A12-011

作品名稱
具遠端監控／即時三維建圖與自主駕駛功能之智慧導覽系統
Intelligence Guide System with Remote Monitoring/Real-Time 3D-SLAM and Autonomous Driving Functions

隊伍名稱
五隻手指頭，才是一個拳頭！ / Two heads are better than one!

隊長
戴嘉輝　中山大學機械與機電工程學系

隊員
葉駿穎　中山大學機械與機電工程學系
蔡昀修　中山大學機械與機電工程學系
林家億　中山大學機械與機電工程學系

作品摘要

在全球定位系統（GPS）及智慧型載具普及化與蓬勃發展的環境下，定位與導航在載具上已是一套不可或缺的系統，然而載具仍需要由駕駛者來控制並配合導航設備來輔助駕駛，但此種方式卻隱含著不可預知的危險性，危及其他用路人與使用者。近年來，車用電子與行車輔助系統不斷的推陳出新，無疑是以提高行車安全，降低事故率為最終目的。

本作品開發一套以安全性為前提之系統，系統中包含自動駕駛與循跡移動、即時遠端監控、即時三維建圖與視覺辨識功能，作品中利用GPS路徑紀錄導覽路線做為自動駕駛參考軌跡，配合動態接收衛星資訊並判斷偏移資訊，透過模糊演算法計算使方向盤轉動，並配合前方雷射掃描儀進行車前障礙物偵測，達到危急停車，完成安全自動駕駛功能；為了能夠了解導覽車輛之位置與實現停車功能，作品在此導入智慧型手機作為接收車輛位置資訊與發送停車命令之平台，位置資訊透過手機接收即時車輛經緯度，並透過手機內建Google Maps將車輛位置標示出來，且手機使用者可於導覽車站發送停車指令，使車輛於該站進行停車載客與語音介紹之服務。

於自動駕駛中，作品加入視覺輔助系統，此視覺系統包含了三項影像技術，分別為道路線偵測、車輛辨識與行人偵測；其中道路線偵測可以做為GPS循跡偏移資訊的輔助，藉由道路線偵測可算出車道中心線，當GPS脫鎖情況下自動導入修正，維持車輛穩定性；而車輛與行人辨識系統則用來偵測車前行人或移動車輛，提供車前障礙警訊，輔助前方雷射掃描儀可能面臨的掃描死角，讓車輛能夠在有前方障礙物情況下安全停車。

系統導覽過程中，為使乘客擁有清晰的行車路線與環境地圖，作品中也首度使用三維光達（LiDAR）建圖系統，將行車路線中的所有環境建物以3D方式呈現，將三維環境資訊套疊於傳統等高線地圖，讓一般導覽地圖不再是冷冰冰的路線圖，而是具有三維環境建物資訊的高階電子地圖。

結合上述之所有功能，本作品完成一套具有高安全性與多功能智慧型導覽車輛，替未來的車用電子、大眾運輸以及地理資訊系統提供一項新的技術與選擇。

Abstract

Nowadays, the rise of intelligent vehicles and the global position system, the localization and navigation systems have become the most important components of vehicles. However the drivers can not operate the navigation system when driving on roads because this behavior is very dangerous. There is no doubt that the innovations in Automotive electronics and driving assistance systems enhance the traffic safety and reduce the casualty rate.

The purpose of this product focuses on designing an intelligent, safe, and robust system with automatic driving, vision recognition, remote monitoring and 3D mobile mapping. The reference trajectories of the automatic driving system depended on the recorded data from the Real-Time Kinematic Differential Global Positioning System. During the process, the offset and displacement angle of the vehicle are calculated and sent to the fuzzy controller to generate a suitable command to drive the steering wheel. In addition, a laser range finder is used to detect the obstacle in front of the vehicle. When the obstacle is too close, the breaking system will be executed to improve the traffic safety. Remote monitoring system must be an important subsystem that can find out the vehicle position real time. A smartphone is used to receive the GPS Information and send the stop command to the vehicle. In remote monitoring system, Google Maps navigation, GPS information and moving icon are displayed on the screen. Users can get the position of the vehicle easily. This product also provides the station services and users can command the vehicle to stop by using a smartphone. Then the system will take passengers on board and provide audio-guide services.

The vision system contains three functions including lane detection, vehicle detection and pedestrian detection. The information of offset and displacement angle from lane detection can assist the lost GPS signal to maintain the stability of the vehicle. In addition, vehicle and pedestrian detections are used to support the obstacle detection of a laser range finder for dead space scanning and let the vehicle stop safely.

In order to obtain the driving path and road map of the vehicle, the real-time 3D mobile mapping system is designed to measure the distance of objects around the vehicle by use of two laser range finders. Through coordinate transformation and data mapping, the system reconstructs the building with point clouds. The point clouds map is different to 2D tradition map. The 3D map contains with 2D contour map and 3D point clouds. The 3D map is not only a street map but also a street view map in 3D visual. This system proposes a lifelike 3D electronic map for passengers.

In summary, this work provides an autonomous vehicle with a high-safety and multi-functional intelligent guide system. We hope this system can bring a novel solution of automotive electronics, public transportation and GIS in the future.

指導教授

彭昭暐

中山大學機械與機電工程學系

1995年與1997年獲得元智大學電機工程學系學士與碩士學位，2003年取得交通大學電機與控制工程學系博士學位，2004-2008年擔任交通大學電機與控制工程學系研究助理教授。2008年加入中山大學機械與機電工程學系擔任助理教授迄今，成立「系統工程研究室」發展先進感測與控制技術，以實際系統整合與實現為目標，培育系統工程人才。

研究領域

自動控制、智慧型車輛、智慧型機器人、嵌入式系統、數位訊號處理、系統工程。