

# Requirements Document

**Project:** Liberty

**Task:** *Localization*

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## 2.0 CAPABILITIES

### 2.1 PURPOSE

The purposes of localization are the following:

**REQ - LOC- 2.1.1:** To set the odometry readings. The first full localization shall reset the x and y coordinates, as well as the Theta ( $\theta$ ) readings within the starting square before anything else is done.

**REQ - LOC- 2.1.2:** To update and correct the odometry readings. As the system is traveling along a path, the grid lines separating the tiles can be detected and used to update and fix errors in the odometer. This correction applies to intersection as well.

### 2.2 SCOPE

**REQ - LOC- 2.2.1:** The full localization procedure should update reset odometer positioning as accurately as is feasible.

**REQ - LOC- 2.2.2:** Initial localization will take place within the first block and as such will have 929 cm<sup>2</sup> of space (see **REQ - GEN - 2.2.1** for tile dimension) to perform initial localization,

**REQ - LOC- 2.2.3:** As mentioned in the **Project Description (v 1.2F)** “[Initial localization] must be completed within 30 second”.

**REQ - LOC- 2.2.4:** To apply this correction the system shall perform localization routine as each intersection, in which minor changes are made to the system’s odometer, at least once every 43.11 cm (assuming relatively linear motion).

### 2.3 CONSTRAINTS

See **CON - GEN** for the detailed list of constraints.

### 2.4 USER FUNCTIONS

Before and during system operation the user will not be able to interact with the localization procedure. See **REQ - GEN; 2.4.1**.

### 2.5 OPERATING ENVIRONMENT

Ultrasonic localization will be conducted against vertical wooden placks at the edge of the map. Light localization will be conducted against the board itself, in which the light sensor should receive, after filtering, uniform readings, with minimums

readings indicating black grid lines. The board will be placed in a large open room, lighting will be provided from windows. As such, varying light conditions during runs could trigger false positives of line detection or could cause lack of detection. Due to the unreliability of the ambient lighting conditions over long periods of time light sensor comparison values can not be hardcoded from testing, but rather must dynamically adjust to the ambient light readings.

## **2.6 PERFORMANCE**

Time performance: *see REQ - LOC; 2.2.3.*

Total operation distance: *see REQ - LOC; 2.2.4*

# **3.0 COMPATIBILITY**

## **3.1 COMPONENT RE-USE**

The initial full localization can be performed in a manner identical to that of Lab 4. As such, code from lab 4 can be refactored and used as a base for localization. Cases emerge in the project however that are not covered by Lab 4, such as localization updates and full localization away from the edges of the board.

## **3.2 COMPATIBILITY WITH THIRD PARTY PRODUCTS**

N/A

## **4.0 GLOSSARY OF TERMS**

**Note that this document should be reviewed with the “Clients” and should be developed in conjunction with them.**