Needs and Requirements Specification

February 21, 2015

Team 1

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Customer

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Introduction

The objective of this project is to design and create an autonomous device capable of cutting a customers grass within specifications outlined in the requirements section of this document. Autonomous mowers currently exist, but have little ability to detect or avoid fixtures in the lawn without extensive time spent laying boundary wires during installation. This is a tedious process and one that must be done any time a fixture in the yard is moved. Our goal is to develop a safer, more reliable device capable of being installed with minimal exertion from the customer at a lower cost than our competitors.

Requirements

1 Operation Requirements

1.1 The mower must be battery powered.

1.1.1 The battery must be rechargeable.

1.2 The mower must be autonomous as outlined in requirement 3.

1.3 A home base will be provided for the mower.

2 User Interaction Requirements

2.1 The user may issue the following commands to the mower.

2.1.1 Begin mowing operations, as specified in requirement 3.4.

2.1.2 Stop immediately, as specified in requirement 3.3.

2.1.3 Return to base, as specified in requirement 3.2.

2.2 The following state information will be provided to the user.

2.2.1 Current battery level.

2.2.2 Battery is charging.

2.2.3 Battery has completed charging.

2.2.4 Mowing operation is in progress.

2.2.5 Desired grass height.

2.2.6 Days of week the mower is scheduled to run.

2.2.7 Time of each day the mower is scheduled to run.

2.2.8 Mower operation has been forcefully stopped because of a violation in requirements outlined in 4 and 6.

3 Autonomous Functions Requirements

3.1 The mower must return to base when it detects low battery level.

3.2 Return to base on command from interface.

3.3 Stop immediately on command from interface.

3.4 Begin mowing on command from interface.

3.5 Begin mowing on schedule.

4 Operating Environment Requirements

4.1 The product must be able to operate normally within an environment that

4.1.1 is above 32 degrees Fahrenheit.

4.1.2 is below 115 degrees Fahrenheit.

4.1.3 has ground which the mower detects is less than 33% incline.

4.1.4 has no snow accumulation.

4.1.5 has no ice accumulation.

5 Weather Resistance Requirements.

5.1 The product's electrical components must be protected by a NEMA Type 3R enclosure. (https://www.nema.org/Products/Documents/nema-enclosure-types.pdf)

5.2 The product's components must comply with International Protection Marketing Code 25 (IP25. http://www.dsmt.com/pdf/resources/iprating.pdf).

6 Safety Requirements

6.1 The mower must stop immediately (requirement 3.3) when...

6.1.1 it senses an foreign object in its path.

6.1.1.1 A foreign object is any object small enough that the mower might be capable of running over it, such as garden hoses, small gardening tools, tennis balls, etc.

6.1.2 an emergency kill switch is pressed.

6.2 The mower will sound an alarm when removed from its configured boundaries.

6.3 The mower will cease to function when removed from its configured boundaries.

7 Product Configuration Requirements

7.1 All of the below must be configurable one or more times.

7.1.1 The user can set operating boundaries for the mower.

7.1.2 The user can set desired height of grass.

7.1.3 The days of week the mower will run.

7.1.3.1 Multiple days may be selected.

7.1.4 The time of day the mower will run.

7.1.4.1 One time must be selected for each day.

8 Budget Requirements

8.1 The total cost of the project including, but not limited to, the following shall not exceed $2,500.

8.1.1 Labor.

8.1.2 Prototypes.

8.1.3 Final product.

8.1.4 Unforeseen costs.

Need

Our customer desires a more cost-effective, more sustainable, and less expensive product that can be used to cut a bounded section of grass. Our customer wants the device to be a user-friendly, configurable device that is safe for both his lawn fixtures as well as any foreign objects that are introduced to the cutting area. Our customer needs this product to be able to withstand weather conditions common to Knoxville, as outlined in the requirements section of this document. The disabled, elderly, and lazy all are in need of this type of device. Companies that maintain large properties or use non-autonomous devices for lawn maintenance would be able to purchase this type of device to meet their lawn care needs without paying another company to service properties on their behalf.

Summary

The goal of this project is to design and develop a device capable of properly maintaining a residential lawn with high precision and high accuracy. This device should meet the safety standards as documented in the requirements section of this document. This device needs to be inexpensive while preserving its effectiveness. The product should withstand mild precipitation, temperature fluctuations, and must be able to operate effectively in these conditions. This product appeals to a large market due to the convenience of having a device capable of effective, consistent lawn care without the anxiety of supervising or constantly maintaining the device.

Customer Agreement

The undersigned customer agrees that the requirements outlined in this document meet his or her needs for the product.

Customer	Date