Computer Science Senior Software Engineering Project

HEAD-UP DISPLAY ALIGNMENT SYSTEM

WEEKLY BLOG POST

Group 65:
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Contents

I. Fall 2016

A. Jiongcheng Luo (Fall 2016)

Week 3 (Oct. 10 ~ 14, 2016)

- **Plans for the coming week**
  My primary plan for next week is to complete the problem statement that is satisfied by the clients also have them sign on it. The next step is to understand the problem more in depth in the technical perspective, I hope to illustrate the problem by using mathematical and physics way, and be able to translate into CS problem such as what would be software program that we will build for the project.

- **Progress since last week**
  The most important progress I've made was I have built a better relationship with my teammates I have known them better. I also have a more clear understanding on the problem that we are trying to solve for the given project. We completed our first draft of problem statement even though it didn't meet the requirement from our clients, but it helped me comprehend the entire problem more deeply.

- **Any problems I encountered**
  It's hard to follow the agenda of our client, which we always had to wait for an uncertain long time for getting their email back, which may affect to our work progress in the future. In addition, the scheduling within our group is not settled yet, we have not yet set up a fixed time for the group meeting.

Week 4 (Oct. 16 ~ 21, 2016)

- **Plans for the coming week**
  By next week, the primary goal is to get the problem statement fixed as the expectation of the client, that in terms of the consistence of the entire statement. We will include more explanation in plain language to the technical terms. After that, I plan to do more and deeper researches, and start to working on the first design procedures to the problem.

- **Progress since last week**
  My progress is I understood how a team collaboration is so important to the success of this project, we have been getting closer as an entity and I started know the the character of each team member: what each of them good at and lack, that understanding helps me to know how to make better complement for each of us.

- **Any problems I encountered**
  The problem I met at this moment is how to improve the relationship between us and the client, since we had an issue that has led to breakdown of our relationship. Besides, I still have unclear problems for our projects such as the I am still not clear about the real time requirement for our algorithm, or like what kind of data we will get for test.

Week 5 (Oct. 23 ~ 28, 2016)

- **Plans for the coming week**
  The primary goal of next week is to complete the requirement document, which requires us to start thinking and planing for working on the project. I also plan to have one or two meetings with our client in regards to the requirement documents.

- **Progress since last week**
  My biggest progress from last week was that we have completed the problem statement as the expectation from our clients. And by that, I have become more familiar with the terminologies of our project, I have a clear picture in my mind about the problem that we are dealing with.

- **Any problems I encountered**
  I am still not sure about the resolution to our project, such as what kind of software and hardware we are going to play with. In other word, I am still not clear about our procedures for doing this project.

Week 6 (Oct. 31 ˜ Nov. 5, 2016)

- **Plans for the coming week**
  By next week, I hope finish up the requirement document including all the sectiosubsections; and I plan to decided which hardwares (boards) to use for our project and start thinking to purchase. And after decide which board to use, I plan to start looking at more detail of the board and maybe starting do some simple coding simulation.

- **Progress since last week**
  By writing on the requirement document, I know much better about the specific points of the project such as the detail workflow, input/output of the product and restriction, etc. In addition, we have known about what sort of boards that we are using for building the product, which helped me narrow the learning process so that I know what to look up and learn about.

- **Any problems I encountered**
  We are still struggling about some of the detail information about the product when writing on the requirement document, many specific points are unknown until we start the implementation.

Week 7 (Nov. 7 ˜ Nov. 11, 2016)

- **Plans for the coming week**
  My plan for the next week is to finish up the the technology review, that's not only for the writing part, but also plan to list out and truly understand all the technologies that we may use as well as how to use these technologies for our project. Also, I plan to list out all the hardware that we are going to implement on and prepare to purchase for those.

- **Progress since last week**
  We have eventually finished the requirement document by last week and move on to the technologies review, by writing up the requirement document, I have a deeper understanding to the restriction and the problem that we may meet during the real implementation process.

- **Any problems I encountered**
  We still have no solutions or ideas for solving some of the specific problems. For example, we need two groups of input data and one of them represent the correct aligned "Aircraft" IRU data for this project, how do we get the "correct aligned" data, what reference do we take to assume those data we come up is correct?

Week 8 (Nov. 14 ˜ Nov. 18, 2016)

- **Plans for the coming week**
  By this week, I plan to start up and hopefully finish a rough draft by the end of the week. I also nail down the all the hardware that we are going to use and send out the list to Kevin. In addition, I plan to send out an email to our client to report our progress and ask about some questions: 1. How to get correct aligned data as reference? 2. Ask for generic HUD symbology picture 3. GitHub Account.

- **Progress since last week**
  We have finished up our technologies review and we have discuss about the question about how to get correct aligned data as reference, even though we do not if our assumption will be correct or doable or not when doing the real implementation. But we assume we can "make" a group of correct aligned data by manually adjusting it and assume this data is correct, so that we will let the other group of data to be correctly aligned based on this assumption.

- **Any problems I encountered**
  The problem I had so far is for getting the correct aligned data as reference, and we have to figure out the hardware we going to use.

B. Drew Hamm (Fall 2016)

Week 3 (Oct. 10 ˜ 14, 2016)

- **Plans for the coming week**
  I want to start looking into the hardware we might be working with for this project. Specifically I will be reading the specifications for both the Motion Sensor Evaluation Board: MPU-9250CA-SDK and the Ellipse-D: Miniature Dual GPS INS. Besides familiarizing myself with the hardware I want to learn about Quaternions as advised by our client in order to better understand the output data we will be working with. Lastly, I plan on finishing up my section of the problem statement as well as working with my team to finish it as a whole.

- **Progress since last week**
  Met up with team members to work on the problem statement and finish a first draft. Received feedback from clients further specifying the project details.

- **Any problems I encountered**
  I found out that my first understanding of the project was incorrect. At first I thought we were mostly working on a proof of concept. I realized my understanding of hardware error was poor. Since our project requires accurate results, I need to spend some time to understand how much error might be expected from our solution.

Week 4 (Oct. 17 ˜ 21, 2016)

- **Plans for the coming week**
  I'll be working together with the group in order to finish up a new revision of our problem statement. We want to address a couple of our clients concerns in order to get their signed approval. We have a meeting with our client on Wednesday to which I want to prepare questions for. We should also be able to get our problem statement signed so we can move on to working on the requirements document.

- **Progress since last week**
  Met with group to clear up some miscommunication we had with our client. Worked on on the problem statement along with research on both MEMS IRU and aircraft IRU specifications.

- **Any problems I encountered**
  The technical writing required to create the problem statement has been difficult. Most of this difficulty is due to having to learn the specialized terminology as well as hardware that we will be working with.

Week 5 (Oct. 24 ˜ 28, 2016)

- **Plans for the coming week**
  I will be working on the requirements document. This will also involve getting together with the group and doing more research in order to fully explain our solution. We will need to get in touch with our client once we have a working draft of the document.

- **Progress since last week**
  Finished our problem statement and met with our client. Our meeting was productive as it helped to answer a few questions we had as well as to ensure that we are covering everything of importance within our project.

- **Any problems I encountered**
  Schedule conflicts for myself and the group made this week difficult. Our solution was less meeting in person and more work being done online.

Week 6 (Oct. 31 ˜ Nov. 4, 2016)

- **Plans for the coming week**
  Continue working on the requirements document. Hopefully finish by Friday. Send client our finished document.

- **Progress since last week**
  Met with group members and decided what sections we are each responsible for writing within the requirements document. Started writing the my sections of the document.

- **Any problems I encountered**
  Some aspects of the project are quite complex and will require extra time to research.

Week 7 (Nov. 7 ˜ Nov. 11, 2016)

- **Plans for the coming week**
  First, I need to decide what to include in the tech review. Next, the group needs to choose who will be responsible for each item. Lastly, start working on the tech review and finish it by Friday.

- **Progress since last week**
  We finished the requirements document and sent it off to our client.

- **Any problems I encountered**
  Last week was busy with midterms and other assignments. Both group members and myself struggled to find time to meet and finish the requirements document.

Week 8 (Nov. 14 ˜ Nov. 18, 2016)

- **Plans for the coming week**
  Although we submitted the tech review I want to look into our project for other options we might need to decide on later. Looking for additional items will carry over into starting work on the design document. Planning to meet with group so we can decide what sections everyone will be responsible for.

- **Progress since last week**
  Finished the tech review. Researched filter techniques for sensor data. Learned about advancements in MEMS quality assurance testing.

- **Any problems I encountered**
  We originally choose 9 items for the tech review however, one of the items was too straight forward to find alternative solutions. We had a hard time finding an additional item to include so we left the document with only 8. I found that the tech review took more time than expected to complete as the research I had to do was quite complicated.

C. Krisna Irawan (Fall 2016)

Week 3 (Oct. 10 ˜ 14, 2016)

- **Plans for the coming week**
  I am planning to do more research on Quaternion, since we will be working on the data in terms of Quaternion rotation. I also want to finalize our problem statement and have a clear understanding of our project. Lastly, I want to start exploring the possibilities of solution that we comes up with. I tried to learn more about the correlation of the acceleration between two data and the error that the integration gives.

- **Progress since last week**
  My team and I work together on the problem statement this week. We also be able to get more information of this project from our clients and have a greater understanding of this project. We also have meetings that really challenge

us to think more deeply about this project and make sure our team are on the same page.

- **Any problems I encountered**
  Although we have a better understanding than last week, it seems that we are still missing some of the points about this project. I am really grateful with the communication that our clients give to us, it is really help us to get a better understanding about this project. We also have difficulties in finding the perfect meeting time for our group. I am still not aware of my teammates schedule. However, we are successfully held our meeting this week and will improve on the schedule communication.

Week 4 (Oct. 17 ~ 21, 2016)

- **Plans for the coming week**
  I am planning to finalize our problem statement and get our final problem statement signed by our clients. I will also be working on the requirement documents and see if we have any more question about this project.

- **Progress since last week**
  My team and I work together on clearing the communication breakdown that happens this week between our team and our clients. I now have a clearer understanding on how to deal with a real work environment.

- **Any problems I encountered**
  We have a breakdown in our communication with our clients. We are trying to resolve this problem and got some tips from our teacher regarding this issues. This project going to be a learning curve for me, I have to learn more about some terminology and knowledge about hardware.

Week 5 (Oct. 24 ~ 28, 2016)

- **Plans for the coming week**
  I am planning to further refine our requirement documents and ask some clarification question to our clients (if any). We are also planning on getting our requirement document to be signed before the end of next week.

- **Progress since last week**
  We have another meetings with our clients this week on Wednesday. We clarify some stuff to move forward for our requirement documents. We also get our problem statement signed by our clients.

- **Any problems I encountered**
  I have a time management problem when working on the requirement documents this week. My schedule for this week is packed with assignment and midterms. I haven't got an optimal time to do the requirement documents this week. However, I will refine our requirement documents during the weekend and hopefully can get feedback from our teacher before we send it to our clients.

Week 6 (Oct. 31 ~ Nov. 4, 2016)

- **Plans for the coming week**
  We will send our requirement documents to our client at the end of the week and see if we need to further refine our requirement document to be signed. I will also start to work on the Technical Review documents, looking for more options that we can do (or can't do) for this project.

- **Progress since last week**
  We work on the Requirement Document. Our clients has found out the ideal hardware that we will be working with for this project. Creating the requirement document makes me think more deeply about this project and how we going to achieve our goal. I got a clearer understanding on how to implements our project.

- **Any problems I encountered**
  The biggest problem for this week is time management. This week is a midterm week for all of us. This makes it hard

for us to focus on the documents.

Week 7 (Nov. 7 ~ Nov. 11, 2016)

- **Plans for the coming week**
  I will start investing my time in the Tech Review documents. I will ask more clarification question to the teacher about this documents. I will push myself in getting started with the design documents.

- **Progress since last week**
  We got a really good review for our requirement documents. Our clients are really pleased with the requirement documents that we send to them. I am glad that things works out and we pleased our clients with our work.

- **Any problems I encountered**
  The biggest problem that we faced is finding time to meet together and spend our time working together on the documents. We also have some question about our project during the weeks but our clients clarify those stuff and really help us to get the information that we need.

Week 8 (Nov. 14 ~ Nov. 18, 2016)

- **Plans for the coming week**
  We are trying our best to finish our Design Documents before the thanks giving break.

- **Progress since last week**
  We already submitted our signed requirement documents on Monday. We have finished our Tech review documents on Wednesday noon.

- **Any problems I encountered**
  Working on the Tech Review documents makes me think more deeply about the project and how we actually going to build this project. This requires me to do a lot of research and make a design decision.

Week 9 (Nov. 21 ~ Nov. 25, 2016)

- **Plans for the coming week**
  We will be working on the Design documents and finished it before Wednesday. We will be working on the Progress report after we submit the design documents to the clients.

- **Progress since last week**
  We get the foundation for the design documents ready. We have a better idea about the progress report.

- **Any problems I encountered**
  It was hard to find a time to work on the document during thanks giving break.

Week 10 (Nov. 28 ~ Dec. 2, 2016)

- **Plans for the coming week**
  Finished up the progress report document and video.

- **Progress since last week**
  We get the design document submitted.

- **Any problems I encountered**
  Busy schedule for dead week.

II. WINTER 2016

A. Jiongcheng Luo (Winter 2016)

Week 1 (Jan. 9 ~ 13, 2017)

- **Plans for the coming week**
  Getting all the basic hardware components and devices, start working on hardware setup including board hoop-up and sample code testing. Also set up a meeting with our clients to talk about plans and changes of the project progress.

- **Progress since last week**
  We held the first group meeting of the term and we decided to purchase our own board if the hardware not arriving yet.

- **Any problems I encountered**
  Delayed on getting the necessary hardware components and we couldn't start the implementation.

Week 2 (Jan. 16 ~ 20, 2017)

- **Plans for the coming week**
  Getting all the basic hardware components and devices ASAP, start working on hardware setup including board hoop-up and sample code testing, modify the project schedule that due that to the delayed hardware devices

- **Progress since last week**
  We held the first meeting with the client and talked about our plan and blocks currently.

- **Any problems I encountered**
  Still have not yet gotten the necessary hardware components and we couldn't start the implementation.

B. Drew Hamm (Winter 2016)

Miss.

C. Krisna Irawan (Winter 2016)

Week 1 (Jan. 9 ~ 13, 2017)

- **Plans for the coming week**
  We will tried to get all the necessary hardware to start this project. We will have a meeting with our clients on Wednesday next week.

- **Progress since last week**
  We meet as a group this week. We have a solid plan for next week.

- **Any problems I encountered**
  Getting started with all the logistic and the scheduling of the class and the project. Trying to get all the necessary hardware for this project.

Week 2 (Jan. 16 ~ 20, 2017)

- **Plans for the coming week**
  We will tried to get all the necessary hardware to start this project. We are trying our best to meet with our teacher to get the hardware.

- **Progress since last week**
  We meet as a group with our clients last Wednesday. We let them know about our logistic problem.

- **Any problems I encountered**
  Getting started with all the logistic and the scheduling of the class and the project. Trying to get all the necessary hardware for this project.

Week 3 (Jan. 23 ~ 27, 2017)

- **Plans for the coming week**
  We will start on the implementation of the project. We will finished up the hardware set up and a brief user interface.

- **Progress since last week**
  We finally get our hardware last Thursday. We can now really start on the implementation of the project.

- **Any problems I encountered**
  The logistic problem really set us back for a couple week behind the schedule. We will work hard to catch up with that.

Week 4 (Jan. 30 ~ Feb. 3, 2017)

- **Plans for the coming week**
  Continue to develop the user interface.

- **Progress since last week**
  We have a brief user interface.

- **Any problems I encountered**
  Getting the hardware setup.

Week 5 (Feb. 6 ˜ Feb. 10, 2017)

- **Plans for the coming week**
  Finished up the midterm progress report and document revisions.

- **Progress since last week**
  Our user interface is ready and finished.

- **Any problems I encountered**
  There is no generic user interface plug-in that I can use. I have to create the user interface from scratch.

Week 5 (Feb. 6 ˜ Feb. 10, 2017)

- **Plans for the coming week**
  Continue with the User Interface first user study.

- **Progress since last week**
  We finished the midterm progress report and revision for our documents.

- **Any problems I encountered**
  Finishing up the documents and video took most of our time this week.

Week 6 (Feb. 13 ˜ Feb. 17, 2017)

- **Plans for the coming week**
  Continue with the User Interface first user study.

- **Progress since last week**
  We finished the midterm progress report and revision for our documents.

- **Any problems I encountered**
  Finishing up the documents and video took most of our time this week.

Week 7 (Feb. 13 ˜ Feb. 17, 2017)

- **Plans for the coming week**
  Start to work on the statistical analysis portion of this project.

- **Progress since last week**
  We finished the midterm progress report and revision for our documents.

- **Any problems I encountered**
  We do not have a chance to meet this week.

Week 8 (Feb. 27 ˜ Mar. 3, 2017)

- **Plans for the coming week**
  Start to work on the statistical analysis portion of this project.

- **Progress since last week**
  Continue to work on the statistical analysis portion of this project.

- **Any problems I encountered**
  We do not know the structure of this class. We are not sure where we at in the class in terms of grades.

Week 9 (Mar. 3 ˜ Mar. 10, 2017)

- **Plans for the coming week**
  Work on the poster.

- **Progress since last week**
  We have a class meeting this week. We were practicing for the expo

- **Any problems I encountered**
  We have to finished up the project soon.

Week 10 (Mar. 13 ˜ Mar. 17, 2017)

- **Plans for the coming week**
  Finished up the progress report. Connect the user interface and statistical analysis to the Arduino module

- **Progress since last week**
  We finished the poster

- **Any problems I encountered**
  We have to finished up the progress report during finals week.

III. Spring 2016

A. Jiongcheng Luo (Spring 2016)

Week 1 (Apr. 3 ~ 7, 2017)

- **Plans for the coming week**
  As the first week after break, I plan to have a meeting with the entire group as well as our clients, we will plan to give a short report to them and we plan to move on with our project

- **Progress since last week**
  I briefly took a look at the new schedule of the spring term and start making plan based on our current situation.

- **Any problems I encountered**
  We still found hard to retrieve two sets of data from the two different IMUs, we considered our old GUI program is NOT clearly enough to for our demonstration purpose, we planned to develop a new GUI program.

Week 2 (Apr. 10 ~ 14, 2017)

- **Plans for the coming week**
  By the coming week, we plan to update and fix our poster as the second draft. We also plan to group up to work on the project together, specifically will focus on the design of the UI of the demonstration system.

- **Progress since last week**
  We held our first meeting since the spring break and we planned out our schedule for the rest of the term.

- **Any problems I encountered**
  We found hard to fix the poster since everything is on a very level terminology, and since we have not done the statical analysis for our final testing result, we won't be able to put a specific result onto the poster.

Week 3 (Apr. 17 ~ 21, 2017)

- **Plans for the coming week**
  We plan to fix our poster for the final draft and have it send to our client for verification. We also plan to meet up again to continue woking on the project together.

- **Progress since last week**
  We got some feedback from the TA in terms of how to fix and update for our poster. We finally found a Python library called VPython that is easy to implement, and it provides ideal graphical interface (3D model animation) for our project virtual demonstration, we have also figured out the hardware configuration in terms of getting data from two IMUs as different addresses.

- **Any problems I encountered**
  We could not illustrate the best graphical display model for showing off to the audience in the expo, we want it to be straight forward and understandable, but also be able to demonstrate our result and outcome of the complex system.

Week 4 (Apr. 24 ~ 28, 2017)

- **Plans for the coming week**
  We will try to finish up everything for the project and have a well plan for the demonstration in the expo. We had grouped up again and made some progress on the project.

- **Progress since last week**
  We fixed the refined our poster, we submitted the final draft of poster to our client, everything looks good to them.

- **Any problems I encountered**
  We could not show our result to our client as they expect, we are still trying to improve the accuracy and stability of our output, and we will figure out the best way to show off the detail of the alignment.

Week 5 (May. 1 ˜ 5, 2017)

- **Plans for the coming week**
  We will try to finish up putting the Arduino program with the demonstration UI program together and test for expo demonstration, we will make a detailed plan for the demonstration in the expo, also plan to show our result to our client see if we can improve based on what we have.

- **Progress since last week**
  We finally submitted our poster for printing. We roughly finished all implementation on the software part of the project, and we updated our github repo with the latest version of our project, and we also updated the README file in terms of our project description.

- **Any problems I encountered**
  We could not improve the accuracy for the final output result, we may need to ask for some suggestions from our client, we also have not not yet test for the performance of the GUI, we may need to spend some time to debug.

Week 6 (May. 8 ˜ 12, 2017)

- **Plans for the coming week**
  The Friday of coming week will be the engineering EXPO day, so we plan to finalize our project for the expo demonstration, and we also plan to build our demonstration system.

- **Progress since last week**
  We have finalized our GUI and we found out that our dynamic alignment process makes a not bad result.

- **Any problems I encountered**
  We found out a our result is not accurate enough especially and we believe that is because of something goes wrong with yaw calculation or implementation, but we could not determine if the problem comes from the hardware or our algorithm.

Week 7(May. 15 ˜ 19, 2017)

- **Plans for the coming week**
  We plan to implement our physical test on our current system and we also plan to set up a meeting with our client to report our result.

- **Progress since last week**
  We finally held our EXPO last week, although we could not complete our project in hundred percent, we did demonstrated our project and we did attracted a number of visitors to our expo. And even though our project seems to be hard to understand for general audience, some people were still quite interested in knowing about our project.

- **Any problems I encountered**
  We could not demonstrate our system with the static alignment algorithm since something goes wrong within the algorithm. Another problem I encountered was that I could not explain my project clearly to the audiences, I could not explain well to those who do not have any background knowledge about our project.

Week 8(May. 22 ˜ 26, 2017)

- **Plans for the coming week**
  We plan to do our final physical test to verify our result and also plan to set up a meeting with our client to report our

final progress.

- **Progress since last week**
  We discussed and designed for the physical test.

- **Any problems I encountered**
  We did not set up the meeting with our client yet since we have not finished the physical test.

- **If you were to redo the project from Fall term, what would you tell yourself?**
  You should start working on the project as soon as possible discussed with the client mote often.

- **What is the biggest skill you've learned?**
  The biggest skill I learned is how to get into a field that I am unfamiliar with before or even not having any experience, my project is kind of like that, which I did not know anything about my project or any background knowledge before I really worked on it, however, throughout this project, I learned how to get start with a project like this.

- **What skills do you see yourself using in the future?**
  I think I will use the skill of dealing with projects involve in both hardware and software.

- **What did you like about the project, and what did you not?**
  I like that my project was not purely dealing with software or programming, but involve much with hardware, physics and mathematics; One thing I do not like about my project is that we did not have much resources or equipments to test with, we got only some conceptual ideas and thoughts and we did not have the chance to work with the real HUD (equipment).

- **What did you learn from your teammates?**
  From Drew, I learned that we should not rely on other external examples or existed libraries too much during implementing our project, we should design our own one based on other resources.

- **If you were the client for this project, would you be satisfied with the work done?**
  I probably will not be 100% satisfied with the current work done since we did not have a result as expected, however I can understand with that since we had limited time, knowledge and resources for our project implementation.

- **If your project were to be continued next year, what do you think needs to be working on?**
  First we can test with varied models of IMUs and select the one that has the best performance and is the easiest to deal with, then we will try to use more IMUs to work together for achieving better performance, and the most important thing that I consider need to be worked on is to design a complete test procedures for in order to precisely test the output of the system.

B. Drew Hamm (Spring 2016)

Week 1 (Apr. 3 ˜ 7, 2017)

- **Plans for the coming week**
  Meet with our group and work on the micro controller code as well as the GUI.

- **Progress since last week**
- **Any problems I encountered**
  I've been looking for a new place to live and finally moved this week so so my time has been limited.

Week 2 (Apr. 10 ˜ 14, 2017)

- **Plans for the coming week**
  I am planning to work on the poster for expo as well as further improving our code.

- **Progress since last week**
  I met with our group over the weekend to discuss the project and make plans for the term.

- **Any problems I encountered**
  We are using a I2C bus to facilitate communication between devices in our project. However, their is a limit to the length in which the I2C bus may be before negatively effecting its performance. This may be a problem given the realized interconnectivity within an aircraft.

Week 3 (Apr. 17 ˜ 21, 2017)

- **Plans for the coming week**
  I continue making improvements to our code in terms of refactoring. I will work on improving the calibration and static alignment processes.

- **Progress since last week**
  I made changes to our poster to improve readability as well as adding the necessary content required by my part. I started refactoring our code to improve readability as well as to promote further development.

- **Any problems I encountered**
  The magnetometer data seems to be skewed. We are having trouble deciding on the data and format to be sent to the GUI.

Week 4 (Apr. 24 ˜ 28, 2017)

- **Plans for the coming week**
  Improve the calibration process and submit the final version of our project in terms of what will be graded. I need to submit my release form for expo.

- **Progress since last week**
  I met with our group to continue work on our solution and test it with the GUI. I made changes to our poster to improve grammar and adjust positioning of elements. We finished and submitted our poster

- **Any problems I encountered**
  Inconsistent calibration results and limited micro controller memory. Started using the Arduino IDE serial plotter for analyzing individual sensor data which has been insightful. We also need to perform physical tests on our system but we are having a hard time creating a plan of attack.

Week 5 (May. 1 ˜ 5, 2017)

- **Plans for the coming week**
  Research methods for improving data readings and sample selection. Work on the midterm progress report. We will be meeting with another team to review each others posters and give feedback.

- **Progress since last week**
  I was able to push a working version of our alignment solution. Submitted my release form for expo.

- **Any problems I encountered**
  When taking the offset using quaternions I found that the result was inaccurate while the quaternion was converging as a result of the filter algorithm. I tried to remove samples taken during the convergence period by analyzing the change of values over time. More work needs to be done to improve this process. Another problem I faced had to do with the error of individual samples. Even when the device was stationary, I noticed values spiking at times. I attempted to remove these samples by using a hard coded threshold that was determined heuristically. I'm not sure what the best approach would be at this current time.

Week 6 (May. 8 ˜ 12, 2017)

- **Plans for the coming week**
  We will meeting up to make some last minute changes with our project in terms of what will be displayed during expo.

- **Progress since last week**
  We have been having problems with the magnetometer data and poor readings. I'm not sure if I miss configured the device or am not performing sufficient calibration. Since expo is next week, we will explore a 6-axis filter instead of the 9-axis filter.

- **Any problems I encountered**
  Worked with Krisna to add the statistical confidence interval when finding the static offset. Our group met with another group to review each others posters and provide feedback. We started working on our midterm progress report.

Week 7(May. 15 ˜ 19, 2017)

- **Plans for the coming week**
  We will try to make plans to test our system.

- **Progress since last week**
  I finished my part of the midterm progress report. We met up to discuss our project to ensure we were all on the same page for expo. We built a simple demonstration system that could be manipulated during expo to help explain our project. EXPO!

- **Any problems I encountered**
  My audio input is not working so I had to meet up with Roger and use his laptop to record my presentation. Our system has yet to undergo the physical tests that are required before sending our results to RC. Since our system has yet to be tested, I realized late that our solution was not correctly checking for static offset. In order to make our solution work, we would have to move the HUD sensor from the IRU to the HUD and then take the difference. Our error was a result of testing our system on a with an aligned axis. What we were really detection was simple the sensor bias. Our false interpretation was reaffirmed because we were successfully taking the dynamic offset.

Week 8(May. 22 ˜ 26, 2017)

- **Plans for the coming week**
  I am planning on meeting with our group and getting in contact with our client. I'm also planning on working on our

final documents.

- **Progress since last week**
  Started working on our final documents.

- **Any problems I encountered**
  We were not able to meet this week so testing the system and contacting our client delayed.

- **If you were to redo the project from Fall term, what would you tell yourself?**
  First of all, I would tell myself to setup version control early and make use of the skills learned in my software development classes to promote collaboration and a sense of direction while building momentum as milestones were reached. Next, I would tell myself to utilize the availability of our clients by asking more questions when referencing the technical challenges of our project. Lastly, I would stress testing early; both physically and programmatically.

- **What is the biggest skill you've learned?**
  I think biggest skill I have learned would have to be the ability to work with sensors such as an accelerometer, gyroscope and magnetometer. I choose this because there was a lot involved. First, I had to learn how to configure devices by reading through the devices register mapping documentation. Next, I had to learn how to calibrate the devices by taking initial readings during setup, comparing them against factory defaults and storing the results in the appropriate registers or using that information to modify future readings. I also had to learn how communication between devices worked and why and how some devices should be configure as slaves or masters.

- **What skills do you see yourself using in the future?**
  Considering the shift towards the Internet of things, I can see myself working with multiple devices while facilitating the necessary communication for those devices in future work or even hobby projects.

- **What did you like about the project, and what did you not?**
  I liked that I was given an opportunity to work in an area I was not familiar with. I did not like how much work was required to catch up in understanding of particular topics when I would have rather been making significant progress towards a solution.

- **What did you learn from your teammates?**
  I learned additional interpersonal skills and strategies to overcome poor first impressions. My team also helped me to learn skills relating to latex and vpython.

- **If you were the client for this project, would you be satisfied with the work done?**
  I would have liked to see a better solution but I believe the documented requirements have been met.

- **If your project were to be continued next year, what do you think needs to be working on?**
  Memory considerations when analyzing sensor output. Improve calibration of sensors then test against documented hardware error tolerance specifications. Magnetometer considerations. Physical tests against filtered quaternion output and the resulting offset with static values. Look into physically testing dynamic values. Research methods to handle drift such as resetting to a known reference then finding ways to physically test against under expected conditions.

C. Krisna Irawan (Spring 2016)

Week 1 (Apr. 3 ~ 7, 2017)

- **Plans for the coming week**
  We are planning to set up a meeting with our clients. We are planning to work together on our project this weekend. Hopefully we can finished up our project before week 3.

- **Progress since last week**
  We know the schedule for the class this term. We know our plan for this term.

- **Any problems I encountered**
  To connect the statistical analysis portion, I need the data from the offset algorithm. Our team still working on the offset algorithm.

Week 2 (Apr. 10 ~ 14, 2017)

- **Plans for the coming week**
  We are planning to finished up the poster. We also planning to meet up with other groups to do the extra credit for this class.

- **Progress since last week**
  We meet with the TA and talk about our current state and where we are heading next.

- **Any problems I encountered**
  We are not able to do much work this week.

Week 3 (Apr. 17 ~ 21, 2017)

- **Plans for the coming week**
  We are planning to finished up the project this week. We are hoping to get the poster signed by our clients this week.

- **Progress since last week**
  We the poster feedback from our TA, we will incorporate that feedback to our poster. We are almost done with the project. We take care of the algorithm and reading from 2 sensors.

- **Any problems I encountered**
  We found a language called vpython that will help us to create the 3d simulation of the HUD. We are still learning about this language.

Week 4 (Apr. 24 ~ 28, 2017)

- **Plans for the coming week**
  Set up an interview for the WIRED style review. Finished up the WIRED style review.

- **Progress since last week**
  I finished making the 3d simulation and convert the statistical analysis portion to python.

- **Any problems I encountered**
  We have to wrap up our project before the code freeze on May 1st. We will be working hard this weekend.

Week 5 (May. 1 ~ 5, 2017)

- **Plans for the coming week**
  Start to work on the midterm progress report. Finishing the hardware user interface setup.

- **Progress since last week**
  I finished the WIRED style review assignment.

- **Any problems I encountered**
  We have a busy schedule this week, we will work on the project on the weekend.

Week 6 (May. 8 ˜ 12, 2017)

- **Plans for the coming week**
  Do our best in the expo. Finished the midterm progress report.

- **Progress since last week**
  We do the extra credit assignment. We are almost done with the midterm progress report.

- **Any problems I encountered**
  We need some time to debug our code, especially, the Yaw value for the calculation.

Week 7(May. 15 ˜ 19, 2017)

- **Plans for the coming week**
  Start to work on the final documentation of the project

- **Progress since last week**
  We successfully finished the expo!

- **Any problems I encountered**
  We work hard to get our project done for the expo. We finally get it done!

Week 8(May. 22 ˜ 26, 2017)

- **Plans for the coming week**
  Start to work on the final documentation of the project. I have to work on the three small writing assignment that our instructor gave to us.

- **Progress since last week**
  We went to the final class this week. We knew what we have to do for the rest of the term.

- **Any problems I encountered**
  We did not have a chance to meet this week except during class time.

- **If you were to redo the project from Fall term, what would you tell yourself?**
  Start early, get closer to the client before hand.

- **What is the biggest skill you've learned?**
  I learn about Arduino IDE and how sensors work.

- **What skills do you see yourself using in the future?**
  Working with IMU.

- **What did you like about the project, and what did you not?**
  We have an amazing clients that really supportive. I like to visualize the plane movement on the user interface. I have

a hard time learning about quaternion.

- **What did you learn from your teammates?**
  I learn a lot about IMU and Arduino IDE from my teammates.

- **If you were the client for this project, would you be satisfied with the work done?**
  Honestly, I think there is some part that we can improved on. Overall, I think we meet the requirement that our clients gave.

- **If your project were to be continued next year, what do you think needs to be working on?**
  Solve the drifting yaw angle. Also, improve on the accuracy of the algorithm and sensors.