基于多传感器数据融合的姿态控制与应用

刘明亮　1，崔宇佳　1，张一迪　1，林海静　1，陆起涌　1,2
(1 复旦大学 电子工程系，上海 200433；2 复旦大学 信息科学与工程学院智慧网络与系统研究中心，上海 200433)

摘　要：设计了利用MPU9250九轴姿态传感器和STM32F103获取、处理姿态数据的智能吸尘器系统.考虑到在实际应用中嵌入式系统对实时性以及姿态检测准确性的要求，提出了一种算法——利用加速度、陀螺仪数据分别更新四元数并通过互补滤波算法进行融合，然后利用阈值中值滤波后的磁力计数据修正航向角,实现了系统对传感器数据的融合以及对载体姿态的估计.将算法应用于智能吸尘器平台，利用上述算法处理的数据进行姿态控制，通过仿真和实验证明了算法的可行性和有效性，实现了智能吸尘器姿态的准确控制.在姿态控制的基础上进行路径规划，可以提高智能吸尘器在室内清洁区域的覆盖率.

关键词：　〖HTF〗MPU9250；姿态检测；智能吸尘器；STM32

Attitude Control and Application Based on Multi-Sensor Data Fusion

LIU Ming-liang　1, CUI Yu-jia　1, ZHANG Yi-di　1, LIN Hai-jing　1, LU Qi-yong　1,2
(1 Department of Electronic Engineering, Fudan University, Shanghai 200433, China；　2 Research Center of Smart Networks and Systems, School of Information Science and Engineering, Fudan University ,Shanghai 200433, China)

Abstract：An intelligent vacuum cleaner system using MPU9250 nine-axis attitude sensor and STM32F103 which acquire and process the attitude data is designed. Aiming at the real-time requirement of embedded system and the necessity of accurate attitude detection in practical application, an algorithm is proposed - using the accelerometer and gyroscope to update quaternion respectively, and using the fast complementary filter to fuse the data. And then, the heading angle is corrected by the magnetic flux density which is processed by median filter based on the threshold value. Therefore, the system fuses data of sensors and estimates the attitude. To verify the feasibility and effectiveness of the algorithm, we applied it to the intelligent vacuum cleaner platform. The experimental results demonstrate that the intelligent vacuum cleaner using proposed algorithm realizes the accurate attitude control and can accurately select path. And path planning based on the attitude control can improve coverage of the indoor cleaning area for intelligent vacuum cleaner.

Key words：MPU9250; posture detection; intelligent vacuum cleaner; STM32

作者简介：
刘明亮　男，（1990-），硕士研究生.研究方向为多传感器数据融合与路径规划.E-mail:mlliu14@fudan.edu.cn.
崔宇佳　女，(1992-)，硕士研究生.研究方向为模式识别以及音频处理.
张一迪　男，(1993-)，硕士研究生.研究方向为信号处理及其应用.
林海静　女，(1994-)，硕士研究生.研究方向为嵌入式系统.
陆起涌　男，(1966-)，教授，硕士生导师.研究方向为智能控制、嵌入式系统、物联网技术等.