Smart Transit Ticketing System (using LPC2148 and Smart Cards)

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Abstract— The main goal of this paper is to improve daily problem of public bus transportation system. Traditional method of ticketing is like every bus has one conductor who will collect money and issue ticket to each passenger. This process takes lots of time and more use of paper, it also create manual error sometimes. Also money exchange problem, ticketing problem etc, to overcome that problem a new system is introduced i.e. Smart transit ticketing system. Similar system was introduced for railway transportation system but not for bus transportation system in India. Smart transit ticketing will provide clear and smart ticketing without any manual error. It includes smart card reader, LPC2148, keypad, LCD display. A smart card will store information about passenger like name, amount, a unique ID number etc. Passenger will keep that smart card with him whenever he wants to travel through bus. When passenger will travel along a route he will give a smart card to conductor. The conductor will swipe that smart card in smart card reader device. All the information will get read from card and will be displayed on the device. According to destination stop, conductor will do entry and required amount will get deducted from the account of smart card holder. Like this one by one entry of each and every passenger will get done in smart card reader device by conductor. Then smart card will hand over back to passenger. In more advance way encryption and decryption term will get add for security purpose.

Key words: LPC2148, Smart Card, Keypad, Smart Card Reader Device

I. INTRODUCTION

In developing countries like India, many fields were developed and many fields are developing, also more and more advancing is in process. Nowadays transportation is also one of the more focusing fields. As people from ruler area come and stay in big cities like Mumbai, pune, delhi etc. due to that population of such metropolitan cities increases. So each and every person according to their convenience or luxury level buy their own vehicle and used it for daily routine. Public transportation system is not providing that good service hence private vehicles are moving on roads. Because of that two major problems get face by people daily. First problem is traffic, lots of vehicle moving on roads at a time which creates blocking or traffic jam. This takes more time for smaller distances and irritates a person. Second problem is pollution, one of the reason for global warming. These two problems are big enough to sick attention. So nowadays while accepting new life style one thought should be kept about reducing such problems. There are chances to improve public transportation by adding new techniques and removing old methods from system. If public transportation shows good outputs after adding new technologies then more and more people will use it and so number of vehicles on road decreases. This will show beneficial changes. Public transportation in metropolitan cities includes railway system i.e. (locals),metro and bus system. From this three systems bus transportation system is less developed. But this system is used by huge number of people. It is major source of income. But as it has some flaws, people on bus transportation is reducing. There is scope of improvement for such flaws. Problems faced by them are money exchange problem, ticket issuing problem, pick pocketer etc. Such problems are overcome by this new system i.e. Smart Transit Ticketing System. This new system will reduce time of ticketing. This system provides easy way of ticketing for conductor as well as passengers with help of smart card and smart card reader device.

Two main components are present in Smart transit ticketing system one is smart card and other is smart card reader device. Passenger has to hold smart card with him only no need of money for travelling. Each passenger will hold a smart card. Conductor will hold a smart card reader device. Smart card contains information like Name, amount, unique ID number etc. Smart card reader device will read all above information with the help of smart card reader. According to destination stop of individual passenger, entry will get done and according to that amount will be deducted from smart card. This information of deduction in amount will get stored in microcontroller in smart card reader device. Instead of these two components, it also include micro-controller, LCD, keypad etc. This system can be expand by using of IOT i.e. Internet of things in future.

II. EXISTING SYSTEM

The existing system of bus ticketing does not easily clarify the boarding place of passenger, the route of the bus, how much time the bus will take to travel up to the destination. Hence most of the time passenger is confused or rather new passenger on the said route is in trouble while travelling in bus. A. A. Nunes et al(2016)[1] introduced a smart method of AFC i.e. automatic fare collection for ticketing. This system describes new validation features which give accuracy of destination and travel route. The methodology in this system helps to enhance the raw AFC system data with the details of individual journeys. This paper describes development of algorithm to implement the methodological results and its applications to bus ticketing services or bus service data. The data of new AFC system integrates automatic vehicle location, records a transaction of each passenger, the route of the bus, the travel card used by the passenger along with time and the location where the journey began. This data is easily accessible in the system whenever required.

F.Araujo et al(2014)[1] realized the challenge of creating an electronic ticketing system for public transport, which can be able to run on the cloud. This challenge was discussed considering the scope of an industrial project. The final system should reach a large number of customers and may provide two key advantages: lower operational cost, for

smaller clients without IT departments, and faster execution of queries for periodical requirements of analysis, using the user friendly cloud-based resources. To achieve the targets of the project, a system was introduced with very standard technologies and procedures like three-tiered architecture; a separation of the online and analysis database; and an Enterprise Service Bus to collect the input from very diverse hardware and software stacks. This work defines many features to be considered as preliminary, and some open details remain for future work like comparison of existing system and smart card system. In respect of public transport the quantum of city buses and state transport buses is very large, also count of people travelling by buses is very high. This transport also gives major revenue to local NagarPalika and corporation even to state government. The introduction of this smart card system in this public transport will help faster services to public, easier mode of operation for employs in the buses and errorless transaction for the respective organizations and public as well. Following are some table which describes and compare new methods which were introduced and what are advantages and drawbacks of it.

Existing System	Smart Card System
The current system works in following phases	The smart system works in following phases.
Money is directly provided by the passenger to the conductor as ticket is issued.	Smart card is provided to the passenger.
According to the amount that is decided for a particular trip, the amount is taken from the passenger.	Here conductor swipes the card on the reader, entry for the trip is done and amount is deducted from the passengers account/card.

Table 1: Comparison of existing system and smart system

In Pune, in 2008 PMPML transport service was started. Traditional ticketing method was adopted for that purpose.	 Fig. 1: Photo 1
Later on, the system was developed and transformed into electronic based ticketing system. Diagram shows the handheld machine used for ticketing purpose.	 Fig. 2: Photo 2
	A system was developed in which on issue of ticket a message was sent on the passenger phone.

Table 2: Details of changing in modes of tickets

III. PROPOSED WORK

In this paper we have introduced smart transit ticketing system. In which we are going to use smart card reader, smart card. Each passenger will be provided with one smart card; which will store all details about that passenger and which is rechargeable. Passengers have to give that card to conductor. Information of the passenger like name, unique ID number is saved in the smart card, which can be read using smart card reader. According to passengers destination stop money will be deducted from smart card. After reading all information message of fair deduction with unique ID number of that smart card will be displayed on that device. As smart card has a memory when smart card again get swipe last message of deducted money will get displayed.

Following flowchart will describe phases included in new smart system.

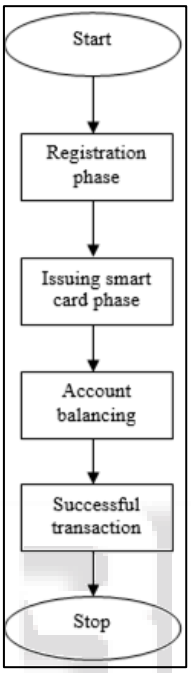


Fig. 3: Flowchart showing phases included in smart system

A. *How that phases works*

1) Registration Phase

This is the first phase for issuing smart card to passenger that registration should be done with all required details In this phase passenger have to fill a registration form in which he or she will include all details about them like name, address, attachments of documents needed etc. after submitting all this data registration phase will be completed. They will provide different facilities to passenger, if passenger is student or senior citizen. Depending on that details or different entries should get done.

2) Issuing Smart Card

This phase is very important and necessary as smart card is the one on which all information get stored and used by passenger. After completion of registration phase an account will get created. Having individual user name and password and one enrollment number will get provided to each account. Once identification of account and enrollment number is done. Staff present there will issue a smart card to that particular passenger.

3) Account balancing

Once smart card gets issued, many options will be available for passenger about transferring money for random amount or directly transferring for a week or for a month. Here also facilities get provided by them if passenger is student or senior citizen.

4) Successful transaction

After completion of above three phases now passenger ready to travel through bus using smart card. Passenger has to provide smart card to conductor. Conductor will swipe that card to device with him. A message will get displayed on that device that will be nothing but smart card identification number and other information. And then according to destination stop of passenger, entry will get done by conductor and that much money get deducted from smart card.

These are four phases which should be completed before travelling through bus public transport system. This process is beneficial for booking office. As if booking office have all details of each and every passenger then it will easy to keep record of them by just one number i.e. smart card ID number which will be provided by booking office themselves for every account. It also keep details clearly, then in case of any card missing or fraud these details will be helpful.

B. Block Diagram

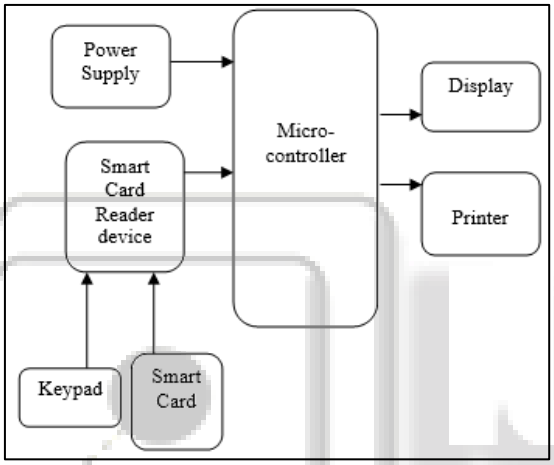


Fig. 4: Block diagram

Block diagram includes following blocks

- Microcontroller-LPC2148.
- Smart card Reader
- Smart Card
- Liquid Crystal Display
- Keypad.
- Printer

1) Micro-controller (LPC2148)

LPC2148 is widely used IC from ARM7 family. It is manufactured by Philips and it is preloaded with many inbuilt peripherals making it more efficient and a reliable option for high end application developer.

2) Smart card Reader

Amphenol FCI E series smartcard connector uses adding contacts and a sealed card detection switch. It is suitable for harsh environments and has ability to direct connection to PCB or via flexible printed circuit.

3) Smart card

The IS24C16A Smart Card provides 2 KB of serial EEPROM accessible by the Smart Card Reader (#32320). Memory is organized into eight 16-byte pages, providing a vast amount of storage for smart card application

4) Liquid Crystal Display

Liquid Crystal displays (LCDs) are a flat panel display. This is used in the application of displaying any data which is in the form of analog signal or digital data.

5) Keypad

Keypad is a format where keys are present from 0 to 9 and other keys as per requirement. Using keypad entry of destination stop will get done in smart card reader device.

Sr. No.	Components	Specifications
1	Microcontroller	LPC2148(ARM7)
2	Smart Card	IS424C16A
3	Smart Card Reader	619-32322
4	LCD	16*2

Table 4: Hardware Specification

C. Software Requirements

- Keil uVersion4.
- Flash Magic

IV. WORKING OF PROJECT

According to requirement of all components that are smart card, smart card reader and Arduino UNO board was selected. Study was done about card specifications and Arduino board. LCD interfacing was done with Arduino UNO board. Arduino UNO board was used for prototyping purpose. Then implementation was done of card reader, Arduino UNO board and LCD on Zero PCB Board. On zero PCB copper patches are present so components can be solder on it but it doesn't have any connection together. After implementation of all components on zero PCB board, coding was done on Arduino software for Read –Modify-Write operation. Following is Hardware module using Arduino UNO board. In final Hardware Module Arduino UNO board will get replace by ARM 7, LPC2148.

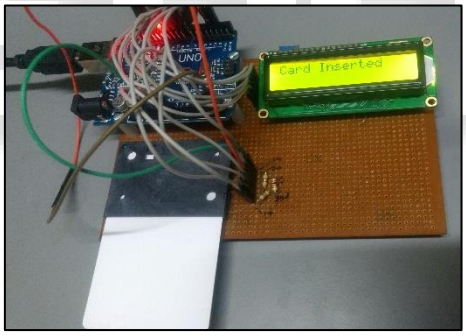


Fig. 5: Photo 3 Hardware Module (Smart card is inserted)

A. Final Hardware Module using LPC2148

Fig. 6: Photo 4 Hardware Module (Smart Card is to be inserted)

Following is the result table as per work proceeds in hardware section as well as software section using LPC2148 (ARM7).

Start of the Journey. i) Whether to start a new trip or ii) Details of previous trip.	

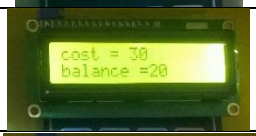
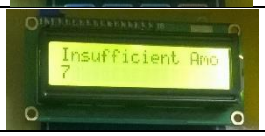
If i) is choosen then the stop from which the passenger has taken the bus is to be entered.	
The destination to which the passenger want to travel is entered.	
Details of the travel stops.	
Total cost of the travel.	
If there is insufficient balance in the card, then the amount and notification is displayed.	

Table 5: Result table

V. ADVANTAGES

- Provide more secure transportation.
- Use of paper will be reduced in large amounts.
- Re-writing is possible in smart card and also it can be recharged again and again, this is important advantage of it.
- Smart system for Smart city.
- Data entry will be digital hence no chance of fraud.

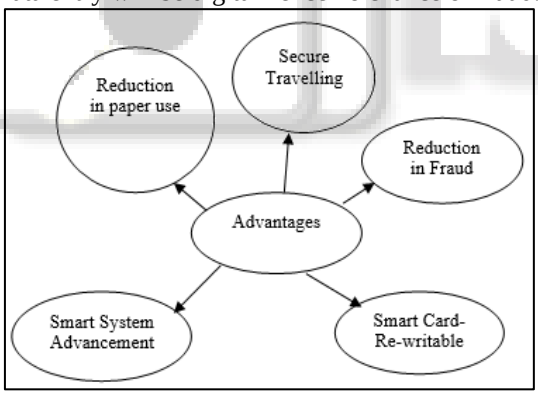


Fig. 7: Advantages of Smart Transit Ticketing system

VI. CONCLUSION AND FUTURE SCOPE

Smart card technology is one of the fastest spreading techniques. It is almost covering more and more part of fields in many applications. So when this smart card is used for public bus transportation system it will be satisfactory change for daily bus travelling people with features like fast ticketing ,security, reduction in paper use, digital ticketing etc. These features make it a real time project with a good commercial and social value. Fare is debited from the recharged amount. No need to handle cash for longer, smart cards can be loaded with enough amounts for travelling. Also no need to keep correct changes. It will make the passenger comfortable to travel with this user-friendly system. This project can also be expand by using IOT i.e. Internet of things. Using IOT we can book ticket and can know timing and location of buses at any route from anywhere, this one will be a great advancing in public bus transportation field. After implementation of this project it will create mass production which results in effectively reducing overall cost of project. Hence this implementation will be economical. By utilizing VLSI technology the size of the device will get more compact. In future we can implement the recharge system by directly transferring the amount from our bank balance.

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