Gesture Recognition with mmW Radar Tracking

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Aims (J)

Simplified and User-friendly Presentations

- Our innovative gesture recognition system offers a new way to deliver presentations.
- Uses mmW Radar Tracking technology and tracks your hand gestures to control your presentation
- Vertical gestures adjust the volume (Up = Increase Volume, Down = Decrease Volume).
- Horizontal gestures navigate slides (Left = Previous Slide, Right = Next Slide).
- An M5Core2 timer is used to set the presentation's duration.
- An M5Core2 gesture display provides real-time feedback to the presenter.

System Overview (T)

mmW Radar AWR1843

- Capture movement data and send to the PC for processing

M5Core2 and Nucleo Board for User Interactive Interface

- Have interactive button that can be used to manage the presentation
- Can set timer to start/stop the hand gesture recognition feature, hence the presentation
- Visualise presentation progress using LCD and on board LED

M5Core2 to Display Gesture

- Enhance user experience by displaying the gesture captured using and LCD

PC as Hand Gesture Processor

- Communicate and extract Range-Doppler data from mmW Radar over serial communication
- Managed in real-time by M5Core2 through MQTT protocol
- Ultilise Machine Learning with Tensorflow Keras to train the model for hand gesture recognition

Results (Mi)

Mmw Radar

- Radar can capture the doppler data in batches.
- General direction of gestures can be determined with relevant data points.

M5Core2

- Timer is configured based on a real-life model. Seconds can be set by tapping the left two buttons, minutes can be set by holding the left two buttons.
- Vibrations occur at the start of the timer, at the last 30 seconds of the timer and when the timer stops.

Nucleo Board

- LED's can be changed from UART from the gesture displaying M5Core2.

Machine Learning

- Is able to learn from the doppler vector data provided.
- Results can be a bit inconsistent at times.
- More data and a better model would need to be implemented for higher accuracy day to day use

GUI

- PC python GUI for adding extra training data has been made.

Conclusions (To)

Performance

- The radar can successfully recognize some of the gesture and control the slides accordingly
- The M5 core 2 timer is functioning properly
- The other M5 core 2 can display gesture correctly based on the recognized gesture

Significance

- The doppler and range data which captured by the AWR1843 is the compulsory data which is needed for gesture recognition
- The development and training of the AI model is the key which allows the PC to recognize gesture

Future Development

- An advanced AI model is recommended to discover to improve the accuracy of the AI training
- Research is recommended on other possible sensor which can improves the accuracy on capturing data