CONSTRAINTS DOCUMENT

GROUP 4

2nd December 2016
Version 2

Contents

1 BACKGROUND

1.1 Edit History

Jake Zhu: 2016-10-20, Initial set up

Jake Zhu: 2016-10-23, Bullet points with description instead of just sentences, added TABLE OF CONTENTS and finalised the document

Kareem Halabi: 2016-10-24, Grammatical and content improvements

Jake Zhu: 2016-10-28, Ported to LaTeX

Kareem Halabi: 2016-11-24, Edits to structure and grammar

2 ENVIRONMENTAL ISSUES

2.1 Floor

The boards used during the lab demos were a smaller version of the one we are going to use for the project demo. Refer to Requirements section 2.5.1 "Operating Environment - Floor" for the issues that this presents.

2.2 Lighting

Our demos were done in the basement of Trottier. The final demo for the project will be done on the second floor of Trottier, which has many large window panes. Refer to Requirements section 2.5.2 "Operating Environment - Lighting" for the issues that this presents.

3 HARDWARE CONSTRAINTS

3.1 LeJOS Kit

We can use up to 3 LeJOS kits in order to build this project. For more information on the contents of the kits, refer to the System Document section 3 "HARDWARE AVAILABLE AND CAPABILITIES". Although we are allowed to use up to 3 EV3 bricks we may encounter some issues such as communications interference between several bricks if using Wifi or Bluetooth as well as synchronization issues if we must run separate programs on each brick. These issues may be solved by communicating over USB and having all the logic run on one master brick which simply uses Java RMI requests for motor rotations and sensor data from slave bricks. We can use any parts outside the kit with the explicit permission of the instructors.

3.2 Battery

We will have to charge the battery up to a certain level. The battery voltage should be at or above 7.0 at any given time. This is to prevent low battery levels from affecting the control of the robot. Sensors may also be affected if they are provided with insufficient power. Inaccurate sensor readings would be detrimental as they influence a large part of the

robot's logic. In addition, the torque of the motors may be reduced if the battery supply is too low which can cause mobility issues.

4 SOFTWARE CONSTRAINTS

4.1 Java

Our code is written in Java thus we cannot directly access hardware or low level memory. We are required to use the given LeJOS classes in order to access these components. Using Java is advantageous as it is an object-oriented language. This allows us to represent and manipulate physical hardware such as motors with objects but it also allows us to represent more abstract concepts such as a positions or the locations of various zones.

4.2 Threads

Threads allow us to run multiple tasks concurrently. For example, we can have a thread displaying LCD information while another thread can be running the odometer. However we need to be careful about synchronizing access to key variables (such as position coordinates) to avoid corrupting the data in those variables. The maximum number of threads that can be run concurrently is currently unknown and may be researched in the software research phase.

4.3 Filtering

We will have to filter the data coming from sensors. This is to eliminate noise that alters the true value of the sensor. If the sensor readings are not filtered, a greater chance exists for false positives or false negatives to occur. The light sensors will most likely utilize mean filters while the ultrasonic sensors may use median or clipped median filters.

5 AVALIABILITY OF RESOURCES

Our meetings with Professor Lowther have been scheduled for Tuesdays 10:50-11:10 in TR4105 starting October 25 while our meetings with Mr. Dubois have been scheduled for Tuesdays 15:00-16:00 in TR4104 starting November 1st. We plan on meeting with each other during the regular lecture times on Tuesday, Thursdays and Fridays and also any extra time we have. For more information on the available time slots, please refer to the the capabilities document.

6 BUDGET

Our primary budget item is time. We each have a budget of 54 hours for the whole project. That means each person cannot spend more than 9 hours on average a week on this project. We will try to follow the schedule according to the GANTT chart. We are planning to spend the first week researching various hardware and software models while working on a finalized hardware design. We plan on completing the mechanical and software design by the third meeting and begin coding shortly before for about a week to hopefully get a working prototype by a week to a week and a half after the third meeting.

A beta demo has been scheduled for November 18 where we are to present to the client our progress in completing the objective. The final delivery date is November 29 where our robot will compete in 4 rounds with other robots to see which robot can accumulate the most amount of points. We will also be presenting our design and methodology to 3 judges throughout the day.

7 GLOSSARY OF TERMS

Mindstorms EV3: This is the modular hardware kit designed by LEGO that will be used to build our robot and run our software.

LeJOS: the firmware and library we are using to program the EV3.

Trottier (TR): Lorne M. Trottier Building located at 3630 University Street, Montreal, Quebec, H3A 0C6

GANTT Chart: A chart that displays the timeline. There are specific tasks within the GANTT chart for us to do.

Java RMI: Java Remote Method Invocation, refer to
https://docs.oracle.com/javase/tutorial/rmi/