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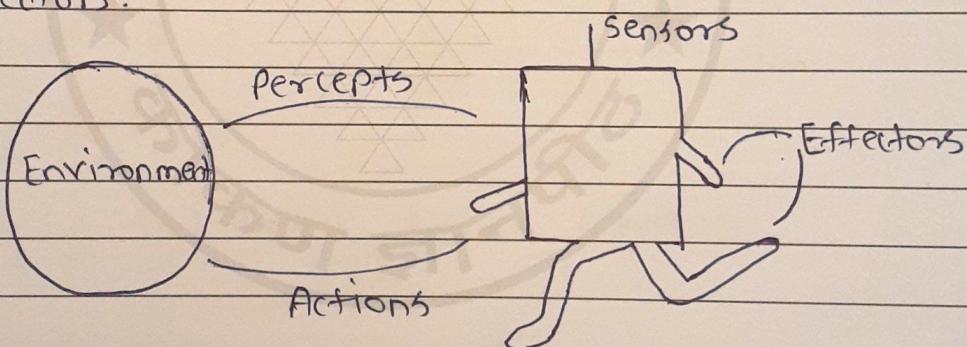
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Tutorial 1 : Design of Intelligent Agent

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 it's environment. The Agents act in their environment. An agent is anything that can perceive it's environment through sensors and acts upon that environment through effectors.



* AI Agent with Environment *

Agent in Particular can be

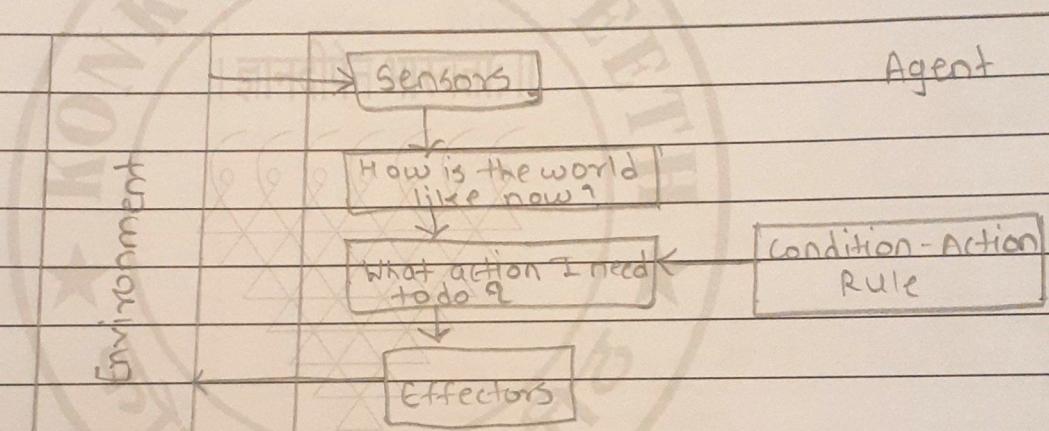
- Human agent has sensory organs such as eyes, ears, nose, tongue and skin parallel to the sensors, and other organs such as hands, legs, mouth for effectors.
- Robotic agent replaces cameras and infrared range finders for the sensors, and various

motors and actuators for effectors.

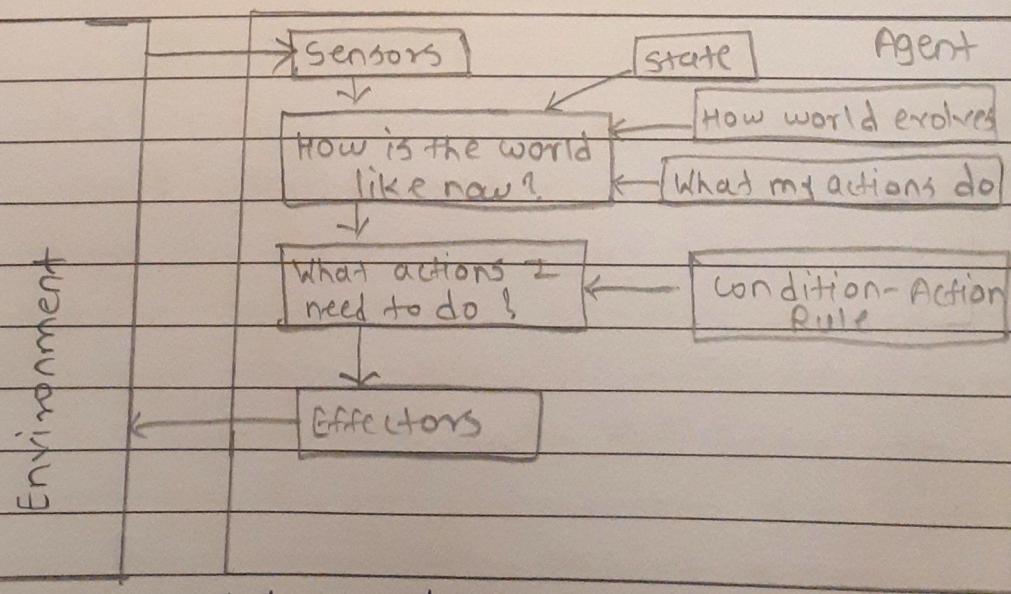
- Software agent has encoded bit strings as it's programs and actions.

Agent structure can be viewed as a combination of Agent architecture and Agent program.

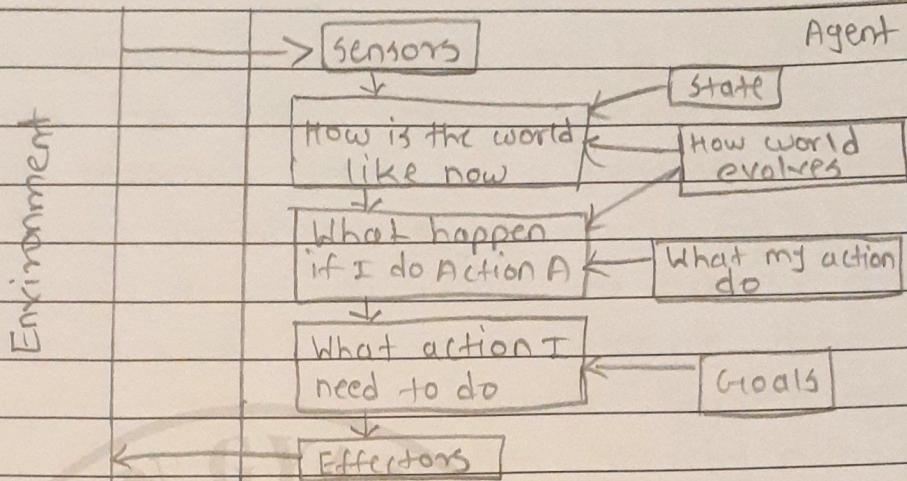
Fig 2 shows four important types of agent architectures.



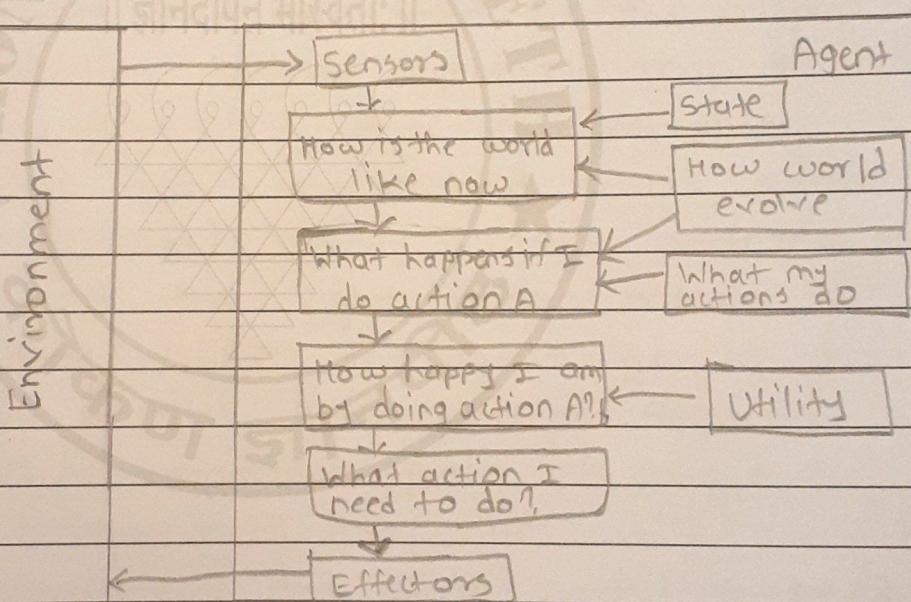
(a) Simple Reflex Agent



(b) Model Based Reflex Agent



(c) Goal Based Agent



(d) Utility Based Agent.

Fig 2 : Agent Architecture Types

As seen in fig 2 a 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 percept. Agent environment for such agents is fully observable. Model Based Reflex

Agent as shown in fig 2b use a model of the world to choose their actions. They maintain an internal state as a persistent information. Goal based agent shown in fig 2c, choose their action in order to achieve goals. Goal-based approach is more flexible than reflex agent since the knowledge supporting a decision is explicitly modeled, thereby allowing for modifications. Finally, the utility based Agents shown in fig 2d choose actions based on preference for each state. On the other hand utility function ~~objectivly~~ objectively map how much being in a particular state is desirable.

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.

Another important piece of information is task environment properties while analyzing task environment the agent architect need to consider following properties :-

i) Discrete or Continuous: If there are a limited number of distinct, clearly defined, states of the environment, the environment is discrete (for ex, chess); otherwise it is continuous (for ex, 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 percepts 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 is non-deterministic.

5] Episodic or sequential: In an episodic environment, each episode of event consists of the agent perceiving and then acting. The quality of its action depends just on the episode itself. Subsequent episodes do not depend on the action in the previous episode.

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

7] Accessible or Inaccessible: If the agent 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 Application in following scenarios and identify who agent for that application. Further list out PEAs descriptors for agent environment in each of the case. Finally try to classify task environment properties like a list of attributes from above list of 7 task environment properties.

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 screen, CPU

Sensors : chess board

Task environment properties : Discrete, fully observable, static, deterministic, sequential, single agent, Accessible.

2] Eliza the Natural language processing computer program created from 1964 to 1966 at the MIT Artificial Intelligence Laboratory by Joseph weizenbaum.

Performance measure : understanding user, maintaining conversation.

Environment : user, program, keyboard, user text input, output window.

Actuators : Texts.

Sensors : User texts inputs

Task environment properties : continuous, fully observable, static, Deterministic, Sequential, single agent, Accessible.

3] Sophia is a social humanoid robot developed by Hong Kong based company Hanson Robotics. Performance measure: Understanding user, maintaining conversation, facial expressions, response time.

Environment : Humans, objects, - - -

Actuators : Arms, mouth, legs, speaker

Sensors : Eyes, ears, mic, audio sensors.

Task environment properties: continuous, fully observable, Dynamic, Deterministic, sequential, single Agent, Accessible.

Q) Apples virtual assistant Siri

Performance measure: understanding user text and speech producing best results, summoning (trigger), response speed

Environment : User, speech, text

Actuators : mobile screen , speaker

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 , hints , visible letters , crossword board

Actuators : Desktop screen , program.

Sensors : Crossword board

Task Environment properties : Discrete , fully observable , static , deterministic , episodic , single agent , Accessible .