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CPSC 491

Mr. Worobec

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Individual HW #5

**Formatting:**

I found the formatting for this assignment easier to follow when divided by section:

Section N.N

N.N Draft

N.N Revision

N.N Discussion

**Section 1.1**

**1.1 Draft**

The problem that we are trying to solve is a lack of delivery options in areas that aren’t reachable via roads mapped by GPS. The main area we’re going to be focusing on is Gonzaga’s campus, due to its population density and proximity to where we live. In the past few years we have seen massive growth in delivery services such as Uber Eats and Postmates, but there are some markets that these companies are not focusing on. They largely neglect deliverables besides food. School supplies, cheap electronics (e.g. phone charger, earbuds), or small household supplies. To address these geographic areas, you need a small robot that is able to deliver these products to areas that would otherwise not be reachable by vehicle. We are working on creating this small robot, with our end goal being focused on addressing the more specific and specialized markets.

To do so, we have to develop hardware and software that is able to work together to navigate the terrain and safely drive itself to designated areas. We are focusing on creating a computer vision platform that utilizes cutting edge techniques in a 3D mapping algorithm known as SLAM (Simultaneous Localization And Mapping), image detection and image recognition to provide this to users. Through the design and implementation of this product we will create a solution to this problem that can be expanded into specialized markets beyond Gonzaga campus.

**1.1 Revision**

The problem we intend to solve is a lack of delivery services within sidewalk-enclosed areas. To that end, we will focus on Gonzaga’s campus due to its population density and proximity to where we live. There are delivery services currently operating, namely Uber Eats and Postmates, who efficiently deliver goods over short to medium ranged distances. These companies have been successful in their current operational domains but have yet to extend their reach into smaller-scale, geographically enclosed areas. Sidewalk-safe autonomous robots are needed to effectively address deliveries in these areas for economic and logistical reasons. We plan to build a small autonomous robot capable of fulfilling delivery needs in this specific market segment.

We must develop a hardware and software platform able to safely navigate campus sidewalks and securely deliver goods to various locations on campus. Our efforts are focused on creating a robotics platform that utilizes state-of-the-art techniques in computer vision, robotics, and controls. We will engineer a solution to this problem that can be expanded into other small-scale enclosed regions beyond Gonzaga’s campus.

**1.1 Discussion**

The primary changes made in this section are to clean-up the way our project is communicated. Changes made to the first paragraph make the problem statement clearer and more concise (beauty). The first paragraph is thirty-two words less yet conveys a clearer message. I think this is considerably tauter (economy) and more informative (tone) than the initial project plan. There were also a few grammatical errors (grammar) that I removed. The second paragraph had issues with throwing around buzzwords that were unnecessary and didn’t convey much meaning (obfuscation). Changes made to the second paragraph were for the sake of economy, beauty, and obfuscations. Like the first paragraph, it is shorter in length and clearer.

**Section 1.2**

**1.2** **Draft**

Our major project objective is to write software for a robot that can autonomously navigate Gonzaga campus to make deliveries. Our robot should be able to receive and execute delivery instructions that, at a minimum, are directly passed into the robot’s software as parameters. As a stretch goal, we’ve discussed including WiFi functionality to allow users to input delivery requests remotely. We also plan to work with the hardware team to design the physical, hardware-based aspects of the robot. The bot should be able to support, carry, and transport small items (such as food, beverages, school supplies, electronics, and small household supplies) from point A to point B on the Gonzaga University campus. While the method of inputting delivery requests will depend on our progress throughout the rest of the year, we are dead set on having the robot act completely without human intervention once it does receive this request.

**1.2** **Revision**

The primary objective of our project is to create a valuable delivery service for people on Gonzaga’s campus. If people have the option for delivery from 1887 or the Marketplace, they can potentially have more free time to do whatever it is that they want to do. We believe people hate waiting in lines and would rather wait in Herak, Colllege hall, or elsewhere on campus. It can be a pain if you are busy studying at the library and pack up your things to grab a snack. Our service would alleviate this annoyance.

Once we have a functional MVP for Gonzaga’s campus, we hope to expand the functionality of our project to work in other populated enclosed areas such as golf courses, beach side boardwalks, and retirement homes. Our project has the potential to create added value for people who regularly find themselves in these areas. Besides creating value for these people, we would also like to make valuable contributions to the mobile robotics community by making our source code and hardware designs open-source.

Our objectives can be laid out as:

* Create an open-source sidewalk delivery system for a store on Gonzaga’s campus.
* Build an open source logistics platform for tracking and planning mobile robot deliveries.
* Learn about and contribute to state-of-the-art technologies in computer vision, mobile robotics, and controls.

**1.2 Discussion**

We wrote about the what when we should have written about the why behind our project. I thought it would be better to write this section from our own perspective as students. We have busy lives and it’s often true that we don’t have much time to drop what we are doing and walk to the Marketplace. I also think it’s important to talk about potential extensions of this project as well as associating it with open-source. I think in doing so it clears up our motivations behind the project. I will probably go back to this section to make more revisions because I think our objectives has room for improvement. We can probably better-define and express our objectives.

**Section 1.3**

**1.3 Draft** Stakeholders

● Software team (Us)

● Hardware team

● Worobec (Advisor)

● Ryan Hendrickson (DAB)

● Gonzaga Students

● Gonzaga Faculty

● Anyone else on Campus that could benefit from an autonomous robot delivery system

● Sodexo

Our number one stakeholder is ourselves and the hardware team, as we are a self sponsored team and our success as a team in this project determines whether or not we graduate. This presents a somewhat unique challenge for our team as we are responsible for deciding on an appropriate scope and MVP for our project and also requires a higher level of being responsible with meeting development timeline goals. Another stakeholder is our faculty advisor, Dr. Worobec who will be keeping track of our weekly task sheet and at times serving as an advisor/pseudo sponsor to the project. Our target stakeholders are the on-campus users at Gonzaga who would potentially use our delivery robot to deliver them food or other items to any location on campus.

**1.3 Revision**

The table below describes the stakeholders of our project

|  |  |
| --- | --- |
| Software/Hardware teams | As a self-sponsored team, our success is very dependent on the planning and work we put into this project. |
| Bruce Worobec | As our faculty advisor, Bruce will be helping us see our project through by providing managerial guidance. |
| Ryan Hendrickson | Ryan is our DAB member advocate. He will be helping us alongside Bruce as a helpful resource in helping our project come to life. |
| Folks on campus | The people on campus are also stakeholders in that if we are successful, they will have a valuable service to use. |
| Campus shops | If we are successful campus shops will be able to increase revenue. |
| Robotics community | Our contributions will potentially help people interested in mobile robotics have another source of information or technology for working in robotics. |

**1.3 Discussion**

I took up your suggestion and turned our bullet points and prose into a more suitable format – a table. This makes paints a clearer image of our stakeholders and provide a clearer description of each of their roles in the project.

**Section 1.4**

**1.4 Draft**

Our final project deliverable will be an autonomous robot that is able to deliver goods to locations on campus. This will include visualizations of the object detection and SLAM, which will be running on the bot. We will also include documentation of how we accomplished the different features on our bot and how to use and train it.

**1.4 Revision**

Our final project deliverable will be an autonomous robot that delivers goods to locations on campus. This deliverable may be split into two categories – hardware and software. The physical robot will be designed by the hardware team, and the software that controls the robot will be designed by our team. The teams are decoupled enough so that each team is capable of success independent of the other team. But note that this decoupling is not to a degree that hinders each team from putting together our works to make a more engineered solution. We hope that both teams are successful so that we can reach our objectives more thoroughly.

For our side-deliverables, we will open-source all plans, software, and add a wealth of documentation on our project blog website. We hope to provide the greater-robotics community with a great source of information about what we will have developed and what we learned as a group in our endeavors. We will regularly post project updates on our websites and to various robotics forums.

**1.4 Discussion**

The first revisions I made to this section was making things more exact. I expanded a bit on the ideas we were trying to express regarding the deliverables and the dynamics of each team. I think this section might need a little more revision in fleshing out a description of our deliverables. I think once we have our user stories a bit more concretely written; we will be able to improve upon this section.

**1.6** **Draft with slight revisions**

The Amazon Scout [0] does sidewalk-delivery of Amazon orders to houses in Snohomish County, WA. The Scout has six wheels, runs off an electric battery and moves through suburban and urban areas at walking pace. Based on images provided by Amazon, the robot appears to have four or more sensors in the front, as well as fog lights and brake lights. The Scout is still in its testing phase, as Amazon plans to have human supervisors making rounds to monitor the success of the Scouts. Amazon has mentioned rolling these out on college campuses, likely due to their population density and the fact that campuses are generally rather compact. This is our rationale for choosing to test our project only on Gonzaga campuses, and this appears to be a good call based on the similar plans made by Amazon. The Scout is based on deliveries from Amazon, which are mostly packages that are ordered online. Our product will be different because it is focused on campus deliveries from campus-based stores.

Amazon Scout Delivery Bot [image omitted to save printing costs]

The most similar existing system is from Starship Technologies [1]. They have a small robot they call Starship. It is built around delivering food and packages. Based on images provided on the official Starship website, they appear almost identical in design to Amazon’s Scout. Eight sensors/cameras sit at the front of the robot, which sports six wheels and an overall shape nearly indistinguishable from the Scout, aside from branding and livery. Starship Technologies have recently partnered with Sodexo to have a presence on campus [1]. One of the things that separates our project from Starship’s is that we are using the campus as a training area to get an MVP, but our end goal is to target places such as golf courses and boardwalks. It seems as if they focus on cities and urban driving, where our bot would eventually want to target specific markets that are outside of that realm. This is the main competitor in the area, and as they are expanding into new markets, we are keeping up with information about them and how to differentiate our product them theirs.

Starship Delivery Bot [image omitted]

Another existing system that is working to provide a similar service is the autonomous delivery vehicle by Nuro [3]. Nuro has partnered with the grocery chain Kroger to deliver groceries directly to people's houses. The vehicle is capable of driving on roads alongside cars and goes up to 25 miles per hour. This is a very different project from ours because it is a large vehicle which is designed for urban driving. However, it could provide us with lessons about how to deal with other vehicles which our bot will have to do in a small sense when driving around Gonzaga’s campus. It’s difficult to accurately compare our robot with the above projects above due to all listed projects being in the development stage, but at a high level, Starship, Scout, and our robot are quite similar. All three projects are intended to reduce the need for human intervention in delivery services by designing a robot that can autonomously navigate and deliver small items in a more-or-less urban environment. One major difference is that the scale of our project is much smaller, and we’re not doing the project for profit. In terms of scale, our project will focus on delivering packages within a small area (Gonzaga University Campus). Amazon Scout and Starship are intended to be used in suburban and urban areas to deliver larger packages that were ordered through an online shopping service.

[0] <https://www.theverge.com/2019/1/23/18194566/amazon-scout-autonomous-six-wheeled-deliver>; <https://blog.aboutamazon.com/transportation/meet-scout>

[1] - <https://www.starship.xyz/>;

[2] - <https://www.theverge.com/2019/1/23/18194566/amazon-scout-autonomous-six-wheeled-deliver>

[3] <https://www.washingtonpost.com/technology/2018/12/19/tired-going-grocery-store-arizona-robot>-driven-car-will-deliver-groceries-your-home/

**1.6 Discussion**

I think this section is solid as it is. We’ve done our research on existing systems and are knowledgeable about the current solutions people are working on. I tightened up a few of the sentences in this section and made some grammatical corrections. I also removed a sentence that starts with “Obviously,” to rid the sentence of the upper handedness and to make it sound more austere.