



Boston University
Electrical & Computer Engineering
EC463 Capstone Senior Design Project

Second Prototype Testing Plan

5G Network Performance Testing - Sky Seer



Team #16
5G Drone Team Red

Team Members:

Ryan Mondoneda, mondor28@bu.edu
Peter Wallace, peterjw@bu.edu
Jong Whee Jeon, crm04140@bu.edu
Dohun Ji, kaahsh38@bu.edu
Jungin Chang, changju@bu.edu

Overview and Setup

Data Collection App:

This overall system for the project has a hardware and software component. The software components include kotlin-based Android application using Ookla SDK connected with Firestore database, a Flask web application, and machine learning model.

The main point of this test is to present the process of data collection stage by running our Android application that automatically measures and stores collected data to our database, web application showing and controlling the status of data collecting, pre-processing data for training, and predicting network speed with machine learning model. As test constraints, since it will be conducted in the lab, our application will only collect ground network speed data followed by its altitude. Another important point to mention is that the prototype test will use a lot less data points than the actual project since the test is being demonstrated real time. A larger training dataset will need to be developed over time for the final product.

The main setup is to ensure the phone is connected to the desired network. The actual project will use a 5G network, but as mentioned, a 4G network will be used for now. The database can be viewed and the machine learning algorithm can be run on a laptop.

Drone:

The hardware component consists of an assembled drone and a 5G Android phone with a 5G SIM card. The 5G Android phone is mounted on the drone and runs the data collection software during flight to collect data at different altitudes.

The main purpose of this test is to show that the drone and phone mount works. We are not able to do a flight demonstration in the lab, so the test will just be that the drone turns on and the propellers spin. Secondly, we will check that the phone would be securely held to the drone in the event of pitching during actual flight. If the phone is fine for such events, it would also be fine for minor winds (we will not be flying the drone to collect data if there are strong winds).

The setup required for turning on the drone is connecting the drone battery and turning on the RC transmitter. The phone mount is already attached to the drone so the only setup for the phone test is inserting the phone into the mount bracket on top of the drone.

Testing Materials

Hardware:

- 5G Android phone
- Laptop
- 5G SIM card
- Drone (including required components, ex: battery)

Software:

- Android data collection mobile application

- Ookla speedtest via Speedtest SDK (provided by Ookla)
- GPS via android native hardware
- Flask web application
- Machine learning model code
- Firebase Firestore (Google Cloud Platform)

Data Collection/Software Testing Procedure

1. Run mobile application manually
2. Run mobile application remotely via our web application
3. Observe collected speedtest data (via SDK) and longitude/latitude/altitude data (via GPS)
4. The collected data is pushed into the database (multiple observable iterations)
5. The machine learning algorithm is run to produce predictions from the collected data
 - a. Read data from the database
 - b. Data pre-processing for training
 - c. Calculate predictions (MultiOutput Regression)
 - d. Plot for visualization

Testing Procedure for Drone

1. Turn on drone
2. Have propellers spin
3. Turn drone off
4. Attach phone to drone
5. Turn the drone on its side in all four directions and check if the phone is secure

Drone Testing Criteria

- ☐ Drone turns on
 - ☐ All 4 motors work, propellers spin
- ☐ The phone is securely attached to the drone once drone is turned on its side all four times

Data Collection/Software Testing Criteria

- ☐ Network speed tests can be performed by the phone
 - ☐ Compare network performance data with OOKLA speed test app and see if there are any correlations
- ☐ Data collected by the phone can be pushed to the database
- ☐ Web application can control network speed test installed on a mobile phone
 - ☐ Remotely control the network test operation

- ☐ Fetch the result whenever the test is finished
- ☐ Data can be accessed from database for use in the machine learning algorithm
 - ☐ Import data from Firestore database
 - ☐ Data pre-processing
- ☐ Machine learning algorithm can calculate predictions from gathered data
 - ☐ Use the collected data to make predictions
 - ☐ Make note of the predictions that the ML model made
- ☐ Location data
 - ☐ Record *longitude, latitude, and altitude*