Vision Statement - Northrop Grumman

Project Title: Autonomous Aerial Mapping

Team name: Game of Drones

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About our Project

This project is about creating new solutions with industry leading drone technology. The issue we are aiming to solve is the difficulty of gathering 3D map data in areas with limited topographic information available. This issue is particularly important for our military, since they often go to remote areas of the world that have not been sufficiently mapped out. Anyone can search Google Earth and get a 2D image of an area, but this image has no information associated with it. One would not know the dimensions of the building they are looking at or the geographical features of the surrounding area. 3D map data on sources like Google Earth is limited and sometimes inaccurate, especially in remote areas. Our project aims to eliminate these issues by developing an autonomous drone that maps the nearby terrain using sensor data. We will work with the Northrop Grumman team to achieve our goals over the next two quarters.

Project Outcome

The ideal outcome of our project is to create the software necessary for a drone to autonomously and accurately map any given area. The drone will be able to survey the nearby area and create a detailed 3D model of the landscape. The drone can be flown by a user or autonomously. If being flown autonomously, the drone will utilize on board sensors to detect and avoid nearby objects. It will then take note of these objects and optimize its flight path for the next run. The 3D model will be displayed in a mobile phone application that will be updated as the drone makes progress.

Along with the final product, as a team we have some other specific goals we want to achieve. We want to incorporate industry software standards like test driven development and efficient

bug tracking into our project. We will also use the Agile software development process as effectively as possible. We will document all of our progress along the way and hold each other accountable at scrum meetings for the work we each say we will complete. Our team will have effective communication and weekly goals that revolve around our project milestones.

Initial Project Milestones

The project has been split into two main missions. Missions one is to program a drone that can accurately map a nearby area while being flown manually by a user. This map will be displayed on a mobile device application. This first mission will be split into three major milestones. The first is interfacing the guidance system and our sensors onto the drone. This includes installing several cameras and the DJI Guidance system. We also need to familiarize ourselves with all the hardware and how to fly the drone. The second milestone of mission one is creating the mobile application. The application needs to display the map and render it in real time as the drone collects data. Both of these milestones can be worked on simultaneously and do not require interaction until further along in the project. The third milestone is sending the correct information from the drone to the phone and accurately rendering a 3D map. This final milestone will likely be the most difficult and will require interfacing the results of the first and second milestones.

Mission two of the project is to make the drone autonomous. This mission will also be broken down into three main milestones. The first milestone will be creating a flight algorithm that utilizes the DJI guidance system and avoids all obstacles in its path. This algorithm must be able to fly in a pattern that optimizes the drone's ability to collect map data. The second milestone will be designing the drone to fly the most optimal path from point A to point B if the drone has a map of the area already. The final milestone will be incorporating these new drone features into the mobile application and giving the user the option to fly manually or autonomously.

Our Solution

To achieve our milestones we will use a variety of technologies. We will use Git, Trello, and Slack for project integration and communication. We will implement our solution using Android Studio for the mobile application as well as the drone SDKs provided by DJI for autonomous flight and mapping capabilities.

We will use agile development process to achieve our milestones. This involves daily scrums in which we address what each of us will accomplish in the next twenty four hours. We will also have bi-weekly sprints where we outline and allocate the tasks we need to accomplish and then complete these tasks over the two-week sprint.