Targets

Derivation of Targets / Method of Validation:

The targets were developed to ensure customer satisfaction. The weight target of 20 lbs. was determined by assessing an office worker's ability to carry an object without being too burdensome. The size target of 24 cubic inches was determined by marrying two objectives. One being that the platform must fit through a typical office space. The smaller the platform is, the less likely it will be to collide with obstacles. However, if the platform is too small, people in the environment may step on or fail to see the platform as it navigates the space. The speed target of 2.5 mph was determined by taking the lower range of an average human's walking speed, which was found to be between 2.5 and 4 mph. The target of autonomy we determined to be most crucial as the goal of the project is to increase workplace efficiency. Should the platform require direct human manipulation, it would fail to accomplish this goal. Additionally, there is included the platform's ability to traverse various terrains found in a typical office environment. These include fine carpet, tile, and the transition between carpet and tile. The device can either navigate these environments, or it cannot. The platform must also have the ability to cut power if needed. We quantified this target by its ability to stop locomotion in 2 seconds. Finally, the speed at which the platform collects the data contained in the QR code was determined to be 2 seconds. This was deemed to be a reasonable amount of time for the scan to occur.

These targets, their metrics, and other pertinent information is included in more detail below.

List of Targets:

Autonomous Driving

- **Function / Not a Function**: This is not a function.
- **Metric**: Navigate to and successfully scan a QR code while avoiding all obstacles.
- **Value**: Autonomous
- **Justification**: The main idea of this project is to create an autonomously driven robot.
- **Level of Importance**: Crucial
- **Consequences of failure**: Missing this target would amount to failure of the project.

Size Specifications

- **Function / Not a Function:** This is not a function.
- **Metric:** External platform dimensions.
- **Value:** 24x24x24 inch.
- **Justification:** Exceeding the size specifications would be impractical for an office environment.
- **Level of Importance:** Intermediate
- **Consequences of failure:** If the size does exceed the specification by 5%, there will be negligible consequences to project success

Weight Specifications

- **Function / Not a Function:** This is not a function.
- **Metric:** Platform weight.
- **Value:** Less than or equal to 20 pounds.
- **Justification:** exceeding weight specifications would be impractical for an office environment.
- **Level of Importance:** Intermediate
- **Consequences of failure:** If the weight does exceed the specification by 5%, power consumption might increase, making it harder for us to not pass these costs onto the consumer.

Multiple Terrain Navigation

- **Function / Not a Function:** This is not a function.
- **Metric:** Able to traverse various surfaces typically found in an office environment
- **Value:** No wheel slipping in office environments.
- **Justification:** The robot needs to travel to the destination with minimal jerk.
- **Level of Importance:** Intermediate
- **Consequences of failure:** Wheel slippage increases power consumption and increases the time taken to navigate to the QR code.

Speed of Navigation

- **Function / Not a Function:** This is not a function.
- **Metric:** Navigates at average human walking speed.
- **Value:** 2.5 miles per hour
- **Justification:** The robot needs to navigate to the target in a timely manner while reducing the risk of collision.
- **Level of Importance:** Intermediate
- **Consequences of failure:** Exceeding speed specification by 2% may increase risk of collision or injury.

Data Processing

- **Function / Not a Function:** This is the data processing function.
- **Metric:** Scans QR Code at a specified destination and collects the information in a timely manner.
- **Value:** Processes information in 2 seconds.
- **Justification:** The key idea is to scan a QR code using an autonomous robot.
- **Level of Importance:** Crucial
- **Consequences of failure:** Missing this target would amount to failure of the project.

Enabling / Disabling Platform

- **Function / Not a Function:** This is not a function.
- **Metric:** Turns the robot on or off.
- **Value:** Must turn off/ on within 2 seconds.
- **Justification:** Makes use of the platform easier for customers.
- **Level of Importance:** Intermediate.

- **Consequences of failure:** Can exhaust batteries. Ease of use will be lowered.

Metric Number	Need	Metric	Importance	Units	Marginal Value	Ideal Value
1	Weight	Total pounds	Intermediate	Lbs.	± 1 lb.	20 lbs
2	Size	External Volume	Intermediate	in^3	± 1.2 in.^{3}	24 in^3
3	Speed	Average human walking speed	Intermediate	mph	0.8 mph	2.5 mph
4	Autonomous	Successful navigation to target w/o collision or direct human control	Crucial	Pass/Fail	N/A	Pass
5	Multi-Terrain	Ability to traverse different terrain types in office environment	Intermediate	Pass/ Fail	N/A	Pass
6	Power Cutoff Switch	Turn platform on/off	Intermediate	On/Off	±5%	2 seconds
7	Data collection speed	Scan QR Code	Crucial	Seconds	±5%	2 seconds

Summary:

These targets were developed to ensure meeting the customer's requirements. Our level of success will be measured based on our ability to meet all the targets listed above. We identified our ideal values through preliminary research and, in the case of a range, deciding on an acceptable value.

To validate this project, our robot must be able to navigate an office space while making zero collisions with any obstacles in its path to the QR code. The customer desires minimal interruption to the office space during operation and for the device to only rely on visual interaction with the environment.

The importance of these targets was in the order of least to greatest as Low, Intermediate, and Crucial. Low importance means that while the target is desired, it does not affect the success of the project or other systems. Intermediate means that the target affects other systems but does not affect the

overall success of the project. Crucial means that the completion of the target is necessary for project success.