Introduction to Unmanned Vehicle Systems
Fall 2019

# AUVSI Student Competition Homework

Deliverable 1:

Competition Name: Intelligent Ground Vehicle Competition (IGVC) with Rulebook 2019.

Challenge: Auto-Nav Course

1. Objective:

A fully autonomous UGV system is to be designed to meet the layout for the challenge and the constraints are fed into the system design specifications. The vehicle will travel between the given waypoints within the allocated time for course navigation. With the help of the sensors embedded on the vehicle, the UGV will plot its course and collect data from its environment and analyze it in a way that it will function, using its actuators, according to its environment.

2. Mapping to UxV Components:
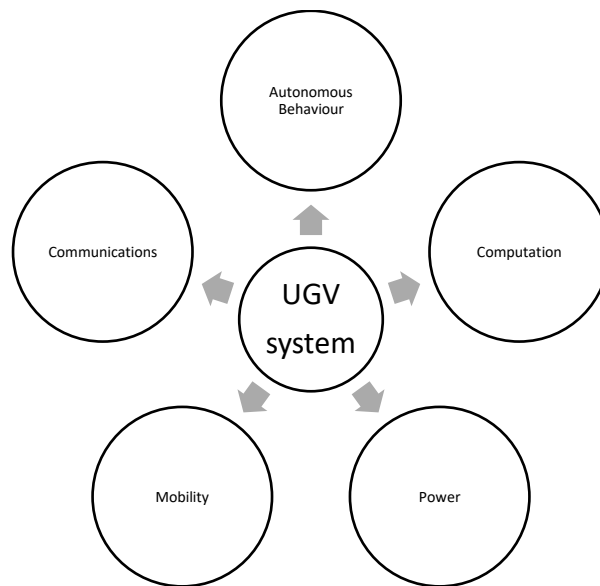
2.1   Power

The UGV system would require power to drive itself throughout its run until it completes its goal. According to the rules, the vehicle power needs to be generated onboard.

2.2   Mobility

Must be a ground vehicle (propelled by direct mechanical contact to the ground such as wheels, tracks, pods, etc. or hovercraft). The type of vehicle mobility needs to be completely autonomous until the task is complete, with no human interface (except for E-stop qualification). The vehicle will be required to carry a payload. Speed will be checked at the end of a challenge run to make sure the average speed of the competing vehicle is above one (1) mph over the course completed. Vehicle slower than the minimum average speed will be disqualified for the run.

2.3   Communication

This is an important component of the UGV system. For an autonomous mobile vehicle, there is no human interaction (external communication) permitted. However, there needs to be communication among interconnected components and sub-systems for an efficient functioning aiming to a common objective.

2.4   Computation

The onboard electronics sub-components make a part of this sub-system. The motor controllers and encoders assist to drive the vehicle motors and obtain wheel odometry. A microprocessor/mini-computer (Adafruit/Nvidia Jetson,etc) helps to compute the autonomous behavior of the system like path planning, perception, sensor fusion and many more. One more important part is the logic PCB board which interfaces between electrical and software systems.

2.5   Autonomous Behavior

The following component belongs to the software system. It consists of perception, navigation, path planning, learning and adaptability and many more. Perception: the vehicle needs to detect obstacles to avoid collisions in the lane using sensors. Path planning: the vehicle needs to plan and generate an economically shortest path using GPS waypoints. Learning: this sub-component is a significant part where the system self-analyses its actions in order to improve its performance.