

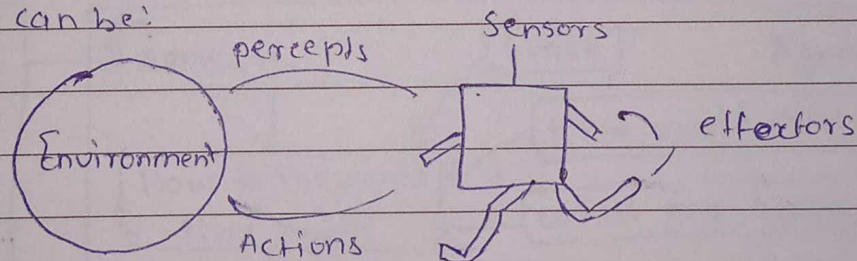
Module 1

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 and its environment. The 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. An agent in particular can be:

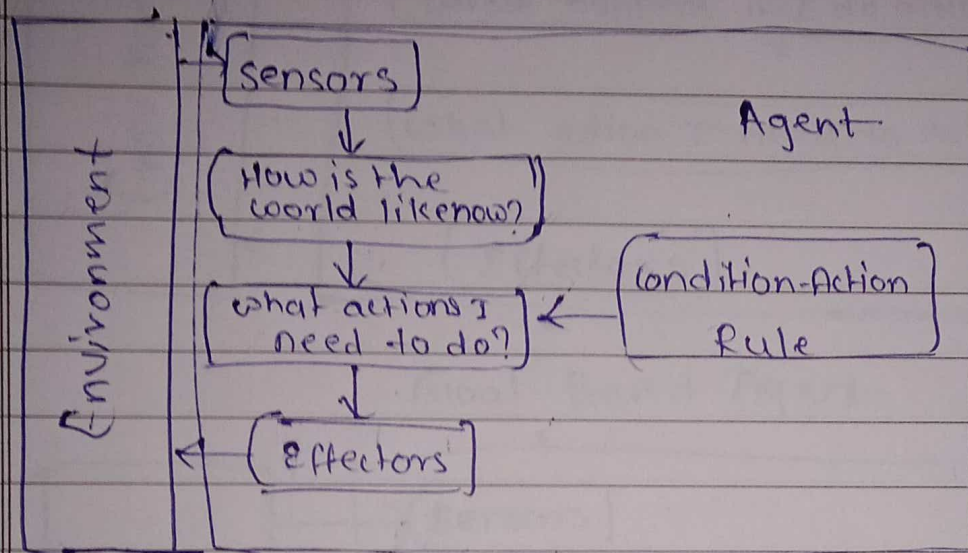


Human Agent has sensory organs such as eyes, ears, nose, tongue and skin parallel to the sensors, and other organs such as hands, legs, mouth, for effectors.

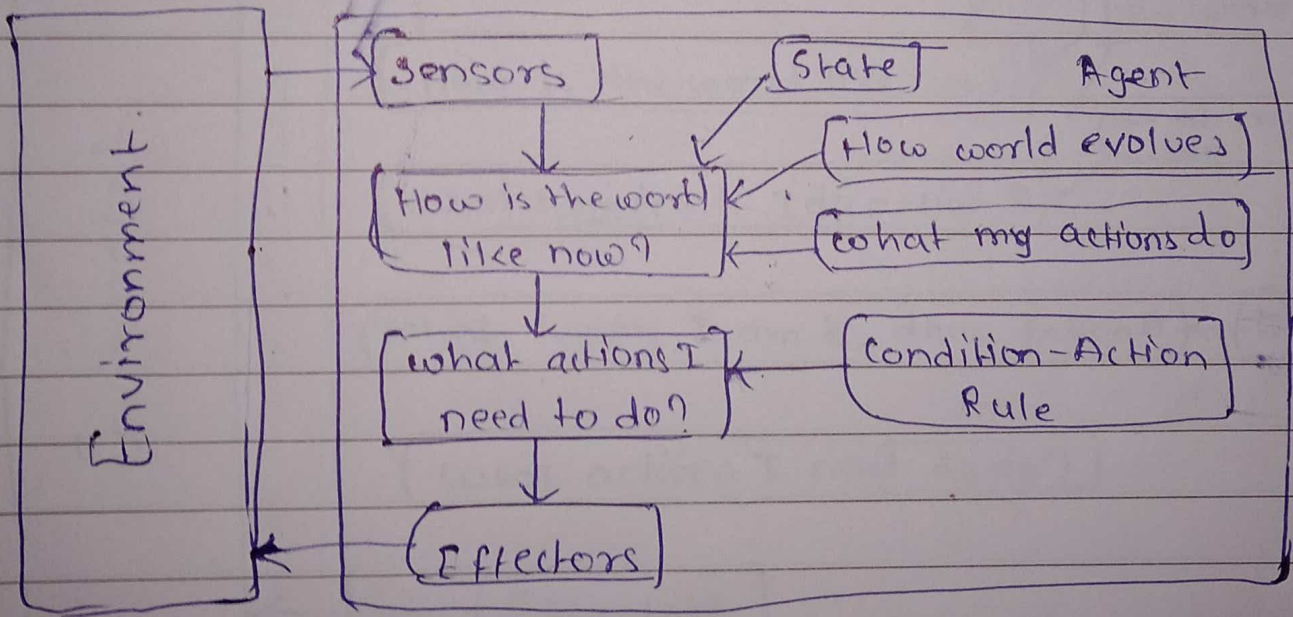
Robotic Agent replaces camera and infrared range finders for the sensors, and various motors and actuators for effectors.

Software Agent has encoded bit strings as its program and actions.

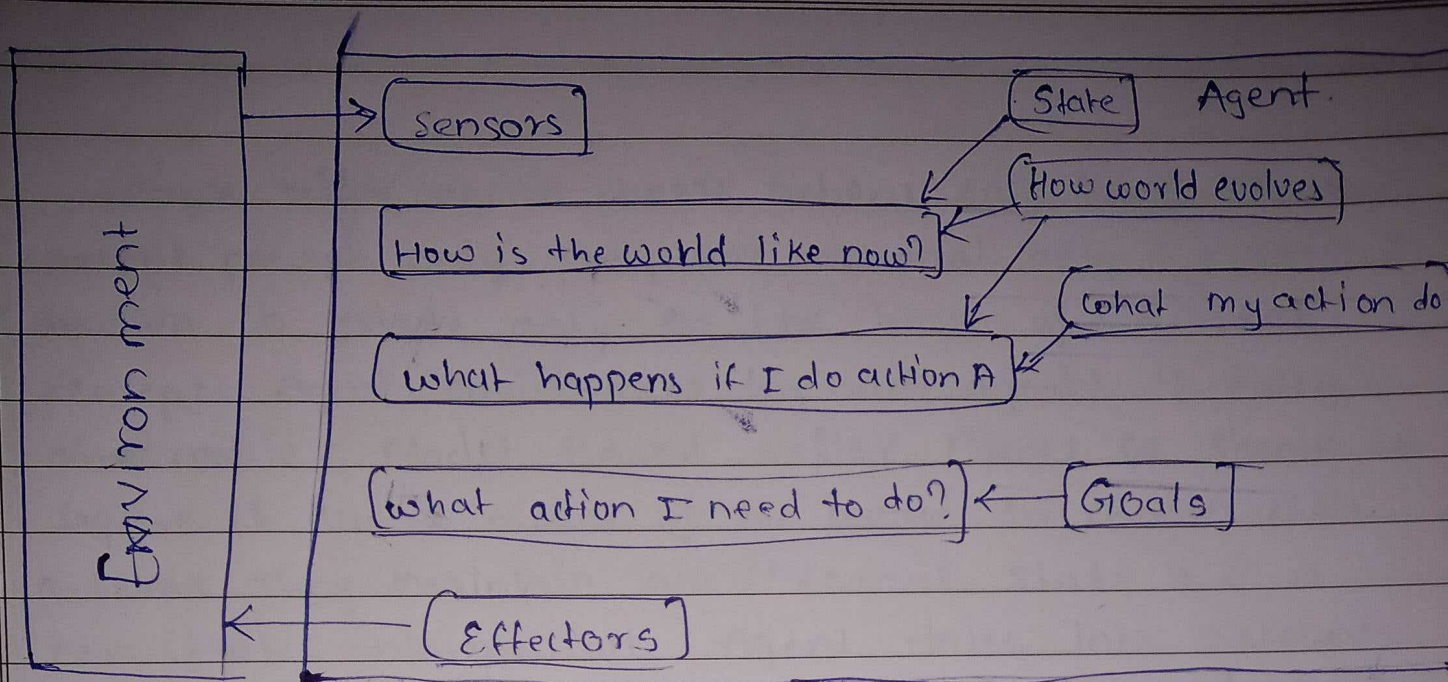
Agent structure can be viewed as a combination of Agent architecture and Agent Program. Agent Architecture refers to the machinery that an agent executes on whereas Agent Program is an implementation of an agent function.



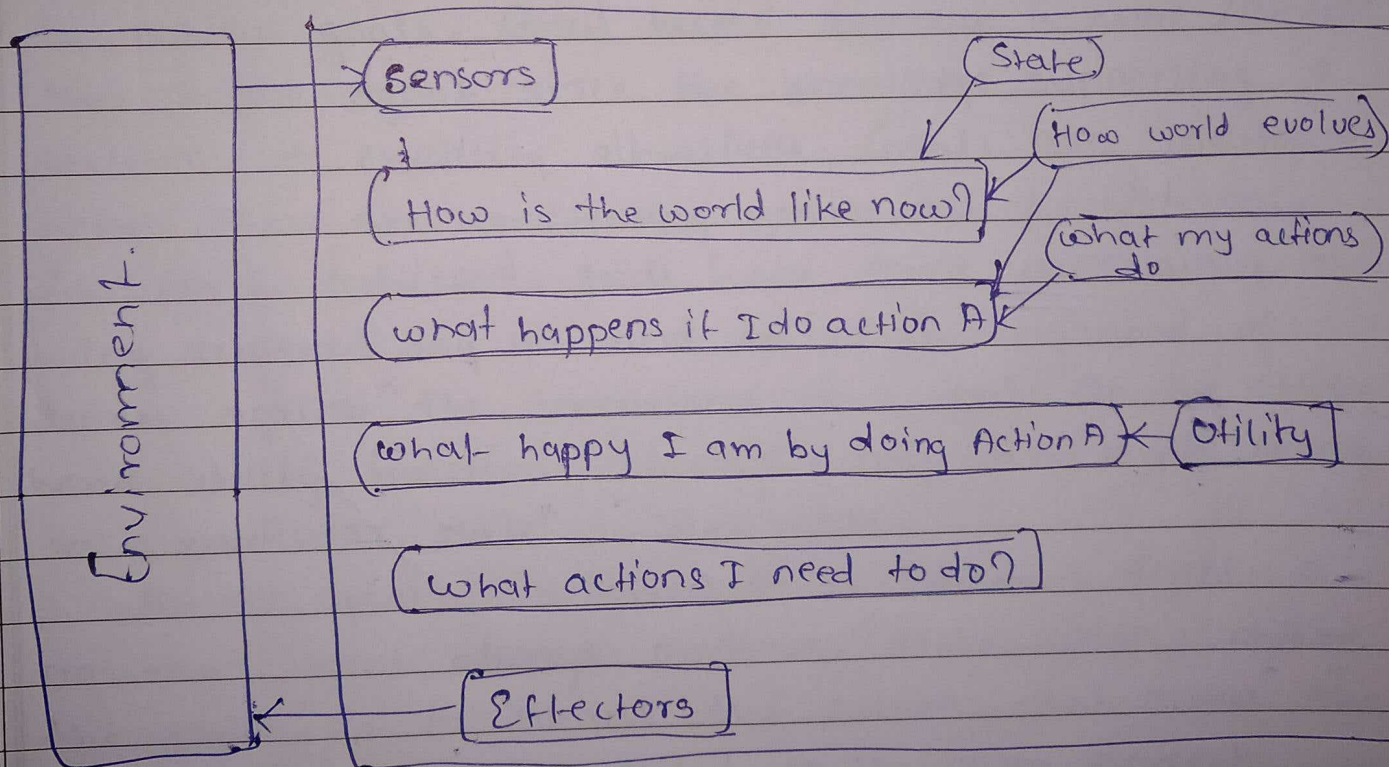
a) Simple Reflex Agent.



b) Modal Based Reflex Agent.



Goal Based Agent.



a) Utility Based Agent

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 figure 2b use a model of the world to choose their actions. They maintain an internal state as a persistent information. Agent take into account how its actions affect the world. Goal based agents shown in figure 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 situations. Goals are indelible when there are conflicting goals, out of which only few can be achieved, goals have some uncertainty of being achieved any 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, 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, and Sensors (PEAS). PEAS descriptors provide important insight into agent and the task environment it operates in.

1. ~~Discrete~~ or Continuous - If there are a limited number of distinct clearly defined, state of the environment, the environment is discrete; otherwise it is continuous.
2. Observable or Partially Observable - If it is possible to determine the complete state of the environment at each time point from the 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 and the actions of the agent, then the environment is deterministic.
5. Episodic or Sequential - In an episodic environment, each episode of events consists of the agent perceiving and then acting. The quality of its actions depends just on the episode itself. 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.

Working:

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 source, CPU.

Sensor: chess board

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

- 2. performance measure: understanding user, maintaining conversation.

Environment: User, program, keyboard, user text inputs. Eliza text, output window.

Actuators: Text

Sensors: user text inputs.

Task environment properties: Continuous, fully observable, static, Deterministic, sequential, single agent, Accessible.

Performance measure: understanding maintaining conversation
facial expressions, response time.

Environment: Humans, objects...

Actuators: Arms, mouth, legs, speaker.

Sensors: Eyes (Camera), ears, nose, audio sensor.

Task environment properties: Continuous, fully observable
Dynamic, deterministic, sequential, single agent.

4. Apple's virtual assistant Siri

performance Measure: Understanding user text & 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.

properties: Discrete, static, episodic, single agent.