AFC Saga：From a Magnetic Ticket to All Contactless Payments

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Abstract

As populations grow, cities and countries are pressed to provide their populations with increasingly more complex transport networks. Meeting these needs requires equally sophisticated transportation technologies. Here is a look at how some of these technologies have been improving the quality of life for people in Taipei and worldwide as well, and will keep doing in the future.

As in the National Palace Museum of Taipei where an impressive chronological table describes the evolution of the various civilisations worldwide over the past centuries, this article explains how Taipei choices for its public transport fare collection systems have fitted in the development background of this field, from magnetic tickets to be used in the MRT only to the contactless smart EasyCard, a mobility card enabling to travel anywhere in Taipei City.

New contactless form factors are coming now, from a contactless smart token for single journeys to the mobile phone which will be both a fare media and a personal way to buy a value and load it into the chip: no more queuing in front of a booth or a vending machine.

自動收費系統的重大事蹟

從磁票轉變到全面非接觸付費

摘　要

因爲人口的成長，使得各個城市及鄉村被迫提供其民眾日趨複雜的運輸路網，因此需要同樣繁複的運輸科技以符合其需求。本文係探討某些運輸科技過去對台北及世界各地人們的生活品質所作的改善及其於未來如何持續的進行。

如同台北國立故宮博物院內令人印象深刻的依年代次序排列圖表述說過去數個世紀許多文明國家的演進，這個主題說明台北所選擇的大眾運輸收費系統已符合此領域的發展背景，從僅適用於捷運系統的磁票到臺北市各處旅遊都可使用的行動卡－非接觸式悠遊卡。

新型的非接觸卡已問世，從單程票之非接觸晶片式代幣，到可兼作車費媒介及個人儲/加值時載入晶片之行動電話：亦即不再需要於詢問處或售票機前排隊了。

Business Development Director TFCS
Thales Transportation Systems S.A.

Major steps in the early years of Automatic Fare Collection

The use of the magnetic technology in public transport started in Montreal in 1967 with the opening of the 1st metro line: our company, named CGA at that time, originated this concept enabling the opening of automatic gates after the checking of the data on the magnetic stripe. This became a "standard procedure" to control access to metros: Paris, Mexico, Rio, San Paulo …

In 1974, due to its station to station fare system, the new San Francisco BART had to implement not only entry gates, but exit gates as well, and introduced the notion of stored value card with the calculation of the fare to be paid at exit. The fare cards were printed and a non sufficient remaining value could be transferred to a new stored value card.

In 1982, Hong Kong for the same reason also used stored value cards, but plastic ones with no printing capability, to be recycled within the system. Two main reasons for that choice: high humidity that would create jamming problems with paper cards and improvement of the life-cycle cost by recycling several thousands times the same plastic fare media.

History starts in Taipei

When the DORTS decided the construction of a metro in Taipei, it chose the latest proven and suitable technology available: an automatic fare collection system based on the use of recyclable plastic magnetic stripe cards.

As mentioned, such a system was already in use in the Hong Kong MTR. It was about to be implemented in the Singapore MRT. But Taipei added one more feature to reduce the risk of demagnetisation of the cards: the use of high coercivity magnetic stripes which was brand new in the market and needed to be processed by specific types of magnetic heads.

CGA, which was selected as the system provider together with K & C, was pioneering that technology and Taipei became an early adopter.

This magnetic stripe card was already enabling to carry a single journey ticket or a stored value as well.

At that time, the Taipei bus users could drop coins or a token into a fare-box to pay a single journey or buy a 10-journey paper card in a kiosk to be punched by the driver. In the 90's, some bus operating companies launched a magnetic stored value paper ticket, but that fare media was not compatible with the technology to be used in the MRT because of a lack of a common vision.

Actually, the DORTS was already aiming at enabling the use of the same magnetic card in the buses: as in a lot of places in the world, it took years to achieve that goal, until a political will pushed for it.

From the start of revenue service in 1996, the stored value became very popular among the MRT users, reaching a very significant rate of use among the passengers: 68% in 2002.

When new technology meets political goals

In 1994, with the rapid development of Taipei, a White Paper for Transport Policies expressed the strong objective to “create a civilised transport system for Taipei people”.

Among the guidelines that directed the actions to be taken were:

a humanistic transportation environment with people as first priority, cars as secondary,

a computerised transportation service and an integrated transportation system of high efficiency,

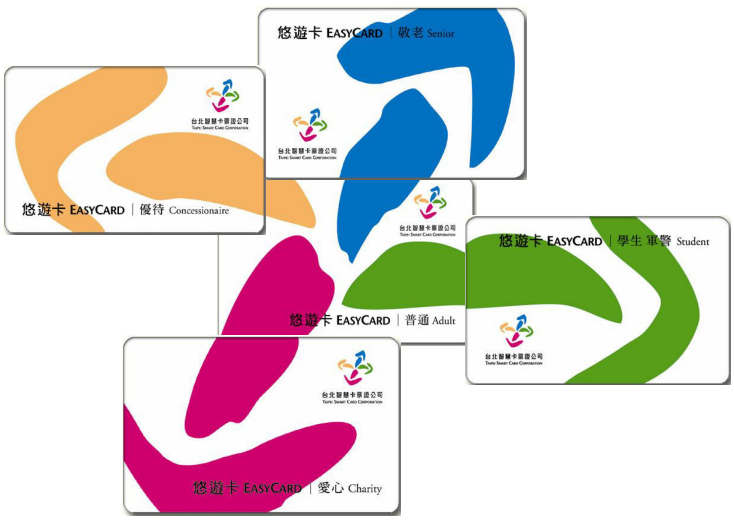
a fair traffic environment and implementation of user fees.

These guidelines led the Taipei City Government to set up in 1996 an Evaluation Committee to assess the application of a Contactless Smart Card（CSC）ticketing system and to decide, after a feasibility study driven by the Industrial Technology Research Institute, to invest in an ambitious integrated contactless smart card system with the political objective to provide “one card for all”, including the payment of parking lots in connection with the public transport network: the IC Card system.

A bidding process was launched in 1999 and the consortium that we built with our partner Mitac was awarded the contract in February 2000. The card technology to be used was the most widely used worldwide: the Mifare 1 card. But Taipei pioneered the use of diversified keys to improve the security of that memory card, and was actually the first one worldwide, and Thales CGA was the first system supplier to provide that technology.

New venture

In March 2000, Taipei Smart Card Corporation（TSCC）was established to set up and operate the CSC integration system. TSCC invested to set up back-end and front-end systems for service providers, banks and retail shops, being in charge of operation, repairs and maintenance, coordination, etc...



The brand name chosen for the IC card project was EasyCard. The launch in TRTC took place in June 2002. It started in buses in September 2002.

The EasyCard is loaded with a NT$ value enabling its holder to travel all over the public transport network: each operator deducts the appropriate fare to be paid from the EasyCard stored value used by the passenger in relation with a relevant transfer policy to encourage the use of public transport.

The first stage of the project included the implementation of EasyCard in the MRT（64 stations）, the 5 000 urban buses operated in Taipei City and part of Taipei County and 47 city owned gated parking lots:

☆ All fare gates in the MRT stations were upgraded with a contactless card reader but kept the existing magnetic card reader.

☆ All buses have been equipped with a stand alone contactless card validator that replaced the former magnetic card validator; fareboxes has remained to enable occasional passengers to still pay with coins.

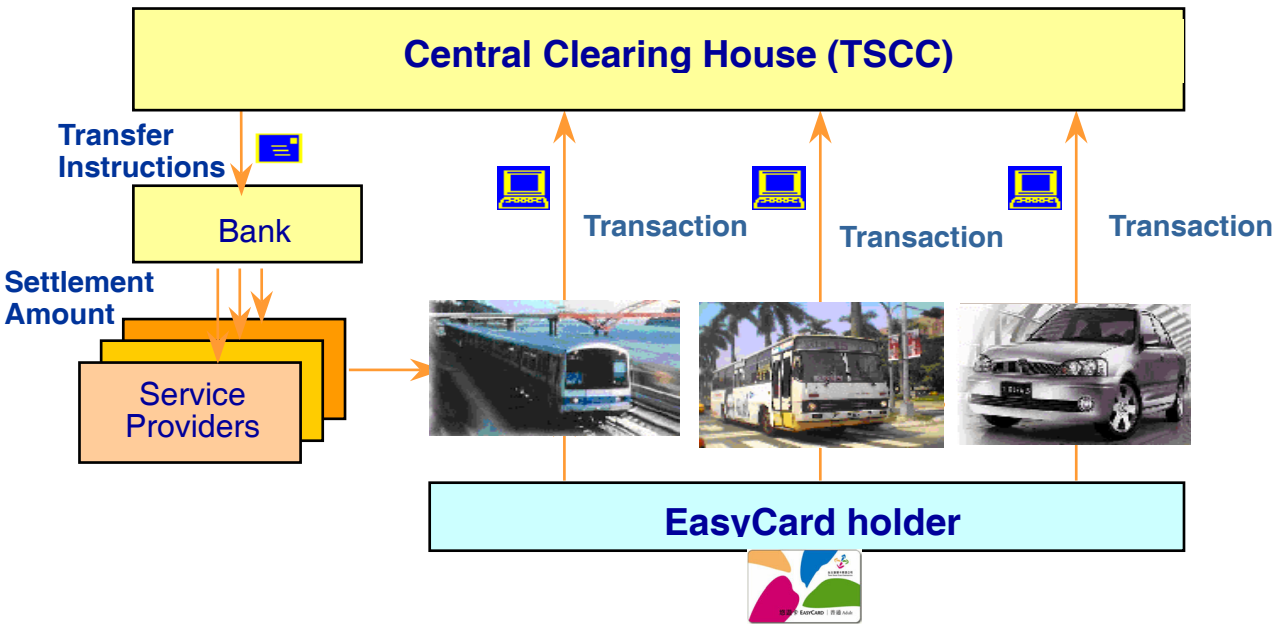
☆ All public car parks entry and exit gantries have been upgraded with a contactless card reader.

The EasyCards can be reloaded at MRT sales outlets or at AVM（Add Value Machines）or in convenience stores equipped with point of sale terminals.

All the transaction data stored in the various card accepting devices are downloaded into the related Central System to ultimately feed the Clearing House which every night apportions the revenues collected from the stored values between the operators.

The system has been extended to some taxis and to on-street parking: those new fields are still at a pilot stage.

The system is organised according to the following chart:



The benefits of EasyCard concern the passengers（one card for all, speeding passage, decreasing usage of coins）as well as the Taipei City Government（transport improvement, operation integration, credibility for fare and subsidy policy）and the transport operators（management improvement, operator co-ordination, cost reduction）.

A new step on the move

The second stage of the project is taking place right now: the MRT network is growing from 64 to 104 stations with the extension of existing lines and the construction of new lines. DORTS & TRTC have decided to move to an all contactless solution, replacing the existing magnetic stripe cards by contactless smart tokens with the same recycling principle. Therefore, all the gates in the existing stations will be replaced by new ones. The single journey token system will be in operation in August 2007.

The token is read at the entry gate and encoded with the entry station and price paid. At the exit gate, the traveller inserts his token into a dedicated slot, which only opens when a token with enough value is detected. No foreign object is accepted. The token is then electronically cancelled when falling down to the internal container. To perform these functions, the card reader located in the gate controls 2 antennas.

Once a day, that container will be removed and carried safely to be loaded into a Token Vending Machine.

This solution was developed for the Delhi metro, and was also implemented successfully in Bangkok and Nanjing. Once again, Taipei chose the most cost-effective and suitable solution.

Getting rid of the magnetic technology means savings for the capital cost and for the yearly maintenance as well, because there is no more moving parts in the equipment.

Trends for the future: new applications, new sale channels

One of TSCC goals is that the EasyCard evolves towards an electronic purse and get into non transport applications such as retail and recreation business, although its statute mentions that its assigned field is transport. For such new applications, a banking license is required and TSCC will have to get one as Octopus Cards Ltd did in Hong Kong.

TSCC is also looking to combine the use of EasyCard with an ID function which would enable post-billing or a loyalty program. The main targets are universities and schools to integrate a student identification in the EasyCard.

New technologies now also enable to purchase a value through the internet: a web server to process the request for a card number and a bank server to pay for it. The card number is downloaded into all the front end equipment so that when that card number is identified in an action list, it is automatically loaded with the purchased amount. No need to go through a booth or a TVM.

There are now some models of mobile phone that have a contactless chip additionally to the SIM card, using the NFC（Near Field Communication）： this enables to implement various functions that will allow to buy a value and to load it into the contactless chip. No more queuing in front of a booth nor an Add Value Machine. The mobile phone will be used as a contactless card in front of the same front end equipment.

So simple ! But so complex backstage.