



Low Cost Real-time Room Occupancy Indicating System

Chirag Shah, Srijal Poojari Guide: Prof. Priya Deshpande
Department of Electronics Engineering, Sardar Patel Institute of Technology, Andheri (West), Mumbai-400058

Introduction

- The objective of this project was to tackle a problem faced by corporate environments.
- In a typical corporate environment there exists multiple conference/meeting rooms.
- Anyone can book any meeting room for any time (if the room is available) using a mobile app

Problem Definition

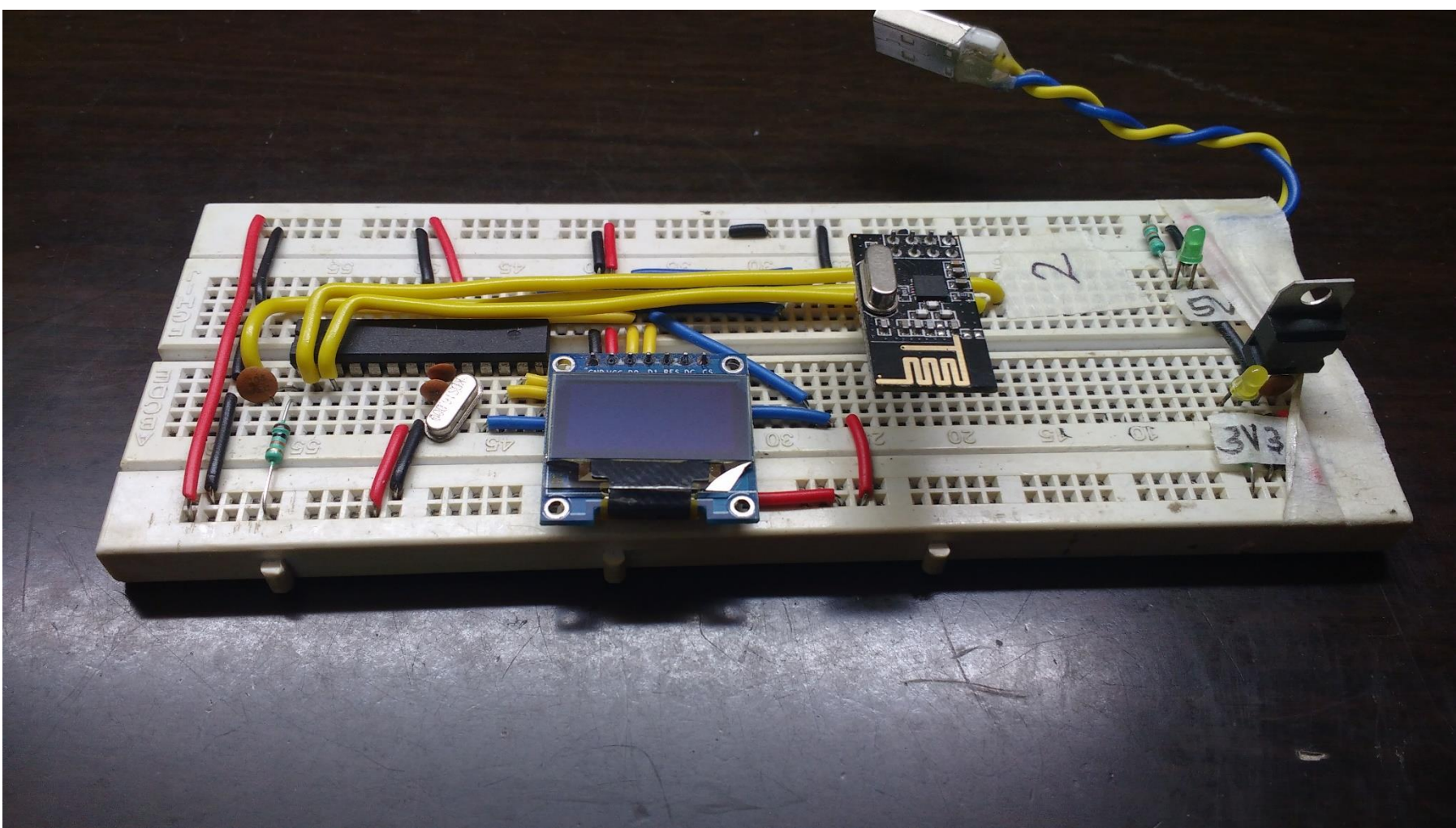
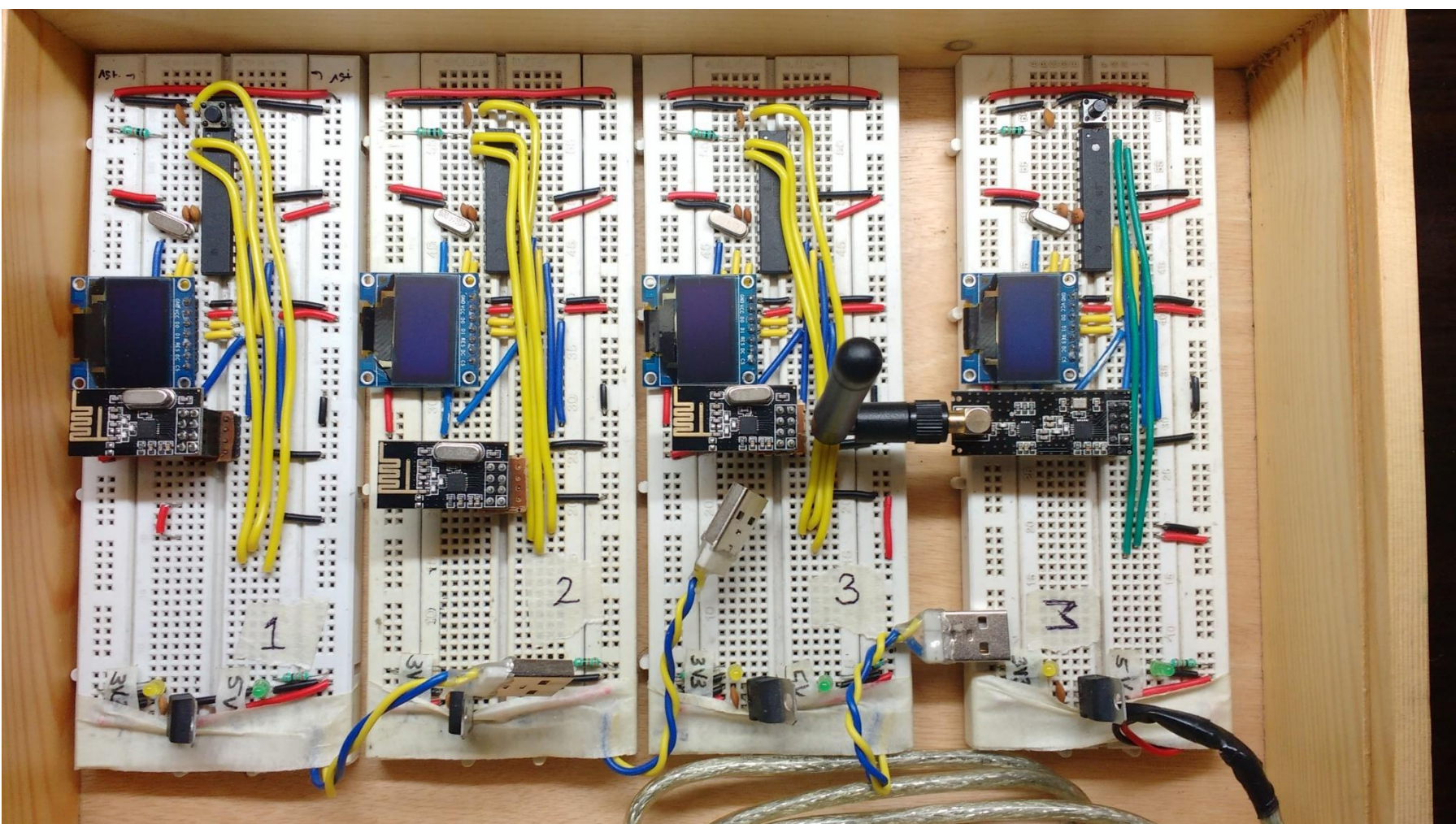
- Employees require frequent access to these meeting rooms, but lack of real-time knowledge of its availability leads to inconvenient hassle.
- The problem was that anyone could book a meeting room and then not use it. Or if someone wanted to have a meeting without pre-booking the meeting room the he/she would have to go from room to room to check the availability of the rooms. The would create a lot of unnecessary hassle and would lead to unoptitmal utilization of the workspace.

Solution Design

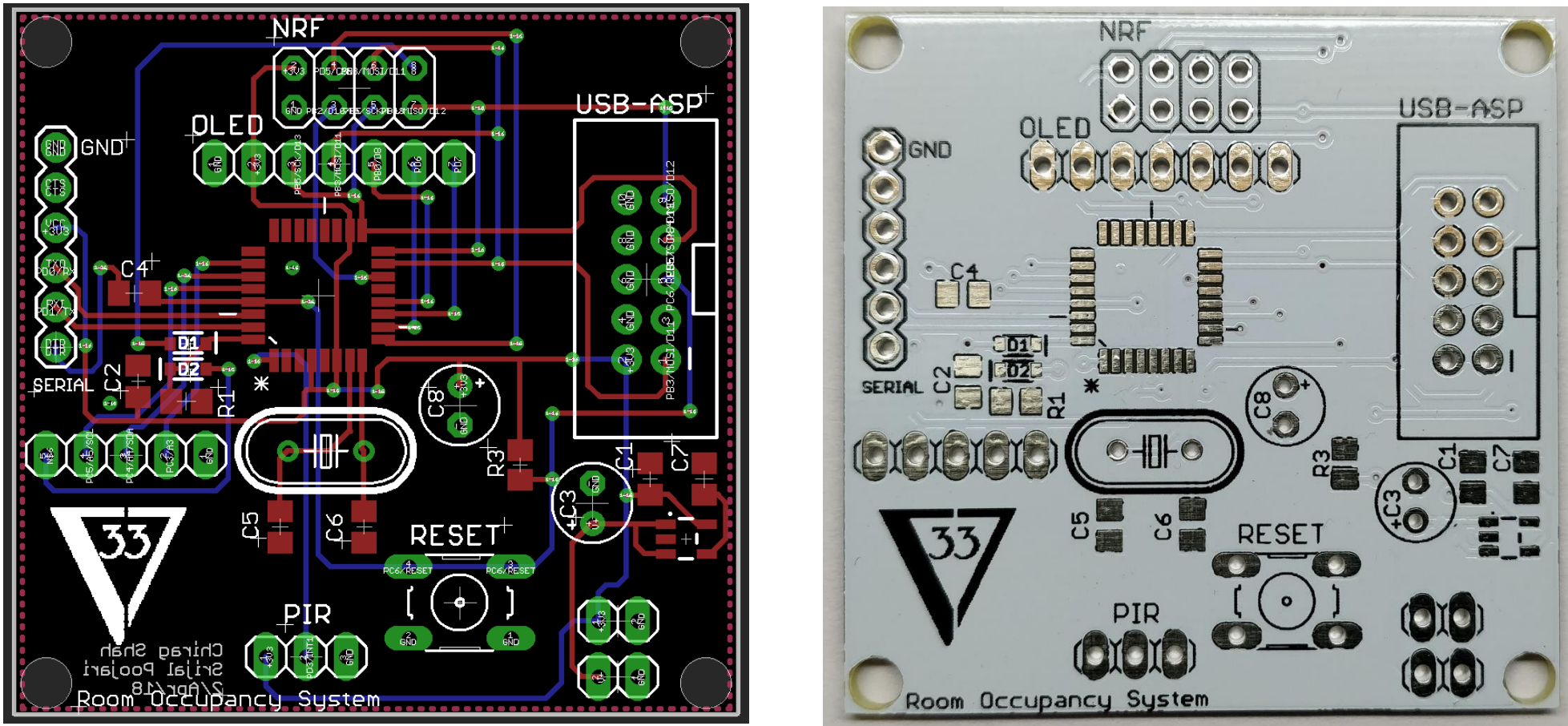
- We used a PIR sensor to detect occupancy of the room
- The sensor is connected to an Atmel microcontroller which relays the information to a central device via radio modules configured in a mesh configuration
- The central device will push the data to the internet using an RF module.
- All the devices are battery powered
- Since the devices are battery powered – we used a low dropout voltage, low quiescent current voltage regulator. This improved the quiescent current to 17uA compared to 5mA used by a standard voltage regulator like a LM1117. Also the dropout voltage improved to 100mV from a typical 1.5v.

Work Done

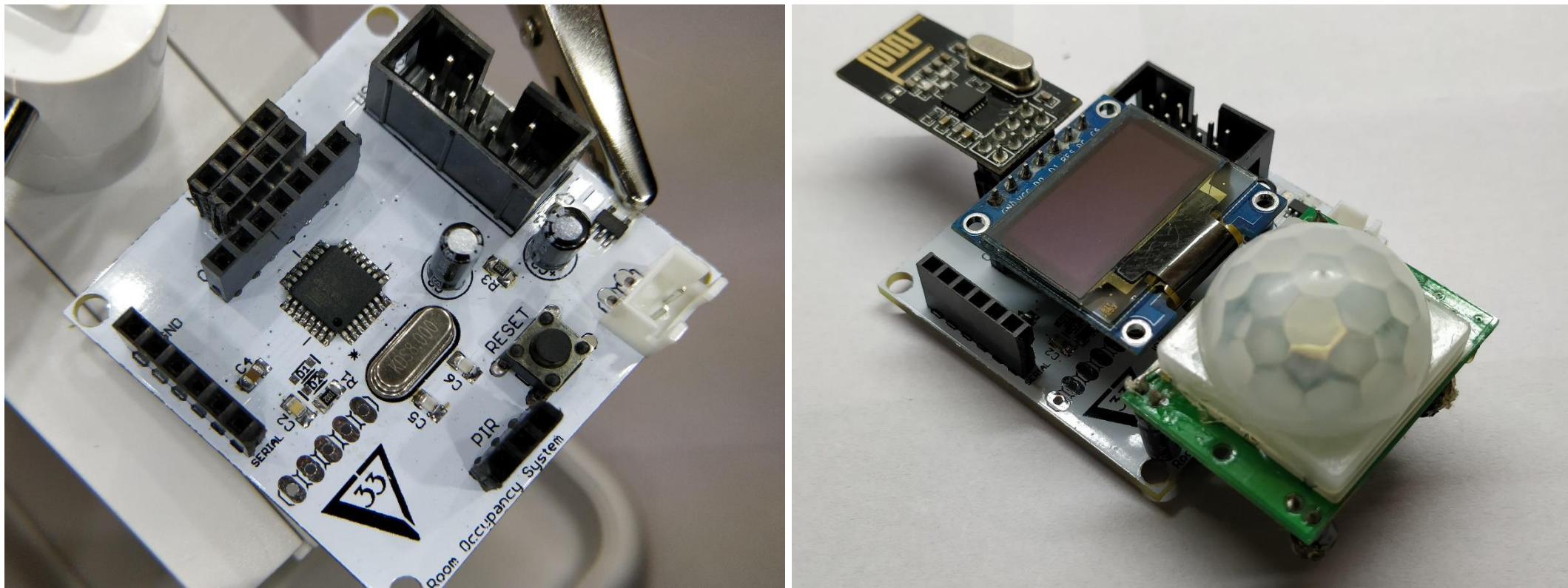
- Designed the prototype of the circuit on breadboards which included the microcontroller, radio module and an OLED display



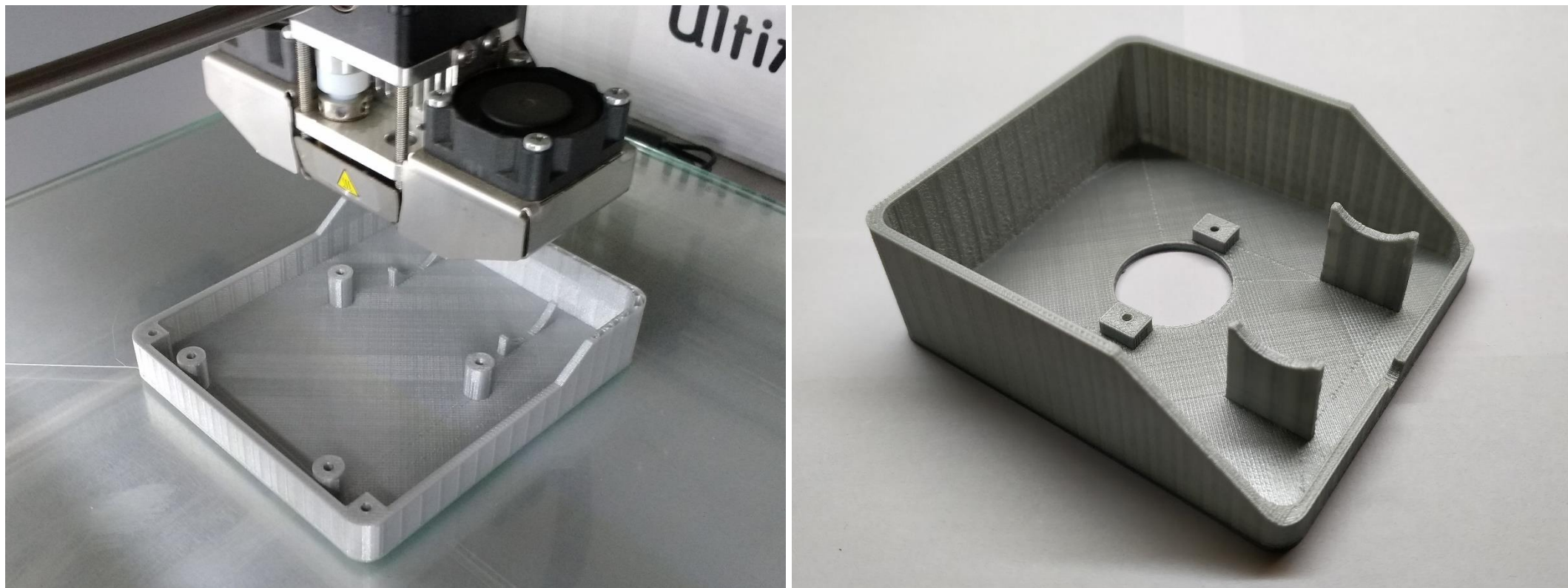
- Designed the PCB of the circuit in Eagle and got it manufactured from a PCB prototyping service (PCBway.com)



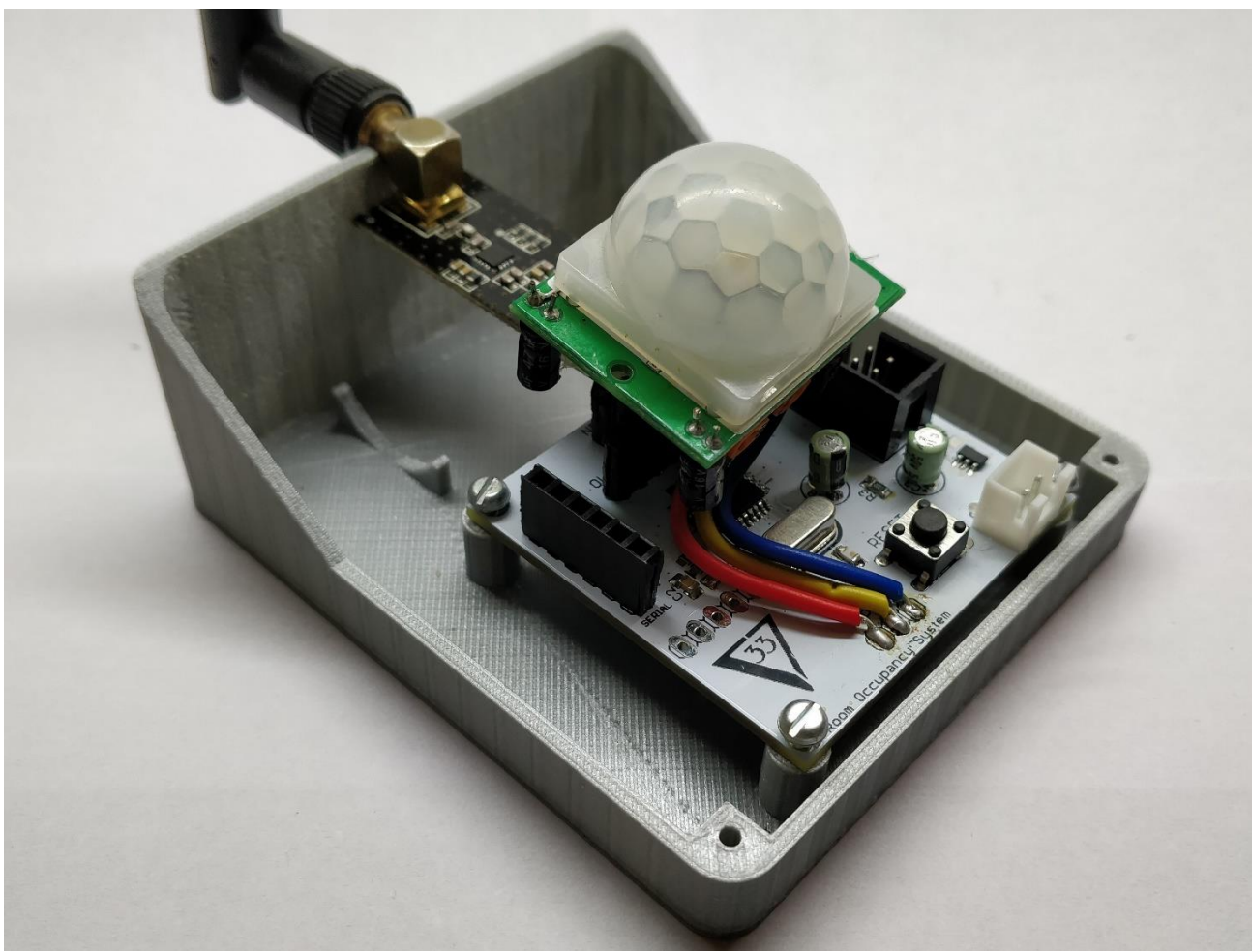
- We assembled the board



- We manufactured the housing unit using 3D printing



- Inside the housing of the final product



- Web interface to show the occupancy status of each room

Status: Connected

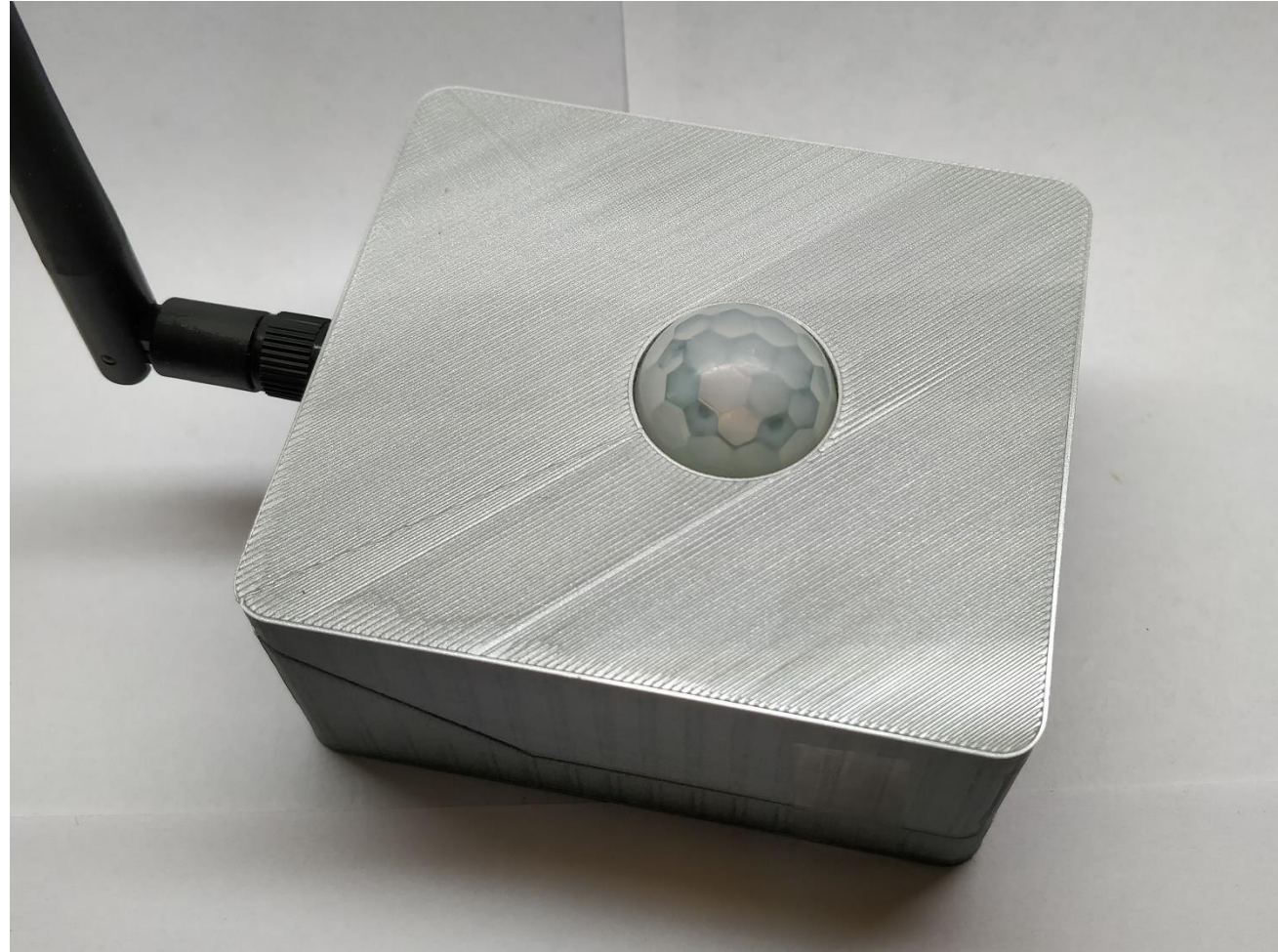
Room: 303		
<div>Node 1</div> <div>Active</div> <div>Activity: Detected</div> <div>State changed 4 minutes ago</div>	<div>Node 2</div> <div>Active</div> <div>Activity: None</div> <div>State changed a few seconds ago</div>	<div>Node 3</div> <div>Inactive</div> <div>Activity: None</div> <div>---</div>

Highlights

- We created a complete end-to-end product
- Designed a network of wireless battery operated devices with PCBs professionally manufactured
- 3D printed the product housing
- Designed the web interface

Results

- The end product



- Web interface showing the occupancy status each room

Status: Connected

Room: 303		
<div>Node 1</div> <div>Active</div> <div>Activity: Detected</div> <div>State changed 4 minutes ago</div>	<div>Node 2</div> <div>Active</div> <div>Activity: None</div> <div>State changed a few seconds ago</div>	<div>Node 3</div> <div>Inactive</div> <div>Activity: None</div> <div>---</div>

Status: Connected

Room: 303		
<div>Node 1</div> <div>Active</div> <div>Activity: None</div> <div>State changed a few seconds ago</div>	<div>Node 2</div> <div>Active</div> <div>Activity: None</div> <div>State changed a few seconds ago</div>	<div>Node 3</div> <div>Inactive</div> <div>Activity: None</div> <div>---</div>

Conclusions

- Future scope includes reducing the power consumption of nodes by utilizing microcontroller sleep techniques.
- We may have an opportunity to implement this in a real life corporate environment

References

- [1] Sparkfun.com, “nRF24L01+ Transceiver Hookup Guide”, [Online]. Available: <https://learn.sparkfun.com/tutorials/nrf24l01-transceiver-hookup-guide> [Accessed: 10-Feb-2018]
- [2] geekstips.com, “Internet of Things Project – Communication between ESP8266 modules”, [Online]. Available: <https://www.geekstips.com/two-esp8266-communication-talk-each-other/> [Accessed: 10-Feb-2018]
- [3] Scargill, “Networking the nrf24l01”, [Online]. Available: <https://scargill.wordpress.com/2013/05/17/networking-the-nrf24l01/> [Accessed: 10-Feb-2018]