K.G.C.E.
Karjat - Raigad

Tutorial No. 1

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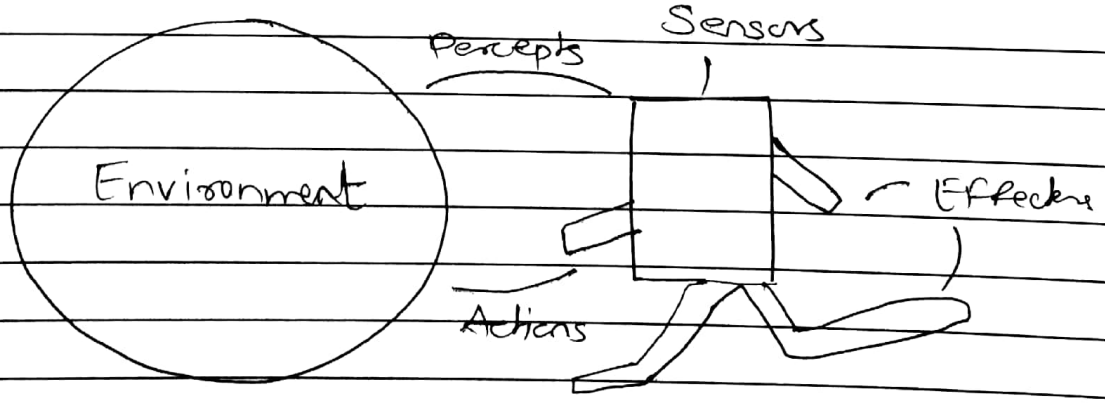
1 Module 1

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 & acts upon that environment through effectors. This can be clearly seen in Fig.1 An



AI Agent with Environment

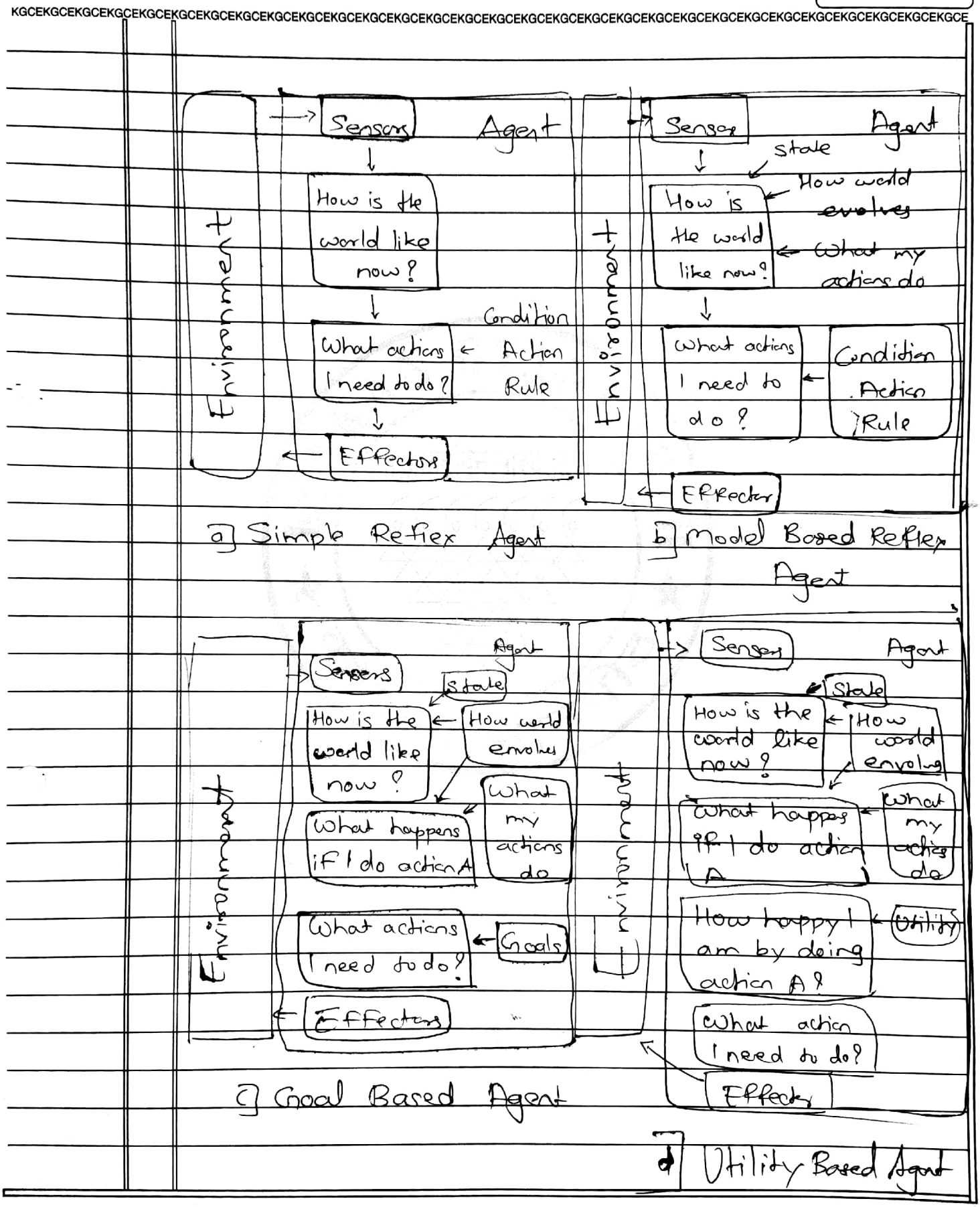
agent in particular can be :

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

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

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

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. shows four important types of agent architectures



a] Simple Reflex Agent

b] Model Based Reflex Agent

c] Goal Based Agent

d] Utility Based Agent

As seen in figure, Simple Reflex agents 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 fig. use a model of the world to choose their actions. They maintain an internal state as a persistent information. Here the model means knowledge about how the things happen in the world. that is representation of unobserved aspects of current state depending on percept history. Agent take into account how its actions affect the world. Goal based agents shown in Fig. 2c. choose their actions in order to achieve goals. Goal-based approach is more flexible than reflex agent since the knowledge supporting a decision is explicitly modeled, thereby allowing for modifications. Goal shown in fig 2d choose action based on a preference for each state. Goals are inadequate when there are conflicting goals, out of which only few can be achieved goals have some uncertainty goals, out of which only few can achieved. On the

untility 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 Performance Measure, Environment, Actuators, & Sensors (PEAS). These are collectively referred to as PEAS descriptors for the agent task environment it operates in. These insights are very useful in agent design.

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; 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 ~~pre~~ 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 state & the actions of the 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 the agent ~~pre~~ perceiving & then acting. The quality of its action depends just on the episode itself. Subsequent episodes do not depend on the actions in previous episodes. Episodic environments are much simpler because the agent does not need to think ahead eg. 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 of the same or different kind as that of the agent. 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 the environment is accessible to that agent.

(Q) Working Search internet for AI based applications in following scenarios & identify who is agent for that application. Further list out 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

7. developed by Hong Kong based company Hansun 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 Patients.
9. Casper : Helping Insomniacs Get Through the Night.
10. Marvel : Guarding the Galaxy with Comic - Book Crossovers
11. Automated Cross word Solver.

Resources The above diagrams a taken from online tutorial available at Tutorials points on topic AI - Agents & Environments.