Embedded Systems International

Project Statement of Work (PD3)

Team Identifier: E-3

Team Name (optional): Byte-Sized Tacos

Team Member Names: Layne Bennett, Gage Baker, Camden Beightler, Conner Houdek, Daniel Khalandovskiy

Submit your document as a PDF file in Canvas under the corresponding project assignment.

One of your section's lab TAs must approve of this Statement of Work by adding a comment in the Canvas assignment. The team is responsible for requesting approval promptly after submission.

Refer to the Project Requirements document before completing this Statement of Work (SOW). A statement of work is a focused concise proposal and agreement that describes work to be done. Teams should complete and submit this SOW form, which represents several parts of a statement of work, including a plan for what you are doing and how. The SOW defines the scope of your project and the approach you are taking to deliver on the goals.

Problem Statement

First, has your team reached consensus on the autonomous vehicle (AV) application you will use as the context or story for your project? All projects, regardless of application, will need to meet the same basic requirements and will be recognized for innovative features.

To define your problem, think about one or more users and their needs. Write at least one Point of View (POV) statement for your application. Follow Steps 2 and 3 in the following guide (also in Canvas as a PDF document):
Define and Frame Your Design Challenge (links to IDF webpage)
URL: https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-byhttps://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-wecreating-your-point-of-view-and-ask-how-might-we
See the Lab Project page in Canvas for the PDF file for the webpage.

Next, think about and write a few sentences that give a high-level summary of the broad mission goals for your AV application. For example:
The purpose of the AV is to provide ... . The AV will be capable of doing ... .

The mission goals and user needs establish the purpose of the project and why you are working on it. Now you should translate these into a more detailed problem statement that provides a specific, concise, clear and thorough description of the context for the problem, an explanation of user needs that will be addressed, and an outline of your proposed technical approach to solving the problem.

Problem Statement
People are hungry and want delicious authentic Mexican street food.
POV statement:
User [hungry ISU campus-goers during the day] needs [fast, reliable Mexican street food delivered to their location] because [delivered food is best fresh, and needs to be restocked often to maintain this freshness].

High-level mission goals:
The purpose of the cybot is to safely deliver food from point A to point B. It will drive on street to get between restock point and customers to deliver tacos. Truck (cybot) must not get damaged and stay on the road on the way.

Short description of the problem:
There is a taped out home square where the robot will go to restock on food (a variable to keep track of the truck's stock will be refreshed). The cybot will drive down the road until it sees a medium sized object (a road sign in this case) which will indicate for the robot to turn. Once the robot travels to the drop off point, it will park against the curb (short sized objects). The cybot will scan to see if there is a customer in line on the other side of the curb. If there is a customer, we subtract the food stock variable by 1. If we run out of food and there are still people, we drive back to the home square to refresh our stock and drive back to the drop off zone until there are no more customers left.

While driving on the road, occasionally there will be obstacles like walking pedestrians (small width objects) or a collapsed tree (large width object) that the cybot will need to either navigate around or wait out before continuing to either the home or to the drop off zone.

In addition to writing a paragraph about the problem, you are to draw a **problem sketch: a one-page sketch illustrating your solution with a user context (big picture view)**. This should show the scope of your work in relation to one or more user needs. Refer to the sample project sketches.

Design Approach

Next, consider your AV application in relation to the project requirements and the five categories by which it will be evaluated.

1) Functionality in relation to the AV application mission goals and user needs
2) Mapping of functional requirements to platform components and capabilities
3) Elements of the test field
4) Serious incident penalties
5) Feature bonuses

In this section, you will identify and describe how you will design your application for each of these categories.

To complete the tables below, your team may want to use ideation tools, such as Lotus Blossom. Refer to the Lab Project page in Canvas and see the project ideas guidelines and Lotus Blossom worksheet as needed.

In addition to completing the tables below, you are to draw a **technical system sketch: a one-page sketch depicting a high-level technical system diagram of your proposed solution, such as a block diagram or dataflow diagram**. This should show both hardware and software modules.

The tables below are your initial proposal, and you may update these before your demonstration.

Functionality

Describe each of the basic functionalities required for the project in terms of your AV application. **The functionality must be specific to the problem and user(s).** Several functional statements are given in the example functional description for the Mars rover application in the Project Requirements document.

Basic Functionality	Mapping to AV Application

Cybot Communication	PuTTY terminal used as controller relaying commands between remote driver and cybot
Cybot Movement	Movement sensors and functionality on the roomba that allow it to travel along the road.
Object Detection	IR sensor to detect signs, trees, customers
Object Avoidance	Bump sensor for curbs, IR sensor for signs, trees, customers, cliff sensor for tape/roads
Boundary Adherence	Cliff sensor for tape/boundary
Arrival at Destination	Plays mariachi music after arriving at target locations (home and customers)
User Interface	GUI built for remote driver to see what the cybot sees
Base Station Control	PuTTY terminal, using UART communications to convert key presses to movements
Other Application Specific Functionality (may be novel features for bonus points) The sombrero and the mustache is mandatory	

Mapping to Platform

Briefly describe how each of the basic platform components required for the project will be used in your AV application.

Basic Platform Components	Usage in AV Application

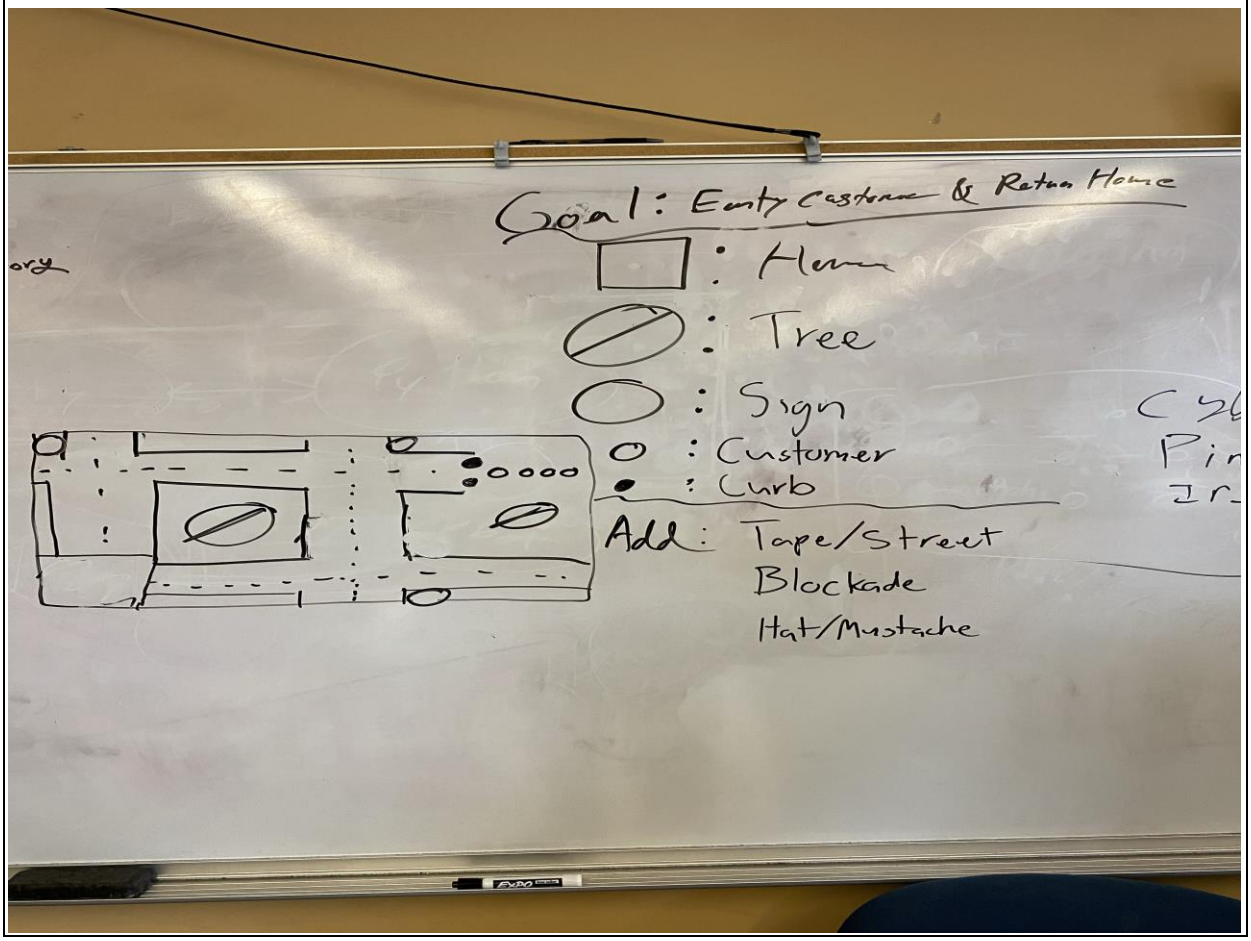
Open Interface and iRobot Sensors	Bump detection – curb detection (close range) Ping sensor – curb detection (long range)/ general object detection IR sensor – object detection (tree, sign, customer) Cliff sensor – tape/road/border
Interrupts	Key presses can interrupt certain movement related events
ADC	Infrared sensor scanning
Input Capture	Keyboard/GUI input that sends commands through putty
PWM	Turning the servo
UART/WiFi	PuTTY communication to send RX/TX signals to bot/base station control
Other Platform Components or Modes (may be novel features for bonus points) Sombrero and mustache Music	

Elements of the Test Field

Briefly describe a test field in the context of the real application (e.g., Martian terrain, city streets, etc.). Then state what each of the basic objects and other elements required for the test field represent in terms of the AV application. Draw and attach a **sketch of a possible simple test field for the lab**.

Test Field Description
Campus style streets with various obstacles, a home (hole), and a destination (customers).

Hole is the home where restocks happen
Big pillar are trees
Medium pillars are signs
Skinny pillars are customers
Short pillars are curb
Tape is street and border
Cardboard is blockade



Basic Objects and Other Elements	Mapping to AV Application Test Field
Tall objects (wide or composite)	Trees, signs
Short objects	Curb
Holes	Home/restock

Pillars (thin tall object)	Customers
Out of bounds	Tape
Destination zone	Pillars/customers
Other Application Specific Elements (may be novel features for bonus points or incidents to avoid) Tape for road	

Serious Incidents to Avoid and/or Novel Features (Optional)

You may have identified novel features in the tables above. Enter them in the table below and propose possible bonus points if demonstrated successfully. In addition, describe any additional serious incidents that might happen in your test field for your AV application.

Novel Features	**Bonus Points**
Sombrero and mustache and music sensor playing mariachi	Depends on how good the music is. +100 if Jesse dances +50 for humming +10 per head nod

Serious Incidents	**Deductions**
Taco truck kills a man by running them over	Double the deduction of normal infraction (i.e. hitting a tree, going out of bounds). Take more points for a small genocide.

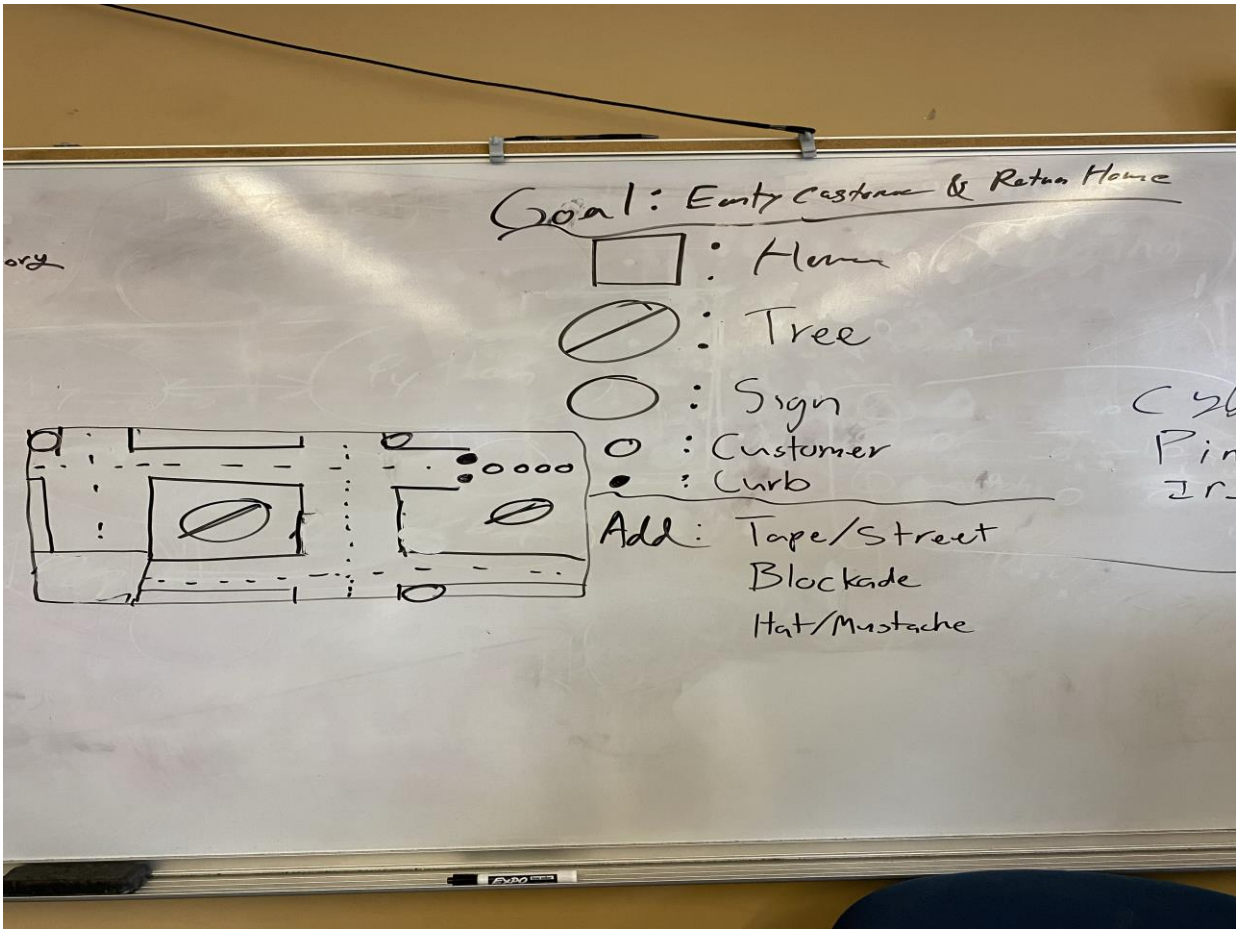
Sketches

Attach the following sketches to your submission. These were noted above in red.

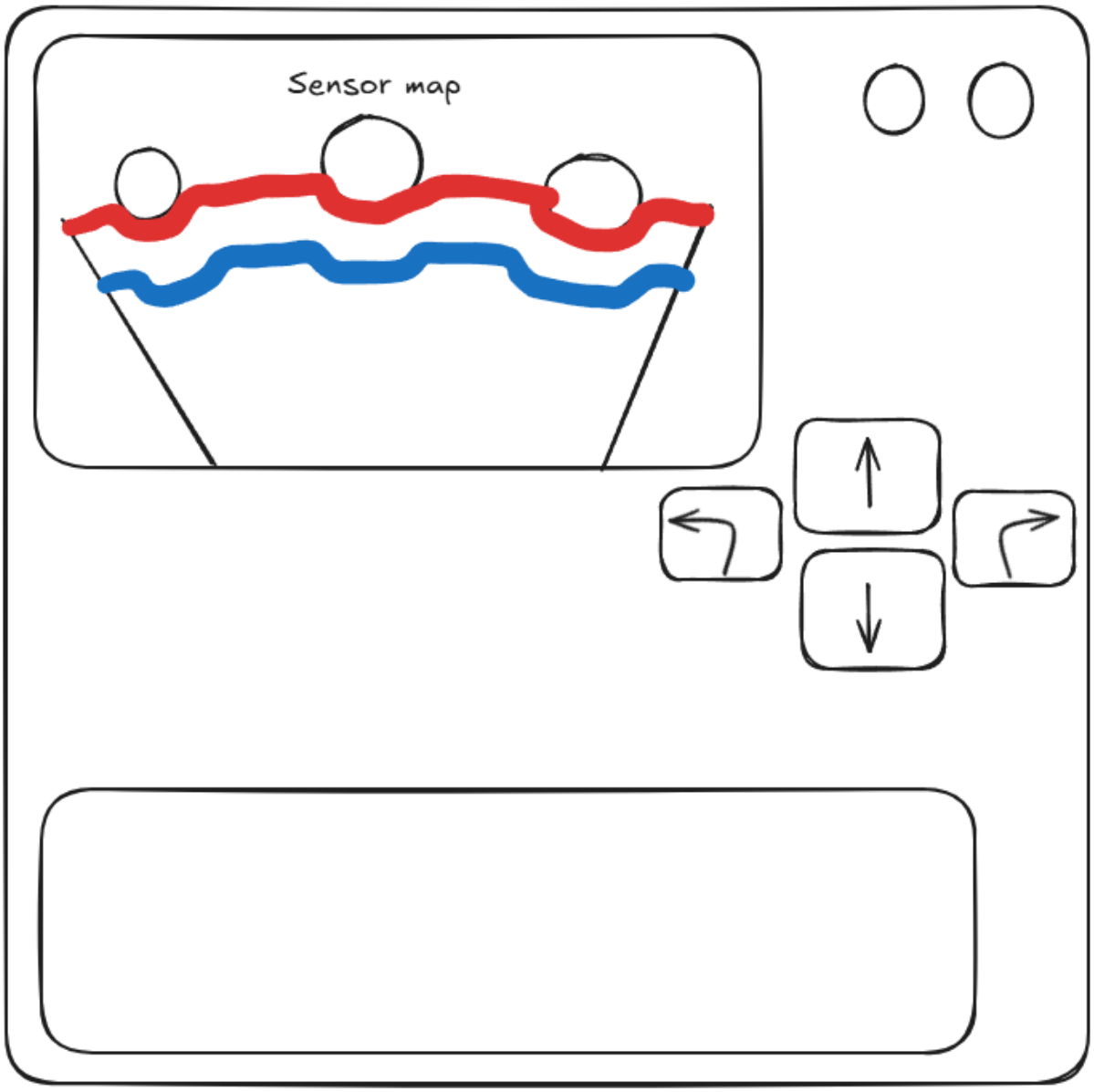
- **Problem sketch**

- **Technical system sketch**
- **Test field sketch**

Visual communication is helpful for sharing information. There are many ways to represent your information. The problem sketch could be anything from a cartoon (informal) to a UML use case diagram (more formal). The technical system sketch is similar to what has been used/shown in class and lab. The test field sketch probably needs no explanation.



GUI Example


Sensor map