AI + API Integration Module for Humanoid Robot

Overview

We propose to handle the AI and API integration component of the humanoid robot for the MEP1001 project. Our objective is to give the robot the ability to interact intelligently with humans and its environment, leveraging AI models, speech recognition, natural language understanding, and real-time response generation.

Core Features of the AI Module

1. Speech recognition using Google Speech API or SpeechRecognition library.
2. Conversational intelligence using OpenAI's GPT-3.5 model via API.
3. Text-to-Speech capability using pyttsx3 or Google TTS.
4. Emotion detection via HuggingFace Transformers (sentiment analysis pipeline).
5. Facial expression control by mapping emotions to servo motor triggers.
6. Command-based action execution (e.g., waving, greeting) via Arduino integration.

Sample Python Script Logic

```
1. Capture audio from mic using SpeechRecognition.
2. Convert audio to text using Google API.
3. Send text input to OpenAI's GPT model using their API.
4. Receive response and convert it to voice using pyttsx3.
5. Analyze response sentiment using HuggingFace pipeline.
6. Based on keywords or sentiment, trigger corresponding servo motor actions via
serial communication.
```

Technology Stack

1. Python 3.10+
2. openai (GPT-3.5 API access)
3. speech_recognition + Google Speech API
4. pyttsx3 / gTTS for TTS
5. transformers from HuggingFace
6. OpenCV / MediaPipe (for vision)
7. Arduino + Serial library for physical control

Reference Materials

YouTube Guides:

- OpenCV Basics: https://youtu.be/oXlwWbU8l2o
- Speech Recognition: https://youtu.be/B2n4BHKIaZg
- OpenAI GPT with Python: https://youtu.be/yvGCz9JZM_8
- TTS with pyttsx3: https://youtu.be/nXxubIC5eGc

Research Papers / Docs:

- OpenAI GPT-3.5 API Docs: https://platform.openai.com/docs
- HuggingFace Sentiment Analysis: https://huggingface.co/course/chapter1/3

- Google Speech API Docs: https://cloud.google.com/speech-to-text/docs