Department of Computer Science & Engineering
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System Requirements Specification
CSE 4316: Senior Design I
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Team Epsilon
S.C.A.R.A. Robot

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Revision History

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CONTENTS

List of Figures

1 Product Concept

This section describes the purpose, use and intended user audience for the SCARA Robot Arm product. The SCARA Robot Arm is a system that performs typical industrial sorting routines. Users of the SCARA Robot Arm will be able to use the SCARA Robot Arm to efficiently sort various common industrial objects.

1.1 Purpose and Use

The SCARA Robot Arm is designed and intended to be used in an industrial atmosphere to perform routine sorting/picking processes in an efficient manner.

1.2 Intended Audience

This product has been designed and manufactured for the public audience's use. If this product were made available to the commercial market it has been designed and intended for industrial use. The targeted consumer base for this product is the large scale e-commerance market i.e. Amazon, industrial production facilities i.e. "nut and bolt factories", and the large scale retail vendor market i.e. Frito Lay.

Figure 1: X conceptual drawing

2 Product Description

This section provides the reader with an overview of the SCARA Robot Arm. The primary operational aspects of the product, from the perspective of end users, maintainers and administrators, are defined here. The key features and functions found in the product, as well as critical user interactions and user interfaces are described in detail.

2.1 Features & Functions

The SCARA Robot Arm will perform the actions of recognition of user defined object within groups of objects of different shapes, sizes, colors where the Arm will extract the desired object and place it in a designated sorting bin attached to the SCARA Robot Arm's base.

The principal parts of the SCARA Robot Arm consist of two separate arm segments which separately pivot 270 degrees fixed atop the mounting base attached to the 18 inch x 18 inch work area. Each arm segment is 12 inches in length with a pivot point on each end.

Movement for the SCARA Robot Arm is handled by 2 Nema 23 stepper motors, one in the base assembly on the rotational axis for the first segment and the second mounted above the axis of the rotation point for the first arm segment located on the axis of the base assembly. The end effector's vertical movement's responsibility is handled by an Linear Actuator with a lead screw design type.

2.2 External Inputs & Outputs

Describe critical external data flows. What does your product require/expect to receive from end users or external systems (inputs), and what is expected to be created by your product for consumption by end users or external systems (outputs)? In other words, specify here all data/information to flow into and out of your systems. A table works best here, with rows for each critical data element, and columns for name, description and use.

2.3 Product Interfaces

Specify what all operational (visible) interfaces look like to your end-user, administrator, maintainer, etc. Show sample/mocked-up screen shots, graphics of buttons, panels, etc. Refer to the critical external inputs and outputs described in the paragraph above.

3 Customer Requirements

Include a header paragraph specific to your product here. Customer requirements are those required features and functions specified for and by the intended audience for this product. This section establishes, clearly and concisely, the "look and feel" of the product, what each potential end-user should expect the product do and/or not do. Each requirement specified in this section is associated with a specific customer need that will be satisfied. In general Customer Requirements are the directly observable features and functions of the product that will be encountered by its users. Requirements specified in this section are created with, and must not be changed without, specific agreement of the intended customer/user/sponsor.

3.1 Requirement Name

3.1.1 Description

A detailed description of the feature/function that satisfies the requirement. For example: *The box will be slate blue. This specific color is required in order to ensure that the box matches other similar boxes in the Box Systems Premium line of products. Slate blue is specified as #007FFF, using six-digit hexadecimal color specification.* It is acceptable and advisable to include drawings/graphics in the description if it aids understanding of the requirement.

3.1.2 Source

The source of the requirement (e.g. customer, sponsor, specified team member (by name), federal regulation, local laws, CSE Senior Design project specifications, etc.)

3.1.3 Constraints

A detailed description of constraints on satisfying the requirement (e.g. one such constraint might be: *The specified color must be commercially available in paint capable of adhering to the material of which the box is manufactured. (See customer requirement 3.x for production material specification.)*

3.1.4 Standards

A detailed description of any specific standards that apply to this requirement (e.g. *NSTM standard xx.xxx.x. color specifications [**?**].*)

3.1.5 Priority

The priority of this requirement relative to other specified requirements. Use the following priorities:

- Critical (must have or product is a failure)
- High (very important to customer acceptance, desirability)
- Moderate (should have for proper product functionality);
- Low (nice to have, will include if time/resource permits)
- Future (not feasible in this version of the product, but should be considered for a future release).

3.2 Requirement Name

3.2.1 Description

Detailed requirement description...

3.2.2 Source

Source

3.2.3 Constraints

Detailed description of applicable constraints...

3.2.4 Standards

List of applicable standards

3.2.5 Priority

Priority

4 Packaging Requirements

Include a header paragraph here. Packaging requirements are those requirements that identify how the delivered product will be packaged for delivery to the end-user; or how it will "look" when finished and delivered. For example, you might specify that the software required for operation will be pre-loaded on the hard drive, delivered on CD/DVD, or available via download. Software might be customer installable, or not, etc. Hardware components could be all in a single package, provided as a "bag of parts" to be assembled/installed by the user, painted a certain color, logos affixed, etc. Care should be taken not to duplicate requirements found in other sections of this document.

4.1 Requirement Name

4.1.1 Description

Detailed requirement description...

4.1.2 Source

Source

4.1.3 Constraints

Detailed description of applicable constraints...

4.1.4 Standards

List of applicable standards

4.1.5 Priority

Priority

5 Performance Requirements

Include a header paragraph specific to your product here. Performance requirements address items such as: how fast specific critical operations must complete; how long it takes to start/stop activities; how long the battery must last; maximum time it must take to set up; etc.

5.1 Requirement Name

5.1.1 Description

Detailed requirement description...

5.1.2 Source

Source

5.1.3 Constraints

Detailed description of applicable constraints...

5.1.4 Standards

List of applicable standards

5.1.5 Priority

Priority

6 Safety Requirements

Include a header paragraph specific to your product here. Safety requirements might address items specific to your product such as: no exposure to toxic chemicals; lack of sharp edges that could harm a user; no breakable glass in the enclosure; no direct eye exposure to infrared/laser beams; packaging/grounding of electrical connections to avoid shock; etc.

6.1 Requirement Name

6.1.1 Description

Detailed requirement description...

6.1.2 Source

Source

6.1.3 Constraints

Detailed description of applicable constraints...

6.1.4 Standards

List of applicable standards

6.1.5 Priority

Priority

7 Maintenance & Support Requirements

Include a header paragraph specific to your product here. Maintenance and support requirements address items specific to the ongoing maintenance and support of your product after delivery. Think of these requirements as if you were the ones who would be responsible for caring for customers/end user after the product is delivered in its final form and in use "in the field". What would you require to do this job? Specify items such as: where, how and who must be able to maintain the product to correct errors, hardware failures, etc.; required support/troubleshooting manuals/guides; availability/documentation of source code; related technical documentation that must be available for maintainers; specific/unique tools required for maintenance; specific software/environment required for maintenance; etc.

7.1 Requirement Name

7.1.1 Description

Detailed requirement description...

7.1.2 Source

Source

7.1.3 Constraints

Detailed description of applicable constraints...

7.1.4 Standards

List of applicable standards

7.1.5 Priority

Priority

8 Other Requirements

Include a header paragraph specific to your product here. In this section specify anything else that is required for the product to be deemed complete. Include requirements related to customer setup and configuration if not specified in a previous requirement. Add any known requirements related to product architecture/design, such as modularity, extensibility (for future enhancements), or adaptation for a specific programming language. Consider requirements such as portability of your source code to various platforms (Windows, Linux, Unix Mac OS, etc.).

8.1 Requirement Name

8.1.1 Description

Detailed requirement description...

8.1.2 Source

Source

8.1.3 Constraints

Detailed description of applicable constraints...

8.1.4 Standards

List of applicable standards

8.1.5 Priority

Priority

9 Future Items

In this last section, you will reiterate all requirements that are listed as priority 5. This is repetitive, but necessary as a concise statement of features/functions that were considered/discussed and documented herein, but will NOT be addressed in the prototype version of the product due to constraints of budget, time, skills, technology, feasibility analysis, etc. Use the following format for this section.

9.1 Requirement Name

9.1.1 Description

Detailed requirement description...

9.1.2 Source

Source

9.1.3 Constraints

Detailed description of applicable constraints...

9.1.4 Standards

List of applicable standards

9.1.5 Priority

Priority