Class and Branch: TE AI-DS A
Student Roll no.: A07 (A1 Batch)
Student Name: Niharika Seth

DOP: 19/07/2024

EXPERIMENT NO.: 02

AIM: Discuss suitable Agent Architecture for the problem

OBJECTIVES: From this experiment, it will be able to:

- Understand agent architecture.
- Understand different types of agents.

OUTCOMES: The learner will be able to:

- Ability to develop a basic understanding of AI building blocks presented in intelligent agents.

SOFTWARE REQUIRED: Given problem definition.

THEORY:

In artificial intelligence, an agent is a computer program or system that is designed to perceive its environment, make decisions and take actions to achieve a specific goal or set of goals. The agent operates autonomously, meaning it is not directly controlled by a human operator.
Agent is something that perceives or identifies its environment through sensors and act upon that environment through there actuators or effectors.

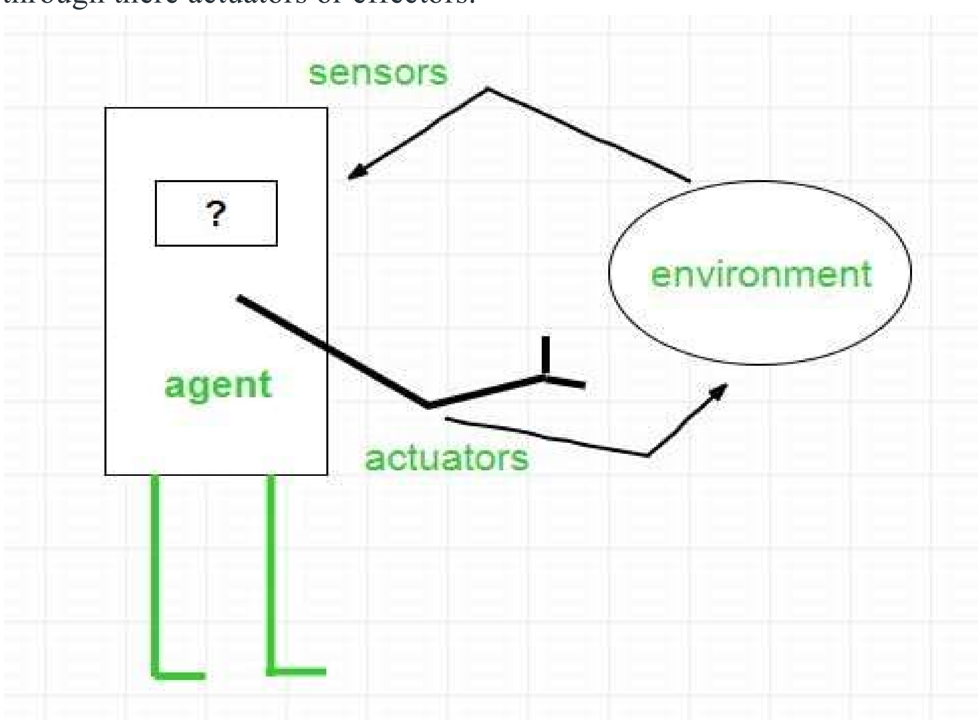

Fig: Structure Of Intelligent Agent

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Types of Agents**:**

Agents can be grouped into five classes based on their degree of perceived intelligence and capability:

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

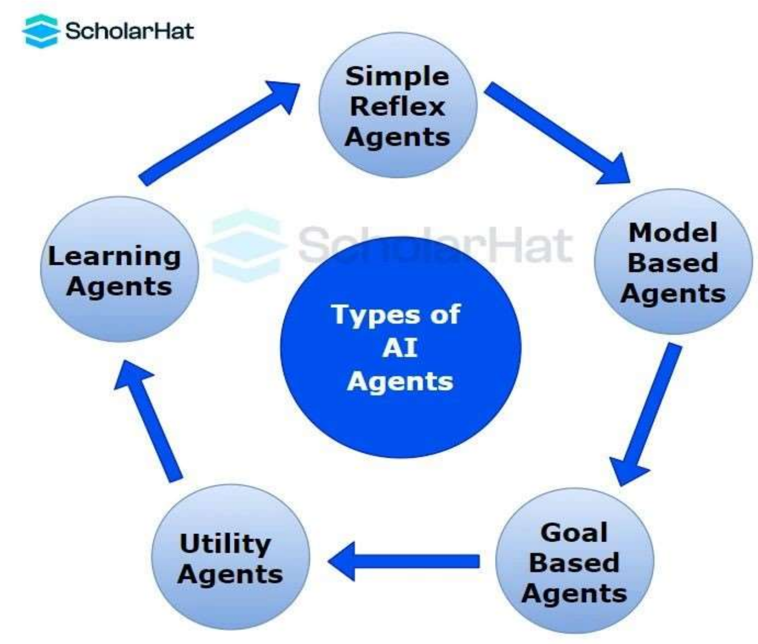

Fig: Types Of Agents

PROCEDURE/PROGRAM:

When discussing a suitable agent architecture for a problem, you typically want to conduct an experiment to identify which architecture best addresses the requirements of the problem. Following is the structured procedure:

1. Clearly articulate the problem to be solved and list both functional and non-functional requirements, such as performance metrics and environmental constraints.
2. Identify and research various agent architectures relevant to the problem based on literature and previous work.
3. Set up the experiment with a clear plan for testing each architecture. Define metrics for performance evaluation and implement the architectures in a controlled environment or simulation.
4. Analyze the data to compare performance across architectures. Discuss findings, make recommendations for the most suitable architecture

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RESULTS:

1. Simple Reflex Agents

- Simple reflex agents ignore the rest of the percept history and act only on the basis of the current percept. Percept history is the history of all that an agent has perceived to date.
- The agent function is based on the condition-action rule. A condition-action rule is a rule that maps a state i.e., a condition to an action. If the condition is true, then the action is taken, else not.
- This agent function only succeeds when the environment is fully observable.
- For simple reflex agents operating in partially observable environments, infinite loops are often unavoidable. It may be possible to escape from infinite loops if the agent can randomize its actions.

Problems with Simple reflex agents are:

- Very limited intelligence.
- No knowledge of non-perceptual parts of the state.
- Usually too big to generate and store.

Example**:** A thermostat in a heating system.

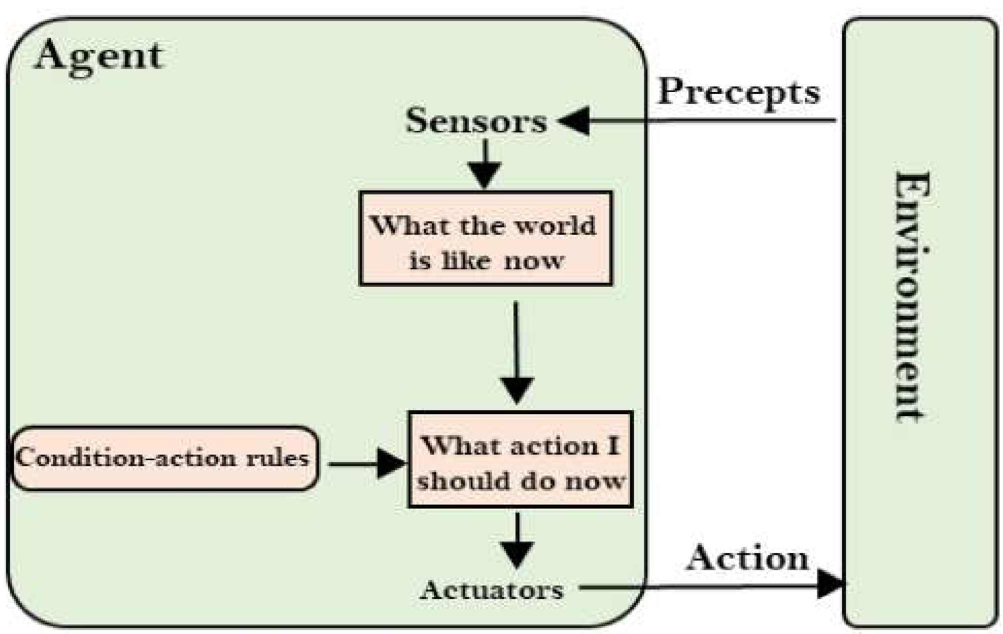

Fig: Simple Reflex Agent

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2. Model-Based Agents

- It works by finding a rule whose condition matches the current situation.
- A model-based agent can handle partially observable environments by the use of a model about the world.
- The agent has to keep track of the internal state which is adjusted by each percept and that depends on the percept history.
- The current state is stored inside the agent which maintains some kind of structure describing the part of the world which cannot be seen.
- 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.
- Example:
  - A vacuum cleaner that uses sensors to detect dirt and obstacles and moves and cleans based on a model.
  - If an obstacle is detected in front of the robot, then stop and change direction.
  - If the temperature exceeds a certain threshold in a climate control system then activate the cooling system.
  - If the demand for a product exceeds the available inventory then increase production.

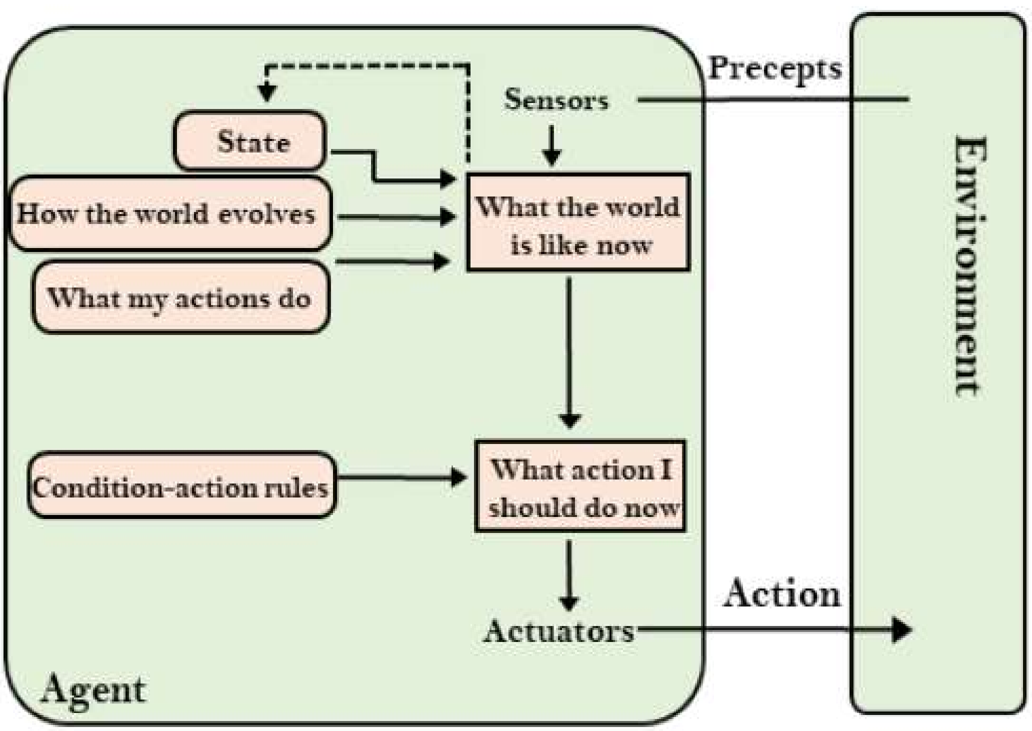

Fig: Model – Based Agent

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3. Goal – Based Agents

- These kinds of agents take decisions based on how far they are currently from their goal (description of desirable situations).
- Their every action is intended to reduce their distance from the goal.
- This allows the agent a way to choose among multiple possibilities, selecting the one which reaches a goal state.
- The knowledge that supports its decisions is represented explicitly and can be modified, which makes these agents more flexible.
- They usually require search and planning. The goal-based agent's behavior can easily be changed.
- 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.
- Examples:
  - Once the car is programmed with an end destination or goal, it will be able to make decisions that will help the passenger arrive at their destination. This is the step that transforms a model-based agent to a goal-based agent.
  - A chess-playing AI whose goal is winning the game.

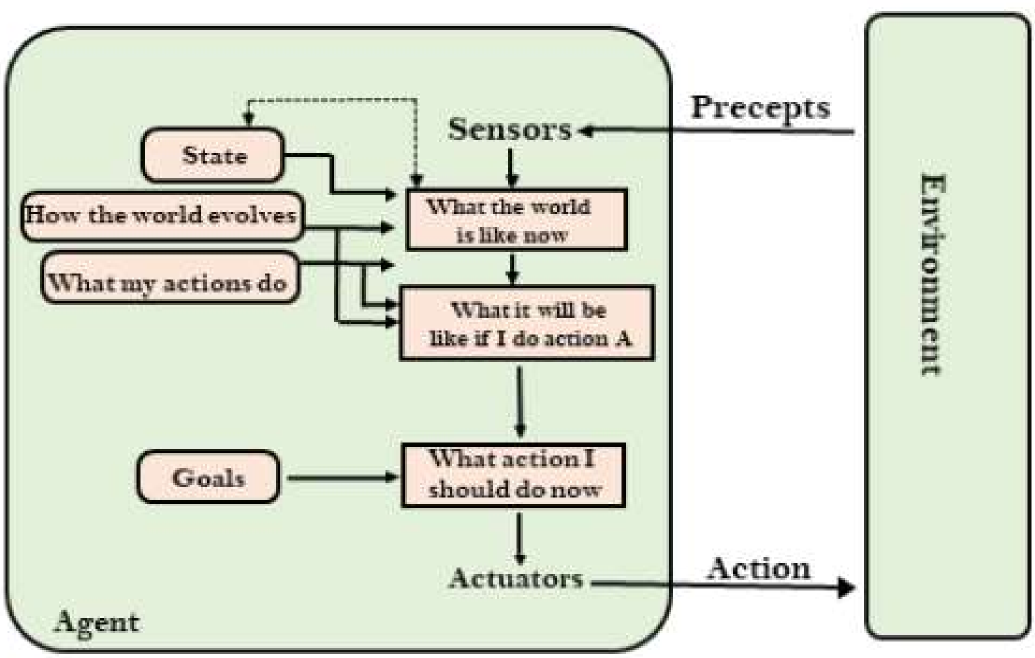

Fig: Goal – Based Agent

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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.
- Utility describes how “happy” the agent is. Because of the uncertainty in the world, a utility agent chooses the action that maximizes the expected utility.
- A utility function maps a state onto a real number which describes the associated degree of happiness.
- Examples:
  - There could be a home thermostat that knows to start heating or cooling your house based on reaching a certain temperature.
  - A delivery drone that delivers packages to customers efficiently while optimizing factors like delivery time, energy consumption, and customer satisfaction.

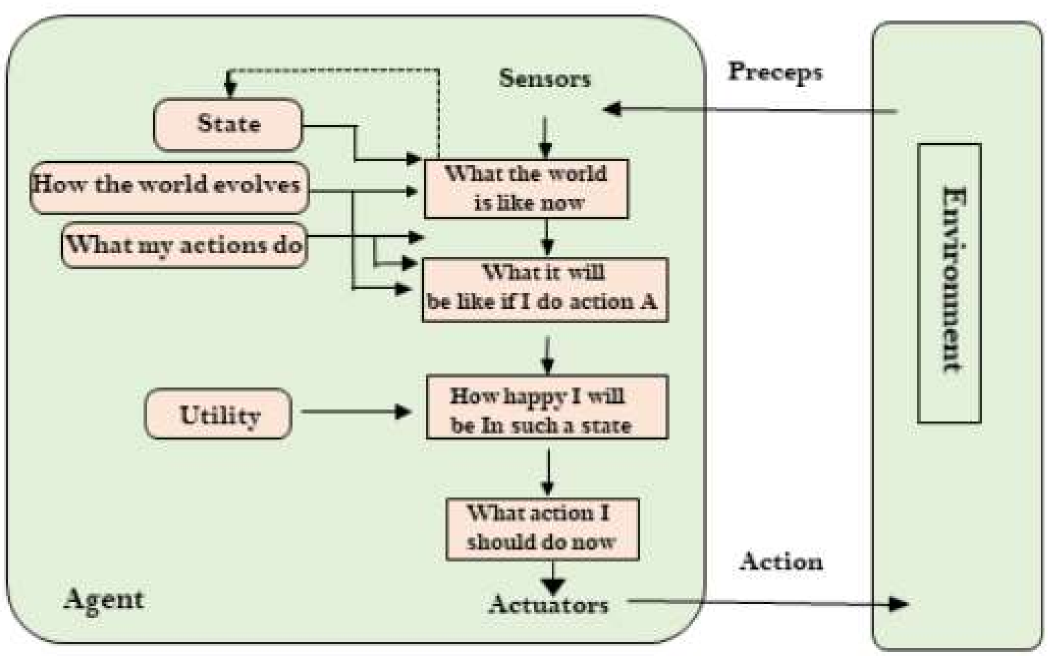

Fig: Utility – Based Agent

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5. Learning Agent

- 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.
- Examples:
  - A spam filter that learns from user feedback. It gains basic knowledge from past and uses that learning to act and adapt automatically.

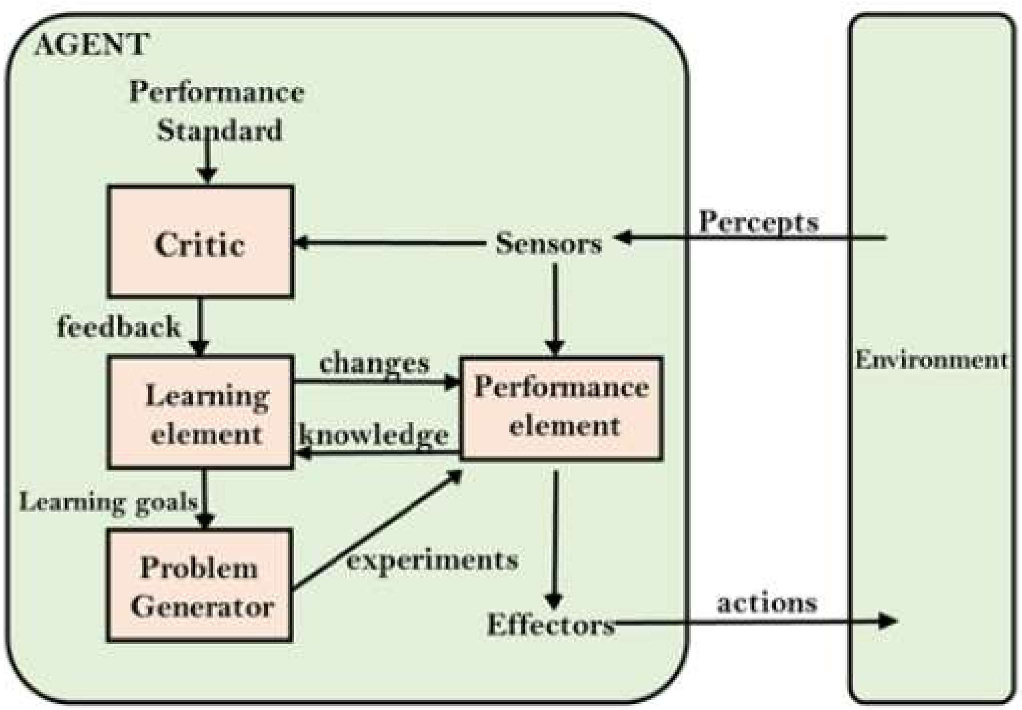

Fig: Learning Agent

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CONCLUSION:

In conclusion, selecting an agent architecture involves assessing problem complexity, environment dynamics, and task requirements. It's crucial to choose algorithms that enable efficient interaction with the environment and adaptation for optimal performance in achieving set goals.
In discussing the suitable agent architecture for any problem, the goal is to match the characteristics and requirements of the problem domain with the strengths of different agent architectures. This involves a deep understanding of the problem's complexity, the dynamics of the environment, the tasks to be performed, and the efficiency and scalability needed.

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