Task 1

To facilitate communication and interaction between the trucks in a platooning scenario, several types of data, signals, and events are required. These elements enable the trucks to coordinate their movements, maintain a safe distance, and respond to changing traffic conditions.

1. Speed and Acceleration Data:

Data Type: Real-time speed and acceleration measurements.

Protocol: A protocol like Controller Area Network (CAN) or a more advanced one like Dedicated Short-Range Communication (DSRC) can be used to transmit speed and acceleration data.

State Machine Event: "Receive Speed and Acceleration Data."

2. Distance Measurement:

Data Type: Real-time distance measurements between the vehicles.

Protocol: Utilize a communication protocol like DSRC, which is designed for vehicle-to-vehicle communication and can transmit distance information effectively.

State Machine Event: "Receive Distance Measurement."

3. Braking and Acceleration Commands:

Data Type: Commands for braking, acceleration, and maintaining a specific following distance.

Protocol: CAN or a higher-level protocol for transmitting control commands, with an emphasis on safety and precision.

State Machine Event: "Receive Control Commands."

4. Lane and Position Data:

Data Type: Information about the lane the vehicle should occupy and its current position within that lane.

Protocol: CAN or DSRC for lane and position data transmission.

State Machine Event: "Receive Lane and Position Data."

5. Lane Change and Coupling/De-coupling Commands:

Data Type: Commands for lane changes and coupling or de-coupling from the platoon.

Protocol: Use a robust and secure communication protocol to transmit these critical commands.

State Machine Event: "Receive Lane Change or Coupling/De-coupling Command."

6. Collision and Obstacle Detection:

Data Type: Data regarding detected obstacles, other vehicles, or potential collision risks.

Protocol: CAN or DSRC can be used for transmitting this safety-critical data.

State Machine Event: "Detect Collision or Obstacle."

7. Emergency Signals:

Data Type: Emergency signals and warnings in case of unexpected events or system failures.

Protocol: Implement a dedicated and high-priority protocol for emergency signals to ensure prompt responses.

State Machine Event: "Receive Emergency Signal."

8. Initialization and Handshake Signals:

Data Type: Signals for initializing the platoon and establishing communication.

Protocol: Implement a reliable and secure protocol for the initialization and handshake process.

State Machine Event: "Initialize and Establish Communication."

State Machine: Platooning Communication

States:

1. Idle

2. Initialize

3. Form Platoon

4. Follow Leader

5. Lane Change

6. Emergency

Transitions:

- Idle -> Initialize: Upon platooning initiation request.

- Initialize -> Form Platoon: Once communication is successfully established.

- Form Platoon -> Follow Leader: During de-coupling.

- Follow Leader -> Lane Change: When a lane change command is received.

- Follow Leader -> Emergency: In response to emergency signals or collision detection.

- Lane Change -> Follow Leader: After completing the lane change.

- Follow Leader -> Form Platoon: During coupling .

- Emergency -> Follow Leader: After resolving the emergency situation.

Events:

- Receive Speed and Acceleration Data

- Receive Distance Measurement

- Receive Control Commands

- Receive Lane and Position Data

- Receive Lane Change or Coupling/De-coupling Command

- Detect Collision or Obstacle

- Receive Emergency Signal

- Initialize and Establish Communication