REQUIREMENTS DOCUMENT

Project: ECSE 211 Final Design Project – Team 6
Document Version Number: 6.0
Creation Date: 14/10/2017
Original Author: Alex Hale
Edit History:
[14/10/2017] Frederic Cyr: set up the format of the document.
[16/10/2017] Alex Hale: added content from project specifications; changed version system to WEEK.EDIT (e.g. it is currently week1, edit 2 => 1.2).
[22/10/2017] Alex Hale: transferred to Word document for easier formatting; minor revisions
[30/10/2017] Alex Hale: resolved Scope TODOs
[4/11/2017] Alex Hale: changed to present tense; various minor changes
[19/11/2017] Alex Hale: minor updates after being informed of final competition details

1.0 TABLE OF CONTENTS

2.0 CAPABILITIES

2.1 PURPOSE

Create an autonomous vehicle capable of navigating around an obstacle course, crossing a zip line, finding and recognizing coloured blocks, and returning to a specified zone.

2.2 SCOPE

Size of Area: 12x12 grid of squares, each with a side length of 30.48cm
Capabilities of Robot:

- receive parameters from game control server
- localize in starting square
- navigate around the playing field
- traverse a zipline
- find a block of a specified colour in the given zone
- beep three times
- return to the starting zone along a specified path

Time Limits:

- 30 seconds to localize
- 5 minutes to complete the run

Tolerance on Robot Capabilities:

- navigate with enough accuracy to mount the zip line
  - the robot will only mount the zip line if the zip line wheel is aligned with the zip line within a 4^{o} margin of error in either direction
- differentiate between colours of blocks

2.3 CONSTRAINTS

See Constraints Document.

2.4 USER FUNCTIONS

The user may interact with the device before it operates, but once the robot is given to the TA to be placed on the field, the robot must act entirely autonomously. The user can operate the device using the keypad on the front of the brick.

2.5 OPERATING ENVIRONMENT

The robot operates on the playing field, which is a 12x12 grid of squares, each with side length 30.48cm. The surface of the field is beige wood, with black grid lines separating each square to help the robot navigate. The lighting of the environment is variable, so the performance of the colour sensors is carefully tested. The competition is held indoors, so any other external environmental factors are negligible.

2.6 PERFORMANCE

Since user input only occurs before the start of the trial, response time to commands need only be fast enough to make testing easy for the user. Other time limits and travel requirements are outlined in Section 2.2 - Scope. The travel speed of the robot has no explicit requirements, but faster is better - the faster one can go without making errors, the higher the probability of victory against the opposing robot.

3.0 COMPATIBILITY

3.1 COMPONENT REUSE

Any hardware or software created during the Research and Development phase (Labs 1 through 5) can be reused. However, it is important to ensure that those products do not pose restrictions on the robot. For example, all the hardware designs in the labs required fewer sensors than are required on the final robot. The most important existing components that are used are the LEGO Mindstorms EV3 set and the leJOS library.

3.2 COMPATIBILITY WITH THIRD PARTY PRODUCTS

The robot hardware is entirely made up of LEGO parts, so the frame does not have to interface with components from other suppliers. The robot's sensors are calibrated for the wooden floor and coloured blocks that are part of the competition, both of which are made available before the competition. The robot’s zip line arm must be at the correct height to interface with the zip line. Some custom structural pieces can be 3D printed specifically for the robot if needed.

4.0 GLOSSARY OF TERMS

None required.