Off Road Spotting Drone

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Capstone Project

DAIMLER

Abstract

The ability of drones to get a different perspective of an environment becomes useful in off-roading, where the success of the vehicle depends on choosing the perfect route through the terrain. Through building an off-road spotting drone, Mercedes hopes to achieve an engaging and safe off road experience for their SUV market.

Approach

We decided to build our drone instead of buying one because of the added control over the drone's features and abilities.
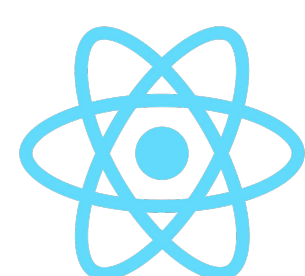
Drone
- PX4 drone firmware
- LIDAR sensor for scanning

Server
- Raspberry Pi Server, running A* best path algorithm
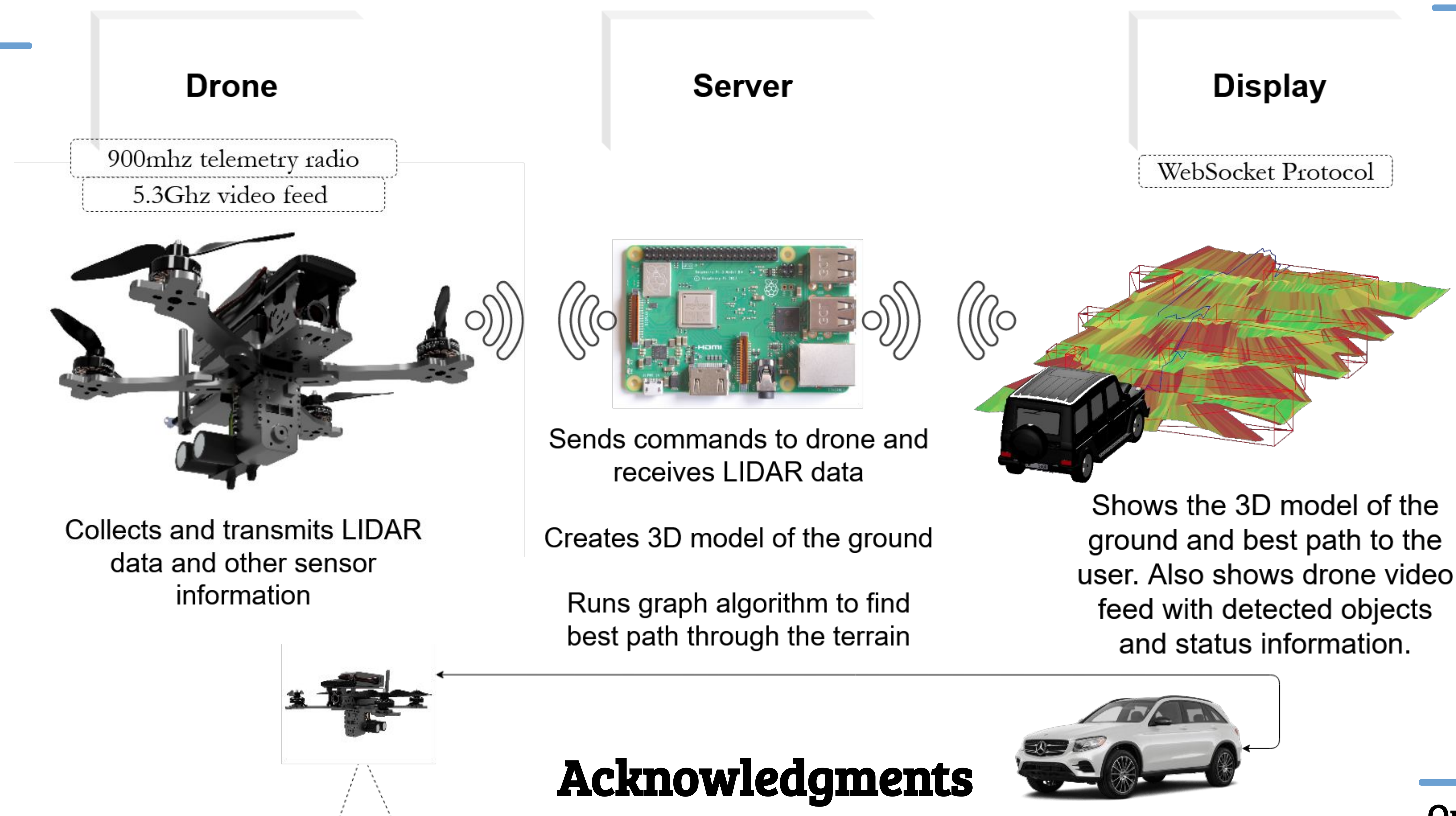- QGroundControl open source ground control

Display
- React Native app
- WebGL rendering used for creating the depth map

Overview

Mercedes is committed to improving the experience customers have with their vehicles. In order to bring more convenience and utility to the user they sponsored our team to build a drone integrated with their SUVs, to provide real-time information on the terrain that a driver cannot directly see and improve off-road safety. We utilized a drone with multiple sensors to achieve:
- A 3D mapping of the environment.
- An algorithm to find the best path through the terrain ahead.
- An intuitive app display showing obstacles and the best path to the user.

Architecture

Drone

900mhz telemetry radio
5.3Ghz video feed

Collects and transmits LIDAR data and other sensor information

Server

Sends commands to drone and receives LIDAR data

Creates 3D model of the ground

Runs graph algorithm to find best path through the terrain

Display

WebSocket Protocol

Shows the 3D model of the ground and best path to the user. Also shows drone video feed with detected objects and status information.

Acknowledgments

Challenges

Finding and learning about the combination of technologies such as drone firmware and best path algorithms required to put together this project was our team's greatest challenge. Ultimately we gathered a strong blend of techniques to give us a stable and reliable system.

Results

- Built a drone capable of taking off and landing from a trunk, scanning the ground in front of the vehicle and returning the LIDAR data back to the server.
- Built a server for communicating between the display and drone.
- Designed an app that is able to show a 3d model of the ground and live video from the drone with obstacle overlay, and help the user navigate the terrain.

Conclusion

Our drone system creates a 3d map of the environment in front of the vehicle and finds the best path through the terrain.