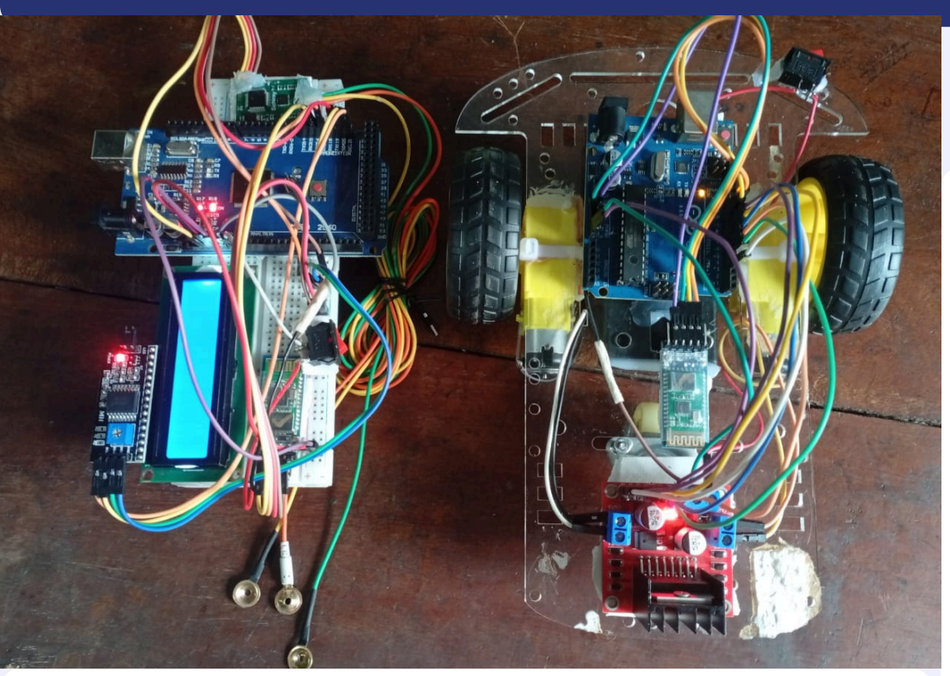
Rajshahi University of Engineering & Technology

EEG Rover- A Brain-Controlled Smart Wheelchair For Paralyzed People

Introduction

- Designed to assist people with severe physical disabilities.
- Arduino Uno processes the signals to control the wheelchair's movement.
- Combines neuroscience, embedded systems, and robotics.



Objectives

- to control the wheelchair without touching. This project is designed especially for disabled people who are not able to move from one place to another using their limbs.
- focusing on using affordable and easily available components, so this technology can be more accessible and not just something high-end hospitals can afford.
- The system should be able to understand these brain signals in real time and respond quickly and accurately to the user's thoughts or mental actions.

Result & Discussion

Necessity

1. manual control, which is unsuitable for paralyzed patient.

2. Joystick & Head controlled wheelchair are limited because of no motor control.

3. Eye tracking stuffs are useful but suffer from fatigue and calibration issues.

Rationale

This project focuses on creating a low-cost, Arduino-based brain-controlled rover using the TGAM EEG module. It uses attention and meditation signals to control basic movements like forward motion or stop. With components like Arduino Uno, L298N motor driver, and optional Bluetooth (HC-05), the system offers a simple, wireless, and accessible solution for brain-controlled navigation.

Expected results

Our designed and implemented system can run by analyzing brain signal and move without manual limb movement. The only thing we need to run our wheel chair battery connection and human desire.

Technical Design and Implementation

- Microcontroller: Arduino Uno processes EEG data from the NeuroSky TGAM.
- Motor Control: L298N dual H-bridge drives the motors.
- Telemetry: HC-05 Bluetooth modules provide wireless communication.
- Power Supply: LM2596 buck converter delivers 5 V for logic and 7.4 V for motors from a single Li-ion battery.
- Control Logic:
  Attention > 60 → Move forward
  Meditation > 60 → Stop
  Timed pulses → Turn
- PCB Design: Two custom PCBs (via KiCad):

Control Shield: Hosts TGAM, HC-05, and pin headers
Power Board: Carries L298N and screw terminals

- Design Rules:
- 1 mm power traces
- 0.3 mm signal traces
- 0.2 mm clearance
- 1.6 mm FR-4 board
- Continuous ground plane
- Decoupling capacitors at each IC
- Stitched thermal vias for EMI resistance and manufacturability

Addresses Complex Engineering Problem criteria

The EEG Rover solves the challenge of enabling mobility through brain signals for people with severe disabilities. It combines EEG signal processing, Arduino-based control, and robotic motion in one system. Using the low-cost TGAM module and open-source tools, we convert noisy brainwaves into real-time motion commands through modular design, signal calibration, and iterative testing, making the solution both accessible and practical.

Project Justification:

The EEG Rover enables affordable, hands-free robotic control via brain signals for people with disabilities. Using simple components (TGAM, Arduino, L298N), it combines EEG signal processing with embedded control. Designed for accessibility and low cost, it supports inclusive tech and serves as a base for future neural-controlled systems.

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Scan here for more details: