Autonomous UAV for Plant Health Analysis

EE 175A, F25

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Week 5, 10/27 - 11/02

Executive Summary

The goal of this senior design project is to design an autonomous unmanned aerial vehicle quadcopter to monitor plant and crop health. The health analysis of flora will be implemented using the open-source PlantCV Python package. This analysis will be conducted via a camera sensor rigged onto the UAV to capture images of flora. Captured images will be processed using the ML algorithm by an onboard computer. Data packets containing results of post-processed images are then transmitted via onboard LoRa wireless antenna to a ground station system monitor (PC) through a LoRa wireless antenna receiver.

Implementation of autonomous navigation will be conducted using a Ground Control Station (GCS) application to define a mission flight path to be uploaded to the drone's flight controller. The autopilot flight controller, executed with PX4 Autopilot software, will then follow predesignated waypoints and stop at specific points to capture images of flora.

Design approaches of the UAV quadcopter are to be determined. Approaches we have considered range from purchasing a pre-built drone, constructing custom-built drone, or purchasing an open-source drone kit.

Contents

Week 5

This week was our first meeting with Professor Chomko. We discussed incorporating more techniques from electrical engineering courses as well sub-routines such as a “return to base” function, using a motion capture camera sensor instead of an image capture sensor, and a function to force manual control of the UAV quadcopter. The System Block Diagram (SBD) was updated to reflect a more thoroughly designed system as seen in Figure 1.

We distributed the implementation of each software component amongst the team. Ying is analyzing You Only Look Once (YOLO), Adam is investigating PlantCV, and I (Angel) am handling the ESP32 LoRa communication. Progress includes:

- Soldering the male header pins to both modules.
- Assembling the Heltec ESP32 LoRa board framework.
- Flashed factory test sketch to verify boards function properly.

Appendix

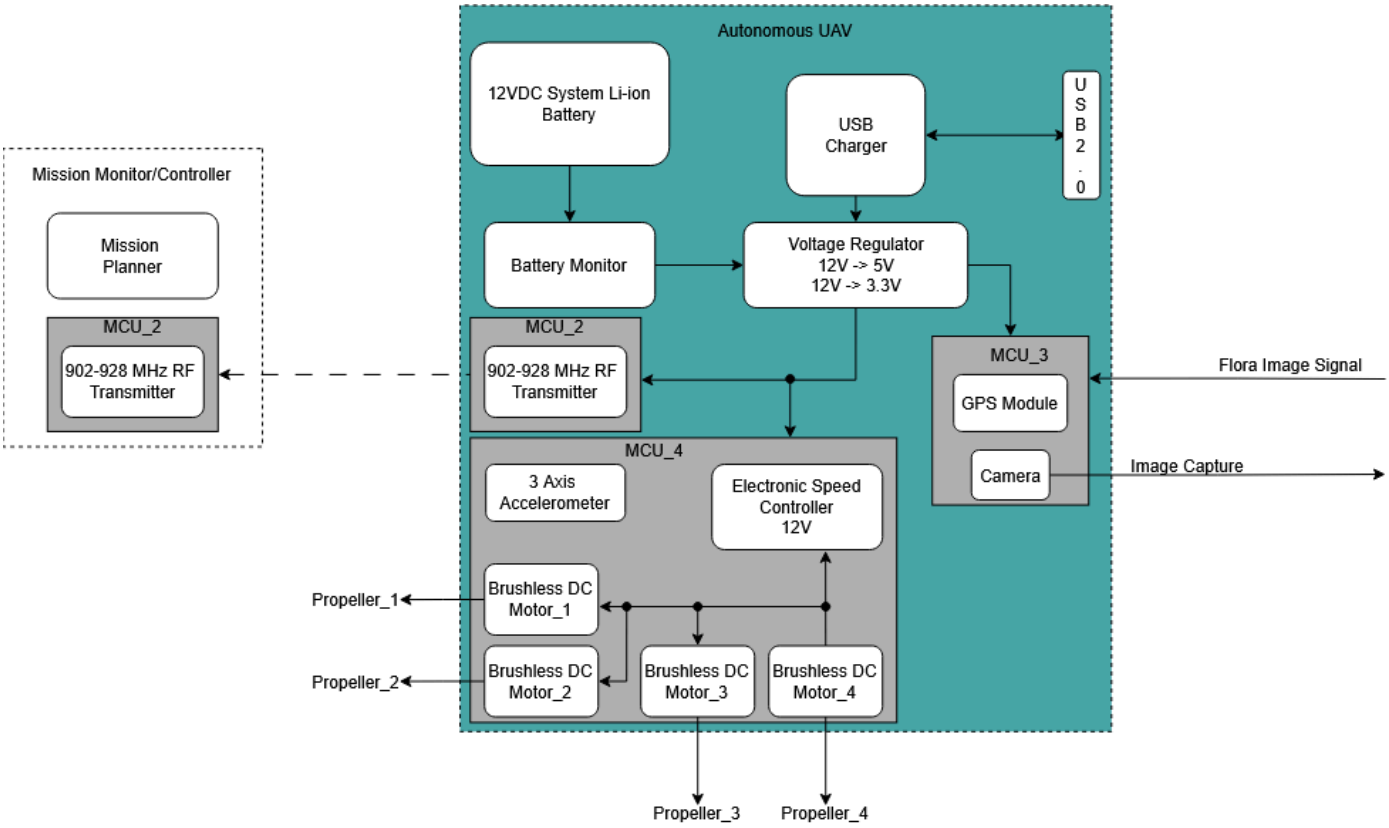

Figure 1: Second version of system block diagram.