

Aim : To understand concept of Agent Abstraction by Studying definition of Rational Agent , Agent environment, Task Environment Descriptors , environment types.

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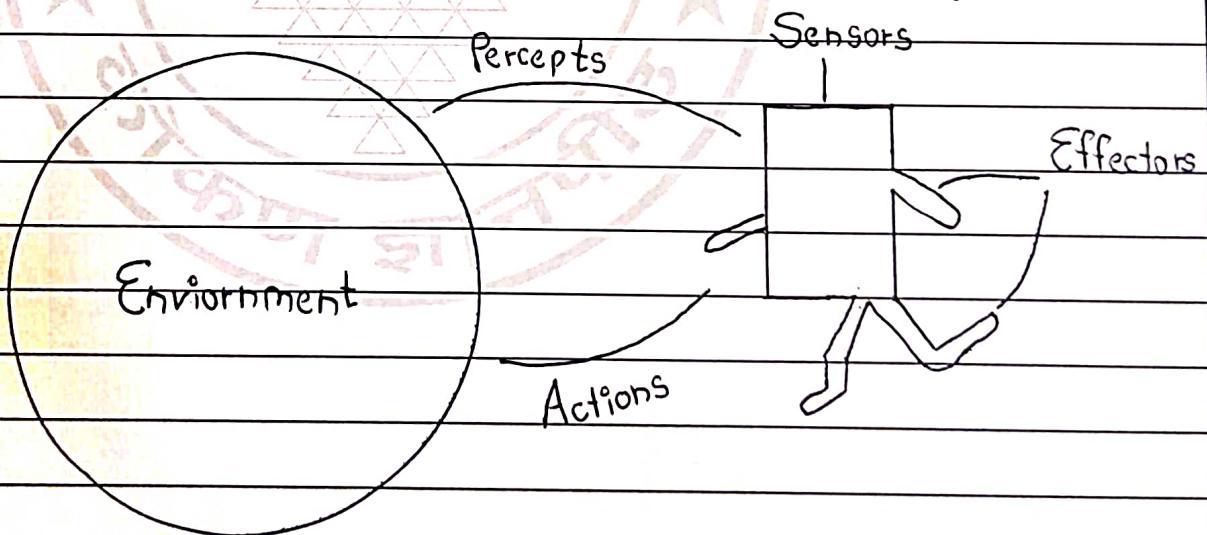
Subject : AI

Module 1

1.1] 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 & its environment. The agents act in their environment. An agent is anything that can perceive its environment through sensors & act upon that environment through effectors. This can be seen in foll. figure.



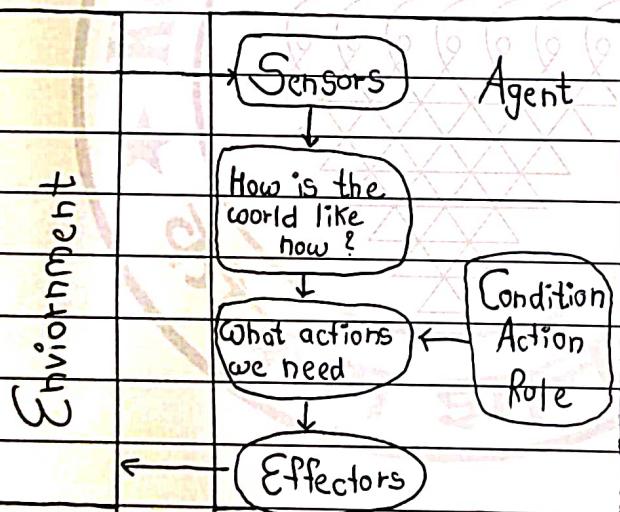
An agent in particular can be :

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

Robotic agent replaces cameras & infrared range finders for the sensors, and various motors and actuators for effectors.

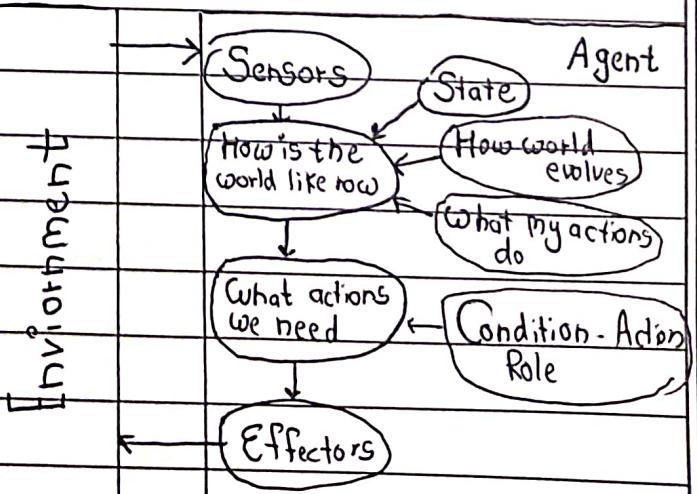
Software agent has encoded bit strings as it programs & actions.

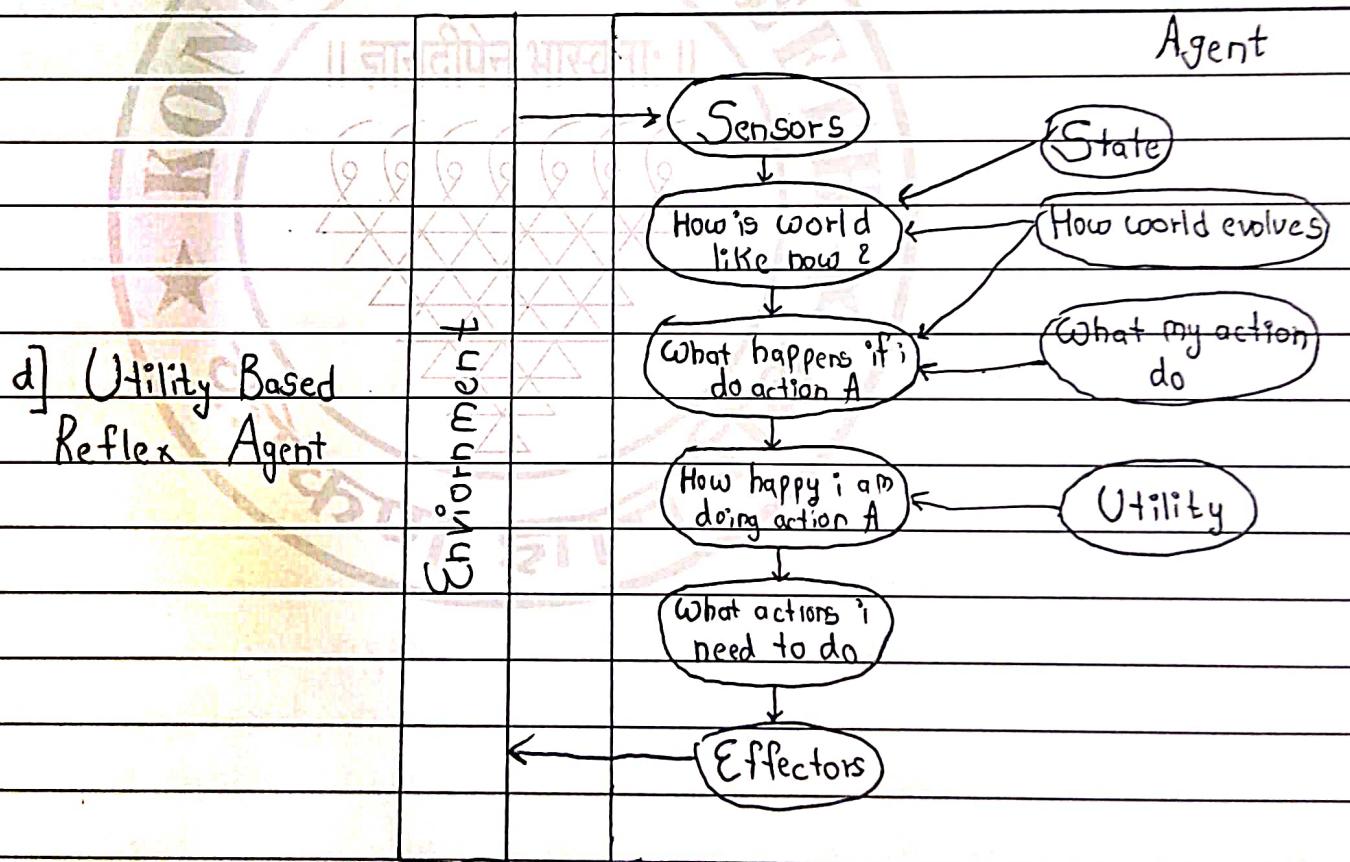
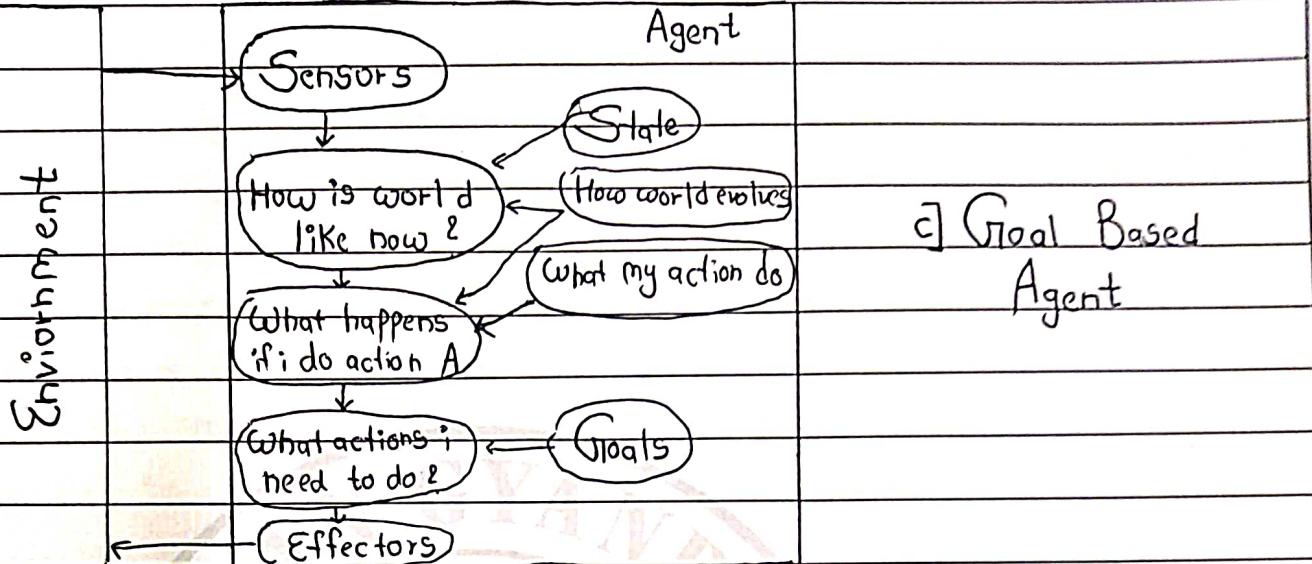
Agent Structure can be viewed as a combination of Agent architecture & agent Program. Agent Architecture refers to machinery that an agent executes on whereas Agent Program is an implementation of an agent function. Following fig. shows four important types of agent architecture.



a) Simple Reflex Agent

b) Model Based Reflex Agent





Agent Architecture Types

As seen in above figures. Simple Reflex agent choose actions only based on 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 fig. use a Model of the world to choose their actions. Here the models mean knowledge about how the things happen in the world that is representation of unobserved aspects of current state depending on percept history. Goals based agents choose their actions in order to achieve the goals. Finally the Utility Based Agents choose their actions based on a preference (utility) for each state. Goals are inadequate when there are conflicting goals, out of which only few can be achieved, goals have some uncertainty of being achieved & you need to weigh likelihood of success against the importance of a 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, when the right action means actions that causes the agent to be most successful in given percept sequence. The problem agent solves is characterized by Performance Measure, Environment, Actuators & Sensors (PEAS). PEAS descriptors provide important insight to agent & task environment it operates in. These insights are very useful in agent design.

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

- 1] Discrete or Continuous : If there are a limited no. of distinct, clearly defined, states of the environment, the environment is discrete ; otherwise it is continuous
- 2] Observable or Partially Observable : If it is possible to determine complete state of environment at each time point from 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 environment is completely determined by current state & actions of the agent .
- 5] Episodic or Sequential : In an episodic environment, each episode of events consists of agent perceiving & then acting. Subsequent episodes do not depend on the actions in the previous episodes. Episodic environments are much simpler because agent does not need to think ahead e.g. Part Picking robots .

6] Single agent or Multiple agents : The environment may contain single agent or other agents which may be of same or diff. kinds as that of the agent.

7] Accessible or Inaccessible : If the agent's sensory apparatus can have access to complete state of the environment, then environment is accessible to that agent.

Working Search internet for AI based application in following scenarios & identify who is agent for that application. Finally try to classify task environment properties like a list of attributes from above list of 7 task properties.

- 1] Autonomous Lunar Rover
- 2] Deep Blue Chess playing computer program.
- 3] Eliza natural language processing program created from 1964 to 1966 at MIT AI lab by Joseph Weizbaum.
- 4] Automatic Portfolio Management.
- 5] Sophia a humanoid robot developed by HK based company Hanson robotics.
- 6] AlphaGo is a computer program that plays board games
- 7] Apple virtual assistance Siri.
- 8] Endurance : A Companion for Dementia Patients
- 9] Casper : Helping Insomniac Get through night
- 10] Marvel : Guarding the Galaxy with Comic Book crossover.
- 11] Automated Cross Word Solver.

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 : Discrete fully observable, static,

Properties 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, output window

Actuators : Texts

Sensors : User texts inputs

Task Environment : Continuous, fully observable, static,

Properties Deterministic, Sequential, Single agent accessible

3)

Sophia is a Social humanoid reboot developed by Hong Kong based company Hanson Robotics

Performance Measures : Understanding user, maintaining conversation, facial expressions, response time

Environment

: Human objects

Actuators

: Arms, mouth, legs, Speaker

Sensors

: Eyes (camera), ears, mic, audio server

Task Environment : Continuous, Fully Observable Dynamic.

Properties

: Deterministic, Sequential Single Agent, Accessible.

4)

Apple's Virtual assistant Siri

Performance Measures : Understanding users text & speech producing best results, Summoning (trigger), response speed.

Environment

: User speech text

Actuators

: Mobile screen Speaker

Sensors

: Mobile source, speaker

Task Environment

: Continuous, Fully observable,

Properties

: Static, Deterministic, Episodic,

: Single agent Accessible.

5) Automated Crossword Solver

Performance Measure : Understanding hints, analyzing hidden & visible letters, time to solve.

Environment : Hints, visible letters, crossword board

Actuators : Desktop screen, program

Sensors : Crossword board

Task Environment : Discrete, fully observable, Static, Deterministic, Episodic Single agent, Accessible.