

Professional Self-Assessment Report

1. How have I satisfied the learning objectives in this course and contributed to team and course outcomes? Cite each learning objective and refer to examples throughout the term. The course learning objectives were listed on the course syllabus distributed the first week of class (see the course web site).

The overall goal for the learning experience in ECE 480 is to have each student actively participate in an engineering design team that would plan, design, and build a product that involves an embedded computer while demonstrating individual competence with designing electrical circuits and programming a microcontroller. Our team's project was to take an inexpensive automotive alternator and design a circuit that would control it with a microcontroller to act as a DC motor. The following specific learning objectives were satisfied:

1) Describe various forms of technical communication and the reasons for using them

Technical communication can be achieved through different mediums, such as a technical presentation or a technical document. Technical communication is used in industry to inform engineering colleagues of the information pertaining to a certain product, process, or idea. In ECE 480, both forms of communication were used in the form of a technical presentation and a technical application note.

2) Write well-organized technical reports

Throughout the design process, technical reports are extremely important to document ideas and processes used throughout the development of a product. Although final reports are important, documenting the steps taken and processes used are as well. To do this quickly and efficiently, organization schemes are key in the preparation process. A good organizational strategy is to break technical reports up into sections or chapters and then break those sections up into sub-topics, which can be written about with great detail. In ECE 480, there were technical reports including an application note, which explained an engineering process pertaining to the project as well as a final overview report for the entire project.

3) Write a team proposal for a major design project and obtain approval

A vital step in the engineering design process before any hardware or software development can take place is the documentation of the proposed idea. In most cases in the engineering world, a team of individuals must approve this idea before the project can begin. In ECE 480, our team's idea for completing the project needed to be approved by our sponsor and facilitators in the form of a written proposal, as well as a formal proposal presentation.

4) Comprehend appropriate content and style of oral presentations

In the engineering industry oral presentations are critical in ensuring colleagues fully understand your idea or concept. While these presentations must usually be very technical, the style in which the information is delivered is very important to make sure the audience can understand what you are saying. In ECE 480 we gave presentations ranging from our project proposal to a technical lecture, as well as our final presentation, which allowed us to practice different forms of oral communication.

5) Access relevant standards and interpret their meaning and application

Throughout the design process many different components can be considered for use in a final design. A good engineer is able to shop around for various parts that will work for a certain task and be able to choose the best fit for a balance between cost and functionality. In ECE 480, our circuit design required multiple expensive elements, such as high voltage MOSFETs or a microcontroller. To effectively choose the best option for our project, we had to understand the constraints and analyze data sheets to choose the best component for our application.

6) Delineate the principal design criteria and constraints for an electrical or computer engineering design project—e.g., cost, size, power, environmental factors, reliability, safety, maintainability, and reusability

During the design process for an engineering project many different design constraints must be considered for initial prototyping. Cost, reliability, and safety are generally always constraints that need to be considered. For our project in ECE 480, we had to design a cheap alternative to a DC motor using an automotive alternator. For this project, our major design criterions considered were cost, power, reliability, and size. Through the understanding of these design constraints we were able to narrow down the project ideas quite easily.

7) Describe and understand the overall engineering design process—e.g., project justification, identification of constraints, establishment of design criteria, establishment of timetables, identification/scheduling of critical path, the partitioning of work, project monitoring, and project evaluation

The engineering design process includes many different steps to ensure a successful completion of a project. For our project in ECE 480, we determined the motivation for our project first, followed by the criteria and constraints of the project with our sponsor. After this we created a timetable to layout our critical path during the semester to make sure we divided up the work during the semester to stay on track.

8) Describe and understand contemporary industry practices and trends with respect to electrical and computer engineering

The electrical engineering industry is one of the fastest growing industries in the world, so being able to stay updated on the newest technologies is crucial to success as a young engineer. When faced with the decision to employ a newer technology as opposed to an older one, sometimes new ideas or possibilities can be discovered that have not been thought of before. For our project in ECE 480, we are using a new idea related to pulse-width modulation that has very little exposure despite our team's effort to find information regarding the topic.

9) Describe, understand, and apply key tools used in the overall electrical and computer engineering design process

In recent years, the field of electrical engineering has become more and more of a hybrid between computer engineering and electrical engineering. While the mastery and understanding of analog hardware is vital to success in the field, there has become a need to understand the software aspect of most systems as well. To succeed in the industry, one must have a firm grasp of basic computer programming and logic systems. For our project in ECE 480, we are using a microcontroller to drive a MOSFET switching circuit, so understanding of the syntax and logic behind the code driving the system is important.

10) Understand the benefits and potential problems of teaming, describe qualities and processes of effective teams, and describe the role of teamwork in system design

Working with teams and working individually both have benefits. While in a team, members are able to bounce ideas off their colleagues and sound team objectives can be easily and efficiently delegated to their appropriate place in the process. But, working individually has its advantages as well in that sometimes sitting down to think about a problem in a quiet environment is key to solving an important problem. Effective teams are driven by good leadership and organization of its members, as well as a desire to succeed by every member.

11) Acquire and understand information contained in contemporary technical literature—e.g., trade journals, magazines, books, conference proceedings, and supplier literature—about hardware components, software, design tools, third-party suppliers, etc.

The ability to read and interpret data sheets for various electrical engineering components is critical in the field and especially in the design process. Being able to analyze different forms of engineering literature is also important because new ideas and processes can be learned from other members in the engineering community.

12) Browse the web to acquire information about electrical and computer engineering, software, design tools, third-party suppliers, etc

To be an effective engineer, the ability to learn from different sources is very important. In the industry one may encounter a piece of equipment or software that is unfamiliar and in the case, being able to find and interpret the information about the device can make or break their successes as an engineer. For our project in ECE 480, we needed to find information about the microcontroller we used to ensure we were maximizing its functionality as well as find information about the transistors we used to make sure we were operating them correctly.

2. What have I learned about the design process from my work on the design project. Restate your portion of the overall project as defined in your team's design proposal, which was developed and completed in week 6 of the semester. Describe your work during the semester on your TECHNICAL portion of the design project. In your write-up discuss your work in terms of the overall engineering design process – e.g., project justification, identification of constraints, establishment of design criteria, establishment of timetables, the partitioning of work, project monitoring, and project evaluation. Also discuss your work in terms of design iterations that occurred during the semester.

Throughout the semester in ECE 480, the engineering design process has emerged as a critical cog in the development of a project. To begin a project, a basic need has to be determined to justify spending time working on a design or idea. For our project, we needed to design a cheaper and more efficient alternative to a traditional DC motor. From this project definition, the main constraints we were concerned with were cost, efficiency, reliability, and size. Reliability and size were taken into consideration as this design has the intention to be mounted and used on a small rugged electric tricycle. For the basic design criteria, there were essentially five main components that would be used in the final design. The main components were the automotive alternator, the MOSFET switching circuit on a PCB, the microcontroller, the rotor angle sensor, and the throttle. The design team we established was partially split into two sub-groups, hardware and software. This was to increase the efficiency of the team so that two parts of the project could be developed simultaneously. Once the sub-groups were formed, a timetable was developed to ensure the team was staying on track throughout the semester. As an electrical engineer, I was part of the hardware sub-group which was mainly focused on learning how the different alternator parts worked, developing a MOSFET switching circuit, and developing an efficient PCB layout for the final design. The first step taken during the semester was to determine how to make the alternator spin. To do this we manually attached a 12V car battery to each phase of the stator coils to make the alternator act similar to a stepper motor. Once we figured out the sequence of the stator coils to make the alternator complete a full rotation we could begin to design the high-voltage MOSFET switching circuit. The first step in this

process was to verify the turn-on voltage of the MOSFETs and determine how to safely use them. To experiment with the MOSFETs we created a proof-of-concept switching circuit with LEDs acting as the stator coils for safety purposes. Once this circuit was working as intended, we began to integrate all the circuit elements we were going to use as footprints in Eagle's PCB designer. When all the footprints were created, we then connected all the elements in the circuit schematic and imported the schematic into the PCB designer layout. At this part we were able to brainstorm a space efficient way to layout the different circuit elements and began to construct the traces. Once the entire layout was completed and printed in the ECE shop, we began soldering the different elements to the board. Since the MOSFETs would be handling a lot of current we added heat sinks to dissipate the power lost to heat. At this point we were able to integrate the hardware and software sub-groups to construct our prototype. The final steps in this project before design day are to optimize our software algorithm to make the motor run the most efficiently, as well as prepare the prototype for demonstration.

3. What technical communications have I done this semester? List the reports and presentations you have help prepare. Also indicate those presentations for which you were a speaker.

In ECE 480, we have executed different forms of technical communications. These technical communications include a written design proposal as well as a presented design proposal, a technical application note relating to our project as well as a technical lecture on a topic related to our field of study, and a final report of our project along with a final presentation. I participated as a speaker in each of the 3 presentations.

4. What is the impact of this course on my career objectives and professional goals?

This course has taught me a lot about all the different steps required in starting an engineering project as opposed to just trying to build a prototype. The organization required to keep a team on track is vital to success in the industry. Our project of building a DC motor alternative using an automotive alternator was a great learning experience because the project required analog circuit design as well as programming using a microcontroller, and it dealt with the topic of alternators, which I had little prior experience with. The fact that this project utilized a piece of an automobile provides a great bridge for gaining experience in the automotive industry especially in the Midwest area.

5. What are my primary strengths and weaknesses?

My primary strengths when working with an engineering team is my ability to listen to ideas of team members and expand on them. I also feel I excel at staying organized and breaking a large problem down into smaller, simpler problems. I also

feel I am good at verbalizing any ideas that may be hard to explain. My weaknesses may include the fact that I have the ability to sometimes get off-topic and start focusing on a small problem that might not be relevant to the big picture.

6. Where would I like to be professionally five years after graduation?

Five years after graduation I would potentially like to be part of a smaller company when each individual is important to the company's success. I want to work on a project that I helped propose potentially dealing with electromagnetics or RF technology. In this time I would also like to return to school to get a Masters degree that can hopefully be financially supported by the company I work with.

7. What lifelong-learning steps must I plan to undertake in order to achieve this five-year professional goal?

What has helped me so far in academia is to always ask questions about thing you don't understand, whether it is at school or in a job. The worst thing you can do is proceeding doing something that you don't understand, which will cause many problems down the road. After graduation in December, I plan on working full-time at an engineering company for a few years to expand my experiences and see where my life takes me after that.

Appendix (Resume)

Myles Moore

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Targeting 2016 Full Time Position

- Current Michigan State University senior majoring in electrical engineering with demonstrated strong academic performance.
- Strong interest in electromagnetic capability.
- Quickly learns new technology; equally successful in both team and self-directed settings; possesses strong problem solving skills; and very comfortable working in a lab environment.

EDUCATION

Michigan State University, East
Lansing, MI

September 2011 to Present

Electrical Engineering Student; GPA:
3.62/4.00

Graduation: December 2015 (BSEE)

RELEVANT EXPERIENCE

Electrical Engineering EID – LED Albeo

5/2015 to 8/2015

GE Lighting, Cleveland, OH

- Solved EMI problems on Albeo fixtures with the use of ferrite beads and electrical filters.
- Provided electrical engineering support for the launches of various new products.
- Updated and maintained Albeo website with technical information about current products.

Passive Safety Development Engineer – Chassis Controls

Robert Bosch LLC, Plymouth, MI

5/2014 to 8/2014

- Primary assignment was to create a MATLAB tool to automate the data transfer of OEM airbag target fire times. The creation of this tool resulted in a 30% efficiency improvement in airbag calibration.
- Resolved numerous programming issues to improve fidelity of OEM crash event data recording.
- Harmonized separate data integrity report tools across several OEMs.
- Developed standard workflow for referencing vehicle integration reports used to set up data integrity report tool.

Lead Calibrator – Climatic Laboratory

Trescal, Hartland, MI

5/2013 to 8/2013

- Single point lead for calibrating advanced climatic laboratory test equipment.
- Experienced in thermocouples, resistance temperature detectors and thermo hygrometers.
- Mentored incoming technical associates to perform core test calibration.

Laboratory Support Calibrator – General Test Laboratory

Dynamic Technology, Hartland, MI

5/2012 to 8/2012

- Calibrated core test instrumentation including accelerometers, pressure transducers and modal analysis hammers

Proficient in MATLAB, C and Pspice

OTHER EXPERIENCE

- **Michigan State Cafeteria Services,** General Support Staff
9/2011 – 5/2012
- **DIN Associates, LTD,** Hockey Referee (Level 3)
2008 – Present
- **Northwest Hockey Association,** League Treasurer and Scorekeeper
2006 - 2008

OTHER ACTIVITIES

Audio Enthusiasts and Engineers Club – Michigan State University

Golf, Ice Hockey, Ultimate Frisbee, Sailing