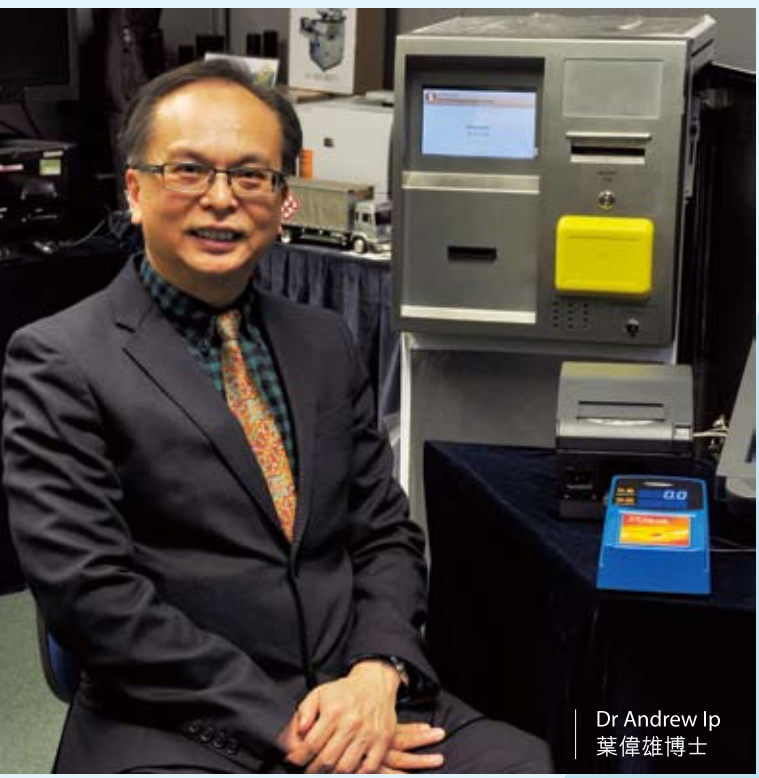
# Radio Frequency Identification Technology's Multi-application and Hong Kong Industries

As one of the most promising emerging technologies of the 21st century, Radio Frequency Identification (RFID) technology has been the focus of development work of many researchers. The rapid growth of applications of RFID technology can be easily found in daily life, ranging from auto payment systems to pets' identification chips. Among these applications, "Internet of things" (IoT) is listed on the National 12th Five-Year Plan (FYP) which states that IoT will be one of the nine major areas of development planning, and the establishment of IoT is one of the key demonstration projects.

Department of Industrial and Systems Engineering (ISE) of The Hong Kong Polytechnic University (PolyU) has engaged in the research of applications of RFID technology since 2000. "RFID itself is not new. What is new is how it is integrated with other management systems in unprecedented ways," says **Dr Andrew Ip, Associate Professor, ISE, PolyU**, who leads a research team on total RFID solutions for various industries and businesses. The team has spent years on research of applications and technological transfer of RFID, Wireless Sensor Network (WSN) and mobility technologies. They also provide tailor-made technical supports, consultation services as well as enhancement solutions to supply chain and logistics industries, helping them improve quality and reduce costs. They have co-operated with many manufacturers and business units and are currently working on an IoT-based "Advanced Automobile Parking Navigation Platform" with Sino Parking Services Ltd, and collaborating with Pok Oi Hospital to develop a tailor-made system named "RFID-based Electronic Nursing Management System".

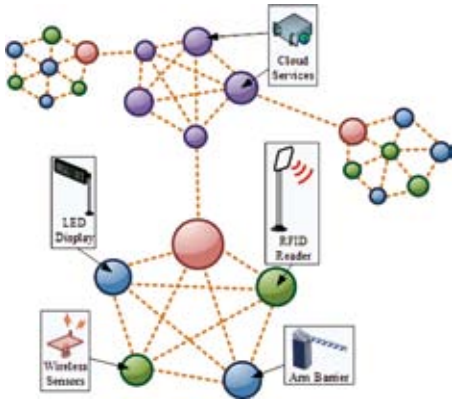


Dr Andrew Ip
葉偉雄博士

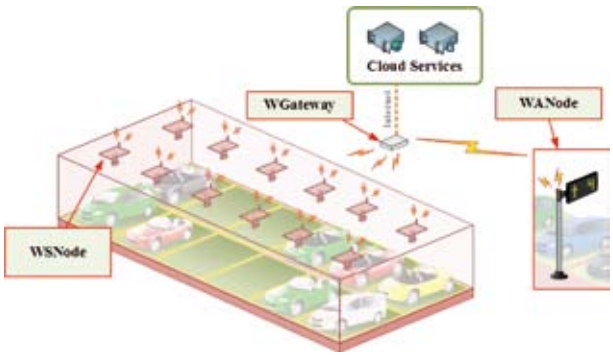
## What is RFID?

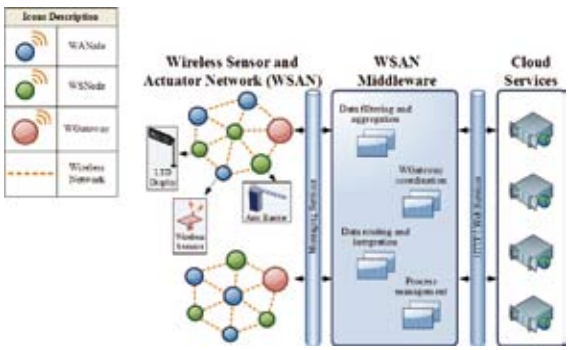
RFID technology is an advanced automatic identification technology. It uses radio frequency signals to acquire data remotely from tags within readable range. RFID technology has been widely used independently for a period of time already; moreover, its applications are becoming increasingly innovative. Nowadays, RFID technology integrates with other technologies and they are applied to a wider range of industrial processes. Dr Ip explained with a practical example that RFID tags can be attached to clothing labels during the garment manufacturing process. This application not only improves logistics management in bringing convenience of tracking products, but also enables investigation of consumer habits. To be more specific, the RFID technology can be used in inventory level recording. Consumer habits can then be analysed after the adoption of suitable data mining techniques. This is certainly an innovative way which integrates the academic

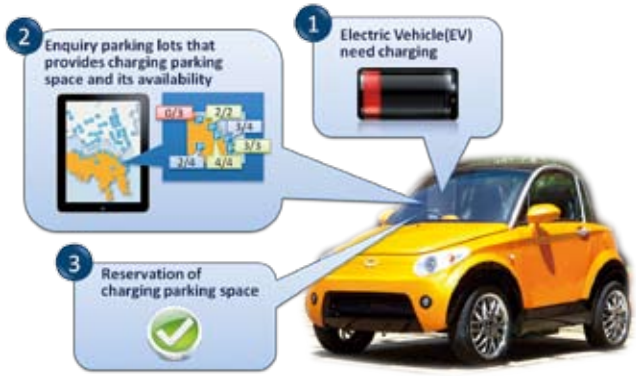
## Technology principles of "Advanced Automobile Parking Navigation Platform" 「先進車輛停泊導航平台」的技術原理








research result with commercial usage.

Dr Ip explained that RFID and WSN technologies are no longer individual technologies. In response to the FYP, his PolyU research team combines the emerging Cloud Computing, RFID and WSN technologies to promote the IoT technology in their research applications. The two latest projects that the PolyU research team are working on, one in collaboration with Sino Parking Services Ltd for the project "Advanced Automobile Parking Navigation Platform", and the other with Pok Oi Hospital's "Electronic Care Management System", are based on the IoT and RFID technologies to develop respectively.

### Project Principles

The two projects are very innovative and both hold their competitive advantages which mainly promote informatisation of system, automation and intelligentisation aiming at improving service quality and reducing workload of staff. The "Advanced Automobile Parking Navigation Platform", which makes use of IoT, WSAN, WSAN middleware and Near Field Communication (NFC) technologies, is aimed at providing customers with the most sophisticated vehicle parking navigation services. It replaces the traditional manual parking lot to optimise vehicle parking services and elevate the transparency of availability of vehicle berths, hence allowing users to find suitable parking spaces easier and quicker. This platform effectively allows greater flexibility and scalability of car parks and thus enhances the efficiency of parking system, benefiting both the car park operator as well as the customers.

The "Electronic Care Management System" which is launched by Pok Oi Hospital also makes use of the RFID technology. Together with the wireless networking technology and the installation of tablet personal computers (PCs) in the dormitories, the nurses can gain access to patients' information, such as their location, room status and diagnostic records, via the system in real time. This can avoid the repetitive process of recording information, thus improving service

quality and efficiency, as well as enhancing internal communications .

Dr Ip explained that the range of applications of RFID technology is wide and the applications can be very flexible. As long as his research team has a certain degree of understanding of an industry, they can provide innovative ways to make use of the above mentioned technologies and integrate them for improvement. He further elaborated that since the applications of RFID technology can provide a higher degree of transparency of supply chain management, the entire chain of operation process can then be visualised and re-integrated into Business Intelligence (BI), including knowledge discovery, data collection, Enterprise Resource Planning (ERP) and asset management, or even logistics and retailing. It is believed that the solutions offered by the team help various industries solve common problems and explore different business opportunities.

Dr Ip reiterated that these applications can bring positive impacts on both the upstream and downstream of manufacturing industry. Every industry can be benefited from enhanced service quality, optimised workflow and enhanced working efficiency through automation, intelligentisation and informatisation, especially for key industries such as manufacturing, medical services and logistics.

Dr Ip says that when PolyU co-operates with companies, the sharing of Intellectual Property Rights (IPRs) must not be overlooked. In addition, the users' awareness of existing viable


PolyU co-developed "RFID-based Electronic Nursing Management System" with Pok Oi Hospital.
理大亦與博愛醫院合作研發了「電子護理管理系統」。

technologies is always insufficient, that they may underestimate the potential of feasible technological solutions. Therefore, it is essential that his research team customise different methodologies for each individual company.

In conclusion, applications of RFID technology not only enhance productivity and operational performance of organisation, but also explore new business opportunities and promote the growth of new technologies as well as the development of IoT. "With support and sponsorship from industry and Government, our new laboratory will be completed in early 2013, and this will definitely bring positive impacts to our research on application of hardware, middleware and software innovation," says Dr Ip. He is hoping that, through PolyU's education and training, users will learn to be more open-minded in accepting new technologies. He also expects that the development trend of RFID and WSN technologies in the next few years will match with those listed in the FYP, and the gradual establishment of IoT will replace Internet and will lead to the transition of communication system from the Human-to-Machine system (H2M) to a Machine-to-Machine (M2M) system. Through the use of new technologies, the interaction, seamlessness and timelessness linkage among people, objects and systems can be enhanced, and thus our living standards. He also welcomes invitation for collaboration from SMEs and industries such as medical services, logistics, environmental protection, anti-counterfeiting and cultural conservation.

# 無線射頻識別技術的多元應用與香港工業


21世紀最具潛力的新興技術—無線射頻識別（RFID）技術已成為不少研究人員的重點項目。迅速冒起的RFID技術在日常生活中的應用極為廣泛，例子常見易尋，從自動付款系統到寵物身份識別晶片，幾乎無處不在。當中尤以物聯網（IoT）的應用更為不容忽視。「十二五」規劃提到，物聯網是九大領域發展規劃之一，而建立物聯網也將成為其中一項重點示範工程。

自2000年以來，**香港理工大學**（理大）**工業及系統工程學系**一直致力研究RFID技術的應用。該學系**副教授葉偉雄博士**解釋：「RFID技術本身並不是一項新技術，創新之處在於它如何與其他管理系統以前所未有的方式整合。」葉偉雄率領理大研究團隊為各行各業提供RFID解決方案，多年來一直從事RFID、無線感知網絡（WSN）與移動技術等的應用研究和技術轉移，並致力為供應鏈及物流工業界，提供度身訂做的技術支援、諮詢服務及各種優化方案，以提升品質和降低成本。他們曾與許多製造商和商業機構合作，目前正與信和集團旗下信和停車場管理有限公司共同設計及研發了一套利用物聯網的「先進車輛停泊導航平台」，以及與博愛醫院屬下屯門護養院合作研發基於無線射頻識別技術的「電子護理管理系統」。

## 什麼是RFID？

RFID是一種自動識別技術。它在可讀取的範圍之內利用射頻訊號，從RFID標籤遙距取得所需數據。RFID技術早在多年前已被廣泛運用，近年的應用亦越見創新，當中包括將RFID技術與其他技術整合或融入於不同工業工序之中。葉偉雄舉例，在生產成衣的過程中，可以把RFID標籤加進衣服標籤內，這除了方便物流管理以追蹤產品外，還可用作分析消費者的習性：譬如把RFID技術應用於存貨記錄中，並透過資料探勘技術分析消費者的習性，這無疑是一種創新的方式，把技術成果融入商業用途。

葉偉雄指出，RFID和WSN不再是個別題目，他們的團隊為配合國家「十二五」規劃，在研究應用中加入近年興起的雲端計算（Cloud Computing），以促進物聯網科技。而理大RFID方案實驗室（RFID Solutions Laboratory）早前與信和停車場管理有限公司


The "Advanced Automobile Parking Navigation Platform" is developed by the PolyU RFID Solutions Laboratory and Sino Group based on the IoT and RFID technologies.
理大RFID方案實驗室與信和集團基於物聯網和RFID技術共同研發了「先進車輛停泊導航平台」。

合作的「先進車輛停泊導航平台」，以及與博愛醫院合作的「電子護理管理系統」正正是分別基於物聯網和RFID技術而開發的。

## 項目概念

這兩個項目非常創新亦各具優勢，主要推動系統訊息化、自動化和智能化，從而提升服務質素及減少員工工作量。與信和集團共同研發的「先進車輛停泊導航平台」運用物聯網的雲端服務、無線感測制動網路（WSAN）、WSAN中介軟體及近場通信科技（NFC），並取代傳統停車場的全人手操作，優化車輛停泊服務及提高車輛泊位的透明度，讓駕駛者可以即時知道空置車位位置以便找尋。這個平台除了有效增加停車場的彈性和擴充性外，亦有效提高車輛停泊系統的效率，令停車場營運者與用戶均可得益。

與博愛醫院合作研發的「電子護理管理系統」則以RFID技術配合無線網絡科技，在院舍房間裝設平板電腦，讓護理人員透過系統便可取得實時資料，如院友位置、房間狀況和診斷紀錄等，以有效改善院舍的實務運作，護理人員可避免重複記錄資料，這不但可以提高服務質素和效率，同時更可加強內部溝通。

葉偉雄指出，RFID的應用既廣泛又靈活，研究團隊只要加以瞭解某一行業，就可以以創新的方法運用上述提及的技術，再加以整合，提供解決方案。他認為透過RFID技術可提高供應鏈管理的透明度，預視整個操作流程，再融入知識探索（Knowledge Discovery）和數據收集（Data Mining）等商業智能技術，或加入企業資源規劃、資產管理，甚至融入物流業，零售業等，研究團隊的解決方案實有助各行業解決常見問題，同時發掘各種商機。

葉偉雄強調，這些應用對工業生產的上游和下游均帶來好處，各行業可以透過自動化、智能化和訊息化提升服務質素，優化工作流程，並提升工作效率。而當中對製造業，醫療和物流的影響最為深遠。

葉偉雄表示，與企業合作研發的過程中，絕對不能忽視大學與企業在知識產權上的分配；另外，用戶往往對現有技術認識不多，而低估該技術的潛力。所以，他在與企業合作研發的過程中，許多時都需要靈活地與企業制訂特定的方案。

總括而言，RFID技術的應用不但可以提高生產力、提升營運表現，更可發展新商機、拓展創新科技及推動物聯網的發展。葉偉雄表示：「我們得到業界及政府的支持和贊助，新實驗室將於2013年初落成，用作硬件、中介軟體和軟件的創新應用研究。」葉偉雄期望透過理大的教育及人才培訓，使用者能夠接受新科技和事物。他亦指出，RFID和WSN技術在未來幾年的發展趨勢將繼續配合國家「十二五」規劃，物聯網會逐漸取代互聯網，並引領從人對機器（Human-to-Machine）到機器對機器（Machine-to-Machine）的轉變。透過新技術，不但可優化人、物件和系統三者之間的互動無縫實時連繫，更可改善生活質素。他亦歡迎與各行業如醫療、物流、環保、防偽和文化保育等合作。