Thingy:52 Activity Classification (CSSE4011)

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AIM

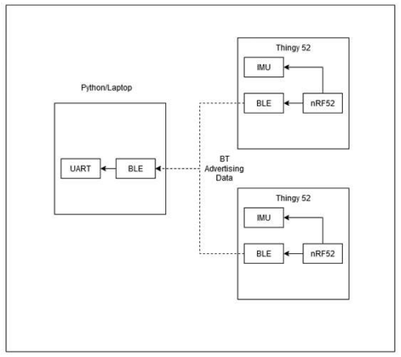
The aim of this project is to develop a pair of sensors (both thingy:52) which can detect and classify the physical activity of a person. Activities such as walking, running, sitting and standing etc. will be distinguish from each other using K-Nearest Neighbors and displayed onto a web dashboard (TagoIO). The dashboard will show which activity is currently being done, as well as the category of movement over time.

Key Performance Indicators

- Training Data: A large amount of training data (1500 samples) should be collected for a successful project.
- Classification Time: The classifier should get a good estimate within 5 seconds.
- Repeatability: The classification should be easily repeatable, and person independent. That is, training on one person should allow classification for another.
- Accuracy: the prediction should be correct > 80% of the time.
- Dashboard: The dashboard should update in as close to real time as possible.

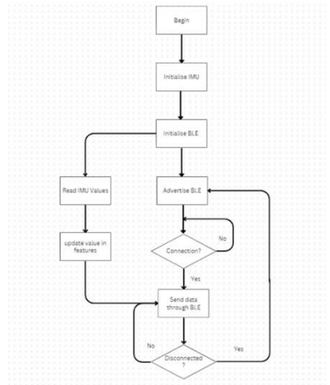
SYSTEM OVERVIEW

Hardware Architecture

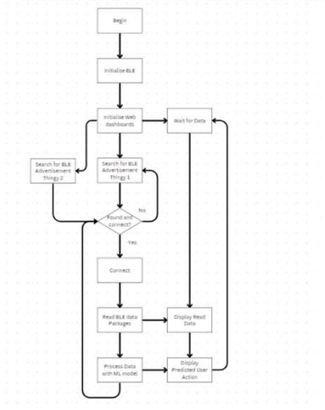


Software Implementation

- Mobile Node:



- PC:



Sensor Method

Two Thingy 52s initialized with IMU will detect and update its accelerometer values upon any triggers via movement in the Thingy. Updated accelerometer sensor values will be broadcasted as a new advertising data.

PC Communication Method

The Laptop act as a client to retrieve BLE broadcasting data from two separate Thingy 52s. Updates within the Thingy will be displayed onto TagoIO (web dashboard) along with action prediction retrieved from Software implementation side.

Data Collection Method

A Thingy is strapped onto the user's left arm and the other Thingy placed inside the user's pocket. User is required to perform target action for 2 mins and the resulting data is collected and its classification stored.

Machine Learning Method

The machine learning algorithm selected is k–Nearest Neighbors. This will be used for the classification of the movements. KNN searches an existing dataset for the nearest k data points to the target data point. This is an effective method as data for each activity should be clustered together.

RESULTS

After ML training, system can uniquely identify every trained action. These include:

- Walking
- Jumping
- Swinging
- Lying Down
- Jogging
- Standing
- Sitting

ML Model can respond to action changes in 3-4 seconds

CONCLUSION

BLE communication and ML model both achieved outstanding results.

- With more than 1500 samples collected, ML model can successfully classify all trained actions within 5 seconds.
- Predictions achieved >90% accuracy for all actions.
- Predictions are unaffected by the change in user.