EECS 159A (2020) Take-Home Midterm Assignment

Autonomous Trail Rescue Rover

Due Date: 11/13/20

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2.1) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare.

Our project addresses modern issues of public health, safety, and welfare on the trail by shortening the time it takes for injured hikers to get the help they need. As it currently stands, hiking has seen a largely upwards trend in popularity as a means of recreation for many Americans. Prior to the onset of COVID-19, hiking found itself to be the 4th most popular outdoor activity in the United States. According to a 2019 study by The Outdoor Foundation, hiking was the 4th most popular outdoor activity behind running, fishing, and biking (McManus 2019). With any outdoor activity comes the possibility of injury--a 2018 study by the British Columbia Injury Research and Prevention Unit (BCIRPU) found that 6.1% of Yosemite hikers found themselves injured while hiking (Krolikowski 2018). In the absence of cell reception, there are currently no viable solutions for injured hikers to get the immediate medical attention they need. If travelling in a group, a member of an injured hiker's party would need to run to a ranger station and ask for help, or find a place with cell service. If travelling alone, an injured hiker would have to wait for another hiker to pass, and ask for the same preceding actions. For both cases, the existing solutions take too much time.

Our Autonomous Trail Rescue Rover would solve the problem for both of these cases by providing a way for both solo hikers and group hikers to get the immediate attention they need in the case of an injury. Specifically, hikers would be able to physically interface with our rover, which would ping the hikers' locations back to a ranger station upon determining that medical attention is necessary, and a ranger would be able to call for medical services at the injured hikers' gps coordinates. If our rover could constantly patrol certain difficult to reach or

injury-prone areas of a trail, we could greatly minimize the time it takes for injured hikers to get the medical attention they need.

2.2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of global, cultural and social factors.

Our project demonstrates consideration for the global world through some of the design decisions we made. By selecting hiking as the real world use case, we are improving an aspect of life that is not only popular in the United States, but across the globe (McManus, 2019). People from all walks of life can enjoy a hike and our rover seeks to improve the experience of anyone who frequents hiking trails. The rover will be able to enhance the social experience of hiking, by decreasing the amount of time it takes for help to arrive in emergencies, improving safety.

In light of the COVID pandemic, with the increased need for social distancing, our rover can provide a way to aid hikers without requiring direct contact with a park ranger or medic (Godoy, 2020). The rover aims to patrol hiking trails, reducing the need for park rangers to do this physically themselves, which can then eliminate potential close contact between hikers and rangers on the trail. Rangers would only be requested to come help those who specifically ask or are unresponsive. Furthermore, a potential extension of this project is to attach a payload of medical supplies to the rover, to be distributed on request to hikers in need. Minor medical issues could be addressed without any human contact at all.

Another way in which we may be able to increase the effectiveness of this project is to add the ability to communicate in different languages. While we have now decided not to include this feature in our first prototype, we initially considered implementing audio that could speak in multiple languages, to increase the likelihood the rover would be able to communicate with

hikers in need, as well as to allow the project to potentially be installed in other countries other than English-speaking nations. One way this could be implemented in the future is to utilize a text-to-speech API that supports multiple languages. Similarly to a telephone machine prompt, the rover's speech could cycle through the same message in several different languages in order to be able to help the widest range of people possible. Furthermore, extensions to our UI panel could be added, allowing users to select the rover's current language.

2.3) An ability to apply engineering design to produce solutions that meet specified needs with consideration of environmental and economic factors.

It is within the best interest this rover can help provide more immediate assistance to hikers who require them along populated trails. As of the National Trails System Act of 1968, the establishment of hiking trails to be available to all people of any age, skill or condition would mean that these would be the more congested trails when people would be more likely to appear, including those who may be injured. With an autonomous rover who can patrol areas along these paths to occasionally monitor people or search for those who have strayed off-course, it acts as a quick medium that can notify a park ranger quicker than an extensive search party that expects people to be working along the trails constantly.

A majority of National Parks having a legal issue of a No-Drones Policy as an unmanned aircraft device may pose threats to aesthetic or natural wildlife in the area, usage of a rover along a common hiking trail does not disturb the natural scenery. The structure and system itself for the rover allows for non-polluting energy through rechargeable power as well as a series of GPS landmarks allows park rangers to consistently record the status along the trails. By having them

to be aware of wherever the rover detects signs of assistance, rangers can have more precise manned rescues rather than scattered searches that would waste their resources and fuel to travel.

4.1) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments considering the impact of engineering solutions in a global and societal context.

In our thought process of the Autonomous Rescue Rover, we have taken into account the importance of ethics in engineering and have implemented the National Society of Professional Engineers (NSPE) Code of Ethics for Engineers into our work and documentation. Under the NSPE code of ethics section II subsection 3, we exercise our documentation of our work in the most truthful manner and include all relevant information of the date the work was conducted (NSPE, 2019). To incorporate untruthful information is to deceive others and violate the engineering code of ethics, rescinding the trust of society on the development of science and technology.

We student engineers working on the Autonomous Rescue Rover exercising professional standards and understand the responsibilities as engineers and document all information throughout the process, be it failure or success. Being truthful with our work is the most important aspect as it impacts the future of technological development and strengthens global and societal trust advancements in technology. In being completely truthful and just with our work is to implement ethical conduct in our work at all times, including giving credit where it is due. Under the NSPE code of ethics section III subsection 9, credit for work and inspiration will be given where it is due via work or sources. Exercising the most professional of standards is to become better engineers ethically and responsibly address global and societal issues.

4.2) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in an economic and environmental context.

Our goal in designing an autonomous rescue rover is to provide assistance to hikers and rangers along hiking trails. Through our work and documentation, we research components and items that we believe only to be crucial in structuring our project and do not ask for anything more. To capitalize and misuse funding is to violate professional conduct and ethics as engineers. Deceitful acts in pursuit of personal gain is unethical in an economic sense as misuse of designated funds for any unauthorized purchases disregards the trust of providers and advisors.

Addressing environmental concerns, we are planning to implement a rechargeable power system to reduce production of pollutants, especially on hiking trails where many enjoy a scenic walk and a breath of fresh air. It would be unethical in an environmental sense to pollute areas many turn to for fresh air and exercise. In implementing a rechargeable power system, we can address the issue of introducing pollutants in an area and providing assistance to hikers and rangers on hiking trails.

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Autonomous Rescue Rover involves building a rover from scratch and one of the challenges would refer to mechanical engineering. Since we don't have any mechanical engineers in our team we will have to research on our own the basic fundamentals of mechanical physics and what would be best for our scenario. Our approach to an unknown problem would be to focus on what we know for now and then when we know that it 100% works with what we

know, we can add on to it. If a problem arises, we will at least have something to fall back on and rethink a new strategy.

Our current tentative approach for the chassis structure of the rover would be to use four wheels instead of our initial concept of six wheels. The reason we chose to use six wheels was because in our research we discovered that there are a lot of benefits for having six wheels such as superior terrain navigation. However, after further review we concluded that designing a structure for six wheels would be a challenge for our field. Therefore as a team we determined it would be better to have four wheels work as our first checkpoint, before challenging the addition of six wheels.

One strategy that we talked about as a team was to divide and conquer, which basically means that we each have a specification on parts of the rover we will manage. After we each research our own parts we come back together and discuss our findings and if it would be applicable with respect to each specification. With this method we can summarize the main idea to each other more effectively than each of us doing all of the research ourselves.

References

1) Godoy, Maria, and Allison Aubrey. “It's Time To Get Serious About Social Distancing. Here's How.” *NPR*, NPR, 17 Mar. 2020, www.npr.org/sections/health-shots/2020/03/17/817251610/its-time-to-get-serious-about-social-distancing-here-s-how.
2) Krolikowski M, Black A, Richmond SA, Babul S, Pike I. Evidence Summary: Hiking/Mountaineering. Active & Safe Central. BC Injury Research and Prevention Unit: Vancouver, BC; 2018.
3) McManus, Melanie Radzicki. “The 'Wild' Effect? Why Hiking Is Surging in Popularity in the U.S.” *HowStuffWorks*, HowStuffWorks, 26 Mar. 2019, https://adventure.howstuffworks.com/outdoor-activities/hiking/wild-effect-hiking-surging.htm
4) “National Trails System Act Legislation.” *National Parks Service*, U.S. Department of the Interior, 2019, www.nps.gov/subjects/nationaltrailssystem/national-trails-system-act-legislation.htm.
5) “Unmanned Aircraft in the National Parks (U.S. National Park Service).” *National Parks Service*, U.S. Department of the Interior, 2019, www.nps.gov/articles/unmanned-aircraft-in-the-national-parks.htm.
6) “Code of Ethics for Engineers|”. *National Society of Professional Engineers,* 2019. https://www.nspe.org/sites/default/files/resources/pdfs/Ethics/CodeofEthics/NSPECodeofEthicsforEngineers.pdf