The development of autonomous vehicles has progressed rapidly in recent years. Autonomous vehicles, particularly ground vehicles, have the potential to offer independent mobility, increased transportation safety, reduced traffic congestion, and significant energy savings. Currently, the following sensors are used in driving assist systems and autonomous vehicle technologies: vision, LIDAR, radar, ultrasonic range, GPS and inter-vehicle communication. Data fusion strategies and artificial intelligence rely on these overlapping and often complementary sensors to provide navigation and control of the autonomous vehicles.

However, in the event of extreme weather, during the occurrence of natural disaster and cellular/internet outage, or entering into an uncharted terrain, some of the above sensor technologies may be rendered insufficient for safe navigation. There is a need for a local 'beacon' system that can be incorporated into the road infrastructure which would communicate with vehicles with regard to its unique location on the road (preferably off the power grid), lane demarcation, curb or intersection, to provide additional navigation input and allow for safe guidance of autonomous vehicles in these types of non-ideal but real life operational conditions. This project added in 2020-2021 a component aimed to design, manufacture and test novel self-powered infrastructure location smart sensors, augmenting and continuing the work on sensor fusion, navigation and control of vehicles using vision system, GPS, LIDAR and ultrasonic range detectors.

In 2021-2022 we propose to add a third element to this project, an integrated wheelchair/autonomous vehicle. Finally a developed proof-of-concept self-powered infrastructure location smart sensor will be tested on the road, and the information received will be integrated into the developed sensor fusion algorithm to assist the control system of the vehicle when other existing onboard sensors are subjected to less than idealized operating conditions.

Team structure:
The team will consist of four main technical groups:

1. Self-powered smart sensor design and selection (All Mech and Aero students)
2. Design and integration of accessibility and safety features (such as wheelchair) in a vehicle (Mech, AERO B and Bio-Mech)
3. Sensor fusion, software development, navigation and control of a small vehicle (All Mech and Aero students with interests in software development)
4. Cost analysis and integration (All students)