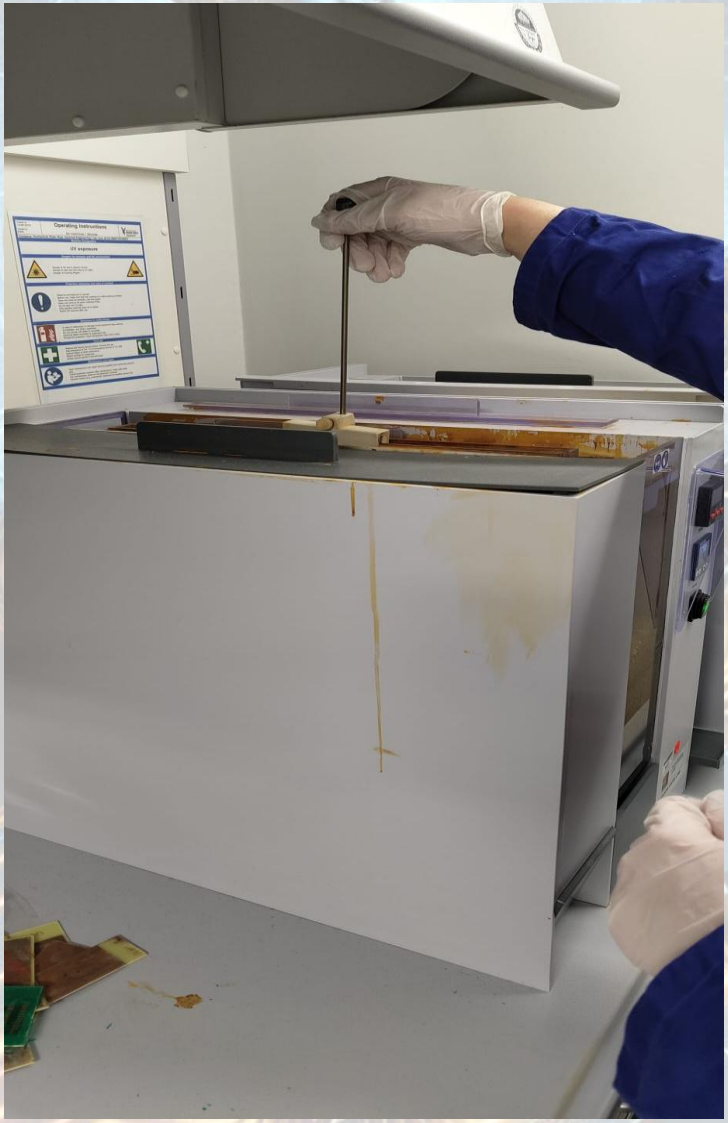
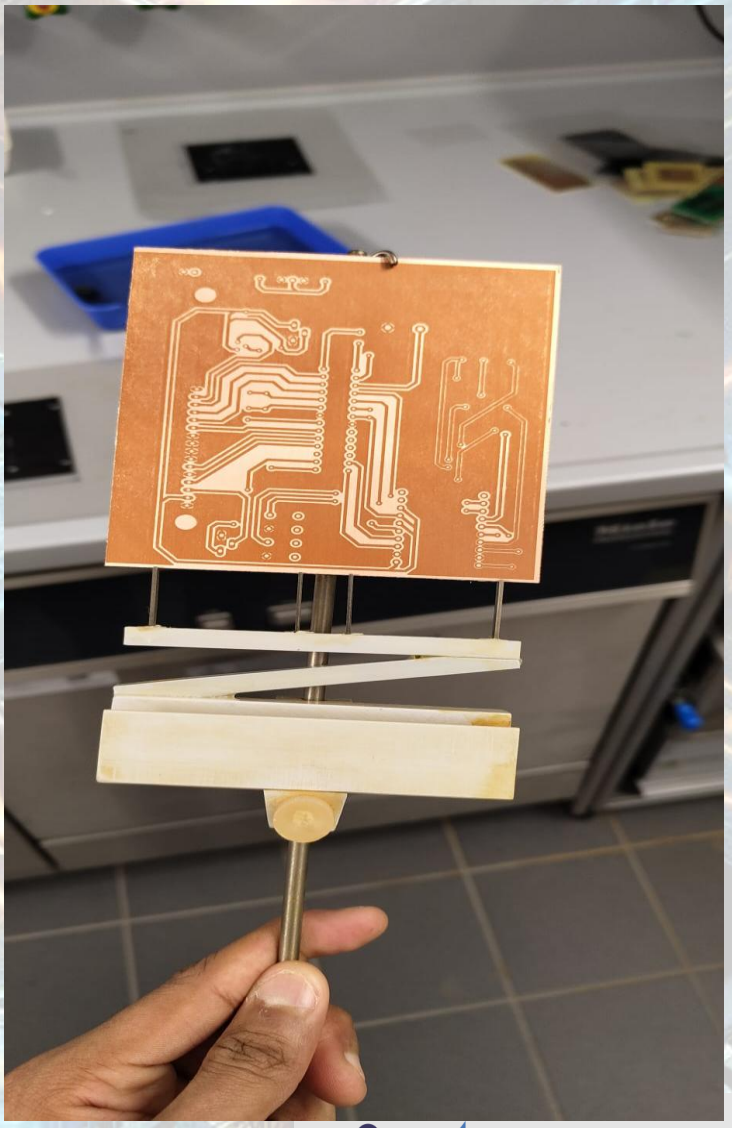
PCB etching – PCB dipped in NaOH

PCB etching – etching process in





Methodology

Total power consumption: 1.29W, where V = 6V and I = 0.22A

Actual useful power consumption: 1W, where V = 4.85V and I = 0.21A.

What exactly happened?

As we all know from demonstration, the person has to pass both sensors in order to register the count, since our product is a directional one.

Conclusion

As aspiring engineers, we think that this project came to a success. However, there might be some unsolved challenges that we did not come across and we would be more than happy to solve them in the future.

References

Schematic ideas: myAVRboard, Arduino UNO R3

Documentation: Datasheets