ME 4234: Final Project Guidelines

Highlights:

1. *Think about a project and run your idea by an Instructor.*
2. *Turn in **Project Proposal** right after the last lab. The exact date is on the syllabus.*
3. *Get your **Project Work Summary** sheet signed by the instructor each time slot you work in the lab during the period until the last day of class, not the last day of the final exam period. This is optional.*
4. *Demonstrate the final functioning system to an Instructor and get signed off on **Project Work Summary** sheet by the last day of class. This is mandatory.*
5. *Turn in **Final Project Report** by the last day of class (by 11.59 PM).*

Details:

The Final Project is an open-ended design exercise. Innovation, creativity, and imagination are encouraged, and will receive heavy weighting in the project grade.

Selecting a Topic

Propose a final project related to an engineering interest, such as your senior design project. The project theme should show the relevance of automated sensing, signal processing, and/or actuation to a realistic engineering application. If you cannot think of a topic from your studies, then find one from your hobbies or everyday activities. It can be a task of automating a useful manual task or addition of a security/safety feature to an existing system. The project should address one or more aspects of automation, sensing, actuation, data acquisition, condition monitoring, system identification, dynamic modeling, or closed-loop control. At least some aspect of your project *must* include hardware implementation on a PC, microcontroller, PLC, digital circuit, or analog circuit.

Project Scope

The scale of the project should be such that the effort is proportional to the grade percentage assigned. You should be researching the project topics approximately 1 hour a week.

Project Resources

The following experiments are available in the lab. One of these may be used as a hardware platform for your project, but you should relate your work to a realistic engineering problem:

1. *Double tank*: Water is pumped from a reservoir into the uppermost of two tanks. The upper tank drains into the lower tank, which drains into the reservoir. The pump motor speed is controlled, and the liquid levels in both tanks are sensed.
2. *Two-story building*: This is the experiment used for the modal analysis labs. The base motion is controlled, and the accelerations of the base and two floors are sensed. There is also a motorized cart that can be mounted on the top story.

3. *Construction kits*: We have two general-purpose construction kits available. These are FisherTechnik components like the ones we used for the conveyor belt lab, and VEX robot components. Both kits include structural pieces and various sensors and actuators.
4. *Miscellaneous*: All the various components and sensors used during the semester are available, such as potentiometers, LEDs, photoresistors, et cetera.

Project Proposal

It is highly recommended that you discuss your project idea with one of the course instructors before starting on a project to make sure that the project is suitable for earning the full credit upon its completion. Also the Instructors may be able to suggest possible modifications, simplifications or additions to your ideas to improve them. Upon selecting your topic you should fill out and upload a Final Project Proposal to Blackboard in PDF format. The template for the Final Project Proposal form has been provided in MS Word format and you must submit a professional looking document.

Lab Time

Students are required to reserve lab time on the signup sheet posted in the lab. Make sure to reserve the laboratory hardware when you signup. Fill a Project Work Summary sheet available in the lab. The lab time slots will cover until the last day of class (not the last day of final exams). If you choose to buy your own hardware (like Arduino kits) you will not need to sign up for lab time but you may drop in and seek help from the Instructors. Get your Project Work Summary sheet signed by the instructor each time slot you work in the lab or come to seek help.

Lab Policies

The following rules must be observed in the lab at all times. Violators will lose all lab privileges *immediately upon the first offense*.

1. Students must be accompanied in the lab by a lab instructor at all times.
2. Safety glasses must be worn at all times.
3. Circuits should be checked by a lab instructor before connecting the power.
4. Turn off all power before modifying a circuit.
5. Lab instruments and hardware are to be used inside the lab only. Absolutely, no hardware components to be taken out from the lab.

Grading

1. The grade of the final project will be determined by several factors namely; originality of the idea, creativity, complexity, lab work and level of completion, demonstration, the project proposal, and the final report. However, it may not be necessary to have all of these aspects covered in order to earn the full grade. The tasks achieved in your projects should be nontrivial. Also they should not be a trivial modification of any laboratory experiments. Before starting a project, you may consult an Instructor to make sure that your project idea is worth for earning the full credit.
2. During the lab times you work on the project, the Instructor may take some notes on your performance. Your in-advance preparation, basic knowledge of laboratory hardware and motivation may earn some points in the project grade.
3. A completed and functioning system must be demonstrated to one of the Instructors before turning in the final report and get your project signed off on Project Work Summary sheet. The Instructor will take notes for grading. No credit will be given without a demonstration. During the pandemic era, students may make a video demonstrating the project. In this case, provide the link to the video. Do not upload a video file to the blackboard.
4. If you choose to work on your project outside the lab, you can bring the functioning system to the lab and demonstrate it to one of the Instructors. If the project is too large, an instructor may travel to look at your project. The Instructor may ask a few questions and also may ask to show how to do some modifications in order to evaluate your understanding and authenticity of your work.
5. Full completion of the proposed project is required to earn full credit for the project. However, the partially completed projects will also be graded depending on reported or demonstrated progress or achievements.
6. The report is the basis for the project grade. Activities and accomplishments not described in the report will not accrue credit towards the project grade. Clarity is essential. If the graders do not understand the presentation, no credit will be given. Neatness and readability count. It is strongly recommended that flow charts, block diagrams, LabVIEW block diagrams, LabVIEW front panels, ladder logic, circuit diagrams, etc, be carefully and thoughtfully laid out. If they are not understandable, they will receive no credit. Assemble all images, plots, text, etc, into one document. Only one document will be graded. If multiple documents are uploaded to Blackboard, only the most recent will be graded.
7. Originality and creativity will be heavily weighted. These must be demonstrated, explained, and justified in the final report. The graders will not put words in your mouth. If you want credit for something you did, it must be included in the report.
8. Academic misconduct policies as given in the syllabus apply in full to the final project. ALL WORK MUST BE YOUR OWN. Using the intellectual contributions of others without proper attribution will result in an automatic failing grade *for the course*. If it is determined that two reports contain substantially similar content, *both reports* will be considered to be in violation of academic misconduct policies.

Project Due Dates

The final report is due at 11.59 PM on the last day of class. A report template is available in MS

Word format. **The final report must be turned in to Blackboard in PDF format**.

The set of FAQs below may help the students to formulate their final projects.

How complex my project should be?
Answer: Since it is difficult to quantify the notion of complexity, it is useful to know that an average student should be able to implement and troubleshoot his/her project within 4 to 8 hours. The 4 to 8 hours period does not include the time you spend on planning and reporting. Such a work is adequate for full credit.

Can it be just a computer program without any hardware implementation?
Answer: No, every project needs to have a hardware aspect.

What type of hardware should I use?
Answer: You may use any combination of the hardware you used during the lab classes. Lab experiment setups, LabVIEW with DAQs, Arduino microcontrollers, PLCs and electronics are common tools for you to build your project. You can use any new hardware available.

Should I buy my own hardware?
Answer: It is not necessary for you to buy them unless you need to use them outside the lab. However, there are some inexpensive hardware you may buy so that you can have your project with you to demonstrate an interviewer. For example, you may be able to purchase an Arduino UNO board for less that $25 online. The local stores like Texas Electronic Supplies or RadioShack carry some common hardware and electronic components.

I do not remember how to program a microcontroller/ PLC, where can I get a help?
Answer: You should first read the relevant lab worksheets/ assignments. Then you can search web for more help. For example, there are millions of example codes for Arduinos. You can consult the instructors for troubleshooting.

Where can I look for project ideas?
Answer: There are several possible sources. A task related to your senior design project can be simplified enough so that you can complete within the given time. Or you may look around your home and think what function you wish to have automated to make your life easier. Or else, you can formulate a project to do with existing laboratory experiments (double tank system, two-story building model or belt conveyor system); as long as it is substantially different from the lab class.

Can I simplify a complex task or system so that I can demonstrate the idea?
Answer: Yes of course. You can imagine a complex real life situation and formulate your project. Then the instructors may be able to help you to simplify so that you can test the idea in the lab with a simpler version.

Can I and my friend share the same project?
Answer: No, the project has to be an individual work. But you and your friend may work on two different parts of a single larger project as long as their implementations do not depend on each other. You need to write your own report and work your own hardware part. However, you will

not be excuse for saying you were not able to finish the project because of incompletion of the friend's part.

Can you give me some examples of the projects from previous semesters?
Answer: Yes. Examples: Automating an old coffee maker, Room temperature control system, Mapping objects in the surrounding using ultrasonic sensors, Crash detection using accelerometers, Moving an object using the robot arm kit, Automated deer feeder, Light sensitive window louvers, Burglar alarm system, Automated garage door closer, A simple game on an Arduino, A guitar tuner, Clap operated light switch, Monitoring water level of cattle feeder via text messages, etc.

If I complete a simpler version of a complex real life project, what should I write in my report?
Answer: You should first explain the original idea and then should explain how you simplify it mentioning any assumptions you made. After that you may report what you accomplished during the implementation.

How long should my report be? How many pages?
Answer: You will not be rewarded for a long report. Your report should be concise but still contain enough information for the grader to follow. Under 10 pages excluding the Appendix should be enough. You need to include all the references and the code. The code must be in the Appendix. The report should contain all the information needed for someone else to recreate your project.