Tutorial No: 1.1

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Tutorial 1: Design of Intelligent Agent.

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

Theory: An Artificial Intelligent (AI) system is composed of an agent act in their environment. An agent is anything that can percieve its environment through sensor & acts upon that environment through effectors.

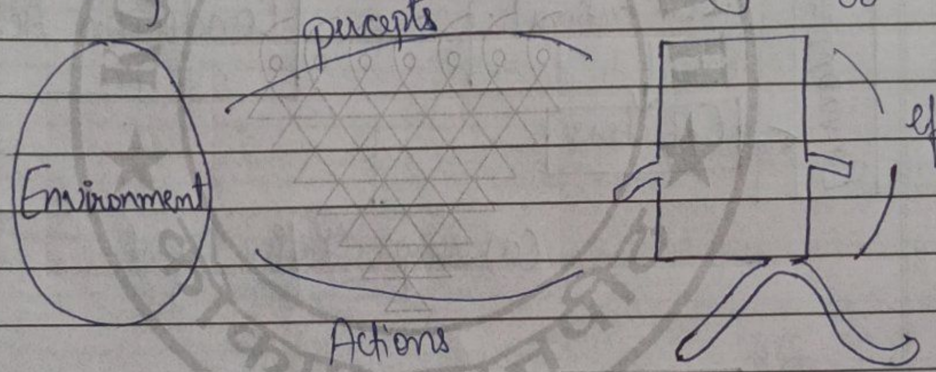


fig1: AI agent with Environment

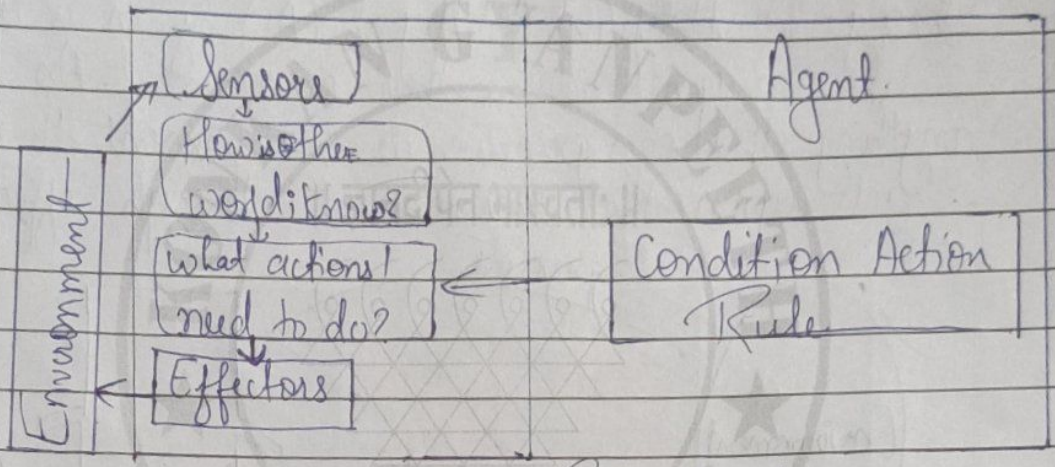
Agent ~~in particular~~ can be :-

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

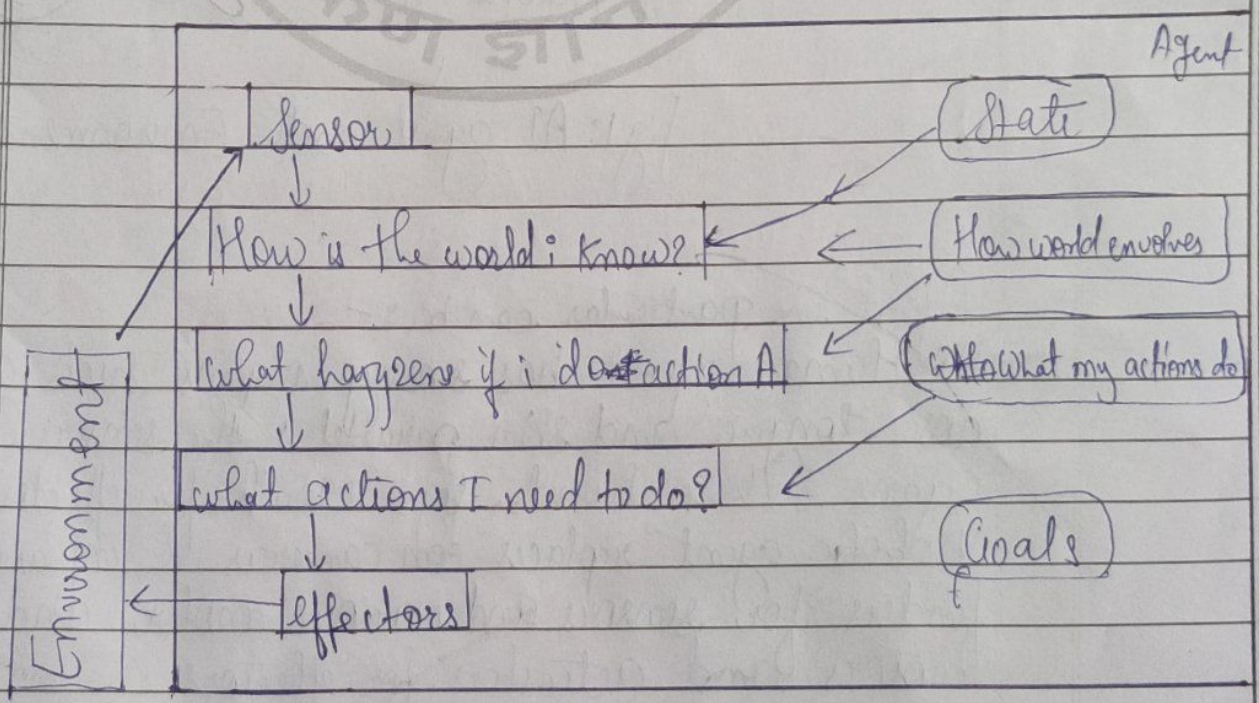
Robotic agent replaces ~~con~~ cameras & infrared range finders for sensors and various motor and various motors and actuators for effectors.

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

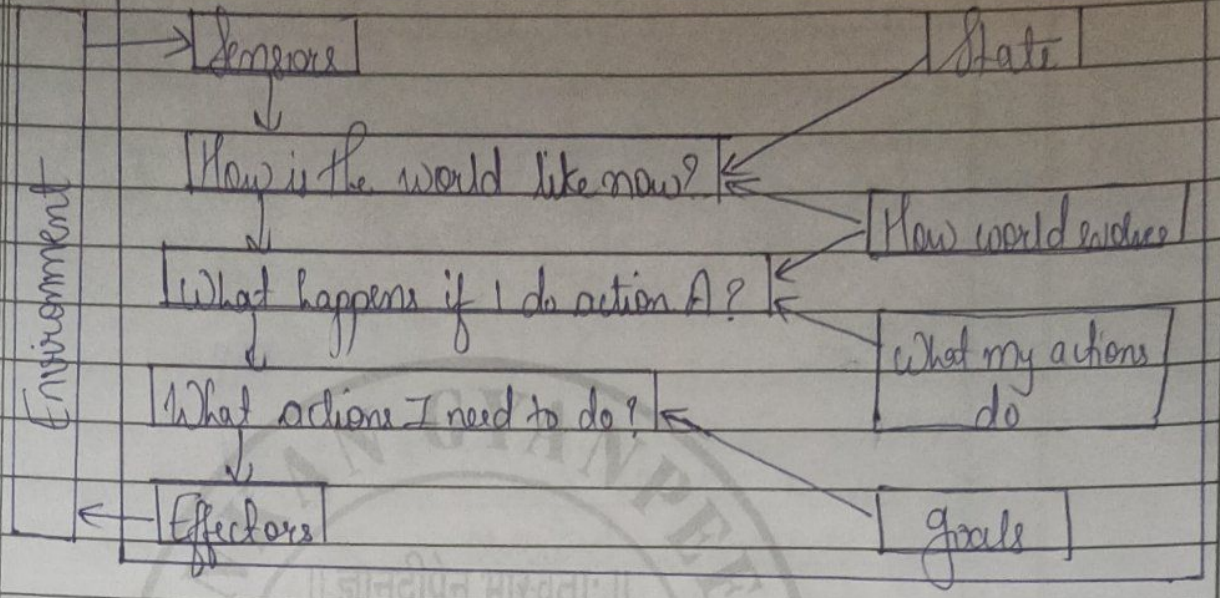
Agent structure can be viewed as a combination of agent architecture & agent programs.
Fig 2 shows the important types of agent architecture.



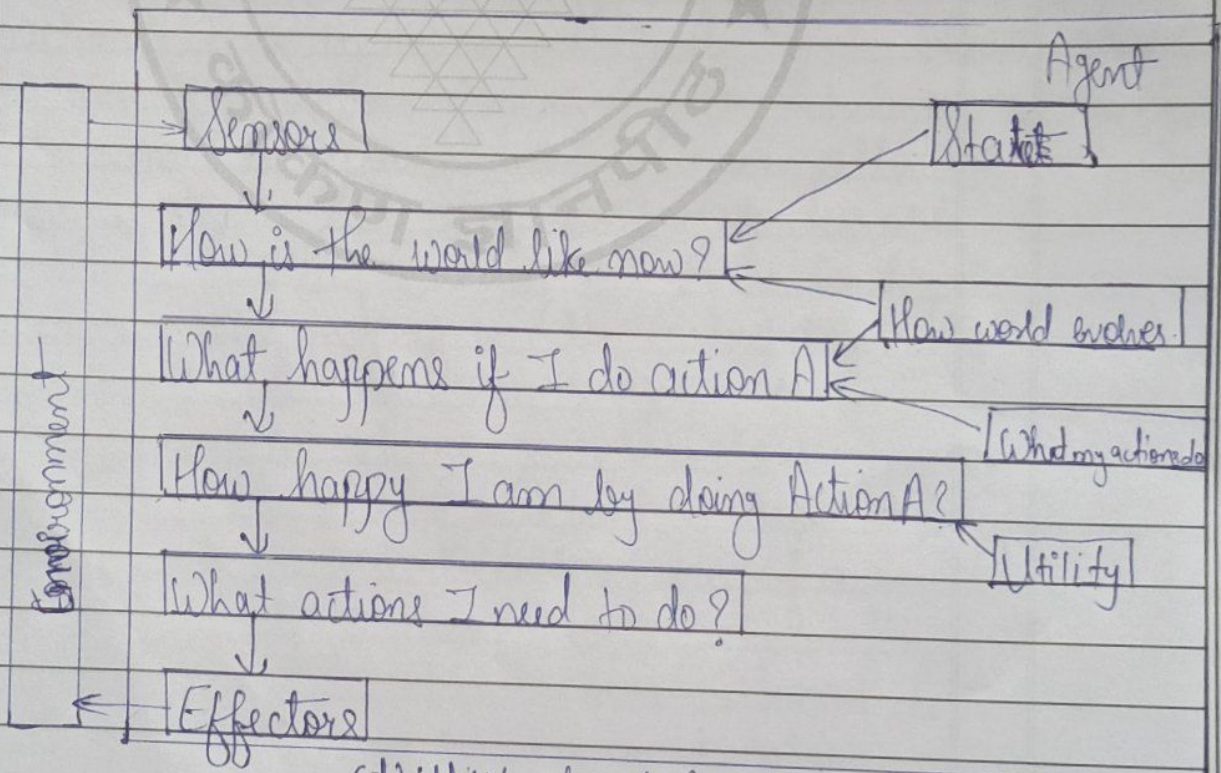
(a) Simple Reflex Agent



(b) model based reflex agent.



(c) Goal based Agent.



(d) Utility based Agent

fig 2 : Agents Architecture Types.

As seen in fig 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 basis of current precept. Agent environment for such agents is fully observable. Model.

Model based Reflex Agent as shown in fig 2b use a model of world to choose their actions. They maintain an internal State as persistent information. Here model means knowledge about how things happen in world that is representation of unobserved aspects of current state depending on percept history. Agent take into account how its actions in order to achieve goals & affect the world.

Goal based agents shown in fig 2c, choose their actions actions in order to achieve goals. Goals-based approach is more flexible than reflex agent since knowledge supporting a decisions is explicitly modeled there allowed for modifications. Goals is description of desirable situations. Finally, the Utility Based Agents shown in fig 2d choose actions based on preference for each state. Goals are inadequate when there are conflicting goals, out of which only few can be achieve, goals have some uncertainty of being achieved and you need to weigh likelihood of success ~~or~~ against the importance of a goal.

An AI agent is referred to as Rational Agent. A rational agent always perform right action, where the right action means the action that causes the agent to be

most successful in given percept sequence. The problem the agent solves is characterized by Performance Measure, Environment, Actuators, and Sensors (PEAS). These are are collectively referred to as PEAS descriptors for the agent task environment. PEAS descriptors provide important insight into agent and task environment it operates in.

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 district discrete distinct, clearly defined, states of the environment, the environment is discrete; otherwise is continuous
2) Observable or Partially Observable: If it is possible to determine to complete state of environment at each time point from percepts it is observable; Otherwise it is dynamic only partially observable
3) Static or Dynamic: If environment does not change while an agent is acting, then ~~environment is~~ it is static; Otherwise it is dynamic
4) Deterministic or non deterministic: If next state of the environment is completely determined by current by the current state and actions of 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 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. Episodic environments are much simpler because the agents does not need to think ahead. eg. Packing Part Picking 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 same or different kinds as that of agents. These agents may be co-operating or competing with each other.

7) Accessible or Inaccessible:- If agents sensory apparatus can have access to complete state of 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 PEAS descriptors for agent environment in each of 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: Cheers 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: Understanding user, maintaining conversation
Environment: User, program keyboard, user text inputs, Eliza texts, Outputs windows
Actuators: Texts.
Sensors: User, tests inputs
Task environment properties: Continuous, Fully observable, Static, Determenastic, 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, ...

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Actuators: Arms, Mouth, legs, speaker.
Sensors: Eyes (cameras), ears, mic, 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, 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, Episodic, Single agent, Accessible.

5. Automated Crossword Solver

Performance Measure: Understanding, hints, analyzing hidden and visible letters, time to solve.
Environment: Hints, visible letters, Crossword board.
Actuators: Desktop screen, program.
Sensors: Crossword board.
Task Environment properties: Discrete, Fully observable, Static, Deterministic, Episodic, Single agent, Accessible.