

AI Agents: Concepts, Purpose, and Functionality

1. Introduction and Background

Artificial Intelligence (AI) has evolved from static rule-based systems to dynamic, autonomous entities capable of perception, reasoning, and action. These entities are known as **AI Agents**.

Definition

An **AI Agent** is an autonomous computational system that:

- **Perceives** its environment through sensors or input data.
- **Reasons** about the environment to make informed decisions.
- **Acts** upon the environment through actuators or output actions.

Historical Context: The idea of an “agent” traces back to early AI (1950s–1980s), where systems simulated human-like problem solving. With the rise of *machine learning*, *reinforcement learning*, and *large language models (LLMs)*, today’s AI Agents are dynamic, adaptive, and context-aware.

2. What is an AI Agent?

An AI Agent is a self-directed software entity that performs tasks or achieves goals using reasoning and decision-making mechanisms. It acts as an *intelligent intermediary* capable of taking initiative, not just reacting.

$$f : P^* \rightarrow A \tag{1}$$

Here, P^* denotes percept sequences (inputs) and A represents actions. The function f defines the agent’s behavior—mapping perceptions to actions.

In Essence

AI Agents can:

- Analyze context.
- Choose actions intelligently.
- Learn and adapt over time.

3. Why AI Agents?

AI Agents exist to enable **autonomy**, **efficiency**, and **scalability**. They reduce the need for human supervision in decision-heavy or repetitive environments.

- **Automation:** Execute tasks continuously and accurately.
- **Decision-Making:** Evaluate complex choices using data and logic.
- **Adaptability:** Learn from changing situations or user feedback.
- **Interactivity:** Communicate naturally using language models.

Modern Use: In LLM-based systems, agents can call APIs, query databases, or chain reasoning steps autonomously—like ChatGPT calling a currency API or browsing the web.

4. How Do AI Agents Work?

AI Agents operate in a continuous cycle known as the **Perception–Reasoning–Action Loop**.

4.1 Core Components

- a) **Environment:** The world the agent interacts with.
- b) **Sensors:** Input systems gathering data.
- c) **Actuators:** Output systems performing actions.
- d) **Agent Program:** The brain—reasoning, planning, and decision logic.

4.2 The Agent Loop

1. Perceive the environment.
2. Analyze and determine a goal.
3. Decide the best action.
4. Execute and observe results.
5. Repeat continuously.

5. Types of AI Agents

- **Simple Reflex Agents:** React to the current state (e.g., thermostats).
- **Model-Based Agents:** Maintain a representation of the environment.
- **Goal-Based Agents:** Take actions to reach objectives.
- **Utility-Based Agents:** Maximize performance metrics or reward.
- **Learning Agents:** Evolve through feedback or experience.
- **LLM-Based Agents:** Use large language models for reasoning and tool use.

6. Example: Currency Conversion Agent

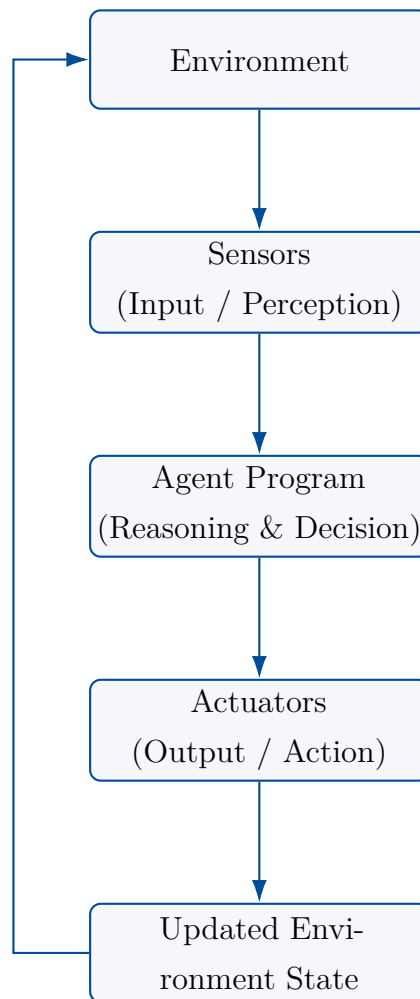
Scenario

A user asks, “Convert 10 USD to BDT.”

1. Perceive: The agent reads the query.
2. Reason: Identifies that it needs an exchange rate.
3. Act: Calls `get_conversion_factor(USD, BDT)` and gets 114.23.
4. Compute: $10 \times 114.23 = 1142.3$.
5. Respond: “10 USD \approx 1142.3 BDT.”

This demonstrates reasoning, decision-making, and real-world interaction in a single loop.

7. Visual Representation



8. Summary

AI Agents represent a major leap toward autonomous, intelligent systems. From simple reactive programs to advanced LLM-driven entities, they embody the future of automation, real-world reasoning, and intelligent interaction.

Key Takeaway

AI Agents = **Autonomy** + **Intelligence** + **Adaptability**. They learn, reason, and act — transforming digital systems into dynamic, self-improving entities.