Tech Symposium Poster (Final) - Deadline: 11/10/2022

EE/CpE 4812 – ECE Capstone Design I

Fall 2022

Instructor: Johnathan Votion Ph.D.

Team name: D2R

Team members: Ehab Afsoonko, Conrad Obeng, Lexi McMinn, Mark James Jr., Matthew Moubray

Description: Final Draft of the D2R's Tech Symposium Poster

Alternative Transportation Modes for UAV Systems

Sponsor: USL Lab, UTSA

Ehab Afsoonko, Conrad Obeng, Lexi McMinn, Mark James Jr., Matthew Moubray

ECE Electrical & Computer Engineering

UTSA Engineering Unmanned Systems Lab

Abstract

This project aims to expand the number of vehicle transportation modalities traditionally associated with QuadCopter Drones, so that customers are not pigeon-holed into one method of transportation. Specifically, the project aims to bring VTOL Fixed-Wing and Rover transportation modes to a drone, allowing for longer flight times with less battery, and ground-based transportation, respectively.

Need for Product

If an end-user only has a single UAV/UGV/unmanned system, that machine is limited to a single transportation modality. However, having separate re-attachable modules for different movement options allows the operator to change the functionality of the unmanned system without needing to purchase an additional system. Currently, most professional Fixed-Wing VTOL UAVs can cost anywhere from $1,000 to $20,000. By creating a Fixed-Wing VTOL and Rover re-attachable module, we enable the ModiFly Drone to be an extremely versatile and adaptable UAV versus it's competitors, while also saving the consumer both time and money.

Design Concept

The goal is to add multiple reattachable-modules to an existing drone framework model with the intent to expand and improve the functionality. The primary module will add rover functionality that allows the drone to be able to land and switch to a ground-based transportation mode. The Rover module should be able to switch modes without needing the operator to be in close proximity, as well as preserve the flight or drive data between mode switches. The current solution is to design a new arm module that replaces the previous feet with a wheel, axle, and transmission assembly without adding too much weight to interfere with the flight capabilities. The second module will be a Fixed-Wing module that will allow for increased flight duration while retaining the Vertical Take-off and Landing capabilities already present on the base drone.

Major Features

- Air and ground transportation modes without operator's physical interaction
- Fixed-wing VTOL Module
- Foldable wing design for Rover mode
- Flight/drive data consistency between mode changes

Picture References

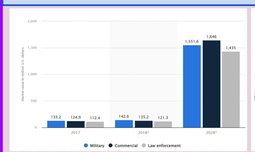

Fig. 1 Size of the global fixed-wing hybrid vertical take-off and landing (VTOL) UAVs market from 2017 to 2026, by end-user

Fig. 2 Image of the ModiFly Drone platform

Fig. 3 (top) Flytech Birdie VTOL Module
Fig. 4 (bottom) SYMA X9 Fly Car

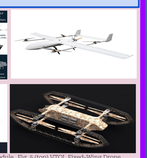

Fig. 5 (top) VTOL Fixed-Wing Drone
Fig. 6 (bottom) HUVER Hybrid Drone

Functional Block Diagram

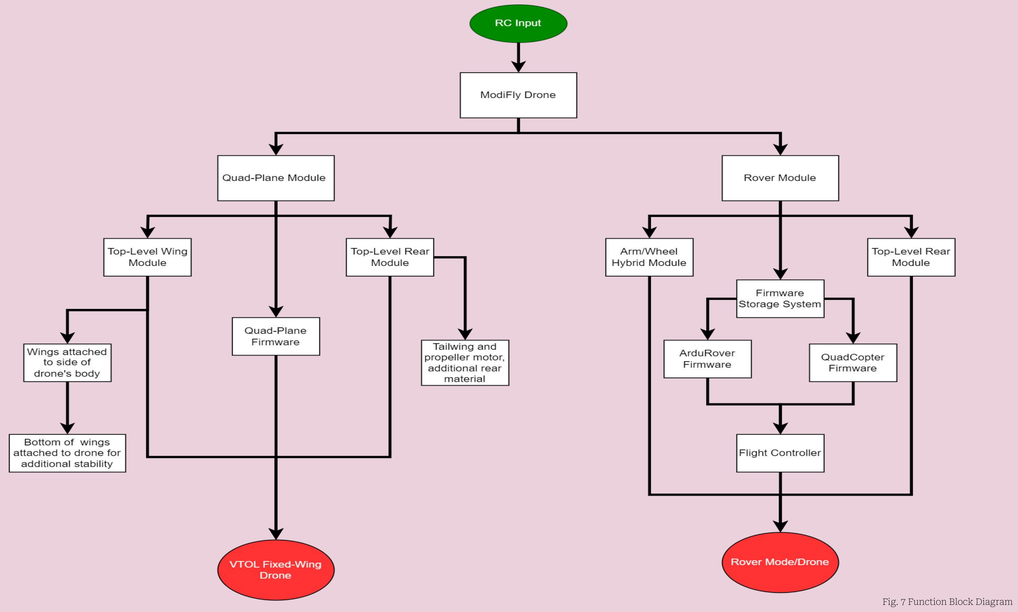

Fig. 7 Function Block Diagram

Software Flowchart

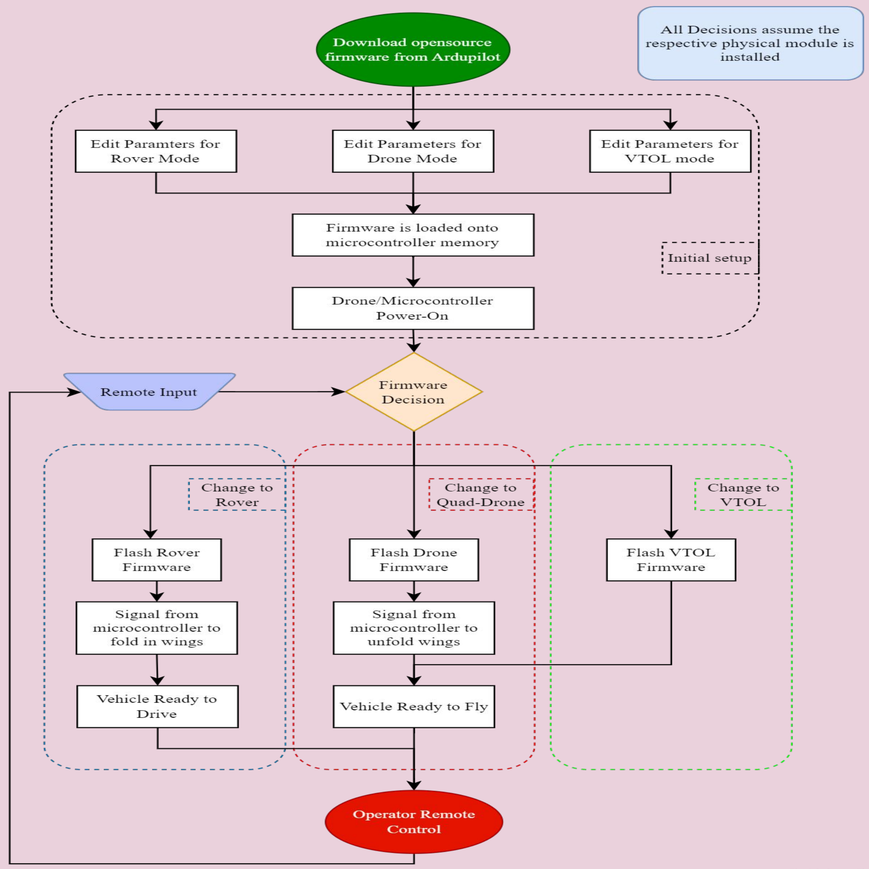

Fig. 8 Software Flowchart

Components

- Flywoo Goku F745 Flight Controller
- ModiFly Drone Platform
- VTOL Fixed-Wing Module (Connector, wings, propeller, etc)
- Rover Module (Connector, wheels, etc)

Work Breakdown Structure

1. Month 1 - November:
   1.1. Download and familiarize with flight controller firmware
   1.2. Begin first design of Rover mode modules
2. Month 2 - December/January
   2.1. Prototype of Rover module
   2.2. First firmware modification test
   2.3. Implement Firmware swapping
3. Month 3 - February
   3.1. Begin prototyping Fixed-wing VTOL & firmware
   3.2. Continued development of Rover module
4. Month 4 - March
   4.1. Rover Module in final state, firmware close
   4.2. Fixed-Wing VTOL development continued
5. Month 5 - April to End
   5.1. Rover Module with switching capability implemented and fully document
   5.2. Fixed-wing VTOL module and firmware fully implemented

Fig. 9 Gantt Chart

Acknowledgments

The Drone To Rover(D2R) team would like to give a special thanks to Dr. Yongcan Cao, ECE, USL Lab, UTSA, and Josh Barron for the technical and financial support of our project. We would also like to recognize the UTSA Makerspace, Student Success Center, and the UTSA ECE department faculty and staff for providing the resources, instruction and support related to this project.

Terminating Sheet

Role	First and Last Name	Contribution (%)
Engineering Manager	Conrad Obeng	20%
Secretary	Ehab Afsoonko	20%
Systems/Software Engineer	Lexi McMinn	20%
Financial Officer	Mark James Jr	20%
Hardware Engineer	Matthew Moubray	20%

Date: 10 November 2022

Assignment: Tech Symposium Poster (Final)