McGill University

ECSE 211: Final design project

# Requirements Document

*Nayem Alam, Philippe Papineau*

supervised by
David A. Lowther

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# 1 Summary

The goal of this document is to try to make sure that the requirements of the client are fully understood. It is composed of several sections, each of which tries to address one aspect of the specification and to try to identify all the related issues. The sections are detailed below and are reasonably generic. Once this document is completed, we should know everything about the problem to be solved and the end device to be created. However, as the design process progresses, questions will arise which lead to answers or decisions which might contradict this document. In this case, we need to go back to the document and the client and clarify the issue and update the document appropriately. This is a living document.

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# 2 Task

Project: Robotic Player - Design Principle and Methods (ECSE 211) Final Project

Task: Construct an autonomous robot to play a one-on-one game; capable of localizing its position on the field and able to figure out what position it plays (forward or defense). Is also capable of navigating itself in a 12X12 field without hitting obstacles. The instruction are received via WiFi.

# 3 EDIT HISTORY

## 3.1 Document Version Number

- 0.0.1: Version presented to Prof. Lowther on the 22/02/2017
- 0.0.2: Version presented to Prof. Lowther on the 06/03/2017

## 3.2 Edit History

1. 20/02/2017
   - 19:13 (Philippe): Start a summary of the document, fill all if not most sections
   - 22:59 (Nayem): Filled in Task, Purpose (fix up), add extra stuff in Scope, Table of Contents and Glossary
2. 05/03/2017

   (Philippe) Reformated the document in LaTeX

# 4 CAPABILITIES

## 4.1 Purpose

(what is this product intended to do this should be as detailed a description as you can get. You could probably start by putting in the specification that you have to date. Note that while details may change, the overall purpose is unlikely to alter. So the starting purpose for this project is to create an autonomous vehicle capable of navigating around an obstacle course, collecting balls and tossing them at a target.)

To create an autonomous robot that is able to play a one-on-one game between soccer and basketball. It does so by localizing and correctly assume its position on the field as either forward or defense (two modes: depending on instructions). Also, is able to navigate around an obstacle course (12X12 field), collect balls and toss them at the target. Forward must: bounce the ball into the

goal (green region) before scoring. Defense stays anywhere in the 8X10 region behind the red dotted line excluding the green region.

## 4.2 Scope

(range of capabilities, limitations, etc. this is likely to be detailed and could change as the project progresses as budget issues, technical issues, etc., start to be recognized. As a starting point, you need to develop a set of questions and get the answers to them. For instance, you need to know the size of the area the device will function in; you need to know if there are time limits on the competition; you need to know what the final competition might be;, Are there tolerances on any of the parameters? Also, is this a one-shot operation or is it the prototype for a future design?)

12X12 floor (8X10 field) 30 seconds to localize 3 rounds (2 rounds are forward and defense, 3rd play forward)-7min/round 3rd round: series of obstacles placed in the forward zone maximum of 3 collision between robots wandering outside robots respective zone for ¿ 10 seconds: penalty 1point Instruction via WiFi 3 Mindstorm Kits (Set of Components) Size of robot: no restrictions

Basic parameters of the system:

## 4.3 Constraints

(Has the client imposed any constraints on the design? Often these might be cost or the need to use a particular set or subset of components. There could be limits on size and weight. Are these given or implied by other parts of the client specifications, What about power requirements and operating time? You need to determine the basic parameters of the system and then look for any limits e.g., mechanical systems, electrical systems, software systems, processor limitations, etc. a first constraint from the user is that you are only allowed 3 Lego systems, what other limits or constraints might there be?) You might decide not to fill in this section but to put a pointer here to the Constraints Document where all the constraint information is held.

Please refer to the Constraints Document

## 4.4 User function

(Can the user interact with this device (a) before it operates, (b) during operations? Is there an interface that the user will have access to for operating the device? Is this usable during the device operation? Do you set it up in a batch mode? in terms of subtasks, this might be more important..)

Before it operates Via WiFi Instructions are sent to interact with the robot for the competition

During operations WiFi instructions

### 4.5 Operating Environment

(Where will the device operate? What is the composition of the competition surface? Will this have an effect on the performance of the device in its navigation? Could this affect locate itself? What about ambient lighting? External sounds? Are there any restrictions due to this? What about the temperature environment, external effects, etc.? etc.)

- Floor size: See Figure 1 of the Design Project Specifications; 12X12 floor size with 8X10 field.
- Floor Composed of nine 4X4 hardwood-covered metal panels that lock together
- Field: 8X10. Surrounded by a band 2 tiles wide on the sides, 1 tile wide on the top and bottom.
- Surface: Hardwood, same used in the labs
- Ambient lighting: Lots of light from the windows, could change the reading of the color sensor.

### 4.6 Performance

(Minimal performance requirements, e.g. response time to a command, how long must it operate for, how far will it have to travel, etc. Some of this will have been covered in the SCOPE and CONSTRAINTS sections and repetition may not be good much better to reference the other section that way changes only need to be made in one place.)

Operation time: See Scope Travel distance:

## 5 COMPATIBILITY

### 5.1 Component re-use

( Are you allowed to use existing components? (in a real design this might involve an extra cost), e.g. those developed in the labs? Is there existing software that can be leveraged? What else?)

Hardware: catapult used in lab 5 Software: Any relevant code from the labs can be reused. WiFi code provided by teacher

### 5.2 Compatibility with third party product

(Does the system have to interface with/connect to devices or components from suppliers other than Lego? What about software and software support?.Does the client specification mandate particular products to be used?)

Need special permission to use other material than Lego kits

# 6 GLOSSARY OF TERMS

N/A