

Tutorial No. 21

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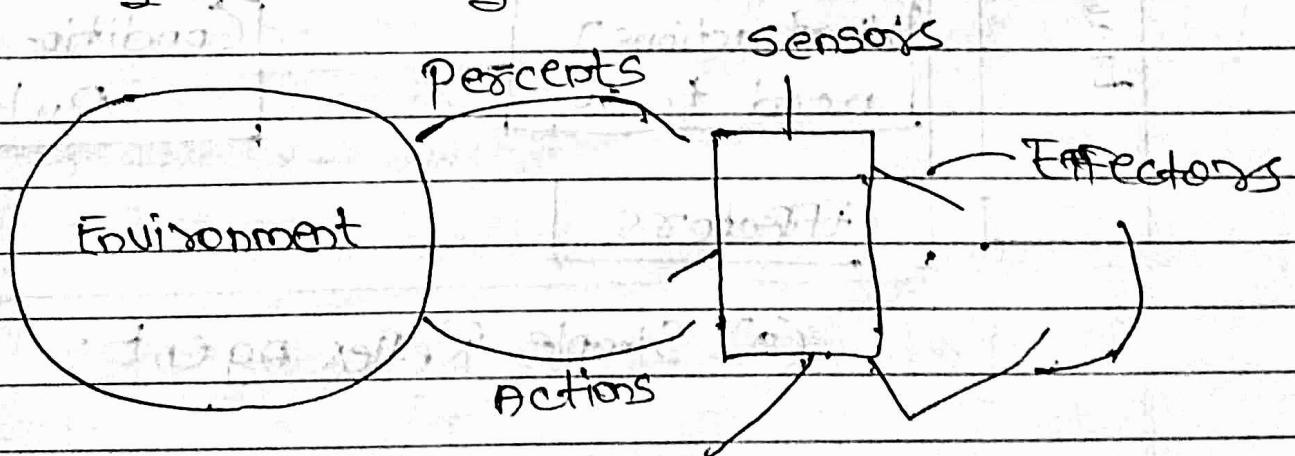
Module 1

1.1 Tutorial 1: Design of Intelligent System Agent

Aim: To Understand Concept of Agent Abstraction by studying definition of Rational agent, Agent environment, Task environment Descriptions, environment types

Theory:

An Artificial Intelligent System is composed of an agent and its environment. Agents act in their environment. An agent is anything that can perceive its environment through sensors and acts upon that environment through effectors. This can be clearly seen in fig. 1



* Agent with Environment *

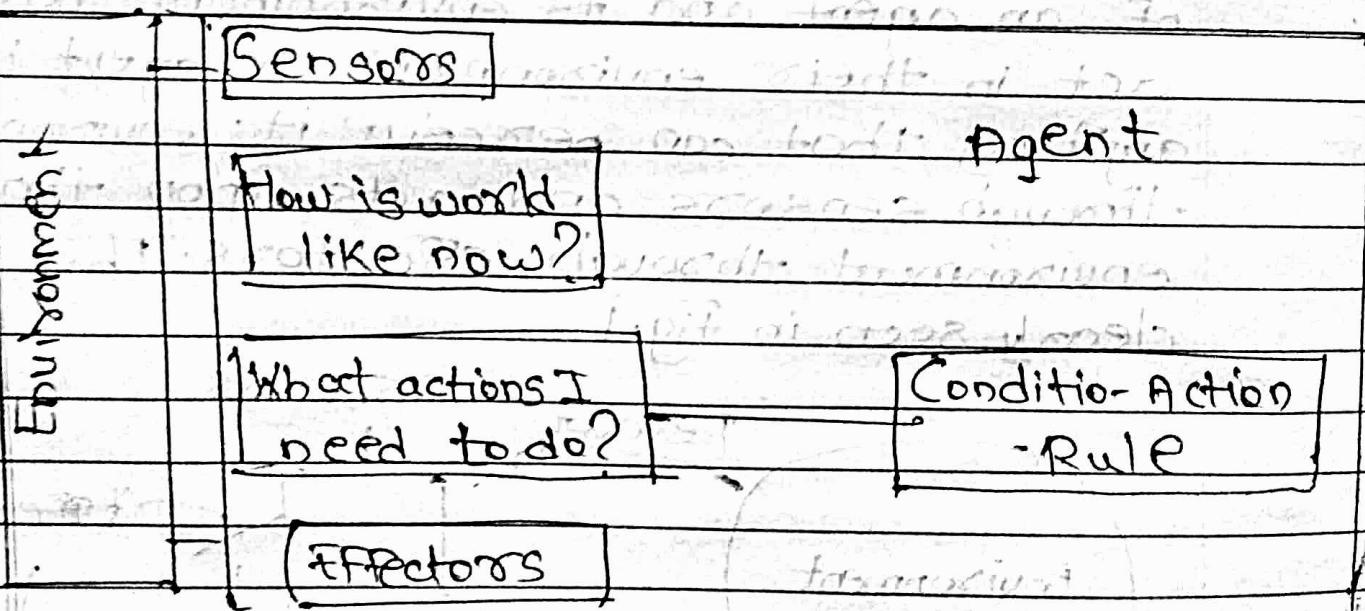
Human Agent: has sensory organs such as eyes, ears, nose, tongue and skin parallel to sensors of other organs such as hands, legs, mouth for effectors

Robotic Agent: replaces cameras of robot, range finders for sensors, and various motors or actuators for effectors.

Software Agent: has encoded bit strings as its programs and actions.

Sensors

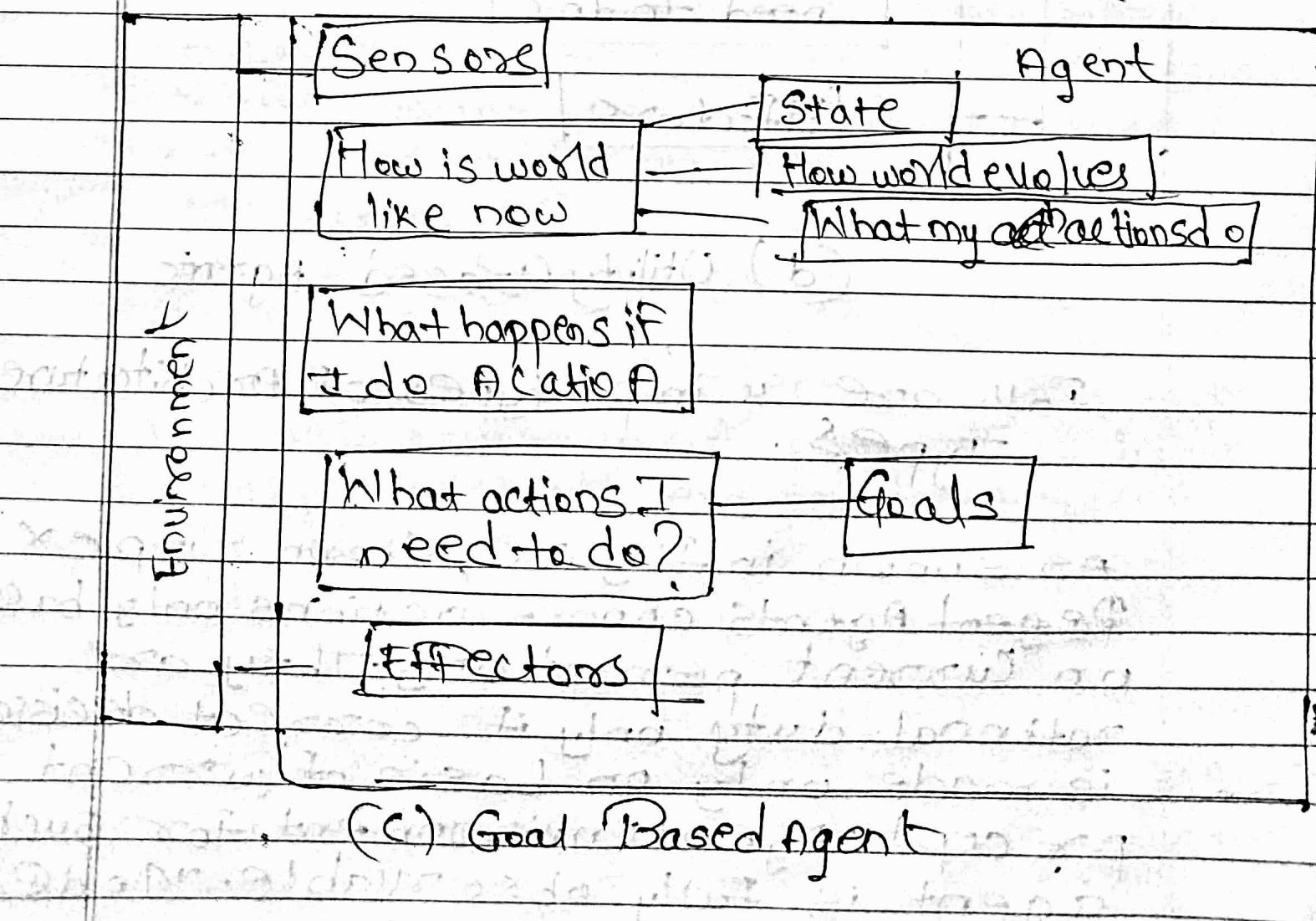
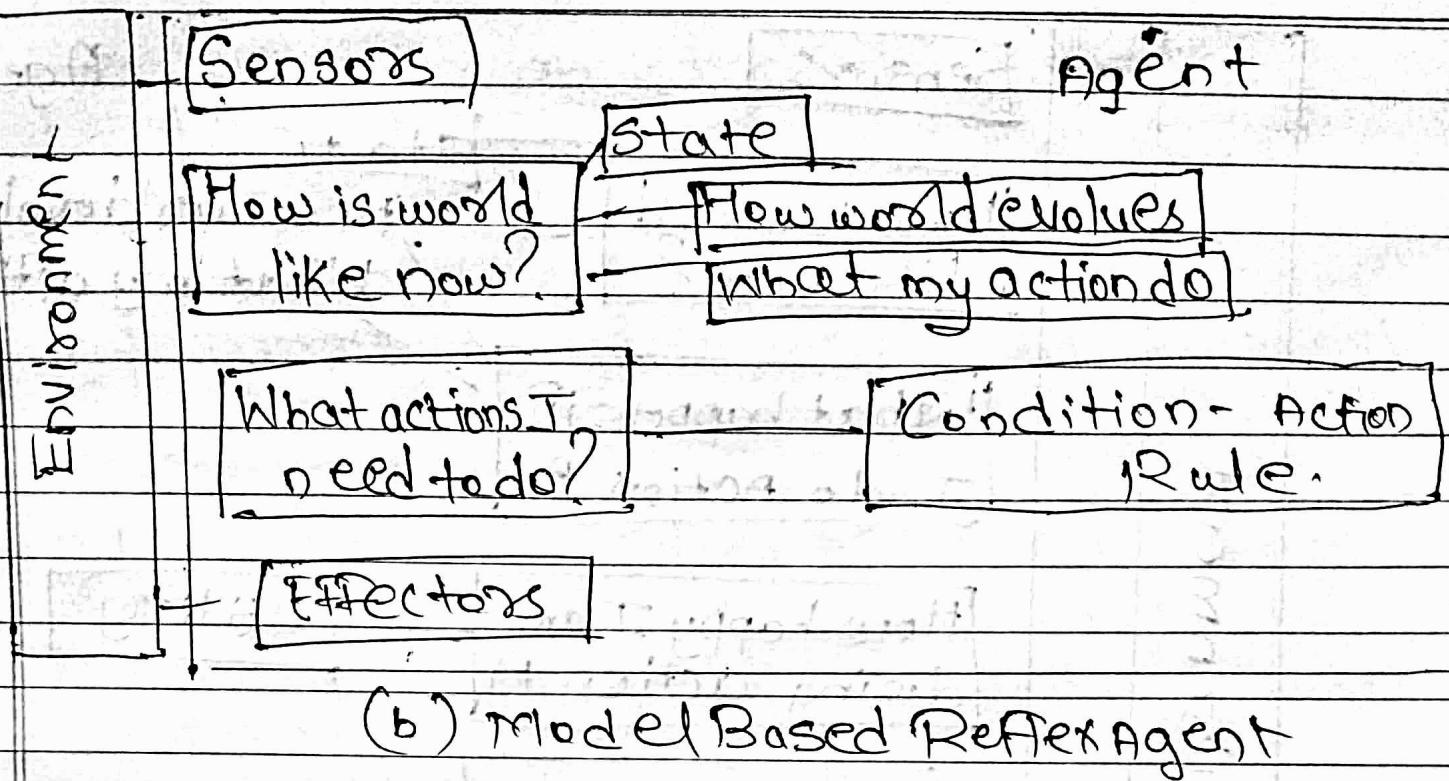
~~How is world like now?~~



Effectors

Condition-Action
Rule

(a) Simple Reflex Agent



Sensors

How is world like now?

State

How world evolves
What my actions do

What happens if

I do action A

How happy I am
doing action A

Utility

What actions I
need to do?

Effectors

(d) Utility Based Agents

Foll. are 4 imp. types of architecture
Types.

As shown in figure, shown Simple x
Reflex Agents choose actions only based
on current percept only. They are
rational only if correct decision
is made only on basis of current
percept. Agent environment for such
agent is Fully observable. Model
Based Reflex Agents as shown in fig.

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. Goal Based agents choose their actions in order to achieve goals. Goal-based approach is more flexible than reflex agent since knowledge is supporting a decision is explicitly modeled; Finally the Utility Based Agents choose actions based on preference for each only few can be achieved, goals have some uncertainty of being achieved and you need to weigh likelihood of success against importance of goal.

Another important piece of information is task environment properties while analysing task environment agent architect needs to consider following properties

1. Discrete or Continuous:

If there are limited no. of distinct clearly defined states of environment, the environment is discrete.

2. Observable or Partially observable:

If it is possible to determine complete state of environment at each time pt. from precepts it is observable else it is only partially observable.

3. Static or Dynamic:

If environment does not change while an agent is acting, then it is static else it is dynamic.

4. Deterministic or Non-Deterministic:

If next state of environment is completely determined by current state and action of agent then environment is deterministic else it is not.

5. Episodic or Sequential:

- Quality of action depends just on actions episode itself. Subsequent episodes do not depend on actions in previous episodes.

6. Single agent or Multiple:

Environment may contain single agent or other agents which may be of same or diff. kind as that of agent.

i. Accessible or Inaccessible:

- If agent's 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 full scenarios and identify who is a agent for that application. Further list out PEAS descriptors for agent environment in each of case.

1. Autonomous Lunar Rover
2. Deep Blue chess playing Computer program
3. Eliza natural language processing computer program created from 1964 to 1966 at MIT Artificial Intelligence laboratory by Joseph Weizenbaum.
4. Automatic Portfolio management
5. Sophia is Social humanoid robot developed by Hong Kong based company Hanson Robotics
6. AlphaGo is Computer program that plays board game Go. It was developed by Alphabet INC Deep Mind 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 Galaxy with Comicbook Crossovers.
11. Automated Cross word Solver.

Working:

Search internet for AI based applications in following scenarios and identify who is agent for that application. further list out PEAS descriptors of an 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/arrow, safety of chess pieces, safety of King piece, no. of moves, time for each move.

Environment: chess board, chess pieces.

Sensors: Chess

Actuators: Desktop, CPU

Task Environment: Discrete, fully observable, static Deterministic, sequential, single agent, Accessible.

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

Performance Measure: Understanding user, maintaining conversation

Environment: User, Program, Keyboard, user input, input texts, output, Window.
 Actuators: Text
 Sensors: User, texts, inputs

Task environment properties: Fully measurable, continuous, static, Deterministic, Sequential, single agent

3: Sophia is social humanoid robot developed by Hong Kong based company Hanson Robotics.

Performance measure: Understanding user maintaining conversation, social expressions, response time.

Environment: Humans, objects.

Actuators: Arms, mouth, legs, speaker

Sensors: Eyes, ears, mic, audio sensors.

Task environment properties: Continuous, fully observable, Dynamic, Deterministic, Sequential, Single Agent

4 Apple's Virtual Assistant Siri:

Performance measure: Understanding user text & speech producing but results, summoning, response with speed.

Environment: User, speech, text.

Actuators: Mobile screen, B.Speaker.

Sensor: Mobile screen, mic.

Task Environment Properties:

Continuous, fully observable, static,
Deterministic, Single agent.

5. Automated Crossword Solver:

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

Environment: Hints, Visible letters, crossword

Actuators: Desktop Screen, program

Sensors: Crossword

Task Environment Properties:

Discrete, fully observable, static,
Deterministic, Single agent, Accessible.