Integrating Voice Control and AI Vision for Tracked Vehicle Intelligent Navigation and Autonomous Follow-Up System

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Abstract

This paper proposes an intelligent system based on a self-made tracked vehicle motor tracking control module to realize wireless remote control (RC), voice control and AI visual following navigation. The system receives the travel speed and rotation angular velocity from the NVIDIA navigator or mobile phone remote control through the vehicle control module, and calculates the required control speed of the left and right wheel motors. The PID speed control sends out PWM signals and GPIO signals to control the speed and direction of the motor drive respectively to achieve precise tracking control of the tracked vehicle. Combined with the ROS2 system built into Jetson Orin Nx, the navigation path of the tracked vehicle is issued based on voice and visual commands, and IMU sensing and motor encoder feedback are used to complete the navigation odometer to achieve precise navigation and control. In terms of navigation control, the system integrates 2.4G wireless remote control function, and realizes voice control and touch screen joystick control of mobile phone APP through ESP32 WiFi module. In addition, in terms of autonomous navigation, the web-based simultaneous localization and mapping (SLAM) navigation also uses YOLOv11 image recognition and PTZ camera vision capture to calculate distance and relative coordinates, realizing the autonomous following function of the tracked vehicle.