Barone2 Report Week of 3/23/21

Sprint 5,

Prepared by Dylan Harootunian

**Executive Summary of Progress:**

For this sprint, we hoped to reach all the milestones needed to be ready for the fabrication process at the start of next quarter. Although meeting milestones was successful in some areas such as remote control implementation in the simulation or driving the sensors with interrupts, other milestones such as finalizing all vendors required more time in order to complete especially considering that a handful of parts had not been finalized, so finding a vendor was not possible. This sprint was set arbitrarily to the end of the quarter when realistically we needed through spring break to meet most of these milestones. This sprint also overlapped with finals week where all of our team members had many time commitments outside of this project causing velocities across the board to be lower than anticipated. However, it is worth noting that many of the incomplete milestones are mostly done with a few small roadblocks such as finalizing a remote controller, holding up many milestones from being completed. Another issue was once again time discrepancies between team members, this issue ties back to the end of the sprint being arbitrarily placed at the end of the quarter. In the future team members need to have workloads comparable to the team member with the largest and the sprint length would be set accordingly.

On the mechanical side materials selection was completed for the envelope and 3D printed parts. Time was also spent doing thermal analysis and double checking previously selected parts to assure they still worked with changes. The big incomplete here is in vendor selection which could not be completed due to unfinalized parts, as well as wanting to spend extra time to find the best helium supplier possible. In the simulation remote control was successfully implemented, however implementation of drag force was incomplete due to delays in the RC implementation. In controls, C code was written to assist with the implementation of remote control in the simulation. Although some initial analysis and simulation was done, autonomous terrain tracking was incomplete. Sensors programming did complete interrupt driven protocol for all sensors and collected data to determine accuracy. However driving all the sensors simultaneously was incomplete. The wiring of the PCB was incomplete due to having to constantly update the wiring schematic as changes were made in these final weeks. Power management was successfully able to complete the analysis of passive power draws but could not finalize the power budget due to unfinalized parts such as the remote controller. The story is the same across the team, although much progress was made in many areas, due to choke points like the selection of the remote controller and having to catch up on previously incomplete milestones, many of the end-of-quarter milestones were not met.

**Progress made toward acceptance criteria:**

| Task Deliverable/  Acceptance Criteria | Status | Responsible Party | Anticipated Hours | Details |
| --- | --- | --- | --- | --- |

**Mechanical Design:**

| Finalize Envelope Material using Pugh chart | Complete | Dylan | 4 | Choosing a material to fabricate the envelope from based on the force analysis and pugh chart |
| --- | --- | --- | --- | --- |
| Add extra support 3D printed parts to CAD | Complete | Dylan | 2 | CAD plates to sit inside the envelope to distribute the force of the attached parts more evenly |
| Do analysis to decide on Heat Sink | Complete | Dylan | 2 | Run Thermal Analysis in Solidworks based on heat loss in power budget to decide on if a heat sink is needed. |
| Double check/look for a better ESC and Servo, finalize decision. | Complete | Dylan | 6 | Checking analysis done on ESC and Servos, to assure that they will work for our applications due to some small changes in the design |
| Finalize a Servo Connector piece | Complete | Dylan | 2 | Find a joint to connect the servo to the motor shaft |
| Find Ultrasonic Screws and Add to CAD | Complete | Dylan | 2 | Find screws to attack ultrasonics to the sensor bracket at the front of the envelope |
| Finalize all parts and vendors | Incomplete | Dylan | 8 | Finalize all parts needed in the fabrication process as well as vendors to receive them from. 90% |
| Write up C library to communicate between microcontroller and sensors | Incomplete | Dylan | 4 | Spend time assisting sensors with catching up with the interrupt driven sensors libraries. |

**Drone Simulation:**

| Decide on GUI variables for RC | Complete | Isaac | 4 | In order to have a working open-loop control, open-loop variables are needed as inputs to compute the rotation and movement of servos needed to carry the balloon forward. The four variables we chose were propeller speed, backward/forward, turn, and descend. |
| --- | --- | --- | --- | --- |
| Implement Remote Control in Vrep | Complete | Isaac | 20 | Much of implementing remote control was done in research and understanding the code George provided, in order to convert C code into a working Lua code handled entirely by V-rep, variables and outputs were swapped and modified. |
| Add Drag Force to Vrep | Incomplete | Isaac | 6 | More research is needed to implement drag forces. |
| Import Newest CAD Design | Complete | Isaac | 10 | Worked with Dylan to find a method, in which CAD import would be able to translate into V-rep without breaking the model into several parts. |

**Controls Design:**

| Write alpha angle program in C | Complete | George | 5 | Wrote a program in C code to determine the servo angles in the propulsion system based on RC commands |
| --- | --- | --- | --- | --- |
| Write throttle factor program in C | Complete | George | 2 | Adjusted throttle in the open loop RC control response to prevent unwanted roll moments |
| Apply LQR to develop PD control | Incomplete | George | 5 | Use LQR to find optimal pole placement for the system response. |
| Add integral control to system | Incomplete | George | 5 | Use integral control to improve disturbance rejection |
| Discretize system with Zero Order Hold | Incomplete | George | 5 | Apply zero order hold to the system in order to discretize it for use on the microcontroller |
| Run simulation to test robustness | Incomplete | George | 1 | Test robustness of the system using disk margin and/or other methods |
| Develop Nonlinear system model to act as system response to control commands | Complete | George | 6 | Write a nonlinear model to take the outputs of the control system commands to simulate a realistic system response to the linearized controls. |
| Run simulation of nonlinear responses to linear control commands | Incomplete | George | 7 | Test step responses on the system using the nonlinear model as response and linear model for controls. |
| Run simulation to test path following and terrain tracking | Incomplete | George | 10 | Run a simulation in Matlab to test the ability of the drone to follow the path and maintain constant height with the control system. |

**Sensors:**

| Write library for each sensor to read from them using interrupts | Complete | Leon | 20 | Write code in order to read data from sensors (ultrasonic, IMU, altimeter, GPS) through the use of interrupts |
| --- | --- | --- | --- | --- |
| Write code to use every sensor at the same time | Incomplete | Leon | 5 | After writing code for each sensor, write code in one file to have all sensors working at the same time with no conflicts |
| Perform test run around neighborhood showing sensors working over time logging data and make data presentable | Complete | Leon | 5 | After writing code for each sensor, log data for each sensor over time and make data presentable in order to show accuracy and validity |

**PCB Design:**

| Update documentation with current version | Complete | Ryan | 3 | Microcontroller and microprocessor pinouts and sensor pinouts are documented in the engineering notebook. |
| --- | --- | --- | --- | --- |
| Wire up balloon pressure sensor and add it to the BOM | Complete | Ryan | 1 | Wire up a pressure sensor with the microcontroller. Verify the connections using the pressure sensor datasheets. |
| Update all parts in BOM with weight allocation | Incomplete | Ryan | 2 | RC transmitter and receiver is still being decided at the moment. |
| Hand wire the board with a 5V plane, GND plane and wire up all ICs solder points. Reduce signal noise by separating data lines from voltage rails as much as possible | Incomplete | Ryan | 10 | Due to the RC receiver being not finalized. The PCB board cannot be complete until pinouts for receiver inputs are finalized as well as transmitter for data collection. |
| Verify PIC32 microcontroller oscillator if it needs an external oscillator | Complete | Ryan | 1 | Look through the PIC32 datasheet to verify if the PIC32 microcontroller needs an external oscillator to generate clock cycles. |
| Write up C library to communicate between microcontroller and sensors | Complete | Ryan | 12 | Write C code for communication between sensors and microcontroller. |

**Power Management:**

| Finalize Power Budget | Incompete | Jeremy | 5 | Finalize the power required for the controlling components, sensors, and actuators used in the power budget |
| --- | --- | --- | --- | --- |
| Get PCB power simulations working | Complete | Jeremy | 12 | Simulate the passive component power draw that the sensors and other components will use to communicate in protocols such as I2C and SPI |
| Write up C library to communicate between microcontroller and sensors | Complete | Jeremy | 6 | Help the systems programming team member write code to make sure all the sensors work with MPLabX IDE and the microcontroller used |

**Calculate sprint velocities:**

| Team Member | Estimated hours of all tasks | Estimated hours of completed tasks | Sprint Velocity | Reasoning for members <1 |
| --- | --- | --- | --- | --- |
| Dylan | 30 | 18 | 0.6 | Although Vendors for Helium were found, More time was deemed needed to check for other possible sources possibly though an on campus lab. A vendor could not be found as an RC controller as it has not been finalized yet. This task was a large amount of hours and it being incomplete is the reason for the low sprint velocity. Since more time was being spent searching for vendors time was not spent helping to write sensors code. |
| Isaac | 40 | 34 | 0.85 | Remote Control implementation was needed to fully complete the drag force. So any delay in completing RC was transferred to major forces implementation. |
| George | 46 | 13 | 0.28 | I encountered a software error in MATLAB that prevented me from implementing pole placement. Even though work for all other incomplete tasks has been done and were near completion, they needed final pole placement to be considered complete. Currently, I am deconstructing the pole placement myself and writing scripts to handle the size of the system, but that is taking a lot of time to write that I did not originally plan for. |
| Leon | 30 | 25 | 0.83 | All sensors were set up to be read from with interrupts and had their data logged over time, but inaccuracies in the data have shown that there are some bugs and errors in the code that must be fixed first before having all sensors working at the same time. |
| Ryan | 29 | 14 | 0.56 | PCB Schematic is being updated by RC controls. Exact number of channels needed to connect to the receiver to be determined. |
| Jeremy | 23 | 18 | .783 | Power budget was not finalized due to the receiver and transmitter still being decided and due to the uncertainty of the drone motor power |
| Total | 198 | 122 | 0.62 | The team overall had a low velocity of this sprint. This was due to two main factors. One the overlap of this sprint with finals week where all the teammates had large time outside of this project. Secondly the delay in a decision on the remote controller caused many tasks with large hours values to be mostly complete, but none of the hours counting. |

**Product Owner, Teaching Team, Client Feedback:**

| Functionality Demonstrated | Feedback | Team Response |
| --- | --- | --- |
| A Force Analysis was done on the largest forces applied to the envelope. Using these force values a material was selected to fabricate the envelope with | The force analysis was done using equations from a reputable textbook. However these equations need to be double checked by the team.and verified that the fabric will be held taught | A lot of time was spent on this force analysis and the equations were checked by a teammate as verification. But the toughness of the envelope is a question that needs to be answered. A light wire frame could possibly be added in order to assure the envelope holds its shape. |
| 3D printed parts were designed in CAD to fit the curve of the envelope to spread the force applied from the attached parts over a larger area. | These parts should evenly distribute the force applied to the envelope. This will especially help with the Gondola as the force is now being spread over 48in2 which will greatly reduce psi being applied. | These parts should be easy enough to adjust if that becomes necessary. Another analysis should be done to assure these pieces will not crack from forces. |
| A thermal analysis was done in solidworks using the heat loss from the voltage resistors in the power budget. | A good start however the voltage regulators may need to be rethought entirely which would mean this has to be redone. Also be sure the factor in the Thermal conductivity of the material that the voltage regulators are made out of. | This analysis was a good learning experience for using the thermal analysis tool in solidworks. This analysis will need to be redone as the voltage regulators will be changed. |
| The force analysis on the moment applied to the motor from the servo was double checked and found that the servo should be good. A New ESC was chosen, even though it was found the older ESC may have worked, the new one has a more in depth data sheet which will allow us to more confidently interface with it using the correct protocol. | The work on the Servo was fine as before. Although the new esc will work. It is questionable whether choosing a new and heavier ESC only based on having a better data sheet is a good enough engineering rationale to make a change. | The analysis on the torque applied from the servo has been checked multiple times. The only concern would be that the data sheet is somehow inaccurate to the point where the angular acceleration would be far greater than anticipated. |
| A servo Coupler was chosen to connect the Dshaft to the servo | Although the coupler should fit both the servo and the Dshaft, more force analysis should be done in order to prove that it will be able to withstand the force being applied from the motor. | More analysis needs to be done on this coupler. Although it is made of stainless steel and can take the force, the question of will the force applied to the servo be too much still needs to answered |
| Ultrasonic screws where found and added to the CAD | The screws will fit and should work fine. | These screws are the standard screws used for ultrasonic sensors. |
| Many of the Retailers have been finalized in the BoM. With the expectation of helium and unfinalized parts. | All the parts that have retailers tend to be ordered from the same websites as much as possible. This is good as it will save on shipping costs. It should be well worth it to take extra time to find helium. As this could save a lot of money and it is not needed right away. | Emails have been sent to the biochem department and they connected me to someone who should be able to give me more information about access to helium through the school. |
| GUI controls were added to control Throttle, motor angle, Turning and decent where added. | These controls seem like a good simplified version of controls to work on RC implementation and matches in parody with the previous matlab code done for remote control. | Controls are a product of the code, so as individual inputs to each function, these variables only serve as well as the functions intend them to. Working out the variables requires a good understanding of what the RC implementation does. |
| Remote Control implementation added to Vrep simulation. | The RC implementation looks like a good start. Adding simple closed loop control to the RC could be beneficial to help reduce some of the natural wobbling seen in the simulation. | Remote control will hopefully be improved by closed loop control, which will further depend on the progress of autonomous design. Testing and simulation will be important tasks that determine the success of both cases. |
| Newest CAD design added to Simulation. | It is imported and looks good in the SIM. I think the decision to only import the more finalized version is good as it saved a lot of time from not having to import the CAD design with every small update. | Mechanical design is finishing its last designs, so another import will be the final step of finishing this task. |
| C code was written in order to implement alpha angles in the simulation | The code works well and was successfully implemented into the simulation. | The system response was tested in Python for quick and simplified simulation before being passed to the VREP Environment simulation |
| C code was written in order to implement throttle factor in the simulation | This C code was proven to work when a modified version was implemented into the Vrep environment. | The system response was tested in Python for quick and simplified simulation before being passed to the VREP Environment simulation |
| Nonlinear Model for System response created | The math and programing behind the analysis done here needs to be peer reviewed by the team, to help the team better understand the controls side of the project. | The nonlinear model behaves as expected when given known values and outputs. Ready to be used to test control response |
| Protocols with interrupts were written to interface with each necessary sensor and get back readings | The coding done uses correct protocols to interface with the various sensors. Taking time to double check timer baud rates and interrupt priorities would be worth the time in order to make the system code run as fast as possible. | Research will be done into how often data about the drone will be needed, and will determine the sampling rate of the sensors |
| Data was collected from sensors to validate sensor accuracy | Although these tests show that the sensors are collecting accurate data, I think more research into what is causing the errors seen in the data, as well as data collection across a greater range of values would be valuable to the project. | The code that interfaces with the sensors needs to be debugged until sensor accuracy aligns more closely with what the datasheet promises |
| Wiring schematic of pressure sensor was completed in eagle | The wiring schematic is done correctly and employs correct logic, and there should not be any critical errors. Time should be taken to ensure good engineering technical documentation such as right to left inputs/outputs. | The pressure sensor for helium leakage is added to the schematic. However, the PCB wiring is not complete yet. The MPR pressure sensor connects via I2C bus to PIC32. |
| Verified PIC32 microcontroller oscillator using family reference manuals | Analysis was able to show that the microcontroller should be able to have external clocks to help time our systems, as well as supporting all protocols necessary for our project. The microcontroller will suffice. | Two external oscillators are added to the PIC32 microcontroller. CB3LV oscillator provides primary 8MHz clock rate to OSC1 and OSC2, which powers the I2C and SPI clocks. The ASEK oscillator provides the secondary 32.768kHz clock rate to the PIC32 via SOSC1 and SOSC2 pin. |
| Passive component power draw was calculated by hand and added to the power budget | The values added to the power budget look correct. However the math behind these numbers should be more easily accessible to the team so that they can be verified by other team members. | The values gained will be gone over by the rest of the team before moving on to the next task to ensure they were done correctly |

**Possible Sprint Improvements:**

* **Team Improvements**:
  + Many incompletes due to final week and final presentation
    - Sprint was too short, sprints need to be longer
    - Sprints need to be based on milestones
      * Milestones that are farther off could be used to delegate other work
  + Need to implement a peer review system for checking each other’s work
    - Sub-team group meetings should be used to check each other’s work
      * These should also rotate once at a time
      * Possible to have a day of peer-evals
  + Slides need to be done earlier, not a day before presentation
  + Still underestimating time needed for research tasks
  + Overall, quality of work has been increasing
* **Individual Improvement**:
  + Dylan-
    - Underestimates research tasks still
    - Needs to have an order to do tasks in instead of doing them at any time
  + George-
    - Needs to get better at estimating tasks time needed
  + Isaac-
    - Needs to talk more during group work and sharing his criticisms
    - Needs to have better time management with tasks
  + Jeremy-
    - Peer evaluation on power management
  + Ryan-
    - Do more research on tasks before doing them
    - Needs more peer checking on his work
    - Estimate task time with better time management
  + Leon-
    - Manage time better, allocate more time to tasks
    - Present more work to the team in understandable terms

**Spring Break Goals:**

* Dylan (20 hours)
  + Finalize helium vendor, and vendors for newly finalized parts (6 hours)
  + Check in with Mircea about the lab space (1 hour)
  + Order all needed parts for fabrication on the BoM(5 hours)
  + Prepare Sprint 5 Documentation (3 hours)
  + Team meetings (5 hours)
* George (48 hours)
  + Get the PID control working in simulation for path following and terrain tracking in MATLAB. This includes all incomplete tasks from this sprint.
    - Apply LQR to PD Control - 20 hours
    - Apply integral control - 5 hours
    - Discretize Controller - 5 hours
    - Run Simulation to test robustness - 3 hours
    - Test response of the controller using the nonlinear response model -5 hours
    - Simulate terrain tracking and path following - 5 hours
  + Apply for Porter Student Project Fund - 5 hours
* Isaac (32 hours)
  + Get drag force working in simulation (30 hours)
    - Add necessary GUI variables for wind speed - 1 hour
    - Implement function to deal with inputs - 8 hours
    - Research how drag force works in a 3-dimensional axis - 10 hours
    - Add that force to Vrep - 5 hours
    - Testing the new feature - 3 hours
  + Meeting hours(5 hours)
* Jeremy (16 hours)
  + Check motor power usage with Dylan’s equation (4 hours)
  + Confirm switching voltage regulator with Ryan (2 hours)
  + Guide someone through everything on the power budget to check for mistakes (2 hours)
  + Meeting hours (5 hours)
  + Subteam meetings (3 hours)
* Ryan (25 hours)
  + Add switching voltage regulator to schematic (2 hours)
  + Connect all power rails in PCB board diagram (6 hours)
  + Connect all data bus in PCB board diagram (6 hours)
  + Send PCB design to OSH Park for fabrication, verify DRC (3 hours)
  + Meeting hours (5 hours)
  + Subteam meetings (3 hours)
* Leon (28 hours)
  + Finish setting up all sensors working at the same time (5 hours)
  + Implement servo and motor control in software (15 hours)
  + Meeting hours (5 hours)
  + Subteam meetings (3 hours)

**Meeting Minutes for Sprint 5 Week:**

Sprint 5 Start

Long Flight Time Buoyant Drone March 9, 2021 7:30 PM(PST)

horizontal lineATTENDEES

* Excused absences: N/A
* Unexcused absences: N/A
* Late: N/A

## AGENDA

* Administrative Stuff 7:30
  + Reviewed Gantt Chart to insure that we are on track
  + Decide Scrum master, Dylan
* Define Goals (General, see where we need dependencies etc) 7:54
  + Dylan - 7:56
    - Finalize All Parts 3/14
  + Isaac - 7:56
    - Implement drag force and RC 3/19
  + Leon - 7:57
    - Be able to read from every sensor at once 3/19
  + George - 7:59
    - Write C libraries for use in simulation
    - Path Following and Terrain Tracking in Matlab Simulation.
      * Include calculations for power usage to confirm power budget values.
      * Use the linear MIMO state space discrete time-Zero Order Hold model for control, but use a nonlinear model for physical responses to commands to check for stability and controllability.
      * Only the ideal sensor model is tested, but disk margin should be tested as well in preparation on stochastic sensor error testing over break.
  + Ryan - 8:00
    - Finalize wiring schematic
    - Finalize PCB board
    - Finalize PCB electronics in BOM
    - Write sensor libraries
  + Jeremy - 8:01
    - Finalize Power Budget
* Define End Date 8:02
  + Sprint end: 3/19/21
* Tasks (Specific) List Requirement ID if available. Time estimate 8:03
  + Leon (30 hours) - 8:13
    - Write library for each sensor to read from them using interrupts (20 hours)
    - Write code to use every sensor at the same time (5 hours)
    - Perform test run around neighborhood showing sensors working over time logging data and make data presentable (5 hours)
  + Jeremy(23 hours) -
    - Finalize Power Budget(5 hours)
    - Write up C library to communicate between microcontroller and sensors (12 hours)
    - Get Wiring Diagram Simulation Spice Eagle CAD to work(6 hours)
  + Isaac (40 hrs) - 8:15
    - Decide on GUI variables for RC (4 hours)
    - Add in code to RC variables (20 hours)
    - Add in drag force depending on movement speed (6 hours)
    - Import better design (10 hours)
  + Dylan (30 hours) - 8:16
    - Finalize Envelope Material using Pugh chart (4 hours)
      * Email about how best to sew parts together (material/method)
    - Add extra support 3D printed parts to CAD (2 hours)
    - Find Heat sink and added to CAD (2 hours)
    - Double check/look for better parts that team is unsure of
      * ESC (3 hours)
      * Servos (3 hours)
    - Find Servo Connector piece (2 hours)
    - Find little screws for ultrasonic sensors and add to CAD (2 hours)
    - Make sure all parts are finalized with vendors by the 14th (8 hours)
    - Sensors Library coding (4 hours)
  + George (46 hours) - 8:19
    - Write alpha angle program in C (5 hours)
    - Write throttle factor program in C (2 hours)
    - Apply LQR to develop PD control (5 hours)
    - Add integral control to system (5 hours)
    - Discretize system with Zero Order Hold (5 hours)
    - Run simulation to test robustness (1 hour)
    - Develop Nonlinear system model to act as system response to control commands (6 hours)
    - Run simulation of nonlinear responses to linear control commands (7 hours)
    - Run simulation to test path following and terrain tracking (10 hours)
  + Ryan (29 hours) - 8:20
    - Update documentation with current version (3 hours)
    - Wire up balloon pressure sensor and add it to the BOM (1 hour)
    - Update all parts in BOM with weight allocation (based on breakout boards) (2 hours)
    - Hand wire the board with a 5V plane, GND plane and wire up all ICs solder points. Reduce signal noise by separating data lines from voltage rails as much as possible (10 hours)
    - Verify PIC32 microcontroller oscillator if it needs an external oscillator (1 hour)
    - Write up C library to communicate between microcontroller and sensors (12 hours)

Meeting End: 8:25PM

**3/10/21 7:30 - 8:30p**

* Leon: Working on initializing interrupts with Microcontroller

7:31

* Jeremy: Resubmitted power budget to get feedback from Tela

7:32

* Isaac: Working on importing new CAD model

7:33

* Dylan: Working with Isaac on the CAD model
  + Fixed weight allocation

7:34

* George: Wrote file for alpha angle and thrust factors for RC control
  + Working on script to update new matrices when numbers change

7:35

* Ryan: Helping Leon with code and updating documentation

7:40

* Gordon got back to us in an email, wants a doodle set up to organize a meeting
* Jonathan also responded, wants to meet next week

7:45

* Finished Final Report Outline and submitted for review

**3/11/21 7:30 - 8:30p**

* Leon: Got Ultrasonic Sensor working with Microcontroller
  + WIll use PIC32 library to get I2C to work

7:35

* Jeremy: Battery and Charger have been redone with 1 battery
  + Added new pressure sensor to power budget
  + Working on total flight time with all included parts

7:39

* Isaac: Rewrote C code in LUA for simulation
  + Working on getting remote API working

7:43

* Dylan: Working on envelope suppliers and getting tensile strength
  + Also added screws to ultrasonics in CAD

7:47

* George: Working on PD control

7:48

* Ryan: Added pins for connection to receiver from raspberry pi
  + Needs to decide on remote controller

7:50

* General:
  + Need to decide on all parts by the end of the sprint
  + Fill out doodle poll to set up a meeting with Gordon

8:00

* Everybody has been given parts of the introduction on the final report to finish

**3/12/21 6:30 - 7:30p**

* Meeting after Alexey meeting

6:39

* Leon: Debugging ultrasonic sensor code
  + Has several sources to help debug, as well as Jeremy and Ryan to help
  + Also looked at remote controllers

6:50

* Jeremy: Power Budget submitted again, will try to get more feedback
  + Will help leon and work on simulation over the weekend

6:53

* Isaac: Finding angle with max propeller forces and finding propeller force equation in simulation

6:55

* Dylan: Looking at heat sinks
  + Picked a new ESC that does not rely on flight controller and has a manual

6:56

* George: Worked on Matlab script, should be good to go after testing
  + Working on root locus and PD control
  + Did research on remote controllers as well, found a few decent options
    - Programmable and has telemetry

6:58

* Ryan: Changed PCB board layout size to 4x4’
  + Tomorrow we should meet to decide remote controller
    - Needs to receive camera, battery, and crash detection
  + Need a rough idea for the controller by Sunday

7:04

* Everyone needs to find sources to their respective parts of the Final report
* Submitting slides for feedback

**3/13/21 7:30 - 7:45p**

* Leon: Ultrasonic interrupts fixed, good to go
  + Working on I2C now

7:33

* Jeremy: Eagle CAD simulation might not work
  + May have to get hand calculations of circuit power

7:35

* Isaac: Propeller force needs to be scaled down to something Vrep can handle

7:36

* Dylan: Tensile strength of nylon figured out for supplier

7:38

* George: PD control still being worked on
  + DGI matrix analysis will have to be set up
  + Added suggestions to outline

7:40

* Ryan: Working on new RAM slot for raspberry pi
  + Schematic behind schedule due to fixes
  + WIll be working on board

**3/14/21 7:30 - 8:30p**

* Leon: Figured out I2C protocol and being able to connect the sensor
  + Needs to get data from sensors still

7:32

* Jeremy: Needs to update Gantt chart because power simulation is not realistic
  + Will have to do everything by hand

7:34

* Isaac: Translating equation into Simulation

7:35

* Dylan: Finalizing materials is due today
  + Lighter material for envelope will be used for 3d printing
  + Heat sink is the last thing to finalize

7:37

* George: Made some progress on the hole placement

7:38

* Ryan: Board wiring diagram had to be changed
  + More regulators added to reduce noise

ETC:

* Email Gordon to set up a meeting before the design review
* Submit slides after the meeting tomorrow, everyone finish their slides
* Final Paper is due Wednesday, everyone complete their assigned sections

**3/15/21 7:30 - 8:30p**

* Leon: Realized sensors had dedicated interrupt pin on them, change notify pins may be a possible alternative to read sensors

7:33

* Jeremy: Added more components to power budget, oscillators and ESC power fixed

7:34

* Isaac: Graphs matlab working with degrees per second of servos
  + Propeller forces scale correctly in Vrep

7:35

* Dylan: Ran solidworks heat simulation, steady state heat is within operating range of components, no heat sink would be required
  + Needs to run simulation again with envelope on top

7:36

* George: DJI Matrix and alternatives written in final report
  + Ready to implement PD control

7:37

* Ryan: Added new crystal oscillators and more voltage regulators
  + Added pins for servos to be powered
  + Board design still in progress

7:41

* Meeting with Jonathan on Wednesday
* Meeting with Gordon on Thursday

7:43

* Working on updating Gantt Chart
  + CAD Design 95% complete

7:49

* Get remote control working and implement drag is next goal for simulation grp

7:55

* Interrupt Driven Sensors 35% done

8:00

* Power of PCB passive components should be done by hand now

8:04

* Went over Slides before submission
  + Slide titles need to be more goal oriented

**3/16/21 7:30 - 8:30p**

* Dylan: Running new solidworks simulation with envelope on drone
* Everyone else is busy with finals

7:36

* Worked on revising the final report introduction

**3/18/21 7:30 - 12:00am**

* Leon: Got all sensors working individually, next needs to get all at same time working
  + Should be done next week

7:33

* Jeremy: Selected New battery, changed power budget to not be worst case for most parts
  + Needs to work on motor power and battery voltage differing over time

7:34

* Isaac: Importing the new model and adding RC to it
  + Debugging RC, trying to find any problems

7:35

* Dylan: Materials chosen for envelope is as light as it needs to be

7:36

* George: PID controller will be done tonight hopefully, will not be tuned until later

7:38

* Ryan: Some changes to the PCB needs to be made to fit power budget changes

7:45pm -12am

* Went over each others slides in a practice design review

Sprint 5 Conclusion Meeting

Long Flight Time Buoyant Drone 3/22/2021 7:30 - TIME(PST)

horizontal lineATTENDEES

* Excused absences:
* Unexcused absences:

## AGENDA

* **Review of progress:**
  + Dylan-7:30
    - Finalized Envelope Material, force analysis with Pugh Chart
    - Added Extra 3D printed parts to CAD for support
    - Didn’t need a heat sink added
    - Changed ESC and doubled check Servos
    - Found Screws for Ultrasonics
    - Finalized all vendors except Helium, 90% complete
    - Remote Controller not finalized
  + George-7:39
    - Wrote alpha angle programming in C
    - Throttle Factor programming is complete in C as well
    - PD control complete
    - integral control to system Not finished, 50% complete
    - Discrete system with zero order hold, 80% complete
    - Needs to run simulation to test robustness, path following/terrain tracking, and non-linear responses
    - Developed nonlinear system model to act as system response to control commands
  + Isaac 7:43
    - Gui variables for RC and code for it complete
    - Open loop RC implementation is complete
    - Drag force dependencies on speed is incomplete
    - Most updated CAD is imported
  + Jeremy 7:44
    - Finalize Power Budget incomplete, need to check motor and voltage regulators, 90% done
    - Helped Leon Write up C library to communicate between microcontroller and sensors
    - Did passive component power by hand instead of simulating
  + Ryan 7:48
    - Updated documentation with current version, 80% complete
    - Wired up balloon pressure sensor and add to BoM
    - Updated all parts in Bom in weight allocation, incomplete, 90% done
    - 0% complete, hand wire board with ground plane, wire all ICs
    - Verify Pic32 external oscillator complete
    - Helped Leon Wire up C library with microcontroller sensors
  + Leon 7:51
    - Write library for each sensor to read from them using interrupts complete
    - Write code to use every sensor at the same time, 25% done
    - Perform test run around neighborhood showing sensors working over time logging data and make data presentable complete
* **Team Improvements**- 7:52
  + Many incompletes due to final week and final presentation
    - Sprint was too short, sprints need to be longer
    - Sprints need to be based on milestones
      * Milestones that are farther off could be used to delegate other work
  + Need to implement a peer review system for checking each other’s work
    - Sub-team group meetings should be used to check each other’s work
      * These should also rotate once at a time
      * Possible to have a day of peer-evals
  + Slides need to be done earlier, not a day before presentation
  + Still underestimating time needed for research tasks
  + Overall, quality of work has been increasing
* **Individual Improvement**-: 8:07
  + Dylan- 8:07
    - Underestimates research tasks still
    - Needs to have an order to do tasks in instead of doing them at any time
  + George- 8:08
    - Needs to get better at estimating tasks time needed
  + Isaac- 8:09
    - Needs to talk more during group work and sharing his criticisms
    - Needs to have better time management with tasks
  + Jeremy- 8:10
    - Peer evaluation on power management
  + Ryan- 8:11
    - Do more research on tasks before doing them
    - Needs more peer checking on his work
    - Estimate task time with better time management
  + Leon- 8:12
    - Manage time better, allocate more time to tasks
    - Present more work to the team in understandable terms
* **Next Goals**-: 8:13(Goals over spring break)
  + Dylan- 8:14
    - Finalize helium vendor
    - Check in with Mircea about the lab space
    - Order all needed parts for fabrication on the BoM, envelope and lift bag already done
  + George- 8:15
    - Get the PID control working in simulation
  + Isaac- 8:16
    - Get drag force working in simulation
  + Jeremy- 8:17
    - Check motor power usage with dylan’s equation
    - Confirm switching voltage regulator with Ryan
    - Guide someone through everything on the power budget to check for mistakes
  + Ryan- 8:18
    - Add switching voltage regulator to schematic
    - Finish PCB wiring diagram
    - Send PCB design to OSH Park for fabrication
  + Leon- 8:19
    - Finish setting up all sensors working at the same time
    - Implement servo and motor control in software
* **Other Business**- 8:20
  + Will send most of the ordered parts to Leon for testing

Meeting End: 8:24

**3/23/21 7:30 - 8:00pm**

* Sprint Review 7:30
  + Leon: Researched how to write sensor code altogether

7:31

* Jeremy: Went over power budget and finalized voltage regulators
  + Regulator needs to be added to CAD for mounting

7:32

* Isaac: Added new variable for drag analysis and wind speed
  + Not sure how to convert it to 3D

7:33

* Dylan: McMasterCart has been ordered and will arrive tomorrow
  + Will email Mircea and other labs on campus for helium

7:34

* George: Can work on Porter college funding for project

7:36

* Ryan: Did research on wire thickness for PCB wiring, will stick with 4 layer PCB
  + Needs to add pin outs for voltage regulator

7:39

* Gantt Chart updates
  + Sub team group meeting tomorrow to finalize RC controller
  + Split open loop and closed loop RC control milestones for Isaac

7:54

* Magnetometer data needs to be offloaded from drone
* RC Controller also needs GPS coordinates and battery functions, also crash report

8:30 end

3Peer Review meeting

Long Flight Time Buoyant Drone 3/24/2021 7:30PM -(PST)

horizontal lineATTENDEES

* Excused absences:
* Unexcused absences:

## AGENDA

* Check in: 7:30
  + Leon/Jeremy/Ryan: Did research and found an RC controller, needs input from the rest of the team to see if it fits requirements
  + Isaac: Researched converting drag force and adding vector
  + Dylan: Ordered motors/servos/ESCs/propellers to ship to leon’s house
    - Emailed biochem department to see if we could get helium, referenced to Glen
    - Emailed Mircea about lab access
  + George: Looked more into getting Porter college funding with detailed bill of materials
    - Need a faculty sponsor
* **Feedback:** Each person will receive feedback from each of the team members and themselves pros and cons, this should be the same feedback you gave on the evals. **BE HONEST**
  + Dylan 7:57
    - Started with struggling in leadership aspects, got a lot better throughout the quarter at being assertive as a leader and holding people accountable to their work
      * Can be better at conflict management between team members
    - Good at asking for help and knowing when to listen
    - Technical work has improved throughout the quarter
    - Struggles with work exhaustion with the project work and as a leader
  + George 8:05
    - Technical aspect has been struggling with the project work, but still has been learning how to do his work across the quarter
    - Put more hours than anyone else, reached most of his milestones
      * Knows the most out of the team and puts a lot of work on himself
    - Can talk more when disagreements occur or when work exhaustion occurs
    - Can explain his work better to the team, because most of it is complicated and advanced, which speaks to his technical background
      * Presentation skills can also use improvement
  + Isaac 8:12
    - Lacking in technical expertise, learning on the go, needs to ask questions to the rest of the team often
    - Can update his work more while showing it to the rest of the team
    - Has been communicating better and working better on the simulation
    - Most improved out of anyone on the team
    - Time management can improve a bit, work exhaustion is a problem for everyone, Start work on milestones earlier in sprints
    - Take notes during meetings so same questions aren’t asked again
  + Jeremy 8:20
    - Needs team members to review his work to help fix mistakes, be more proactive
      * Most criticism with justifying his numbers, sometimes numbers are arbitrarily defined when unknown, should specify when unknown
      * Explicitly show how numbers and decisions are made
    - Improved on helping group members with their tasks
    - Gets tasks done early when assigned
    - Struggles with communication in showing and presenting his work
    - Has to leave early sometime due to time conflict, possibly change meeting time
    - Hard to see how much work he is actually doing on spreadsheets
    - Can speak up more during meetings, veen when topic is inapplicable
  + Ryan 8:30
    - Some work is missing documentation, review technical documentation
    - More research is required to do PCB work correctly
    - He feels like he is doing the least amount of work
    - Good commitment when having to wake up early for the team
    - Presentation can use a work, go faster through presentation because professor gets bored listening to details
    - Procrastination is an issue when facing minor tasks, although he has been completing his assigned tasks
    - Improved with helping others in sub-group meetings
    - Needs to get his work checked by the rest of the group
  + Leon 8:41
    - Getting better at coding with the microcontroller since there was a late switch
    - Time management struggled with other difficult classes
      * Easier classes next quarter should allow more time devoted to capstone
    - Can be more proactive in asking for help
    - Drastic improvement since the last 2 design reviews
    - Can catch up next quarter while asking for help when needed
    - Everyone needs to improve when people are asking why, it doesn’t mean it is the wrong decision it just needs justification
* **Group discussion:** How we can improve as a team, what changes should we make to the team, what should our workflow look like going forward. 8:53
  + Not taking criticism as rejection
    - Everyone needs to improve when people are asking why, it doesn’t mean it is the wrong decision it just needs justification
    - Can be simulated in sub-team groups
  + Everyone can work on presentation, it is lethargic from many people
    - Makes it hard for audience to stay engaged
  + Get slides done earlier to practice before
  + Sprint goals should not be considered done unless there are slides to present on it
  + Help team members with non-technical tasks such as documentation
    - Divide up documentation such as sprint reports better
  + Group assignment work needs to be done before team meetings so the meetings can be used to just review
* **Individual Improvement:** Everyone say one or two things that they are going to improve on before the next design review.
  + Dylan 9:12
    - Step in more during Conflicts to help resolve issues and come to a common consensus.
    - Be more on top of scheduling so that I don't burn out and get exhausted during longer meetings.
  + George 9:13
    - Keep talking throughout the meetings even when tired or frustrated
    - Break down my updates better for the team to better understand my contributions
  + Isaac 9:14
    - Take more notes during meetings
    - Start early on work
    - Clearer communication
  + Jeremy 9:15
    - Get work checked much more often
    - Speak up and ask questions more during group meetings
  + Ryan 9:16
    - Start on tasks early
    - Finish a slide for each tasks
    - Get team members to verify my work
  + Leon 9:17
    - Make Capstone more of a priority and dedicate more time
    - Do more work and ask more questions outside of sub-team meetings
    - Show my work as I’m doing it rather than before Design Review

Meeting End: 9:20 PM

**3/25/21 7:30 - 7:45pm**

* Everyone should fill in their sprint 5 report tasks

7:35

* Sprint Updates
  + Jeremy: 3 commands for inputs, 1 state channel,
    - 1 channel for GPS, errors, and battery

7:41

* + Isaac: Looking at how to convert drag equation in 3 dimensions
    - Origin of drag force is on outer envelope

7:42

* + Dylan: Will order more parts tonight and working on the sprint report
    - Has also been looking at sewing machine to connect envelope pieces

7:43

* + Leon: Almost done with all sensors being done at the same time

7:44

* + Ryan: Working on how to send data back from the receiver to the RC controller

7:45 END

**3/26/21 7:30 - 8:20pm**

7:30 start

* Leon: All sensors are working together, will try to fix bugs with some of the sensor readings
  + Will have a demonstration for the group by tomorrow

7:31

* Jeremy: Working more with motor math
  + RC receiver research has concluded that the receiver cannot detect the battery voltage correctly

7:32

* Isaac: Looking up ways to get drag to work, will have to use matrix math properties
  + Also has been looking at a snake model for drag

7:33

* Dylan: Ordered servo connector pieces, still needs to order camera
  + Working on sprint 5 report
  + Also found sewing machine for envelope pieces

7:34

* George: Working on controls, has been struggling working due to injured finger
  + Porter funding application should be working by tomorrow

7:35

* Ryan: Remote controller has been chosen, however there is still issue with sending data back to the controller
  + Will choose a transmitter and receiver to go to a laptop for data logging

7:37

* Finishing the Sprint 5 report

8:20 END