Self-Assessment Report

ECE 480

James Quaglia

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Part 1: The 7 Questions

1. ECE 480 had many learning objectives to be fulfilled. I feel as though I exceeded the completion of these objectives with my consistent work ethic and the amount of attention I gave to this class. As the group manager, I participated heavily in the Engineering Design Proposal. I wrote many parts of that document including the entire Project Management Plan. I shared in the day-to-day design activities by working on the design solution every single day. ECE 480 was my only engineering class this semester and so I completely applied myself to my project’s completion. Many times during the semester we delivered oral and written presentations. I participated in these by writing significant portions of all of them. I also spoke during the Oral Proposal Presentation and the Technical Presentation. Another one of my contributions has been during the project demonstrations to Professors Udpa and Grotjohn. I demonstrated my knowledge of the project by being one of the best communicators. I was able to effectively shed light on the project by articulating accurately our current successes, current problems, and the direction that I believed the project should go. Part of understanding the project itself was becoming familiar with many of the industry standards that exist in computer vision and image processing. I demonstrate this knowledge in my design issues paper. I talk about the GigE Vision standard for image processing and the fact that the camera supplied to us does not comply with it. Learning objective six focused on delineating the principal design criteria and constraints for an electrical or computer engineering design project. I fulfilled this learning objective when I researched different cameras for our image processing system. I learned that there are many better alternatives than the Axis P1355E for image processing solutions. The seventh learning objective was to have the ability to describe and understand the overall engineering design process. I had an active role throughout the designing process of our computer vision system along with developing technical documentation and presenting technical information. The eighth learning objective was to describe and understand contemporary industry practices and trends with respect to electrical and computer engineering. I actually had the opportunity to revisit the Six Sigma concept during a couple of lectures in class. Since our camera system must be accurate to about 1%, we are complying with somewhere in between Three and Four Sigma. The ninth learning objective was to describe, understand, and apply key tools used in the overall electrical and computer engineering design process. I have absolutely spent well over 100 hours this semester working with the Visual Studios and MATLAB Development Environments, key tools in any software solution development process. The tenth learning objective was to understand the benefits and potential problems of teams, describing qualities and processes of effective teams, and describing the role of teamwork in system design. This was a bit of an issue as some team members took more responsibility than others at times which occasionally led to frustration. But as Team 5 Manager, I took it upon myself to ensure that all problems were communicated to me and then
a strategically transparent response to these problems was implemented. I effectively managed this team to a successful outcome by leading by example. The eleventh learning objective was to acquire and understand information contained in contemporary technical literature. I did this when learning about the Axis P1355E Camera. I read the supplier manuals cover to cover to find out if there were any already integrated solutions or “shortcuts” that we could take by fully understanding the Axis camera itself. The last learning objective was to browse the web to acquire information about electrical and computer engineering, software, design tools, third-party suppliers. As an ECE major, I did not have much experience with Computer Science. ECE 480 gave me no choice but to self educate and become proficient in C++, MATLAB, Python, API Integration, Open Source Solutions, etc. I spent countless hours researching and understanding online material such as the integration of our API, OpenCV, into Visual Studios 2013. Then I had learn the correct functions required in order to achieve frame grabbing, edge detection, blob analysis, and image presentation along with the correct implementation and syntax. I researched and fully understand the GigE Vision Standard for Image Processing. Although our camera is not compliant with this standard, if asked, I could set up a GigE Vision Standard Computer Vision System powered by the robust open source API, OpenCV, in a matter of hours now. I also learned an incredible about about MATLAB and Simulink. I learned that MATLAB by itself is not robust or efficient enough to perform the tasks we required. However, by researching online I learned about MEX files and was able to successfully integrate the OpenCV API into Matlab. This semester was by far the most I have ever learned here at MSU.

2. I briefly got into my technical contribution to the design project in the last part of question number one but will go into greater detail here. In the Project Proposal, team member contributions were assigned. As the semester went on some team members were able to successfully fulfill obligations and some were not. As manager, I took it upon myself to research and assist in the fulfillment of every one of my team members assigned tasks. The code in the Appendix constitutes the entirety of our project. Our project was solely software development. The IP camera is easily assigned to an IP address by a DHCP server. Once on a local or public server address it is easily accessed by our software. Matt Wesolowski and I spent hours and hours researching C++ and OpenCV, building design solutions inside of Matlab and Visual Studios. We then performed testing on both of these solutions to determine which was superior. The technical portions of this project did not lie in fully understanding how a Canny Edge detection algorithm works, and subsequently trying to recreate your own. But rather, in realizing that Canny edge detection algorithm is but a small piece of the puzzle. With today’s robust API libraries, implementing an edge detection on a video stream is as simple as Canny(filename.avi). Linking the OpenCV API to Visual Studio was the painstaking process. Once OpenCV was integrated, performing the various function operation on our IP Camera feed was a simple matter of function name research. I can confidently say that I contribution over 350
hours of technical attention to to completion of this project. I never stopped working on this. I wanted to be proud of the solution we built for ArcelorMittal.

3. I have technically communicated the entire semester. I was in DECS about every other day working with them on MAC Address spoofing, API integration, etc. I participated in the completion of every presentation along with being the majority speaker during the demonstrations to Professors Grotjohn and Udpa. I wrote a very technical Application Note about IP Camera Access on Local and Public Networks. I also had the responsibility to complete the Introduction of our Technical Presentation which broke down the anatomy of an image file, what components an image consists of as well as how a computer handles such a file. I spoke in the Proposal Presentation, the Technical Presentation, and as stated before, the Project Demonstrations.

4. This course has inspired me. I now think of different ways to implement computer vision and image/video process across many disciplines. I was also inspired by Dr. Asif Naseem’s lectures and spoke with him after class. I am drafting a paper that he told me to email to him with some broader industry applications ideas, such as health care, that I have. Working so much with OpenCV and computer vision has given me great enthusiasm. I see computer vision as a huge tool of future industry solutions.

5. My primary strengths would be my communication skills and positive attitude. These are complemented with a robust set of technical skills. I am never afraid of things I don’t know. I have a great ability to ask the correct questions in order to gain the keen insight into situations. This is very beneficial in online research. I am a very skilled “googler” and pride myself on the ability to teach myself anything as long as I have an internet connection. I also feel as though I brought a positive attitude to the group and was able to make my team laugh or smile in some of the more frustrating situations. Some of my weaknesses would be my impatience with progress and my inability to be confident in delegation of tasks. If the team wanted to stop working for the night or the week, I constantly found myself unable to stop because I felt like we were “so close.” So I would take the project home with me and work on it at night or over the weekend. Also, if I felt like one of my team members were unable to complete the task assigned, I often took their load onto mine instead of teaching them or inspiring them to feel responsible for proper completion.

6. I do not want a wife or kids until I am in my 30s. I want to take these next few years and let my career blossom. I do not plan on furthering my formal education other than an MBA, but I will never stop researching and never stop learning new and interesting theories and applications of technology. What I want most out of life is to find a void in an industry and use my technical skills and work ethic to develop technological solutions and create a business model to fill that void. I want to be involved in healthcare. I want to prove that engineers are the most capable species of professionals in the world. My academic life goal is to one day receive an honorary doctorate degree.
7. I graduate in December, but honestly that doesn’t mean much to me. It doesn’t mean I’m done learning or have reached a level where complacency is tolerated. I need to learn more about Open Source solutions and applications of computer vision. Like I said, I want to be involved in healthcare. That means I need to start researching the fundamentals of that discipline and start looking for opportunities to apply my degree and my technical solution design skills in that industry. In order to fill a void, you first need to know it exists.

Part 2: Appendix

C++ Coding Done by James Quaglia and Matt Wesolowski

```cpp
#include <opencv\cv.h>
#include <opencv2\highgui\highgui.hpp>
#include <opencv2\imgproc\imgproc.hpp>
#include <iostream>
#include <stdio.h>
using namespace std;
using namespace cv;

int threshold_level = 190;

int main()
{
    Mat frame, src, src_gray, edges, bw;

    namedWindow("video", 1);
    VideoCapture cap("http://ece480group5-cam.dhcp.egr.msu.edu/mjpg/video.mjpg");
    if (!cap.isOpened())
    {
        cout << "Camera not found" << endl;
        getchar();
        return -1;
    }
    while (cap.isOpened())
    {
        cap >> frame;
        if (frame.empty()) break;

        // Convert the image to grayscale
        cvtColor(frame, src_gray, CV_RGB2GRAY);

        // Convert to binary image
        bw = src_gray > threshold_level;
```
//Edge detect
Canny(frame, edges, 100, 250);

//show var edges in namedWindow "video"
imshow("video", bw);

if (waitKey(30) >= 0) break;
}
return 0;

James Quaglia
44865 Exeter Ct. Novi, MI 48375 248.345.3678 quagliaj@msu.edu

OBJECTIVE
To obtain an entry-level position related to the field of electrical engineering. Seeking a hands-on work environment with opportunity to contribute to the employer by applying education and work-related skill sets.

EDUCATION
Michigan State University East Lansing, MI
Electrical Engineering GPA: 2.8
Senior (graduating December 2014)

EXPERIENCE
Consumers Energy Grand Rapids/Lansing, MI
Electrical Engineering Intern CS&I Division
May 2013 to Present
• Create and develop geographical catalog of key sites in the greater Grand Rapids area to streamline operations between Consumers Energy and Miss Dig
• Inspect and maintain primary power distribution circuits
• Design and release work order directives to improve overall quality and reliability of the electrical power system

Green Machine Landscaping Novi, MI
Chief Business Operator (2011 Revenue: ~$80,000; 2012 Revenue: ~$230,000)
April 2011 to August 2011 & February 2012 to August 2012
• Responsible for advertising, fielding quotes, scheduling jobs, completing jobs
• Hiring and supervising crews, ensuring consistent quality of work
• Invoice and payment management, payroll, accounting

Michigan Institute for Neurological Disorders Farmington Hills, MI
Receptionist
April 2010 – August 2010
• Fielded roughly 40-50 patient calls daily
• Mastered complex structure of interactions between insurance companies, doctors, and patients

**SKILLS**
Familiar with C++, Matlab, Xilinx ISE 9.2i, Linux, and ROOT, Microstation (CAD)
Strong communication skills
Excellent time management skills
Exceptional analytical skills

**PUBLICATIONS**

**RESEARCH/PROJECTS**
Michigan State University - ECE 480
• Design, build, and test “Smart Camera” computer vision solution for ArcelorMittal production control system
National Superconducting Cyclotron Lab 2012-2013
• Undergraduate Researcher

**HONORS/AWARDS**
3rd Place in 2013 Consumers Energy Intern Idea Competition (160 candidates)
National Honor Society – Inducted in 2011
Walker Memorial Scholarship, Yates Memorial Engineering Scholarship, Michigan Competitive Scholarship

References available upon request