FS-AI SYSTEM STATUS REPORT FS2024

DUE 17:00 UTC 30 May 2024 – UPLOAD VIA FS TEAM ACCOUNT

University Name: University of Leeds
Team Name: Leeds Gryphon Racing AI
Entry type (ADS or DDT): DDT

Executive Summary:

Summarise your progress to date, and rank your level of preparedness from 1 to 10 (1 being Totally Unprepared to 10 being All Missions Completed in testing).

The general autonomous system, which processes optical and odometry data and outputs velocity and steering commands, developed by Leeds Gryphon Racing AI has been tested in simulation. However, a complete hardware test has not been conducted at the time of writing this report. Mission specific routine has not been implemented.

Level of preparedness: 5

Software Development:
What is the overall status of your Software Development?

The general autonomous system has been developed and tested in simulation, ROS Gazebo. This system is able to recognise and perceive the cones' types and locations and achieve maping and path planning capabilities.

However, mission specific routines, such as skidpad and acceleration, have not been implemented. Additionally, communications to the ADS-DV have not been implemented.

Please indicate which (if any) of the required Missions you have software prepared for:

Acceleration	[Yes / ~~No~~]
Skidpad	[~~Yes~~ / No]
Autocross	[~~Yes~~ / No]
Trackdrive	[~~Yes~~ / No]
Static Inspection A	[~~Yes~~ / No]
Static Inspection B	[~~Yes~~ / No]
Autonomous Demo	[~~Yes~~ / No]

Software Testing and Integration: Please describe any Model-in-Loop, Software-in-Loop, Hardware-in-Loop or Simulation testing you may have conducted with your software.

The team has tested the software system in ROS Gazebo. Simulation tests include evaluating the perception capability of the trained YOLOv8n object recognition model for range and accuracy, assessing 3D mapping by comparing perceived cone locations against ground truth, and testing path planning and vehicle control on a custom cone track to ensure effective navigation and obstacle avoidance.

Sensor Integration: What is the status of your Sensor Integration?

The autonomous system developed by the team integrates a 3D Lidar, depth camera, and wheel-speed encoders. The 3D Lidar provides high-resolution mapping and distance measurement, whilst the depth camera aids in differentiating cone types. Wheel-speed encoders supply odometry data for localisation and control.

ADS CLASS ONLY:
Please describe the status of your Autonomous Driving System and Emergency Braking System hardware.

ADS CLASS ONLY:
Please describe the test programme you have conducted to date with your vehicle. Include details on the mileage covered and the type of Missions you have tested.

DDT CLASS ONLY:
Please describe the test programme you have conducted to date with the IMechE ADS-DV (or any other vehicle or system). Include details on the number of test days, the mileage covered and the type of Missions you have tested.

The team have not had access to the ADS-DV at the time of writing this report and therefore unable conduct any tests on ADS-DV.

The team have tested the developed software in simulation environment, ROS Gazebo. Custom tracks, compliant with the FS-AI rules, were constructed in Gazebo. A vehicle modelled after ADS-DV in ROS, emulating its vehicle dynamics. This vehicle was placed on the custom tracks with the autonomous system initiated, and was able to autonomously drive around the track until manual intervention, emulating Trackdrive and Autocross conditions.

DDT CLASS ONLY:
Please describe your planned implementation of Software Deployment and Mission Launch that you will use at the July Event.

The team is currently developing a software system which enables communication between the developed ROS framework and the ADS-DV via the provided APIs. The software will enable ROS to control ADS-DV with desired linear velocity and steering angle, whilst ADS-DV provides wheel speed to ROS for odometry computation. The mission specific routines will be defined as ROS launch files, and initiated via the ADS-DV APIs.

Additional Information:
Please include any additional information you wish to provide, such as links to code repositories, links to online materials, links to Social Media, etc.