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***EE 4910 WEEKLY REPORT: 2***

***2/18/2026 – 2/24/2026***

***Group number: 06***

***Project title: Developing a Cost Effective NIR VIS Spectrometer***

***Client &/Advisor: Avishek Das & Manojit Pramanik***

***Team Members/Role: Ryan Majstorovic, Evan Tamer, Dawson Posekany, Samar Gill***

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**Weekly Summary**

This week, we began by meeting with Avishek to conduct a thorough review of our PCB design. We went through the design carefully to verify that everything aligned with our project requirements and specifications, and after confirming it was ready, we received Avishek's final approval. With that milestone cleared, we moved forward and placed the order for the PCB. Alongside it, we ordered four microcontrollers so that each team member will have their own unit to work with, allowing us to all develop and test code independently without bottlenecks.

A significant portion of our meeting was dedicated to getting everyone up to speed with the development environment. We walked through the setup process for STM32CubeIDE together, making sure the toolchain was properly configured and that we all had a working baseline to build from. As part of that, we explored the CubeMX GUI, which provides a visual representation of the microcontroller's pinout and makes it much easier to configure peripherals and manage pin assignments without having to dig through datasheets manually. This will be a valuable tool as we continue building out the firmware side of the project.

We also turned our attention to the optics portion of the spectrometer. We reviewed the components we'll need and ran some tests using materials available in the lab to evaluate whether they could serve our purposes. Unfortunately, the parts we tested weren't quite the right fit for our design requirements, so we won't be moving forward with those. Avishek confirmed that he will handle ordering the correct replacement components, so that side of the project should be back on track shortly.

Another key topic we covered was timing. Given the nature of our CCD-based detection system, precise timing control is critical, and we spent a good amount of time discussing the timing requirements we'll need to meet. This is something we'll be working through in more depth over the course of the week as we get deeper into the firmware and signal processing side of things.

To close out the meeting, we aligned on our priorities going into next week. The main focus will be ensuring that every team member has their STM32F411CEU6 microcontroller in hand and is ready to begin hands-on programming work, so we can hit the ground running as a full team.

## Past week accomplishments

Samar and Dawson prepared for and met with Dr. Kim, an EE professor with a specialization in optics. We reviewed the information that we covered in our previous meeting at the ASC (seen below) and researched the theory of diffraction gratings to better understand how its parameters affects the CCD's absorbance and the required size of the optical system. Evan downloaded the STM32CubeIDE and looked at the MCU datasheet to gain a better understanding of how to program the MCU. Details about the timers were also discussed with Avishek, seen below.

(A) Timer CLK =  $\frac{APB\ timer}{(PSC + 1)}$

$PSC = 0 \Rightarrow \text{Timer CLK} = \frac{20\text{MHz}}{0+1} = 20\text{M}$

(B) Desired freq (2 MHz) =  $\frac{\text{Timer CLK}}{(ARR + 1)}$

$ARR + 1 = \frac{\text{Timer CLK}}{2\text{M}}$

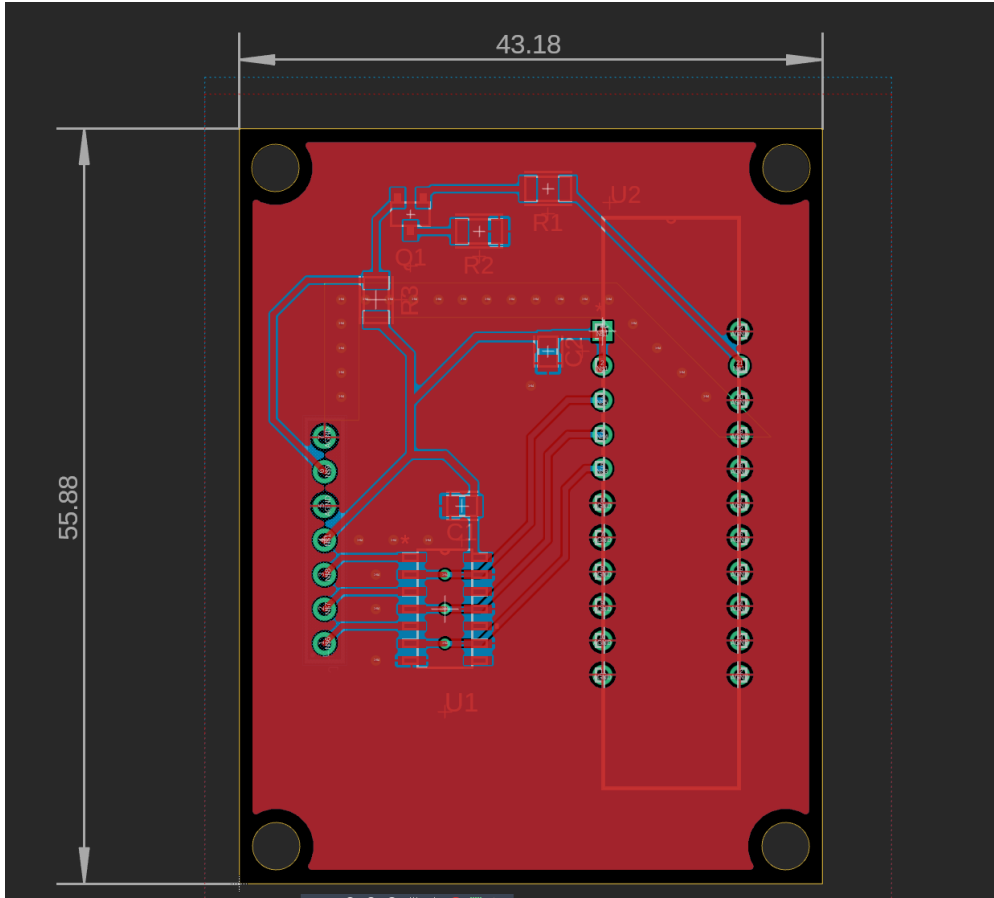
$ARR = \left( \frac{\text{Timer CLK}}{2\text{M}} - 1 \right)$

$= \frac{20\text{M}}{2\text{M}} - 1 = 10 - 1 = 9$

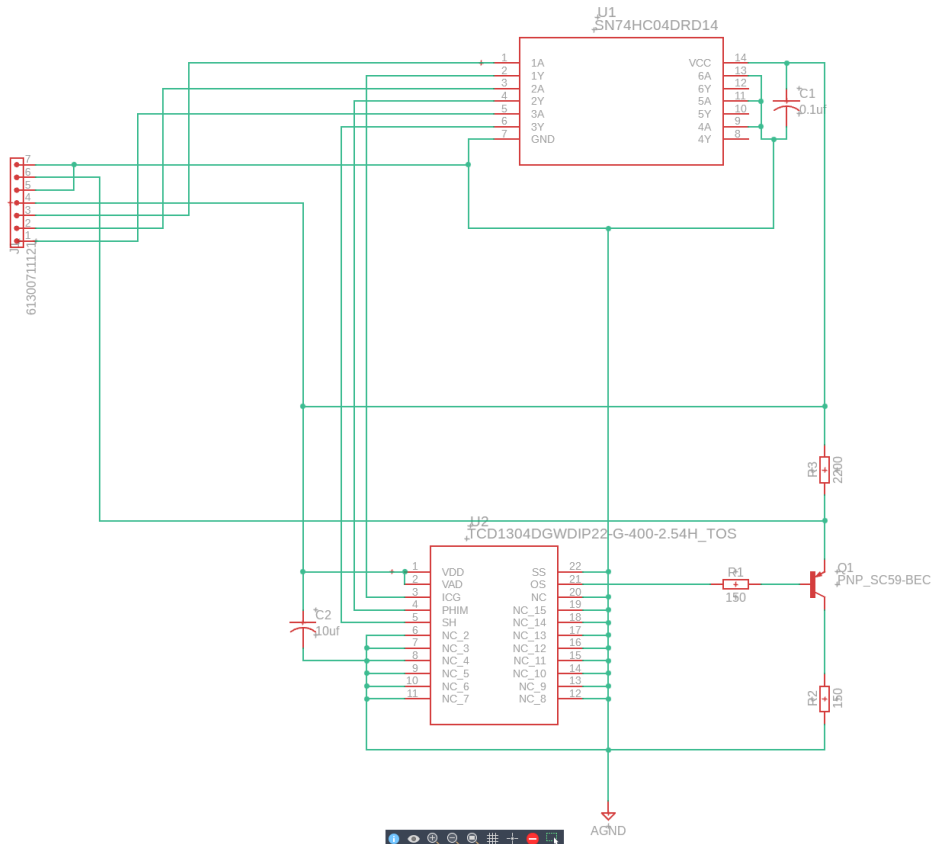
$100 = 0.01\text{ s}$   
 $= 10\text{ms}$

Block Diagram:  
A 3.3V power source is connected to a BMA (Buffer/Multiplexer/Amplifier) block. The BMA is connected to a  $\mu\text{C}$  (Microcontroller). The  $\mu\text{C}$  is connected to an ADC (Analog-to-Digital Converter) block. The ADC is connected to a USB port. The  $\mu\text{C}$  is also connected to a block labeled "① TIM1,2,3 → Oscillo" and "② ADC".

Ryan and the team worked on designing and ordering a driver board for the CCD. For this, the Autodesk Fusion was used to make the schematic and layout. Careful attention was given to via fencing the output signal of the CCD from the clock signals and power to prevent EMI with the analog output. We went through several stages of revisions, checking with Dr. Avishek regularly so that our circuit would need only minor adjustments during our meeting before it was ready to be sent to ETG to purchase the parts.



CCD Driver Board v1



Schematic of CCD Driver Board

## Pending issues

In class work has told us to clearly define our target users. This is done through characterizing 'personas'. The problem is we are unsure what other uses are for this device's convenience and cost. We surmised that this device could be used in a medical setting like a hospital, but we aren't sure if its niche is filled there. We need to discuss with Avishek more about this device's applications so that our design decisions can have our target users in mind.

## Individual contributions

<u>NAME</u>	<u>Individual Contributions</u> <i>(Quick list of contributions. This should be short.)</i>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Ryan Majstorovic	Finished PCB design, ordered PCB and additional MCUs. Installed and got familiar with the Cube IDE.	7	15
Dawson Posekany	PCB Design, Aided in ordering parts, Familiarizing with CudeIDE	6	12
Samar Gill	Learned the CubeIDE and how to setup the project. Established a github repository for collaboration.	6	12
Evan Tamer	Downloaded and learned the functionality of CubeIDE. Looked at datasheets to determine what was required for timers and ADC	6	12

## Comments and extended discussion

- We found the ETG to be a very useful service for taking care of the ordering of parts.
- Working in pairs has worked well for splitting up work, but a balance needs to be struck between paired and group work so that everyone feels like they have an understanding of the whole project.

## Plans for the upcoming week

- Ryan Majstorovic: Setup the Cube IDE and configure the STM32 MCU timers for driving the CCD. Ensure GitHub access for the senior design website.
- Dawson Posekany: Verify our circuit through simulation of the BJT in the PCB design. Further inspect Driver circuit for potential improvements. Set up the cubeIDE and configure the STM32 MCU to the CCD driver board.
- Samar Gill: Continue working with the CubeIDE and trying to establish serial monitoring with the STM32F411CEU6 microcontroller.
- Evan Tamer: Use the Cube IDE to set up timers and ADC for STM32