VERSION HISTORY

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| **Title** | Requirements Document | | | |
| **Description** | Week 1 iteration of this document | | | |
| **Created By** | Luka Jurisic, Documentation Manager | | | |
| **Date Created** | 19th February 2018 | | | |
| **Maintained By** | Luka Jurisic | | | |
| **Version Number** | **Modified By** | **Modifications Made** | **Date Modified** | **Status** |
| 1.00 | Luka Jurisic | Created the document. Set out the overall structure that the document should follow | 19th February | Initial work done |
| 1.01 | Luka Jurisic | Completed the requirements for sections 1.1-1.3 | 20nd February | Much work must still be done |
| 1.02 | Luka Jurisic | Completed the requirements for sections 1.4,1.6 and 3.1-3.2 | 21nd February | Sections 1.5 and 2.1 remain. |
| 1.03 | Enan Ashaduzzaman | Completed section 1.5 | 22nd February | Section 2.1 remains |

# Requirements

**1.0 CAPABILITIES**  
  
 **1.1 PURPOSE**

The defining purpose of this project is to design a fully functioning autonomous robot that can navigate through a series of obstacles within a defined grid, capture an “enemy” flag and finally, return that flag to its area of the grid. An autonomous robot within this scope requires that it be able to localize itself within the grid and navigate, traverse and execute flag capturing without user input. As this a competition, the robot should be able to complete this entire process in a relatively fast time. Also, a key requirement set by the client entails that since there will be two distinctive obstacles, the robot will have to be able to alter its architectural configuration during its run.

**1.2 SCOPE**

The size of the competition grid will be 12x12 feet and is partitioned into squares of 1 foot in length. The squares themselves are separated by black lines of 7mm in thickness. The grid will be split into the following orientation: There will be two rectangular regions denoted as zones, red and green, corresponding to each player’s base. Each of the zones is surrounded by a virtual river, with two methods of traversal- going under via a tunnel, or over via a bridge.

The competition will consist of 4 1v1 rounds, in which a cumulative score will be determined based on the performance of each round. The score is evaluated based on the ability to perform as precisely as possible the key behaviours of localization, navigation, traversal and capture. Withal, the time taken serves as an imperative measure of the efficiency of the robot’s performance. The allotted time of each round has not yet been announced.

The final design of our robot, although very much still in the preliminary stages, could well serve as a prototype for possible future designs. For example, the client specifications do not require that a flag is physically captured and carried. For a future design, a capturing mechanism could be added to the robot to allow it to physically capture a flag and carry it during any obstacle traversal.

**1.3 CONSTRAINTS**

*Hardware:* The final design must be composed of at most 3 Lego Mindstorms Kits, and any additional hardware components that may be required must first be approved the client. There were no limiting specifications regarding the size or weight; however, the robot must be constructing in a manner allowing the centre to be in the corner grid square. This necessitates the robot centre be at most 30cm from its farthest point. The bricks are powered by 6 AA batteries each. The robot must be able to run for the required time for the final competition without running out of battery.

*Software:* The robot must be programmed and run in Java.

*Budget:* The client has imposed a strict deadline of the 11th April. The design process will be spread over a period of 6.5 weeks. Considering that there are 6 team members, there will be 58 allotted hours for each team member to contribute their time and energy in the completion of the project.

**1.4 USER FUNCTIONS**

The user is allowed to communicate with the robot preceding its operation. Information transfer is executed using wi-fi capabilities. The LCD display on the NXT brick allows for a basic user interface that can be used to further interact with robot. However, during operation, the user is not allowed to interfere as soon as it receives its parameters from the team’s main computer.

**1.5 OPERATING ENVIRONMENT**

The surface of the competition grid has not yet been specified, and as such, this current iteration of the document cannot attest to this operating environment. However, it is known that certain black lines, regardless of surface, will be more washed out than others, which affects the robot’s ability to localize. Therefore, the ambient light acting on the surface is a very important environmental factor that must be taken into consideration when performing testing. Similarly, the added presence of spectators will cause shadows that will further impact this consideration. In terms of sound, there is likely to be an abundance of it during competition day, however it is not believed that this will impact the robot’s performance at all. Regarding temperature, it is assumed that it will be very close to room temperature if it is held indoors, and thus there is no need to be concerned of differing wheel grips than the one already experienced in the lab.

**1.6 PERFORMANCE**

The robot must be able to complete individual rounds of the competition. It will have to perform all 4 behaviours listed in section 1.2 within the given time limit and try to better the time of the opponent’s robot.

**2.0 LIST OF UNKNOWNS**  
 **2.1 UNKNOWNS AND QUESTIONS**

**3.0 COMPATIBILITY**  
  
 **3.1 COMPONENT REUSE**

The components used during the 5 labs are integral for this design project and so reuse is essential. However, any external components that might have previously been utilized must be given proof of authorization by the clients before they could be used. In terms of software, the classes developed during the research and development labs, such as odometry and navigation, can and will be reused for this project. Compatibility

**3.2 COMPATIBILITY WITH THIRD PARTY PRODUCTS**

Client specifications mandate that the robot be compatible with Eclipse IDE. The implementation of Bluetooth technology for communication is imperative.