Project Statement of Work (PD3)

Team Identifier: 2\_C

Team Name (optional):

Team Member Names: Koby Fowler, Brock Dykhuis, Charles Zulk, Evan Dunn

**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](https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we) (links to IDF page) (URL: <https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we>)

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.

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| **Problem Statement**  **POV statement:** The user in our scenario would be a company with hopes of exploring any extraterrestrial environment. This would include anything/place that people want exploration done but cannot fit humans in to explore for either safety or cost reasons.  **High-level mission goals:** The main goal of our mission to be able to safely map the surrounding area for any obstacles and correctly navigate the bot into the END zone. The bots first goal is to map all surrounding objects, the bot still will “bump” into the smaller not detectable objects so the reaction will be to stop as soon as possible to not harm any components of the bot. The bot will then be driven into the ending zone to result in a correct test route taken to completion.  **Short description of the problem:** The problems that are faced throughout this mission would include the unknowing of the environment we will receive. Even though the bot is manually driven that will be for mostly precautions, the bot will be able to scan the area and navigate through any objects in the way without making contact with those objects. In the lab scenario the TA’s will make a “random” test field for us to have to map and find safe route of travel to our end goal. |

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.

Diagram, map

Description automatically generated

# 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 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 should 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.

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| **Basic Functionality** | **Mapping to AV Application** |
| Cybot Communication | Relay information back to the users including data holding the surrounding objects |
| Cybot Movement | Send a distance from the GUI to the bot and have the bot safely move that distance, being interrupted by bump, drop, ect. sensors. |
| Object Detection | Detect and map the objects for the drivers so that the drivers can decide if they want to approach or maneuver past the objects |
| Object Avoidance | Avoidance will be done completely by interrupts and manual control. Interrupts will make sure that the border is not crossed, a whole is not fallen into, and any object bumped into is only hit once. The rest would be manual. |
| Boundary Adherence | Boundary will be plotted and also automatically avoided using the light sensor. |
| Arrival at Destination | The destination arrival will be confirmed by both the drivers and the bot. The drivers will have an end goal that will be plotted, the bot will also check the end goal is reached through sensor data. |
| User Interface | The user interface will be a GUI built using python to map the data received from the bot and for the drivers to send data back to the bot. |
| Base Station Control | If a base station were to be used for this project then the bot would find its starting point (base station) using the routing done already (and more sensor readings for safety) and dock itself |
| **Other Application Specific Functionality (may be novel features for bonus points)**  Play music on completion. | |

## Mapping to Platform

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

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| --- | --- |
| **Basic Platform Components** | **Usage in AV Application** |
| Open Interface and iRobot Sensors | Used for data for mapping the surrounding area and displaying that on the drivers GUI. |
| Interrupts | Used for data for bot safety, will stop bot from falling, crossing boundaries, and bumping more than once. |
| ADC | Using IR scanner for object detection/distance. |
| Input Capture | Relays information from GUI to the bot to know distance to move, angle to turn, speed to move, ect. |
| PWM | Used to turn the servo for scanning a wider area. |
| UART/WiFi | Used to communicate between GUI and bot wirelessly. |
| **Other Platform Components or Modes (may be novel features for bonus points)** | |

## 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**.

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| **Test Field Description**  Martian terrain |

Diagram, map

Description automatically generated

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| --- | --- |
| **Basic Objects and Other Elements** | **Mapping to AV Application Test Field** |
| Tall objects (wide or composite) | Large Object = boulder |
| Short objects | Small object = small rock (undetectable by scan, only by bump) |
| Holes | Hole = Crater on Martian surface |
| Pillars (thin tall object) | Skinny object = rock pillar |
| Out of bounds | White tape = border of already known area to traverse |
| Destination zone | End Zone = pre-determined destination with the location detected by the bot. |
| **Other Application Specific Elements (may be novel features for bonus points or incidents to avoid)** | |

## 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.