**Constraints Document**

**Project:** ECSE211 Design Project – Capture the Flag

**Task:** Construct an autonomous robot that can play one-on-one version of the game Capture the Flag

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| Oct. 15, 2017 | Priscilla | Environmental Issues, Availability of Resources, Budget | Added these sections |
| Oct. 15, 2017 | Younes | Software Constraints | Added this section |
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1. **Environmental Issues**

For a description of the demonstration environment, refer to Section “2.5 Operating Environment” of the [*Requirements Document*](Requirements%20Document.docx)*.*

The environment of the robot may pose some issues for how the system operates and must be accounted for. The large windows of the space allow for the external light (or the lack thereof) to enter. The weather and time of day will strongly influence the ambient light level. Therefore, any light sensors must not be calibrated to a specific light setting and work regardless of the ambient light level. Otherwise, line detection is going to be greatly hindered. In addition, the materials of the flooring and platform of the zip line as well as the zip line bar have different coefficients of friction. Therefore, the respective components must account for the slipping of wheels and pulleys. This can be done by corrections in the software design or by smooth acceleration. Since the competition location can be publicly accessed, there will be a lot of external sounds coming from the environment. These sounds are not expected to affect the readings of any ultrasonic sensors but testing must be done to confirm this. However, the ultrasonic sensor may be sensitive to extreme temperature fluctuations so testing must also be done to mitigate this.

1. **Hardware Constraints**

Refer Section “[3.0 Hardware Available and Capabilities](System%20Document.docx#Hardware)” in the [*System* Document](System%20Document.docx) for an outline of the available hardware and limitations due its capabilities.

Although three EV3 bricks are provided, it is very difficult in order to implement a system where the bricks can communicate with each other. Therefore the design will be limited to the four input and four output ports on a single brick.

1. **Software Constraints**

Refer to Section “[4.0 Software Available and Capabilities](System%20Document.docx#Software)” and Section “[8.0 Tools](System%20Document.docx#Tools)” in the [*System Document*](System%20Document.docx) for an outline of all software and tools used and for limitations due to software capabilities.

In addition to the constraints due to the capabilities of the software, there are also constraints imposed by the hardware (see Section “[3.0 Hardware Available and Capabilities](System%20Document.docx#Hardware)” in the [*System Document*](System%20Document.docx)for an outline of the available hardware). Since the number of sensors is limited, the software designs implemented are limited to those sensors and the number of input ports on the brick.

1. **Availability of Resources**

See Section “[5.0 Availability](Capabilities%20Document.docx#Availability)” of the [*Capabilities Document*](Capabilities%20Document.docx) for the weekly schedule of the team and major events that can limit each member’s ability to work.

The team, in general, has other commitments during regular work hours (9:00am to 5:00pm). This means that meetings and task completion is likely to be done in the evenings. However, there are small periods of time when every member is free so brief meetings can be scheduled during those hours if needed. In addition, there are weekly meetings, with Professor Lowther on Thursdays and with our mentor Tharsan on Wednesdays, where any concerns can be addressed.

1. **Budget**

See Section “[5.0 Availability](Capabilities%20Document.docx#Availability)” in the [*Capabilities Document*](Capabilities%20Document.docx) for restrictions of each resource weekly.

The project official span of the project is October 15 to the Competition Day on November 28. During that span, there are 6.5 Design Weeks in which the task should be completed. Each team member is expected to spend approximately 9 hours each week for a total of 58.5 hours over the Design Weeks. With the 6 team members, there are 351 total hours of work available to complete the task. The table below depicts how the hours may be distributed.

|  |  |  |
| --- | --- | --- |
| **Week** | **Task** | **Hours** |
| Week 1 | Initial Meeting  Documentation  Hardware Sketches  Budget Review | 2  10  2.5  3 |
| Week 2 | Meetings  Proposed Hardware Designs  Preliminary Software Architecture  Component Testing  Documentation  Budget Review | 3  9  10  5  12  3 |
| Week 3 | Meetings  Finalize Hardware Design  Software Architecture  Iterative Testing  Documentation  Budget Review | 3  2  6  15  12  3 |
| Week 4 | Meetings  Software Architecture  Iterative Testing  Integrative Testing  Documentation  Budget Review  Beta Demo | 3  6  6  6  12  3  1 |
| Weeks 5 | Meetings  Integrative Testing  Presentation Preparation  Budget Review  Documentation | 3  90  6  3  30 |
| Week 6 | Meetings  Integrative Testing  Presentation Preparation  Documentation Summary  Budget Summary | 3  90  2  4  4 |
| Additional extra hours | | 8.5 |

1. **Glossary of Terms**

* Ambient Light Level: the amount of light in the environment when there is no light provided by the system
* Coefficient of Friction: a value that shows the relationship between the force of friction between two objects and the normal reaction between the two objects involved