

Improvement in Ticketing System for Public Transport by Using Smart Technology

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Abstract— This paper introduces a smarter and intelligent ways of ticketing in public transport such as in BMTC, rather than conventional paper tickets and punched passes, the intelligent and foolproof methodology proposed are a smart card, magnetic cards, barcodes and QR codes, and e-ticketing by mobile apps. In this paper practical outcomes of using smart technology have been analyzed, use of contactless smart card has also been focused. The futuristic technologies call for an effective solutions—namely virtual ticketing system that might be achieved through the introduction of cellular communication and technology. These characteristics are based on system architecture, which has two main generic elements: the mobile device model and user application model.

Keywords— Smart Cards, PDA's, Bluetooth, Card Reader, SMS, Interactive Voice Response Call Center.

I. INTRODUCTION

A huge number of people travel in public transport every day, as in conventional ticketing system there are many problems faced by commuters such as unavailability of change, as it is difficult to have coins with us every-time we board a public transport, another problem faced is the paper tickets are not fool-proof, especially when verifying a handwritten pass.

Hence a system should be developed which is capable of integrating with the infrastructure of the transportation system and are aimed at saving time and costs, ensuring safety and security, reducing congestion, providing real-time traffic information, etc.

The widespread of mobile communication and networking has supported devices and helped them in incorporating newer system which can process automatic payments. The use of those devices in the payment systems has some merits which have been stated below:

- Quick access to service.
- Improves the simplicity of the resources and services.
- Demand variation and exploitation costs are reduced since the cost is shared with the clients, and also they provide the devices to support payment.

The development of those new payment systems requires many brainstorming sessions since there are very few standardization options. A well-planned design flow will allow the companies to adapt themselves in a fluid manner to the wide variety of communication devices and prototype, and to make their experience more comfortable.

In this paper, we will describe an automatic payment system based on a variety of mobile communication and information support devices that are currently increasing both their use and their technological development.

II. AIMS AND REQUIREMENTS

A. An Overview

The chart beneath quickly shows the principal benefits and negative marks of different ticketing frameworks that are utilized as a part of urban open transport frameworks (Table 1).

In spite of the fact that there are only a few qualities which have been looked at and spoken to as a table, one can without much of a stretch see there are not kidding disadvantages of the paper tickets framework in contrast with all others ticketing system accessible.

No scientific model can be utilized for registering on approaches to upgrade the urban transport framework in light of constrained potential outcomes of the paper ticket framework. Physical security issues, i.e. distortion of paper single tickets or passes are additionally significant. In any case, there are some straightforward routes created to anticipate adulteration, for example, goes in BMTC are secured with a multidimensional image, one of which glimmers under the sunshine and the most dynamic arrangement is the presentation of alleged e-ticketing approach.

The improvement of these computerization has prompted a few prerequisites which we can condense as the accessibility of flexible installment electronic gear and gadgets, which has upheld an assortment of modes and customization parameters, advancement of preparing and correspondence components which have allowed us to lessen collaboration to the base, and improvement of systems ensuring information and exchanges

security. These days, contactless smart cards have filled the hole by satisfying great the prerequisites which have been joined in the most recent years into ventures installment frameworks.

B. Smart Card Solutions

Smart cards were created and protected in the 1970s. The most widely recognized applications are – charge cards. The fundamental contrast between the magnetic strip cards and the

smart card is that it contains an installed chip rather than a magnetic strip. The chip is under brilliant contact cushion on one side of the smart card. This is utilized for security. Smart cards can be pre-stacked with certain fiscal esteem, contingent upon the traveler's needs.

The smart card more often than not should be filtered for not as much as a large portion of a moment; the working principle of contactless smart cards appears in Fig 1.

No.	Type of ticket	Validating	Advantages	Disadvantages	Application in Intelligent transport systems and services approach	
1	Paper tickets	Mechanical or electromechanical punching	Cheap to produce. Easy to use. In a case of improvement of systems – costs of withdrawing are comparatively low	Weak protection, risk of falsification. Not multi-functional. Not effective for under-ground urban transport. Does not allow tracking of passenger flows, boarding and disembarking	Incompatible	
2	Paper daily, weekly, monthly, quarterly, tourist passes	Generally no punching	Simple , easy to make	Falsification	compatible	
3	Paper/plastic cards/tokens with magnetic strip (or two strips) – single use and passes.	Card readers – contact validation	Better protected than those made of paper. More durable. Information Gathering options. Very thick and light	Need for contact punching. Risk of <u>disfunctioning</u> or failure on readers. Magnetic strip becomes vulnerable to stronger crease or other contact	Might be duplicated for <u>random travellers</u> or tourists that do not need electronic tickets if the magnetic ticket-ing system had been introduced before launching the electronic one	
4	Smart cards (electronic tickets)	Contact smart cards	Insertion into card reader	Very convenient validating and multifunctional <u>application</u> of smart cards (the same card might be used for parking, library, shopping, etc.)	Expensive to introduce. Risk of fake smart cards – tickets still exists.	Intelligent solution. Well functioning and fast developing ticketing system
		Contactless smart card	Remote scanning			
		Dual interface cards	Allow both ways of validation			
5	E-ticket	SMS-ticket	Via Bluetooth of mobile phone, palms, PC's. Contactless validating	Ticketless or printing on request system. No cash payment. Safe payment, convenient use	Expensive to introduce. Lots of special technical requirement, system should be organized.	The most progressive solution of ITS application in ticketing system.
		WAP page – ticket				
		Printed on request				

Table 1.Comparison of Ticket Type.

There are two fundamental block – logic block and the memory block, radio handset (transmitter-collector) and reception apparatus.

Correspondingly to contact smart cards, contactless smart cards likewise don't have a battery. Rather they have a worked in the inductor to catch a portion of the incident radio – frequency, correct it and utilize it to control card's gadgets.

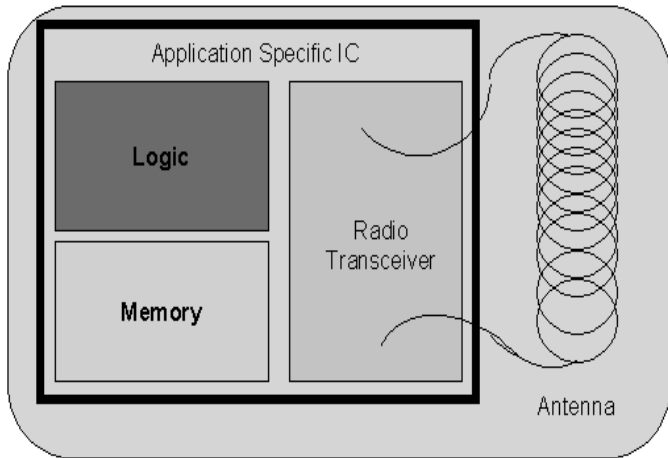


Fig.1. Structure of Contactless Smart Card

Both contact and contactless cards and their perusers can be effectively fitted for people in general transport ticketing. The principal concern is a cost of all framework to be presented. Indeed, if there should be an occurrence of smart cards utilization in broad daylight transport frameworks, contactless cards are great. Where threatening environmental conditions exist, for example, when the card reader is presented with overwhelming precipitation or when contaminants are available, contactless innovation offers a critical preferred standpoint over any contact innovation.

The combi-card is a very late advancement in brilliant card innovation that joins the attributes of both the contact and contactless cards, i.e. they utilize both contact and contactless innovation in one card. Combi-cards can likewise contain two unique sorts of chips as opposed to a double interface card where a solitary chip oversees the two capacities. These cards are additionally utilized as a part of open transport frameworks.

III. E-TICKETING PRINCIPLE

Numerous imaginative frameworks went for paying open transport charges have been produced. One of these is an installment over compact gadgets and in particular the best and helpful is an installment over cell phones. The capability of e-ticketing through versatile gadgets (as indicated by reviews, approx. 90 percent of travelers carry mobile phones).

A rearranged general plan of e-ticketing in an urban open transport appears in Fig 2.

The e-ticket can be checked by auditors or conductors just by perusing an SMS message to demonstrate the installment and approval of ticket by means of the compact gadget.

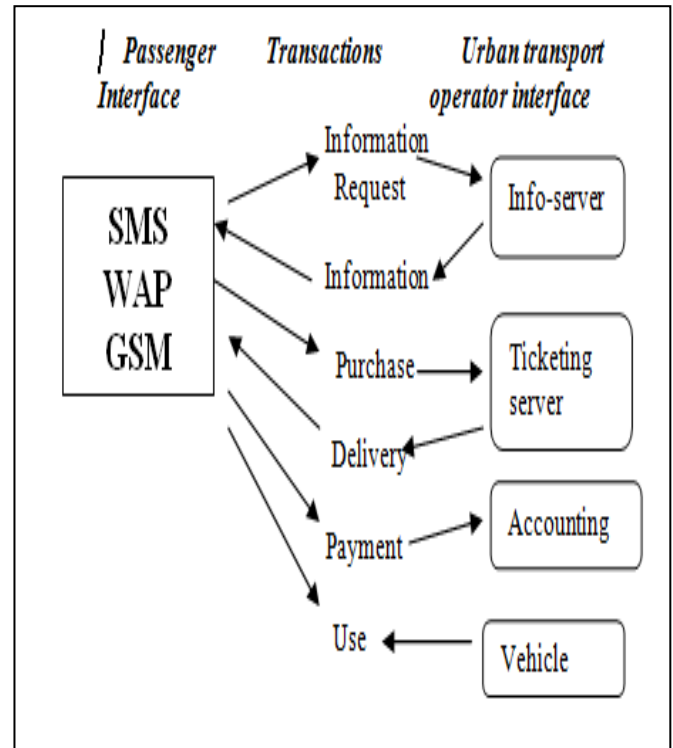


Fig.2. A Generic Example of E-Ticketing.

IV. TELEPAY TECHNOLOGY

TELEPAY – the undertaking went for setting up the specialized, lawful and business practicality of a buy and installment framework for virtual e-ticket through cell phones, utilizing SMS, WAP, and short-range correspondence innovations. The results of the TELEPAY venture served for the further changes of creative arrangements related with e-ticketing in broad daylight transport frameworks. The said venture distinguished the primary framework prerequisites. Considering the bland framework design, a typical innovative (correspondence) stage in light of SMS-WAP For the situation of shut frameworks, a short-range correspondence interface was utilized to open the boundaries/entryways. Short-go correspondence was utilized for the approval of the e-ticket. The installment was performed through the phone bill or utilizing paid ahead of time SIM (Subscriber Identity Module) cards.

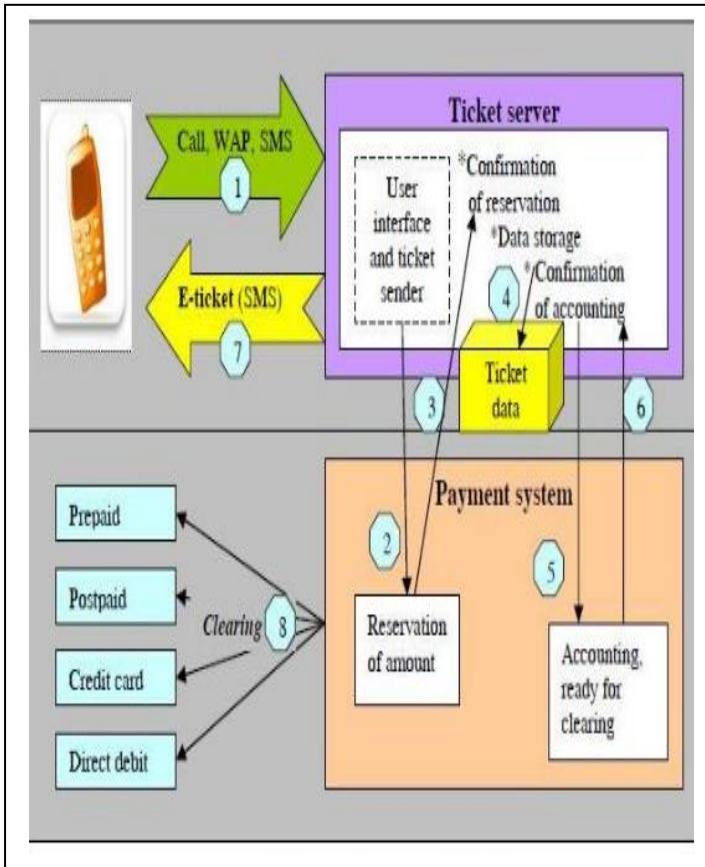


Fig. 3. TELEPAY Solution of E-Ticket System.

A non specific model proposed by Siemens Mobile Organization for TELEPAY venture appears in Fig 3 (Circle shows successive advances).

As should be obvious from the model, travelers have a few options for getting e-ticket: Using advances of a cell phone, one can utilize these administrations gave by GSM (the Global System for Mobile interchanges) systems:

- SMS (Short Message Service), which permits transmission of a message containing data on e-ticket (SMS must be no longer than 160 alphanumeric characters).
- EMS (Enhanced Message Service) – a standard that permits transmitting symbols, sounds or other rich substance messages.
- MMS (Multimedia Message Service) – a standard that will supplant SMS and EMS.
- WAP – (Wireless Application Protocol) – an open detail, that enables clients to in a split second access and interfaces with data and portable administrations.
- GPRS – (General Packet Radio Service) – a non-voice benefit that enables data to be sent and got in organizes.

- Bluetooth – control proficient minimal effort radio framework intended to interconnect cell phones, PCs, scratch pad, palms and different gadgets.
- Infrared – minimal effort interconnection standard that backings point-to-point client display.

As it was specified sometime recently, unique administrations may be utilized for various objectives – i.e. WAP for data recovery, Bluetooth – for quick opening of gates, SMS, MMS for getting e-ticket on the screen of a cell phone, and so forth.

V. SECURITY

All in all, the security is a basic part of any installment framework. Subsequently, there are universal details on the installment frameworks, particularly we have considered the CAO suggestions about passwords security in contactless brilliant cards. Considering that in our framework the methods for installment are upheld by nonproprietary innovation gadgets such as PDAs and cell phones, security is a key issue. We have recognized three fundamental security matters. In the first place, confirmation of customer application; a customer application cannot be duplicated, consequently, any customer application must be related to an extraordinary client and a one of a kind installment gadget. In our framework, each customer application checks that it is running on the gadget where it was introduced. In this manner, a fundamental necessity of the installment gadget comprises of giving an administration to get the exceptional distinguishing proof key related to the gadget at run-time. Second, get to control to the applications; any entrance to information structures and application charges must be finished by approved clients. On the off chance that an unapproved get to is recognized, the exchange must be rejected. Lastly, exchanges control; unapproved customer applications must be identified and dismissed by the foundation.

Another exchanges control viewpoint comprises of the recognition of deficient exchanges. When it happens the framework needs to finish the exchange without anyone else.

At long last, the framework needs to allow sound-related procedures that enable the organization to check the satisfaction of the security standards. To accomplish this prerequisite it is essential the traceability of customers operations.

VI. EXAMPLE OF PUBLIC TRANSPORT

In this area, we outline how the framework has been connected to people in general transport setting. Particularly we disclose how to actualize two sorts of electronic tickets.

Ticket of settled ventures: It comprises of a limited number of excursions with flight point and entry point that can not differ. Each time the customer utilizes this ticket, one outing is

decremented. Transport electronic cash: It comprises of a measure of cash that can be spent to pay a self-assertive excursion.

The utilization of the electronic tickets takes after these means:

- **Setting discovery:** The application is sitting tight for the setting recognition state. Before it is achieved, the application can ask for some data. For instance, to utilize the vehicle electronic cash, the application must demand the goal point.
- **Confirmation of the application:** This progression comprises of sending a setting validation stuffed in a component of the foundation. This allows the customer application to leave the holding up state.
- **Setting data to ask for:** In this progression, the customer application asks for some setting data on the off chance that it is expected to run any summon.
- **Approval:** The customer application sends an information parcel and summons bundle to a component of the foundation to approve the application.
- **Affirmation:** The approval component of the foundation sends to the customer application the refreshed information.
- **Enlisted:** The customer application enrolls the refreshed information in its information structures put away in the installment gadget memory.
- **Exchange warning:** The customer application sends a parcel of finish exchange notice to the foundation.

The information utilized by these customer application illustrations are the accompanying. Customer individual information; this arrangement of information comprises of no less than a one of a kind recognizable proof key related to the customers and a special ID key related to the application. Electronic ticket arrangement information; they determine the kind of electronic ticket and other particular parameters required by the electronic ticket. Lastly, development's history enrolling all utilization of the ticket.

VII. CONCLUSION

In this paper, we have portrayed the fundamental parts of a programmed installment framework for open transport. This framework can use as methods for installment utilizing diverse sorts of cell phones: brilliant cards, PDAs and cell phone. This remarkable limit enhances the conventional installment frameworks utilized as a part of people in general transport setting. E-ticketing depends on paperless or "virtual" ticketing framework that makes it exceptionally appealing and helpful for travelers. This is the most inventive arrangement, which has just been effectively connected in urban open transport frameworks.

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