The objective of this project is to create an accurate prediction for the placement of T-Mobiles Home Internet Device. We completed this through the creation of an AR (Augmented Reality) visual app that displays the closest cell tower and collects RF data. After the data is collected, the app uses a REST API from Microsoft Azure to gain access to well-tuned ML models that will then predict and display if the camera’s location will be the most effective place to place the device.

**RF Data Collection and Analysis**

- **Collection Locations:** Data was collected in the lab space, halls, elevators, and other lab spaces within the ECE building, as well as in a residential building.
- **Amount of Data:** Approximately 77 locations with 26 timestamps per location were collected with Ookla and iPerf. Data included 11 general locations with varying timestamps (ranging from 730 to 2100) depending on signal availability.
- **Data Collection:** RF data was collected using Ookla and iPerf in a lab space and various locations within the ECE building. iPerf was chosen for comprehensive RF data collection, allowing measurement of bandwidth, loss, and other metrics.

**Machine Learning Model and Approach**

- **Goal:** The objective of the machine learning (ML) model was to predict internet speed in MBPS based on RF metrics obtained from the placement of the home internet device. The predicted speed would then be utilized by the app.
- **ML Architectures:** Several ML architectures were tested, including Decision Tree Regressor, RandomForest Regressor, Support Vector Machine Regressor, and Neural Networks.
- **Best Performer:** After thorough evaluation, the RandomForest regressor yielded the best performance results for the given task.
- **Performance and Robustness:** The primary aim was to develop a robust ML model that delivers reliable and reasonable internet speed predictions. The model exhibits a high level of robustness, as it can handle various types of RF information. The model achieves an accuracy of approximately 70%, which indicates its capability to make accurate predictions.
- **Speed Categorization:** For the app’s usage, internet speed is categorized into three groups: speeds above 200 Mbps are considered great, speeds between 100 and 200 Mbps are classified as good, and speeds below 100 Mbps are labeled as poor. The ML model has a nearly 95% accuracy in correctly predicting the speed grouping, demonstrating its effectiveness in classifying internet speeds accurately.

**Results, Future Work, References, and Acknowledgments**

Future work on the app could include larger data collection for a more fine-tuned ML model, and therefore a better placement of the HINT, and adding user-friendly features to the app.

References throughout the project were given to us by our T-Mobile industry mentors. They created documents describing how to log the RF data and gave us a skeleton code for the ML model. The one aspect that was not given any direction was creating the REST API.