Quadcopter Drone Presentation

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Abstract

- Drones are fun to build and control.
- However, the CC3D board does not currently support the “bells & whistles” other drone controllers have
- The project this group will work on is modifying a drone controller to support a more advanced feature set.
- The project contains multiple components
  - The PCB
  - Firmware Program
  - (Optional) Mobile App
- Alex Cutsinger from L3Harris is collaborating with the ELEG and CSCE teams as the sponsor/champion for the project.

Objective

- The objective of this project is to create a quadcopter flight controller with similar or better functionality to commercially available flight controllers
  - Must work with the DYS XCITE 320 quadcopter but should be compatible with almost any quadcopter design
  - Accept PWM RC control signals and output servo control signals to control the quadcopter
  - Must be stabilized to maintain a hover as well as supporting LED indicators
- Stretch goals such as:
  - The ability to accept PPM and S-Bus control signals
  - GPS module and app interaction

Requirements and Design Goals

- For this project, the only requirements are:
  - The flight controller must be mounted to the DYS XCITE 320 chassis
  - The flight controller must communicate with a standard universal radio controller
- Base Design Goals:
  - Decode RC PWM signals to control the quadcopter in flight
  - Output 4 motor control signals to the respective electronic speed controllers (ESCs)
  - Implement an altitude hover feature with an on-board barometer
  - Battery detection to let end user known if the battery is too drained to fly or is in danger of crashing
  - Support commercially available drone attachments like LEDs and sound indicators for customizability
- Stretch Goals:
  - Accept a variety of other RC control signals, like S.Bus and PPM
  - Ability to gather information from the GPS peripheral about current location and altitude
  - Utilizing a WIFI interface to allow control and configuration via a mobile application

Risks and Tasks

- Board failure
  - Power loss / partial power loss – motors shut off
  - Power monitor failure – battery monitor, speaker
- Misuse
  - Warn user about safe use, regulations
- Safety
  - Low flying air traffic / utility lines
- Environmental
  - Battery disposal

- Understanding
  - Base flight controller model
  - Mobile app (if time allows)
- Design
  - Create schematic
  - Final PCB layout
- Implementation
  - Print PCB
  - Program board
    - PWM RC signals, servo control, etc
- Testing
  - Controller functionality
  - Firmware
  - App (if time allows)
- Documentation
  - Instructions for use, pin layout, FAA regulations

Projected Schedule and Deliverables

SCHEDULE:

- Project planning: start of semester – end of semester
- Design: 10/1/20 - 12/1/20
- Implementation: 10/15/20 - 2/20/21
- Testing: 2/15/21 - 5/1/21
- Documentation: 10/1/20 - 4/30/21
- Programming: 1/30/21 - 4/1/21
- Final flight controller presentation: 4/15/21

DELIVERABLES:

- A system block diagram and specifications
- Schematics
- Website
- Final documentation and PCB
- Finished flight controller and accompanying power board
- Code
- Github repositories
- Trello task list
- Research paper

Key Personnel

- **Zachary Heil -** Heil is a senior Computer Engineering and Electrical Engineering double major. He will be responsible for being the team leader of both the ELEG and the CSCE team for the project.
- **Lily Phu** – Phu is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas. She has completed software engineering and is experienced in many programming languages. She will be responsible for the meeting notes and the software design of the project.
- **Stephanie Phillips -** Phillips is a senior Computer Engineering major at the University of Arkansas. She has completed software engineering, digital design, computer organization, embedded systems and is experienced with C, Verilog, VDHL, and Python. She will be working on the software and hardware design of the project.
- **Spencer Ward** – Ward is an undergraduate senior computer engineer at the University of Arkansas. He has experience with VHDL and Verilog, as well as C and C++. He is currently in training for Dr. Di researching asynchronous design technologies. He will be flexible working on software and/or hardware.
- **Dishoungh White II -** White is a senior Computer Engineering major in the Computer Science and Computer Engineering Department at the University of Arkansas. He has completed Digital Design, Software Engineering, Microprocessor Systems Design, and Embedded Systems. He will be responsible for scheduling meetings for the CSCE team and assisting with the software and hardware design of the project.
- **Andy McCoy** – McCoy is a senior Electrical Engineering major in the Engineering Department at the University of Arkansas. He is responsible for researching information about the project.
- **Joel Parker -** Parker is a senior Electrical Engineering major in the Engineering Department at the University of Arkansas. He is responsible for communicating between the team and the L3 Representative.
- **Christ Somophounout –** Somophounout is a senior Electrical Engineering major in the Engineering Department at the University of Arkansas. He is responsible for documenting information on the project.
- **Alex Cutsinger (Champion):** Cutsinger is a Software and Electrical Engineer for L3 Technologies, who graduated from the University of Arkansas with a Bachelor’s Degree in Electrical Engineering. Cutsinger’s interest are robotics and mathematics.

References

- CC3D Flight Control Board (Users Manual), https://www.geeetech.com/Documents/CC3D%20flight%20control%20board.pdf
- Complete List of Flight Controller Firmware Projects, https://blog.dronetrest.com/flight-controller-firmware/
- CopterControl / CC3D / Atom Hardware Setup, https://opwiki.readthedocs.io/en/latest/user_manual/cc3d/cc3d.html
- KiCad STM32 Hardware Design and JLCPCB Assembly, https://www.youtube.com/watch?v=t5phi3nT8OU&feature=emb_title
- PAM vs PWM vs PPM, https://circuitglobe.com/difference-between-pam-pwm-and-ppm.html
- PPM Definition, https://sourceforge.net/p/arduinorclib/wiki/PPM%20Signal/
- PWM Definition, https://www.analogictips.com/pulse-width-modulation-pwm/
- XCITE 320 Quadcopter, https://hobbyking.com/en_us/dys-320-glass-fiber-folding-quadcopter-with-storage-case-pnf.html