# Indoor Location Tracking Using WiFi

Logan Gall

# Background -- A Failed Project

## Indoor Location Estimation Using Wifi Signals (2023)

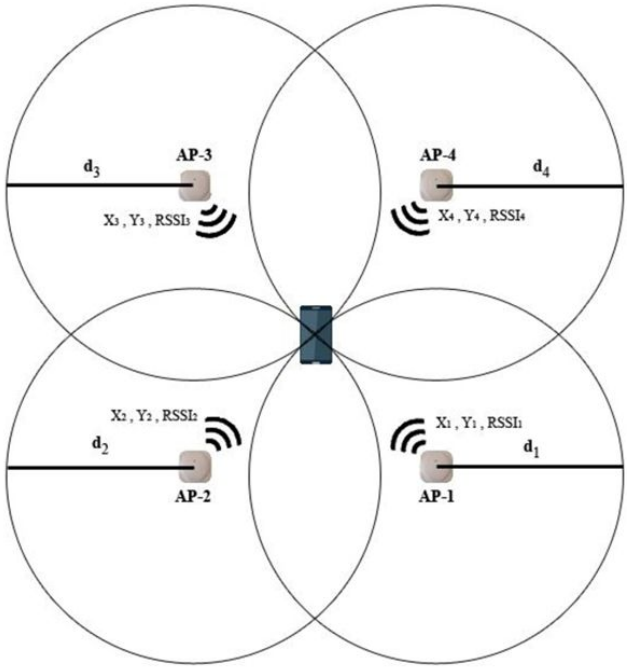
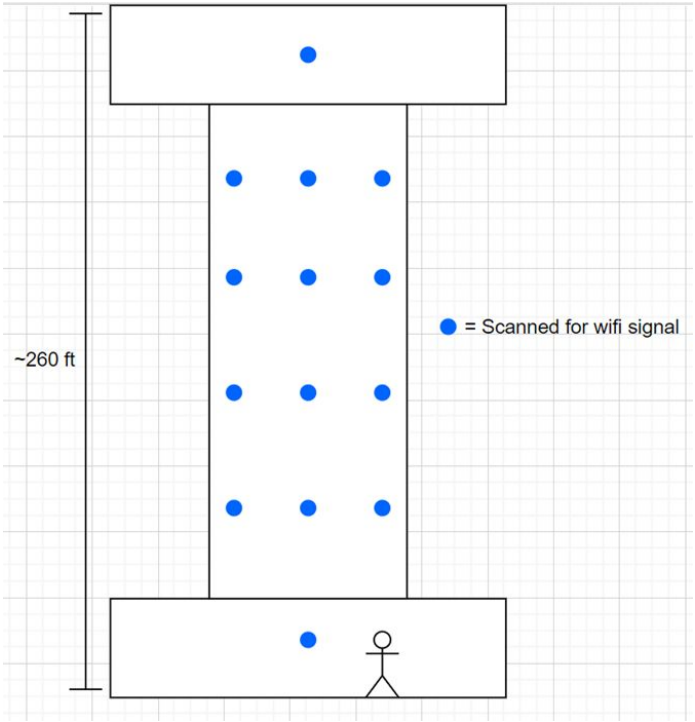
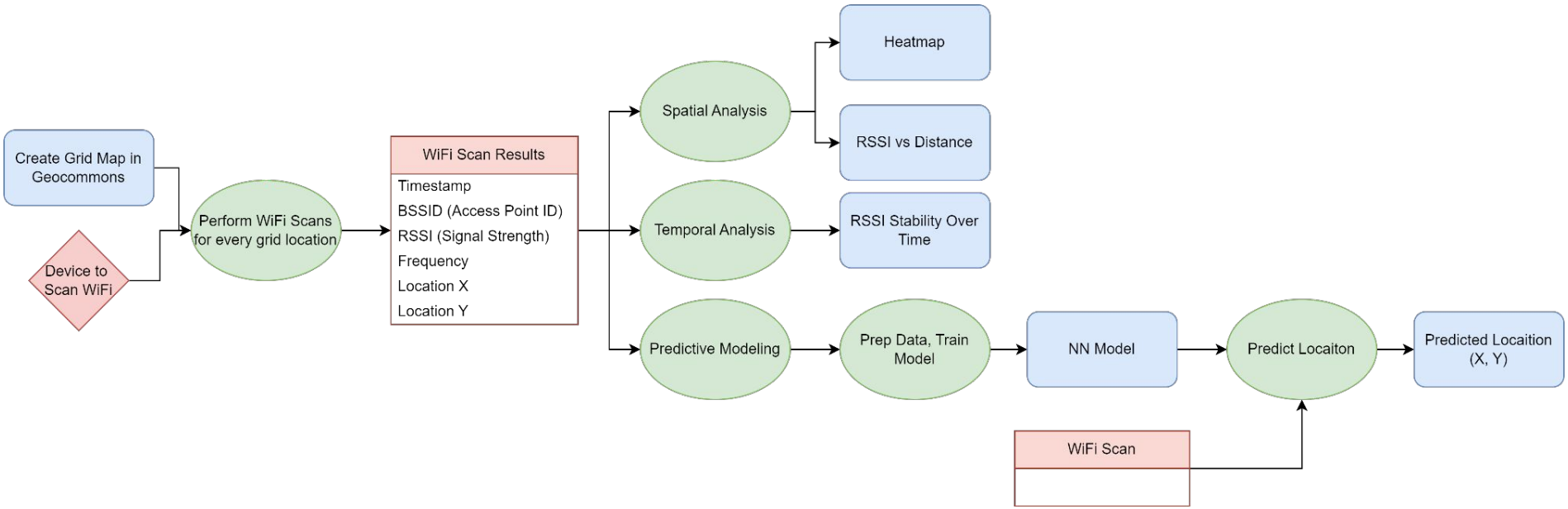



Figure 1. Trilateration method.

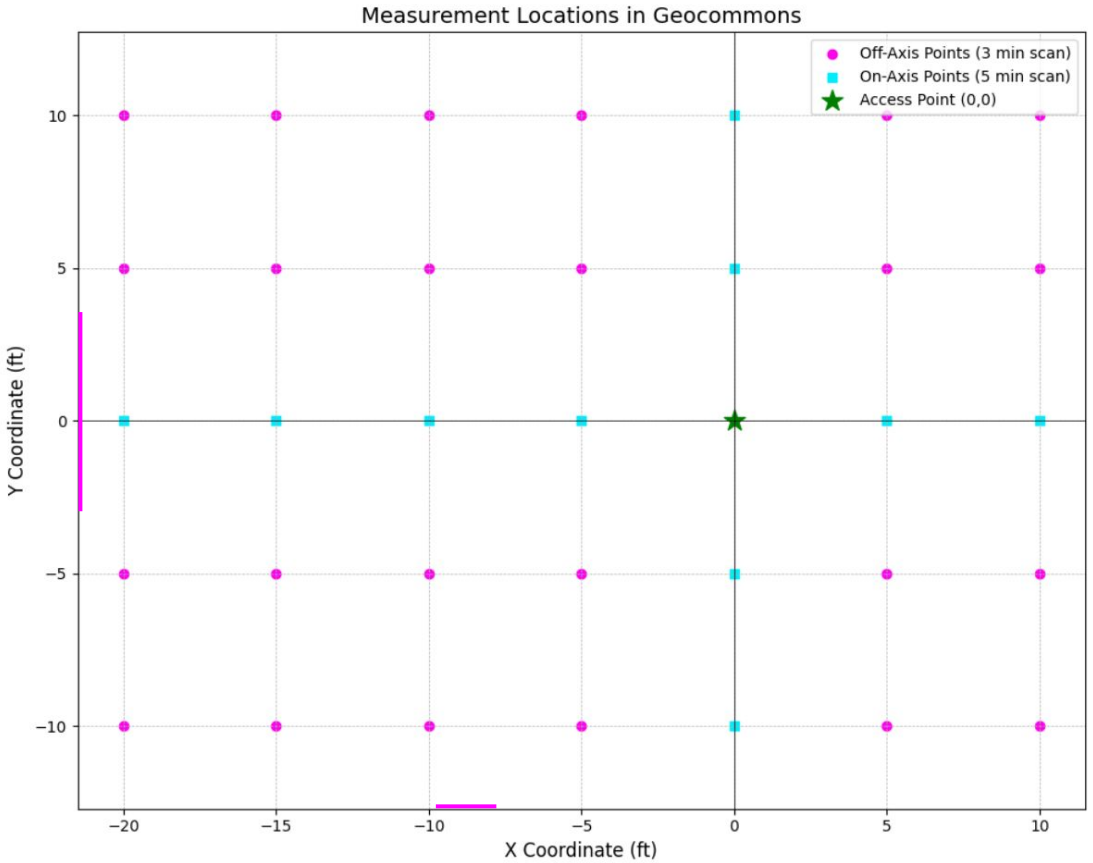


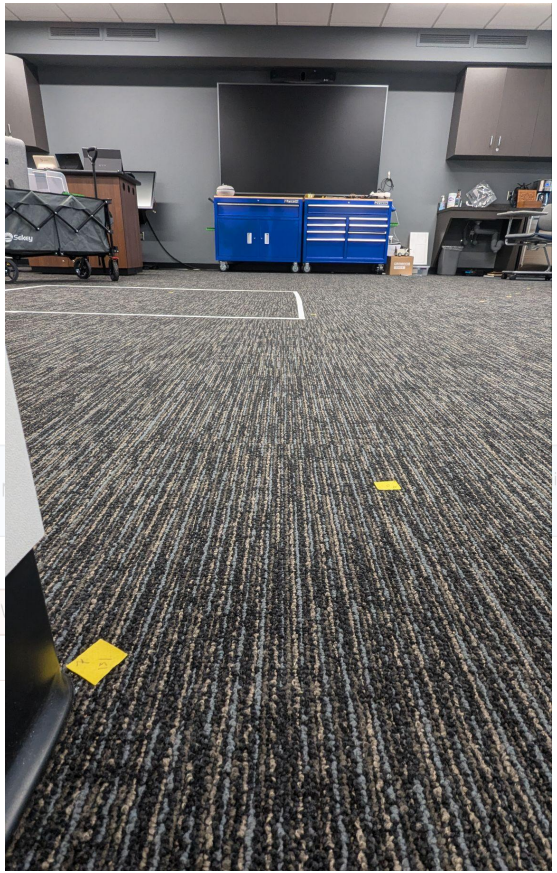

Accuracy
~ 100 ft

# Indoor Location Estimation -- Revival

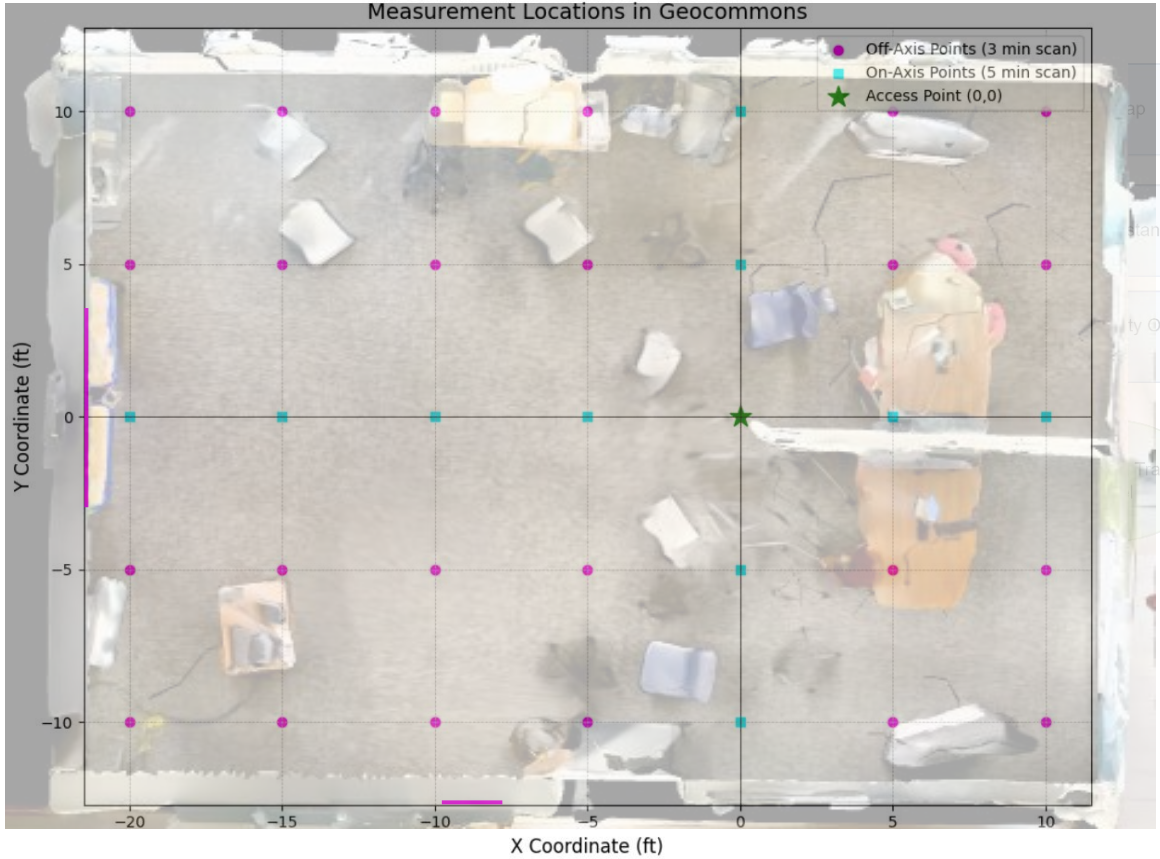


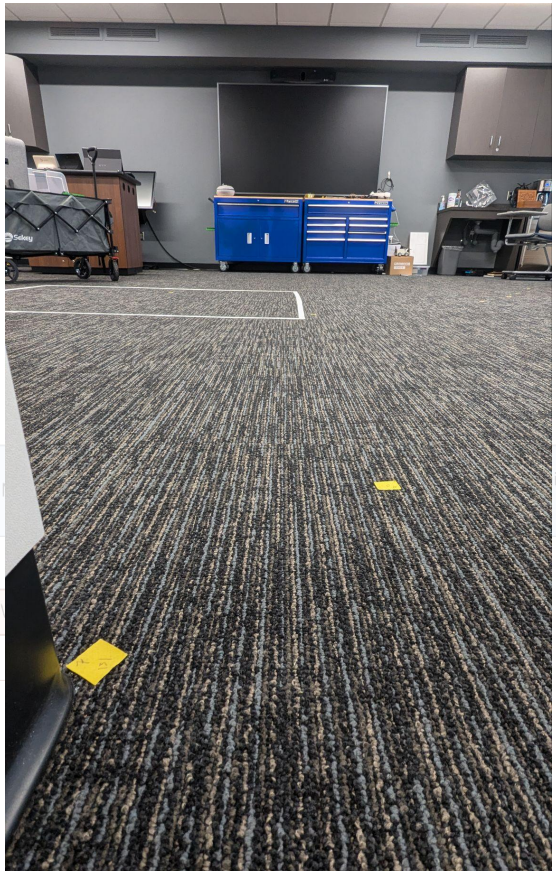
# Methodology



# Methodology

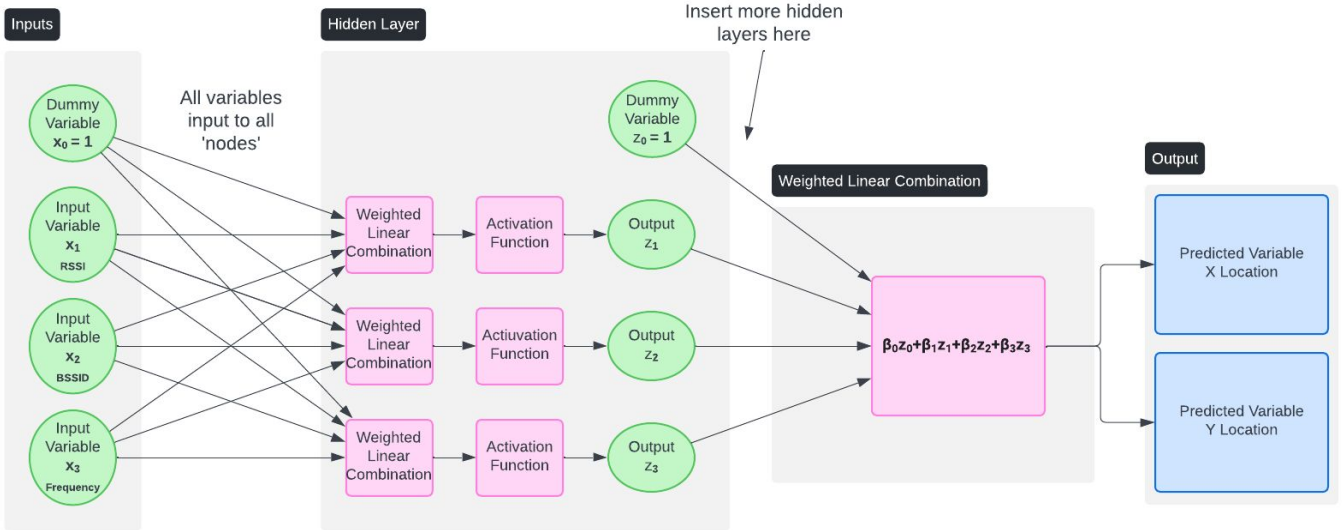


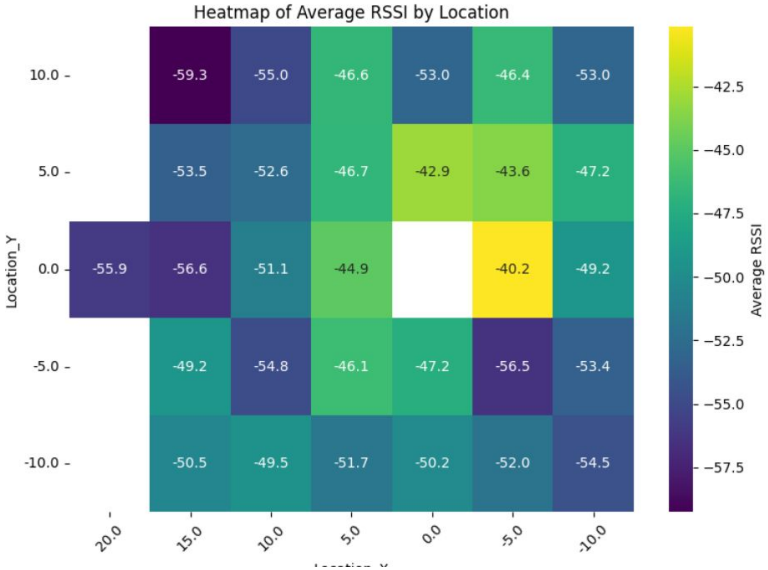
# NN Model

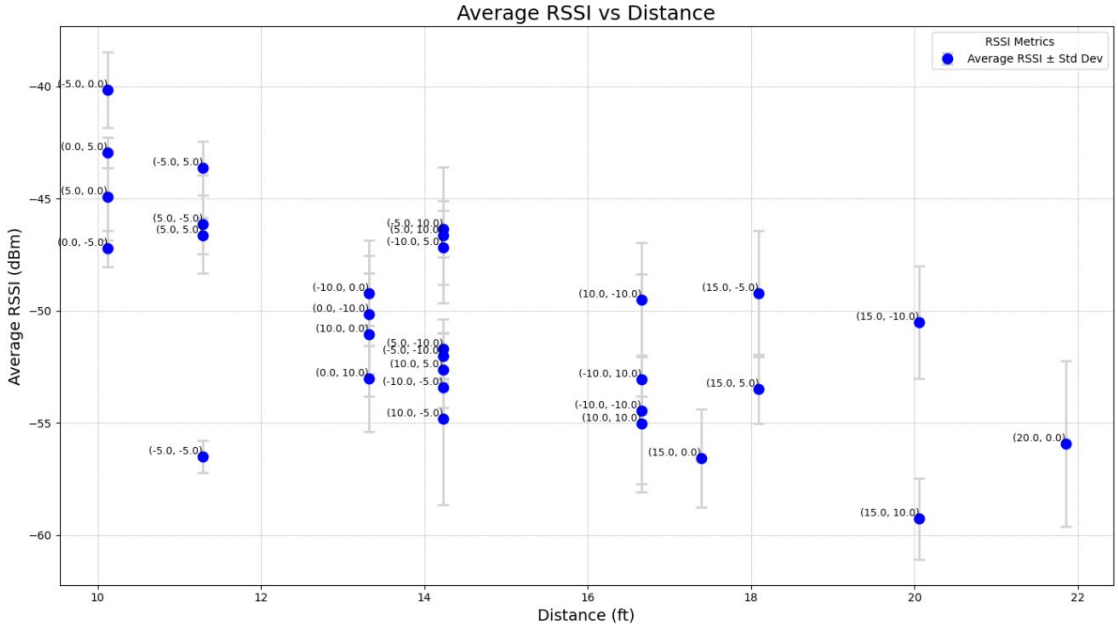
Input: WiFi Scan of all Available Wifi Signals (BSSID, RSSI, Frequency)

Output: Predicted X and Y Locations

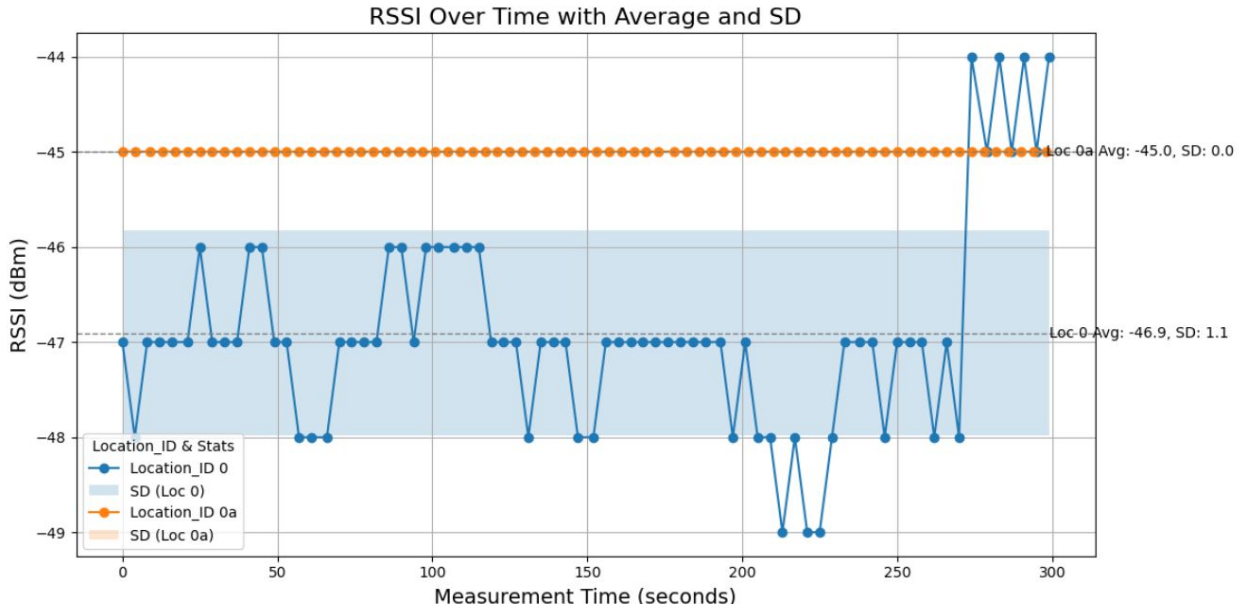


# Distance Plots

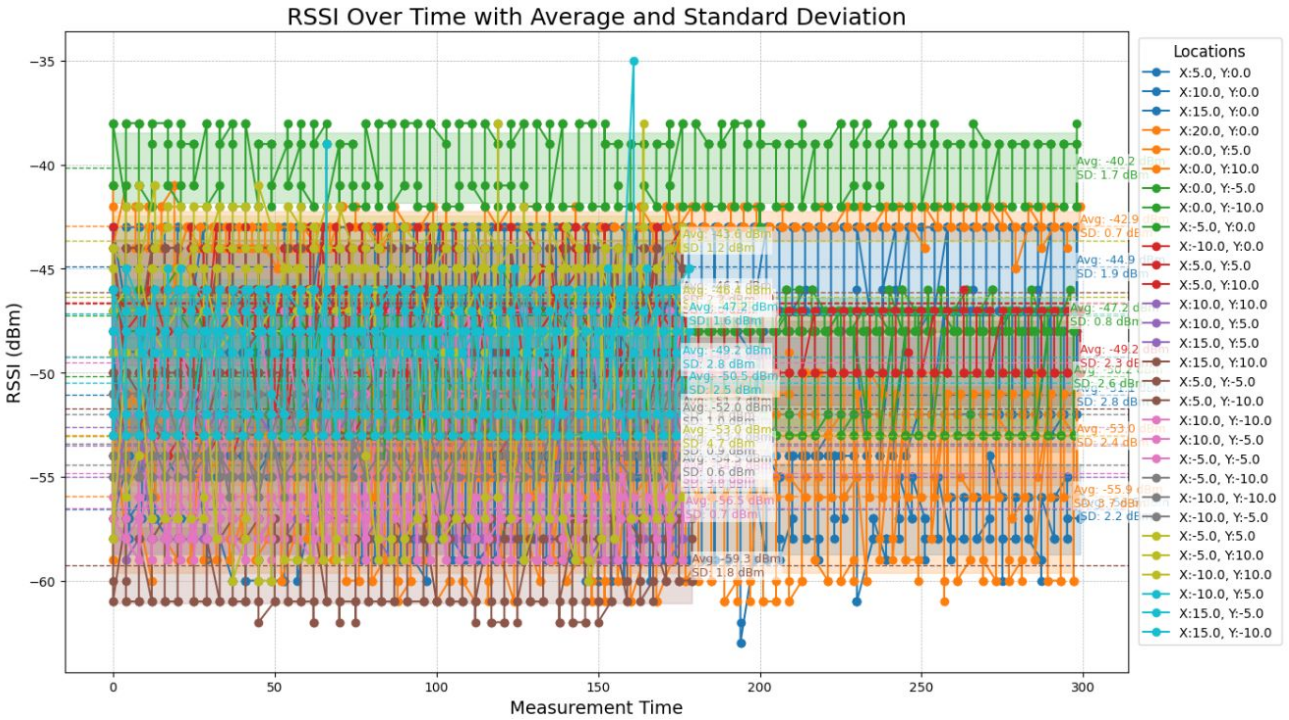


# Time Plot

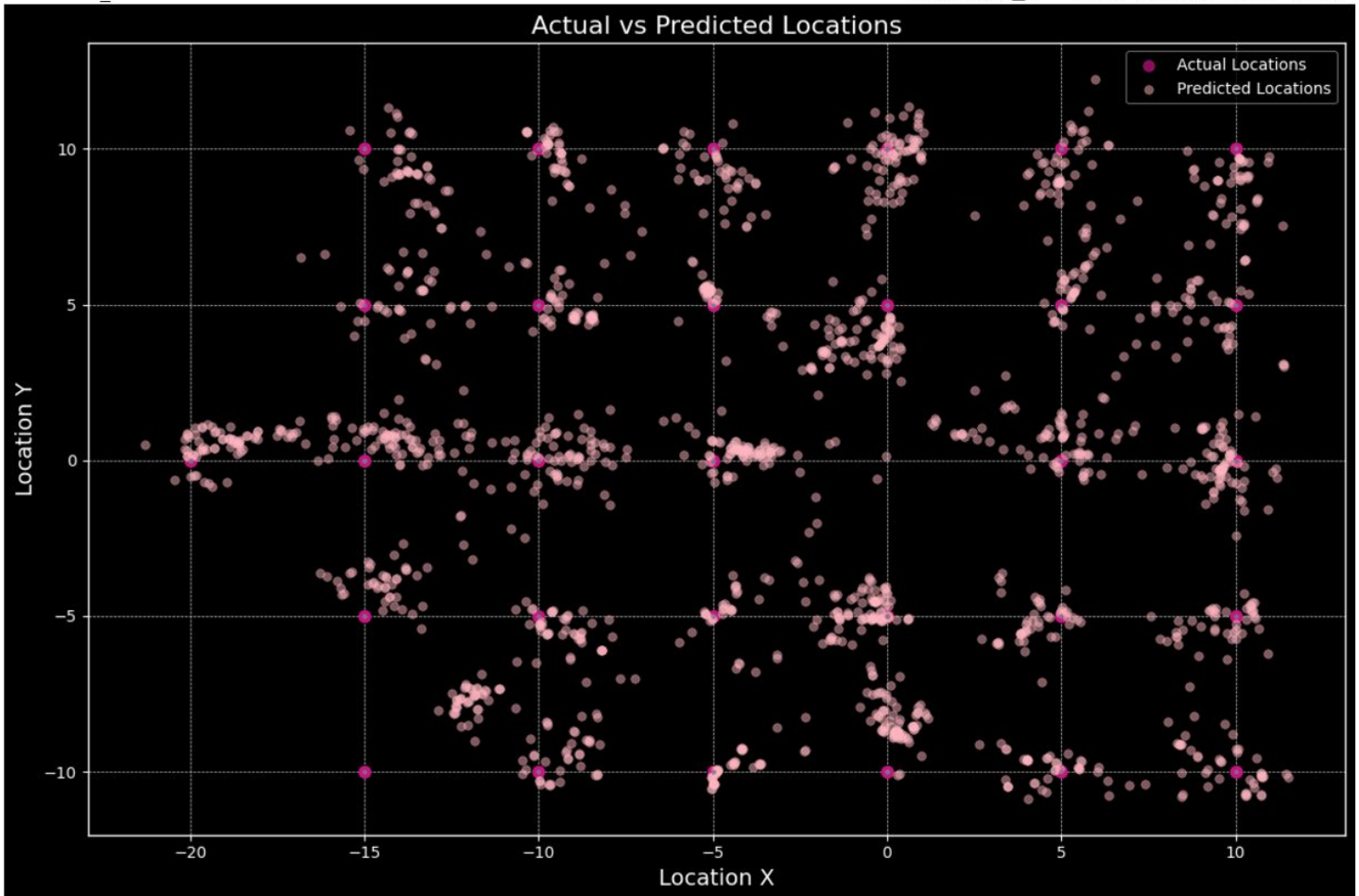

RSSI Over Time with Average and SD
RSSI (dBm)
Measurement Time (seconds)
−44
−45
−46
−47
−48
−49
0
50
100
150
200
250
300
Loc 0a Avg: -45.0, SD: 0.0
Loc 0 Avg: -46.9, SD: 1.1
Location_ID & Stats
Location_ID 0
SD (Loc 0)
Location_ID 0a
SD (Loc 0a)

# Time Plots :(


RSSI Over Time with Average and Standard Deviation
RSSI (dBm)
Measurement Time
−35
−40
−45
−50
−55
−60
0
50
100
150
200
250
300
Locations
X:5.0, Y:0.0
X:10.0, Y:0.0
X:15.0, Y:0.0
X:20.0, Y:0.0
X:0.0, Y:5.0
X:0.0, Y:10.0
X:0.0, Y:-5.0
X:0.0, Y:-10.0
X:-5.0, Y:0.0
X:-10.0, Y:0.0
X:5.0, Y:5.0
X:5.0, Y:10.0
X:10.0, Y:10.0
X:10.0, Y:5.0
X:15.0, Y:5.0
X:15.0, Y:10.0
X:5.0, Y:-5.0
X:5.0, Y:-10.0
X:10.0, Y:-10.0
X:10.0, Y:-5.0
X:-5.0, Y:-5.0
X:-5.0, Y:-10.0
X:-10.0, Y:-10.0
X:-10.0, Y:-5.0
X:-5.0, Y:5.0
X:-5.0, Y:10.0
X:-10.0, Y:10.0
X:-10.0, Y:5.0
X:15.0, Y:-5.0
X:15.0, Y:-10.0

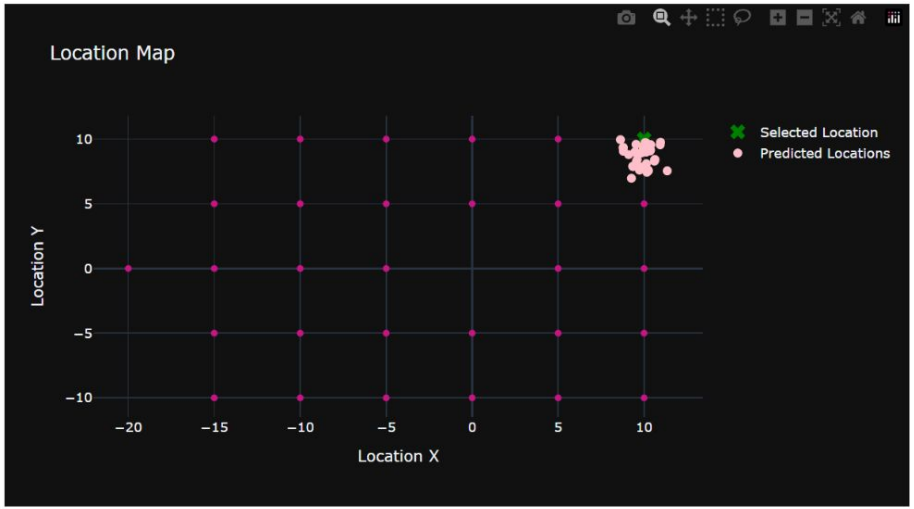
# NN Predictions

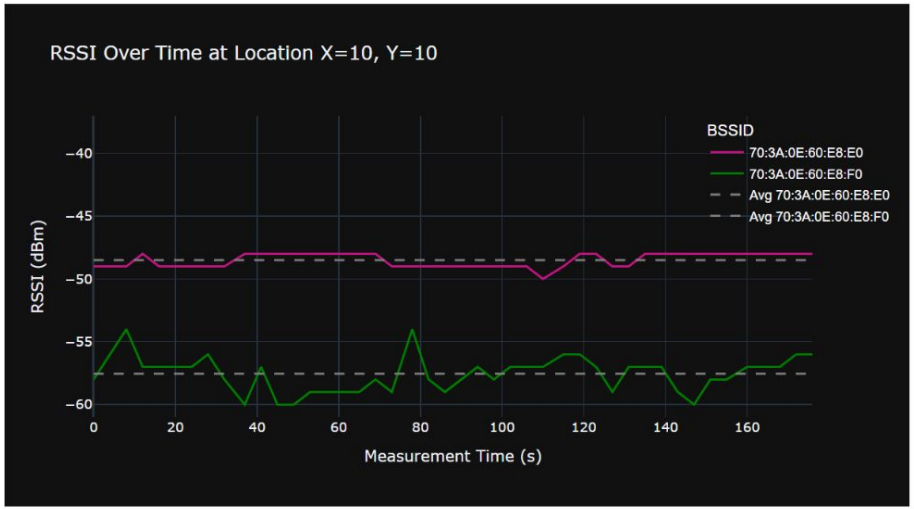
```
Overall Prediction Errors:
Location_X - MSE: 2.13, MAE: 0.99
Location_Y - MSE: 1.32, MAE: 0.85
```




Accuracy
~ 1 ft

# Interactive Plot




https://z.umn.edu/8294_Indoors

https://indoorlocationmodeling-559928205854.us-central1.run.app

# Conclusion

Accurate location can be estimated in indoor environments using WiFi accurately using only WiFi signal scans, assuming ideal environments.

Future Work

- Train a LSTM-based Neural Network model to accommodate for greater temporal variance
- Expand study
  - Larger area (entire floor)
  - Other wireless signals (bluetooth)
  - Other sensors (accelerometer/movement)