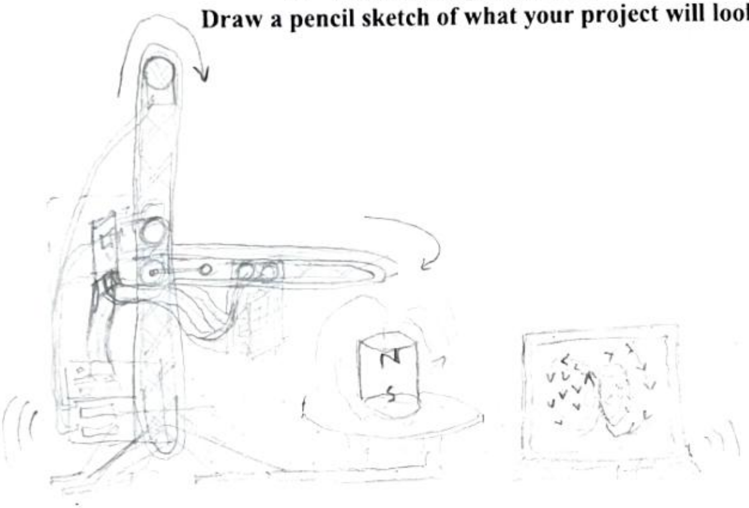
Group code: MON-08 **Student names:** Raunak M, Aditya Verma, N.V. Navaneeth, Suchet, Ashwajit **EDL 2025**

Project title: Magnetic Field Camera **Date:** 20/01/2025

Use your notebooks for discussions and rough work. Fill out this sheet after working individually and discussing within your team.

1. **In simple words, describe what you are going to build in your project, what its purpose is, and how it will function.** Be as detailed as possible, covering all the major aspects of your project.
   a. What is the main goal of your project?
   b. What problem does it solve, and how?
   c. Who will use your project, and in what context?

Draw a pencil sketch of what your project will look like at the end of the course, for final demo.

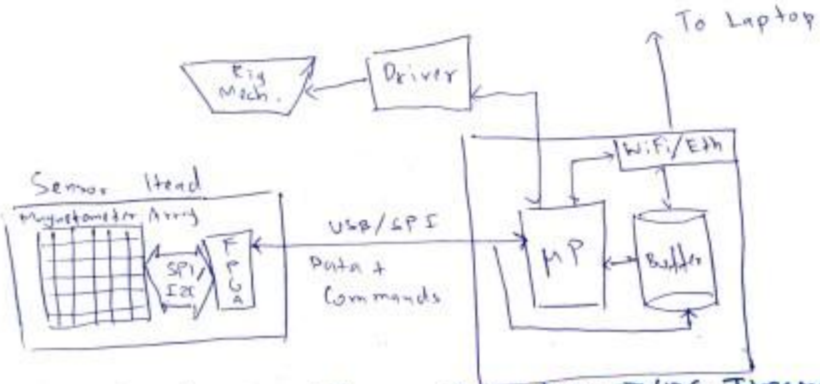


a) To build an affordable magnetic field mapping device for motors, permanent magnets with spatial resolution ~2mm.

b) Very few existing solutions which are prohibitively expensive. We have a lower resolution but is still good enough for larger devices

c) Industrial use, applications where testing of motors is needed e.g. automotive industry, motor manufacturers for QC, etc.

2. **Draw a block diagram of your project.** Create a visual representation showing the key components or subsystems of your project. For each block in the diagram, briefly explain its main function and how it fits into the overall system.
    a. What are the main subsystems or modules of your project?
    b. How do they interact with each other?



Magnetometer array: Comm with FPGA via SPI/I2C. Takes magnetic field readings
FPGA: USB/SPI to μP: Processes commands to mag. array, muxes data.
μP: Sends instructions to rig through driver, receives position. Talks to FPGA to send commands, receive data. Passes readings to laptop via WiFi
Laptop: 3D render of magnetic field

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3. **Write down details for these blocks:** What are the key performance metrics for each block (e.g., power, size, speed)? What trade-offs are you considering in your design choices? Are there any constraints or limitations for each block?

Block	Key specifications of this block	Design choices for this block
Rig mechanism	- The mechanism controlling r, z is ~~through~~ attached to the magnetometer array. - θ controlled by turntable on which object is placed. - Stepper motors keep track of position, homing for calibration.	Size: ~ 300×300×300 mm Speed: Dependent on calibration speed, precision of motors (ideally sweep the area in ~~~(10s) minutes~~ ~1 min Connected to AC power for motors
Processor (Controller) functions	- Error correction of transferred data - Instruction of movements to the rig - Check and correction of continuity of magnetic field.	Requirement - A relitively fast processor is enough as the mechanical part is rate defining Has to have a wifi module to transfer data to visualize
Laptop interface and Rendering	- Send data from the microcontroller to the laptop and cloud. - Processing of magnetic field and ~~de~~ positional data to generate a 3D render.	Using a Wifi module such as ESP8266 capable of supporting HTTP to send data to cloud. Usage of Python with Matplotlib and Mayavi to process the data optimally ~~to~~ depending on amount of readings inputted.
FPGA	- Acquire data at high speed using SPI. Polling / daisy chaining - Give data to processor using USB / other means	Small, compact, should be on the arm
Magnetometer Array	- Performs continuous field acquisition when commanded by the FPGA - μT resolution, < 1ms per frame readout speed	Layout of the array needs to be decided. Are we going to use all 64 for measurement or maybe a few for getting triggered on seeing fields?

4. **What are the unknowns or uncertainties in this project?** Identify aspects of your project that you are uncertain about or that require further research. This may include areas where you know what you need to do but are unsure how to approach it.
    a. What technical challenges or questions are you facing?
    b. Are there any assumptions you must make in order to move forward?

a. The primary technical challenge we are facing include:
   i) Figuring out the 3rd DOF for the sensor head with sufficient sensitivity - θ is difficult to obtain.
   ii) Synchronising position with field readings efficiently

b. The main assumption is that we will be able to obtain position with mm accuracy & that we measure DC fields.

Other things to consider from now until Milestone 1 deadline:

5. **Roles and Responsibilities: How will the work be divided among team members?** Assign specific tasks and responsibilities to each team member. Be clear about who is responsible for each part of the project.
    a. Who will work on which blocks or subsystems?
    b. What are the deadlines for each task?
    c. How will the team communicate and coordinate to ensure everyone is on track?

6. **Next Steps: What is your plan for the next phase of the project?** Outline what needs to be done in the short-term to move forward.
    a. What are the immediate next tasks or priorities?
    b. Are there any dependencies between tasks? How will you handle these interdependencies?
    c. What resources or materials do you need to proceed?

7. **Feedback and Collaboration: How will you gather feedback and collaborate during the project?** Describe how your team plans to share progress, give and receive feedback, and collaborate throughout the course of the project.
    a. How often will you check in with your team members?
    b. Will you conduct regular brainstorming or review sessions?