Tesseract Project Revisit: Specification and Requirements MSE 3302 B

Alan Harris   Robert Potra   Andrew Randell   Kevin Wang
250911270   250914807   250891074   250891074

January 17, 2019

Contents

1 Design Specifications and Requirements

1.1 Performance and Constraints

1.1.1 Required Speed

The speed at which the system operates at must be maximized in order to reduce completion time while remaining stable with minimal overshoot and high accuracy. This speed must not exceed any limits imposed by the magnetic sensor, chassis, drive train, cube transportation system or any other subsystems.

The selected sensors and actuators will impose quantitative restraints on the optimal operating speed.

1.1.2 Required Acceleration

To provide smooth operation, acceleration will be capped at xm/s^2. This will ensure minimal wear on the drive train components and will reduce the probability of dropping the cube.

1.1.3 Required Accuracy and Resolution

The sensors which track the wall must have sufficient accuracy to maintain a constant distance. The magnetic cube sensor must have sufficient accuracy and range to detect when the cube is within grabbing range.

1.1.4 Allowable Overshoot

Overshoot must be kept to a minimum to prevent system crashes. The ideal response of the system is critically-damped which will yield the fastest response with zero overshoot.

1.1.5 Power Rating and Voltage Rating for Power Supply

The Power Supply must provide sufficient power to drive the motors at the required constant speed. The Voltage must not dip or rise outside of a specified range during operation to reduce negative disturbances on the sensors and control system.

1.1.6 Overall Dimensions

Must be agile enough to navigate the course and sweep the entire area. *Constraints given in MSE2202B: 45 x 45 x 25 (cm)* A smaller chassis will yield more agility and allow the system to fully sweep the entire survey area. Any cubes located in the corners of the survey area present an agility challenge for the system.

1.1.7 Operating Forces and Torques

Operating Forces and Torques must not exceed the specified maximums of the materials used. The motors in the wheels must provide enough torque to be able to climb over the obstacles.

1.1.8 Mass and Inertia of Components in Motion

The weight of sensors and actuators will add to the weight of the entire robot, and must be accounted for in calculations. They will also add additional inertia, possibly reducing the accuracy of stopping and starting at set distances.

1.1.9 Structural Frame Rigidity

Frame must support all components used in the system. The frame must be sufficiently rigid to not deform under the weight of the sensors; actuators; controllers; power supplies; and cargo, such that it continues to operate as desired.

1.1.10 Expected Temperature Range

The system must comply with the Industrial Temperature standard of -40 to 85 degrees Celsius. This will ensure that all components used in the system will work in a large range of environments.

Any heat generated by the system must be negligible from an environmental perspective, for example, the system will not emit excessive amounts of heat which can negatively affect the environment.

1.1.11 Expected Cleanliness

The system must not contaminate the environment. Possible Contaminants include Oil; Grease; and Battery Acid. To comply with this regulation, sealed bearings and transmissions will be used in the drive train subsystem and dry-cell batteries will be used for power storage, both of these measures will lower the probability of environmental contamination

1.1.12 Safety Features

Industrial Safety standards surrounding heavy equipment must be complied with to ensure human health and safety. The system will employ measures to protect human health sand safety such a restraints and guards around moving parts; adequate shielding around components which emit large amounts of electromagnetic interference; and substantial insulation around wiring.

Ethics must be followed with regards to autonomous decision making.

2 Milestones and Timeline

2.1 Project Timeline

Week of:

Jan. 14	●	Specifications and Requirement Deliverable
Jan. 21	●	*Research Applicable Senors?*
Jan. 28	●	*Do Design?*
Feb. 04	●	*Finalize Sensor Simulations?*
Feb. 11	●	Preliminary Sensor Selection Deliverable
Feb. 18	●	*Research Applicable Actuators?*
Feb. 25	●	*Do Design?*
Mar. 04	●	*Finalize Actuator Simulations?*
Mar. 11	●	Preliminary Actuator Selection Deliverable
Mar. 18	●	*Evaluate Preliminary Sensor and Actuators?*
Mar. 25	●	*Obtain feedback and iterate?*
Apr. 01	●	Finalize Final Simulations and Report