Tesseract Project Revisit
Preliminary Sensor Selection
MSE 3302 B

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Contents

1 Sensor Specifications

1.1 Autonomous System (Vehicle)

1.1.1 Local Position relative to Perimeter

Concept Generation

1. **LIDAR** - This method involves using pulsing lasers to scan the perimeter, and using response times to map out the surrounding area.

2. **Ultrasonic** - This sensor placed on the outside of the vehicle uses sound to detect nearby objects, and avoid obstacle collisions.

3. **Sonar/Radar** - This method is similar to ultrasonic, but on a much larger scale. It uses the same principles, but will allow the robot to gather a larger image of the perimeter.

1.1.2 Local Position relative to Tesseract

1.1.3 Local Position relative to Pyramid(s)

1.1.4 Global Position

From a macro perspective, the vehicle will need to know an approximate location of where it is on a map, as well as the approximate locations of pyramid(s) and tesseracts.

GNSS (Global Navigation Satellite System) is the global positioning technology that is applicable. GNSS is a generic world-wide term used to describe satellite navigation systems. The specific technology used is dependant on the region where it is being used. Regional tecnologies include GPS, GLONASS, Beidou, and Galileo. This technology provides *approximate* latitude, longitude, and altitude metrics to their host device.

Hardware Implementation of GNSS on devices is very straight forward with GNSS Modules. These modules are integrated GNSS receivers which can easily be implemented onto devices. They generally require a power input and provide NMEA 0183 GNSS coordinates over a UART connection. A table below has been compiled of high ranking GNSS modules. The controller must support UART communication for compatibility with most GNSS modules.

Table 1: GNSS Modules

MPN	Manufacturer	Sample Rate	Interface	Baud Rate	Type	Supply Voltage
GPS-L10	MoTeC	10 Hz	RS232	38400	PnP	5V
NEO-M8L	uBlox	30 Hz	UART	config.	PCB	3.3 V
CAM-M8Q	uBlox	10 Hz	UART	config.	PCB	3.3 V
EM-506	GlobalSat	5 Hz	UART	config.	PCB	5V
Venus638FLPx	SkyTraq	20 Hz	UART	config.	PCB	3.3V
LS20031	Locosys	5 Hz	UART	config.	PnP	3.3V

Software Implementation will require prior mapping of the power plant. The GNSS will provide approximate coordinates on this software map. This will be used in conjunction with local sensing techniques to make informed decisions about the locations of the autonomous system relative to the tesseract and pyramid(s).

1.2 Controller

Navigational Map, Machine Learning - In this method, the robot is manually controlled and does a complete survey of the perimeter. After sweeping the entire location, it can then create a navigational map based on the distance it traveled. It then uses this map to navigate autonomously.

1.3 Modeling

2 Project Timeline

Week of:

Feb. 11	**Preliminary Sensor Selection Deliverable: Step 2 Due Feb. 15th**

Feb. 11 — **Preliminary Sensor Selection Deliverable: Step 2 Due Feb. 15th**
- Prepare and finalize report for step 2 deliverable

Feb. 18 — **Research Applicable Actuators**
- Restate and redefine actuator specifications
- Identify possible actuator options based on previous concepts

Feb. 25 — **Continue Actuator Design**
- Concept generation using possible actuator options
- Refine logic connecting the sensor data to actuator actions

Mar. 04 — **Finalize Actuator Simulations**
- Perform actuator simulations using Simulink
- Begin preparing report for step 3 deliverable
- Perform concept selection using actuator simulation results and analysis

Mar. 11 — **Preliminary Actuator Selection Deliverable: Step 3 Due Mar. 15th**
- Continue preparing and finalize report step 3 deliverable

Mar. 18 — **Evaluate Sensor and Actuators**
- Evaluate the proposed system of sensors and actuators
- Create a kinematic system model and perform analysis using Solidworks

Mar. 25 — **Obtain Feedback and Iterate**
- Identify possible problems with the proposed system of sensors and actuators
- Refine analysis for the transducers, control device, kinematics, and power supply

Apr. 01 — **Finalize Final Simulations and Report: Step 4 Due Apr. 5th**
- Continue preparing final report for step 4 deliverable