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NeuroCar

Brain Computer Interface (BCI) Based Remote Controlled (RC) Car Using EEG Technology and Arduino Integration

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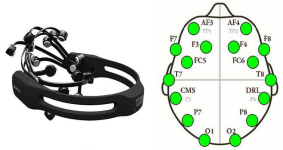
Introduction

Current RC car systems rely on manual input and commands. There's a steep learning curve, and a lot of mental effort required. While our project uses an RC car as a prototype, it demonstrates how EEG signals could one day control assistive technologies like wheelchairs or prosthetics, expanding accessibility for individuals with physical disabilities and reducing reliance on traditional input devices.



(a)

(b)

Fig. 1 EEG Nodes and Headset

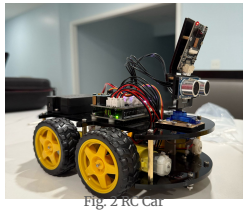


Fig. 2 RC Car

Novelty

Using the BCI technology offers manual input with minimal effort and allows for no use of controllers or joysticks. The BCI technology is unique and innovative instead of typical user interfaces. For example, cognitive signals from the EEG headset (Fig. 1) are measured and converted into controls used for a vehicle. Overall, this project contributes to Neuroscience and Computer Science while integrating different technological elements such as Arduinos.

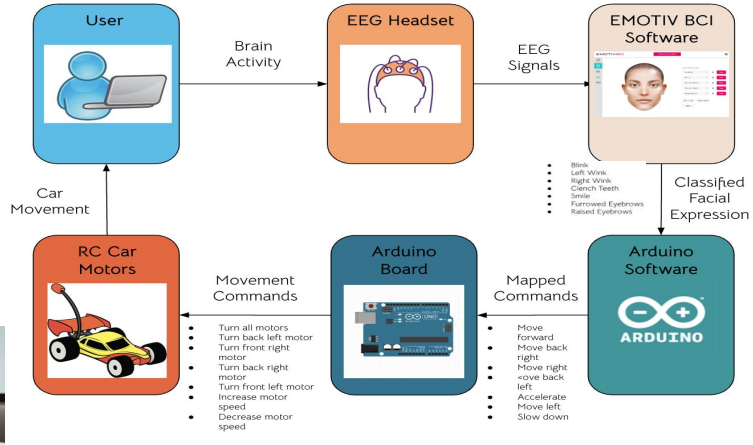


Fig. 3 Systems Architecture

Method

The system begins by interpreting brain activity to enable hands-free vehicle control. EEG signals are captured through electrodes and processed by the EMOTIV BCI software, which classifies facial expressions linked to specific movement intents. These expressions are mapped to commands within a custom program. The mapped instructions are then transmitted wirelessly to an Arduino board on the RC car (Fig. 2), which activates the appropriate motors. The user observes and adjusts movement in real time, completing a responsive, closed-loop control system (Fig. 3).

Results

Our system successfully enabled basic remote control of an RC car using EEG signals processed through the EMOTIV BCI platform. We were able to achieve directional control by performing specific facial expressions mapped to brainwave patterns. Across 70+ trials, consistent directional movement was observed, validating the system's core functionality. However, significant limitations were encountered, including high signal sensitivity, erratic turning behavior, and latency in response time. These challenges suggest the need for improved filtering, stable signal classification, and real-time feedback optimization in future iterations.

Impact & Future Works

Traditional RC car systems demand intense manual control, limiting access for individuals with physical disabilities. Our EEG-based BCI system offers an alternative by enabling users to control movement using brain signals alone. While demonstrated with an RC car, this serves as a foundation for future applications in assistive technologies such as EEG-controlled wheelchairs or prosthetic limbs. Moving forward, we aim to refine signal interpretation, improve system reliability, and adapt this technology to enhance mobility and independence for users in real-world rehabilitation and healthcare settings.