Team 504- Object Tracking and Locating

1.1 Project Scope

The mission of our project is to create a device that can locate and track static and dynamic objects from both a fixed and moving position.

1.1.1 Key Goals

The key goal of this project is to be able to reliably track a moving or nonmoving object while the device is simultaneously moving. The device should also be able to attach and work with an autonomous vehicle.

1.1.2 Assumptions

The device will be moving and will need to be able to keep track of an object that will either be moving or stationary. The project will also need to be operational in an outside environment. It will have to be relatively small so that it will fit on the $1/10^{th}$ scale autonomous car. We can also assume that the project will be used in an area where GPS is available.

1.1.3 Stakeholders

The stakeholders of this project will be the CIA, Dr. McConomy, as well as the general public.

1.1.4 Market Types

The primary markets of the project are the CIA, autonomous car companies, and security companies. The secondary markets for this project are parents interested in using the tracker as a nanny cam, dash cam companies, and general traffic camera manufacturers.

1.2 Customer Needs

At the time of writing this report, the CIA has not yet been available to provide us with a full outline of the project, nor their requirements for the design. With that being the case, we have decided to research the needs for this project using outside sources such as the F1 Tenth project competition website, from which the project is drawn, and news articles related to the current interest of the CIA. Doing this provides us with direction in getting started on the project, however we know that the vision is subject to change depending on the needs of the sponsor.

1.2.1 Sponsor Meeting Questions

Question: *What do you expect the end product to do?*

"The product will be able to locate and track objects that are stationary or moving with the camera moving as well. It will work simultaneously with the F1-10th car."

Our interpretation is the system can classify objects in its environment and determine if they should be ignored or treated as obstacles, while from the perspective of a moving reference frame. The product can also be attached to and communicate with the F1-10th car as it maneuvers around its terrain.

1.2.2 F1-10th Research Questions

Question: *What are the hardware requirements of the F1-10th competition?*

The F1-10th system requires use of a processor with capabilities equal to or lower than that of the NVIDIA Jetson Xavier NX and a LIDAR sensor equivalent or lower than a Hokuyo 10LX. There are no restrictions on cameras, IMUs, or other sensors, except for indoor GPS.

Question: *What kind of environment should we expect in operation?*

The F1-10th system is expected to work in various environments including outside and indoor tracks, and on different terrain surfaces.

Our interpretation is the designed product can work in multiple environments that can have different layouts, terrain types, and lighting.

Question: *What kind of programs are we expected to use to code the system?*

The F1-10th recommends using Robot Operating System (ROS) to handle the robot controls. ROS is a software library that makes building robot applications easier by providing channels for communication between components. ROS libraries can be built in C++ or Python.

1.2.3 Future questions

To achieve the specific needs of our sponsor, we will ask the following set of questions in the next meeting:

- "Considering the CIA's area of experience, should we build this project with any stealth components in consideration?"
- "Will the system need to be able to differentiate a person from the rest of the environment space?"
- "Will we need to implement encrypted communications or similar security measures into our project?"