

**RBE 595 — FAIR-AV**  
**Assignment #2**

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## Problem 1

If the digital driver or virtual driver is used to control an autonomous vehicle, what changes in the vehicle have to be made?

Hint #1: Think of the framework of shared control and replace the human driver with a digital driver.

Hint #2: The changes in the vehicle could be from hardware, software, and system architecture.

## Solution

The digital driver or virtual driver is a software system that is responsible for controlling the vehicle. The digital driver is responsible for making decisions about the vehicle's control inputs, such as steering, throttle, and braking. The digital driver is also responsible for perceiving the environment around the vehicle and making decisions based on this perception.

The digital driver is a replacement for the human driver in an autonomous vehicle. The digital driver is responsible for all aspects of driving the vehicle, including perception, planning, and control. The digital driver must be able to perceive the environment around the vehicle, plan a safe and efficient path through this environment, and control the vehicle to follow this path.

In order to use a digital driver to control an autonomous vehicle, several changes must be made to the vehicle. These changes can be categorized into three main areas: hardware, software, and system architecture.

1. **Hardware Changes:** The hardware of the vehicle must be modified to support the digital driver. This may include the addition of sensors, such as cameras, lidar, radar, and ultrasonic sensors, to enable the digital driver to perceive the environment around the vehicle. The vehicle may also need additional computing power to run the digital driver software and process the sensor data in real-time. In addition, the vehicle may need actuators, such as electric motors, to control the vehicle's steering, throttle, and braking systems.
2. **Software Changes:** The software of the vehicle must be modified to support the digital driver. This may include the development of perception, planning, and control algorithms to enable the digital driver to make decisions about the vehicle's control inputs. The software must also be able to interface with the vehicle's sensors and actuators to enable the digital driver to perceive the environment and control the vehicle in real-time.
3. **System Architecture Changes:** The system architecture of the vehicle must be modified to support the digital driver. This may include the development of a distributed computing system to enable the digital driver to run on multiple processors and communicate with the vehicle's sensors and actuators. The system architecture must also be fault-tolerant to ensure the safe operation of the vehicle in the event of a software or hardware failure.

In conclusion, the digital driver is a replacement for the human driver in an autonomous vehicle. In order to use a digital driver to control an autonomous vehicle, several changes must be made to the vehicle, including hardware, software, and system architecture changes.