

## 作品名稱

基於嵌入式平台之智慧導航與行車安全系統  
Intelligent Navigation and Driving Safety  
System Based on Embedded Platform

## 隊伍名稱

北極星 North-Star

## 隊長

陳盈翰 交通大學電控工程研究所

## 隊員

王昱壬·林榮達 交通大學電控工程研究所

葉仲軒 交通大學電機工程學系



## 作品摘要

近年來，電子技術應用於汽車上的發展是一日千里，尤以導航系統與行車記錄器的需求與發展最為驚人。目前導航系統均利用GPS並搭配各地區的數值地圖，能夠規劃路徑與提供導引方向協助。但是目前的規劃方式均是以最短路徑為考量的結果，並沒有考慮到當下真實的交通情況，另一方面，目前的導航系統只適用於已有地圖資料的地方，若到一個如校園這種封閉、又無地圖資料的大型區域，傳統的導航系統便一籌莫展。

在行車記錄器的部分，隨著現代人對於行車安全的日益關注，以及相關硬體設備價格越來越親民，已儼然發展成汽車的標準配備。然而，行車記錄器只提供在事件發生後調閱當時行車記錄影像的功能，無法在駕駛行為不良時主動提醒駕駛，以確保行車安全。另外，傳統行車記錄器並未提供良好的檢視介面，使用者若需調閱就必須將整段記錄影像看完，缺乏效率。

鑑於上面所述的幾點目前導航與汽車安全產品的不足，以及實際生活的需求，我們設計出了North-Star系統，North-Star結合了高公局與運研所提供的全國路況資訊資料庫，提供國道以及一般道路的速度資訊及道路影像，並結合地圖資料，提供主動式智慧導航與路徑規劃服務。考慮到進入無地圖資料的區域後，人通常會下車採步行方式到達目的地，再加上智慧型手機的日趨普遍，因此在Android手機上實作了行人導航系統，提供更新地圖資料的功能，並以擴增實境(Augmented Reality, AR)導航的方式，導引行人到達目的地。

此外，North-Star利用一對攝影機搭配影像處理與辨識技術，偵測車輛前方道路資訊，判斷車輛目前是否車道偏離或是否與前車距離過近以避免危險的行車狀態，也同時將行車的影像以及相關狀態加以記錄，搭配系統的事件檢視器，提供方便的調閱記錄影像服務。

整體而言，North-Star以嵌入式平台（EDK6446 以及Android 手機）作為運算核心，結合行動網路、GPS以及攝影機，成功實現了以下幾項創新功能：

- 自動取得國道及市區道路之道路狀況及影像。
- 可提前避開壅塞或事件路段的主動式智慧型路徑規劃。
- 人性化的擴增實境導航。
- 獨特的前方車道線以及車輛偵測的汽車安全系統。
- 作品以單一嵌入式平台實現，符合實際需求。
- 創新的行車狀態記錄及事件檢視器。



圖一系統架構

## 指導教授

吳炳飛 交通大學電機與控制工程研究所

- 81年獲美國南加州大學電機工程學系博士，目前任教於交通大學電機與控制工程研究所。
- 現為交通大學特聘教授，曾獲資訊月傑出資訊人才獎、傑出自動控制工程獎、中工會傑出工程教授獎及IET Fellow，並屢次帶領研究團隊獲得國內重要論文及創意競賽。近年來投入於車用電子研究上，重要成果如「車輛偏離警示系統」，已技術移轉著名的汽車電子股票上市公司，並獲國科會「技術移轉獎」。
- 研究領域：訊號處理、先進車輛影像與控制系統及3C整合科技的應用方面。主要從事影像及聲音壓縮與辨識、智慧型汽車安全控制、嵌入式系統設計、小波理論的應用及晶片設計之研究。



## ABSTRACT

In recent years, the development of automotive electronics industry grows rapidly, especially in the demand of navigation systems and driving recorders. Traditional navigation systems use GPS and GIS information, integrating path planning algorithms to provide guidance assistance. However, current path planning algorithms focus on looking for the shortest path, and do not take real traffic conditions into account. On the other hand, traditional navigation systems cannot work without knowing the map information, which leads them ineffective in closed and large area like campus.

With the growing concern for driving safety, and prices getting lower and lower, driving recorders have become essential equipment in vehicles. Nevertheless, driving recorders only provide basic recording function, so they are considered insufficient in offering a safe driving environment. Besides, there is no friendly user interface for video viewing in traditional driving recorders. Even users only want to check a certain part, they have to examine the entire recording video, which lacks of efficiency.

Considering the deficiency mentioned above, we propose a North-Star system, an intelligent navigation and driving safety system based on embedded platforms. A cloud service providing real-time traffic information is established by integrating databases of Taiwan Area National Freeway Bureau and Institute of Transportation. With real-time traffic information, North-Star provides an actively intelligent navigation and path-planning service. This service automatically queries traffic information to detect the current traffic status. If there is a traffic jam ahead, the driver will be guided with a new path to avoid wasting time.

For the area lacking route and map information, e.g. campus, people tend to walk to their destinations. With the increasing popularity of smart phones, we implement a pedestrian navigation system on Android platform. Users can access and update map information of the area via QR code, and then the system can guide them to the destination in way of augmented reality.

Furthermore, North-Star applies image processing and recognition technology to implement a lane departure warning and forward collision warning system. This system would warn drivers if they deviate from lanes or do not keep a safe distance from the front car. In this way, the system can effectively reduce drivers' irregular driving behavior and improve the driving safety. Accompany with the lane departure warning and forward collision warning system, North-Star records timestamps when irregular events occur during video recording. Therefore, when the users review the recorded videos, they can easily access the interested part of videos with our customized video viewer.

To sum up, North-Star integrates mobile networks, GPS, and cameras to develop an intelligent navigation and driving safety system based on embedded platforms (EDK6446 and Android smart phone). Six innovations are successfully implemented in the following list.

- Automatically fetch traffic information and CCTV videos.
- An actively intelligent navigation and path-planning technology to avoid traffic jam in advance.
- User-friendly.
- Lane departure warning and forward collision warning system.
- Implementation on embedded platforms.
- Innovative driving video and state recorder and event viewer.