**AI-Based Text-to-Speech System Using ESP32 and I2C Audio Output**

**Problem Statement:**

In modern embedded and IoT ecosystems, enabling natural and intuitive interaction between humans and machines is increasingly becoming a core requirement. Among these interactions, speech output plays a crucial role in enhancing accessibility, improving user experience, and facilitating real-time feedback. However, most low-power embedded systems lack an efficient, integrated method to convert text into human-like speech, thereby limiting their potential in voice-enabled applications. Conventional text-to-speech (TTS) solutions often rely on cloud APIs or external processing units, which introduce significant drawbacks. These include increased hardware complexity, higher costs, dependency on internet connectivity, and critical issues related to data privacy and system latency. For applications such as smart home assistants, IoT-based alert systems, accessibility devices for differently-abled individuals, and voice-driven automation, these limitations can severely affect reliability and user trust. To address this, there is an urgent need for a local, self-contained, and offline-capable TTS system that can run directly on resource-constrained microcontrollers. This work proposes the design and implementation of such a system using the ESP32 microcontroller, leveraging its onboard computing power and peripheral support. The ESP32 runs an HTTP web server, allowing users to input text from any device connected to the same Wi-Fi network. Once the text is received, the system processes it locally and generates audible speech using the Arduino Audio library in conjunction with I2S/I2C digital-to-analog converters (DACs). The output is then delivered through a speaker connected to an I2C-compatible audio amplifier or DAC chip.