无人车控制系统软件开发

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摘　要：无人车技术融合了现代高科技与传统汽车技术，拥有广泛的应用场景和巨大的发展潜能。智能无人车将是未来智慧交通的重要组成部分，其中关键性的技术有环境感检测、路径规划、行为决策、路径跟踪、运动控制等，提高智能无人车的稳定性、安全性是无人车软件开发的重点内容。无人车的底层控制系统是智能无人车运动与自主规划的基础，它包括了软件底层各类驱动的开发，无人车各类传感器的信息采集，还要深入研究相关软硬件及控制理论完成对控制系统综合性能的测试。

软件开发主要实现无人车的横向控制与纵向控制，具体表现为前进、转向、刹车等基本功能。底层驱动的开发包含了 PWM 对电机的控制，CAP 模块捕获外部信号，串口通信实现数据收发，以及 CPU 定时器看门狗的初始化等。纵向控制分解下来就是对油门和刹车的控制，由于油门和刹车有着互斥的逻辑关系，所以纵向控制算法可以分解为油门控制算法、制动控制算法、控制切换算法。横向控制尽可能分析模型的各项参数预测出车辆的输入输出特性，在此基础上调试转向控制，从而确保横向控制的准确性。算法设计结合车辆特性使用了 PID 控制策略，根据车辆在不同状况下的运动状态，控制不同的输出速度，实现车辆稳定的运动控制。

关键词：无人车；底层驱动；运动控制；

Research on Software Development of Unmanned Vehicle Control System

Abstract: Unmanned vehicle technology combines modern high-tech with traditional automotive technology, and has a wide range of application scenarios and huge development potential. Intelligent unmanned vehicles will be an important part of future intelligent transportation. Among the key technologies are environmental sense detection, path planning, behavior decision-making, path tracking, and motion control. Improving the stability and safety of intelligent unmanned vehicles The key content of human vehicle software development. The unmanned vehicle's underlying control system is the basis for intelligent unmanned vehicle movement and autonomous planning. It includes the development of various types of software underlying drivers, the acquisition of various sensor information for unmanned vehicles, and the in-depth study of related software and hardware and control theory Complete the test of the comprehensive performance of the control system.

Software development mainly realizes the horizontal control and vertical control of the unmanned vehicle, and the specific functions are forward, steering, and braking. The development of the low-level driver includes the control of the motor by the PWM, the CAP module captures the external signals, the serial communication realizes the data transmission and reception, and the initialization of the CPU timer watchdog. The longitudinal control is decomposed to control the throttle and the brake. Because the throttle and the brake have mutually exclusive logical relations, the longitudinal control algorithm can be decomposed into the throttle control algorithm, the brake control algorithm, and the control switching algorithm. Lateral control analyzes the parameters of the model as much as possible to predict the input and output characteristics of the vehicle. Based on this, the steering control is debugged to ensure the accuracy of the lateral control. The algorithm design combined with the vehicle characteristics proposed a fuzzy PID control strategy, according to the vehicle's motion status under different conditions, control different output speeds to achieve stable vehicle motion control.

Key Words: unmanned vehicle; horizontal control; vertical control; path tracking