To: Dr. Kamal El-Sankary

CC: Dr. Jason Gu and Dr. Jason Rhinelander

From: Brendon Camm, Dylan Humber, Lucas Doucette

Subject: Design Memo for Programmable Flight Controller

Date: October 25, 2016

1 Background

We have been tasked to design a programmable flight controller for a quad-rotor drone (here-in referred to as the drone) by Dr. Jason Rhinelander of Reiland Systems Limited. Most commercial off the shelf drones currently available do not have the ability to customize the firmware on the device which limits the ability to carry out any type of research. Dr. Rhinelanders research is highly focused on machine learning algorithms and to further his research he requires the drone to have the ability to program or tweak different algorithms on the fly.

2 Objectives

2.1 Short Term Objectives (Oct. 2016 - Dec. 2016)

- Simulations of the controller and flight dynamics
- Construction of the quad-rotor drone
- Initial design of the controller (physical and software)
- Initial testing
- First term report

2.2 Long Term Objectives (Jan. 2017 - Apr. 2017)

- Final design of controller (physical and software)
- Graphical User Interface design
- Final testing
- Final report

3 Specifications

3.1 Design Criteria

- Able to respond to control inputs in a correct and timely manner
- Able to hover steadily
- Able to fly for 15-20 minutes continuously
- Able to land to follow safety protocols

3.2 Constraints

- Must be controlled over Wi-Fi
- Must control the drone provided by Reiland Systems Limited
- Must have a GPS that continually reports the drones position to ensure it is flying within the allowed limits

4 Performance Goals

- Controlled landing upon loss of communication or component failure
- High wind drone stabilization
- Ability to carry the weight of a high definition video camera
- Implement multi axis controller to control altitude, yaw, pitch and roll.
- Utilize a graphical user interface for value manipulation

5 Deliverables

- Raspberry Pi based communication interface software
- Arduino based flight controller program
- Flight control programs
- Detailed documentation for software.

6 Timing and Deadlines

Please find attached Gantt Chart in Appendix A.

7 Safety Features

Given that the drone will be controlled over Wi-Fi, the drone will be unable to fly so far as to be out of sight. Should communications with the drone be lost, it will either retrace it's path or land. Should the drone detect that a motor-fault has occurred in flight it will attempt to land.

8   Intellectual Property

Software, controller, and documentations and any accompanying rights will belong to Reiland Systems. Ownership of any prototype hardware supplied by Reiland systems will be retained by Reiland Systems. The project group will retain ownership of any physical hardware supplied by them in the process of testing.

_____   _____
Brendon Camm   Date
Group Member

_____   _____
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Dr Jason Gu   Date
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Dr Kamal El-Sankary   Date
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