

# Tutorial 1 : Design of Intelligent Agent

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## Tutorial 1 : Design of Intelligent Agent.

Aim: To understand the concept of Agent Abstraction by studying definition of Rational Agent environment, Tasks Environment descriptors, environment types.

Theory : An artificial intelligent (AI) system is composed of an agent is anything that can perceive its environment through sensors and acts upon that environment through effectors. This can be clearly seen in below diagram.

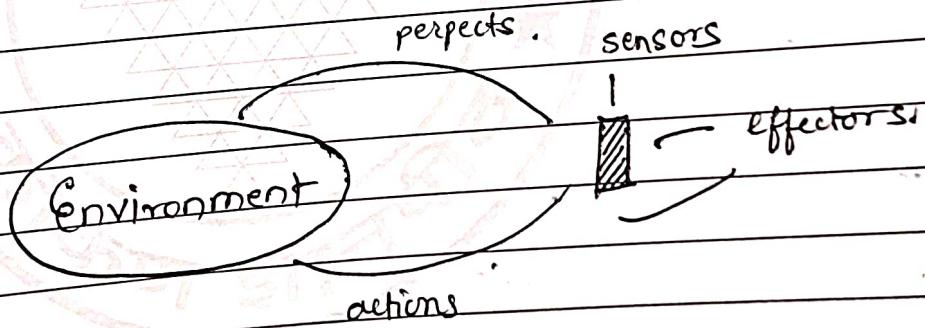


Fig: AI agent with Environment.

An agent 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 finders and various motors and actuators for effectors.

## Agent Architecture Types.

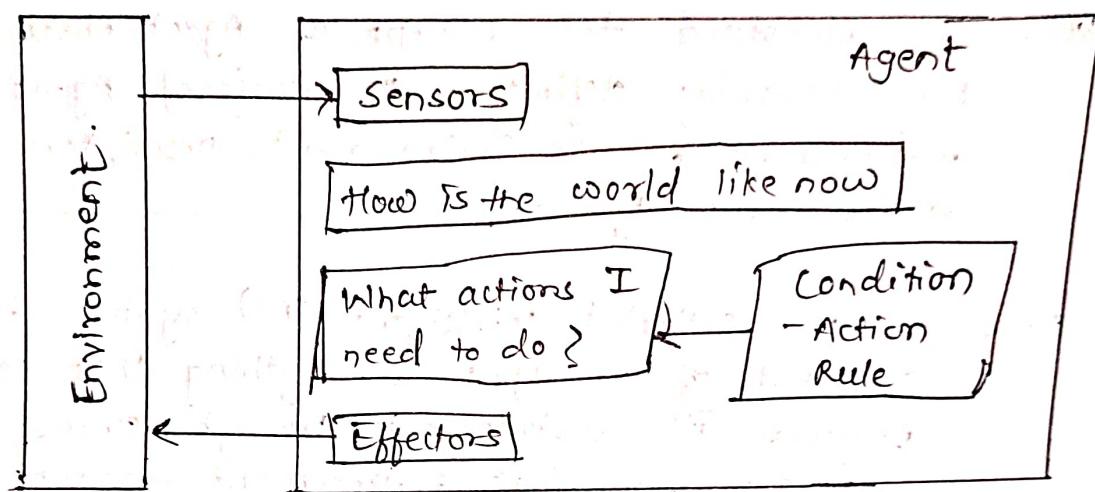


fig: Simple Reflex Agent

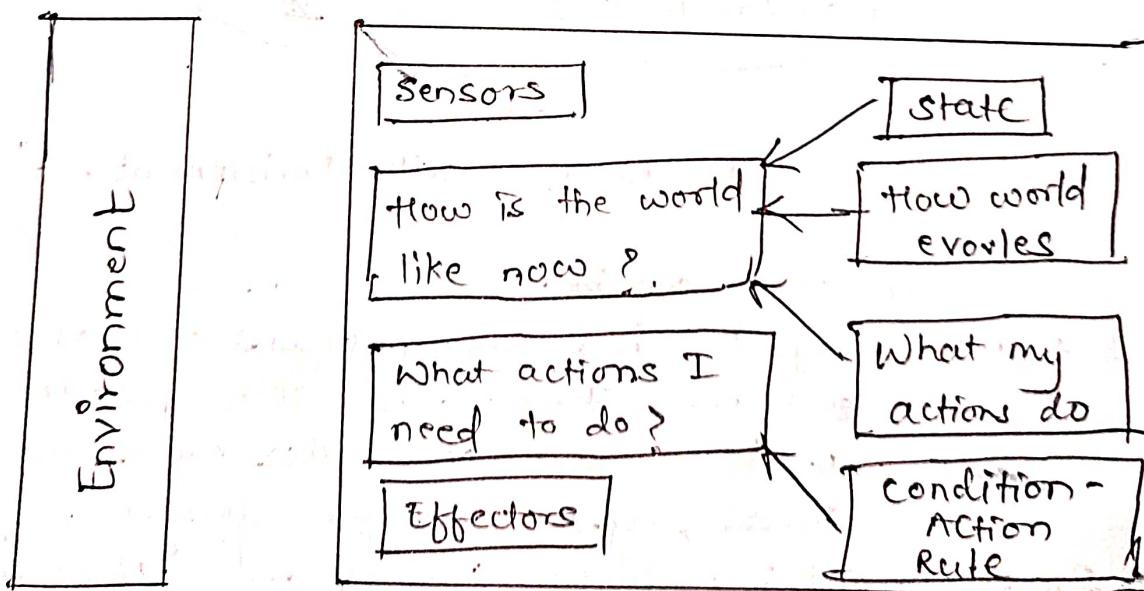


fig: Model based Reflex Agent

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.

Simple Reflex 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 Agents as shown in figure, use a model to choose their actions. They maintain an internal state as a persistent information. Here that model means knowledge about how the things happen in the world that is represented. Goals based agents shown approach is more flexible than reflex agent since the knowledge supporting a decision is explicitly modeled, thereby allowing for modifications. Goal is the description of desirable situations. Finally, the Utility Based Agents shown in figure chose actions based on performance preference (utility) for each state. Goals are inadequate when there are conflicting goals, out of which only few

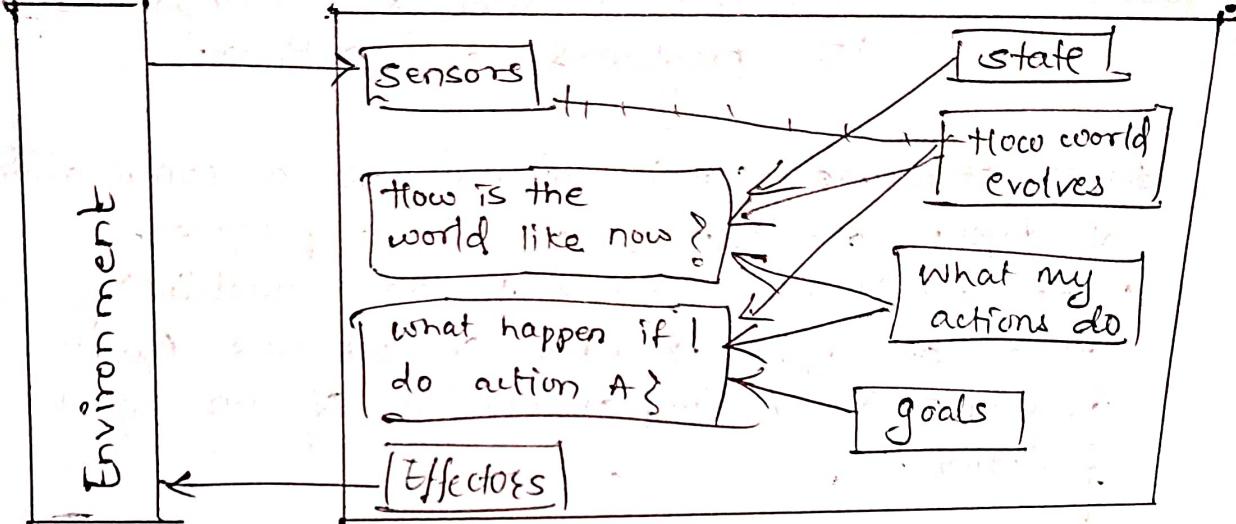


fig: goal based agent

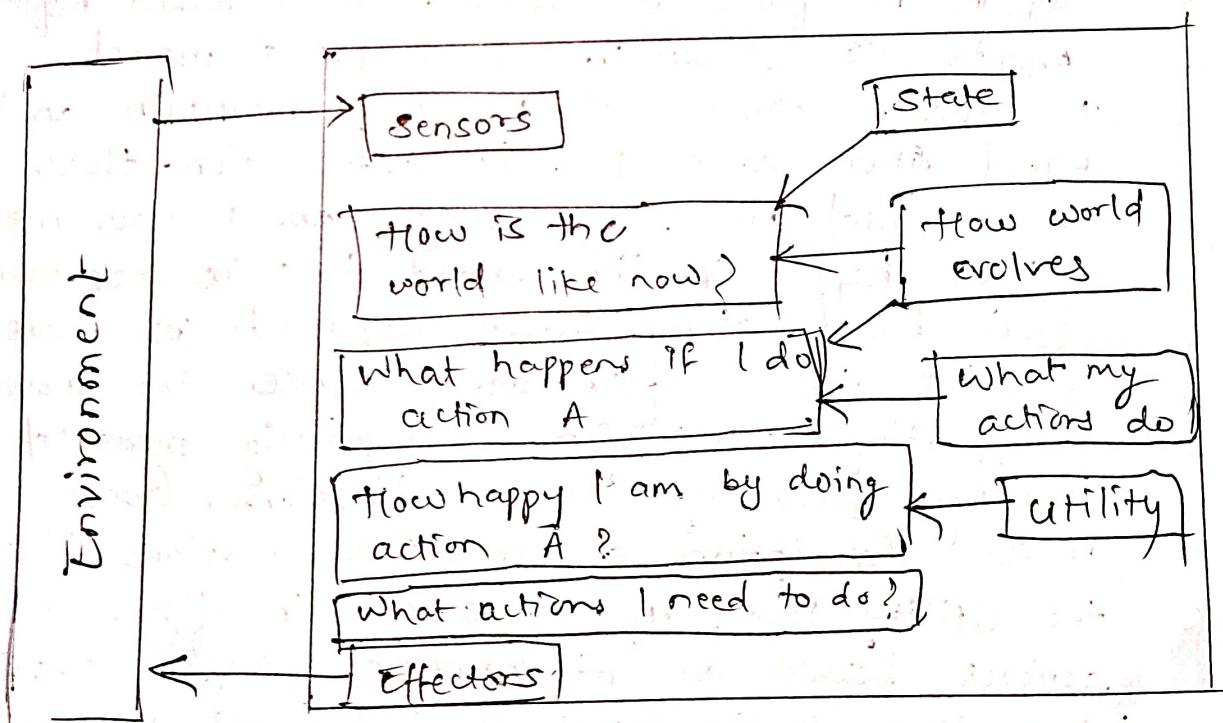


fig: utility based Agent

can be ~~ex~~ achieved, goals have some uncertainty of being achieved and you need to weigh likelihood of success against the importance of the goal. On the other hand utility function 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. The problem the agent solves is characterized by ~~by Ref Ref~~ Performance Measure. Environment, Actuators and Sensors (PEAS). These are collectively referred ~~ref~~ to as PEAS descriptors for the agent task environment. PEAS descriptors provi

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

1. Discrete or Continuous : If there are a limited number of distinct, clearly defined, states of the environment, the environment is discrete (For example: chess); otherwise it is continuous (For example: 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 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 depends just on the episode itself. Subsequent episodes do not depend on the actions in the previous episodes. Episodic environments are much simpler because the agent does not need to think ahead, e.g., Part parking robots. Complementary to this is sequential environment where current action dictates the future action.

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 agents. 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 environment is accessible to that agent.

Working :- Search internet for AI-based applications in following scenarios and identify who is agent for that application. Further list out PLEA 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. Autonomous Lunar Rover
2. Deep Blue chess playing computer program.
3. Eliza the natural language processing computer program created from 1964 to 1966 at the MIT Artificial Intelligence laboratory by Joseph Weizenbaum.
4. Automatic Portfolio management.
5. Sophia is a social humanoid robot developed by Hong Kong based company Hanson Robotics.
6. AlphaGo is a computer program that plays the board game Go. It was developed by Alphabet Inc Deepmind lab in London.
7. Apples virtual assistance Siri
8. Endurance: A companion for Dementia Patient.
9. Casper: Helping Insomniacs Get through the Night
10. Marvel: Guarding Galaxy with Comic-Book crossover.
11. Automated crossword solver.

Working :

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 NLP computer program created for 1964 to 1966 at the MIT Artificial Intelligence Laboratory by Joseph Weizenbaum .

→ Performance Measure : Understanding User , maintaining conversation

Environment : User , program , keyboard , user text inputs , Eliza texts , 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 expression, response time.

Environment : Humans, ~~etc~~ consistent power source

Actuators : Arms, mouth, legs, speakers.

Sensors : cameras, mic, ~~speed~~ proximity sensor, audio sensors.

Task environment properties:

continuous, fully observable, dynamic, deterministic, sequential, single agent, accessible.

4. Apple's virtual assistant Siri

Performance Measure : Understanding user text and speech, producing best results, response speed.

Environment

: User, speech, text

Actuators

: Mobile screen, speaker.

Sensors

: Touch sensor, mic, audio interpreter.

Task Environment properties: continuous, fully observable, static, deterministic, episodic, single agent, accessible.

5) Automated crossword solver

Performance Measure : Understanding hints,  
Time complexity,  
Analyzing hidden and  
visible letters,  
valid English words  
as result.

Environment

: Hints, visible letters,  
crossword board

Actuators

: Desktop screen,  
program.

Sensors

: Mouse & keyboard  
Input

Tasks Environment Properties :

Discrete, Fully observable, static, deterministic,  
Episodic, single agent, Accessible.