Artificial Intelligence(23CP307T)

AI Agent

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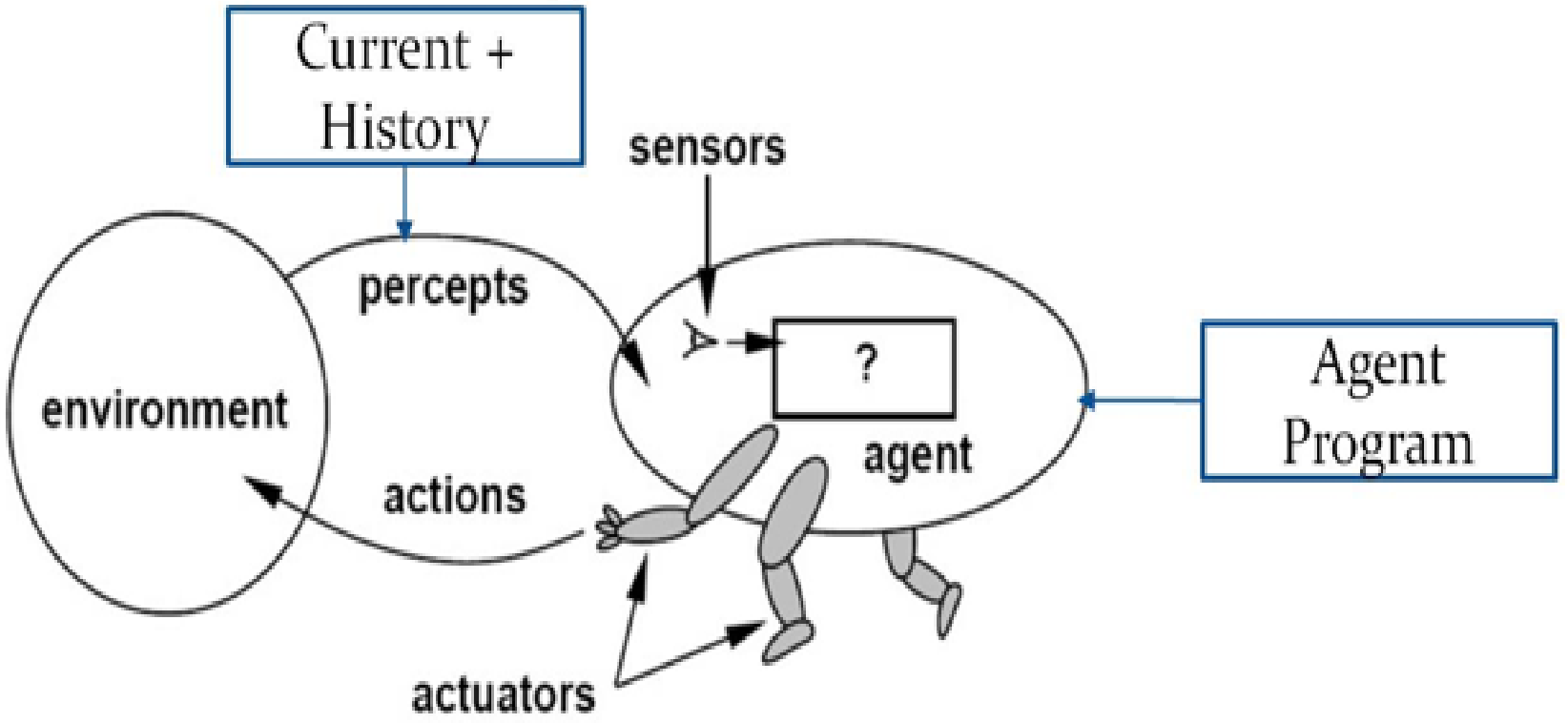
AI Agent

An AI system consists of **agents** and their **environment**.

- Agents act within their environment, which may also include other agents.
- An **agent** is anything capable of perceiving its environment through **sensors** and acting on it using **actuators** and **effectors**.



AI Agent

- **Environment:** The external system or surroundings where the agent operates.
- **Sensors:** Devices or tools used by the agent to observe changes in the environment.

  Example: Cameras, microphones, temperature sensors.
- **Actuators:** Hardware components that convert energy into motion or other actions required by the agent. They bridge the gap between the agent's internal decision-making and its ability to act physically.
  - Example: Motors, gears, rails, or servos used to control wheels, robotic arms, or other effectors.
- **Effectors:** Components or mechanisms through which the agent performs actions in the environment.
  - Example: Wheels, legs, robotic arms, fins, or a display screen.

AI Agent vs AI Assistant

AI Agent: An AI Agent is an autonomous entity that perceives its environment, makes decisions, and takes actions to achieve specific goals. It operates without direct human intervention, often making decisions based on pre-defined objectives.

Real-Time Example:

Autonomous Vehicles: AI agents in self-driving cars perceive their environment through sensors, make decisions on navigation, and act to safely transport passengers to their destination.

AI Assistant: An AI Assistant is a system designed to assist humans in performing tasks. It provides recommendations, answers queries, and helps in decision-making, often requiring some level of human interaction.

Real-Time Example:

Virtual Assistants: Systems like Siri, Alexa, and Google Assistant help users set reminders, play music, control smart devices, or answer questions based on voice commands.

PEAS Framework:

P (Performance Measure): Defines the criteria for evaluating the success of the agent.

Example: For a self-driving car, safety, time efficiency, legal adherence, and passenger comfort.

E (Environment): The surroundings or context in which the agent operates.

Example: Roads, vehicles, traffic signs.

A (Actuators): The mechanisms the agent uses to take action in its environment.

Example: Steering, accelerator, brakes, signals, horn.

S (Sensors): The tools the agent uses to perceive its environment.

Example: Cameras, GPS, speedometer, odometer, sonar, and accelerometer.

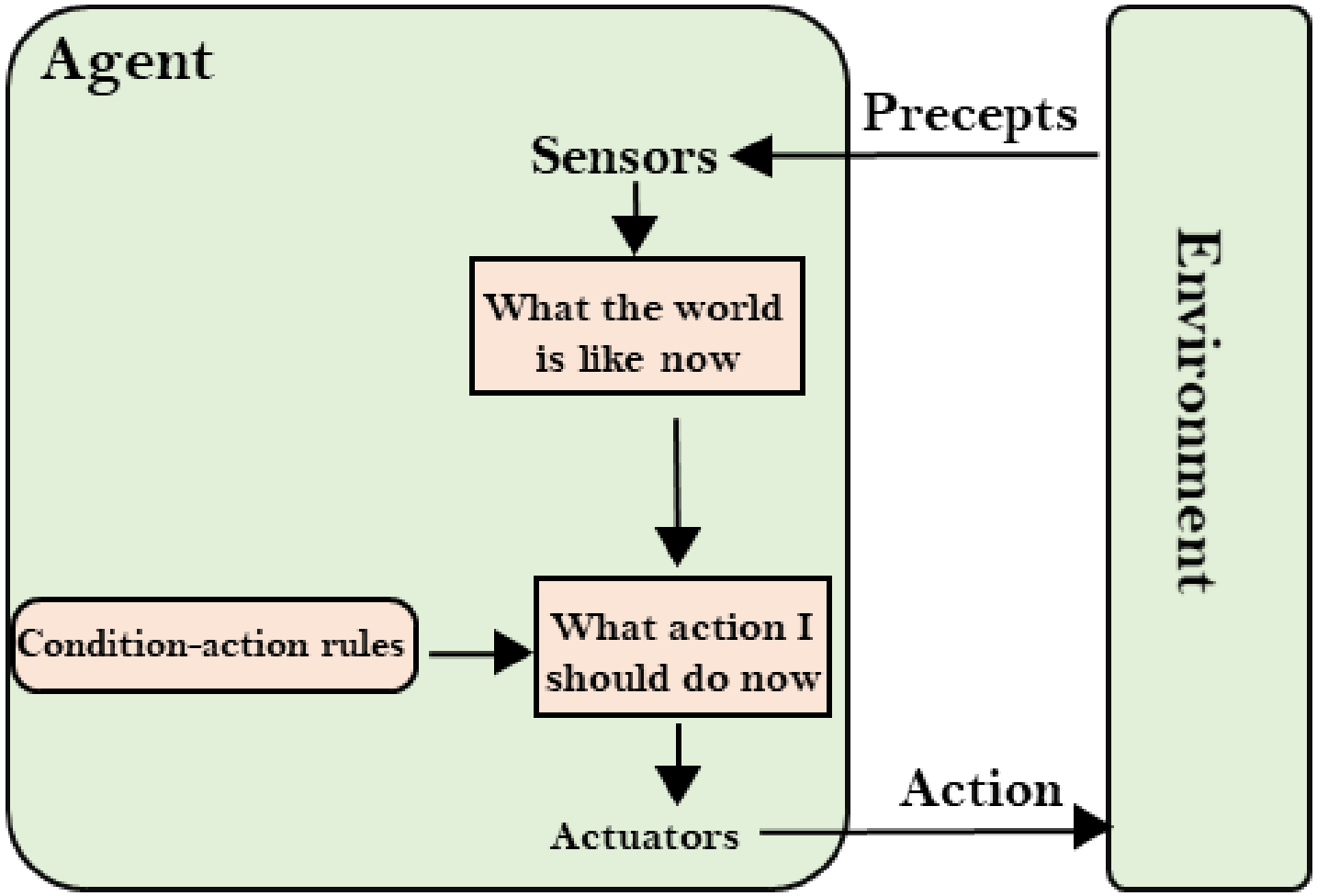
Types of AI Agents

Agents can be grouped into five classes based on their degree of perceived intelligence and capability. All these agents can improve their performance and generate better action over the time. These are given below:

- Simple Reflex Agent
- Model-based reflex agent
- Goal-based agents
- Utility-based agent
- Learning agent

1. Simple Reflex agent:

- The Simple reflex agents are the simplest agents. These agents take decisions on the basis of the current percepts and ignore the rest of the percept history.
- These agents only succeed in the fully observable environment.
- The Simple reflex agent does not consider any part of percepts history during their decision and action process.
- The Simple reflex agent works on Condition-action rule, which means it maps the current state to action. Such as a Room Cleaner agent, it works only if there is dirt in the room.
- Problems for the simple reflex agent design approach:
  - They have very limited intelligence
  - They do not have knowledge of non-perceptual parts of the current state
  - Mostly too big to generate and to store.
  - Not adaptive to changes in the environment.


Agent
Precepts
Sensors
What the world is like now
Environment
Condition-action rules
What action I should do now
Action
Actuators

2. Model-based reflex agent

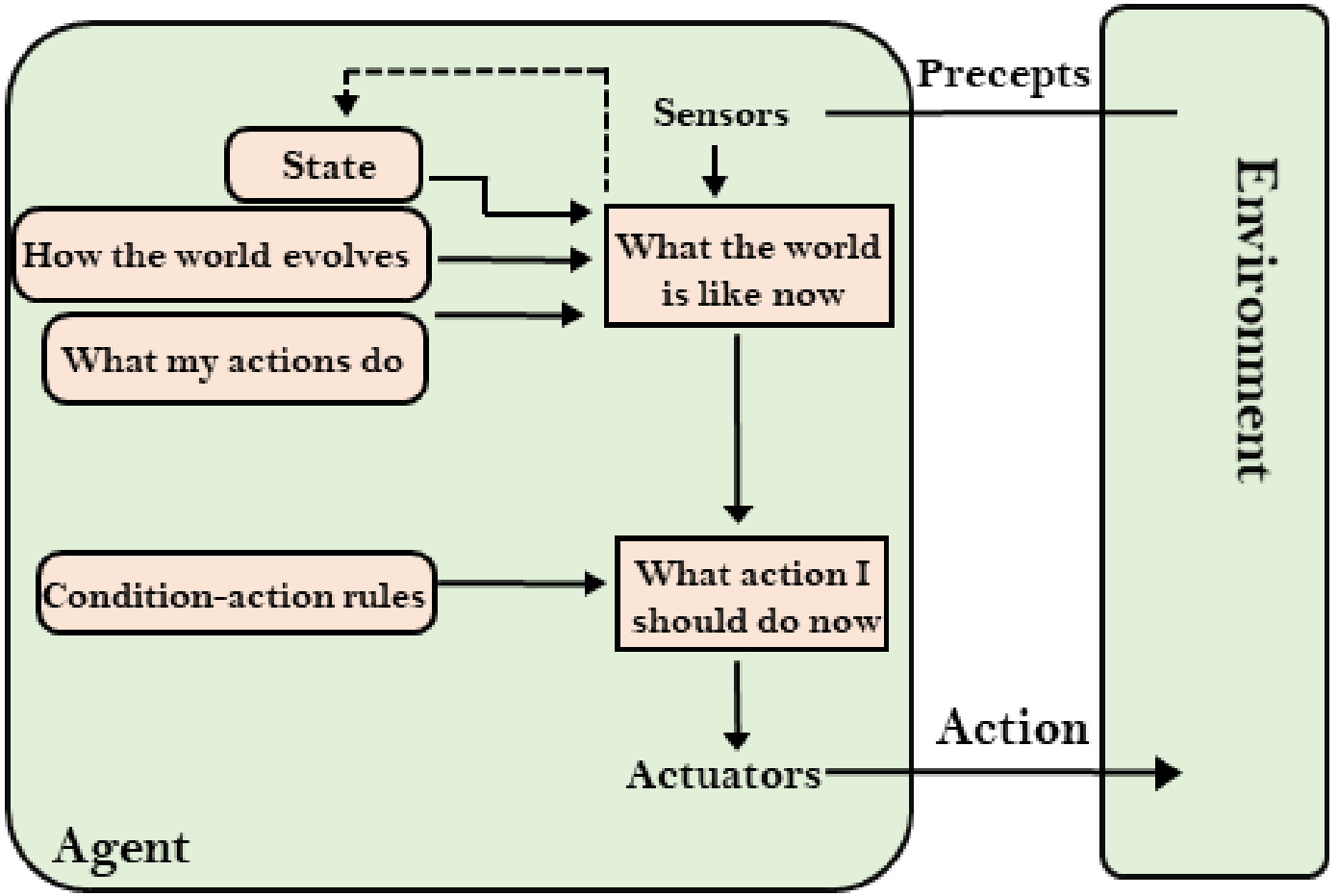
- The Model-based agent can work in a partially observable environment, and track the situation.
- A model-based agent has two important factors:

  Model: It is knowledge about "how things happen in the world," so it is called a Model-based agent.

  Internal State: It is a representation of the current state based on percept history.
- These agents have the model, "which is knowledge of the world“ and based on the model they perform actions.
- Updating the agent state requires information about:

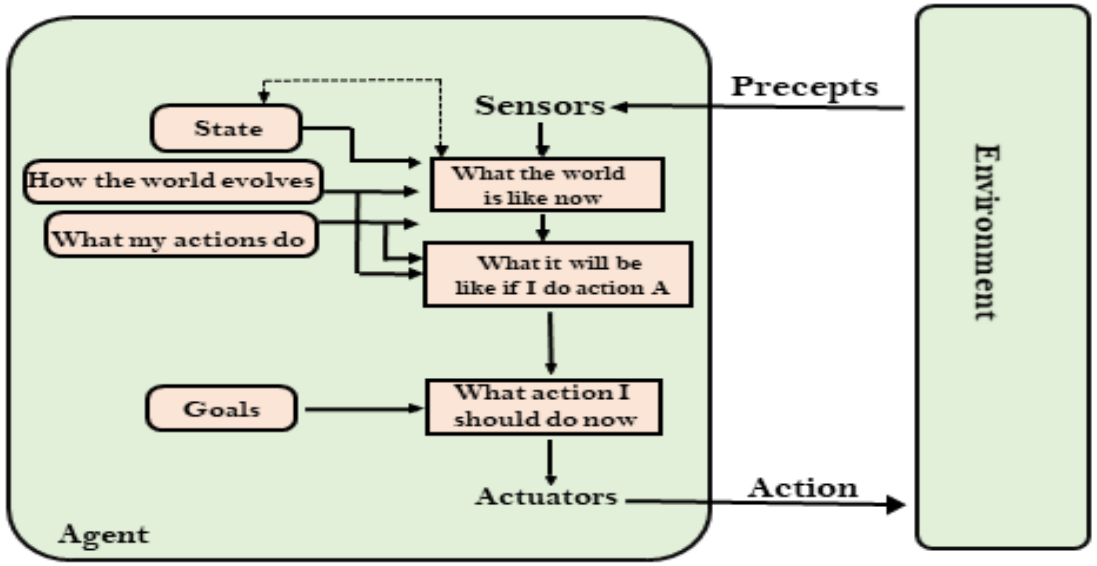
  How the world evolves

  How the agent's action affects the world.


Precepts
Sensors
State
How the world evolves
What my actions do
What the world is like now
Environment
Condition-action rules
What action I should do now
Action
Actuators
Agent

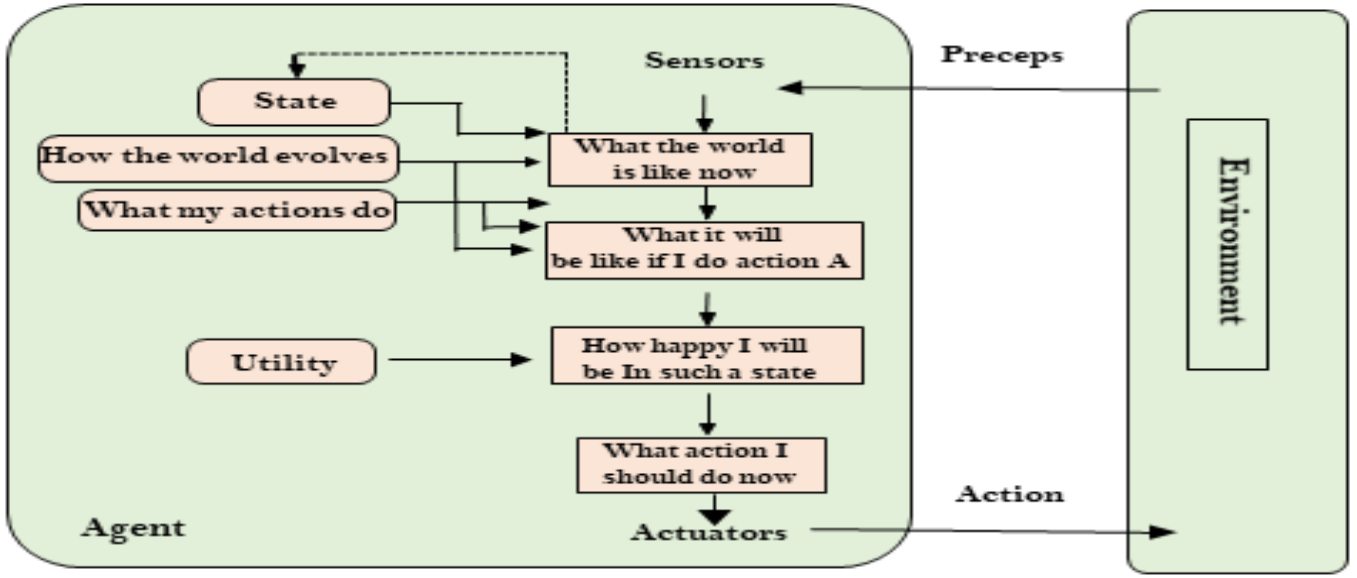
3. Goal-based agents

- The knowledge of the current state environment is not always sufficient to decide for an agent to what to do.
- The agent needs to know its goal which describes desirable situations.
- Goal-based agents expand the capabilities of the model-based agent by having the "goal" information.
- They choose an action, so that they can achieve the goal.
- These agents may have to consider a long sequence of possible actions before deciding whether the goal is achieved or not. Such considerations of different scenario are called searching and planning, which makes an agent proactive.



4. Utility-based agents

- These agents are similar to the goal-based agent but provide an extra component of utility measurement which makes them different by providing a measure of success at a given state.
- Utility-based agent act based not only goals but also the best way to achieve the goal.
- The Utility-based agent is useful when there are multiple possible alternatives, and an agent has to choose in order to perform the best action.
- The utility function maps each state to a real number to check how efficiently each action achieves the goals.



5. Learning Agents

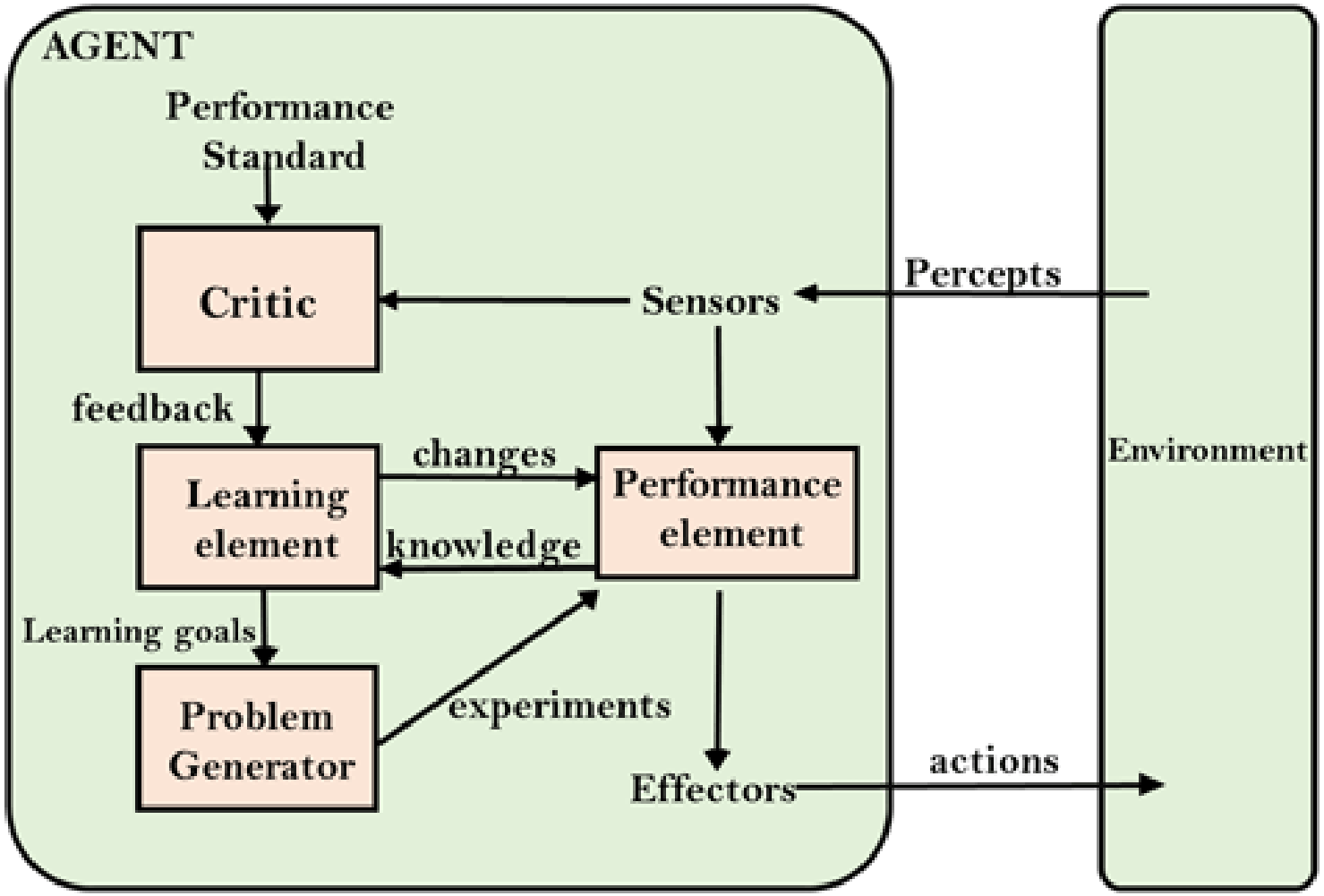
- A learning agent in AI is the type of agent which can learn from its past experiences, or it has learning capabilities.
- It starts to act with basic knowledge and then able to act and adapt automatically through learning.
- A learning agent has mainly four conceptual components, which are:

  Learning element: It is responsible for making improvements by learning from environment

  Critic: Learning element takes feedback from critic which describes that how well the agent is doing with respect to a fixed performance standard.

  Performance element: It is responsible for selecting external action

  Problem generator: This component is responsible for suggesting actions that will lead to new and informative experiences.
- Hence, learning agents are able to learn, analyze performance, and look for new ways to improve the performance.


AGENT
Performance Standard
Critic
Sensors
Percepts
feedback
changes
Learning element
Performance element
knowledge
Environment
Learning goals
Problem Generator
experiments
Effectors
actions

Intelligent Agent: A goal-directed entity that perceives its environment using sensors, processes the information based on observations and knowledge, and acts through actuators to influence the environment.

Key Characteristics:

- Operates based on observations.
- Uses built-in knowledge to take actions.
- Goal-oriented.

Rational Agent: An agent that performs the right actions based on what it perceives, aiming to maximize its performance measure.

Key Characteristics:

Rationality: Involves being reasonable, sensible, and exhibiting good judgment.

Decision-making: Concerned with selecting actions that lead to the best outcome.

PEAS Framework: Rational agents are typically characterized by their performance measures, environment, actuators, and sensors.