Final Project Proposal

Year: 2022 Semester: Fall Team: 08 Project: Hermes

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Team Members (#1 is Team Leader):

Member 1: Michael Langford Email: mjlangfo@purdue.edu

Member 2: Jonathan Wosiak Email: jwosiak@purdue.edu

Member 3: Santiago J. Garcia Delgado Email: garciads@purdue.edu

Member 4: Owen Mandel Email: omandel@purdue.edu

1.0 Project Description:

Hermes is an autonomous quadcopter drone that will autonomously navigate and search a room to find a visual target, and is intended for remote emergency response/search and rescue operations, via grid search, in a final use case. The drone platform will utilize a custom flight controller for aerodynamic stability and a navigation computer using LIDAR & computer vision for autonomous GNC and obstacle avoidance. The flight controller will ensure aerodynamic stability via IMU sensors, filtering and stabilization algorithms, and communication to the motor controller. It will respond to dictated flight control commands from the navigation computer via a digital communication link, or a remote control based on dictated flight mode.

2.0 Roles and Responsibilities:

Michael Langford has had significant experience in embedded software and hardware design, as well as digital signal processing, having taken ECE362, ECE337, ECE438, and work experience at Raytheon Missiles & Defense. While interning at Raytheon, he led a software team to communicate with missile GNC subsystem. Outside of courses and work, he has independently created a custom flight controller and working drone. Due to experience, he will act as Team Leader, as well as joint Hardware Engineer for the flight controller.

Jonathan Wosiak has had significant experience in software engineering, from being a teaching assistant for Software Engineering tools and Python for Data Science to his software engineering internship. Having taken Computer Vision for Embedded Systems as well as Embedded Systems this semester his skillset lends perfectly to Hermes as Software Engineer.

Santiago J. Garcia Delgado has had previous experience with robotics in high school. He has worked with Banco Popular’s in the AI division in testing different toolboxes. He’s also an experienced programmer in C, C# and Python. All these previous experiences will assist him in his role as Systems engineer.

Owen Mandel has had significant experience in software engineering, including building an enterprise level file sharing service, multiple business grade websites, as well as leading a team to develop an autonomous go-kart. He has extensive experience with a plethora of coding languages, most notable, C++, Python, Java and JavaScript. He has experience taking products from design to prototyping to production and as such will be acting as Systems engineer and Software engineer.

2.1 Homework Assignment Responsibilities

Below are the assigned homework responsibilities (Figure 1).

|  |  |  |  |
| --- | --- | --- | --- |
| *Design Component Homework* | | *Professional Component Homework* | |
| A3-Software Overview | OKM | A9-Legal Analysis | JMW |
| A4-Electrical Overview | MJL | A10-Reliability and Safety Analysis | MJL |
| A6-Mechanical Overview | SJGD | A11-Ethical/Environmental Analysis | OKM |
| A8-Software Formalization | JMW | A12-User Manual | SJGD |

OKM: Owen Mandel MJL: Michael Langford JMW: Jonathan Wosiak SJGD: Santiago J. Garcia Delgado

Figure 1: Assigned Homework Responsibilities

3.0 Estimated Budget

Note, some prices listed are for devices that will be acquired by checking out from the lab, and so will not incur any cost.

|  |  |
| --- | --- |
| Item | Estimated Price |
| Mechanical |  |
| Drone Chassis kit with motors | $250 |
|  |  |
| Electrical |  |
| Flight Controller PCB | $25 |
| Flight Controller microcontroller | $20 |
| Flight controller sensors & components | $50 |
| Radio receiver | $30 |
| Flight computer (NVIDIA Jetson or SBC) | $100 |
| GPS | $25 |
| Camera | $20 |
| Motor Controller | $90 |
| Battery | $50 |
| Radio Transmitter | $150 |
|  |  |
|  |  |
|  |  |
|  |  |
| TOTAL: | $560.00 |

4.0 Project Specific Success Criteria

The success of the project will be determined by the following:

1. An ability to read axis channel values from incoming signal from off the shelf radio receiver (via PPM)
2. An ability to send and receive navigation command and IMU sensor data between an onboard single-board computer and flight controller microcontroller
3. An ability to send signals to a motor controller and control speed of all 4 motors simultaneously (via DSHOT)
4. An ability to communicate with and read sensor data off a gyroscope & accelerometer (via SPI)
5. An ability to measure distance to walls or floor from LIDAR proximity sensor (vis I2C)

5.0 Sources Cited:

No external works were used to write this report.