

Detecting Room Occupancy via mmW Radar

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AIMS

The key performance indicators for the project can be summarized by the following visual representation.



Radar Sensor

Should be able to detect at least 3 objects (occupants) in a range of 20x20m and track them with a range resolution of 10cm and velocity resolution of 1m/s

Communication Systems

Overall transmission rate delay should be a maximum of 5 seconds with a data loss of < 10%. Transmission of data via SPI and Bluetooth for online upload.



Machine Learning

Should be able to accurately provide a location estimate. Machine learning algorithm should be able to track as many targets as the radar is capable of.



Data Visualisation

Should be able to update and show the visualiser with a refresh time of less than 5 seconds. Can accurately interpret data retrieved from the radar and provide a visual representation.

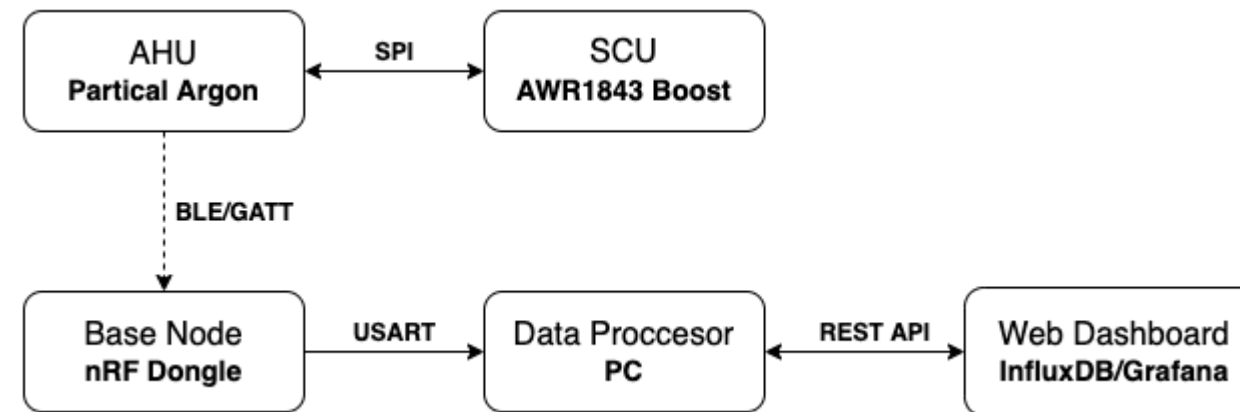


Firmware Integration

Can use the sensors in correlation with the software to send data to the dashboard and be able to track at least 3 occupants within the room to the display.

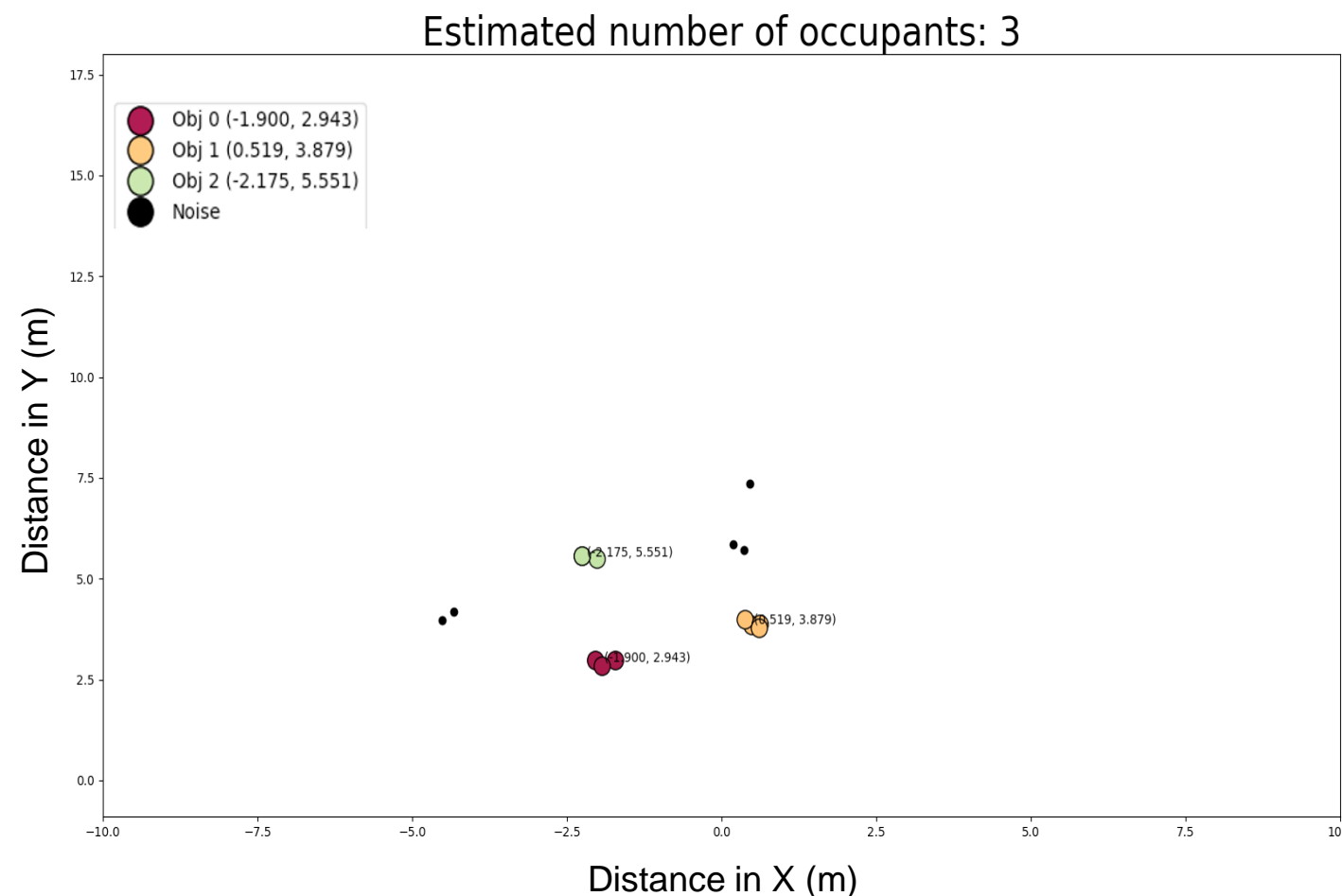


SYSTEM OVERVIEW



RESULTS

The Python GUI demonstrates the field of view of the radar, with the machine learning clustering to identify groups of points as one object. The display shows three people being identified within a range of approximately 10x5m cone.



CONCLUSIONS

Radar Sensor

- Can more realistically achieve a range of 10x10m
- 20x20m possible using larger areas
- Resolution is accurate to within 10cm
- Has a velocity resolution of 1m/s

Communication Systems

- Transmits at 2 frames per second
- Has a delay of no greater than 1 second
- Data loss is negligible hence is < 10%

Machine Learning

- Can accurately determine a group of points as a single object
- Filters out static objects
- Objects must be moving at least 0.1m/s to be detected as a cluster

Data Visualisation

- Data updates within 1 second and accurately tracks position in real time
- Can accurately update multiple objects in real time

Firmware Integration

- Can track at least 3 occupants, and can even track more than the desired occupancy
- Works extremely well at closer ranges e.g. < 7m
- Updates data to the online dashboard