**Assignment 7: Design Constraints**

Two constraints that apply to our project are economic constraints and health and safety. Our goal is to create a new transportation method for injured students to get around campus faster using an automated golf cart. Our design is constrained economically because to obtain good autonomy, we need plenty of vision. This means high resolution cameras, RADAR sensors, and/or LiDAR sensors with wide fields of view. Each of these sensors is increasingly more expensive to provide the best vision for our algorithms. To produce more of these autonomous vehicles, we need to give each cart enough sensors to detect all obstacles in all weather conditions. A single high resolution LiDAR sensor with a wide field of view can cost over $50k, and they are only now starting to come down in price on worse models. Therefore, only the largest car companies can focus and come out with their own versions of self-driving autonomy.

Health and safety are more constraints of our product because self-driving has not reached full autonomy yet even in the mainstream with trillion-dollar companies working on it. This means that our vehicle, which should be able to detect obstacles and make decisions to avoid them so no one gets hurt, will not react perfectly in every scenario. Currently, the driver in an autonomous vehicle must be attentive while their ADAS vehicle is going. This is level 2 autonomy and will require much deeper machine learning to reach the next level of autonomous driving. Things like bad weather can affect how our well our sensors can see and reduce the amount of accurate information we are receiving to decide what are obstacles or not. Our cart is restricted to staying on campus because we are not adding lane detection or other necessary components for driving autonomously. Even though 94% of serious crashes are due to human error, our cart will still have to be able to react to the occasion when a human makes an error and steps in the way or cuts off our vehicle.

For engineering standards, our cart is going to reach level 3 autonomy as seen in the diagram below. This means that our passengers should not have to drive unless absolutely necessary. Currently, the US does not allow level 3 autonomous vehicles on highways and the driver must be the main operator of the vehicle. There are no cars for sale on the market even with level 3 autonomy, though there are level 4 autonomous vehicles allowed in cities with slow moving traffic and slower driving speeds than on the highways. Since we are only on campus, we will be using a geofenced area with preset paths around our campus to achieve our level 3 autonomy.

Diagram

Description automatically generated with medium confidence

<https://www.sae.org/blog/sae-j3016-update>