**EE175AB Essays**

**Project Title**

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| Date Submitted |  |
| Section  Professor | Dr. Ping Liang |
| Revision | e.g., revision 2.1 |
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## **1.** **\* Understanding of Professional and Ethical Responsibility**

Write an essay (500 or more words) to answer the following

(a) what are the ethical implications of your project if your design becomes a commercial product or service, examples include but not limited to implications in health, education, privacy, social attitude, fairness of access, privacy, public safety, psychological and developmental effects on children and young adults, etc.

(b) how you addressed them, and

(c) what you learned through this design project about professional and ethical responsibility.

Every team member must contribute to this essay and it must state that every team member contributed to this essay.

Our senior design project is an autonomous ground target vehicle that was proposed by NAVSEA as a method of training on the shooting range. The main goal of this project was to allow for a dynamic method of practicing target shooting. This removes the repetitive nature of a predesignated shooting course and forces the users to stay attentive and approach each exercise without any previous expectations.

The primary users of our project are as stated, NAVSEA and potentially training firing ranges

that incorporate target shooting. Ethically, we are challenged with the reality

that our design will eventually be used to train soldiers who will use their

skills to either wound or potentially kill their opposition in combat or non-combat

situations.

However, the effect of improved training and increasing the individual capability of soldiers pays off with the reduced possibility of collateral damage and a higher survivability chance for the soldier themselves. Civilian and non-combatant casualties are unavoidable in conflict, but by increasing one’s aptitude to selectively choose and discriminate targets from non-targets is vital to preventing such tragedies from occurring. Another desired outcome from our design is ensuring the survival of our soldiers through the combined cooperation and support between members of the same fireteam.

Another one of the bigger, but rarer ethical issues that arises from honing a civilian’s skill in firearms proficiency, if accessible for the civilian populace, would result in the theoretical increase their efficiency in committing a mass shooting if ever a case were to arise. We gave this particular issue much thought because of the implication of potentially providing a would-be shooter the opportunity to practice and increase the casualty risk of such an event. Upon reflection, we think that the opportunity to provide this to the general populace would also provide the police force as well as well intentioned civilians to prevent or counter such a happening from occurring.

Further expanding on the effect of training the firearms proficiency of the police force, we were again faced with another ethical dilemma: the further militarization of the police force. In training the force to be able to shoot to kill or maim targets we somewhat dilute the purpose of the policing of the public: to protect and serve. We somewhat mediated this somewhat by considering the situations in which particular police force would exercise the use of firearms, and determined that the particular skillset that our robot provides is quick target acquisition, friend or foe identification, and snap decision making is better to provide than not.

In retrospection, a simple robot that raises and lowers a target raises more ethical questions than we have initially imagined. We gave the conflict between one’s ethical and professional consideration much thought, since the decision to develop a technology which could result in another’s injury or death is one that we have to mediate within ourselves. Do we or do we not bear the responsibility of causing damage to another being through our work; and if we do refuse the task are we dooming another to question the same ethical dilemmas we experience in the first place?

## **2.** **\* Global, Economic, Environmental and Societal Impact**

Include an essay (500 or more words) that discusses the potential global, economic, societal, and environmental impact of the project if your design becomes a commercial product or service. You do not need to address every aspect, just focus on a couple of aspects that are related to your project. For example, if your design becomes a commercial product or service, how will it improve quality of life, affect the environment, energy usage, resource allocation, enhance entertainment, education, globalization etc.? Are there any ethical or political debates, laws and regulations that are related to your project?

Every team member must contribute to this essay and it must state that every team member contributed to this essay.

Our project implements autonomous programming with dynamic variation, GPS orienteering, and active pathing with the primary focus being improving the method of training soldiers in combat situations. Since we are building a training robot geared towards military application, we do not expect this product to hit the market as one used for training, but perhaps the source code we produce can alternatively applied as another variation of GPS navigation, further exploration of robotic automation, or pave a path for future iterations to expand upon. Our impact on the world as a whole is not significant in regard to the specific use of our project, however the conceptual implementation of certain aspects of our design have a greater impact

The goal set for us by NAVSEA was to help marines hone their shooting skills and better improve their accuracy and precision. In doing so, we can reduce unnecessary collateral damage to humans or the environment. Better preparing soldiers to be able to react to an elusive target increases their survival chance as well as reduce damage on the area around it. Wherever the US flexes its massive military ability, it ravages the landscape of which conflict occurs; during and after war. Lead, scrap metal, and explosions mar the environment, taking decades to disappear fully. The solution for this is more accurate weapons and better trained individuals to limit the effect of waging war. However, in this time of turbulent peace, the further strengthening and investment into the United States’ military strength sends ripples in the global political atmosphere.

As the concept of complete autonomy of vehicles gradually approaches, we can only imagine the impact of the replacement of occupations which primarily relies on motor skills and repetition. For instance, the job of target activation and deactivation was previously done by a soldier standing in a lowered position with a target affixed to a stick. Recent development and engineering has replaced this dangerous task with a simple machine. In general, further development of automation introduces a safer work environment, with the costly trade-off of replacing contemporary jobs and higher manufacturing costs as more complex systems are developed. The societal impact of this gradual domination has yet to be fully realized; modern literature has brushed over the potential of this technological takeover, but the result is varied in scope. Not only does this affect the global job market, this also requires a massive investment and implementation of alternative power/fuel to further develop and feed the internet of things. This is beneficial in that the sustainability and stability of our planet’s climate is preserved, as well as providing faster and more available supply of goods and services for which we can utilize in a safer manner than was previously possible. In turn, need for higher skill labor will increase, increasing the demand for higher education. This will eventually usher in a new way of looking at the needs of society as well as create a sweeping change of a human’s role and responsibility in the world as a whole.

## **3.** **\* Contemporary Engineering Issues**

Include an essay (500 or more words) on the contemporary engineering issues related to the project. Potential contemporary engineering issues related to your project include new technologies, new industry standards, new design methods, new materials, new trends in manufacturing, etc. You do not need to address every aspect, just focus on a couple of aspects that are related to your project. Example: One trend in electronics is high level integration and very low power consumption requirement, how is that related to your project? Another example is distributed real-time sensing and real-time decision, how does your project fit with that trend? Other examples of contemporary engineering issues are cloud computing, broadband wireless data becoming more widespread, renewable energy, natural resources becoming increasingly limited, population becoming old and needing more care, Internet security threats are increasing, etc.

Every team member must contribute to this essay and it must state that every team member contributed to this essay.

As with many other senior design projects, one of the biggest challenges in developing the form factor. We had nothing to base the design off of and instead we relied on previous experience with building robotics to approach the design. The biggest issue in the design was space and wiring. We have a total of 4 DC motors and 2 stepper motors that control the movement and target apparatus respectively. The DC motors were mounted straight onto the chassis because it was meant to hold it. Regarding the stepper motors however, we had to create a platform made of TETRIX beams with custom dimensions.

Our Raspberry Pi 3 Model B is at the heart of our project and controls everything from GPS location tracking to motor control. We had originally purchased one 11.1V battery as the power source for all 4 DC motors and 2 stepper motors. We had intended to use the same power source for the Raspberry Pi but we would run into overcurrent issues. Therefore, we purchased another 7.4 battery to power the Raspberry Pi and nothing else. The Raspberry Pi runs off of 5V DC and draws 2.5A. The battery we have is rated at 7.4V and has a capacity of 3300 mAh. We regulated the power with a 5V 2.5A voltage regulator and the Pi successfully turns on. Although this solution allows for mobility, there is still the potential of undervolting during operation. The Raspberry Pi did show an undervolting error but that was only during startup and extremely heavy computational instances.

To communicate and execute programs that we have written on the Pi, we are utilizing a virtual network, specifically Hamachi, to allow us to SSH in. During the testing phase, we will have the Pi connected to the internet via a 4G hotspot so that we can access it wirelessly. Implementing the use of a virtual network made it much easier for my teammates and I to work on the code simultaneously from our respective houses because we did not have to work with our schedules to figure out what times we could work. When we all were free at the same time, we did get together and code but when we had to work remotely, we would be able to SSH into the pi at anytime and get work done.

Overall, our project was not affected greatly by contemporary engineering issues. Primarily, design and efficiency were the biggest obstacles we had to overcome but because the idea behind our project was relatively straightforward, we were able to approach the contemporary issues with relative ease. Having the chance to develop our own design and implementing it to work with our software was a great experience for us to put all our knowledge from previous classes to the test. In the future, we hope to see this project go beyond the scope of this class and see it in action not only in NAVSEA but also in general firing ranges.

## **4.** **\* Recognition of the need for and an ability to engage in lifelong learning**

Write an essay (200 or more words) on how doing this design project helped you

(a) recognize the need, and

(b) developed the ability in lifelong learning.

Every team member must contribute to this essay and it must state that every team member contributed to this essay.

This project in particular presented a difficult challenge for us, forcing us to explore new methodology and expand our technical comprehension further than we previously attempted. The comprehensive need to explore what options are available as a solution to a presented problem is critical for our future endeavors as engineers. The sheer amount of knowledge required to put together a simplistic project is mindboggling on reflection. We needed to analyze every aspect of our design, from specification details of power draw and voltage requirements to size restraints and pin availability. Each aspect needed to be scrutinized for hours before purchase and fitting. We ran into some setbacks in which a minor detail would be overlooked, resulting in hours to days lost waiting for and returning useless parts. As a result, we felt we needed to scrutinize and discuss the applications in groups to both bounce ideas back and forth and to jointly analyze and determine whether or not we were within our specifications; effectively learning from eachother and expanding our combined pool of knowledge. Our consensus on the bare requirement for our future work endeavors is that we would constantly need to research and learn in order to sit on the leading edge of technology.

## **5.\* Importance of Team Work**

Write an essay (100 or more words) on how doing this design project helped you understand the importance of working with a team.

If you team includes members from other non-EE majors, describe what you learned from working in a multidisciplinary team. If your team is all EE majors, describe how you sought assistance or input from people in other disciplines (e.g., mechanical engineering, computer science, bioengineering, physics, etc.)

In working in a team with different disciplines, such as a Computer Engineer and Electrical Engineers, we had to combine our knowledge from our respective fields to be able to overcome the obstacles this project created. For example, we had to do some coding in Python, where the Computer Engineer taught us how to do it and how to code it to make sure it was in line with the project and it was clean.

We also had to seek assistance from a Mechanical Engineer to build our chassis and make sure we did not overload certain parts of the chassis or damage the supports.

## **6. \* Project Management**

One paragraph from each team member

How was the project managed, how was tasks distributed, how was scheduled made, what project management software/method did you use, your experience in working together, what have you learned in terms of team work, time management, project management etc., from this project.

Samuel Choi:

This senior design project was distributed among the three of us into software and hardware portions. Taylor and I had more experience with the hardware aspect whilst Francisco had more experience with software. We created a gantt chart at the beginning of the school year and attempted to follow it accordingly but it was difficult. Time management was a big factor in completing this project and teamwork was the most important part of this project. Without us helping each other, there would have never been any progress. Communication skills were vital as well in order to keep the flow of the project smooth.

Taylor Che:

This project was divided equally between three of us into two sections, hardware and software. I and Samuel worked on the hardware portions from the beginning, while software was handled by Francisco and once the hardware was completed, all three of us worked on software. Scheduling was complicated, conflicting schedules was a major contributor in meeting our deadlines, but was made up for by our cohesive teamwork. I feel that I further developed a better understanding of planning, realistic objective design, and issue resolution.

Francisco Munoz:

The project was divided evenly, with the software, mechanical, and electrical components. I was in charge of the software side and Taylor Che and Samuel Choi were in charge of the mechanical/electrical side of the project. For managing the project, we used a Gantt Chart to divided down the tasks and the time we had to complete the project. It took us a while to get used to working with each other and about five weeks in, we were coordinated with working on different tasks and not interfering with others tasks. With team work, we have to sacrifice some things to ensure the completion of the project. Time management was a strong point to pay attention to so we could all coordinate our schedules and make use of our time.