

Experiment No. 2

* Aim: Assignment on State Space formulating PEAS representation for various AI applications

* Theory:

I) Intelligent systems and its characteristics

Intelligent systems are technologically advanced machines that perceive and respond to the world.

It is a machine with an embedded, network-connected computers which gathers & analyze data and communicate with other systems

→ Characteristics

- ability to simulate and emulate in near real time
- automated learning and machine learning
- digital feedback loops that influence product development.
- action based on sensory data & algorithms
- customized device experience in the cloud.
- true compute on far edge
- adapting tasks based on reprogramming via cloud
- ability to predict stresses & failures
- detection & resolution of events
- total automation
- near-real-time, seamless connections across multiple ecosystems
- realtime collaborative workflow platform
- experimenting as a learning system

II) Significance of PEAS descriptor:

- PEAS (or Performance, measure, environment, actuators, sensors) are descriptive measures on basis of which an AI agent or rational agents, are made

• Eg: Self driving cars has

Performance measure: safety, time, legal drive, comfort

Environment: Roads, road signs, pedestrians

Actuators: Steering, brake, accelerator, signal, horn

Sensors: Camera, GPS

III) Generic properties of task environment

1. Fully v/s Partially - observable

Fully observable environments can gather all necessary information required to take actions.

Partially observable environments can't provide errorless or complete information for every internal state as the environment cannot be at any given time.

2. Single v/s multi-agent

Whether the agent is operating on its own or in collaboration with other agents decides if a single or multi agent environment is required respectively.

3. Deterministic v/s Stochastic

An environment is deterministic if next state can be completely pre-determined based on previous state and action. Stochastic environment means indecisiveness about actions is enumerated in terms of probabilities.

4. Episodal v/s Sequential

An episode task environment is the one where each of the agent's action is divided into atomic incidents called episodes. In sequential environment, the previous incident affects the future decisions.

5. Static v/s Dynamic

If an environment remains unchanged while agent performs the given tasks than environment is called static. If the environment changes while agent performs tasks, then it is called dynamic environment.

6. Discrete v/s Continuous

When there are distinct & clearly defined inputs and outputs or percepts and actions, then it is called discrete environment.

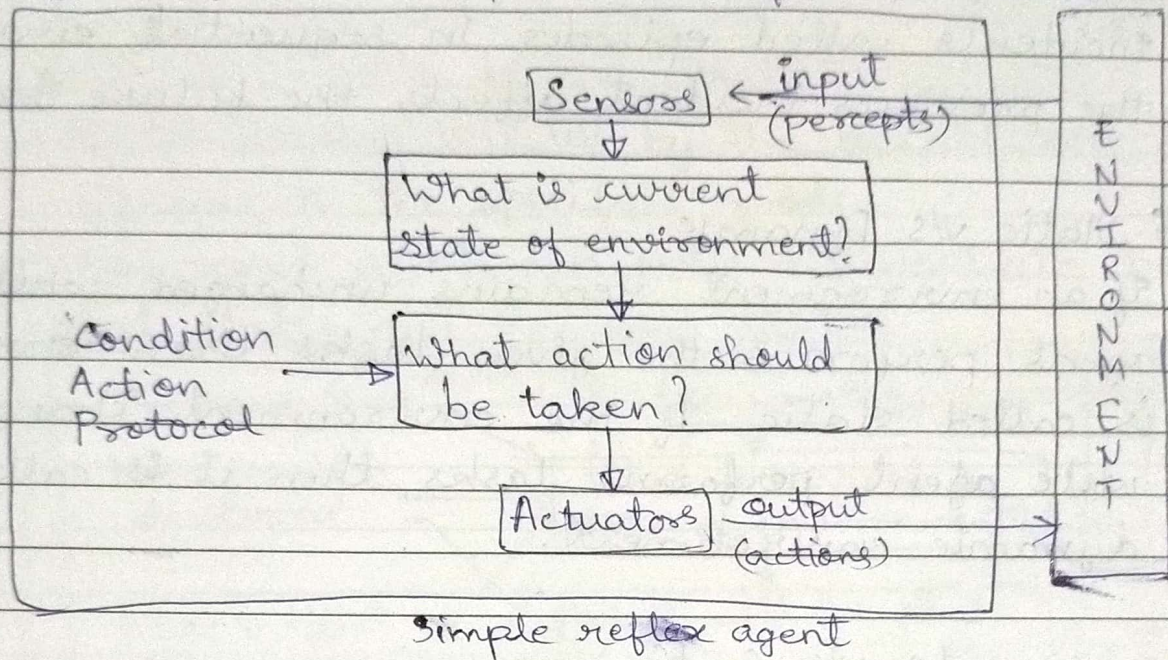
When continuous input signal is received by an agent, all the percepts & actions cannot be defined beforehand, then it is called continuous environment.

7. Known v/s Unknown

In a known environment, the output for all probable actions is given. In unknown environment, for an agent to make decisions, it has to gain knowledge about how the environment works.

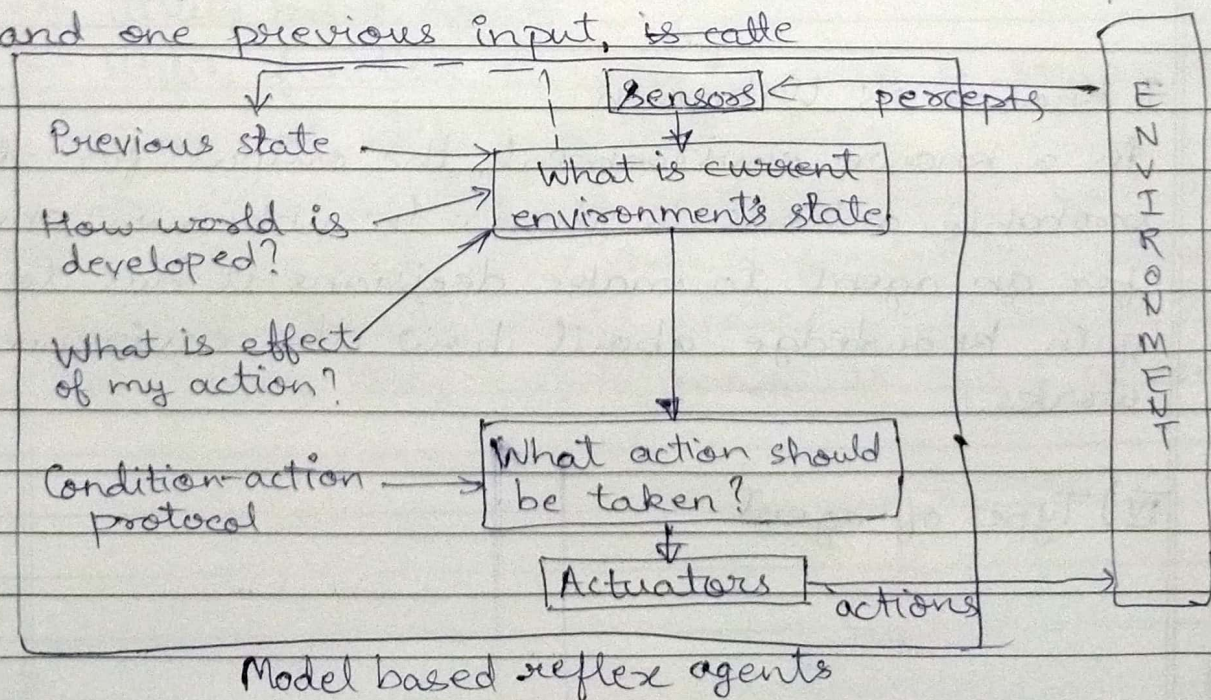
IV) Types of agent

1. Simple reflex agent: is an agent which performs actions based on the current input only, by ignoring all the previous input. is called



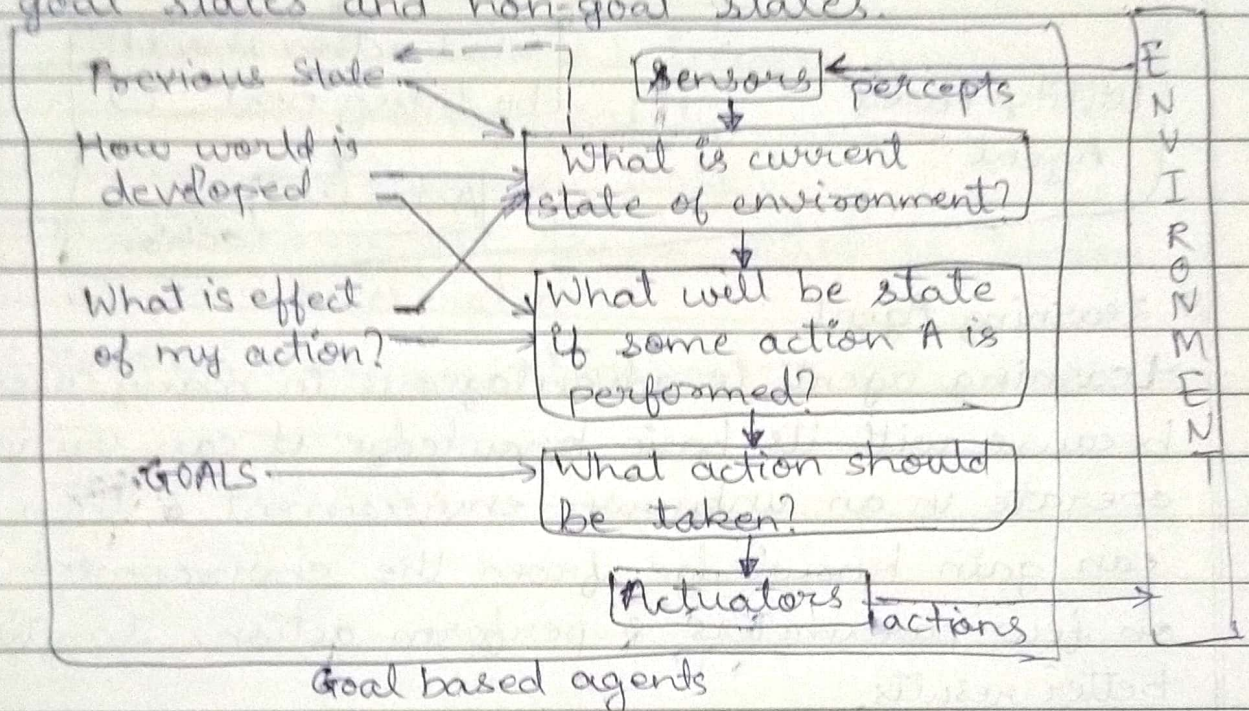
2. Model-based Reflex agents

→ Partially observable environment cannot be handled well by simple reflex agents because it does not keep track on the previous state. So, one more type of agent was created that is model based reflex agent which performs actions based on current input and one previous input, is called



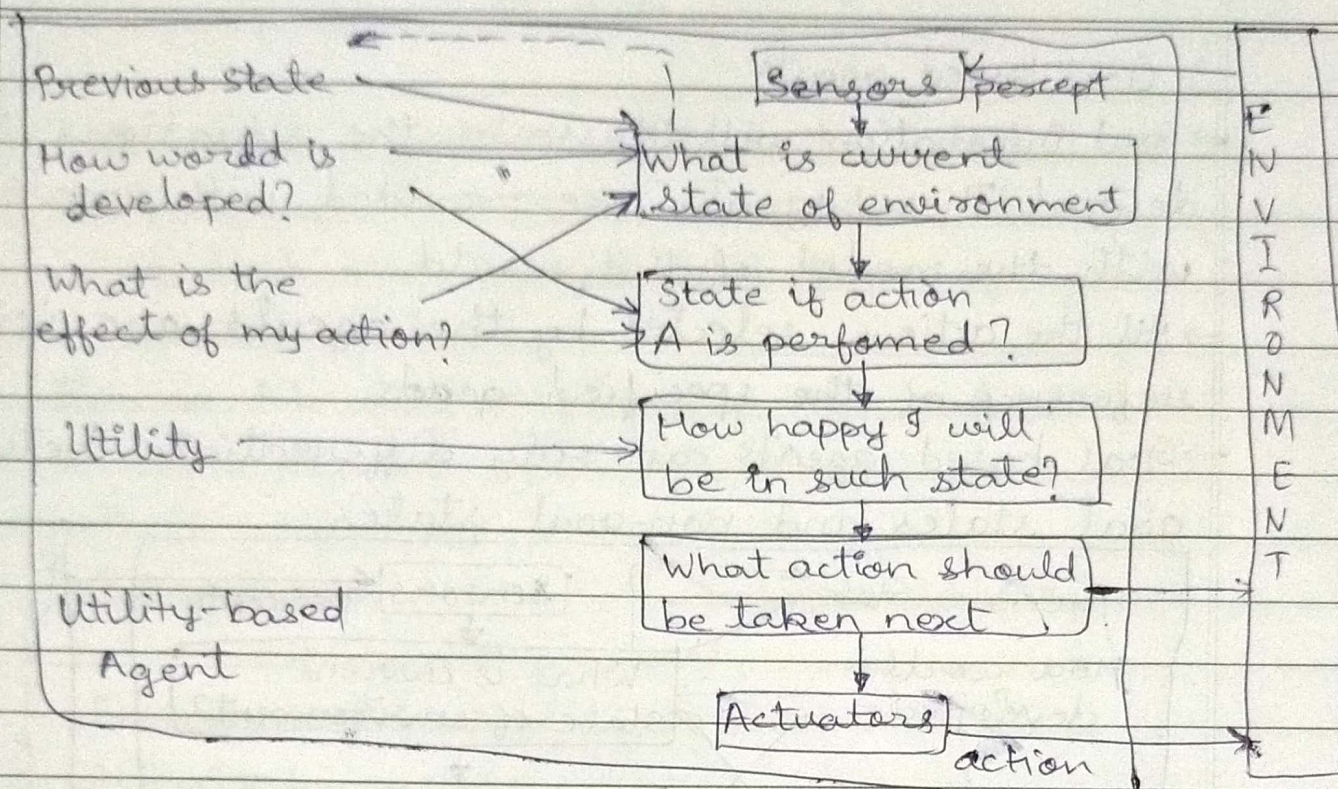
3. Goal based agents

- Goal Information will illustrate the situations that is desired. These agents are provided with goals along with the model of the world.
- All the actions selected by the agents are with reference of the specified goals.
- Goal based agents can only differentiate between goal states and non-goal states.



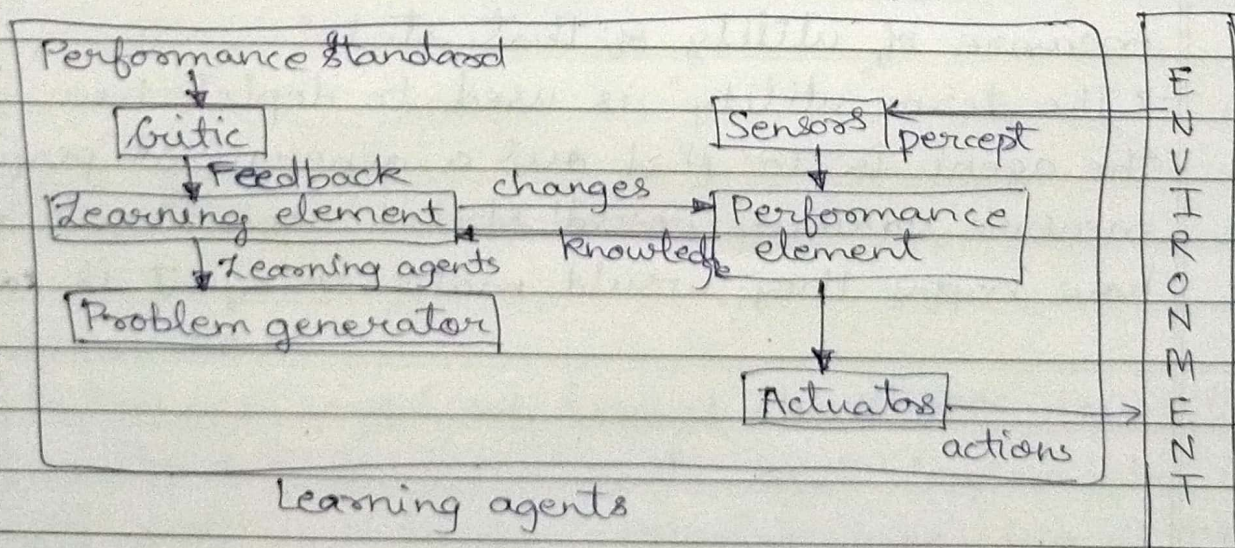
4. Utility based agents

- Utility function is used to map a state to measure of utility of that state.
- The term "utility" is used to depict how "happy" the agent is to find out a generalized performance measure, various world states according to exactly how happy they would make an agent is compared.



5. Learning Agent

- Learning agent is advantageous in many cases, because with its basic knowledge it can initially operate in an unknown environment & then it can gain knowledge from the environment based on few parameters & perform actions to give better results.
- Its components are: critic, learning element, performance element & problem generator.



Task: Select a problem statement relevant to AI.

Recognize the PEAS descriptor, identify properties of task environment and type of agent for the selected problem.

For an AI for exploring the subsurface of oceans of ~~moon~~ Titan.

1. PEAS descriptor

- Performance measure: images quality, video quality, safety
- Environment: ocean, water
- Actuators: mobile driver, steering, brake, accelerator
- Sensors: video, accelerometers, GPS, depth sensor

2. Task Environment

- Fully observable
- Deterministic
- Episodic
- Dynamic
- Discrete
- Multi-agent
- Unknown

3. Type of agent: Goal-based agent

* Conclusion:

In this experiment, we learnt about PEAS descriptor, agents & task environments and implemented it for problem "AI for exploring subsurface of Titan's ocean".