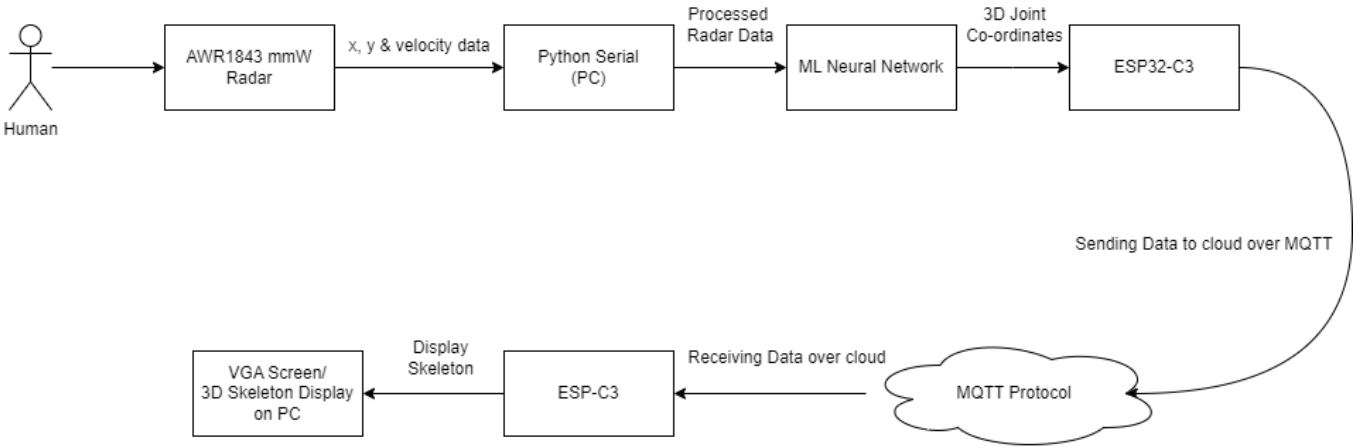


# SKELETON TRACKING WITH mmWave RADAR

Thor Gold – Tu Nguyen, Ethan Pinto, James Hudson, Nick Bassett

## Project Overview

This project involves the implementation of a Human Skeleton tracker with mmW Radar tracking. The AWR1843 radar sensor module is used to gather input data regarding the location of the human skeleton in the form of a 5D point cloud. The data is then run through a custom ML model and sent between two ESP32-C3 nodes via MQTT to then be displayed on a VGA Monitor/PC.



## Team Member Roles

Tu: ML Model Processing  
Ethan: Communication (MQTT)  
James: Radar Data Collection  
Nick: VGA Screen

## Equipment

**AWR1843BOOST:** single-chip 76-GHz to 81-GHz automotive radar sensor evaluation module  
**ESP32-C3-DEVKIT-M1:** general-purpose Wi-Fi and Bluetooth LE combo module that comes with a PCB antenna.  
**PC:** reading, writing data and displaying the skeletal motion.  
**VGA Monitor:** used to display the live skeletal motion.

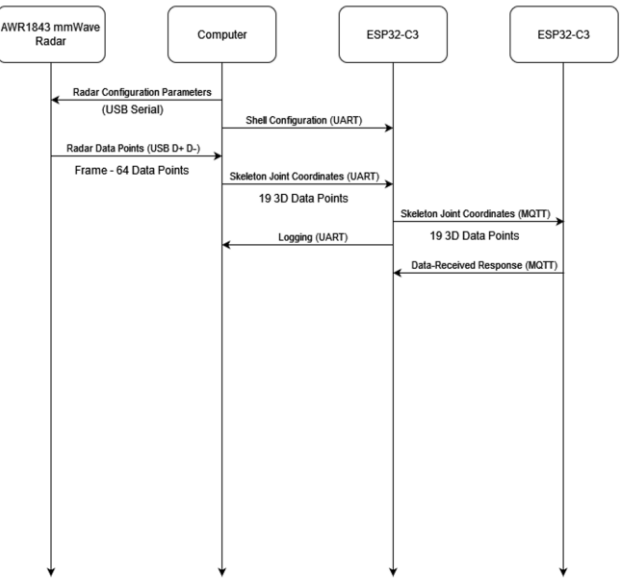
## KPIs

1. Interfacing w/ AWR1843 sensor and ML Mode
2. MQTT communication
3. 3D Model / VGA Skeletal Display
4. High Model Accuracy (40%)
5. Below 3s Movement Delay

## KPIs Met - Success Rate

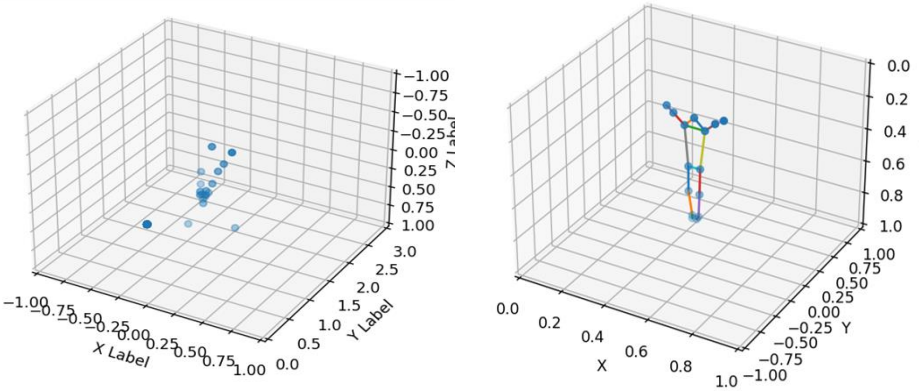
- Successfully interfaced with AWR1843 sensor - passed data through ML model to get 15 joint points
- Completed MQTT -> ESP 1 publishes data, ESP 2 reads data.
- 3D Model display on PC, VGA progress nil
- Model is fairly accurate for three poses
- Delay between movements is fairly minimal.

## Communication Protocol Diagram

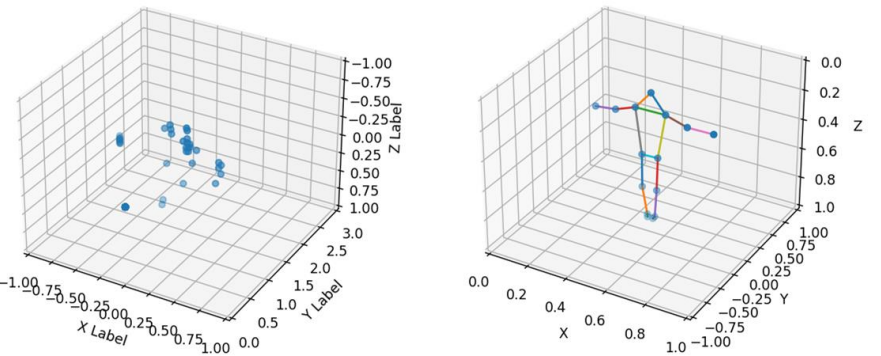


## Radar Point Cloud Data & Corresponding Visualisation Output

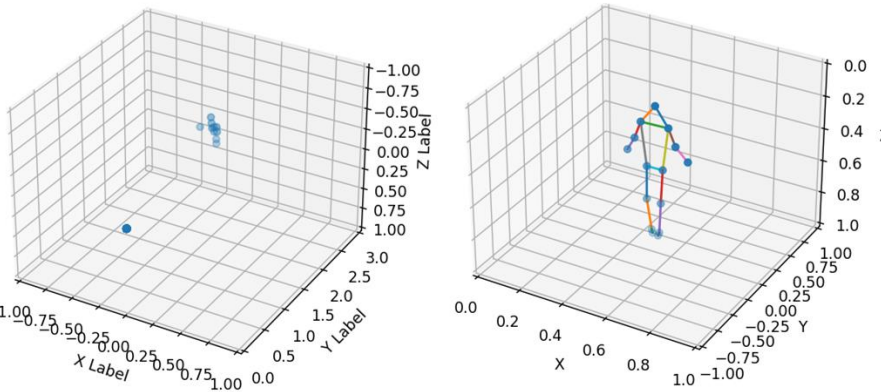
### Arms Up



### Arms Side



### Arms Down



## Problems Faced

- Reading from the second ESP with the PC via UART. The data sent via MQTT was not aligned and hence could not be parsed.
- Initial idea of using pre-trained MARS ML model led to inaccurate results. Thus, we were forced to train our own model.
- VGA Screen timing slightly inaccurate, resulting in no display.

## Extensions

- One extension of the project is to collect more data and use a larger variation of poses to train the ML model.
- Create a custom configuration for the radar.

## VGA Synchronisation Output:

