Project Title: Titan Providence: Self-navigation drone

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Data and analysis of information have become a crucial aspect in society's current development, allowing accurate awareness of our environments, benefitting maintenance, safety, and overall innovation. At the same time the big data trend has grown in popularity, the use of drones has also taken off to be considered as valuable data collection devices. However, the control of drone always lies with the pilot who uses visual tracking to determine its position and orientation. To overcome these issues, we propose an advanced technology that allows a drone to autonomously fly to preprogrammed points through the incorporation of GPS and smart IoT devices on the drone. The proposed Titan Providence utilizes drones and their improved accessibility and maneuverability to enable applications in various fields that would otherwise be prohibitive given previous limitations. Differing from common Unmanned Aerial Vehicle (UAV) systems, Titan Providence implements edge smart computing with GPS system, allowing for fully autonomous completion of extensive analysis of GPS coordinates which allow for the drone to enter, vast, hazardous, monotonous environments, or a combination thereof, in addition to having the benefits of an overall lowered cost in finance and labor. Our objectives for this project including construction and design of the drone framework, adaptive pathfinding, and awareness, in addition to task assignment.

To achieve our goals, we integrated a Raspberry Pi with a compatible flight control module with additional telemetry and peripherals docked on a custom quadcopter chassis that allows modularity and expansions in accordance to a task's outline and requirements. By using these two systems in conjunction, we passively maintain the stability of the system through its inertial measurement unit (IMU) and individual multirotor electronic speed controllers (ESC), allowing further independence of the system's microcomputer. Regarding autonomy, the Raspberry Pi hosts the machine learning infrastructure through what is known as Deep Neural Networking (DNN). In regard to future planning, revolving around the use of GPS navigation, we hope to implement DNN, in which the system reads GPS data for planning the path. In the project, we propose a fast speed and optimized CNN model for resource efficient inference task. By using the proposed machine learning technology, we seek the need to store the large amounts of parameters from deep learning models and achieve the self-navigation by feeding into the Raspberry-Pi program

with GPS data in real-time. From this, we were able to have Titan Providence confidently identify paths to follow on an unknown environment with GPS data through its ability to decipher which was the best path to take. We hope to further educate ourselves with the system, regarding more complex classifiers can be learned, and thus more complicated task can be completed autonomously. Additionally, our system architecture allows us to further script flight controls using Python, providing general mission assignments to the drone outlined by the user that is fully localized and that can be initialized through SSH using a cellphone or computer.

With the increasing desire for efficiency and effectiveness, in having the ability to give a UAV a task that would be otherwise too resource demanding or risky for human involvement, Titan Providence provides a significant alternative for surveying and environmental awareness through multiple scheduled assignments and real-time automated problem solving that may be attuned for countless situations and applications.