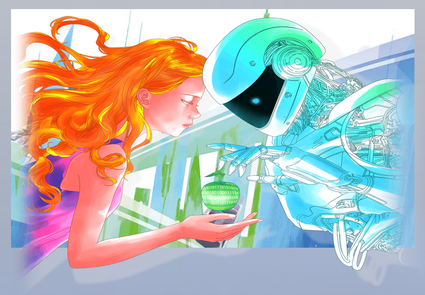


Brain control emergency takeover method and system for driver facing automatic driving failure

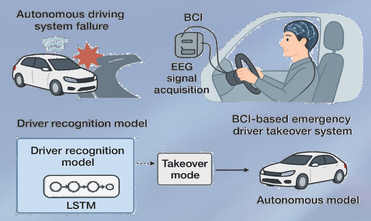
FORUM8

13th CPWC

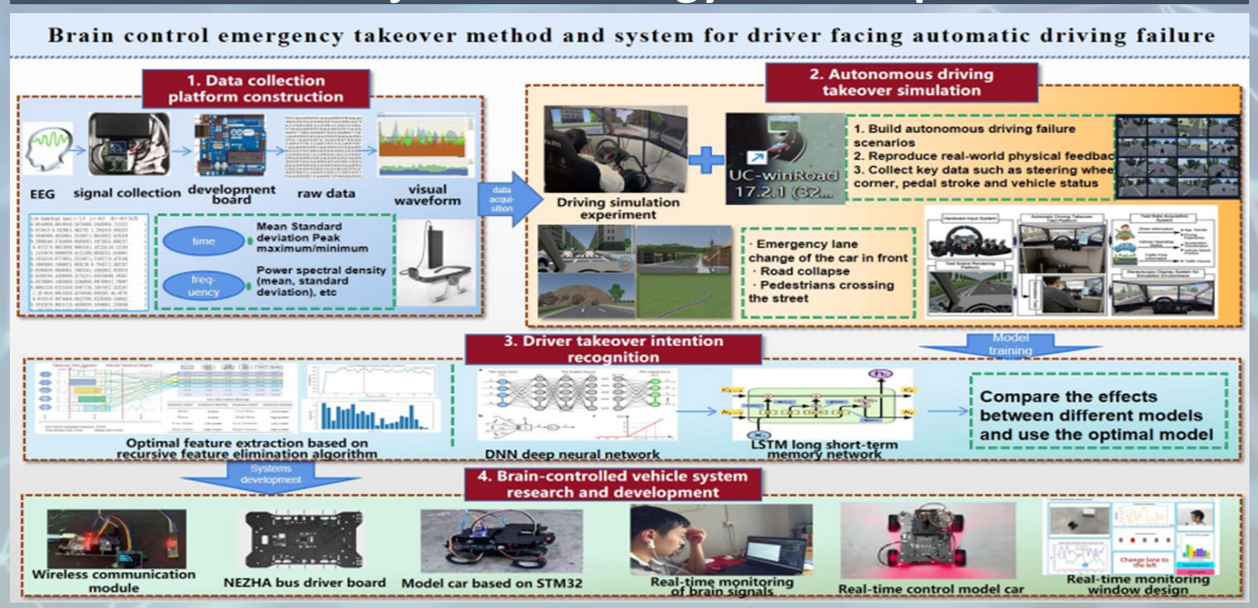
Intelligent Driving Escort Team

Overview

1. Establish an EEG data acquisition platform tailored for drivers in autonomous vehicles, ensuring real-time signal capture.
2. Construct a simulated environment replicating autonomous driving failures to provoke takeover scenarios.
3. Collect pre-takeover EEG datasets and develop a machine learning algorithm for early intent recognition with 90% accuracy.
4. Engineer an integrated brain-computer interface system enabling seamless software-hardware coordination for emergency vehicle control.



Project Technology Roadmap



Innovative Features

Key Innovative Points of the Project

A synchronous acquisition and processing platform for driver takeover control and physiological signals based on a driving simulator was developed.

A takeover intention recognition method based on drivers' EEG was proposed, and the BCI-based emergency takeover technology and hardware-software system for autonomous driving intelligent cars were developed.

Project Features

Real-time performance and fast responsiveness of takeover intention recognition and takeover control based on drivers' EEG signals are achieved.

The rapid takeover mechanism enabled by BCI technology allows the driver's intention to be recognized and converted into vehicle actions within 50 to 100 milliseconds—a level of real-time performance that traditional manual takeover cannot achieve.

Modular Design and Prototype Development of the BCI-Based Emergency Takeover System for Autonomous Driving Intelligent Cars

The research achievements of the project have been integrated into the model vehicle-based driver emergency takeover system, thereby realizing the transformation from theoretical research to practical application.

Research Methods

Construction of data acquisition and preprocessing platform

- EEG Signal Collection
- Eye-Tracking Data Collection
- Driving Performance Data Collection

Autonomous driving failure simulation

Driver takeover intention recognition

- Driver takeover intention recognition indicator system
- Selection indicators based on the recursive feature elimination algorithm
- Construction of the takeover intention recognition model

Development of the driver BCI-Based vehicle- mounted system

Application Prospects

(1) Utilizing brain-computer interface technology to achieve environmental response capabilities, effectively reducing reaction time in emergency situations.
(2) Providing people with physical disabilities the possibility of controlling vehicles through thought.
(3) It can be applied in fields such as military unmanned reconnaissance, hazardous environment operations, and medical rehabilitation.
(4) Incorporating physiological signals such as galvanic skin response and electrocardiogram enables more comprehensive monitoring of driver status, enhancing the safety of rapid vehicle takeover by drivers.
(5) Can be used to detect whether the driver is drunk driving.