ECE 490: Deep Dive

Daylen Mackey

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1 BACKGROUND

Milky Way Solutions has been tasked with developing the first prototype of the X-Calibrator: A device capable of calibrating Dose Calibrators in clinics across the world, while being sturdy enough to withstand the rough contact that comes with international shipping. Dose Calibrators are large, stationary instruments used to measure the concentration of a radioactive sample [1]. This prototype needs a touchscreen for user interaction, a single mains power, and a tough exterior casing. Samples will be put in the portable ion chamber, and small resulting currents are measured using the Dose View Electrometer (DV). A Raspberry Pi will be responsible for coordinating all actions, gathering data from the Temperature/Pressure probe, and outputting the relevant data.

Due to the complexity of our project, I have broken down my area of contribution as follows:

1) **Interface the Raspberry Pi with the touchscreen**
2) **Create a User Interface for the touchscreen**
3) **Build out a Back End on the Raspberry Pi that:**

   a) Allows touchscreen inputs to send out commands to the DV
   b) Calculates Current, Temperature/Pressure correction factors, calculates the amount of a given radioactive sample
   c) Stores measurements and calculations internally with an option to write to an external USB.

All these will be addressed below.

2 NOMENCLATURE:

R-Pi: Raspberry Pi
UI: User Interface
DV: Dose View Electrometer:

3 DEEP DIVE

3.1 Interface the Raspberry Pi with the touchscreen:

This is the least challenging of the tasks. To validate initial ideas, we found other students with R-Pi compatible touchscreens, so we could begin testing. These smaller and cheaper screens (3.2 inch and 4inch Waveshare) required installation of a special driver on the pi, HDMI connections, and 8 pin connections [3] . After discussing parts with our client, we've decided on the 7 inch WVGA Multitouch [4].
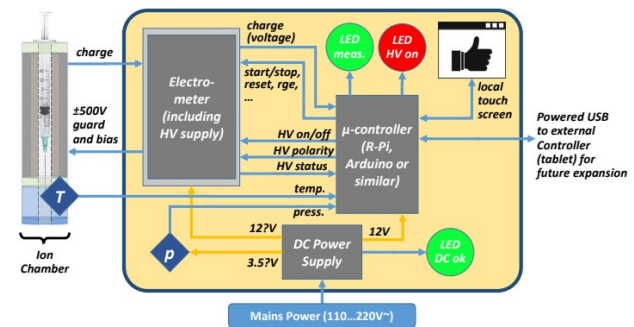

Fig. 1. High Level Schematic of the X-Calibrator [2]

This touchscreen is larger, has a greater resolution of 800 x 480 and should be faster (doesn't need another driver). Another reason for selecting this screen is the large number of open source projects using the screen. [5], [6] . While this isn't exactly a proof of concept, it gives me much more confidence that we can successfully interface the screen as others have already done so. It could also provide us with guidance should we encounter any issues.

3.2 Create a User Interface for the touchscreen

Much discussion went into the design of the user interface. Our client provided us with a basic layout of what he wanted, but the complexity came in choosing the frameworks to use. Because I was confident I would be able to build a simple UI quickly, I began prototyping with HTML, CSS, and JavaScript. As of writing this, the GUI is approximately 75% completed. All that is left to add is a " popup" number pad so that users can enter values using the touchscreen (you currently need a keyboard). The GUI does not look very good right now (it is simplistic and static), but I built it for 2 reasons:

1) It did not require any special hardware to build, so I could begin assembling it during my free time

2) Even if the current version is not the one that's used throughout the project, it gives us something to test once our hardware does arrive.

Further integration of Node JS and Electron JS would allow for a 'sleeker' look, as well as increased functionality and communication with the back end. These two frameworks are commonly used, and could facilitate future expansion efforts.
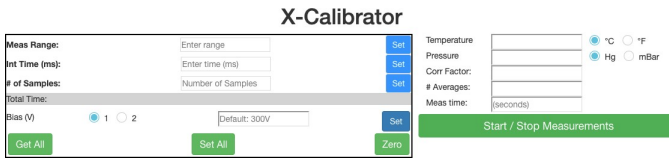
Fig. 2. User Interface Prototype Version 1

Over Christmas break, I intend to build a similar GUI system using Python Tkinter frameworks as well [7] . This may make connecting the front end to the back end systems simpler. If we were on a tighter timeline, I would not go forward with both options. However, since these tasks are not too time-consuming, and we don't have other hardware to work with, I figured I would do both.
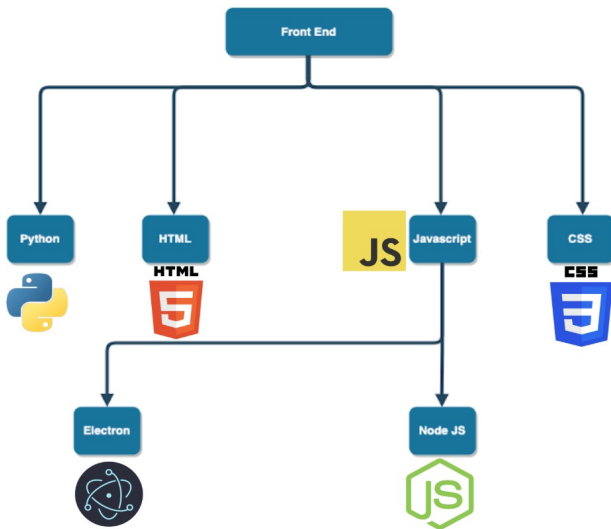

Fig. 3. Overview of frameworks used to build the Front End

3.3   Build out a back end on the Raspberry Pi

3.3.1   Allowing touchscreen inputs to send out commands to the Dose View Electrometer

This task will likely be the most challenging. To complete this task, we need to be able to take the user inputs from the front end, interpret them in the back end, and send off the appropriate commands to the DV. This is challenging because the DV's code base is written in MATLAB, and MATLAB can't be run on a R-Pi. We initially wanted to use Python as our primary language for the back end (for reasons of simplicity and familiarity), but because of the large number of frameworks in use, we need to be flexible. We have considered several approaches for this:

1) Convert all the MATLAB code to Python

This consideration is inefficient and unappealing. Our client spent a lot of time developing the existing code base because the DV's communication protocol is so complex. While adjustments will be necessary, we hope to use what he has already given.

2) Use Octave

Octave is a MATLAB-like program that can be run on an R-Pi. It is compatible with most simple MATLAB scripts

as long as they don't use some of the newer, more complex MATLAB libraries [8] . The idea behind this approach is that we will use import user inputs into our back end language (Python), then pass those values to our octave program. We have already tested our MATLAB code base with Octave, and the two are compatible. That being said, we haven't tried using Octave directly with the DV yet. We plan to begin testing with Octave on a PC, then try through the R-Pi. The reason for this is that the DV requires a special driver that's currently only available for Windows and Mac. By testing on the PC first, we can identify if Octave is the problem, before implementing the new driver. We have found several resources that successfully modified the driver, so we believe we'll be able to implement this successfully [9] .

Another upside of using Octave, is access to the Pythonic library. [10] This library allows you to call and create Python objects, within Octave. The plan has always been to only use Octave when communicating with the DV, but this opens new possibilities. The majority of the back end could potentially be built in Octave, and we could use Pythonic when needed. While we don't plan on taking this approach, it serves as a promising backup.

3.3.2   Calculations (Current, Temperature/Pressure correction factors, and concentration)

This is one of the simpler tasks. Our client has provided us with all the formulas necessary, we just need to implement them in the code. With python libraries like Math, Pandas, and NumPy, implementing these formulas (even with larger scale data sets) will not be challenging.

Because we want the prototype to work for many different radioisotopes, we need to have attributes of each isotope stored on the system. We initially thought this may require the creation of an SQL database, but we should be able to store the data in a Pandas dataframe.
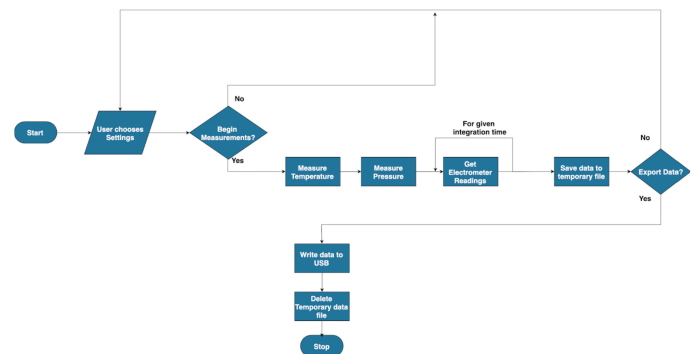
Fig. 4. Flow Chart of Back End Procedures

3.3.3   Storing data internally with an option to write to an external USB

This has been a fairly last-minute addition to the project. The initial plan only included saving the information internally, and maybe displaying it as an onscreen popup. Even for a minimum viable product though, this solution is unimpressive. In the last few weeks I came up with the idea of adding USB writing capability. The results will be logged internally

initially, but once the user is ready to export all the data, the data will be exported as a csv (commonly used for excel) or txt file on to the USB. Upon exporting, the data should be cleared from internal memory. Writing to an internal file or USB will not require additional frameworks, just the file path of the system.

4 CONCLUSION

Over the course of this semester, I have learned a great deal about the design process, and how complex things can be become. When I first looked at this project, I believed it would be simple to implement. However, the more I learn about the project, the more challenging it seems. As it currently stands, I believe I will be able to complete my tasks. However, there are still many unknowns. Because we are relying on the DV, we also need to rely on the driver associated with it. Despite these potential setbacks, I am excited to get start building the X-Calibrator, and I am confident that our final product will meet our client's needs.

REFERENCES

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[10] "Pythonic Documentation." [Online]. Available: https://wiki.octave.org/Pythonic

Weekly Report for <u>2019-12-08</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	Test Octave functionality with the Electrometer	In Progress
2	Figure out how to dual-interface Python with Octave	In Progress
3	Meet as a group to discuss our final report	Completed
4	Finalize the Parts list for order	Completed

<u>Goal 1 & 2</u>

No real progress was made on these two goals as the main focus of the week was finalizing our PowerPoint and rehearsing for our presentation. Last week, I learned about a library called 'Pythonic' that allows you to create and call python objects inside Octave. I discussed the possibility of using this approach with the team this week, and I received no objections.

<u>Goal 3</u>

We met as a group on Friday and determined we would take a similar approach to the Final Report as we did with our Straw Man proposal (structure wise). We discussed how it was absolutely necessary to include citations, and the best elements from our presentation. This would include an adjusted Gantt chart, and greater consideration for how many <u>hours</u> each task will take. Dr. Barlage provided very valuable feedback in his feedback email, and after the presentation – we plan to integrate all that advice into our final report.

<u>Goal 4</u>

The group met Friday afternoon to finalize plans for our parts list. This was largely complete, but our client had some suggestions for us after watching the presentation. The suggestions and decisions are summarized below:

> **Suggestion:** Upgrade from a 7-inch touchscreen to a 10-inch touchscreen with greater resolution.
> **Decision:** We decided against this upgrade largely due to the price difference. The link the client sent us was not in Canadian dollars, so the price difference was actually $80 instead of the $20 difference he initially thought. This $80 increase put us uncomfortably close to our max budget,

so we decided against it. The improvements in resolution and size are not worth the price increase when future purchases may still be necessary.

Suggestion: Find a new power supply with a faster shipping time.
Decision: This was a great catch by our client. We found a different power supply ([The TPP 30-105-J](#)) with identical functionality that would be ready to ship immediately.

Suggestion: Upgrade from Raspberry Pi 3B+ to the Raspberry Pi 4B.
Decision: The group doesn't think this change is needed or very significant, but we recognize our client is trying to "future-proof" his prototype. We decided to move forward with the upgrade because the price change is not very significant ($20 dollar increase), and we still have a Raspberry Pi 3B as backup if we have any compatibility issues.

Evaluation from last week:

This last week was incredibly productive. The group really came together for our final presentation, and I think we knocked it out of the park. While there is still room for improvement, this puts the group in a strong position heading into the final report. We are still within the budget, and we have a great idea of what we need to do next semester.

Goals next week:

Heading into Christmas break I have set some personal goals for myself to complete before next semester:

- Finish constructing the GUI with the added number pad option
- Create a simple GUI with Python and TkInter frameworks

- All the "In Progress" goals in the table above remain.

Concerns: None

Weekly Report for <u>2019-12-01</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	GUI (Graphical User Interface) Construction	Completed
2	Test Octave functionality with the Electrometer	In Progress

3	Figure out how to dual-interface Python with Octave	In Progress

Goal 1

Although not explicitly marked as a goal, in last week's report, I mentioned that I wanted to have a working GUI demo for our client meeting. I was able to meet that deadline and presented a functionally demo modelled after the client's specifications. He provided some feedback regarding the layout (button configuration) and pointed out some possible additions moving forward. All in all, it was a positive interaction

Goal 2

Because we struggled to get the electrometer working this week, we did not get around to testing it with Octave instead of MATLAB. That being said, we were able to run the code independently on Octave. This is very promising, as we now know we don't need to convert the entire 1000-line codebase from MATLAB to another programming language. The one issue I see moving forward is that we will need to find a special driver to allow the Linux system on the Raspberry Pi to communicate with the electrometer. We have found some solutions online, but we have not tested them yet.

Goal 3

I have found some suggestions online, but I have not tested anything yet. This goal is a very important one for our project, but it will require more familiarity with Octave first. The 'mlabwrap' would let us pass python values and arrays to MATLAB (which would be a good starting point), but the end goal is to directly use Octave. There is also a small project still in development called "Pythonic." Pythonic is an Octave package that lets you call any python function from Octave. Using this would mean the majority of our functional code would be written in Octave rather than Python, but it does present some interesting possibilities.

Evaluation from last week:

This week was quite busy with finals and end of term reports, but our term found the time to meet on several occasions. Some important accomplishments worth mentioning:

- We met with Dr. Barlage and found a safe place to store the Electrometer
- We met with the client and readjusted the MATLAB code, and got the Electrometer measurements working again

In the group meetings, we discussed what direction to take our Capstone presentation, and which member is assigned with what task. We haven't coordinated a practice run yet, but our presentation is Tuesday at 6. We have nearly finalized the parts list, and we still have $100 dollars leftover. We thought it would be a good idea to give the group some financial leeway since there may be some necessary additions to the project like a fan to prevent overheating.

Goals next week:

Final Exams are coming up shortly, so Capstone will not be our main focus

- Meet as a group to discuss our final report

- Finalize the Parts list for order

- All the "In Progress" goals in the table above remain.

Concerns: None

Weekly Report for <u>2019-11-25</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	GUI (Graphical User Interface) Construction	In Progress
2	Develop a plan for implementing a command interface.	Abandoned

Goal 1

GUI construction has been largely delegated to me. Over the last two weeks, I've learned how to use Electron.js, and started building the frontend of the GUI. My personal goal is to have a frontend demo ready for our next client meeting (2019-11-27). I am about 3/4 of the way there.

Goal 2

Our client has identified this as a stretch goal, and most likely, something to be implemented in later product iterations.

Evaluation from last 2 weeks:

Even though the "Goals From Last Week" portion don't show it, the last two weeks were very productive.

At the beginning of reading week, we met with our client. He quickly reviewed what he's hoping the final product will look like, then pulled out the electrometer. He showed us his MATLAB codebase, and how to use it with the electrometer. We successfully ran a few tests using our own computers just in case. We started a documentation document for the electrometer, so each member could review/revisit the code as it changes, what each function does, and a general protocol for operation.

We also discussed if the probes and power supplies we were initially considering would be good enough for the project. Our client gave us approval to go forward with the Adafruit BME280 Temperature Humidity Pressure Sensor. Power supplies are still in discussion.

This project heavily relies on the Raspberry Pi. MATLAB can't be run on a Raspberry Pi, so we were a little uncertain how to get around this. We initially considered using executable files, and converting the code to python (either ourselves, or through online libraries). The second option would've been incredibly tedious as our codebase is already more than 1,000 lines long. Luckily, we learned of a software called "Octave" that can be run on Linux. It's compatible with most MATLAB scripts, so we're hoping we can use this moving forward. This also presents another challenge: Figuring out how to tell the PI to use Octave scripts at some points, and Python scripts during others. It could be simple, but it could also involve more complex topics like concurrence.

At the time of writing this, I have familiarized myself with electron.js, and I am about 3/4 done constructing the initial frontend. While this progress is significant, developing the backend will be the most challenging aspect.

Goals next week:

- Test Octave functionality with the Electrometer

- Figure out how to dual-interface Python with Octave

- All the "In Progress" goals in the table above remain.

Concerns: None

Weekly Report for 2019-11-11

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	Research picoamp current sources for purchase.	Completed
2	Test the Raspberry Pi and touchscreen for compatibility	Completed

Goal 1

We have received final confirmation from Dr. Barlage that we can use his device to generate picoAmp currents.

Goal 2

This week, I used the Raspberry Pi and Touchscreen I have at home to begin testing. Preliminary tests were simply, but effective. I started by connecting the two, and just seeing if the two were compatible. From there I went on to test several programs, the command line, and a simple custom GUI.

Evaluation from last week:

This week, the group focused on creating our "Project Pitch." This process was our first real test of teamwork, and I think it went very well overall. There were a few moments of conflict, but we were able to resolve them effectively. It also helped reinforce each member's role within the group. Learning to explain the project in simpler terms helped us better understand each task within the project.

Goals next week:

- Begin building the custom GUI to meet client specifications. No functionality needed, but have everything wireframed, and have a similar layout.

  o Test with both Python and JavaScript frameworks

- Develop a plan for implementing a command interface.

- All the "In Progress" goals in the table above remain.

Concerns: None

Weekly Report for 2019-11-04

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	Start developing sub-groups for our team based on specialties and tasks members may accomplish	Completed
2	Research picoamp current sources for purchase.	In Progress
3	Talk to Dr. Barlage about using the picoamp current source in his lab for testing purposes.	Completed

| 4 | Meet within 1-2 days of our client meeting to discuss and solidify plans moving forward | Completed |
| 5 | Continuous improvement of our proposal | Completed |

Goal 1

After meeting with our client this week, we have a much better understanding of his goals, and milestones. This made assigning tasks much simpler. Tony and Ion will be responsible for integration of the Ion Chamber and Sensors, Leo is responsible for the Electrometer and the Power Supply, and I will take lead on the Raspberry Pi Controller and Designing the custom GUI for our touch screen. Some tasks may be easier than others, but there is a lot of work to go around – if one person finishes their task early, there are other tasks to complete.

Goal 2

This goal is likely to be abandoned next week. We just need to make sure Dr. Barlage's current source satisfies necessary specifications (at initial glance, it will).

Goal 3

During the meeting with our client, Dr. Barlage confirmed that an instrument in his lab would satisfy the requirements for our reference picoAmp current source.

Goal 4 & 5

We held a teleconference to go over what was needed four our Straw Man proposal, and our client meeting.

Evaluation from last week:

This week, we submitted our straw man proposal, and met with our client and Dr. Barlage. I believe our straw man proposal could be much better, especially after meeting with our client (he was clearer with his expectations for the project). We have been working on the project Pitch/Presentation, which has also helped us develop a better understanding of our project, and how to engineer it. Trying to explain complex topics in a simple manner has been eye-opening, as we need to truly understand each component, and how it works to communicate effectively.

Goals next week:

- Test the Raspberry Pi and touchscreen for compatibility

- All the "In Progress" goals in the table above remain.

Concerns:

Weekly Report for <u>2019-10-28</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goal #	Goal	Status
Goals From Last Week (including goals carrying over from weeks prior)
1	Start developing sub-groups for our team based on specialties and tasks members may accomplish	In Progress
2	Research picoamp current sources for purchase.	In Progress
3	Coordinate a meeting date with our client for the end of the month.	Completed
4	Talk to Dr. Barlage about using the picoamp current source in his lab for testing purposes.	In Progress

Goal 1

We are at the same stage for this goal as we were last week. As we progress through the straw man report, we are getting a better idea of what is needed to bring this project to life. As a result, we are also developing a better understanding of each member's roles.

Goal 2

We have been looking at picoamp current sources for purchase offered through online distributors/manufacturers such as Texas Instruments. This may be an unnecessary pursuit, and may be abandoned in the coming weeks.

Goal 3

We scheduled a client meeting with Dr. Barlage, and our client. Topics discussed will include, IP, an NDA, and overall project design.

Goal 4

Dr. Barlage has given us the go-ahead to use his equipment, we need to confirm the functionality though.

Evaluation from last week:

This week was very busy as 3 of the 4 members had 2 or more midterms. I was unable to attend this week's lab meeting, but I called in from the airport to listen. Our group scheduled another teleconference in which we discussed our strawman proposal -- it was a highly productive meeting, and I'm confident we can do some great things moving forward. We also coordinated a meeting with our client and Dr. Barlage to meet and discuss some topics that we are not well versed in (IP and NDAs).

Goals next week:

(Many of us have midterms over the next few weeks, so we don't expect to spend too much time on Capstone)

- Continuous improvement of our proposal

- Meet within 1-2 days of our client meeting to discuss and solidify plans moving forward

- All the "In Progress" goals in the table above remain.

Concerns:

Weekly Report for <u>2019-10-21</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	Start developing sub-groups for our team based on specialties and tasks members may accomplish	In Progress
2	Research picoamp current sources for purchase.	In Progress

Goal 1

We are at the same stage for this goal as we were last week. We have a general understanding of what each member's roles will be, but will have more set ideas once we begin design.

Goal 2

We have been looking at picoamp current sources for purchase offered through online distributors/manufacturers such as Texas Instruments. (See "Evaluation from last week" for more details)

Evaluation from last week:

With more midterms this week, the group did not make an impressive amount of progress. We did however continue communications with our client, and look to schedule another meeting for the end of the month. Ian managed to make time to go to our client's seminar, and apparently learned quite a bit. Ian plans to tell us about it Monday.

Our client purchased 2 Terra-Ohm resistors, and will use these to try and build a reference current source. We are not sure how noise will impact the result, but it will be an interesting experiment.

Goals next week:

(Many of us have midterms over the next few weeks, so we don't expect to spend too much time on Capstone)

- Coordinate a meeting date with our client for the end of the month.
- Talk to Dr. Barlage about using the picoamp current source in his lab for testing purposes.
- All the "In Progress" goals in the table above remain.

Concerns:

Weekly Report for <u>2019-10-15</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	Narrow idea list down to 5 strong ideas	Abandoned
2	Rank list of potential clients	Abandoned
3	Start developing sub-groups for our team based on specialties and tasks members may accomplish	In Progress
4	Host a "brainstorming" session to develop a rudimentary idea on how to complete this project	Completed

Goal 1 & 2

These two goals were abandoned as we have decided to pursue the "Ion Chamber Calibration Device." Dr. Barlage has provided us with final confirmation.

Goal 3

Now that we have a better understanding of the project, we have started assigning group members to tasks. This project would not involve as much hardware design as we initially thought, so Leo may end up working with Ian on designing/identifying a usable picoamp current source.

Goal 4

After meeting with the client on Monday, our team met on Tuesday to discuss possible plans. (See "Evaluation from last week" for more details).

Evaluation from last week:

We met with our client for the first time on Monday and had a very positive experience. Dr. Jans is an incredibly bright, passionate, and organized client. After the client meeting, and team discussion on Tuesday, we wholeheartedly believe we can bring this project to completion, and potentially reach some of his stretch goals.

The biggest challenge may be implementing a picoamp current source. Our client initially discussed the idea of using a simple Tera-Ohm resistor, but we believe there will be far too much noise to make any accurate measurements. Dr. Barlage believes it's possible to construct, admits it would be incredibly challenging. Our Technical Mentor (Saeed Ansari) suggests purchasing the current source instead of trying to build it. He believes designing and building a picoamp current source to be more similar to a PhD project as opposed to a capstone. Saeed also spoke with another Integrated Circuits PhD, who also suggests the same thing.

If we are not able to purchase/create a picoamp current source, we will probably proceed with the controller portion of the project, and not include the measurement component.

Goals next week:

(Many of us have midterms over the next few weeks, so we don't expect to spend too much time on Capstone)

- Begin researching picoamp current sources for purchase.
- All the "In Progress" goals in the table above remain.

Concerns: Our project includes the use of 400 V supplies. I find this frightening. I hope Barlage will host a lecture on how to handle high voltage power supplies.

Weekly Report for <u>2019-10-06</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	Goal	Status
1	Narrow idea list down to 5 strong ideas	In Progress
2	Rank list of potential clients	In Progress
3	Make contact with the potential client	Completed

4	Start developing sub-groups for our team based on specialties and tasks members may accomplish	In Progress
5	Create a group github	Completed
6	Decide whether or not to contact Levven Controls about potential projects.	Completed

Goal 1 & 2

Progress on these two goals were halted as we pursued the biomedical project mentioned in class. These goals are likely to be abandoned by next week's report if the client meeting this week goes well.

Goal 3

We emailed our client on Monday and received a very positive response. Several emails followed coordinating a meeting time. Our group is scheduled to meet Monday October 7th at 10 AM.

Goal 4

We a decent understanding of the roles each member will take, but without complete understanding of what the project entails, it tough to make concrete decisions. We hope to have a better understanding of our roles after the meeting with our client.

Goal 5

I created a group github repo. I am not sure how much it will be used, but it could come in handy. It costs nothing, and may prove valuable later, so implementation seemed worthwhile.

Goal 6

After learning about the team's motivation to pursue the "Ion Chamber Calibration Device" project, we decided it would not be necessary to contact Levven.

Evaluation from last week:

With midterms looming, there was not a lot of time for group to meet and discuss. We were able to discuss options through slack, and whenever classes overlapped.

Scheduling time to meet with our client was challenging. All four of us have different schedules, and midterms approaching. We were however able to find a time that worked for all of us.

Goals next week:

(Many of us have midterms over the next few weeks, so we don't expect to spend too much time on Capstone)

- Host a "brainstorming" session to develop a rudimentary idea on how to complete this project
- All the "In Progress" goals in the table above remain.

Concerns: None

Weekly Report for <u>2019-09-29</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang (Tony) Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	Narrow idea list down to 5 strong ideas	In Progress
2	Rank list of potential clients	In Progress
3	Make contact with the potential client	In Progress
4	Learn more about the biomedical project	Completed
5	Start developing sub-groups for our team based on specialties and tasks members may accomplish	In Progress

<u>Goal 1 & 2</u>

Progress on these two goals were halted as we pursued the biomedical project mentioned in class.

<u>Goal 3</u>

We reviewed all the projects on the list and decided we should contact the client to learn more about the project. An email has been drafted and will be sent out Monday morning.

<u>Goal 4</u>

With the client list being posted this week, we were able to learn more about the "Ion Chamber Calibration Device." We researched how Ion Chambers work, and how to integrate one into our project. In addition, we also found the client's patent. This gives us a better idea of what his goals are, and the direction he wants to take this project in.

<u>Goal 5</u>

We have made progress on this goal since last week, but it is not finalized yet. With a better understanding of our potential project, role designation is a bit easier. While we are still determining roles, we understand Leo and Tony will take lead on the power component of the project as they are the most experienced in that area.

Evaluation from last week:

This last week was exciting because the client list was released, but the biomedical project was not what we envisioned. The technology is exciting, but it does not give our group the chance to specialize in the manner we hoped. We have not finalized which project we will pursue but hope to soon.

Our first meeting with our project manager went well, but we did not discuss details in too much depth as the client list had just been released.

Goals next week:

- Email the Client behind the "Ion Chamber Calibration Device"
- Create a group github
- Decide whether or not to contact Levven Controls about potential projects.
- All the "In Progress" goals in the table above remain.

Concerns: None

Weekly Report for 2019-09-23

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang Yang, Ian Then

Progress this week:

Goals From Last Week (including goals carrying over from weeks prior)		
Goal #	**Goal**	**Status**
1	Narrow idea list down to 5 strong ideas	In Progress
2	Rank list of potential clients	In Progress
3	Create a *Trello* for task delegation	Completed
4	Make contact with the potential client	In Progress
5	Learn more about the biomedical project	In Progress
6	Start developing sub-groups for our team based on specialties and tasks members may accomplish	In Progress

Goal 1 & 2

Progress on these two goals were halted as we pursued the biomedical project mentioned in class.

Goal 3

We made a Trello account this week to aid with task management and planning. It appears to be a good application, but we're not sure if it is necessary yet.

Goal 4 & 5

As I am writing this, the client list has not yet been released, so we have not contacted them. Adding these goals this early on into the schedule may have been a bit ambitious. We've have taken additional steps to learn about the project through Dr. Barlage (described in evaluation).

Goal 6

We have not finalized group member specialties yet, but we have an approximate understanding of what each member's role will be. Leo will handle complex hardware, Tony will be in charge of the communications aspect of the project, Ian will be largely responsible for developing methodologies and researching accurate techniques for radioisotope measurement, and I will be responsible for most of the codebase.

Evaluation from last week:

We did not hit all of our milestones, but we still found some success. The trello account was created, we developed a better understanding of our roles within the group and settled on Tuesdays as our dedicated day to meet with our manager. Leo had the biggest breakthrough when he suggested the possibility of using a *scintillator* to pick up the radioisotope. The scintillator will emit a light in response, that an avalanche photodiode would be able to pick up. The specifics of this technique are still vague, but it seems promising.

Goals next week:

- Learn more about the efficacy of using a scintillator as a measurement device and how to integrate it into our device.
- All the "In Progress" goals in the table above remain.

Concerns: None

Weekly Report for <u>2019-09-16</u>

Student Name: Daylen Mackey (1444775)

Group Name: Milky Way Solutions

Group Members: Leo Marroquin, Jia Xiang Yang, Ian Then

Progress this week:

Goals From Last Week		
Goal #	**Goal**	**Status**
1	Narrow idea list down to 5 strong ideas	In Progress

2	Rank list of potential clients	In Progress
3	Create a *Trello* for task delegation	In Progress
4	Create a *Slack* channel for group communication	Completed
5	Finalize a 4th group member	Completed

Goal 1 & 2

Progress on these two goals were halted as we pursued the biomedical project mentioned in class.

Goal 3

We have not created a *Trello* yet. Since we are still working on delegating roles, missing this milestone is not damaging. The *Slack* channels have served us well, so this goal may be abandoned if deemed unnecessary.

Goal 4

A general *Slack* channel was created for our group. Several sub-channels have also been created to discuss potential ideas, names, and task delegation.

Goal 5

Ian Then was added to the group.

Evaluation from last week:

We did not hit all of our milestones, but I am not concerned. When we learned about the opportunity to aid an external client with a biomedical project, the group shifted their focus towards that goal. We met as a group to make sure each member would be happy pursuing this, then contacted Dr. Barlage to ensure he was also aware of our excitement, and motivation. I see this as a great first step for the team.

Goals next week:

- Make contact with the potential client (may not be possible)
- Learn more about the biomedical project (potentially through their patent or a brief summary)
    - Learn which radioisotope(s) we would be measuring
- Start developing sub-groups for our team based on specialties and tasks members may accomplish (groups may change with time)

Concerns: None

Weekly Report for 2019-09-09

Student Name: Daylen Mackey (1444775)

Group Name: TBD

Group Members: TBD

Progress this week:

- Selected 3 potential group members
  - Leo Marroquin
  - Jia Xiang (Tony) Yang
  - Ian Then
- Had a round table meeting with potential members
  - Discussed project ideas
  - Reviewed each member's strengths and weaknesses
  - Created a list of potential clients to pitch to

Evaluation from last week:

As this was the first week, we didn't come in with any concrete goals. We are making good progress, but I would like to see more novel and potentially patentable ideas on our list next week.

Communication between team members is strong, but we need to be more disciplined moving forward.

Goals next week:

- Finalize a 4th group member
- Narrow idea list down to 5 strong ideas
- Rank list of clients
- Create a *Slack* channel for group communication
- Create a *Trello* for task delegation

Concerns:

There are no concerns at this time, only eagerness to begin.