

# ECE 4950 Project 1

## Setting Up a Device to Receive and Transmit data

### Introduction to Additive Manufacturing / Rapid Prototyping

**Safety: All laboratory activities must be done safely. If you are not sure about the safety of an activity, stop work and consult the TA or instructor. You will never be penalized for stopping an activity because of a safety concern. You must wear safety glasses for all laboratory work requiring close contact and moving/potentially fissile parts.**

#### **Goals**

1. Become familiar with the ECE 4950 laboratory including software, room access, and equipment.
2. Investigate the MATLAB/Simulink real-time software and Arduino for future use in the design project.
3. Appreciate the 3D Printer as a rapid-prototyping tool for mechanical parts. Learn to rudimentarily use SolidWorks.
4. Develop structure and working relationships within project group.

#### **Project Overview**

1. **Each group will test their system by interfacing a sensor and actuator.** The system developed by the teams will use an analog sensor to trigger an electromagnet. The threshold for the sensor will have to be variable to allow for changes upon request by the user. Note that you will not be able to connect the electromagnet directly to the Arduino. You will have to research safe interfacing of the electromagnet to the Arduino and report on your findings and method along with any design considerations and component choices.
2. **Each group will design and fabricate a small object that can be printed on a 3D Printer.** You will have to design a small 4"x2"x1"(LxWxH) part. It should have the team number embossed/debossed on it. You do not have to 3D print the design.

#### **Configuring the Software**

Each group will configure a student-supplied laptop to work as the Host on which the software will be installed. This includes the C++ suite including runtime libraries and Matlab 2021b (you might need to contact CCIT about this). Make sure you copy the installation files from the network drive before installing; This will significantly reduce your installation time. Additional libraries for Matlab/Simulink to work with Arduino might also be needed.

The student-supplied laptop will be needed to operate the real-time control workstation. In order to ensure that the group has a Host available for the project at all times, it is recommended that each group configure multiple Host computers with identical Matlab setups for redundancy.

#### **Tests to be Conducted**

1. Demonstrate the ability to receive signals from a sensor and display the values themselves and as a plot in Simulink. You should use an analog sensor for this test.
2. Demonstrate the ability to turn an electromagnet on or off upon command in Simulink.
3. Demonstrate triggering an electromagnet on or off upon achieving a given threshold of data value from a sensor.

#### **Using the 3D Printer**

1. Download 3D modeling software such as SolidWorks, Sketchup, Autodesk Fusion etc.
2. Design an approximately 4"x2"x1"(LxWxH) part – the height could be less than 1" to be printed on a 3D Printer. Use your imagination with the design – be sure to include the Team Number (and name if you have one) embossed/debossed on it. Please ensure the design is reasonably within the bounds of respectability though you can be humorous.

## ECE 4950 Project 1 – Research Report Rubric

Each group will create a report that will eventually become a section in the “**Research**” section of your final project website. Use the guidelines below to complete your report and add at the end of your report.

Group Member Last Names: \_\_\_\_\_

Score	Pts	
	15	<b>General Format - Professional Looking Document/Preparation (whole document)</b> <ol style="list-style-type: none"> <li>Fonts, margins (11pt, times new roman, single spaced. 1" margins on all sides).</li> <li>Spelling and grammar are correct</li> <li>Layout of pictures – all figures need numbers and captions and must be referenced in the text</li> <li>Follows the page limitations below.</li> <li>References. Use IEEE reference format.</li> <li>This grading sheet is included as the final page.</li> </ol>
	15	<b><u>Page 1: Title, Group Name, Group Members, and Date</u></b> <b><u>Executive Summary</u></b> (~1/3 of the page) Provide a summary of the whole project. Use language that targets a <b>non-technical audience</b> . An important skill for an engineer is to communicate complex technical information to a general audience that may be involved in decision making, e.g. marketing. Important criteria: <ol style="list-style-type: none"> <li>Can a non-technical audience (~ high-school degree) read this section and understand your goals, procedures, and conclusions?</li> <li>Use simple words and graphics to help explain</li> </ol>
	30	The next sections of the report follow the standard <b>laboratory report format</b> . <b><u>Page 2: Materials and Methods for the Sensor/Actuator Demonstration</u></b> (1 page) You are establishing the credibility and usefulness of your results by providing all the details so that <u>someone else could repeat your experiment</u> . As an example, MATLAB 2021a may behave differently than MATLAB 2021b – the software version information which would be required to reproduce your result should be included. This section should answer the following: <ol style="list-style-type: none"> <li>What equipment is used, include software versions.</li> <li>How were the experiments conducted? How is the equipment connected and used? Describe the instrumentation, cables, connections, and experiments using diagrams and photos. You should have drawings (pin connection and connector part numbers)</li> </ol> <b><u>Pages 3-4: Results and Discussion for the Experiments</u></b> (~1 page) Describe what you have done. Include plots (from MATLAB, not photos of the Target screen) for each of the three experiments and a brief discussion of how you interpret the result. Did you demonstrate (through your documentation) that the equipment has been configured and used correctly?
	5	<b><u>Page 4-5: Conclusions and References</u></b> (~ 1 page) <ol style="list-style-type: none"> <li>Based on this experiment, do you recommend this equipment for use in a robot control project? What are the possible limitations? Your results and observations should be the basis for your conclusions. (~1/2 page)</li> <li>What are the possible uses for the 3D Printer in your projects? (~1/4 page)</li> <li>What did you learn from the process of determining your final project design?</li> </ol>
	5	<b><u>Page 6: This Grading Sheet</u></b> <b><u>3D Printed Part</u></b> (turn in with printed report) Grading based on: <ol style="list-style-type: none"> <li>Does the design meet the requirements?</li> <li>Originality and creativity</li> </ol>