AI and It's Agents

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AGENT IN AI

- An AI system study of the rational agent and its environment.
- The agents sense the environment through sensors and act on their environment through actuators.
- An AI agent can have mental properties such as knowledge, belief, intention, etc.

What is Agent?

- An agent is a system or program in the field of AI and computer science.
- It is able to perform a set of actions to achieve specific goals or set of goals.
- Agent interacts with environment to make decisions and carry out tasks.
- Agent is able to sense its environment and act on it.
- Agent is a key element in AI and robotics.
- Agent can be:

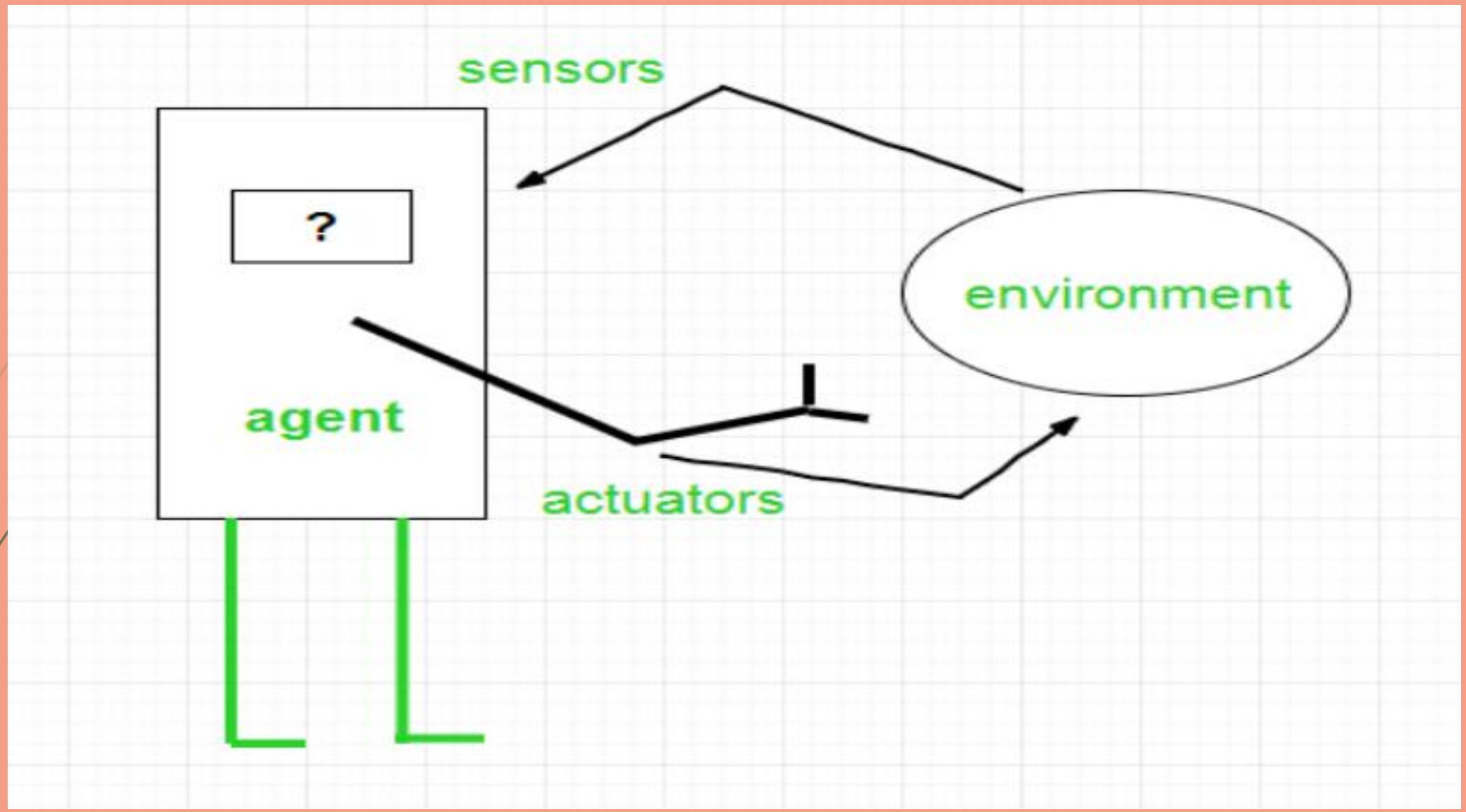
Human-Agent: A human agent has eyes, ears, and other organs which work for sensors and hand, legs, vocal tract work for actuators.

Robotic Agent: A robotic agent can have cameras, infrared range finder, NLP for sensors and various motors for actuators.

Software Agent: Software agent can have keystrokes, file contents as sensory input and act those inputs and display output on the screen.

Before moving forward, we should first know about sensors, effectors, and actuators.

- **Sensor**:
  - ✓ device which detects the change in the environment and sends the information to other electronic devices.
  - ✓ An agent observes its environment through sensors.
- **Actuators:** component of machines that converts energy into motion.
  - ✓ Responsible for moving and controlling a system.
  - ✓ An actuator can be an electric motor, gears, rails, etc.
- **Effectors:**
  - ✓ the devices which affect the environment.
  - ✓ Effectors can be legs, wheels, arms, fingers, wings, fins, and display screen.


sensors
?
environment
agent
actuators

Intelligent Agent:

autonomous entity which act upon an environment using sensors and actuators for achieving goals.

The main four rules for an AI agent:

- **Rule 1:** An AI agent must have the ability to perceive the environment.
- **Rule 2:** The observation must be used to make decisions.
- **Rule 3:** Decision should result in an action.
- **Rule 4:** The action taken by an AI agent must be a rational action.

Rational Agent:

i. Agent which has clear preference, models uncertainty.

ii. maximize its performance measure with all possible actions.

iii. rational agents to use for game theory and decision theory for various real-world scenarios.

Rationality:

- Rationality can be judged on the basis of following points:
- Performance measure which defines the success criterion.
- Agent prior knowledge of its environment.
- Best possible actions that an agent can perform.
- The sequence of percepts.

Structure of an AI Agent:

- Combination of architecture and agent program

Agent = Architecture + Agent program

- Three terms involved in the structure of an AI agent:

❖ **Architecture:** Architecture is machinery that an AI agent executes on.

❖ **Agent Function:** Agent function is used to map a percept to an action.

❖ **Agent program:** Agent program is an implementation of agent function. An agent program executes on the physical architecture to produce function.

PEAS Representation:

- Type of model on which an AI agent works upon.
- It is made up of four words:
  - **P**: Performance measure
  - **E**: Environment
  - **A**: Actuators
  - **S**: Sensors

Example of Agents with their PEAS representation

Let's suppose a Vaccum cleaner then PEAS representation will be:

- **Performance:** Cleanness , Efficiency, Battery life, Security.
- **Environment:** Room , Table , Wood floor ,Carpet, Various obstacles.
- **Actuators:** Wheels, Brushes, Vacuum Extractor
- **Sensors:** Camera, Dirt detection sensor ,Cliff sensor ,Bump Sensor ,Infrared Wall Sensor

Fig: Vaccum Cleaner

Types of Agents:

- Simple Reflex Agents
- Model-Based Reflex Agents
- Goal-Based Agents
- Utility-Based Agents
- Learning Agent

Simple reflex agents:

- Imple reflex agents react to the environment based on predefined rules
- Select actions based solely on current percept, without considering history
- Useful in simple environments where correct action can be determined from a single percept

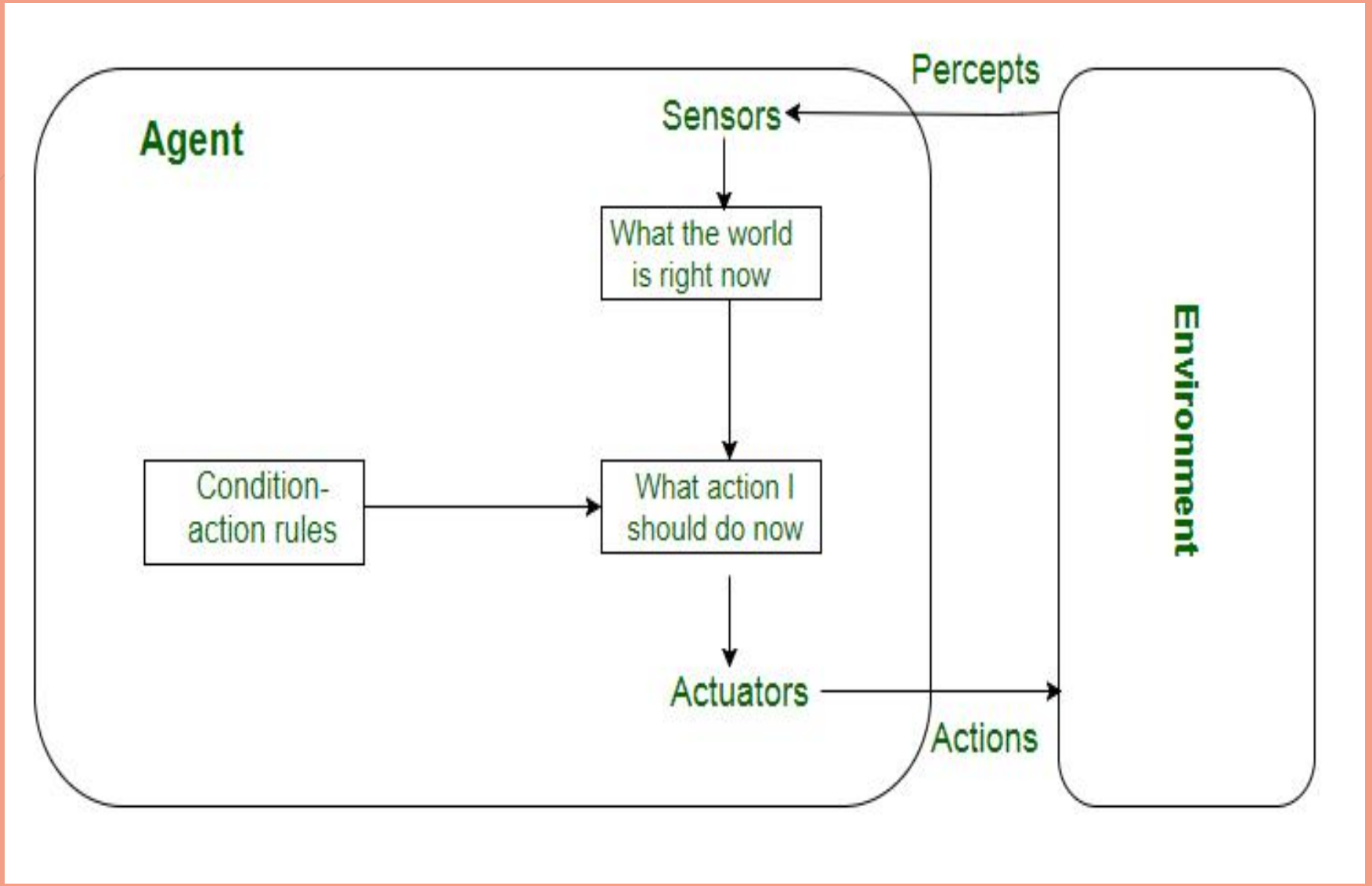


Fig: Simple Reflex Agents

Problems with Simple reflex agents:

- Very limited intelligence
- No knowledge of non-perceptual parts of the state.
- Usually too big to generate and store.
- If there occurs any change in the environment, then the collection of rules need to be updated.

Model-based reflex agents:

- Model-based reflex agents react to the environment based on predefined rules
- Has an internal model of the environment
- Keeps track of state of environment and makes decisions based on history of percepts
- Can handle more complex environments than simple reflex agents
- Uses internal model to predict outcome of actions and make more optimal decisions.

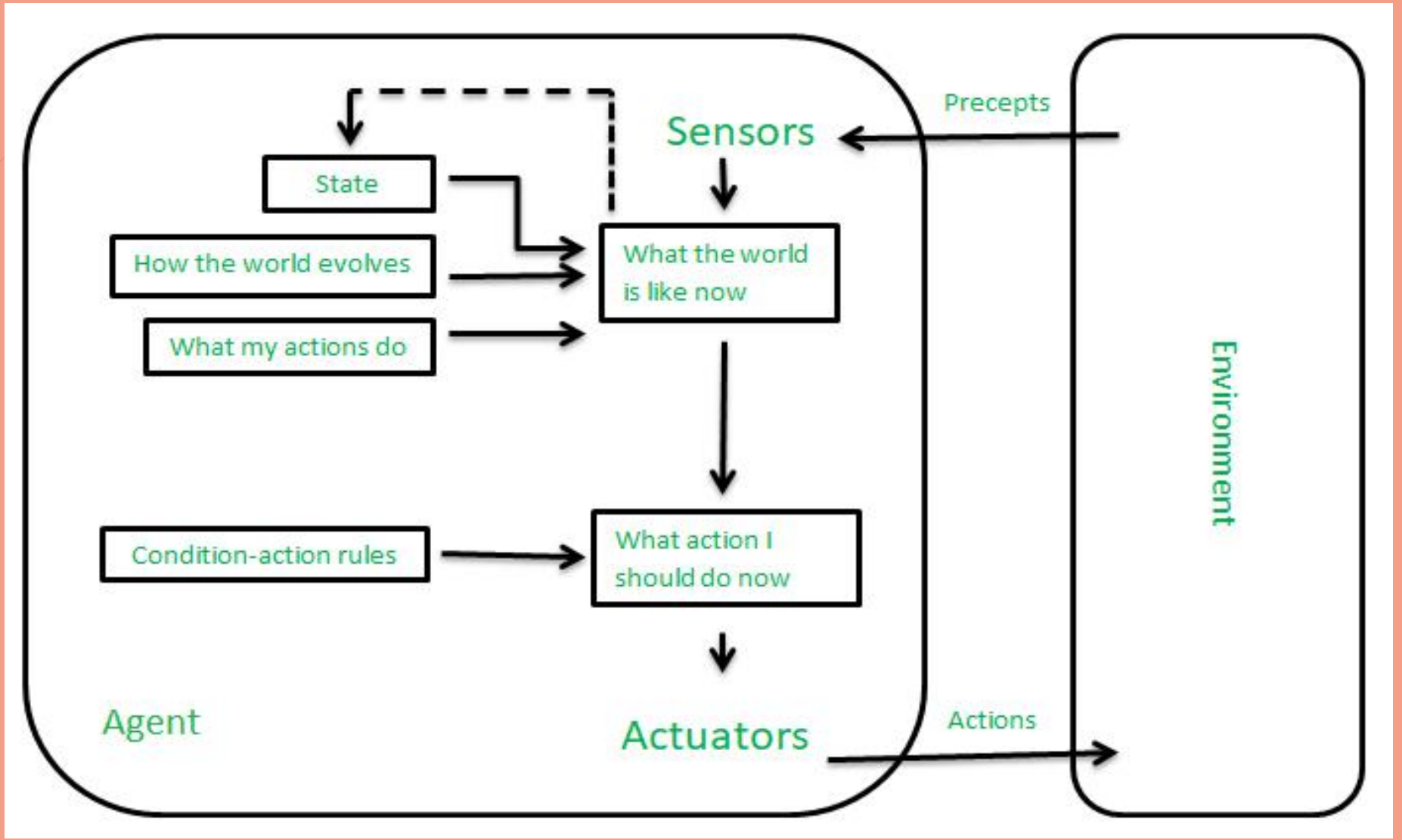


Fig: Model-based Agents

Goal-based agents:

- Goal-based agents have an explicit goal or set of goals
- They use the goal to guide their decision making process
- They are able to plan a sequence of actions to achieve the goal
- They can handle more complex and dynamic environments
- They use a combination of perception, memory, and planning to achieve the goal.

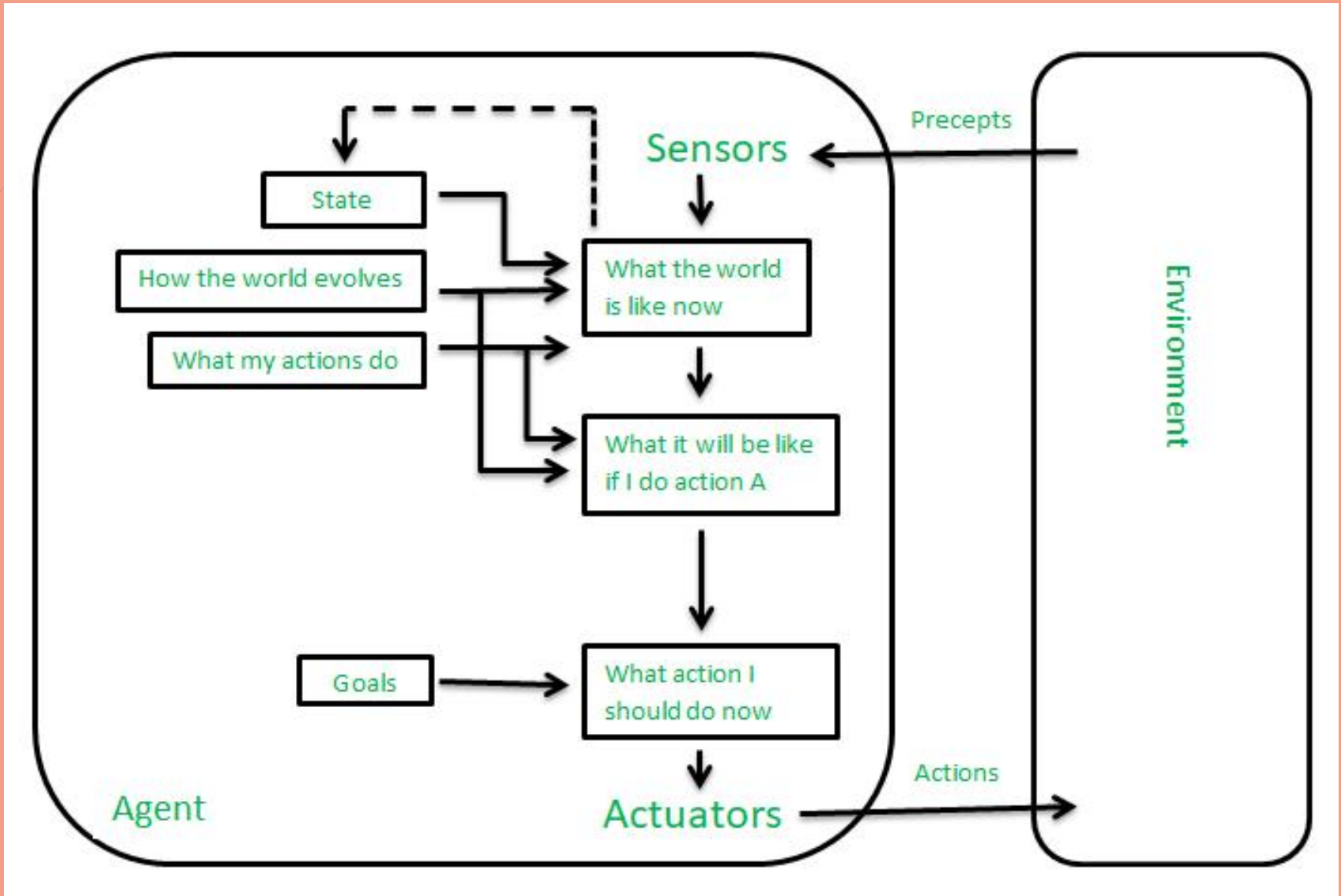


Fig: Goal Based Agents

Utility-based agents:

- Utility-based agents make decisions based on maximizing a utility function
- The utility function assigns a numerical value to each possible action
- The agent chooses the action with the highest utility value
- Utility-based agents can take into account multiple goals and preferences
- Utility describes how "**happy**" the agent is

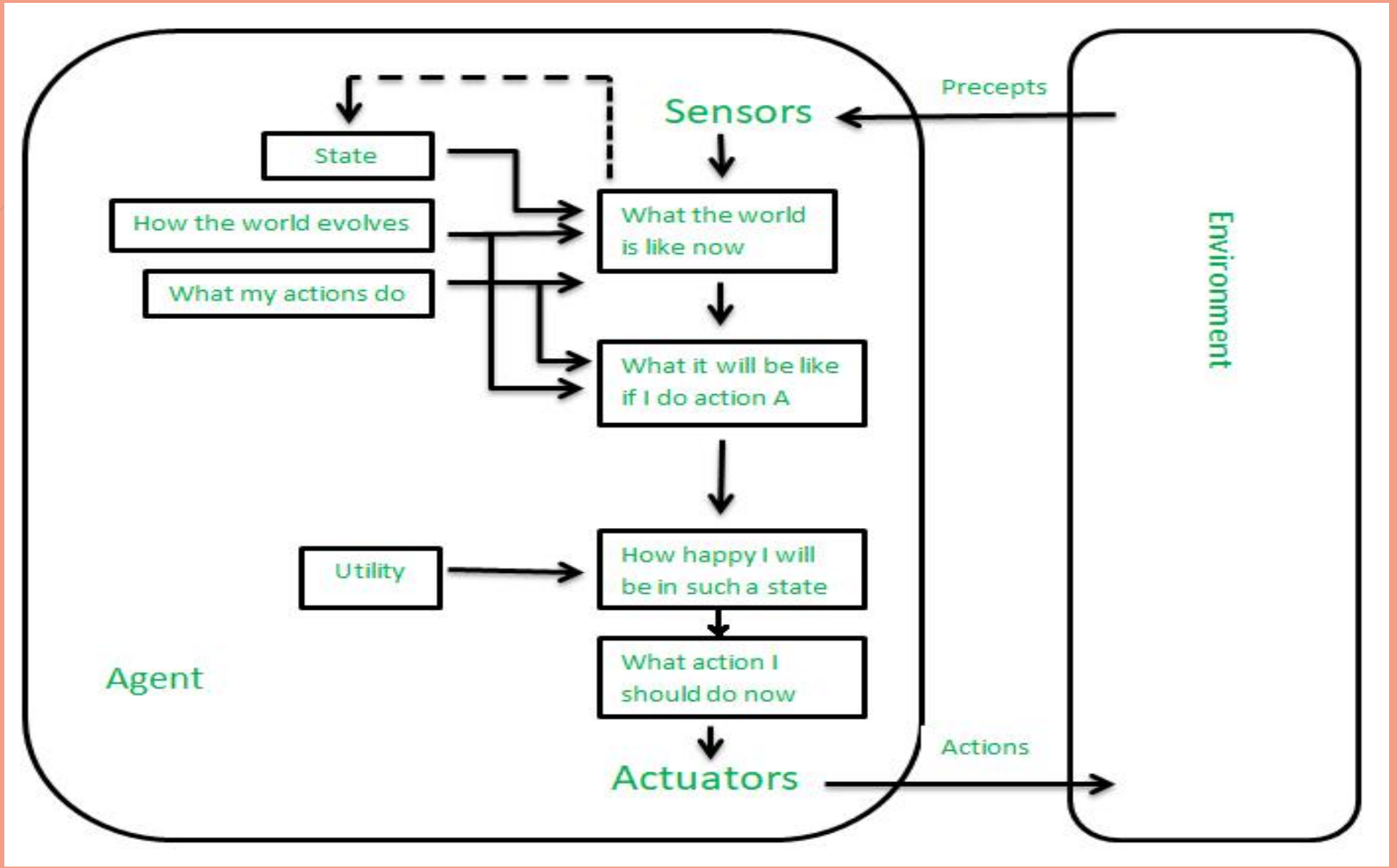


fig: Utility based agent

learning agent:

- Learning agents improve their performance through experience
- Adapt to changing environments and improve their decision-making over time
- Use various learning algorithms to update their internal model or decision-making policy
- Supervised learning, unsupervised learning and Reinforcement learning are some examples
- Used to learn a wide range of tasks such as classification, regression, control and decision making.
- use experiences, feedback and the performance metric to improve their decision-making.

four conceptual components of Learning Agent

1. **Learning element:** It is responsible for making improvements by learning from the environment
2. **Critic:** The learning element takes feedback from critics which describes how well the agent is doing with respect to a fixed performance standard.
3. **Performance element:** It is responsible for selecting external action
4. **Problem Generator:** This component is responsible for suggesting actions that will lead to new and informative experiences.

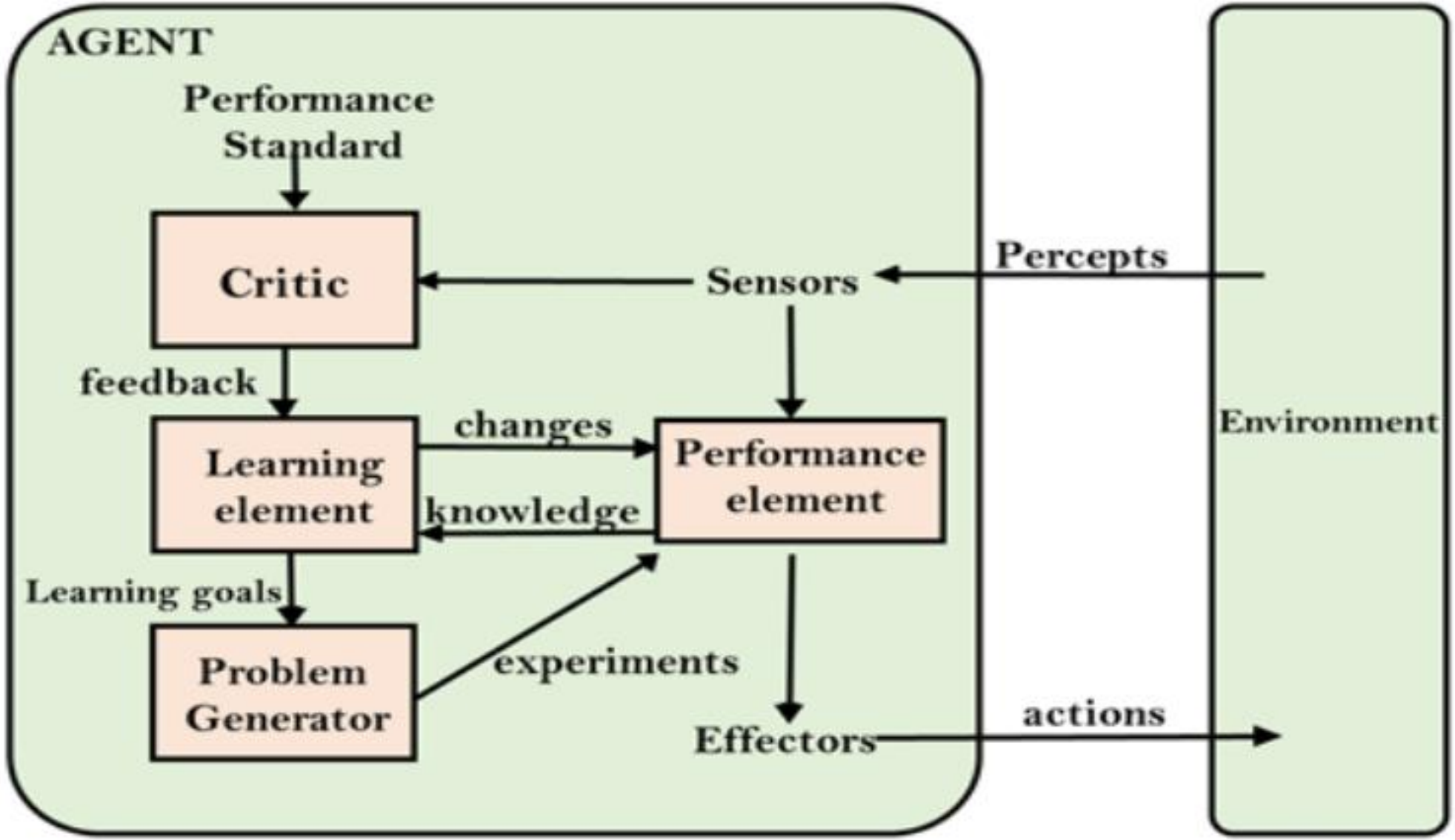


Fig: Learning Agent

Thank You