Low Cost Real-time Room Occupancy Indicating System

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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

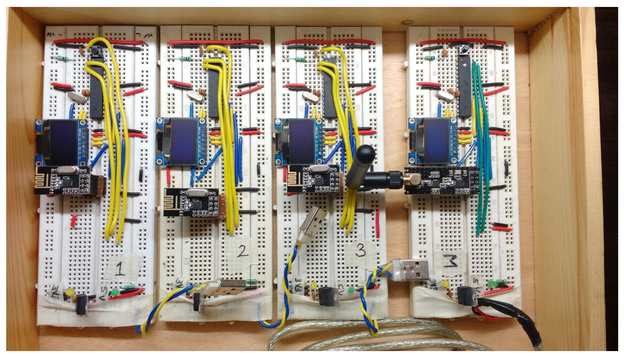
- Employees require frequent access to these meeting rooms, but lack of real-time knowledge of its availability leads to inconvenient hassle.
- The problem was that anyone could book a meeting room and then not use it. Or if someone wanted to have a meeting without pre-booking the meeting room the he/she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

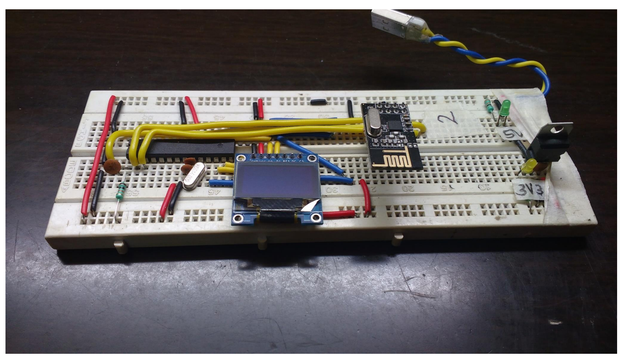
Solution Design

- 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 tree configuration.
- The central device is connected to a PC and it will push the data to the internet via a python script running on the PC.
- All the devices are battery powered.
- To reduce the power consumption, we used a low dropout voltage, low quiescent current voltage regulator. This improved the quiescent current to 20uA compared to 5mA used by a standard voltage regulator like a LM1117. Also the dropout voltage improved to 200mV from a typical 2v.

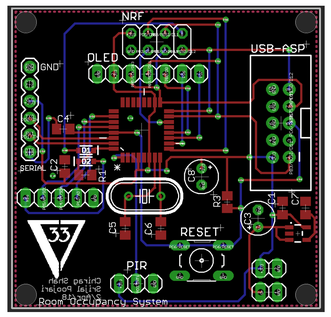
Work Done

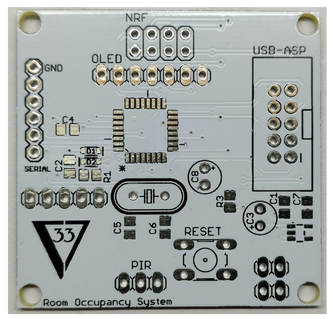
- Designed the prototype of the circuit on breadboards which included the microcontroller, radio module and an OLED display



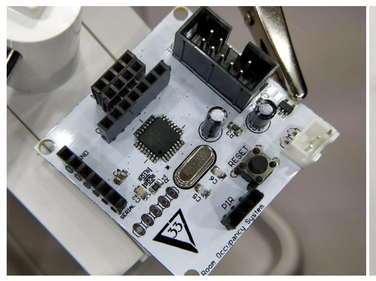


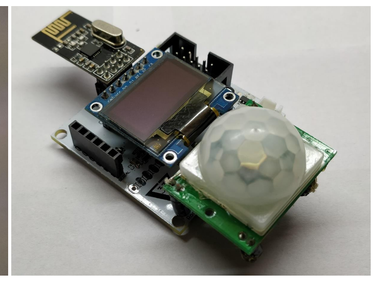
- Designed the PCB of the circuit in Eagle and got it manufactured from a PCB prototyping service (PCBway.com)



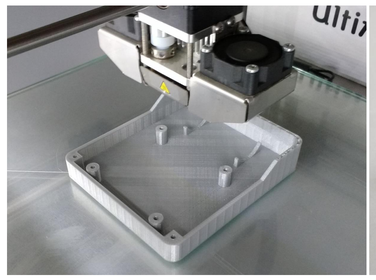


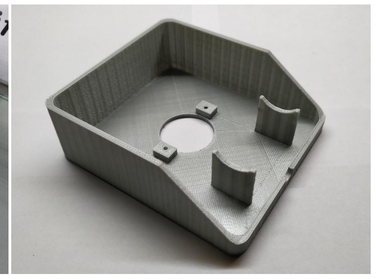
- We assembled the board



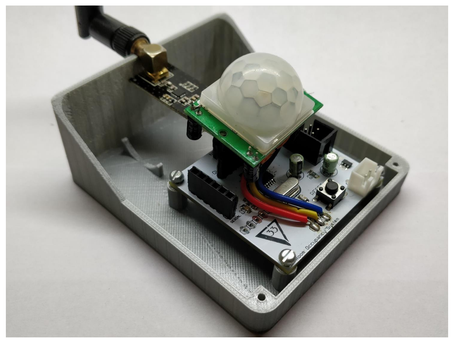


- We manufactured the housing unit using 3D printing





- Inside the housing of the final product



- Web interface to show the occupancy status of each room

Status: Connected

Room: 303

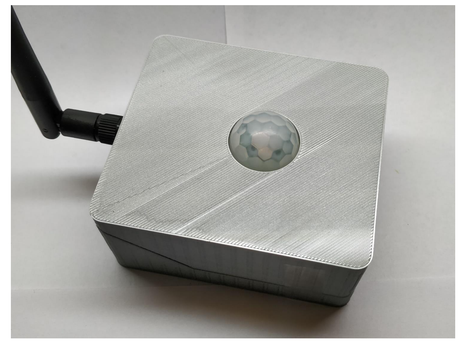
Node 1	Node 2	Node 3
Active	*Active*	*Inactive*
Activity: Detected	Activity: None	Activity: None
State changed 4 minutes ago	State changed a few seconds ago	---

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



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Conclusions

- The standby current of the device is only 80uA. This significantly improves the battery life.
- The cost per device is about 900 Rupees.

Future scope of this project includes

1. Testing with increased number of nodes
2. Building a Mobile Application
3. Implementation at Fractal Analytics

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 nef24l01”, [Online]. Available:https://scargill.wordpress.com/2013/05/17/networking-the-nrf24l01/ [Accessed: 10-Feb-2018]