ECE 480 - Senior Design

Professional Self-Assessment Report

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1. How have I satisfied the learning objectives in this course and contributed to team and course objectives?

a. Describe various forms of technical communication and the reasons for using them.

There were many forms of technical communication used throughout the semester. Written communications included various reports such as a project proposal, design issues, voice of customer, and more personal forms such as maintaining an engineering notebook and writing an application note. Oral communications included presentations on a project proposal and a technical topic, as well as the discussing project requirements with our sponsor. Ultimately, all of these communications were used to explain why I as an engineer made the decisions I made based upon the facts and information found or presented to me.

b. Write well organized technical reports.

In order for a technical report to be useful to another engineer, scientist, or businessman it must be well organized. The reports written in the class were all properly sub sectioned and evaluated for content. This ensured each section was straightforward and important details were able to be found quickly.

c. Write a team proposal for a major design project and obtain approval.

Upon being selected for a project, a proposal was written in order to get approval from the sponsor. In this proposal a number of sections including an introduction, technical approach, key milestones, budget details, and a conclusion were written in order to fully outline the planned approach to the project over the course of the semester.

d. Comprehend appropriate content and style of oral presentations.

Upon completion of the project proposal the team was required to present our proposal to the class. This required setting the stage as to why our project was useful in order to captivate the attention of the audience. Another technical presentation was required later in the semester which required a slightly different style of presentation as the audience was of a similar technical background. This presentation helped explain some of the inner working of our project.

e. Access relevant standards and interpret their meaning and application.

In our project with wireless sensor network there were a few standards that needed to be understood. Specifically, the IEEE 802.11 standard covering local area network communications. It is important that our sensors conform to these standards so it doesn't interfere with other networks and signals.

f. Delineate the principal design criteria and constraints for a computer engineer.

In order for a successful design project our sensor network needed to meet both technical and cost requirements. Thankfully, sensors are relatively inexpensive and already prefabricated. Technical expertise was required when designing the software on top of the data being collected from the network. This required solid knowledge of the software design concepts, such as object-oriented design, UML layouts, and a solid foundation of programming knowledge.

g. Describe and understand the overall engineering design process.

Over the course of the project a number of things needed to be done sequentially in order for the project to be a success. First, project justification, identification of constraints, and establishment

of design criteria, were defined in the proposal. Next, scheduling of milestones and partitioning of work was defined in order to have shared responsibility and goals among the group. Finally, evaluations throughout the semester were ongoing by the team and sponsor providing feedback and revisions to our original plans. Lastly, testing criteria and final evaluation was formalized in order to ensure a quality product.

h. *Describe and understand contemporary industry practices and trends with respect to electrical and computer engineering.*

Many of the industry practices were touched on in the course. The voice of customer was a major one where a firm must strictly define a clients requirements in order please them. Engineering firms must have great communication skills in written reports in order for engineers at another firm to understand what was done and why they did things.

i. *Describe, understand, and apply key tools used in the overall electrical and computer engineering design process.*

Key tools in our project simply required a laptop. The processing power and overall ease of development was the only major tool required in the project besides the sensor network itself. Some of the tools used include the Python programming language and various libraries such as pySerial, matplotlib, and wxPython. These software tools were very important in order to design the application.

j. *Understand the benefits and potential problems of teaming.*

Teaming can have great benefits in terms of idea sharing and working in parallel. Various team members with different backgrounds see problems in different ways allowing for better coverage of design pit falls and problems. Also various expertise the team work more efficiently as members are assigned tasks in fields they have expertise in. Some problems of teaming include resolving conflicting ideas and goals.

k. *Understand information contained in contemporary technical literature.*

Every person needs to know how to read a data sheet and a user manual. Engineers make new things so they must have a solid understanding of the physical processes going on in the things they are working on in order to design something new. Data sheets were used in the course lab and in our project. Also various manual were read in order to understand how the sensor operated and how data was being sent over the wire via USB.

l. *Browse the web to acquire information.*

This was the most crucial learning objective to our project. The information needed to build a full scale application on top of the sensor network was not readily available. I had to browse the web in order to identify proper libraries that may or may not be able to do what I wanted to do. Understanding how to read an application programming interface of various third party packages was crucial to designing and developing a robust application for the project.

2. What have I learned about the design process from my work on the design project. Describe your work during the semester on your technical portion of the design project.

The thing I took away most from my work on the design project was that the design process is futile if there isn't a strong focus on taking the time necessary to do things well. The design process in this class was extremely flawed. I am extremely disappointed on all the time spent on the course lab and various reports that were assigned way too early in the semester to have any real meaning. Fortunately, I have had the opportunity to work multiple internships with Boeing over the past two summers where I was part of the design process at full speed. Over the course of this semester I felt like I was producing low-quality reports simply because I didn't have enough time to do the proper research and revisions to do them right. In industry, the design process only works if there is a strong focus on being thorough (through requirements and reviews) and completing multiple iterations of design and development. I did not feel like I was able to meet any of the requirements I would have needed to meet over the course of my internships on this design project. Overall, I am happy with both my technical and non-technical contributions to this project with regards to the design process, but I would be much more satisfied if this course was structured differently.

The specific technical objectives I was responsible for was designing and programming a software application to read the data from the network cluster head and display it to an operator in a user friendly manner as well implement algorithms for detecting problems in the network. The first and most important thing decided upon was the programming language in which the application was written in. Python was chosen for its ease of programming, strong developer community support, and knowledge of the language amongst the team. Next, a solid understanding of how operating systems interact with their hardware was crucial in reading the data into the application over USB. A python package called pySerial was leveraged in order to read data over the USB port and into a python application. This required careful reading of the application programming interface provided by the package. Once data was being read in properly, I designed a software architecture for our program based upon the model-view-controller design pattern. The controller is responsible for reading data over the port or simulating pre-recorded data. This data is then parsed and sent to the model for sorting and applied to detection algorithms. The view is responsible for polling the model for data periodically and updating itself so that the operator can see the data coming in at real-time. The view was written using the wxPython framework, but the beauty of the model-view-controller framework is that any view can be swapped in and out as long as the correct calls to the model API are made. Ultimately, there were many architecture challenges that were properly designed for which allowed for rapid development. With adequate time I could have developed a remarkable application, but instead due the nature of the course I had only enough time to develop something merely satisfactory. I am satisfied with my technical contribution on this design project, but would have loved to spend a full couple months on development rather than just a couple weeks due to the other deliverables of this course.

3. What technical communications have I done this semester?

This topic was discussed above in describing the course objectives. A complete list of the technical communications I have contributed to is as follows: Air Force Research Lab project proposal, design issues paper, full project proposal, project proposal oral presentation, application note, technical oral presentation, and design project final report.

Of these documents and presentations I am most proud of my application note. Of the course of researching how to read data over a port into python I found many developers extremely confused. I am happy to have created a document which can be used by other developers in the community to help them with their own projects. I think giving back to the developer community is something that all developers should do and I something I will continue to do throughout my career. My application note will have the most impact of all the documents written over the course of this design project.

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

This course has had little impact on my career objectives and professional goals. The only thing I have taken away from this course is that in my career I want to join a companies (or start my own) where I have the time necessary to do thorough work in order to create outstanding products. This course opened my eyes to all the pitfalls of any project and the need to have a cohesive team. I want to join a companies where I have the freedom to use my intellectual expertise where I see fit and be a part of a group of people who are as determined and motivated as me. I am happy I have been able to meet and connect with so many of my classmates and teammates in this course as they will important down the road in opening opportunities for my career. In the end, I had high hopes for this course but was disappointed by the lack of focus on the actual design project but rather on bureaucratic aspects of the project and disjointed lab work in order to meet some arbitrary requirements.

5. What are my primary strengths and weaknesses?

My primary strengths are my breadth of knowledge and wide array of skills. I am very good at articulating my thoughts through oral and written means (although my communication skills have declined throughout my engineering curriculum due to lack of practice) and actually implementing them. My primary weakness is taking on too much responsibility since I always believe I am well suited to do any particular task.

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

I would like to be in a company which rewards my contributions either through promotions or bonuses and where I can grow as a leader, student, and businessman. I want to be able to have the opportunity to select specific projects I am interested in and go work on those projects.

7. What lifelong-learning steps must I undertake to accomplish this goal?

I must continue to be a student in my spare time and on the job. This can either be done formally through a graduate program or online curriculum, or informally through developer communities and networking events. I must be willing to learn and adapt to new technologies in order to stay competitive in the workplace.

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Objective

I am seeking a position in a fast paced environment where I can apply my skills in order to solve challenging problems while expanding my knowledge.

Education

Michigan State University, East Lansing, MI   8/10 to 12/13

GPA: 3.83/4.0

Honors College Member

Bachelor of Science, Computer Engineering

Experience

Design and Analysis Engineer I, The Boeing Company, Fairfax, VA   Starting 3/14

Signal Processing Engineering Intern, The Boeing Company, Fairfax, VA   5/13 to 8/13

- Developed a naval ship system to integrate multisystem communications functionality.
- Participant in an Agile development process as a software developer.
- Implemented a messaging API for tracking status of multiple subsystems.
- Helped configure the system to demonstrate RF processing functionality.

Software Engineering Intern, The Boeing Company, Fairfax, VA   5/12 to 8/12

- Designed (MVC pattern) and coded a UI in Java using the Swing library.
- Integrated the UI into the larger system framework.
- Interfaced to a web service in order to poll for changed data.
- Implemented multi-threaded design to ensure a responsive UI.

Undergraduate Research Assistant, Digital Evolution Lab, MSU   10/10 to 2/13

- Part of BEACON, an NSF-funded Center studying Evolution in Action.
- Adapted lessons from biological systems to develop computational models of complex environments.
- Examined how complexity accumulates throughout the process of evolution.
- Explored algorithms for modeling biological processes in digital environments.

Computer & Lab Skills

- Programming Languages: Python (proficient), Java (proficient), C/C++ (proficient), MATLAB (proficient), Lua (experience), Assembly (experience), VHDL (experience)
- Software: PSpice, AutoCAD, Microsoft Office
- Operating Systems: Linux, Windows, and Android environments
- Software Management: UML, Vim, Eclipse, SVN, GIT
- Lab Skills: Soldering, Oscilloscope, Multimeter, Function Generators

Leadership / Professional Organizations

President, Eta Kappa Nu, Gamma Zeta Chapter, IEEE Honors Society   9/11 to Present

- Manage the ongoing activities of the Gamma Zeta chapter
- Promote electrical and computer engineering to new/incoming students.
- Organize technical presentations from industry