Carnegie Mellon University

Robotics Capstone Project

Requirement Specifications and Analysis

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October 3, 2016

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1 Executive Summary

1.1 Project Overview

- Multi-agent system with small robots - Robot collaboratively work to recreate / draw an image on a variable scale -

1.2 Document Outline

Input in quick outline of what we are talking about **Write summary of flow. Table of contents in words**

2 Project Description

2.1 Product Goal

items work together - break up a large into small independent pieces that can go on at the same time

will have test plan

2.2 Motivation

automate a dull task. Really dull. Could be dirty, in the sun.

It takes a lot of time, can do overnight for like airports so dont have to worry about paying people. This improves infrastructure quality

Also makes sports things easier to maintain.

Fun thing with children for chalk drawings. Toy. Get the robot to bring your picture to life.

2.3 Product Scope

We want to talk about whats in scope and what might be out of scope

its multi-agent. could have tons of robots. Right now we have 2 as a test bed.

while many use cases involve large scale applications like stadiums we are going to do smaller things like on a poster. Expanding to this would involve making same robots but more durable (ie function outside)

explore uses of different types of writing implements/surfaces: sharpies vs chalk vs spray paint vs markers. Wont explore all but explore some. Might use liquid chalk

out of scope: multiple colors, multiple sized writing tools that can be swapped out

2.4 Assumptions

Some introduction to this blah blah

A1: Working on flat, homogenous surface (ie no muddy ground - thats out of scope - reference that section)

A2: Manually loaded writing implement.

A3: Using writing utensil that writes like a pencil, ie not spray something

A4: Clear, perfect communication (no noise). Robots can communicate quickly and fairly perfectly in a timely manner

3 Requirements

Some details

3.1 Functional Requirements

FR1: Move in 4 Directions Priority 1

Fill in more details

FR2: Autonomous Priority 1

Fill in more details

FR3: Robots Localize Globally and Locally Priority 1

Fill in more details

FR4: Safe Priority 1

Doesnt run into things. No dangerous external parts

FR5: Within Bounds Priority 1

Stay within bounds of drawing

FR6: Change Tools Priority 1

Easy to swap out tools

FR7: Drive Control System Priority 1

Details

FR8: Turn on or off writing tool Priority 1

So lift pencil up and down while moving. That way doesn't have to be continuous lines

FR9: Input drawing Plan Priority 1

how well can you give it commands

FR10: Robots Know Progress Priority 1

Keep track of how much you have drawn

FR11: Kill Switch Priority 1

immediately powers off robots for safety

FR12: User Interface to robot Priority 1

how it gets controlled

FR13: Be In Budget Priority 1

how it gets controlled

FR14: Documentation Priority 1

Keep code and design documentation

3.2 Non-Functional Requirements

NFR1: Portable Priority 1

Small, can be carried, easy to move around. Weight less than 50 pounds. Size: bigger than 2 foot cube

NFR2: Completes Task in Timely manner Priority 1

Details

NFR3: Quality Priority 1

Matches input well.

NFR4: Mobile App Priority 1

Neil go nuts on your bullshit

NFR5: Reliability Priority 1

Percent up time

NFR6: Battery Life Priority 1

Needs to last

NFR7: Fault Tolerance Priority 1

Needs to last

NFR8: Coordination Priority 1

dont duplicate work or overlap

NFR9: Efficiency Priority 1

split up work evenly

4 Use Cases

Include pictures in this section

4.1 Chalk Drawing

Drawing large scale items on blacktop/asphalt. People draw for message around campus, proposal, community annoucements

4.2 Parking Lot Lines

Redraw parking lot lines. Can be expanded for highway drawing or street markings. Add pavement lines specifications and details

also lines at airports for runways (get specs)

4.3 Sport Lines

Draw lines for football, american football, etc goal lines and posts.