Smart Home Control System with Generative AI

1. Introduction

This project implements a smart home control system that allows users to interact with virtual smart devices using natural language. The system uses a Generative AI model (OpenAI GPT) to interpret user commands and perform actions like turning lights on/off, adjusting fan speed, and setting the thermostat temperature. It aims to demonstrate the potential of natural language processing in user-friendly automation systems.

2. Objectives

The main objective of this project is to build a functional prototype of a smart home assistant that:

- Simulates basic smart devices in Python
- Interprets commands using a language model (OpenAI GPT)
- Maps those commands to device actions
- Provides clear, real-time feedback to users
- (Optionally) Reports the status of all devices on request

3. System Architecture

The project consists of the following main components:

- **Device Simulation**:
  Python classes simulate a Light (ON/OFF), Fan (ON/OFF + speed), and Thermostat (adjustable temperature). Each device tracks and reports its status.
- **Command Parsing (AI Integration)**:
  User input is sent to the GPT model (`gpt-3.5-turbo`), which interprets the natural language command and returns structured JSON indicating the device, action, and value.
- **Command Execution**:
  A Python function (`execute_command`) reads the parsed JSON and calls the appropriate methods on the simulated devices. Feedback is then displayed to the user.
- **Command-Line Interface (CLI)**:
  A simple interface allows users to type natural language commands, receive AI responses, and view the resulting actions in real time.
- **Optional Feature**:
  Users can ask for the status of all devices with a single command (e.g., “What is the status of all devices?”), and the system returns a full summary.

4. Sample Interaction

```
User: Turn on the light
Response: The light is now ON.

User: Set the fan speed to high
Response: The fan speed is set to high.

User: Set the thermostat to 25
Response: The thermostat is set to 25°C.

User: What is the status of all devices?
Response: The light is ON. The fan is ON with speed set to
high. The thermostat is set to 25°C.
```

5. Technologies Used

- Python 3
- OpenAI GPT (via `openai` Python API)
- Command-Line Interface with `input()`
- Environment variable handling for secure API usage

6. Conclusion

This smart home simulation demonstrates the integration of natural language processing with Python-based automation. The system is simple, intuitive, and expandable. It can easily be extended to include more devices or voice input, and it showcases how Generative AI can make technical interfaces more accessible to everyday users.