

## Sdmay18-33: AR Enabled Ground Station

### Motivation

The AR Enabled Ground Station project seeks to integrate the heads up AR display of the Google Glass with a custom drone flight controller designed by UAVX. The Google Glass UI displays alerts, critical flight data, and general drone status in an efficient and timely manner. This increases the Pilot's domain of control and awareness of the drone's location, flight path, and general welfare. Equipped with the AR Enabled Ground Station, the pilot will enjoy a new horizon of user experience with the ability to access data for their applications, resulting in technologically informed drone piloting and decreased risk of drone negligence.



### Design

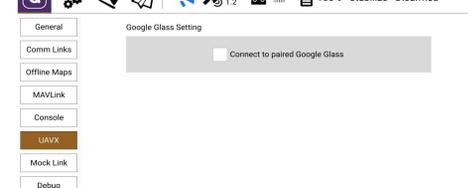
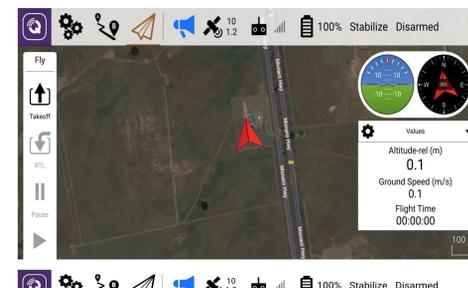
#### Google Glass UI



Available UI Features:

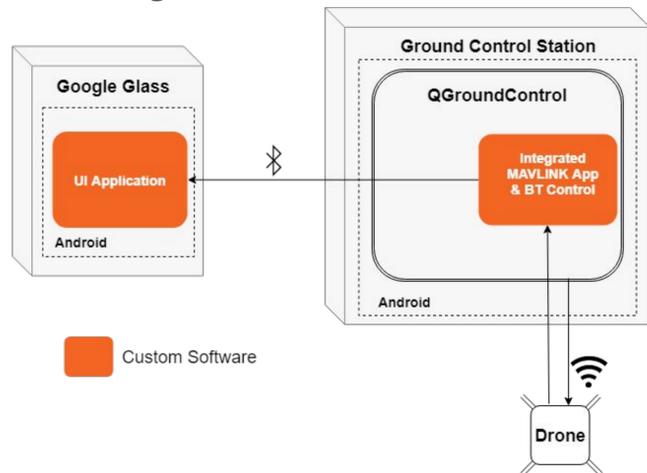
- Airspeed
- Altitude
- Distance From Home
- Bluetooth Connection Status
- Range
- Throttle
- Heading
- Battery Level

#### QGroundControl UI



UAVX settings offers an easy to use way to connect to a Google Glass device, or use the ground station without Google Glass.

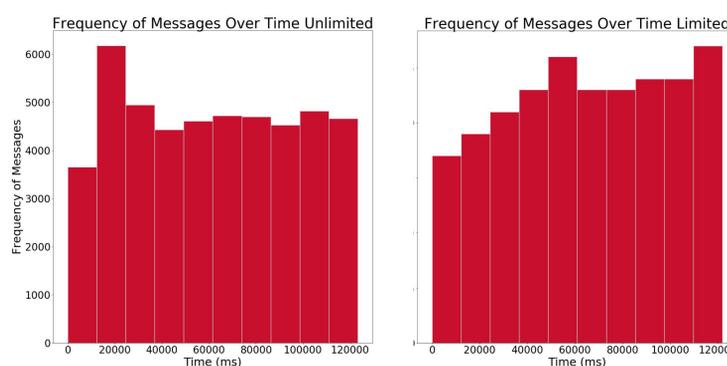
### Systems Level Diagram



The systems level diagram consists of three main components, the Google Glass, the Ground Station, and The Drone.

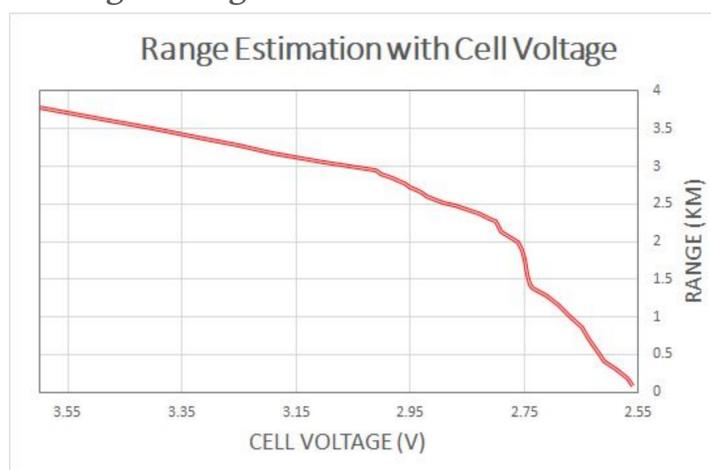
### Technical Issues

#### MAVLink Message Influx



Providing the pilot with vital drone information is paramount to the user experience. However this comes with a price. The messages sent to the Google Glass must be limited in order to maintain the performance of QGroundControl.

#### Flight Range Estimation



The Range Estimator predicts the flight range given current battery life. Along this estimation curve, the range is quantified and displayed to the pilot in the Google Glass UI in real time as the cell voltage decays.

### Requirements

- Create a useful UI
- Provide updates about key metrics when they pass a threshold.
- Glass should connect over Bluetooth to the ground station.
- Glass should update in real time.
- MAVLink Enabled Drone

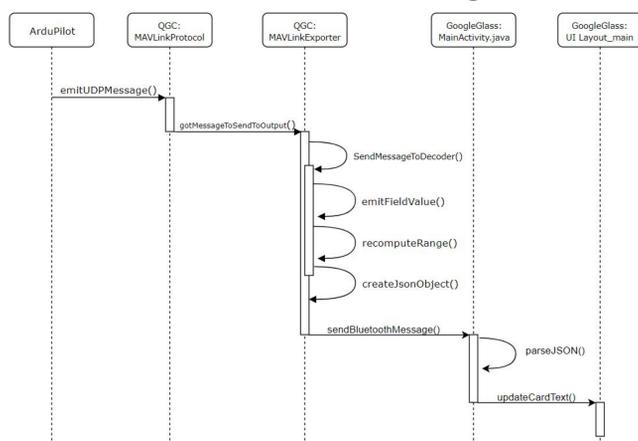
### Standards

- NASA Integrated Display and Graphics Standard (IDAGS)
- IEEE Standard for Wireless Access in Vehicular Environments
- IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture

### Development Tools

QT (C++), Android, Android Studio, Java, Google Glass, Android Phones

### Code Flow for MAVLINK Messages



A custom MAVLink parser and bluetooth controller was developed using open source ground control software. This application connects to the Google Glass application to display the information to the pilot.

### Future Improvements

The accomplished product offers communication between the drone simulation, the UAVX ground-station, and the Google Glass. However, there are a few things that can be improved:

- Provide pilot with AR features to indicate drone location heading.
- Provide more information about drone state.
- Implement user customization for information displayed on UI.
- Performance enhancements.
- Improve connection process between the controller and display device.