**Software Requirements Specification**

**for**

the Monte Carlo Localization Simulation

**Version 2.0 approved**

**Prepared by Julian Pryde, Stephen Kristin, Savanh Lu, Miralda Rodney**

**Embry-Riddle Aeronautical University**

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**Revision History**

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| --- | --- | --- | --- |
| **Name** | **Date** | **Reason For Changes** | **Version** |
| Monte Carlo Localization Simulation | 01 Jan 2016 | Initial Draft | Draft 1 |
| Monte Carlo Localization Simulation | 08 Feb 2016 | Second Draft | 2.0 |

# **Introduction**

## **Purpose**

The purpose of this document is to explain the Monte Carlo Localization Simulation. The document includes the functional and non-functional requirements that are important to the simulation program. The document will describe the different aspects of the simulation and how the program will function. The members of the group will be implementing the features of the program as described by the document.

## **Document Conventions**

There were no specific conventions used in this document.

## **Intended Au**d**ience and Reading Suggestions**

The readers of this document should be the members of the group, the professor, and the creator of this project, Dr. Garfield. This SRS document should be read in the sequence that it is displayed so that the reader can have a proper understanding of the functionality and the goal of the project. And how the group will go about achieving the goals of the simulation.

## **Product Scope**

The Monte Carlo Location project is a two-dimensional simulation that will allow a user to define an environment for the operation of a robot and its sensor. The user should be able to define where the robot will start the simulation and where the robot will end the simulation. The program will randomly generate the point locations in the program. The user will specify the range and accuracy of the sensors, the amount of error in the sensors, the amount of error in the robot’s movement itself. The correctness of the robot’s operation will be documented and saved.

## **References**

https://en.wikipedia.org/wiki/Monte\_Carlo\_localization

# **Overall Description**

## **Product Perspective**

The Monte Carlo Localization Simulation stems from a 5-year project plan to build a robot that will walk through and around campus. The robot will serve as a tour guide for students/families and have the ability to sense its location and take people to a user specified destination. This simulation will allow engineers of the main robot project to test different scenarios in which the capability of sensors and the type of environment varies.

## **Product Functions**

* The product must be able to take inputs from the user for the robot’s sensor noise, path, and speed through the map.
* The product must be able to simulate the robot finding its position on the map using input from its sensors
* The product must be able to simulate the robot finding a path to a point on the map.

## **User Classes and Characteristics**

**Research Team/Students:** Access to see the simulation, conduct new simulations and record data.

## **Operating Environment**

The Monte Carlo Localization Simulation program shall run on any device with a Java run time environment.

## **Design and Implementation Constraints**

* All scripts shall be written in Java.
* Pencil shall be used to make the graphical designs.

## **User Documentation**

UD-1: The system shall provide a help menu to allow users to learn how to use the simulation.

UD-2: The system shall provide a file button to allow users to save or recall data.

UD-3: The system shall provide an about button to show users the purpose and background of the simulation

## **Assumptions and Dependencies**

DE-1:The system requires a user input parameters in order to run the simulation.

# **External Interface Requirements**

## **User Interfaces**

UI-1: The system shall permit navigation and use of the graphical user interface using a mouse.

UI-2: The MCL simulation screen displays shall be similar for all users.

## **Hardware Interfaces**

No hardware Interfaces have been identified at this time.

## **Software Interfaces**

No software interfaces have been identified at this time.

## **Communications Interfaces**

No communications interfacing requirements have been identified at this time.

# **System Features**

## Monte Carlo Localization Simulation

4.1.1 Description and PriorityThe system shall have a GUI to allow user input and control of each iteration of the simulation. The system will have a display area to present a visual interpretation of the simulation for the user to view.

High Priority

Benefit - 5/9

Penalty - 2/9  
Cost - 2/9  
Risk - 2/9

4.1.2 Stimulus/Response Sequences

Stimulus: User inputs the number of zero point locations

Response: System window pops up asking user for more input

Stimulus: Ask User to input sensor range and error at edge of sensor range

Response: System displays map of locations

Stimulus: Virtual robot finishes its path

Response: System prints out a report, gives option to save data and rerun simulation

4.1.3 Functional Requirements

REQ-1: The system shall use a two dimensional square area to simulate the robot’s operation.

REQ-2:The system shall accept user input for the starting location of the robot path.

REQ-3:The system shall accept user input for the ending location of the robot path.

REQ-4:The system shall accept user input for a specific integer amount of zero radius reference points in each instantiation.

REQ-5:The system shall accept user input to define the level of sensor error in percentage for each instantiation.

REQ-6:The system shall accept user input to determine how long (simulated time in seconds)

the simulation will last.

REQ-7:The system shall randomly generate the location of the zero radius point references in

the instantiation.

REQ-8:The system shall simulate the robot moving with user defined percentage of error.

REQ-9:The system shall simulate the robot's sensors functioning.

REQ-10:The system shall have the robot determine the location of each zero radius point

reference.

REQ-11:The system shall have the robot record the location of the zero radius point

references.

REQ-12:The system shall display the robot’s current location (x , y) at each instant in real

numbers to the third decimal place.

REQ-14:The system shall save the data gathered by the robot during each simulation in a log

file.

REQ-15:The system shall be able to load/recall saved log files.

REQ-17:The system shall be able to display log file data on the GUI.

4.1.4 Non-function requirements

REQ-18:Add a help menu to explain program functionality

# **Other Nonfunctional Requirements**

## **Performance Requirements**

No performance requirements have been identified.

## **Safety Requirements**

No safety requirements have been identified.

## **Security Requirements**

No security requirements have been identified.

## **Software Quality Attributes**

Adaptability-1: The system shall have room for improvement. There shall be blocks in the coding to insure that additions can be made in the future.

Portability-1: The system shall be able to run and host on any computer with java.

Reliability-1: The system shall not crash during normal use.

Usability-1: The system shall be easy to use. User only provides input.

## **Business Rule**s

None are needed at this time.

# **Other Requirements**

**Appendix A: Glossary**

**Sensor Error**: the chance that the sensors will detect the wrong number of zero radius point reference points.

**Data Gathered**:

* Time of each simulation.
* Percent error for sensors.
* Percent error for movement.
* Number of zero point references sensed.

**Location**: pair of decimal x and y coordinates to the third decimal that represent a point position on the map.

**Appendix B: To Be Determined List**