

**Project Name IGVC Robot**

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The Intelligent Ground Vehicle Competition (IGVC) Auto Nav event is an annual competition in which teams construct ground vehicles to autonomously traverse an obstacle course. Vehicles are judged on the distance traveled, time taken, and penalties accumulated such as exiting the lanes of the course or making contact with an obstacle. The vehicle (commonly referred to as the robot) must be able to identify lanes painted on grass, utilize GPS waypoint navigation and avoid obstacles in order to qualify and compete.

This year's team reworked and built upon the previous software systems. The vision system of the robot was overhauled with a Convolutional Neural Network to perform instance segmentation in order to locate lanes within the field of view of a ZED Stereoscopic Camera. This proved to be more accurate and dealt better with the reflective properties of grass that troubled the previous canny edge detection-based system. A mapping system was designed and implemented to allow the robot to position itself within its environment and feed into the path planning system. The arrangement and placement of software systems within the computational units existing within the robot were reassessed for practicality. The electrical emergency stop (E-Stop) system was redesigned to allow for the robot to be remotely restarted after being remotely shut down. Additionally, minor changes were made to the body of the robot to improve functionality. A new mount was manufactured for the VectorNav Inertial Measurement Unit (IMU) to position it at the center of rotation to improve the quality of data collected and simplify processing efforts. A new lid was designed to allow users to easily access the internal electronic systems. The robot's overall state received improvements with a large redesign of the software, hardware, and mechanical systems to qualify for a future IGVC Auto Nav event, improve its performance, and thereby meet its goals.

