Intelligent Facial-Controlled Robotic Arm for Hemiplegic patient

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Abstract

This project aims to develop an intelligent facial-controlled robotic arm as a prototype assistive device for individuals with hemiplegia, paralysis, and other mobility impairments. The system integrates facial movement detection using computer vision technology with robotic arm control through a microcontroller. The development process involved collecting and analyzing users' facial movement data, developing a facial detection program and a robotic arm control program, integrating both systems, and conducting performance testing at each stage.

The performance evaluation of the facial control system was conducted using six facial commands: turning the head left, turning the head right, looking up, looking down, opening the mouth, and closing the mouth. Each command was tested ten times, resulting in an average accuracy of 93.33%. The results demonstrate that the system can accurately and reliably detect facial movements and translate them into robotic arm commands. In addition, a user satisfaction survey involving ten participants evaluated the system in terms of control accuracy, response speed, movement flexibility, stability, and safety. The overall mean satisfaction score was 4.58 with a standard deviation of 0.57, indicating the highest level of user satisfaction.

Despite the promising results, the system still has limitations in movement flexibility under certain operating conditions. Future work will focus on enhancing the system's capabilities, improving stability and safety, and integrating advanced computer vision and artificial intelligence technologies to enable autonomous object detection and grasping. These improvements are expected to further enhance the robotic arm's practicality for assisting users in everyday activities.

Keywords: Facial-controlled robotic arm, Hemiplegia, Computer vision, Assistive technology, Microcontroller