PEAS Analysis

- Performance Measure:

The performance measure defines the criteria for evaluating the success of the system. In the context of an autonomous vehicle, the performance measures would include:

1. Safety: The vehicle must navigate safely, avoiding accidents and minimizing risk to passengers, pedestrians, and other vehicles.
2. Efficiency: The vehicle should choose the most optimal routes (shortest, least congested) while maintaining fuel efficiency and minimizing travel time.
3. Comfort: The vehicle should provide a smooth ride, minimizing sudden movements, jerks, and discomfort for passengers.
4. Adherence to Traffic Rules: The vehicle should obey all traffic signals, signs, and road markings, adhering to legal and regulatory requirements.
5. Reliability: The vehicle must be robust and function correctly over time, ensuring minimal system failures.
6. Passenger Experience: The system should provide features like entertainment, connectivity, and a responsive interface for passengers, maintaining a positive user experience.

- Environment:

The environment consists of everything the vehicle interacts with while driving. In an autonomous vehicle system, the environment can be broadly described as:

1. Road Network: Includes highways, streets, intersections, and rural roads.
2. Other Vehicles: Interaction with other vehicles on the road, including other autonomous and non-autonomous vehicles.
3. Pedestrians and Cyclists: Potential interactions with pedestrians, cyclists, and other non-motorized road users.
4. Weather Conditions: Environmental conditions like rain, fog, snow, and ice, which can affect visibility and road traction.
5. Road Infrastructure: Traffic signals, signs, lane markings, construction zones, potholes, and roadworks.
6. Dynamic Obstacles: Moving obstacles, such as animals, fallen objects, or vehicles that stop unexpectedly.
7. Human Drivers and Pedestrians Behavior: The unpredictable behavior of human drivers and pedestrians, which requires the vehicle to anticipate and react to sudden changes.

- Actuators:

Actuators are the components responsible for performing physical actions in response to decisions made by the system's AI. For an autonomous vehicle, these include:

1. Steering System: Responsible for controlling the direction of the vehicle based on planned paths.
2. Throttle and Brake System: Adjusts the vehicle's speed, accelerates, or decelerates as needed.
3. Signal Lights: Indicates turns, lane changes, or stops to other road users.

4. Horn and Alerts: Provides auditory signals to warn pedestrians, other drivers, or cyclists.
5. Wheel System (for movement control): Ensures the vehicle's movement and turning dynamics are smooth and responsive.
6. Parking System: Handles the act of parking the vehicle, including parallel parking, angle parking, etc.

- Sensors:

Sensors are used to perceive the environment and provide data to the AI system for decision-making. These include:

1. LiDAR (Light Detection and Ranging): A sensor that uses laser beams to create a 3D map of the vehicle's surroundings, detecting the distance and position of objects.
2. Cameras: Provide visual data to detect road signs, lane markings, traffic signals, pedestrians, and other vehicles.
3. Radar: Measures the speed and distance of objects around the vehicle, particularly useful in adverse weather conditions.
4. Ultrasonic Sensors: Used for close-range detection, such as parking or collision avoidance at low speeds.
5. GPS (Global Positioning System): Helps in determining the vehicle's location and assists in route planning and navigation.
6. IMU (Inertial Measurement Unit): Measures the vehicle's orientation, acceleration, and angular velocity to help maintain stability.
7. Infrared Sensors: Used for detecting obstacles in low-visibility conditions, such as night driving or fog.
8. V2X (Vehicle-to-Everything) Communication: Allows the vehicle to communicate with other vehicles, infrastructure (traffic lights, road sensors), and even pedestrians to enhance safety.