Report 10 - Nihal Afsal

Vehicle Plant and ISO 26262

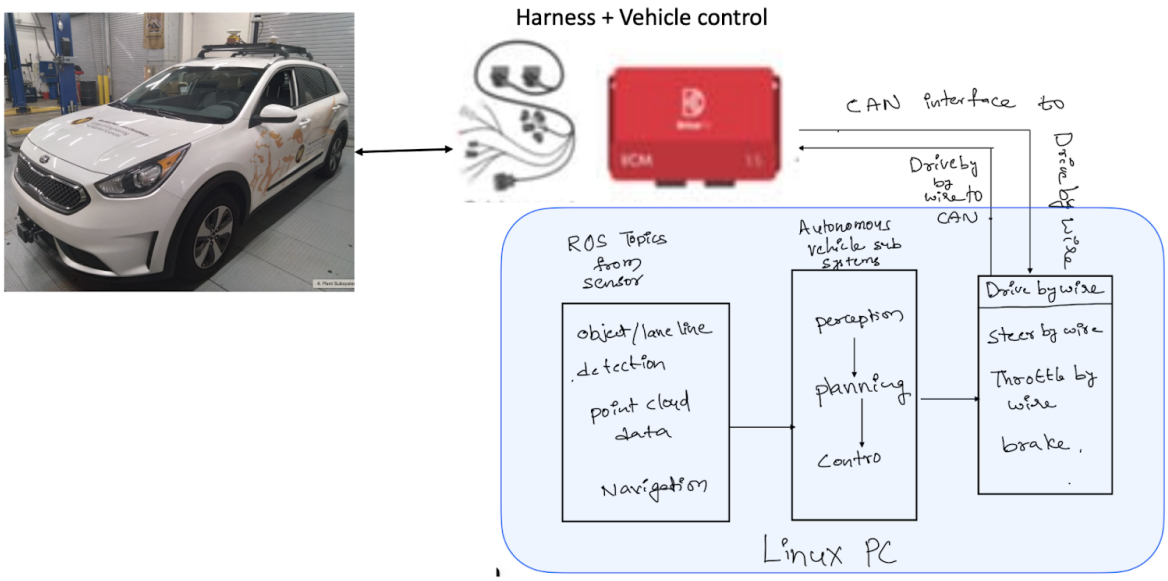
Note: Homework must be uploaded as a **single pdf file**, not a zip file. If a problem solution requires a video, add it as a hyperlink in the pdf. The hyperlink should open the video file which is stored on your Google Drive. Any problem that requires Python code must show the entire code as well as a description of how the code works. Duplicate code submissions will result in a zero.

1. Collaborate with your team to document how the plant is incorporated and used in an autonomous vehicle system using a written paragraph or two, flow diagram, and pictures.

    a. The verbal description must address the CAN bus and drive-by-wire concepts. *(15 pts)*

- The plant is the collection of interconnected components and subsystems in an autonomous vehicle system, such as the powertrain, sensors, and actuators that work together to enable the vehicle to operate autonomously. Controller Area Network (CAN) bus is a reliable communication protocol designed to facilitate the exchange of information between various Electronic Control Units (ECUs) within the vehicle (Minawi et al., 2020). For an autonomous vehicle to operate safely and efficiently, these ECUs are responsible for managing critical subsystems, such as the engine, transmission, brakes, airbag system, and steering. The CAN bus allows for real-time coordination between the plant components and the autonomous driving system. Drive-by-wire (DBW), on the other hand, is the road vehicle system similar to the fly-by-wire systems first used in aircraft, and it suggests that vehicle control inputs, such as the steering wheel, brake pedal, etc., can be fully operated by electronic inputs like a digital signal rather than only mechanical inputs (Brown et al., 2022). The DBW allows the plant to be smoothly integrated into the self-driving system because it enables direct control of the vehicle's moving parts by the autonomous software.

    b. The flow diagram can be a wiring diagram or a conceptual subsystem diagram. Include pictures of one of the lab vehicles in the diagram or separately. *(15 pts)*



2. Collaborate with your team to write 2 systems requirements relevant to your final project. *(10 pts)*

- 1) **The autonomous car system needs to detect objects and shall avoid accidents.**

  - It is important for an autonomous car system to detect objects and avoid accidents for several reasons, which include ensuring safety, efficiency, legal compliance, trust, and technology adoption. These factors are essential for the successful implementation and widespread acceptance of autonomous vehicles. By accurately detecting objects and preventing accidents, autonomous cars can create a safer, more efficient transportation system that reduces traffic congestion, lowers emissions, and ultimately benefits society as a whole.

2) **The vehicle needs to follow the traffic rules, detect, and respond to objects in its environment.**

- Adhering to traffic rules, detecting, and responding to objects in the environment are crucial aspects of autonomous vehicle functionality. Ensuring the safety of passengers, pedestrians, and other road users is a primary concern, and by following traffic rules and accurately detecting and reacting to objects, autonomous vehicles can help avoid collisions and accidents. This, in turn, creates a safer environment for everyone involved. Additionally, traffic rules are designed to promote smooth traffic flow and reduce congestion. Autonomous vehicles that follow these rules contribute to an efficient transportation system, lowering travel times and reducing fuel consumption.

3. Describe how safety is engineered into an Electronic Power Steering Assist Actuator. Also, please describe the difference between ASIL-A and ASIL-D and provide one example of each. *(15 pts)*

- Electronic Power Steering (EPS) Assist Actuator is designed to ensure that the system can continue to function even if one or more components fail as well as it can detect faults in the system and take appropriate action to prevent unsafe conditions. Moreover, EPS Assist Actuator is designed to meet safety standards, such as ISO 26262, which provides guidelines for functional safety in electronic systems.

  ASIL-A is the lowest level of safety integrity and represents systems with the lowest risk of causing harm, for example the interior lighting of a vehicle. ASIL-D is the highest level of safety integrity and represents systems with the highest risk of causing harm, for example the braking system of a vehicle.

4. As a team, complete the Risk Assessment Exercise Template posted on Elearning. *(20 pts)*

- https://docs.google.com/spreadsheets/d/1yTq-Iit6wKLd8YSpXp-dUUHHiM26txVL/edit?usp=sharing&ouid=113251568393770898858&rtpof=true&sd=true