

AI-Driven Voice Controlled Robot with ESP32 and Computer Vision Integration

Problem Statement:

Traditional methods for controlling robotic systems, which predominantly rely on physical interfaces such as remote controls or smartphone applications, necessitate direct manual interaction. This requirement for physical contact renders them impractical and inefficient in a growing number of environments where hands-free operation is not merely a convenience but a critical necessity. Key areas where this limitation is particularly acute include assistive technology for individuals with physical disabilities, sterile environments in healthcare and laboratory settings, and complex industrial automation workflows where operators' hands are already engaged. The demand for more natural, touchless, and intuitive interaction methods is rapidly accelerating. However, existing solutions that offer such capabilities are often prohibitively expensive, technologically complex to implement, and may rely on cloud-based services that introduce concerns regarding latency, privacy, and reliability. This creates a significant barrier to the widespread adoption of advanced robotic systems in many critical applications. This work directly addresses this challenge by proposing the development of a low-cost, efficient, and scalable AI-based alternative for robotic control that leverages voice commands and computer vision. By utilizing open-source tools and readily available components, this initiative aims to create a system that is both accessible and powerful. The proposed solution will employ the VOSK AI speech recognition model for offline voice command processing, ensuring user privacy and minimizing latency. These commands will be transmitted to an ESP32-based robot, which will execute the corresponding movements. This approach will provide a seamless and natural method of human-robot interaction, paving the way for the broader application of robotic technologies in assistive tech, healthcare, and industrial automation.