Letter of Intent

Prepared by Group 10

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Non-Binding Initial Proposal for Here and Now Delivery

MREN 203 - Mechatronics and Robotics Design II

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1 About SSG Robotics

At SSG Robotics, we design autonomous mobile delivery robots. Our solutions are built to last. The goal is always to improve the safety and efficiency of our client's delivery operations. We design precise, lightweight, and strong robots with lasting battery life to achieve these goals. We believe in being prepared. Hence, the robots we design are dynamic to meet the needs of their environments. We consistently strive for excellence in planning, budgeting, and delivering our robots on time. In previous years, we had a $1.2 million project to build robots to support the transportation of small, fragile containers at shipping docks. This project is a last-mile delivery as the robots transport packages from boats to their precise location on the shipping dock. Similarly to the RFP at hand, the shipping dock robot transports packages to dynamically allocated locations. Hence, as a company, we have plenty of experience in this field and see significant potential in adopting similar practices in an airport environment.

2 Problem Definition

Busy airports present many risks to travelers' and employees' safety. These risks include but are not limited to, stolen baggage, dense traffic, and stolen documents. Many of these risks can be mitigated by travelers staying at their designated gates. Hence, the goal of our robot is to prevent travelers from having to leave their gates in hopes of reducing the risks posed by busy airports. SSG Robotics objective is to develop a mobile robot that will navigate and deliver goods within airports to both travelers and employees. This environment was chosen as a good fit for this problem since airports are often crowded and cover a large area. Because of this, a small and maneuverable robot will allow for time sensitive deliveries and goods to move through the airport more efficiently and without human personnel being used, reducing costs. For travelers, this will also relieve the stress of navigating the airport to get things they may need before their flights. The bot will not require any human intervention once sent on delivery and will navigate using both a sensor and a built in navigation system to find the optimal route.

3 Conceptual Overview

In response to HND, SSG Robotics proposes a semi-autonomous mobile robot equipped to handle deliveries of goods in an airport environment upon user request.

A simple overview of the sequence of events is as follows: The user (passenger or staff) requests and pays for a delivery service using a web application. The robot processes the request in a priority queue and executes the next task. Depending on the order, the system alerts a representative from the retailer to either begin making the order or to set aside the required goods. The robot proceeds to determine the optimal route to the pickup point via its path finding algorithm and navigates itself to that point with the use of its Sharp IR and LiDAR sensors. The retail representative deposits the goods into a latched compartment on the robot that is then

locked. The robot once again calculates its optimal route and travels to users' delivery point, making use of its horn or lights if necessary. The user unlocks the compartment with a custom unlocking technique and takes the goods they ordered. The user receives an estimated time of arrival calculated from the position of the robot throughout the duration of the order. For feasibility this process must occur more efficiently or faster than what the user could have done on their own.

3.1 Solution Requirements

To execute the proposed solution SSG Robotics has outlined five key requirements that must be met during the design and prototyping phase.

1. **Time Constraint:** Must make deliveries before the user has to board their plane or in a similar amount of time that the user would do the task themselves.
2. **Navigation:** Must determine the global optimal route and then navigate a dynamically changing local environment.
3. **User Interface:** An application or website must allow the user to make the order, pay for their order and view or track the status of their order.
4. **Safety:** The contents of the order cannot be tampered, stolen or pose any security threat to the airport.
5. **Reliability:** Little to no error is permitted.

3.2 Solution Assumptions

A list of reasonable assumptions has been prepared for HND. Assume:

- The entire terminal of the airport is wheelchair accessible.
- Retail representatives are trained to interact with the robot and can retrieve or prepare orders in a timeline manner.
- Retailers should be able to process online orders or be notified ahead of time.
- The user does not leave the terminal of the airport during the order.
- The user takes all the contents they ordered from the robot.
- The robot is not physically disabled by other people in the airport.

The applications of the robot are not limited to small deliveries to flight passengers. Future considerations for this technology can include transporting high value items from gate to gate for airlines, transportation of small carry-on luggage from gate to gate in time sensitive situations and potentially assisting visitors with directions to their gate or to baggage claim.

4 Strategic Plan

4.1 Project Leads

- Jamie Strain - Software Lead
- Sebastien Sauter - Electrical and Project Management Lead
- Marlow Gaddes - Mechanical and Documentation Lead

4.2 Team Standards and Expectations

- Communication: iMessages and Email
- File Storage: GitLab and OneDrive
- Deliverables: LaTeX or MS Word
- Weekly Workshops: Mondays, 8:30-10:30 am and Tuesdays, 9:30-11:30 am.
- Weekly Meetings: Thursdays, 2:30-3:30 pm.

4.3 Project Timeline

Starting from the release of the RFP, the project has been given a 12-week timeline. SSG Robotics is expected to submit 5 deliverables summarized by **Table 1**.

Table 1: Project Deliverables

Deliverable	Description	Submission Date
Letter of Intent	Non-Binding Initial Proposal	Week 2
Technical Update 1	Prototype Development Summary	Week 4
Conceptual Design Report	Final Design Proposal	Week 7
Technical Update 2	Prototype Development Summary	Week 10
Final Design Exhibit	Public Prototype Showcase	Week 12

Technical challenges and delays are expected while developing the prototype. Therefore, prototype development is to be front-loaded during the workshops to identify design challenges early. Deliverables are to be discussed during the weekly meetings and completed independently.