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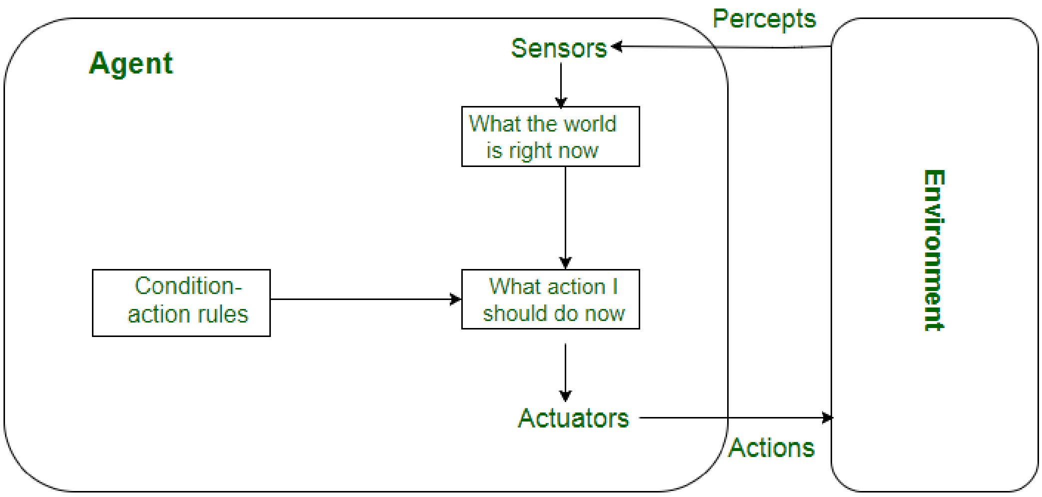
Aim: Identify suitable Agent Architecture and type for the problem.

Objective: To study the structure , characteristics of intelligent agent and identify the type of any rational agent.

Theory:



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.

. 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

  a. How the agent's action affects the world.

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.

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.

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

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

  b. **Performance element:** It is responsible for selecting external action

c. **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.

Conclusion:

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ASIMO (Honda)

Sophia is simultaneously a human-crafted science fiction character depicting the future of AI and robotics, and a platform for advanced robotics and AI research.She is the world's first robot citizen and the first robot Innovation Ambassador for the United Nations Development Programme. Sophia is now a household name, with appearances on the Tonight Show and Good Morning Britain, in addition to speaking at hundreds of conferences around the world.

Type of Agent:
ASIMO is an Embodied Robotic Agent. It operates in the real world and interacts with its environment through sensors and actuators. It functions autonomously to perform tasks such as walking, running, and interacting with humans.

PEAS
Performance Measure:

- Mobility: Ability to walk, run, climb stairs, and navigate various terrains.
- Human Interaction: Capability to communicate with humans through gestures, speech, and facial recognition.
- Task Performance: Success in performing tasks like carrying objects, avoiding obstacles, and maintaining balance.

Environment:

- Indoors and controlled environments like offices, homes, or hospitals.
- Interaction with people and physical surroundings, such as chairs, tables, and other objects.

Actuators:

- Electric motors in joints and limbs to allow for movement (walking, running, etc.).
- Hands capable of gripping and manipulating objects.
- Head and torso movement for a realistic human-like presence.

Sensors:

- Visual Sensors: Cameras for image recognition and environment mapping.
- Audio Sensors: Microphones to detect and respond to speech and environmental sounds.
- Gyroscope and Accelerometer: For maintaining balance and detecting movement.
- Tactile Sensors: In hands for grasping and interacting with objects.

Architecture
ASIMO's architecture can be described as a **Layered Control System**, including the following components:

1. Perception Layer:
   Input from sensors such as cameras, microphones, and motion detectors. This layer processes visual and auditory data for environment awareness and human interaction.
2. Decision-Making Layer:
   ASIMO uses pre-programmed algorithms to decide on tasks like walking or object manipulation

based on sensor inputs. Its decision-making is rule-based and deterministic, meaning it responds predictably to its environment.

3. Action Layer:
   Controls the actuators for physical movements, like walking, turning, gripping objects, or interacting with humans.
4. Safety Control System:
   A critical part of the architecture that ensures ASIMO maintains balance, avoids obstacles, and minimizes harm when operating in a human environment.

Working

ASIMO operates through a combination of its sensors, decision-making systems, and actuators:

1. Mobility: ASIMO uses sensors like gyroscopes and accelerometers to maintain balance while walking or running. Its actuators control its legs for smooth walking, turning, or climbing stairs. It can change speed and direction in real-time to avoid obstacles or navigate complex environments.
2. Interaction with Humans: ASIMO uses its visual sensors (cameras) to recognize faces and objects. Its audio sensors (microphones) allow it to understand spoken commands, enabling it to interact with people. The robot can perform tasks such as shaking hands or serving drinks, recognizing human intent through its sensors.
3. Task Performance: It is capable of performing practical tasks like carrying objects, opening doors, or assisting in simple household chores. These tasks are pre-programmed and driven by its ability to sense and act on its surroundings.

CONCLUSION:

ASIMO is a milestone in humanoid robotics, particularly in terms of mobility and human interaction. Its autonomous operation in a controlled environment highlights the significant advancements in robotic agents, making it a valuable tool for research and real-world applications. ASIMO's ability to walk, run, and interact with humans showcases the potential of robotic systems to assist in everyday tasks. However, while ASIMO excels in mobility and physical interaction, its AI is limited to rule-based decision-making, meaning it lacks the advanced conversational abilities seen in newer AI systems like Sophia. Nonetheless, ASIMO remains a powerful example of how robotics and AI can be applied to enhance human-robot interaction and perform complex physical tasks.