

# Tutorial 1: Design of Intelligent Agent

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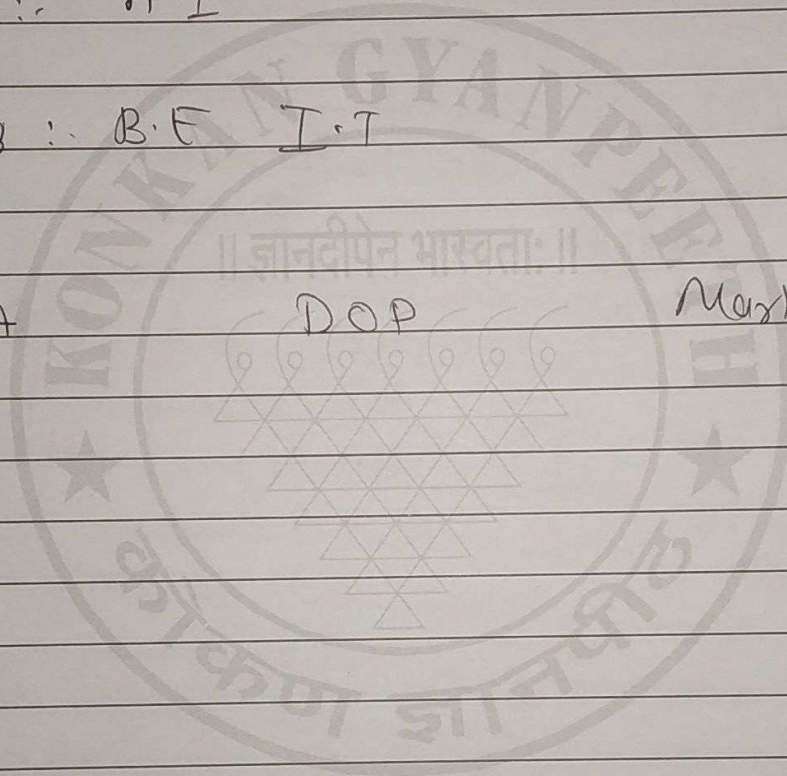
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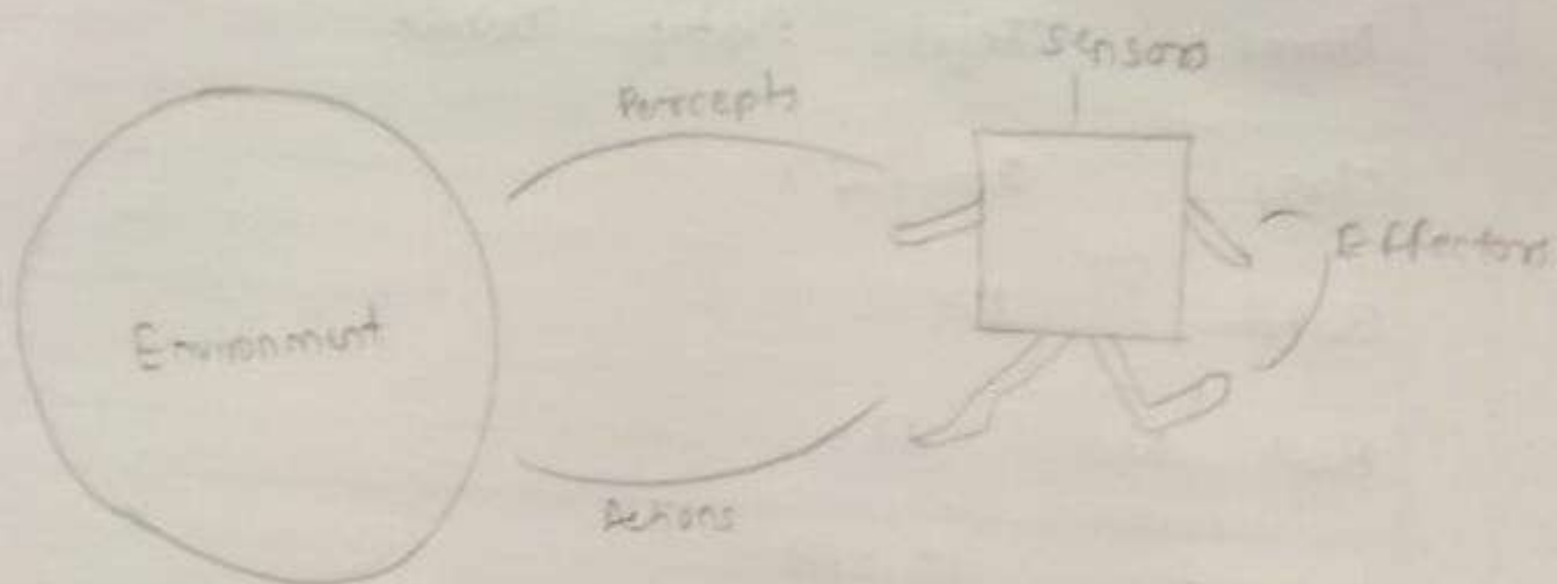
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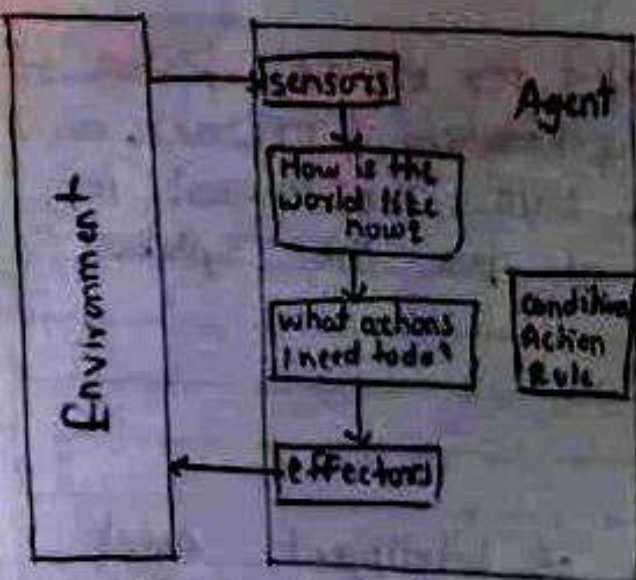
Aim :- To understand the concept of agent Abstraction by studying definition of Rational Agent, Agent Environment Task Environment Descriptors environment types

### Theory

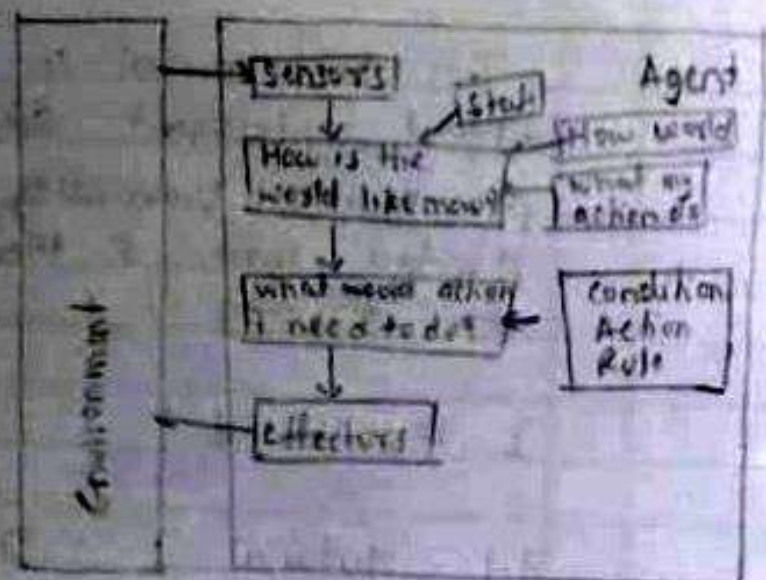
An Artificial Intelligent (AI) System is composed of an agent and its environment. The agents act in their environment. An agent is anything that can perceive its environment through sensor and act upon that environment through effectors. This can be clearly see in Figure. An agent in particular can be :

- + Human agent has sensor organ such as eyes, nose, ear tongue & skin parallel to the sensors. & other organ such as hands, legs, mouth for effector
- + Robotic agent replace camera and infrared range finder for the sensors, and various motor & actuators for effector
- + Software agent has encoded bit string as its program & action

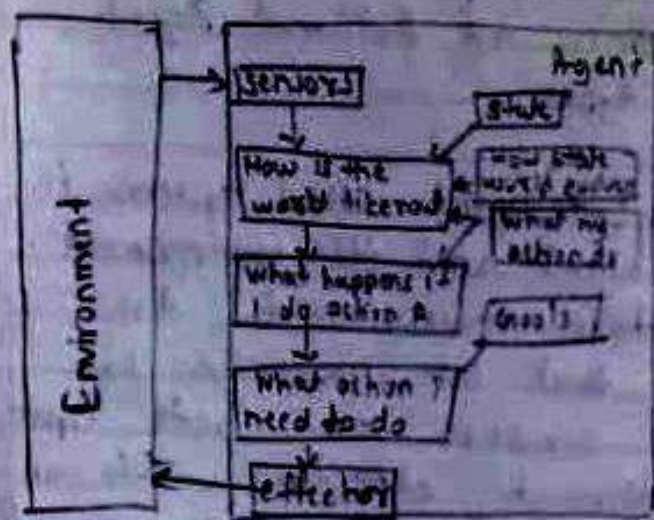




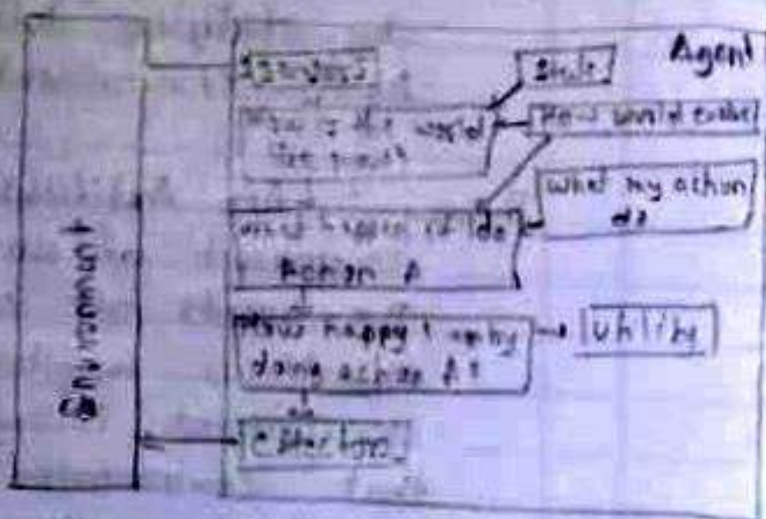
(a) Simple Reflex Agent



(b) Model Based Reflex Agent



(c) Goal Based agent



(d) Utility Based Agent

Figure : Agent Architecture Types.



Agent structure can be viewed as a combination of agent architecture & 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 two important type of agent architecture.

As seen in Figure 2a, Simple Reflex agent choose action only based on the current percept only. Agent environment for such agent fully observable. Model Based a reflex Agent as shown in Figure 2b use a model of the world to choose their action. They maintain an internal state as a persistent information local based agents shown in figure 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, goal are inadequate when there are conflicting goals, out of which only few can be achieved, goal have some uncertainty of being achieved & you need to weigh likelihood of success against the importance of goal.



Another Important piece of information is task environment properties. While analyzing task environment the agent architect 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 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 action of the agent then the environment is deterministic otherwise it is non-deterministic.



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

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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 application in following scenarios and identify who is agent for that application. Further list out PEAS descriptor for agent environment properties like a list of attribute from above list of 7 task environment properties.



## Deep Blue Chess Playing computer program.

- 1 performance measure: win/lose/draw, safety of chess pieces safety of king piece, no. of moves, time of each move.

Environment: chess board, chess pieces

Actuators: desktop CPU

Sensor: chess board.

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

- 2 ELIZA, the NLP computer program created from 1964 to 1966 at the MIT Artificial Intelligence Laboratory by Joseph Weizenbaum.

Performance measure: understand user, maintaining conversation

Environment: user-program keyboard, user text, ELIZA text output windows

Actuator: Text

Sensors: use text 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  
maintaining conversation  
facial expression, time.

Environment : human, object...

Actuator : Arm, mouth, legs, Speaker

Sensors : Eyes (camera), ears, mic, audio  
Sensor

Task environment properties : Continuous Fully  
observable Dynamic Deterministic Sequential  
Single Agent accessible

4) Apple's virtual assistant Siri

Performance measure : understanding User text  
& speech producing but result  
Summarizing trigger response speed.

Environment : User, speech text

Actuators : Mobile Screen Speaker

Sensor : Mobile Screen, mic, button

Task environment properties :

Continuous Fully Observable Static

Deterministic Episode single agent  
Accessible



5 Automated Crossword Solver.

performance measure : Understanding hints  
analyzing hidden and visible letter time to  
solve

Environment : Hint , visible letters , crossword  
board .

Actuator : Desktop seen screen program