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Tutorial 1 : Design of Intelligent Agent

Aim: To understand the concept of Agent Abstraction by studying definition of Rational Agent, Agent environment, Task Environment Descriptors, environment types

Theory: An Artificial Intelligent (AI) system is composed of an agent and its environment. The agents act in their environment. An agent is anything that can perceive its environment through sensors and acts upon that environment through effectors. This can be clearly seen in Figure 1.

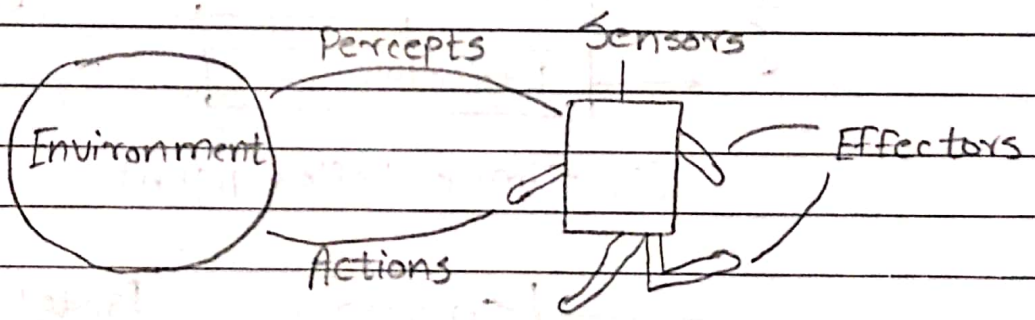

Figure 1: AI Agent with Environment.

An agent in particular can be :

Human agent has sensory organs such as eyes, ears, nose, tongue and skin parallel to the sensors, and other organs such as hands, legs, mouth, for effectors.

Robotic agent replaces cameras and infrared range finders for the sensors, and various motors and actuators for effectors.

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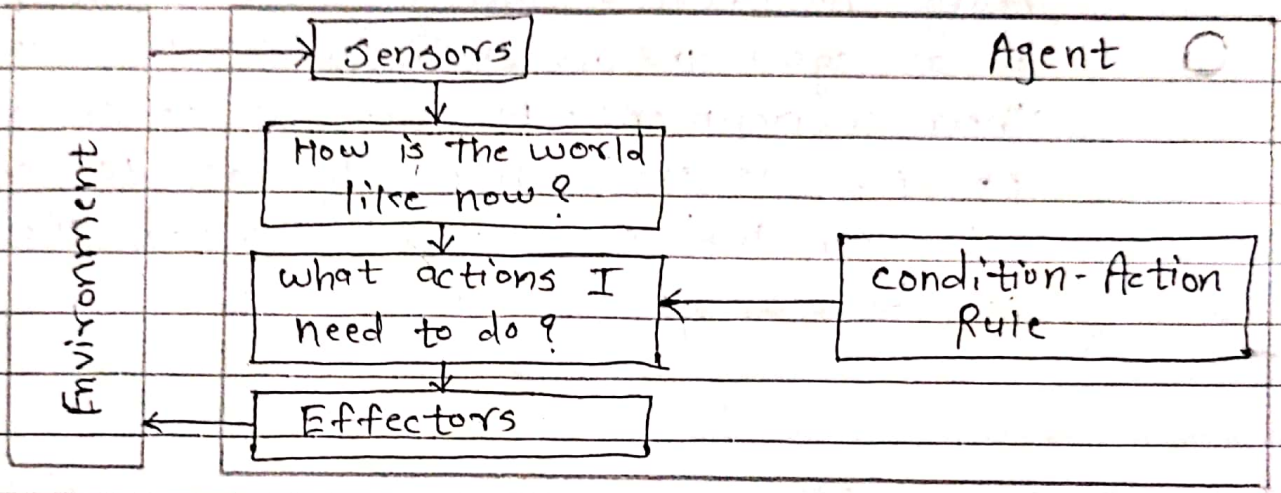
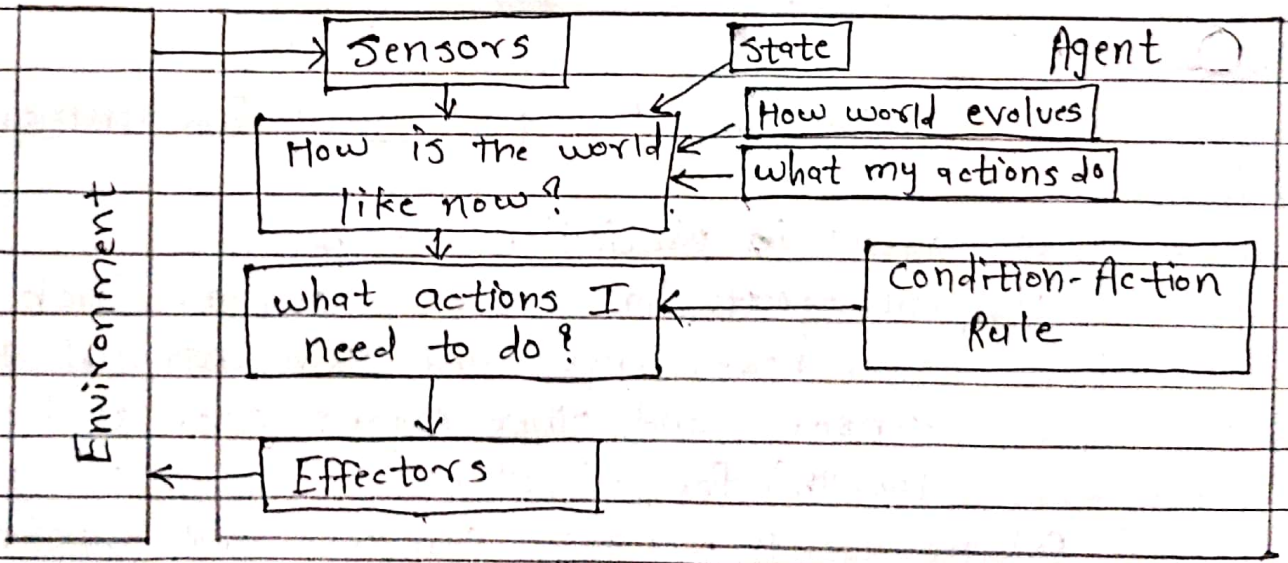
Software agent has encoded bit strings as its programs and actions.

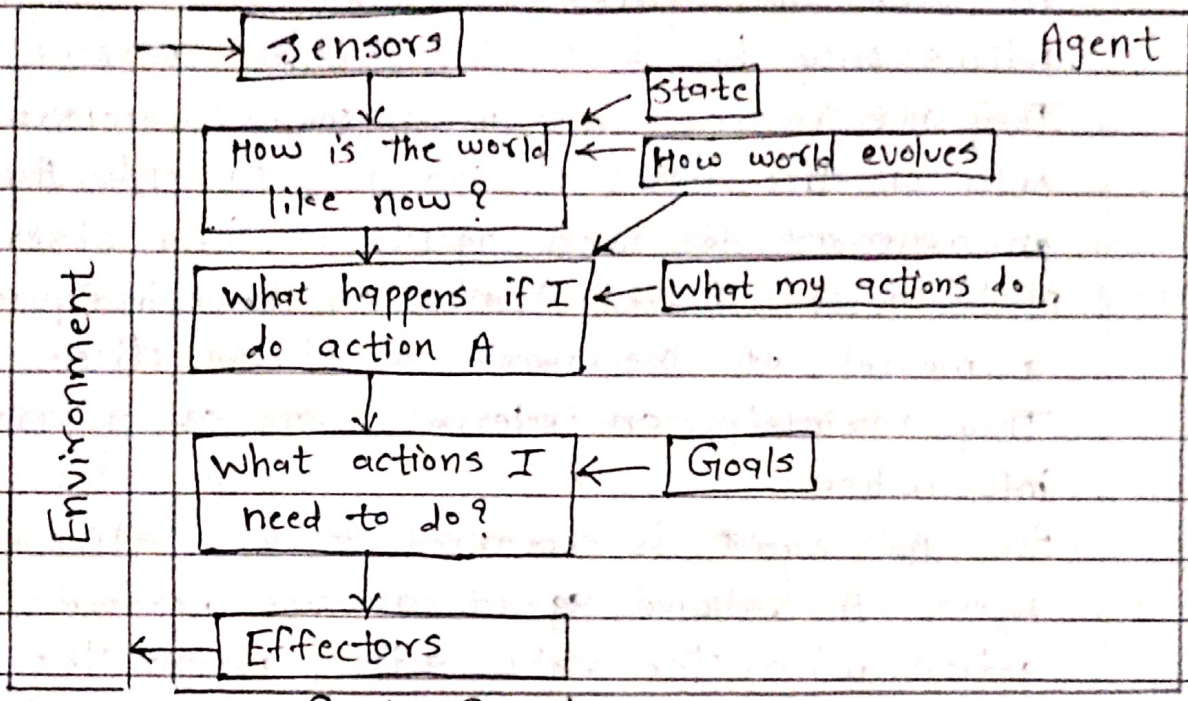
Agent Structure can be viewed as a combination of Agent architecture and Agent Program. Agent Architecture refers to the machinery that an agent executes on whereas Agent Program is an implementation of an agent function. Figure 2 shows four important types of agent Architectures.



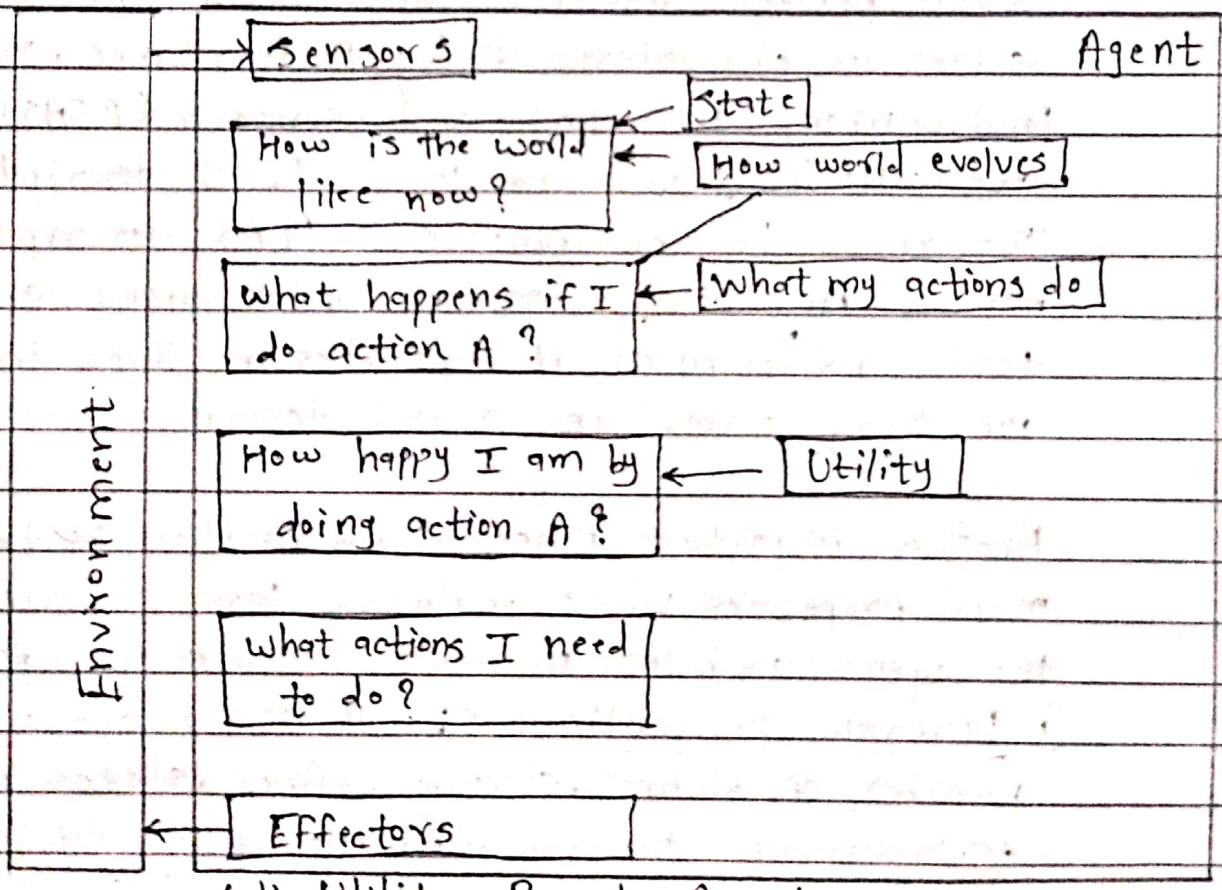
(a) Simple Reflex Agent



(b) Model Based Reflex Agent.



(c) Goal Based Agent



(d) Utility Based Agent

Figure 2 : Agent Architecture Types

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As seen in Figure 2a, Simple Reflex agents choose actions only based on the current percept only. They are rational only if a correct decision is made only on the basis of current precept. Agent environment for such agents is fully observable. Model Based Reflex Agents as shown in figure 2b use a model of the world to choose their actions. They maintain an internal state as a persistent information.

An AI agent is referred to as Rational Agent. A rational agent always performs right action, where the right action means the action that causes the agent to be most successful in the given percept sequence. The problem the agent solves is characterized by Performance, Measure, Environment, Actuators, and Sensors (PEAS). These are collectively referred to as PEAS descriptors for the agent task environment. PEAS descriptors provide important insight into agent and the task environment it operates in. These insights are very useful in agent design.

Another important piece of information is task environment properties. While analyzing task environment the agent architect needs to consider foll. properties:

① Discrete or Continuous: If there are a limited number of distinct, clearly defined, states of the environment, the environment is discrete (For eg. Chess); otherwise it is continuous (For eg. automated driving).

② Observable or Partially Observable: If it is possible to determine the complete state of the environment at each time point from the precepts it is observable; otherwise it is only partially observable.

③ Static or Dynamic: If the environment does not change while an agent is acting, then it is static; otherwise it is dynamic.

④ Deterministic or Non-deterministic: If the next state of the environment is completely determined by the current state and the actions of the agent, then the environment is deterministic; otherwise it is non-deterministic.

⑤ Episodic or Sequential: In an episodic environment, each episode of events consists of the agent perceiving and then acting. The quality of its action depend on the episode itself.

⑥ Single agent or Multiple agents: The environment may contain single agent or other agents which may be of the same or different kind as that of the agent. These agents may be co-operating or competing with each other.

⑦ Accessible or Inaccessible: If the agent's sensory apparatus can have access to the complete state of the environment, then the environment is accessible to that agent.

Working:

Search internet for AI based applications in foll. scenarios and identify who is agent for that appln. Further list out PEAS descriptors for agent envirn

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1] Deep Blue chess playing computer program
performance Measure :- win / lose / draw, safety of chess pieces safety of king piece, No. of moves, time for each move.
Environment :- chess board, chess pieces.
Actuators :- Desktop source, CPU
sensor :- chess board
Task environment properties :- Discrete, Fully Observable, Static, Deterministic, sequencial, single agent, Accessible

2] Eliza the natural language processing computer program created from 1964 to 1966 at MIT.

Performance Measure :- Understanding user, Maintaining.
Environment :- User, program, keyword, user text input Eliza texts, output window.
Actuators : Text
Sensors :- Uses texts inputs.
Tasks environment properties :- Continuous, Fully Observable.

3] Sophia is social humanoid robot developed by Hong kong based company Hanson robotics.

Performance Measure :- Understanding user, maintaining conversation, Facial expression.
Environment :- Humans object...
Actuators :- Arms, Face, legs, speaker.
Sensor :- Eyes, ears, Mic, audio Sensors.

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Task environment properties :- Continuous, Fully Observable Dynamic, Deterministic, Sequential, single Agent.

4] Apple Virtual Assistant Siri:
performance Measure:- Understanding user text & speech response speed.

Environment :- user, Sprech text
Actuators :- Mobile screen, spealeers
Sensors :- Mobile Screen, Mic, button.
Task environment Properties :
Continuous, Fully observable, static Deterministic Single agent, Accessible.

5] Automated cross word solver

Performance Measure :- Understanding hints, analyzing Hidden and visible letters time to solve
Environment :- Hints, visible letters, crossword board.
Actuators :- Desktop Screen, programs.
Sensors :- cross word board.

Task environment Properties :-
Discrete, Fully Observable, static, Deterministic, Single agent.