Project Proposal: NeuroDrive

1. Introduction

NeuroDrive merges Brain-Computer Interface (BCI) and AI-powered autonomous navigation to enable both automatic driving and mind-based intervention. Using NeuroSky's MindWave Mobile, the system interprets high-level brain states (like focus, meditation, or blink) to command a robotic car. Applications include accessible mobility, intuitive control, and smarter vehicle systems.

2. Key Innovations

1. Hybrid Control Paradigm - blends full AI navigation with mind-based overrides.
2. Affordable BCI Integration - leveraging low-cost, single-channel EEG sensors.
3. Intention-to-Action Mapping - e.g., blink -> stop, high attention -> move forward.
4. Smart Safety Blend - brain commands take priority over AI under specific triggers.

3. Technologies Used

- BCI Hardware: NeuroSky MindWave Mobile EEG headset (TGAM-series)
- Car Platform: Arduino/ESP32 + L298N motor driver + ultrasonic sensors
- Vision System: Raspberry Pi or laptop with OpenCV
- Software: Python, PySerial, Arduino C

4. Working Overview

1. EEG Module: headset streams attention, meditation, and blink signals via Bluetooth
2. Reader App: Python captures and maps signals to commands
3. Vision Module: CV outputs steering/obstacle decisions
4. Command Arbitration: Arduino/ESP32 selects between EEG and CV input
5. Actuation: Motors drive based on selected input

5. Time Estimation

- Weeks 1-2: Setup car chassis and test movement
- Weeks 3-4: Implement computer vision for path detection
- Weeks 5-6: Integrate MindWave headset and signal mapping
- Weeks 7-8: Final integration, override logic, and testing

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- Weeks 9-10: Field testing, tuning, and presentation

6. Components & Cost Estimation

Component	Qty	Approx. Cost (INR)	Total (INR)
NeuroSky MindWave Mobile	1	14,500	14,500
Car Chassis + Motors	1	800	800
L298N Motor Driver	1	150	150
Arduino Uno / ESP32	1	500	500
Ultrasonic Sensors	2	100	200
Raspberry Pi / Webcam	1	4,000 / 700	~4,000
Battery & Misc	-	700	700
Total Estimated			~21,850

7. Conclusion

NeuroDrive is a feasible, budget-friendly mini project combining EEG-based high-level intent with AI navigation. The MindWave Mobile provides reliable attention and blink detection. This project showcases interdisciplinary innovation spanning signal processing, computer vision, robotics, and human-computer interaction. It is well-scoped for a collegiate-level demonstration.