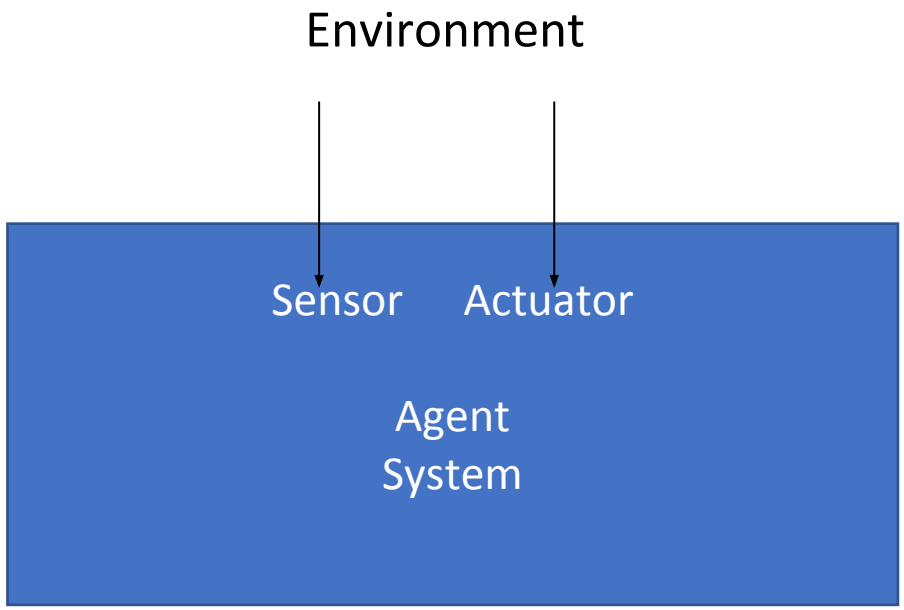
Intelligent Agents

Agent



Basic structure of an agent

- An agent could be anything which makes decisions, as a person, firm, machine, or software.
- An AI system is composed of an **agent and its environment**
- An agent is anything that can be viewed as :
  1. perceiving its environment through **sensors** and
  2. acting upon that environment through **actuators**

Agent = Architecture + Agent Program

Architecture is the machinery that the agent executes on. It is a device with sensors and actuators, for example : a robotic car, a camera, a PC.

Agent program is an implementation of an agent function.

An **agent function** is a map from the percept sequence(history of all that an agent has perceived till date) to an action.

Examples of agent

- A **software agent** has Keystrokes, file contents, received network packages which act as sensors and displays on the screen, files, sent network packets acting as actuators.

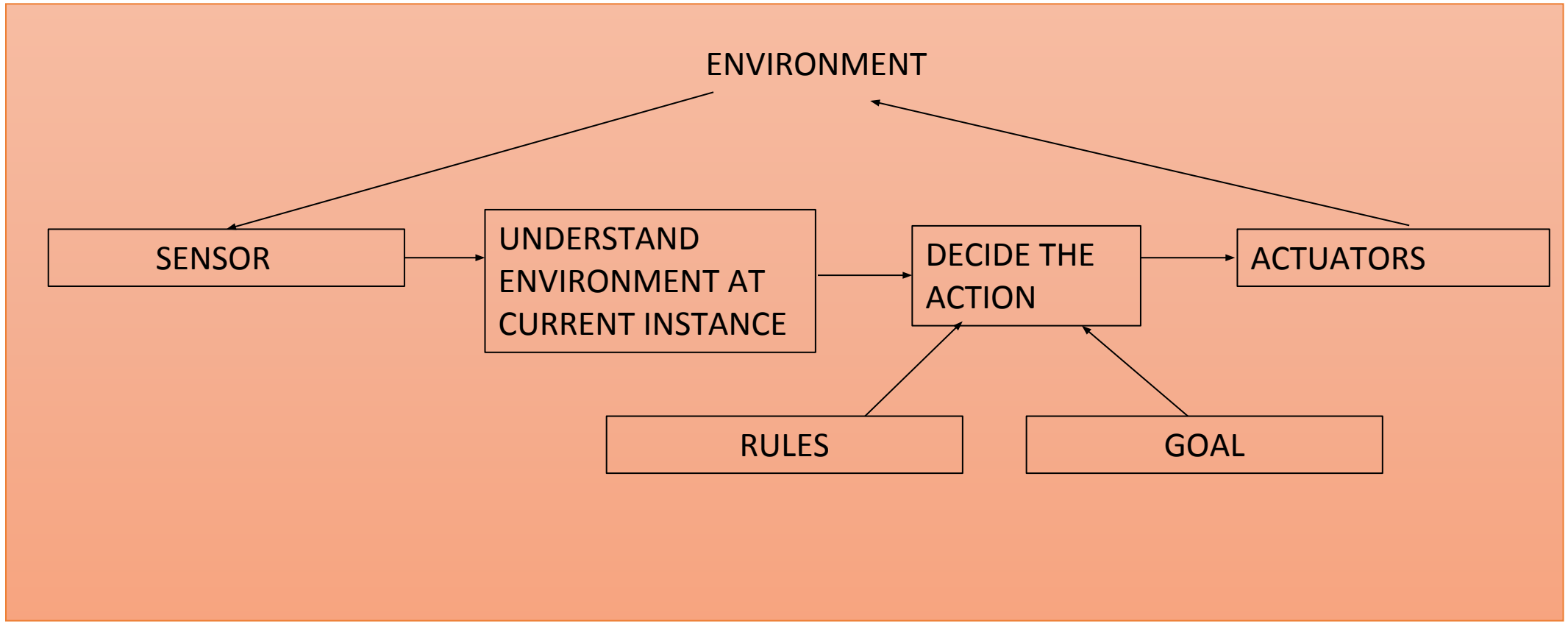
- A **Human agent** has eyes, ears, and other organs which act as sensors and hands, legs, mouth, and other body parts acting as actuators.

- A **Robotic agent** has Cameras and infrared range finders which act as sensors and various motors acting as actuators.

INTELLIGENT AGENT

- Intelligent agent is an entity that:
  - works without assistance,
  - Interprets inputs
  - Senses the environment
  - Make choices
  - Acts to achieve goal
- An intelligent agent is an entity that is autonomous in nature, a good observant to detect environmental changes, with a capacity to govern its action in timely fashion to achieve the goals.

Agent Environment Relationship



Percepts, Agent function

- Percept is agents perpetual inputs (an impression or sensation of something perceived)at any instant.
- A percept sequence is complete history of everything the agent has ever captured.
- The percept or percept sequence is the window of agent to the environment through which it observes the environment.

- **Agent function:** is used to represent the behavior of agent mathematically.
- Actions are tabulated against percept sequence.
- This table is used for mapping and selecting actions.
- Agent program uses agent function to achieve goal.
  - $f : P \longrightarrow A$
  - P: Percept
  - A: Action

Representation of Agent function

- It can be understood with the help of **automatic door opening closing system:**
- The agent function here is
    1. If area is empty, then close the door
    2. If area is occupied, then open the door

Rationality and Rational Agents

1. Rationality is nothing but status of being reasonable, sensible, and having good sense of judgment.
2. Rationality implies the conformity of one's beliefs with one's reasons to believe, or of one's actions with one's reasons for action.
3. It is concerned with expected actions and results depending upon what the agent has perceived.
4. Performing actions with the aim of obtaining useful information is an important part of rationality.

Rational Agent

1. A rational agent is an agent which has clear preferences and models uncertainty via expected values.
2. A rational agent can be anything that makes decisions, typically a person, firm, machine, or software.
3. 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.
4. Rational agent is capable of taking best possible action in any situation.

Example of rational action performed by any intelligent agent:

- **Automated Taxi Driver:**
- Performance Measure: Safe, fast, legal, comfortable trip, maximize profits.
- Environment: Roads, other traffic, customers.
- Actuators: Steering wheel, accelerator, brake, signal, horn.
- Sensors: Cameras, sonar, speedometer, GPS, odometer, engine sensors, keyboard.

Performance measures

- It is the criteria, which determines how successful an agent is.
- The performance of an agent is measured in terms of efficiency, speed, solutions obtained, energy consumed and so on.
- For example: the performance of auto door opening and closing system, the agents performance is measured by:
  1. Timely opening and closing of door or
  2. Time delay in opening or closing the door

Rationality and performance measure:

- Rationality maximizes the performance of an agent, so for an agent to it is important to have certain qualities so as to achieve the maximum performance,
- They are
    1. Ability to gather information
    2. Ability to learn from experiences
    3. Performance knowledge augmentation
    4. Autonomy
- Example of Rationality:
    - Automatic car is expected to slow down when signal is yellow and stop when signal is red.

Flexibility and intelligent agent

- Flexibility means that system should be able to adapt with the changing scenarios and should exhibit rational behavior in those changing scenarios.
- For an agent to be flexible it has to be
    1. **Responsive**
    2. **Pro- active**
    3. **Social**
- Other properties that an agent should have is
    1. Mobility
    2. Veracity
    3. Benevolence
    4. Rationality
    5. learning

Task environment and its properties

- Task environment is the environment in which the task take place,
- For any intelligent agent to work efficiently its task environment should be clearly defined
- The task environment is defined on the basis of PEAS i.e performance measure, environment, agent's actuators, sensors.
- For automatic door opening system PEAS description is as follows:
  - P: timeliness, electricity usage, smooth operation, noise generated, and efficiency.
  - E: Both sides of door, tiles, objects if any.
  - A: Motors that pull or push the door
  - S: cameras along with the mechanism for sensing obstacle.

Environment Types

- An environment is categorized based on how it appears to the agent.
- Environment types
    1. Fully Observable
    2. Deterministic
    3. Discrete
    4. Episodic
    5. Static
    6. Single