MicroGPT-Terminal

Compact AI chat interface built on an ESP32 microcontroller that delivers a ChatGPT-style experience on highly constrained hardware. The system uses a 128×32 SSD1306 OLED display and five physical push buttons to create a navigable on-screen keyboard and a scrolling text interface, allowing meaningful AI interaction on a very small device.

The hardware connections are simple and minimal. The OLED display communicates with the ESP32 over I2C, with SDA connected to GPIO 6, SCL connected to GPIO 7, VCC connected to 3.3V, and GND connected to ground. Five momentary push buttons are connected between ground and the following GPIO pins: Up button to GPIO 2, Down button to GPIO 3, Left button to GPIO 4, Right button to GPIO 5, and Select button to GPIO 10. All buttons use the ESP32's internal pull-up resistors, eliminating the need for external resistors.

The system operates in two main modes: typing mode and reading mode. In typing mode, the user enters text using a button-controlled keyboard arranged in a 3×9 grid containing uppercase letters A through Z and a dedicated send key. Directional buttons move the cursor across the keyboard with wrap-around navigation, while the select button confirms characters and triggers message sending.

When the send key is pressed, the ESP32 connects to the configured WiFi network and securely sends the user's prompt to Google's Gemini API using HTTPS. All AI processing is handled remotely, allowing the microcontroller to act solely as an interface device. The API response is received as JSON, parsed locally, and the generated text is extracted for display.

Because the OLED display can show only four lines of text at a time, the AI response is automatically word-wrapped to fit the screen width. Wrapped lines are stored in a fixed-size buffer, and the user can scroll vertically through long responses using the up and down buttons, creating a terminal-style reading experience.

MicroGPT-Terminal demonstrates how modern cloud-based AI services can be integrated into embedded systems using minimal hardware resources. Through careful UI design, secure networking, and efficient text handling, the project shows that meaningful AI interactions are achievable even on simple microcontroller platforms, making it a strong foundation for further experimentation and enhancement.