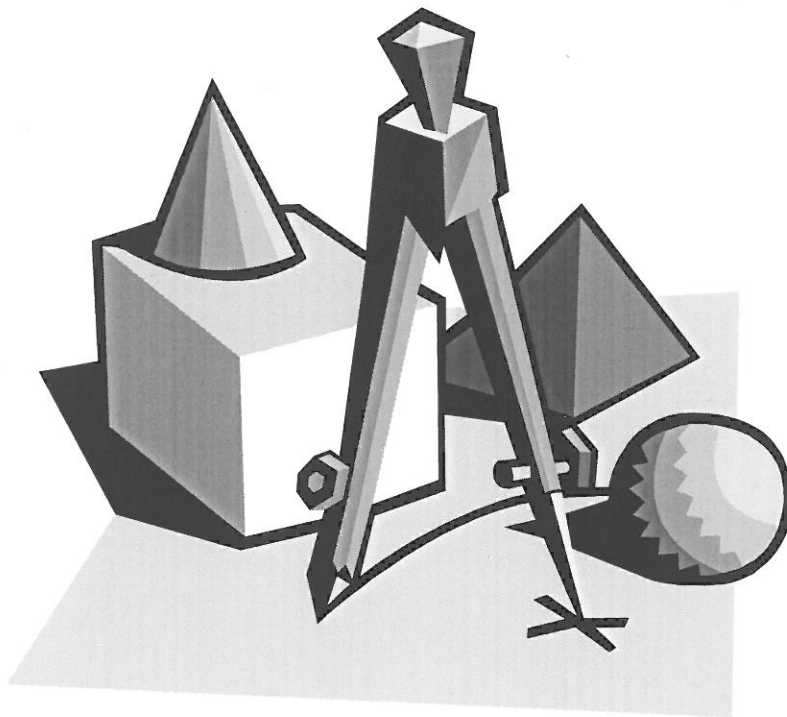


Engineering Design Notebook



Name Zachary Mathews

Project Title Drone Buddy

Contact Info. zmathews3@gatech.edu

Rules for Keeping an Engineering Design Notebook

1. On the front of the notebook enter the project title, your name and other information needed to return the notebook to you in case it is lost.
2. Keep a table of contents at the front of the notebook.
3. All entries must be done in ink.
4. Design notebooks do not have to be neat but they must be legible.
 - a. Do not be obsessed with neatness at the expense of faithfully recording everything as it happens.
 - b. Do not crowd the materials on the pages.
5. Make your entries at the time you do the work.
 - a. Include all results and learned information whether favorable or unfavorable.
 - b. Include all information even if you do not fully understand it at the time of entry.
6. If you make errors, just cross them out with an X or a single line.
 - a. Do not mark through anything so that it can not be read.
7. Do not erase anything.
8. Never tear a page out of the notebook.
9. All data must be in their original form (calculations, charts, pictures, sketches on scrap paper, etc.), not after recalculation or transformation.
10. Rough drawings should be done directly in the notebook. More careful drawings such as machine drawings or computer-generated plots should be made and entered in the book.
11. Information on loose sheets of paper should be entered into the notebook by:
 - a. Taping the loose paper to the next available blank page in the notebook
 - b. Taping each corner of the loose paper
 - c. Use a tape that will accept ink permanently
 - d. Place your signature on the loose paper, continue across the tape and end on the design notebook page. Sign across each corner of the taped page. Date the signature.
12. Information that can be retrieved easily (such as research articles from journals) should not be entered into the notebook. Enter only the needed information and the location and the location of the information in case you must retrieve it again.
13. Title each page of the notebook and enter the information on the Table of Contents.
14. Sign and date the notebook page at the space provided at the bottom.
15. Have your design entries witnessed and have the witness sign and date at the space provided.
 - a. The witness needs to have the technical ability to understand the entry.
 - b. The work can be witnessed periodically.
16. Every page of the notebook must be numbered.
17. No pages should be skinned. This is a chronological record of your work.

A good engineering design notebook is one that can be used to reconstruct your work even years after you have completed the original project. Other engineers should be able to use the notebook to reconstruct your work. The notebook will be used to determine the rightful owner of patents and other proprietary ideas.

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[illegible]

Title of Activity Discussion on Technical Expertise of Team
Title of Project Drone Buddy

Jerrin	→	Analog Design Project Management
George	→	Digital Design Technical Marketing Technical Sales
Sriharsha	→	Real-time Software GUI Design Website Design/Dev
Zach	→	Real-time Software GUI Design Image Processing

Continued on Page _____

Witnessed and Understood by Sriharsha Singh

Date 2/12/2020

Recorded by Zachary Matthews

Date 2/12/2020

Title of Activity Laws on Unmanned Aircraft / Current Uses
Title of Project Drone Buddy

National airspace controlled
by FAA.

→ faa.gov

→ Must register recreational
drones: faa.gov/uas

→ For public safety agencies
there are other programs:
faa.gov/uas/public-safety-gov

FAA given power in H.R. 302
Subtitle B.

Continued on Page _____

Witnessed and Understood by

Seharsha Singh

Date 2/25/2020

Recorded by

Zachary Mathews

Date 2/25/2020

Title of Activity Drone Chassis Research
Title of Project Drone Buddy

Price range: \$50 - \$100

Different styles: Racing
✓ Footage

Possible options: DJI TransTEC (\$69)
Lumier QAV-RXL (\$89)
MQC Fusion V.2 (\$86)

Continued on Page _____

Witnessed and Understood by seharsha singh

Date 3/6/2020

Recorded by zachary mathews

Date 3/6/2020

Title of Activity Flight Controller Research
Title of Project Drone Buddy

Open Source Option: BetaFlight
→ No apparent high-level API
→ Offers granular control down to bare metal (do we need this?)

Proprietary Option: DJI N3
→ Onboard SDK
→ Allows us to tap into problems that have already been solved like stabilization ~~and~~
→ Defines an API for access to peripherals: IMU and GPS Radio

Continued on Page ____

Witnessed and Understood by Seharsha Singh

Date 3/9/2020

Recorded by Zachary Mathews

Date 3/9/2020

Title of Activity Scope of Work / Research on Battery Life
 Title of Project Drone Buddy

Threat Detection: Feasible?

Motion Tracking: Possible through use of CV

Streaming Live Footage: A MUST!

Crime Deterrence: Lights and Sirens?

Pursuit of Assailant: Legal?

Feasible?

Battery life:

→ Mavic Pro: 27 min flight time

→ Mavic Mini: 30 min flight

~ 30 min seems typical

We need more than this

Continued on Page ____

Witnessed and Understood by Seharsha Singh

Date 3/11/2020

Recorded by Zachary Mathew

Date 3/11/2020

Title of Activity

Key Components / Timeline

Title of Project

Drone Buddy

Key Components:

- Drone
- Database
- Server
- App

Drone → Chassis
 → Flight controller/sensors
 → Battery
 → Motors
 → LTE Module

Proposal → Research Motors
 Research FC
 Research Chassis → Order parts → Construct Drone
 Research Battery
 Design App
 Design server database

Continued on Page _____

Witnessed and Understood by

Selvaraj SivaDate 4/1/2020

Recorded by

Zachary MalhotraDate 4/1/2020

Title of Activity Preliminary Bill of Materials
Title of Project Drone Buddy

Drone Chassis: DJI TransTEC (#169)
Motors: Racerstar 10000KV 3S BDC (#32)
Flight Controller: DJI N3 (#419)
Sensors: IMU, GPS (with FC)
Computer: UpBoard (#169) ← ^{May not} _{need}
Battery: VRUAV 3S LiPo 16000mAh (#97)
LTE: Quectel EC25 (#55)
Camera: TBD

Continued on Page ____

Witnessed and Understood by

Seharsha Singh

Date 4/11/2020

Recorded by

Zachary Mathews

Date 4/11/2020

Title of Activity Feature Selection Matrix
 Title of Project Drone Buddy

Feature	Criteria			
	Flight Time	Dev Time	Computability	Functionality
	10	8	4	10
Threat Detection	4	0	0	10
App	10	7	6	10
Scheduling	10	8	10	8
Face Detection	8	6	4	7
Motion Detection	8	7	7	10
Pursuit	1 4	2 4	1 4	4 6
Footage	3 4	10 4	8	10
Streaming	3	10	4	10
Gesture Control	8	1	2	6

Continued on Page ____

Witnessed and Understood by Seharsha Singh

Date 4/15/2020

Recorded by Zachary Mathews

Date 4/15/2020

Title of Activity

Title of Project

Open Source Flight Controller Software
Drone Buddy

Beta Flight → Lots of C code
→ May hamper dev
efforts ~~toward~~ on
more high-level
features

Will continue research...

Maybe there's something usable out
there with a well-documented
API for drone research

Continued on Page ____

Witnessed and Understood by

Seharsha Singh

Date 4/16/2020

Recorded by

Zachary Malhotra

Date 4/16/2020

Title of Activity Mobile App UI Toolkit: Flutter
Title of Project Drone Buddy

Flutter:

- Build once, deploy everywhere for mobile apps
- Uses language Dart
- Sriharsha has experience
- May quicken app development

Continued on Page _____

Witnessed and Understood by

Sriharsha Siva

Date

4/17/2020

Recorded by

Zachary Malhotra

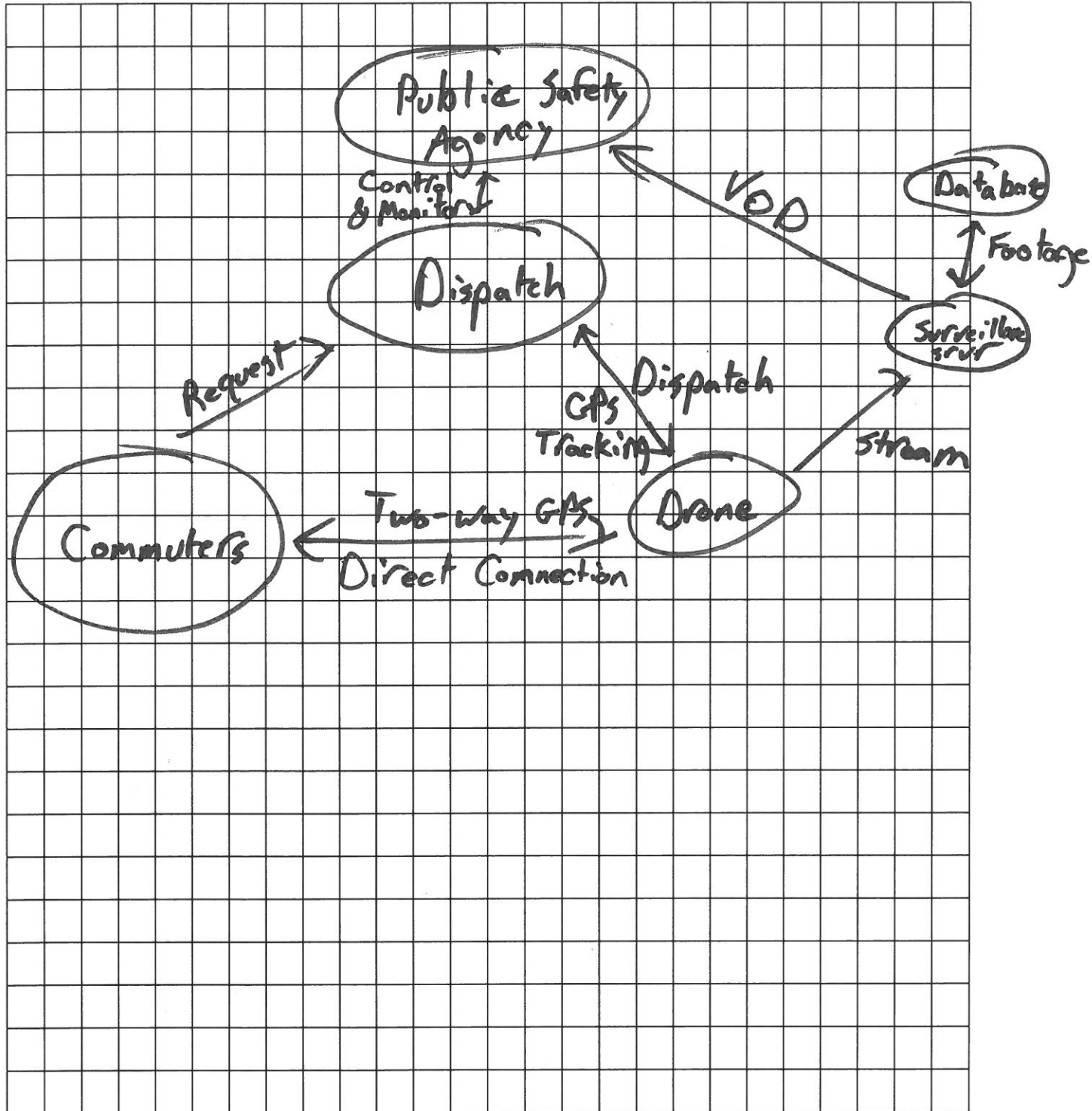
Date

4/17/2020

Title of Activity

Title of Project

Project Network Diagram
Drone Buddy



Continued on Page ____

Witnessed and Understood by

Seharsha Singh

Date

4/19/2020

Recorded by

Zachary Matthews

Date

4/19/2020

Title of Activity Team Meeting @ Beginning of Semester 2
Title of Project Drone Buddy

Everyone present

- Need to work on proposal presentation
- May need to modify scope of project to complete on schedule
 - sensing nefarious activity may be difficult to classify algorithmically.
- Harsh is remote but same time zone.
- Todo: Organize meeting to begin the proposal presentation.

Continued on Page _____

Witnessed and Understood by Seharsha Singh
Recorded by Zachary Mathews

Date 10/2/20
Date 8/17/20

Title of Activity Proposal Presentation Discussion

Title of Project Drone Buddy

Everyone Present

- Needs clarification:
 - Depth of topic discussion
- Changes:
 - DJI out. Lumenier In.
 - Lumenier ^{runs} ~~is~~ open source BetaFlight.
 - We plan to modify BetaFlight to make use of serial commands fed to it by single-board computer.
 - LiPO → LiION
- TODO: complete proposal presentation and incorporate changes by midnight August 21

Continued on Page _____

Witnessed and Understood by seharsha lyga

Date 10/2/20

Recorded by zachary matthews

Date 8/19/20

Title of Activity

Proposal Presentation Development

Title of Project

Drone Buddy

~~XXXXXXXXXXXXXXXXXXXX~~

- Investigated motion ^{detection} ~~control~~ algorithms
- Wrote down talking points for OpenCV.
- Investigated the open source flight controller software BetaFlight.
- It looks like a good starting point to develop additional capabilities for.
- Wrote slide for BetaFlight and prepared talking points.

Continued on Page _____

Witnessed and Understood by Seharsha SinghDate 10/2/20Recorded by Zachary MathiasDate 8/20/20

Title of Activity Meeting w/ Dr. HaslerTitle of Project Drone Buddy

Everybody Present

✓ Finished presentation on Aug 21

- Discussed concerns about the presentation
 - Needs to be shorter.
 - More technical detail
 - Better explanation of how parts fit together
 - Better graphics and figures.
- Need to update presentation and start ordering parts once approved.

TODO: Update Proposal & submit Recording
Get Approval
Order parts

Continued on Page _____

Witnessed and Understood by seharsha SinghDate 10/2/20Recorded by zachary malhausDate 8/31/20

Title of Activity

~~Changes to Presentation~~

Title of Project

Drone Buddy

- Developed better talking points for motion detection and tracking.
- Updated slides to remove fluff about each minor component of the design.
 - Focus on the big picture.
- Harsh to confer with Hasler on additional changes

Continued on Page _____

Witnessed and Understood by

Schroeder LygaDate 10/2/20

Recorded by

Zachary MalkinDate 9/1/20

Title of Activity Additional Changes to Presentation
 Title of Project Drone Buddy

Feedback:

- Needs to focus on big picture of how it all fits together

Changes:

- Reorganized the slides to highlight the major components rather than individual parts
- ~~Added~~ ~~deleted~~

Continued on Page _____

Witnessed and Understood by Saharsha Singh
 Recorded by Zachary Matthews

Date 10/2/20

Date 9/9/20

Title of Activity Creating Proposal Presentation Recording
 Title of Project Drone Buddy

Everyone present

- Divided slides among participants
- Hit talking points on motion ~~the~~ tracking and BetaFlight.
- OK'd recording for submittal to Dr. Hasler.

TODO: Get approval for proposal
 Do Q&A
 Order parts by 9/27/20

Continued on Page _____

Witnessed and Understood by Seharsha Singh

Date 10/2/20

Recorded by Zachary Mathews

Date 9/16/20

Title of Activity Discussion of Parts
 Title of Project Drone Buddy

Everyone present

Topics:

- Who's ordering?
- What's being ordered (i.e. duplicates or alternatives)?

~~Atlanta will~~

→ Group in Atlanta will order complete set.

→ Harsh will order some parts (mostly what's required to test if code is working - flight controller and single board computer)

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Witnessed and Understood by Sebastian Dyer
 Recorded by Zachary Malheur

Date 10/2/20

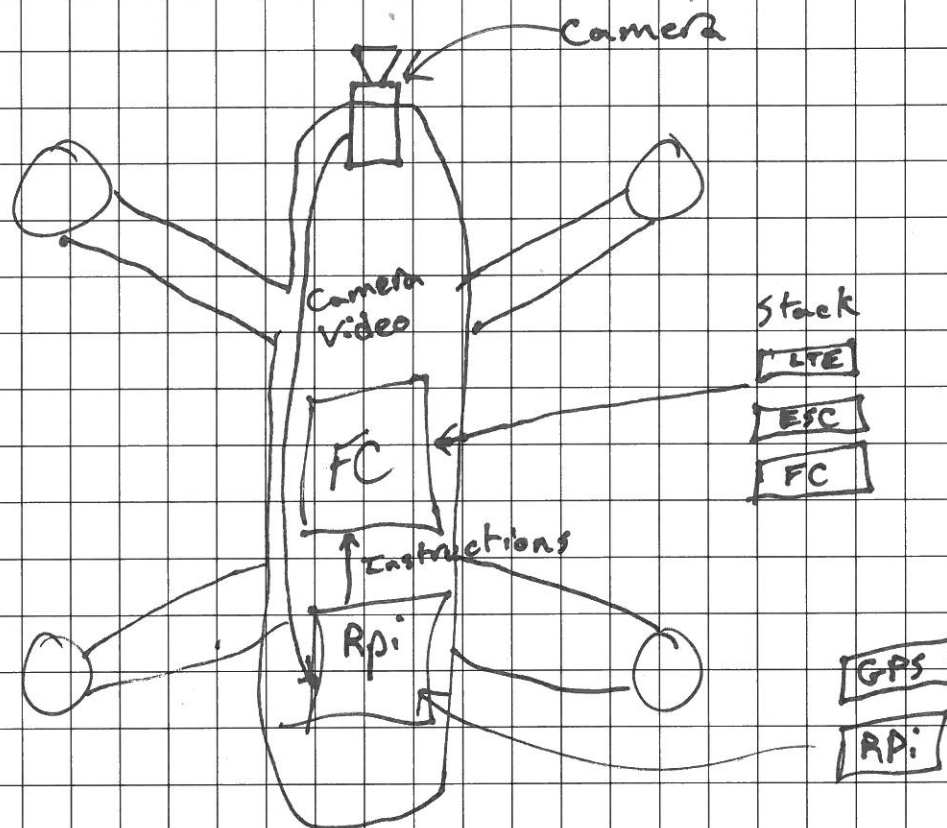
Date 9/22/20

Title of Activity

Finalizing Bill of Materials Among Atlanta Residents

Title of Project

Drone Buddy



+ Battery & Motors

Continued on Page ____

Witnessed and Understood by

Seharsha Singh

Date 10/2/20

Recorded by

Zachary Matthews

Date 9/25/20

Title of Activity Team Status Meeting

Title of Project Drone Buddy

Harsh, George, Zach, Hasler

- Ordered parts
- Discuss concerns w/ Hasler
- Clarify scope w/ Hasler
- User will call Drone via app & use GPS location from phone to locate the user

TODO: Chart plan for 7 weeks to expo
steps to prototype
Assemble drone frame

Get drone flying with base installation
Add functionality

Continued on Page ____

Witnessed and Understood by Selvarsha Suga

Date 10/2/20

Recorded by Zachary Matthews

Date 10/2/20

Title of Activity Assembling Drone
 Title of Project Drone Buddy

Zachary Mathews, George Germanakes, Terrin Kakkannatt

- Drone parts were delivered from GetFPV earlier in the week.
- Discovered motors were a mismatch for the frame.
- Discovered we needed XT60H connectors for the ESC board.

My Goals:

- ☐ Order new motors
- ☐ Research cameras
- ☐ Order remote

Team Tasks:

- ☒ Order parts
- ☒ Assemble drone
→ Assembled frame
- ☐ Plan meeting to continue assembly

Continued on Page _____

Witnessed and Understood by

George Germanakes

Date 11/25/2020

Recorded by

Zachary Mathews
Zachary Mathews

Date 10/12/20

Title of Activity Assembling Drone (pt. 2)

Title of Project Drone Buddy

Zachary Mathews, George Germanakos, Jerin Kakkannatt

- Received remaining parts
- Assembled drone
- Having trouble flashing firmware to flight controller.

My tasks:

☐ Investigate flashing dilemma

☒ Order new motors ^{and props}

☒ Research cameras

☒ Order remote

Team tasks:

☐ Implement server side relay between mobile app and drone

☒ Meet to continue assembly

☒ Continue working on mobile app

Witnessed and Understood by

George Germanakos

Date 11/25/2020

Recorded by

Zachary Mathews

Date 10/24/20

Continued on Page

Title of Activity ~~Assembly~~ Investigating Firmware Flashing Issue
 Title of Project Drone Buddy

- Discovered presence of boot button needed to enter DFU mode.
- Set necessary file permissions to write to FC in DFU mode from Ubuntu operating system.
- Drone motors now spin up and seem to have enough power to lift drone along with required peripherals.
- Discovered previously purchased ^{transceiver} receiver is for video not remote control.

My Tasks:

- ☒ Investigate flashing FC
- ☐ Order new ^{receiver} ~~transceiver~~ for RC

Team Tasks:

- ☐ Implement server relay between mobile app and drone

Continued on Page _____

Witnessed and Understood by

George Zimmerman

Date

11/25/2020

Recorded by

Zachary Mathews

Date

10/25/20

Title of Activity

Testing Flight

Title of Project

Drone Buddy

- Received RC FrSky receiver
- Paired RC remote with receiver
- Fixed motor spin direction as well as propeller placement

My tasks:

☒ Order new receiver for RC

☒ Pair remote

☒ Test Flight

☐ Implement GPS following

Witnessed and Understood by

George Germann

Recorded by

Zachary Matthews

Team tasks:

☒ Implement server

☐ Implement GPS
push/pull (pub/sub?)
over websocket connection
☐ Work on streaming footage to remote location.

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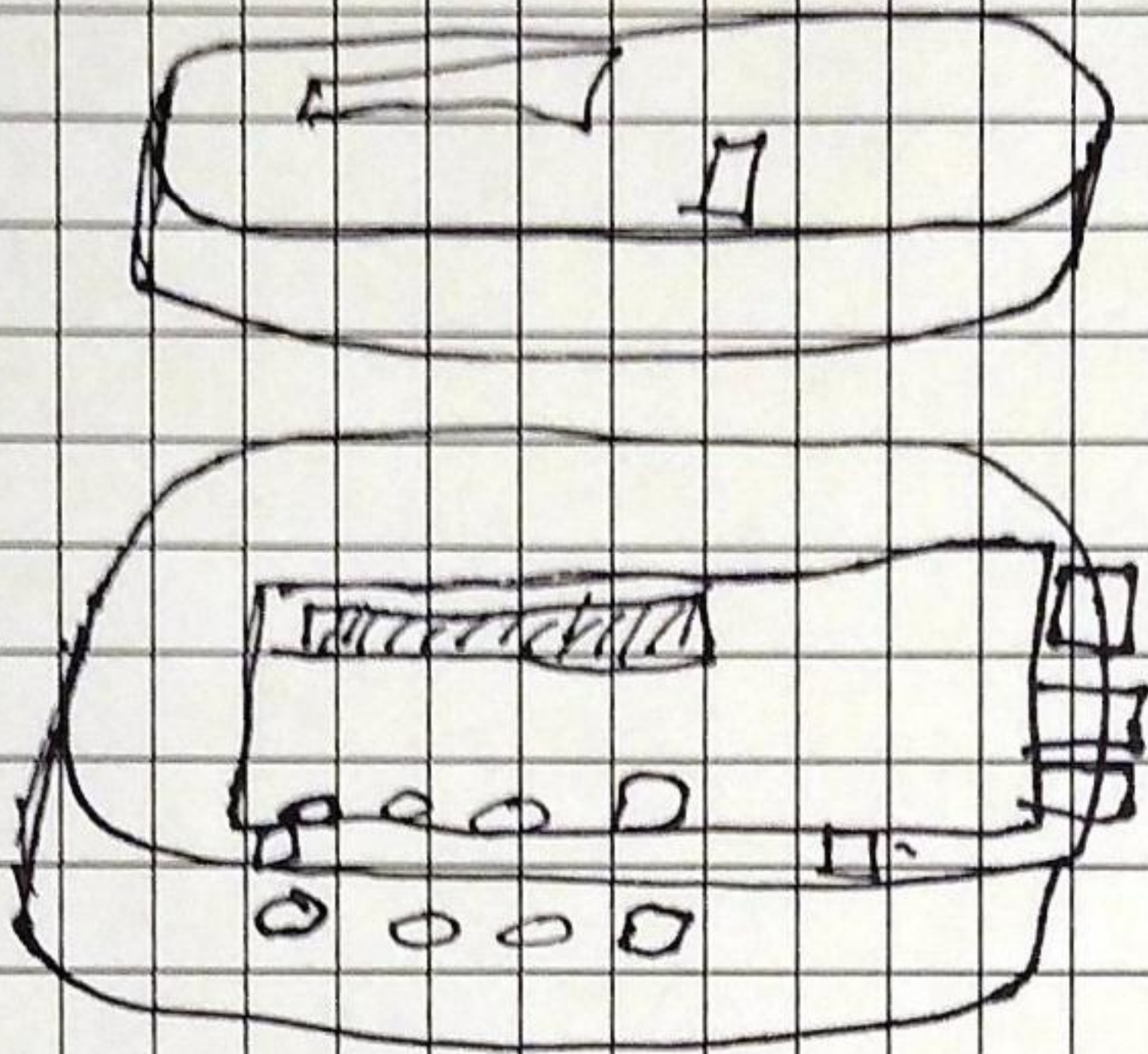
Date 11/25/2020

Date

~~11/25/2020~~
10/30/20

Title of Activity
Title of Project

Raspberry Pi Case Design
Drone Buddy



My Tasks:

☒ Design and print case for RP; 4B

☐ Implement GPS following

Team Tasks:

☐ Design mounts for GPS and receiver and camera

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Witnessed and Understood by

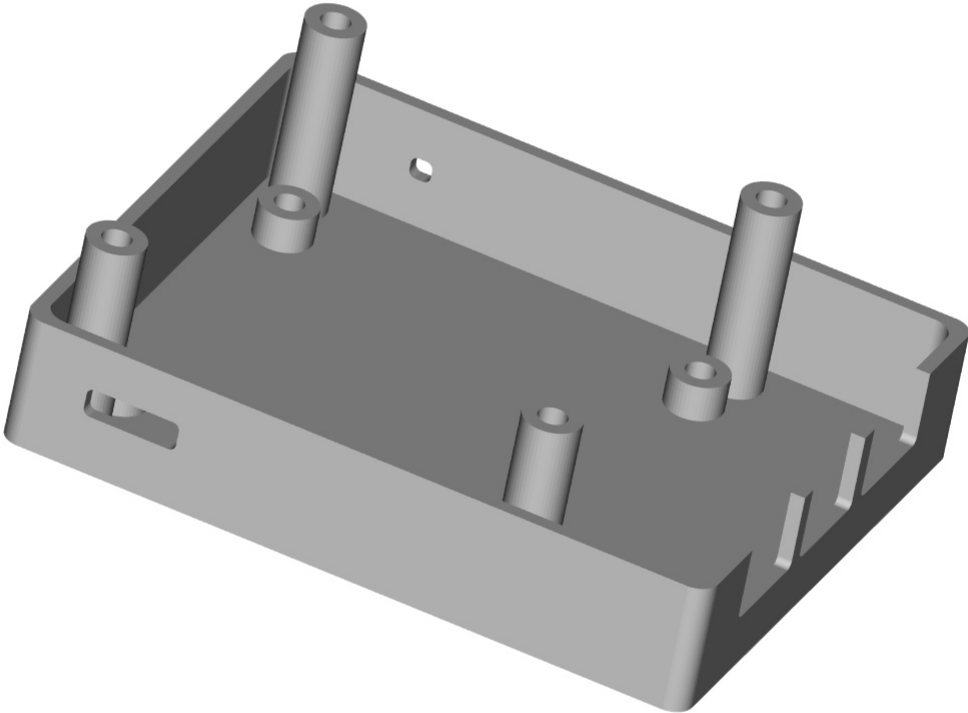
George Germann

Date 11/25/2020

Recorded by

Zachary Mark

Date 10/29 - 11/1



Title of Activity Add GPS Follow to RC Modes

Title of Project Drone Buddy

- Added ability to toggle into GPS_FOLLOW mode using the remote
- Right now the mode has no additional functionality over normal flight mode github.com/Drone-Buddy/betaflight

My Tasks

☐ Implement GPS follow mode

→ work completed towards task

Team Tasks:

☐ Design mounts for

☐ GPS

☐ Receiver

☒ Camera

☐ Continue work on

app and streaming footage

Continued on Page _____

Witnessed and Understood by George Zimmerman

Date 11/25/2020

Recorded by Zachary Mathews

Date 11/8/20

Title of Activity Add AUX GPS to BetaFlight
 Title of Project Drone Buddy

- Added ability to have an auxiliary GPS in BetaFlight
- This will be used to feed the user's phone's GPS coordinates to the flight controller.
- github.com/Drone-Buddy/betaflight/tree/drone-buddy

My Tasks:

- ☐ Implement GPS follow mode
- ☒ Add flight mode
- ☒ AUX GPS
- ☐ Logic and configuration

Team Tasks:

- ☐ Design mounts for
- ☒ GPS
- ☐ Receiver
- ☒ Camera
- ☒ Streaming video

for following user's GPS

Continued on Page _____

Witnessed and Understood by George Zimmerman

Date 11/25/2020

Recorded by Zachary Mathews

Date 11/13 - 11/16/20

Title of Activity

Add Logic for GPS FOLLOW Flight Mode

Title of Project

Drone Buddy

- Modified existing logic for GPS RESCUE mode to meet the needs of GPS Follow mode:
- Added menus to configure AUX GPS and GPS Follow mode.
- Added user icon on GPS tab in Betaflight - Configurator.
- Got new GPS with magnetometer this time.

My Tasks:

☒ GPS follow mode implemented

☐ Test and debug GPS Follow mode

Team Tasks:

☒ streaming video.

☒ call drone app.

☒ Mounts completed.

Continued on Page _____

Witnessed and Understood by

George Gernander

Recorded by

Zachary Matthews

Date 11/25/2020

Date 11/16 - 11/21/20

