

Multi-Rotor Drone Meeting Minutes

Seth Berryhill

August 2, 2019

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1 Initial Meeting

1.1 Team Members

- Seth Berryhill
- Jacob "Cobi" Brower
- Jeremiah Brands
- Jake Miller – mentor
- Dr. Swenson – instructor

1.2 Team Meetings

Tuesday at 1:00PM with instructor.

Monday and Thursday at 1:00PM Team Meetings

1.3 Action Items

- DONE Create Onedrive
CLOSED: *[2019-06-12 Wed]*
- DONE Sign SAPA Form
CLOSED: *[2019-06-14 Fri]*
- DONE Write Contact Questions
CLOSED: *[2019-06-17 Mon]*
- DONE Contact Swenson about meetings
CLOSED: *[2019-06-17 Mon]*
- DONE Start Team Contract
CLOSED: *[2019-06-14 Fri]*
- DONE Type Agenda Minute :Seth:
CLOSED: *[2019-06-12 Wed]*

2 Team Meeting <2019-06-13 Thu>

2.1 Agenda

- Class Discussion of client contract and budget
- Draft Team Contract
- Initiate client contract
- Develop interview questions
- Develop preliminary budget
- Review action items

3 Client Meeting <2019-06-14 Fri>

3.1 Agenda

- Introduce Client Questions

3.2 New Business

- Consider Tools and parts to order.

3.3 Action Items

1. **DONE** Send Peter Interview Questions
CLOSED: [2019-06-18 Tue 13:56]
2. **DONE** Set up Cobi with the budget **CLOSED:** [2019-06-25 Tue 13:56]

4 Team Meeting <2019-06-17 Mon>

4.1 Old Business

- Contact Questions: Cobi and Jeremiah completed these and they are available on the one-drive.
- Contact Swenson about meetings: We will be meeting Tuesdays at 1:00PM in the Drone Lab.

4.2 New Business

- Seth showed Jeremiah the lab, and past documentation.
- Began assembly of vibrating table.
- Discussed possibilities for vertical vibration: ortho-planar spring, or vertical rails, and either crank-slider or voice coil.

4.3 Action Items

1. **DONE** Confirm Tuesday meetings with Peter
CLOSED: *[2019-06-18 Tue 13:56]*
DEADLINE: *<2019-06-18 Tue>*
2. **DONE** Drone Lab access [2/2]
CLOSED: *[2019-07-01 Mon 14:28]*
 - (a) **DONE** Contact Dr. Karl
CLOSED: *[2019-06-17 Mon 15:49]*
DEADLINE: *<2019-06-17 Mon>*
 - (b) **DONE** Confirm Access
CLOSED: *[2019-07-01 Mon 14:26]*
DEADLINE: *<2019-06-26 Wed>*
3. **DONE** Draft Agenda for 6.18 Client meeting
CLOSED: *[2019-06-18 Tue 13:56]*

5 Client Meeting *<2019-06-18 Tue>*

5.1 Agenda

1. Introductions
2. Conduct Client Interview
3. Discuss Funds and Budget Information
4. Establish Weekly Meetings

5.2 Old Business

5.3 New Business

- Weekly Meetings: Peter has agreed to weekly meetings on Tuesdays. He wants to hold "Agile" style meetings, or "stand up" meetings.
- Dr. Swenson will get in contact with Dakota about the budget.

5.4 Action Items

1. Contact Caleb and Makenzie for past work.
2. **DONE** Requirements Document, sent to Swenson.
CLOSED: [2019-06-24 Mon 08:51]
3. **DONE** Gantt chart for the next seven weeks.
CLOSED: [2019-06-24 Mon 08:52]
4. **DONE** Do research on shaker tables.
CLOSED: [2019-06-24 Mon 08:52]

6 Team Meeting <2019-06-24 Mon>

6.1 Agenda

- Discuss plans for the day
- Set Goals for end of day / week
- Table base assembly
- Design Linkages

6.2 Old Business

1. Budget Dr. Swenson said that he would be in charge of the budget, we need confirmation before we can start purchasing things.
2. IRIC Access
3. Completed tasks
 - Req's document
 - Gantt chart

6.3 New Business

- Start mounting the large rails to the plywood.
 - Finish up the product documents, and print
 - Design linkages
1. **DONE** Add changes to gantt chart
CLOSED: *[2019-07-01 Mon 14:26]*
 2. **DONE** Print product requirements document
CLOSED: *[2019-06-25 Tue 13:56]*
 3. **DONE** Buy coffee
CLOSED: *[2019-06-25 Tue 13:56]*
 4. **DONE** Mount rails to plywood
CLOSED: *[2019-06-26 Wed 09:33]*
 5. **DONE** Email IRIC access
CLOSED: *[2019-06-28 Fri 09:35]* DEADLINE: *<2019-06-26 Wed>*
 6. **DONE** Discuss Budget / documentation with Swenson
CLOSED: *[2019-06-28 Fri 09:35]*
DEADLINE: *<2019-06-25 Tue>*
 7. **DONE** Design Linkages
CLOSED: *[2019-06-28 Fri 09:35]*

6.4 Notes

We received packages including:

- Smaller Rails
- stepper motors
- stepper controllers

7 Sponsor Meeting <2019-06-25 Tue 13:08>

7.1 Agenda

1. Design Discussion.
 - Motor selection – Cobi
 - Review design so far – Jeremiah
 - Motor mount directionality – Peter It would make it easier to change motors of the same type (Nema 23) like this one : https://smile.amazon.com/gp/product/B00PNEPW4C/ref=ppx_yo_dt_b_asin_title_o00_s01?ie=UTF8&psc=1
2. Controls questionnaire – Seth
3. discuss ideas and create a specification for the the shaker table controller
 - create some sample operational profiles
 - define controller functions needed to implement the profiles
 - design/specify how to program profiles
4. Review weekly goals – Seth

Design Discussion

- discuss ideas and create a specification for the the shaker table controller
 - create some sample operational profiles
 - define controller functions needed to implement the profiles
 - design/specify how to program profiles

7.2 Controls questions

- Can I ask you to review code?
 - We want good DC gain
 - Probably PI controller
 - Anti windup, limit the value of the integrate
 - At low frequencies our DC gain is infinite.
- Do you have technical requirements?

7.3 Notes

1. Disturbance Environment Mostly just wind, research what that would look like and recreate it.
2. Motor Selection
 - Dakota will not bias us towards one answer, but it must be within our budget.
 - So far we have stepper motors, but apparently we don't know how they work.
 - (a) **DONE** Send Dakota specs on the stepper and controller
CLOSED: [2019-07-01 Mon 14:26]
 - (b) **TODO** Find the bandwidth frequency of the steppers
3. Bandwidth Frequencies
 - We want to graph speed vs torque
 - There are a family of curves based on load
4. Operational Profiles
 - Start with the frequency generator
 - Use the oscilloscope to check that out.
 - Sweep, chirp, and psuedo-random

7.4 Weekly goals

1. **DONE** Test Motors
CLOSED: [2019-06-28 Fri 09:52]
2. **DONE** Build the table.
CLOSED: [2019-06-28 Fri 09:52]

8 Team Meeting <2019-06-28 Fri>

8.1 Old Business

- We discussed open action items and closed some relevant ones.

- Cobi: Worked with Jeremiah in the machine shop to make the first pass of the table. Some lessons were learned about timing, but it was eventually figured out. Cobi made a design for the platform. He worked with Peter on the stepper, and got it spinning with an arduino. For documentation he updated the list of action items, and wrote clear notes about what he had done.
- Jeremiah: He did a lot of design of the table and related brackets and motor stuff, mostly in Solidworks. He spent a lot of time in the shop this week producing brackets and linkages, and assembling the table. There were some iterations in the design whole they worked out what would and would not work.
- Seth: Put the stepper together for the first time, and discovered some of the problems with how it was going to work. From Wednesday on I was working on the control system, starting with understanding the older code and getting it to run on the Seesaw. I have begun to major overhauls to the old code before I start writing new ideas. These are: Separating independent parts into header files, and reorganizing the code with pointers and objects.

8.2 New Business

1. Paperwork

- (a) **DONE** Move the Gantt Chart to excel
CLOSED: *[2019-07-01 Mon 14:26]*
- (b) **DONE** Update the Wiki Page
CLOSED: *[2019-07-01 Mon 14:26]*
- (c) **DONE** Organize Portfolio
CLOSED: *[2019-07-01 Mon 14:27]*
DEADLINE: *<2019-07-02 Tue>*
- (d) **DONE** Contact Swenson about Monday Meeting, and snapshot
CLOSED: *[2019-07-01 Mon 14:27]*

2. Work

- (a) **TODO** Table and Linkages Final Assembly
DEADLINE: *<2019-07-02 Tue>*

- (b) **TODO** Learn Stepper Motor Software/Hardware
DEADLINE: <2019-07-02 Tue>
- (c) **DONE** Finish Code Rewrite
CLOSED: [2019-07-01 Mon 14:28]
DEADLINE: <2019-07-02 Tue>

9 Team Meeting <2019-07-02 Tue>

9.1 TODO Fill out the portfolio

9.2 TODO Add an Integral term to the control system

DEADLINE: <2019-07-02 Tue>

9.3 TODO Update Wiki page

10 Client Meeting <2019-07-02 Tue>

10.1 Agenda

1. Display Shaker Table
 - Mechanical Progress
 - Jeremiah
 - Motor Control Progress
 - Cobi
2. Controls Progress – Seth
3. Discuss Next Steps and Meeting

10.2 Old Business

- A demonstration of the table prototype
- Discussion of issues regarding frequency
 - Heat sink of H-bridges
-

10.3 New Business

1. **TODO** Seth works on Control System
2. **TODO** Cobi works on stepper hardware
3. **TODO** Jeremiah will machine the linkage.
 - Work on Vibration

10.4 Long term controls notes

This is going to be a platform to test new, high performance controllers with high gain.

We might use nonlinear dynamic controllers to optimize for energy use. Kalman filters are based on the Ricatti equation

1. **TODO** Frequency Domain Control Design for high performance systems - John O'brian
2. **TODO** Stochastic Models, Estimation and Control
3. **TODO** Feedback Maximization - B.J Larie
4. **TODO** Classical Feedback Control in MatLab

11 Team Meeting <2019-07-09 Tue>

11.1 Agenda

- Product Requirements - Seth
- Review Gantt Chart
- Design Review Date

11.2 Old Business

- Snapshot Cobi walked through the Wiki page. It went well, we didn't get any hard questions.
- To do items look good
- Meeting with Swenson today at 1:30

- Table has been assembled
- Turned in Logbooks, Wikipage, portfolio, snapshot 1

11.3 New Business

- TODO Design Review at 1:00 next Tuesday

DEADLINE: <2019-07-16 Tue>

Peter has said he wants to be here.

- Meet with Swenson today
- TODO meet with Wolbrecht about quaternions

12 Team Meeting <2019-07-19 Fri>

12.1 Agenda

- Review Action Items
-

12.2 Old Business

- Jeremiah Worked on Table, milled brackets and revamped motor attachment.
- Cobi Worked on sine sweep for stepper motor speed.
- Seth Worked on signal filtering, wrote a complementary filter

12.3 New Business

DEADLINE: <2019-07-22 Mon>

- Issues with Seesaw
 - TODO Make Seesaw Robust

High frequency vibration is causing bolts to fall out.

- TODO Update the gantt chart - Jeremiah

- TODO Update the budget - Cobi
- TODO Update the validation form - Cobi
- Complete bearing calculations
- TODO Complete value proposition

13 Client Meeting <2019-07-23 Tue>

13.1 Agenda

- Where the motor is at

13.2 Old Business

- The motor can do sine sweeps, likely up to 10 Hz.
- The Seesaw needs stops to prevent too much motion.

13.3 New Business

- Apply pseudo-random binary sequence to the table.
- Try legs on the end of the Seesaw arm.