

TUTORIAL 1: Design of Intelligent Agent

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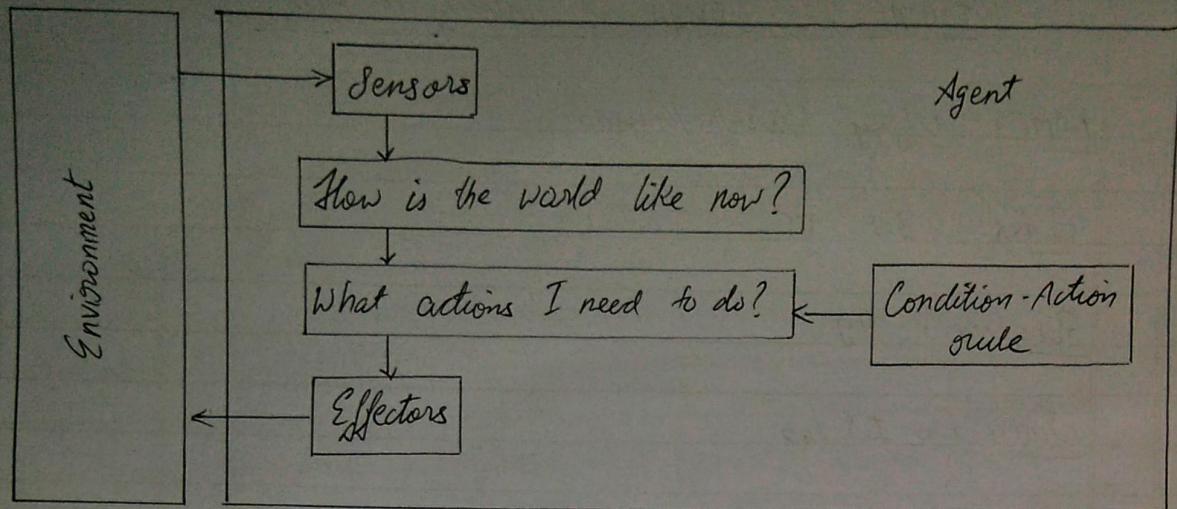
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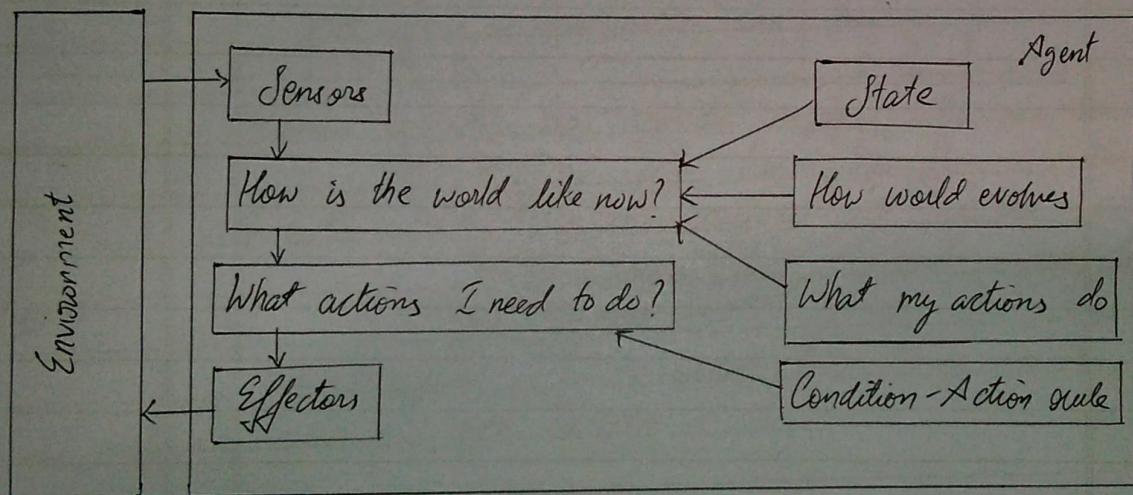
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Agent Architecture types

Simple Reflex Agent



Model based Reflex Agent



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.

An agent in particular can be:

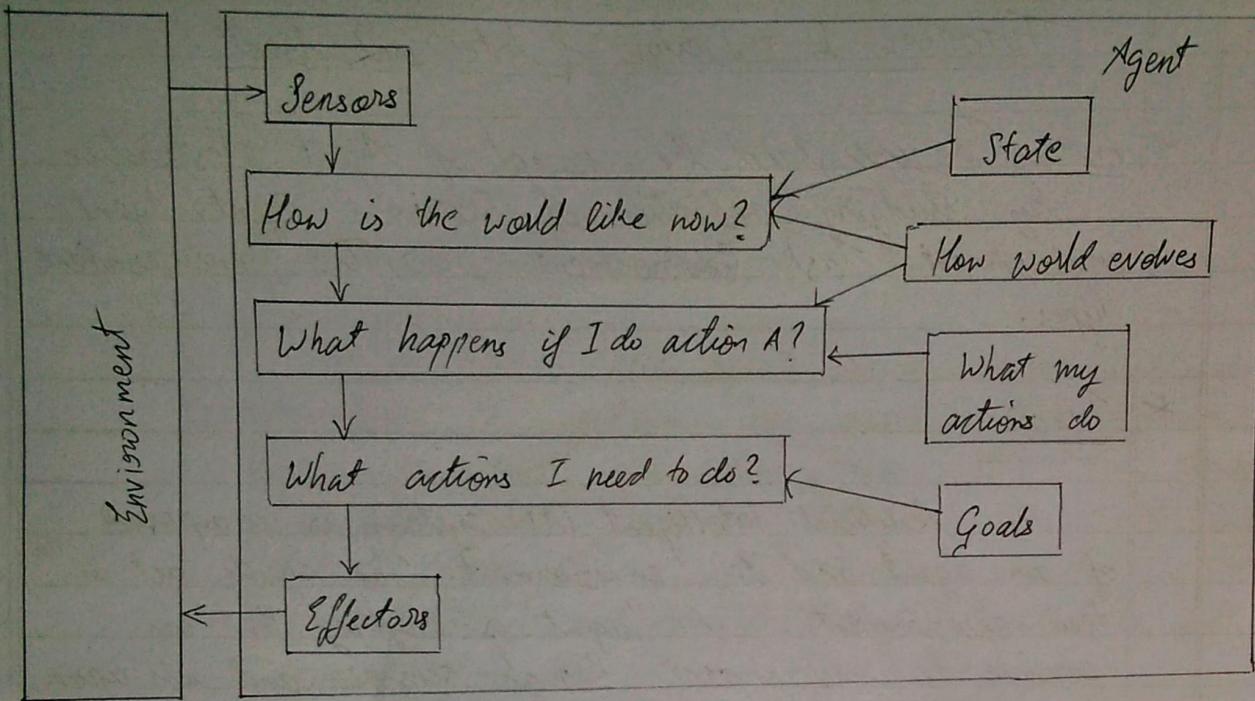
Human agent: has sensory organs like eyes, ears, and other organs like hands, legs for effectors.

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

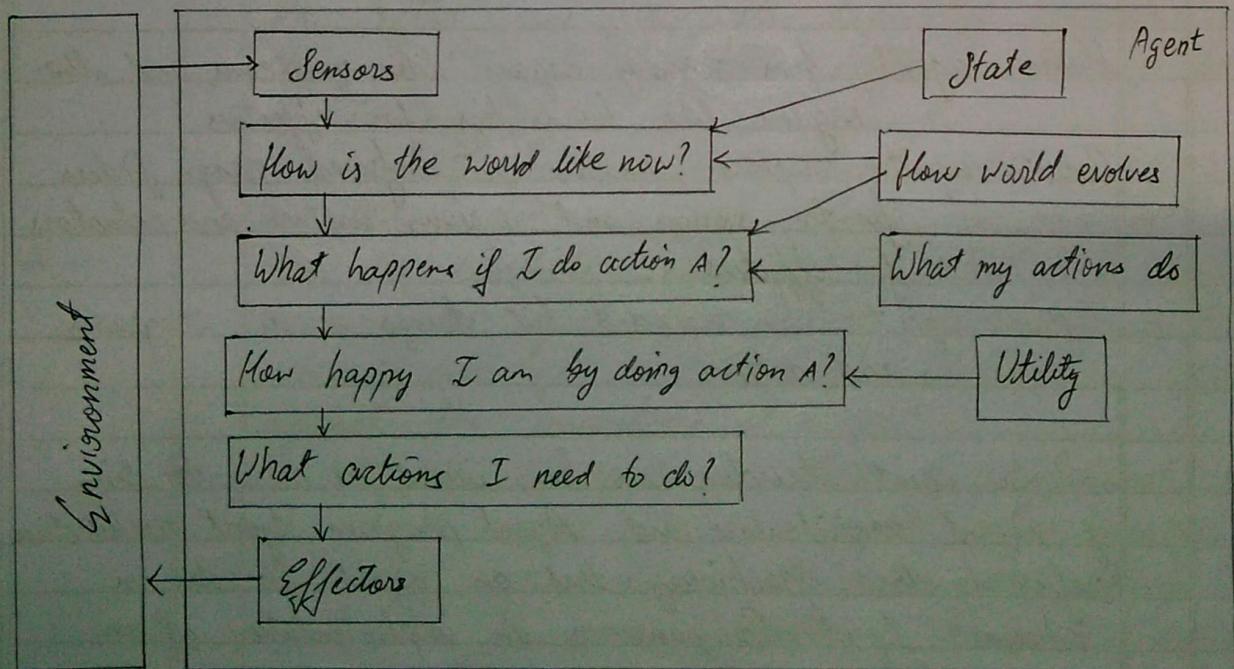
Software agent: has encoded bit strings as its programs and actions

An 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.

Goal based Agent



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 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 takes into account how its actions effect the world.

Goal Based Agents choose their actions in order to achieve goals. Goal-based approach is more flexible than the reflex agent since the knowledge supporting a decision is explicitly modeled, thereby allowing for modification.

Utility based Agents choose actions based on a 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 and you need to weigh likelihood of success against the importance of a goal.

An AI agent is referred to as Rational Agent. A rational agent performs right action always, where the right action means the action that causes the agent to be most successful in the given percept sequence. The problem that agent solves is characterized by Performance Measure, Environment, Actuators and

Sensors (PEAS). These are collectively referred to as PEAS descriptors. While analyzing task environment the agent architect needs to consider following properties:

1. Discrete or Continuous: If there are a limited numbers of distinct, clearly defined, states of the environment, the environment is discrete (like chess); otherwise it is continuous (like 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 percepts, it is observable; otherwise it is partially observable
 3. Static or Dynamic: If the environment doesn't 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; otherwise it is non-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 on just on the episode itself. Subsequent episodes do not depends on the actions in the previous episodes. Episodic environments are much simpler because the agent does not need to think ahead. Sequential environment is 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 states of the environment, then the environment is accessible to that agent.

* Working:

WORKING: Search internet for AI based applications in following scenarios and 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. 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

Sensor: Cherv Board

Task environment properties: Discrete, Fully observable, static, 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 properties: Continuous, Fully observable, Static, Deterministic, Sequential, Single agent, Accessible

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

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

Environment: Humans, objects, ...

Actuators : Arms, mouth, legs, speaker

Sensors: Eyes (cameras), ears, mic, audio sensors

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

4. Apple's virtual assistant Siri

Performance Measure: Understanding user text and 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: Hint, visible letters, crossword board

Actuators: Desktop screen, ~~get~~ program

Sensors = Crossword Board

Task Environment Properties:

Discrete, Fully observable, Static, Deterministic, Episodic,

Single agent, Accessible