

Anti-Pilferage Ticketing System for Public Transport

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Abstract— The paper based public transport ticketing system, prevailing in mega-cities such as Bengaluru, introduces severe problems and corruption in the system. The project suggests a much more user friendly, automated system of ticketing with the use of RFID based cards. The RFID based cards can be preferred over the conventional system due to low cost, easy operation, portability, durability, reliability and more user friendly to use. In the existing system monthly or yearly passes are issued, which can be easily forged and manipulated thereby corrupting the system. In conventional paper based ticketing system, tickets are being printed and thrown away after traveling, thereby littering the environment. Moreover, large numbers of trees are being destroyed since the current system uses paper based ticketing and the used tickets are just wasted. Therefore by promoting RFID based cards passengers can be encouraged, overtime to shun paper tickets in favour of monthly or yearly RFID based passes issued by the concerned authorities.

Index Terms—Anti-pilferage, RFID, Microsoft Access, TFT screen

I. INTRODUCTION

With a spiraling number of everyday bus travelers opting for duplicate and unauthorized bus passes, it is not an astonishing fact that scam has become quite common in the field of public transport. Ever since the introduction of bus passes and the electronic ticketing machine (ETM), travelling has become easy for everyday bus travelers. But the recent events involving the duplicate and expired passes have resulted in inefficiency in the existing system.

The paper is being developed with the objective of project an intelligent system along with a device to eliminate forgery from the system. Along with this a real time detailed information of the passenger, travel history, bus information and status of the pass will be displayed simultaneously. The system will enable a uniform monthly bus pass among the various types of public bus services. The passengers will be provided with RFID based cards which will have a unique ID associated with them. This unique ID is read by the RFID based card reader which is provided in the ticketing system. The server will be updated automatically every time the passenger travels by swiping their RFID card. Every RFID card used by the passenger will have a unique tag number. The card reader checks for the authenticity of the RFID card on the basis of the data stored in the database. If the RFID card is unauthorized it will be cancelled immediately and a message will be sent to the concerned authorities for further enquiry. The system uses the existing ETM along

with an ARM processor, RFID card, card reader, LCD display, GPS and GSM modules [4].

II. LITERATURE SURVEY

Sep 21, 2013, The Bangalore Metropolitan Transport Corporation is giving smart cards and they have called for tenders hoping the cards will end passenger-conductor fights over change and curb pilferage of fare by bus crew. Good news for bus passengers tired of quarrelling with conductors over change. The cards, which can replace tickets to a great extent, will not only end passenger-conductor fights over change but also curb pilferage of ticket revenue by bus crew. The smart cards will come in two types; one, a rechargeable card that passengers can top-up only when they travel, and two, a card that will work like a monthly pass.

How Smart Card Will Work

A passenger must give his/her smart card to the conductor and tell him the destination. The conductor will swipe the card on an electronic ticketing machine and deduct the fare. The smart card will bear the passenger's photo and address. Passengers can use it on all buses including those plying to Bangalore International Airport. The smart card project will also cover the 4 lakh student concessional passes issued every year [3].

Smart Card Features

- ❖ Smart card won't cost more than Rs 40.

- ❖ Each card will bear the passenger's photo and address.
- ❖ Cards can be used in all buses including those plying to Bangalore International Airport.
- ❖ The change, BMTC is planning 'ticketless' travel from Monday, Feb 18, 2013

BMTC plans for paperless passes, bus credit facility as change that will eliminate 'change'. The Bangalore Metropolitan Transport Corporation (BMTC) will soon begin efforts to go paperless, at least with its monthly passes and both commuters and conductors may no longer have to suffer the 'change' problem. In about 10 months, the Bangalore Metropolitan Transport Corporation's Intelligent Transport System (ITS) is expected to kick in, when the BMTC will introduce Bus Credit system through which commuters can pay through smart cards. Apart from Passenger Information system, GPS monitoring of buses will also be introduced.

Electronic ticketing machines (ETMs)

Anjum Parvez, MD, BMTC, said: \Smart cards can be recharged. To pay the ticket fare, passengers will only have to swipe the card and money will be deducted from the card. Even passes such as the BMTC's monthly passes will work this way. Commuters only have to recharge the cards. "He said that the smart card facility will also drastically reduce our problem of getting and giving change to commuters," he said. However, paper passes will also be issued for those who do not have cards. \There will be people who do not have cards and so we need to issue paper tickets. But, over time, we hope to make a reduction in paper tickets," he said.

III. SYSTEM OVERVIEW

The block diagram of RFID based ticket system is as shown in Figure 3.1 whenever the person swipe the card the data is read by the RFID module. The arm processor sends the read data to the server; the data is compared in the data base and sends back the acknowledgment to the arm processor. The particular information about the passenger is displayed on GLCD (Graphics Liquid Crystal Display). The Figure 3.1 consists of following functional blocks.

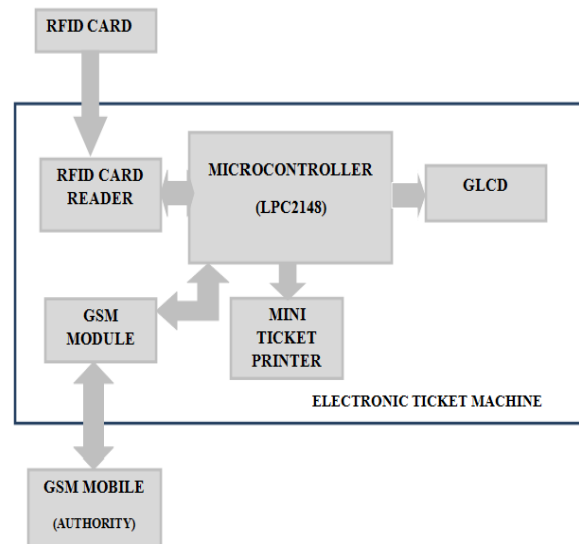


Figure 3.1: Block Diagram of RFID based Ticketing System

MICROCONTROLLER: The LPC2148 microcontroller is used to synchronize the different modules to work on priority level and it integrates the different modules like RFID CARD READER, GSM MODULE, TFT etc. LPC2148 is established on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace provision, that integrate microcontroller with embedded high speed memory extending from 32 kB to 512 kB.

GSM MODULE: GSM module is used to send SMS to the required GSM mobile. This module is programmed using AT commands through UART [2].

DISPLAY: Graphic LCD 128x64 is a monochrome, with 128 columns and 64 rows. It is used to display the text message sent by permitted GSM mobile.

RFID module: RFID module acts Mediator between the microcontroller and the RFID cards. The RFID module CLRC632 RFID IC is the basic element of the RFID module.

RFID cards: The RFID cards are electronically programmed with unique information. There are many different types of RFID systems out in the market.

Execution Process

Figure 3.2 shows the Execution process of Anti Pilferage ticketing system. Basically the designed system consists of two modes one is normal mode and card mode. Whenever the user enters card mode the system will ask to insert the card. As soon as the user inserts the RFID card the system will read the details from the card and compares

that with the data stored in the database system. If the person is authorized then the journey details is updated in database. If the person is unauthorized the system will send SMS to the concerned station informing that the card is being used by unauthorized person and card will be canceled automatically. If the user selects normal mode then the journey details will be displayed. Based the route the passenger is traveling the printer will print the ticket.

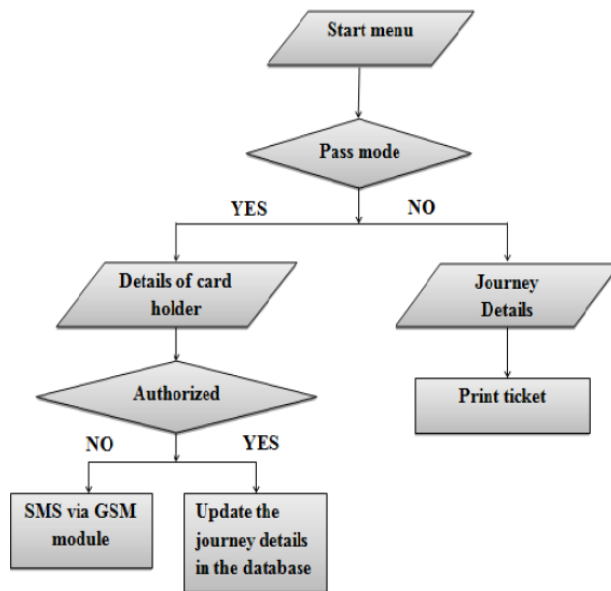


Figure 3.2: Flow chart of Execution Process

IV. HARDWARE DESCRIPTION

LPC2148 Microcontroller

The LPC2148 microcontroller is formed on a 16-bit or 32-bit ARM7TDMI-S CPU through real-time emulation in addition to embedded trace provision that integrates microcontroller with embedded high speed ash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture allow 32-bit code execution at the extreme clock rate appropriate for industrial control and medical systems.

- ❖ 16-bit/32-bit ARM7TDMI-S microcontroller in a small LQFP64 package.
- ❖ 8 to 40 kB of on-chip static RAM besides 32 kB to 512 kB of on-chip flash memory.
- ❖ 128-bit wide interface/accelerator qualifies high-speed 60 MHz operation.
- ❖ One or two (LPC2141/42 vs. LPC2148) 10-bit ADCs deliver a full of 6/14 analog inputs, with transformation times as low as 2.44 s per channel.
- ❖ Single 10-bit DAC affords variable analog output (LPC2148 only).

- ❖ Low power Real-Time Clock (RTC) by self-determining power and 32 kHz clock input.

Mini ticket printer

The Mini ticket printer (Thermal printer) interface module system can be cast-off to prove thermal printing solutions. The module offers designers with a high-quality, space-saving printing solutions, cost-effective for ticketing [1].

The thermal printer interface card has the subsequent features

- ❖ Interface: uses RS232. Jumpers to TTL also obtainable.
- ❖ Baud rate can be changed.(from 2400 to 115200)
- ❖ Supports image printing.(Image info to be sent through UART)
- ❖ Supports English and Hindi languages.
- ❖ Supports bar code. Max length of 11 values(comprises alphabets and numbers)

Power supply requirements: the power supply to be used has to be 7.5v/2.5Amp.the DC jack Connectivity pin is J3 in the Thermal Printer board [6].

Switches: There are 3 switches on the board which perform the following functions:

RESET SWITCH (RST): Resets the printer for printing.

TEST PRINT SWITCH (TP): After pressing TP switch a default text message is printed.

LINE FEED SWITCH (LF): By pressing this switch, the motor shall rotate continuously thus making it easy to load the paper.

V. TFT DISPLAY

The Thin Film Transistor (TFT) display is 3.2" wide and has 320*240 color pixels. The TFT driver (ILI9341) can display full 6-6-6(R-G-B) and is configurable. The display comes with connectivity bard that can be interfaced to the target controller through a 14 pin, 2.54mm flat cable. The unit can be used as an external interface display card for various applications. It is designed with a touch controller in it. The touch IC is XPT2046 and touch interface I included in the 40 pins breakout [6].

Key features:

- ❖ TFT model:KWH032ST05-F02
- ❖ Display driver IC: ILI9341
- ❖ Display Interface: SPI
- ❖ Touchscreen: Resistive
- ❖ Touch Interface:TSC2046/ADS7843/ADS7846
- ❖ Touch Interface: SPI
- ❖ Number of pixels: 240(RGB) x 320
- ❖ Pixel pitch: 0.2025 x 0.2025 mm
- ❖ Display technology: TFT

- ❖ Operating temperature: -20 to +70 degrees Celsius
- ❖ No. of colors: 262K (if 18-bit mode), 65k (if 16-bit mode).

RFID Module

- ❖ The RFID module acts Mediator between the microcontroller and the RFID cards.
- ❖ It provides the wireless communication link, decoding, demodulation of the data being exchanged between the microcontroller and the contactless RFID cards.

VI. SOFTWARE DESCRIPTION

Database

The data base is the second section of the project, which maintains all the data related to the passengers and keeps in track of the record of all the happenings in the bus. The database is kept somewhere in the bus stops. The data in the data base is updated by the administrators. The database provides service to the conductors through the device at any time. The database in the project is remote. Microsoft Access is used to maintain the database.

Different tables are created for different features of the device in the same database. The front end of the database is developed using visual basic 6.0. The front end facilitates in connecting the database to the GSM modem and also enables automatic searching in the database for the query and then replies back.

Microsoft Access

Microsoft Access is a database management system from Microsoft that combines the relational Microsoft Jet Database Engine with graphical user interface and software development tools. Access is supported for Visual Basic applications. One of the benefits of Access from the programmer's perspective is its relative compatibility with SQL (Structured Query Language)-queries can be viewed graphically or edited as SQL statements and SQL statements can be directly used in Macros and VBA Modules to manipulate Access tables .users can mix and use both VBA and "MACROS" for programming forms and logic and offers

Object oriented possibilities. VBA can also be included in queries. The main part of the project is the creation of the tables for database and updating the tables whenever it is needed. For the purpose of creating the tables Microsoft Access is used. Based on our requirement the following tables were created. The table to entry the bus detail is created. The complete details about the different buses will be available in Table 5.1. Every time when the new bus is registered the details in the Table 5.1 will be updated. Table 5.2 contains the details of the passenger. when the

new person comes and apply for the pass then the following details in Table 5.2 should be filled and then the card is used. While traveling in the bus whenever he swipes the card the following details in the Table will be compared and result is displayed on the screen of the Ticket machine.

The Table 5.3 represents the validity of the card. Whenever the card is swiped the details in Table 5.3 will be compared and updated. Table 5.4 is created in order to maintain the daily transaction in the bus. When the conductor swipes the card in the machine. The following details in the table will be updated. This will ensure number of passengers traveled, amount collected etc. If the person is unauthorized the details in the Table 5.5 will be updated indicating the particular card is canceled on that day at particular time and the particular location.

Visual Basic 6.0

Visual Basic 6.0 is the recent addition to the family of Microsoft Visual Studio. VB 6.0 is specifically designed to utilize Internet. User can easily create Web-based applications called ActiveX executable, which are similar to Internet Explorer. VB is an Event-driven programming language, in which the user will have full control over the execution of the program i.e. the user can click a desired button or any other control tool to invoke an event, which instantly executes the code within that event procedure by the computer. Today, VB6.0 has become technology leader, implementing new ways of doing things before any other Visual programming development tools [7]. Visual Basic 6.0 software is used for the creation of the database. This software is used to

Table 5.1: Bus entry Details

Bus ID	Bus make	Bus type	Bus seating capacity	Bus root from	Bus root to
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Table 5.2: Daily Bus Transaction

Bus ID	Day of Travel	No. of Card	No. of Non-card Holders	Amount Collected
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Enter the details into the different tables created in the Microsoft access. The data entered in the forms created in VB6 will go directly to the table. The code will running in the back end of the forms. When the details for the Bus is entered in the form shown in the Figure 5.1 the details in the Table 5.1 will be updated. Figure 5.2 represents the window of the code running in back end of the form filled. The data in the remaining tables will be filled in the same fashion.

Table 5.3: Passenger Details

P-ID	P-Name	P-Address	P-Val-from	P-Val-to	Amount Paid	Contact	Photo
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Table 5.4: Passenger Card

Card-ID	P-ID	From Date	To Date
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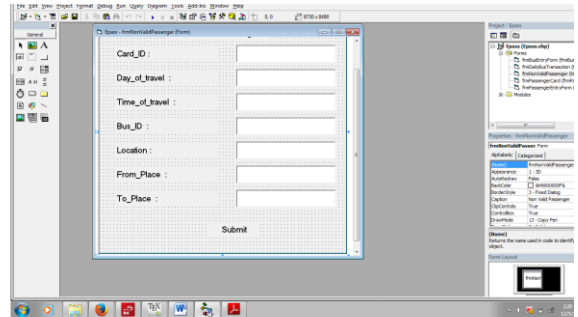


Figure 5.4: Non Valid Passenger Form

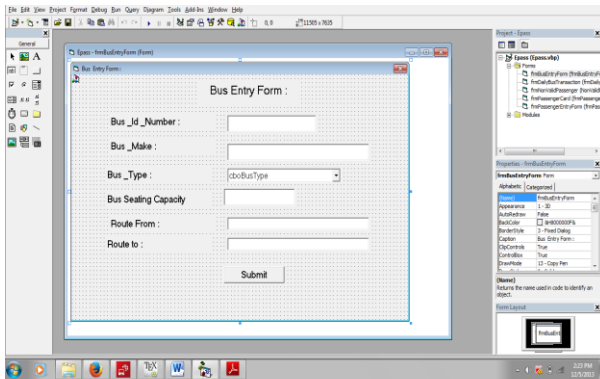


Figure 5.1: Bus Entry details form

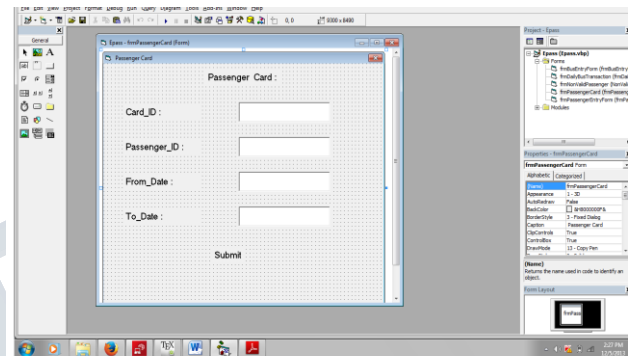


Figure 5.5: Passenger Card Form

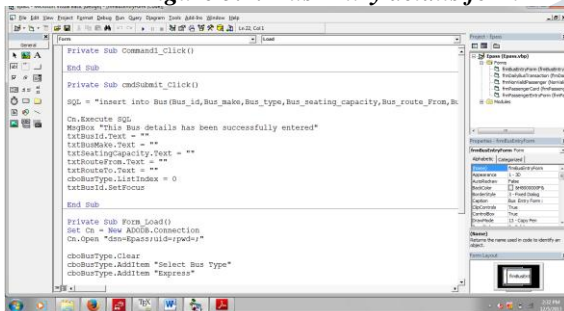


Figure 5.2: Code for Bus Entry Form

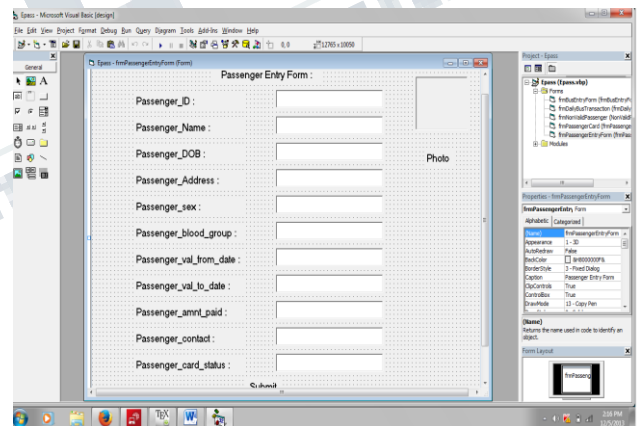


Figure 5.6: Passenger Entry Form

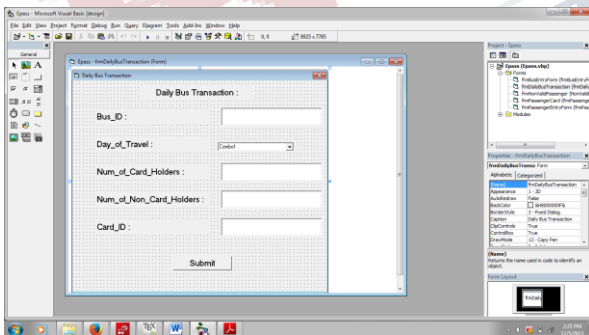


Figure 5.3: Daily Bus Transaction Form

Table 5.5: Non Validity Passenger

CardID	Day of Travel	Time of travel	BusID	Location	From Place	To Place
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VII. EXPERIMENTAL RESULTS

Experimental results are the results obtained by a measurement, test method, experimental design or quasi-experimental design. This paper depicts the working of the system through snapshots of the working model. Initially, the conductor is welcomed with two options on the main menu, pass mode and ticket mode as shown in Fig 6.1.

For non-pass holders the conductor selects the ticket mode as shown in Fig 6.2. The ticket mode enables the conductor to enter the fare and print a ticket according to the destination of the passengers as shown in Fig 6.3. For pass holders conductor selects the pass mode option on the main menu as shown in Fig 6.4. Once a card is read the information pertaining to a particular user is displayed on the TFT display as shown in Fig 6.5. Whenever an authorized card is swiped, the TFT screen displays a message indicating that the card is invalid as shown in fig 6.6. The invalid card is immediately blocked and a message which includes the card number is sent to the higher authority via the GSM module for further enquiry as shown in figures 6.7 and 6.8. The system is re-directed to the main menu for the next menu for the next passenger as shown in fig 6.9.

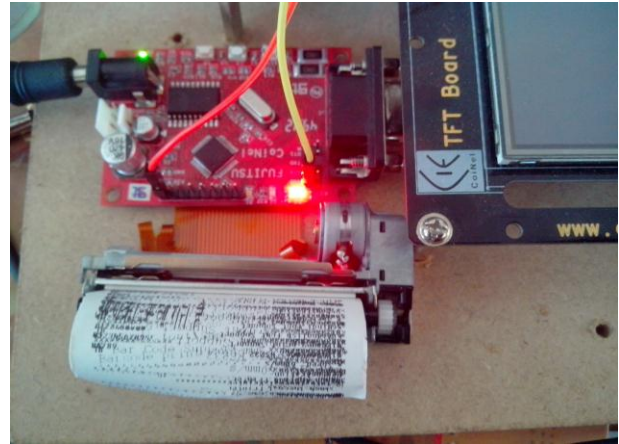


Fig 6.3 Printing of ticket

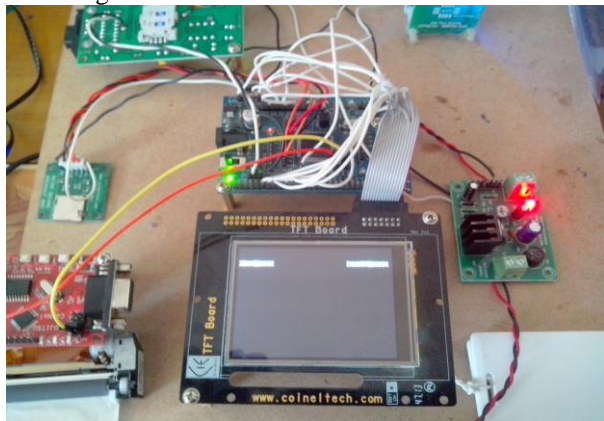


Fig 6.1 Main menu



Fig 6.4 Selection of pass mode



Fig 6.2 Ticket mode



Fig 6.5 Passenger details displayed on TFT Screen



Fig 6.6 Indication of an invalid card

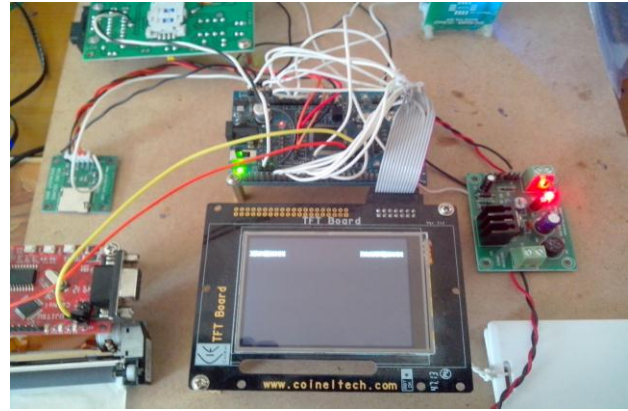


Fig 6.9 Back to the main menu



Fig 6.7 initializing GSM

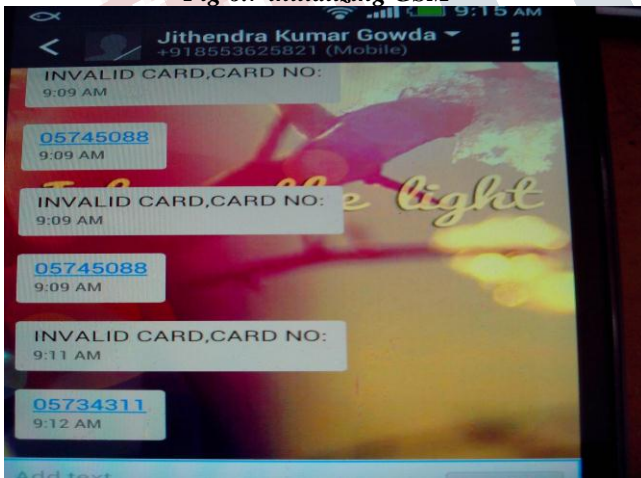


Fig 6.8 Message received by the authority

VIII. CONCLUSION

Anti-pilferage ticketing system for public transport is expected to be fully transparent and convenient to both the concerned authorities and the general public. The main focus of the system is to prevent forgery in the field of public road transportation. Thereby making the transport system more effective and efficient by avoiding theft and bribe. It also aids the environment by reducing the usage of paper based monthly passes. The system can also be used in the railway ticketing system with small or no modification. The RFID cards are re-usable and are updated automatically. Any unwanted events can be avoided as all the passengers carrying RFID cards are monitored every time they travel. The cards being reusable are much more convenient compared to the paper based ticketing system.

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