Project Scope

Project Description

Project F1TENTH is an open-source project intended to foster interest and critical thinking about the rapidly developing field of autonomous systems by utilizing a preexisting $1/10^{th}$ scale RC chassis and implementing various autonomous components such as LiDAR, cameras, speed controllers, and more to develop a platform that can be used for autonomous systems research and education. Originally founded by the University of Pennsylvania in 2016, the project has since expanded its participation to various researchers, engineers, and enthusiasts. The purpose of this project is to develop our own iteration of an F1TENTH vehicle body that houses the various autonomous components to be used by researchers and students studying autonomous algorithms and providing them with a robust and engineered platform for their algorithm implementation.

Project Objective

The objective of this project is to design and fabricate a well-engineered $1/10^{th}$ scale vehicle body that can mount various autonomous driving components while taking into consideration clearly defined mechanical engineering metrics such as center of gravity, moment of inertia, and other mechanical properties.

Key Goals

A key goal is to create a foundational body design that has scalability in production volume where mechanical properties of the body are consistent across different iterations of the body. Another key goal is to determine an optimal material choice to prioritize strength and minimize overall weight. Our final key goal for each of the design iterations is to have guaranteed repeatable metrics. A key aspect of achieving scalability is ensuring that

manufacturing processes are streamlined for manufacturability. Guaranteed repeatable metrics such as the Center of Mass and Moment of Inertia are fundamental to achieving precise control by the autonomous drive system. Ensuring these metrics remain consistent between all vehicle bodies produced is vital for maintaining control algorithms, optimizing vehicle dynamics, and achieving desired performance outcomes. These objectives reflect a commitment to delivering high-quality products that meet the exacting standards of our sponsor.

Primary Market

The targeted primary market for this project is engineering students and researchers studying autonomous algorithms who require a physical platform to conduct various tests and real-world applications to further improve their knowledge and understanding of autonomous systems.

Secondary Markets

Beyond the primary market, the secondary market would be F1/10th open-source project consumers that can access the development of these F1/10th cars or hobbyists who are interested in the F1/10th project that also require a physical platform to study autonomous systems that don't have the ability to create their own F1/10th vehicle. The work done on this project can also be marketed to the remote control car community in general.

Assumptions

The following assumptions were made to establish a clear and sustainable design path for the team. The design will give repeatable results able to be implemented on multiple bodies without performance variation. This means the final design should have no variation across fabricated duplicates when it comes to mechanical properties in order to keep autonomous algorithms accurate. The current design of the vehicle body is not expected to change, all designs

will be made for a single body that may be duplicated. The product will be designed primarily for engineering professors and their students. A high degree of competency with the produced system is expected of the consumer. The vehicle body will be exposed to certain harsh driving conditions such as collisions and roll-over, and must be able to sustain such loading conditions. The vehicle body will be able to be replaced and iterated upon without changing others. Mass is an important factor in vehicle design, distributing the mass evenly will be a major focus in ensuring the design's optimization of the movement system.

Stakeholders

The stakeholders of this project consist of the F1TENTH, FAMU-FSU College of Engineering, as well as Senior Design Coordinator Dr. Shayne McConomy, and Academic Advisor Dr. Moses Anubi. F1TENTH is the sponsor for the project. Furthermore, F1TENTH'S partner Locomotion is also interested in the project since their mission statement is to innovate fully autonomous vehicles. Dr. McConomy, Dr. Anubi, and the FAMU-FSU College of Engineering are represented in the project. Therefore, they are all interested in the project.