Faculty of Computing

Semester I 2025/2026

SECJ3553 Artificial Intelligence

Section 07

Assignment 3

Progress 4: Intelligent Agent

Project Theme:

Smart City - Traffic & Parking Advisor Application (Parkora.ai)

Team: TriSpark Tech

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Submission Date: 25th December 2025

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1.0 Introduction to PEAS Model

The PEAS model is a standard framework used in Artificial Intelligence to formally define intelligent agents and evaluate how effectively they operate within an environment to achieve a specific goal. It includes **Performance Measure** which defines the criteria for success; **Environment** which describes the external conditions in which the agent operates; **Actuators** which enable the agent to take actions and affect the environment; and **Sensors** which allow the agent to receive and gather information from its surroundings.

In Parkora.ai, the PEAS model is used to represent the intelligent Traffic and Parking Advisor Agent which assists drivers in finding optimal parking by reasoning over real-time traffic data, parking availability, user preferences and predictive insights.

2.0 PEAS Model Definition for Parkora.ai

2.1 Performance Measure

The performance measure defines how well the Parkora.ai agent achieves its objectives. The agent is considered successful when it minimises time, effort, cost and user stress, while maximising the parking efficiency, travel smoothness and overall user satisfaction.

Performance measures for Parkora.ai

- **Reduce time spent searching for parking**
  The system should quickly guide users to available parking spots instead of letting them drive around randomly.
- **Maximise the chance of first-time parking success**
  Users should be able to find a parking spot immediately without circling multiple lots.
- **Avoid congested roads**
  The system monitors traffic in real time to choose less busy routes.
- **Reduce overall travel time**
  Parkora.ai finds routes that are faster and avoid heavy traffic.
- **Save fuel and resources**
  By avoiding congestion, the system reduces fuel consumption.
- **Improve user convenience and satisfaction**
  Easy-to-follow guidance, clear notifications and personalised suggestions enhance the user experience.
- **Reduce unnecessary rerouting**
  The system tries to prevent frequent rerouting unless necessary.
- **Support smart city goals**
  Efficient traffic and parking reduce pollution and support urban mobility.

In Proof of Concept (POC)

- Metrics such as **average parking search time, route efficiency score and successful parking rates** are measured.
- Weighted cost functions are applied to **balance time, distance and traffic congestion**, helping the system make optimal decisions.

2.2 Environment

The environment includes everything outside the agent that affects its decisions. Parkora.ai operates in a real-world urban environment where traffic, parking and user locations change constantly.

Environment components

- **Road networks:** Streets, intersections and highways used to calculate routes.
- **Parking lots:** Equipped with IoT sensors to monitor available parking lots.
- **Traffic conditions:** Real-time data from APIs, showing congestion, accidents or roadblocks.
- **Time-based patterns:** Peak-hour traffic or parking demand patterns.
- **External services:** Navigation APIs like Google Maps.
- **User information:** Location, destination and parking preferences.

Environment properties

- **Dynamic:** Traffic and parking conditions can change frequently.
- **Stochastic:** Parking availability is uncertain; a lot may fill up unexpectedly.
- **Partially observable:** The system cannot see all parking spaces or roads at once.
- **Real-time:** Continuous updates are needed to make accurate decisions.

In Proof of Concept (POC)

- Traffic and parking conditions are simulated to mimic real-world scenarios.
- Time-based events such as rush hours or parking lot peaks are included in the simulation.
- This allows the agent to demonstrate adaptive decision-making in changing conditions.

2.3 Actuators

Actuators are the tools or mechanisms that allow an agent to take actions in the environment or send information and instructions to the user. Parkora.ai uses actuators to guide the user and make actions in the system.

Actuators in Parkora.ai

- **Route recommendation engine:** Suggests the best driving path to the user.
- **Turn-by-turn navigation:** Provides step-by-step instructions.
- **Parking suggestions:** Shows available parking lots and spaces.
- **Smart notifications:** Alerts users about traffic, parking availability or rerouting needs.
- **Automatic rerouting:** Changes the route if parking or traffic conditions change.
- **Mobile app updates:** Updates the user interface with new information, such as arrival time estimates or parking confirmations.

In Proof of Concept (POC)

- The user interface shows the chosen route and suggested parking spots.
- Notifications are triggered when conditions change, such as congestion or parking unavailability.
- Automatic rerouting is simulated based on timer thresholds or predicted parking unavailability.

2.4 Sensors

Sensors allow the agent to observe the environment. They provide the data needed for artificial intelligence to reason and make decisions.

Sensors in Parkora.ai

- **IoT parking occupancy sensors:** Detect which parking spaces are available.
- **Traffic APIs:** Provide vehicle density, average speed and congestion information.
- **GPS services:** Track the user’s real-time location.
- **Time and timer sensors:** Help trigger notifications or rerouting at certain time intervals.
- **User input sensors:** Capture destination and preferences, such as cost, proximity and safety.

In Proof of Concept (POC)

- Simulated sensor data represents traffic and parking information.
- GPS coordinates are used to simulate user movement.
- Predefined congestion and parking data help the system predict and plan routes.

3.0 PEAS Diagram for Parkora.ai

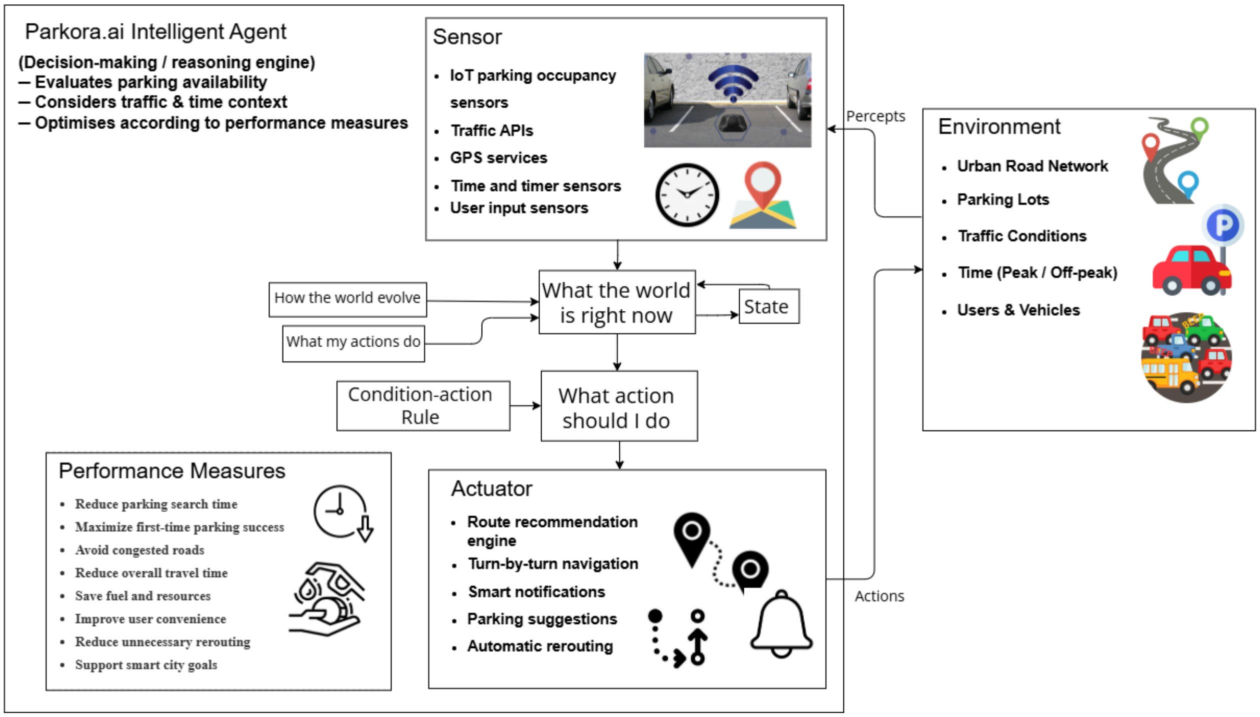

Figure 1: PEAS DIAGRAM for Parkora.ai

3.1 How the PEAS Model Supports the Goal of Parkora.ai

The PEAS model provides a structured representation of how the Parkora.ai intelligent agent operates to achieve its objective within a smart city context. By explicitly defining the Performance Measure, Environment, Sensors, and Actuators, the model ensures that the system's behaviour remains aligned with its intended goal, namely to assist drivers in finding optimal parking efficiently while reducing traffic congestion, travel time, and user stress in an urban environment.

The performance measures guide the agent to prioritise faster parking discovery, minimal rerouting, and reduced exposure to traffic congestion. Consequently, the agent's decision-making process is directed towards improving traffic efficiency and enhancing overall user satisfaction.

Moreover, the environment represents a dynamic and partially observable smart city, encompassing road networks, traffic conditions, parking availability, time-based patterns, and user locations. By modelling these real-world characteristics, the agent can adapt its decisions in response to changing conditions and provide realistic and context-aware recommendations.

Additionally, sensors supply real-time information such as traffic data, parking availability, GPS location, time-based inputs, and user preferences. This continuous stream of information enables the agent to reason accurately about the current state of the environment rather than relying on static or predefined route plans.

Finally, actuators allow the agent to execute its decisions through route recommendations, navigation guidance, parking suggestions, notifications, and rerouting. Through these mechanisms, the agent's reasoning is translated into actionable guidance that directly supports the system's objective in real time. Overall, the PEAS model ensures that Parkora.ai behaves as a rational agent by continuously aligning perception, decision-making, and action execution with its defined performance objectives.

3.2 PEAS representation in POC

PEAS Element	POC Representation
Performance	Quantitative metrics such as parking success rate and average parking search time are used to evaluate the effectiveness of the system
Environment	A simulated urban city map combined with predefined parking availability datasets is used to replicate real-world driving and parking conditions
Sensors	Mock traffic API data and simulated GPS location updates are employed to provide real-time environmental information to the agent
Actuators	User interface components such as route visualisation and notification triggers are used to deliver recommendations and system responses to users

4.0 How the AI Agent Behaves and Achieves the Goal in [Parkora.ai]

Parkora.ai behaves as a goal-oriented intelligent agent that assists drivers in finding optimal parking in a dynamic urban environment. The agent perceives real-time traffic conditions, parking availability, GPS location, and user preferences through its sensors. It reasons over this information using predefined performance measures to select actions that minimise parking search time, avoid congestion, and improve user convenience. These decisions are executed through actuators such as route recommendations, navigation guidance, parking suggestions, and automatic rerouting, enabling the system to achieve its objective efficiently.