

## Tutorial 1: Design of Intelligent Agent

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

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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 agent acts in their environment. An agent is anything that can perceive its environment through sensors & act upon that environment through effectors. This can also clearly be seen in Fig. 1. An agent in particular can be :

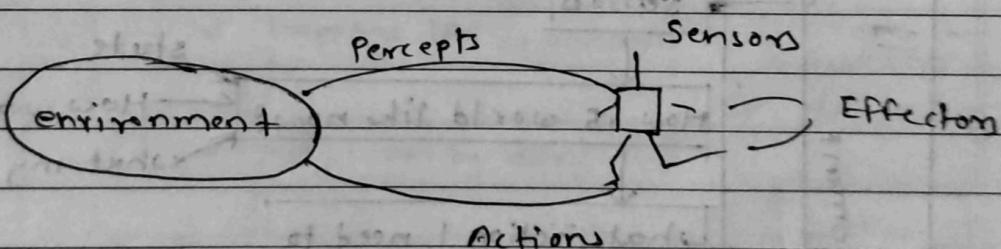


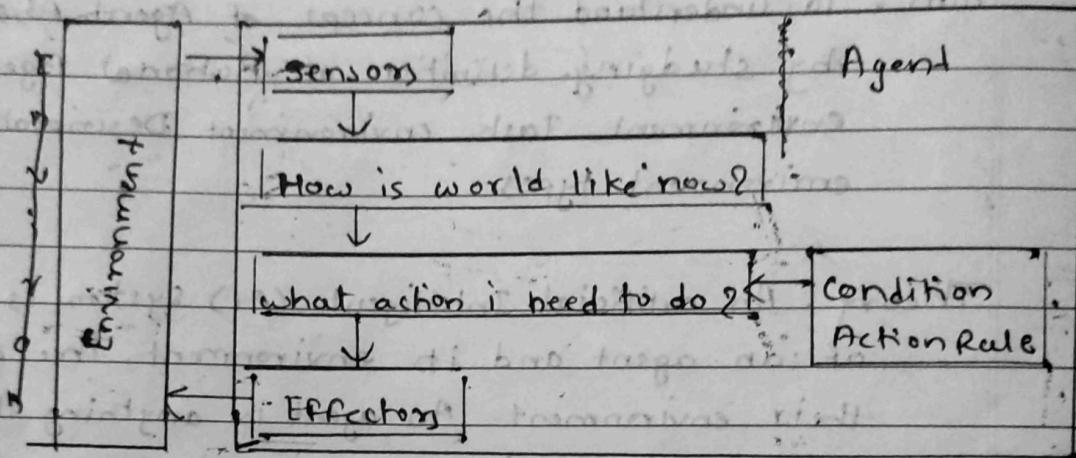
Fig 1. AI Agent with Environment

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

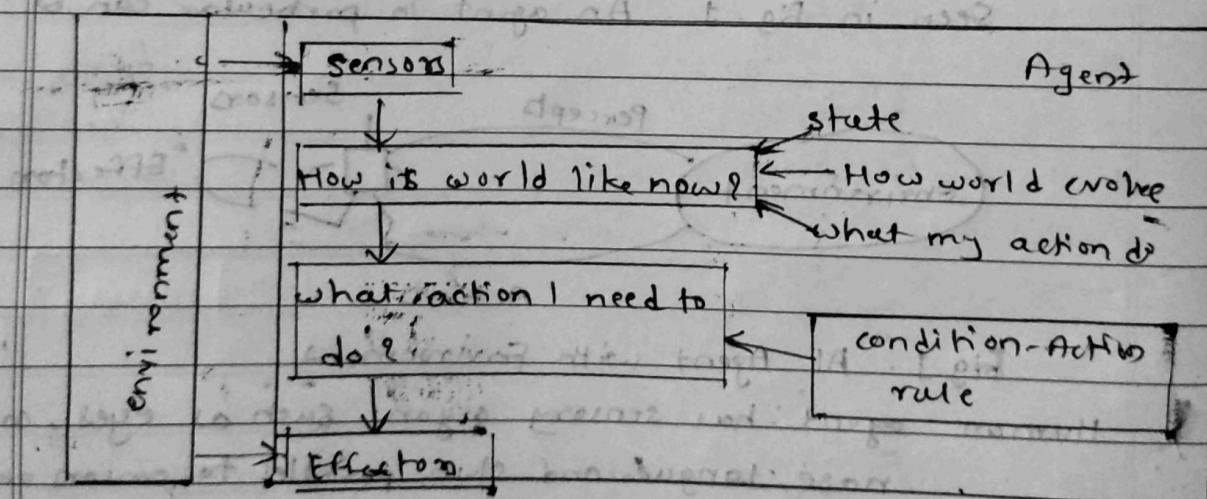
Robotic Agent : Replaces cameras and infrared range finders for sensors & various motors & actuators for effectors.

Software agent has encoded bit strings as its programs and actions

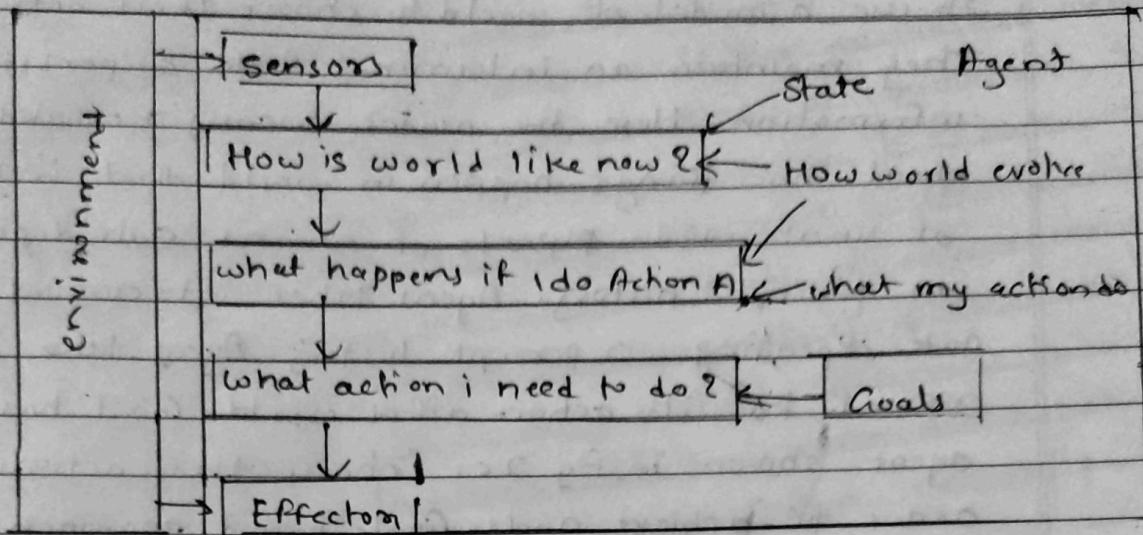
Agent structure can be viewed as combination of Agent architecture & agent program. Agent Architecture refers to machinery that an agent executes on whereas Agent program is an implementation of an agent function.



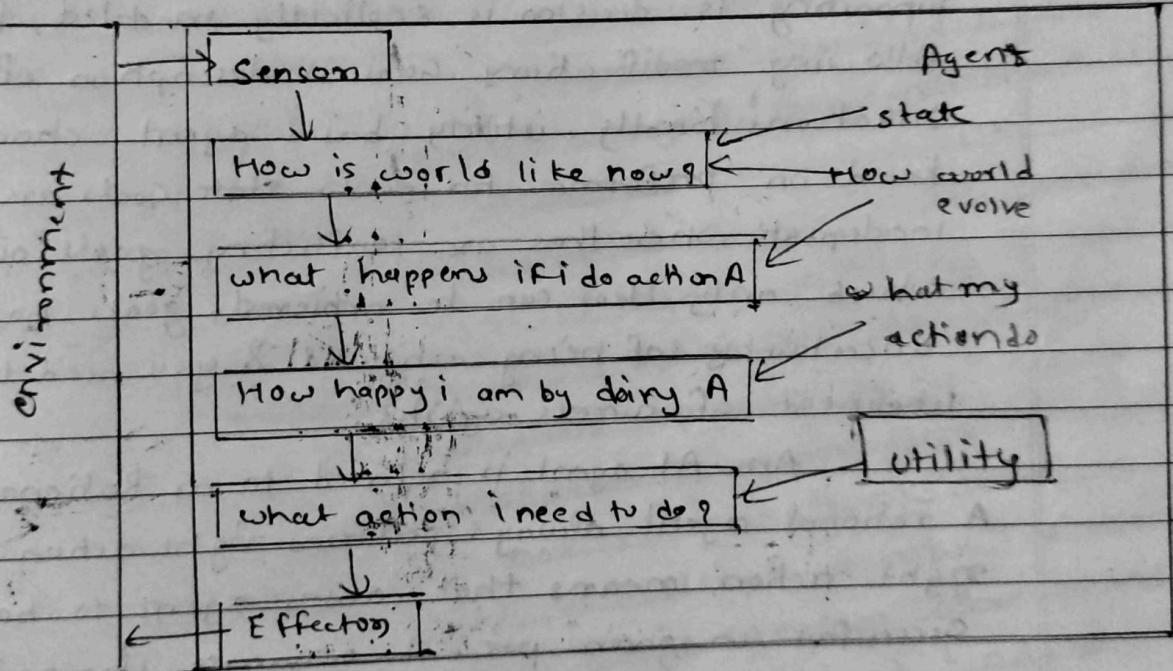
(a) Simple Reflex Agent



(b) Model Based Reflex Agent



(c) Goal Based Agent



(d) Utility Based Agent

Fig 2. Agent Architecture Types

As seen in Fig 2a. Simple Reflex agents chooses action only based on current percept only. They are rational only if a correct decision is made only on basis of current percept. Agent environment for such agent is fully observable. Model reflex agent as shown in Fig

2b use a model of world to choose their actions. They maintain an internal state or persistent information. Here the model means knowledge about how things happen in world that is representation of unobserved aspects of current state depending on percept history. Agent takes into account new state depending on percept history. Agent takes into account how its action affect world. Goal based agent shown in fig 2c. choose their actions in order to achieve goals. Goals based approach is more flexible than reflex agent since the knowledge supporting its decision is explicitly modeled, then by following modification. Goal is description of desirable situations. Finally, utility based agent choose action based on preference for each state. Goals are inadequate where there are conflicting goals, out of which only few can be achieved; goals have some uncertainty of being achieved & you need to weight likelihood of success against.

An AI agent is referred to as Rational Agent. A rational agent always performs right action. When right action means that causes agent to be most successful in given percept sequence. The problem agent is performance measure, Environment, Actuators, Sensors. These are collectively referred to as PEA descriptors for agent task environment. PEA descriptors provide important insight into agent and task environment it operates in. These insights are very useful in agent design.

While analyzing task environment agent architect needs to consider following properties:

1. Discrete or continuous - if there are limited number of distinct clearly defined states of environment, the environment is discrete. otherwise it is continuous.
2. Observable or Partially observable - if it is possible to determine the complete state of environment at each time point from percept it is observable, otherwise it is only partially observable.
3. Static or Dynamic - if environment does not change while an agent is acting, then it is static, otherwise it is dynamic.
4. Deterministic or Non-deterministic - if next state of environment is completely determined by current state and actions of agent, then environment is deterministic, otherwise non-deterministic.
5. Episodic or Sequential - In an episodic environment, each episode consists of agent perceiving & then acting. The quality of its action depends just on episode itself. Subsequent episodes do not depend on actions. Episodic environments are much simpler because agent does not need to think ahead.
6. Single agent or multiple agent - The environment may contain single agent or other agent which may be of same or different kinds as that of agent. These agents may be co-operating or competing with each other.
7. Accessible or Inaccessible - If agent's sensory apparatus can have access to complete state of environment, then environment is accessible to that agent.

Working - Search internet for AI based application in following scenario & identify who is agent for that application. Further list out PEAS descriptors for agent environment in each of case. Finally try to classify task environment properties like, list of attributes from above list of 7 task environment properties.

1. Autonomous Lunar Rover
2. Deep Blue chess playing computer program.
3. Eliza the natural language processing computer program created from 1964 to 1966 at MIT Artificial Intelligent Laboratory by Joseph Weizenbaum.
4. Automatic Portfolio management
5. Sophia is a social humanoid robot developed by Hong Kong based company Hanson Robotics.
6. Alpha Go is a computer program that plays board game Go. It was developed by Alphabet Inc Deep mind lab in London.
7. Apples virtual assistance Siri
8. Endurance : A companion for Dementia patients
9. Casper : helping insomniacs get through night
10. Marvel : Guarding Galaxy with comic-book crossovers
11. Automated crossword solver