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RFID-based Ticketing for Public Transport System: Perspective Megacity

Piyush Chandra¹
Electronics, Bvducoe
Pune, India

Prakhar Soni²
Electronics, Bvducoe
Pune, India

Rakesh Kumar Keshari³
Electronics, Bvducoe
Pune, India

Abstract: The paper based ticketing in public transport system, prevailing in the megacities introduces severe malfunction in the system, malicious argument among public, corruption and most of all traffic jams. This paper actually suggests a much more public friendly, automated system of ticketing as well as the credit transaction with the use of RFID based tickets. The total system mainly acts to bring out the consistency in the public transport system that will conclude in uniform access of passengers in daily rides through an automated server being updated every single time the passengers travel by carrying the RFID based tickets.

RFID: Radio frequency identification detection.

I. INTRODUCTION

As for the RFID application, it's been a widespread tool for both tracking the transit transports and for the public ticketing system. It's already been an outstanding achievement throughout the globe including big cities like London, U.S., Shanghai, Moscow, Porto and many more countries. This system can be implemented for subways, railways and public bus services for the sake of systematic operations in corresponding cases.

In the megacity Pune, the conventional system of public transport is based on paper based bus or railway tickets that ultimately leads to chaos among public, system loss, corruption and most of all traffic jam that is responsible for a huge wastage of time and money and environmental losses. No prior notification of the arrival and departure of the transports are available creating a lot of confusion among the passengers resulting in a rough argument between them and the bus supervisors or the operators. Again having no government authority to take control or keep an eye over the whole scenario, the private sectors are creating a monopoly, taking control over the public transport and autocratic raise in bus fare.

The tracking and ticketing systems using RFID can be merged to solve the prevailing problems. Even though the GPS based system can be designed, we propose the RFID based tickets for its low cost, easy operation, portability, durability, reliability and being much more user friendly. Also the high speed RFID tags and detectors make the tracking system of a running bus merely a child's play.

Public carrying RFID based electronic tickets will have access to any bus service of the city only entering his current location and his destination on the keypad attached to every bus. The data will directly be transferred to the server main database and the equivalent credit will be stored in the corresponding bus account. By using this automated system will save time, have a higher authoritative inspection and reduce chaos and confusion on the road.

II. SYSTEM DESCRIPTION

Radio Frequency Identification (RFID) is a generic term for technologies that use radio waves. An RFID system consists of a tag, basically a microchip with an antenna and an interrogator or reader with an antenna. Most RFID tags contain at least two parts that is shown in figure1. One is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal. The reader sends out electromagnetic waves. The tag antenna is tuned to receive these waves. A passive RFID tag draws power from field created by the reader and uses it to power the microchip's circuits. The chip then modulates the waves that the tag sends back to the reader and the reader converts the new waves into digital data.

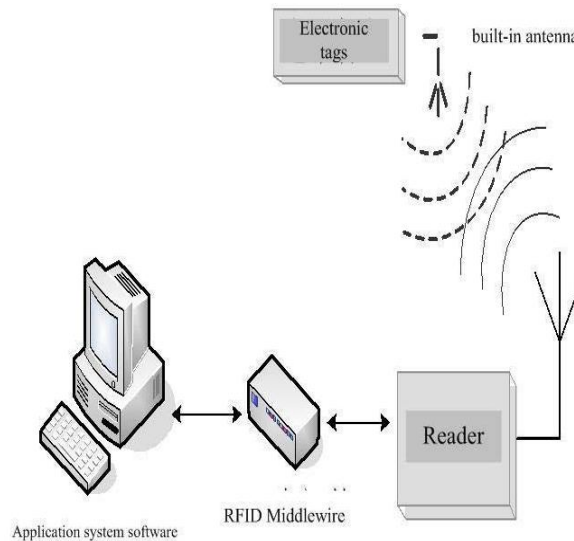


Figure 1-typical RFID system components

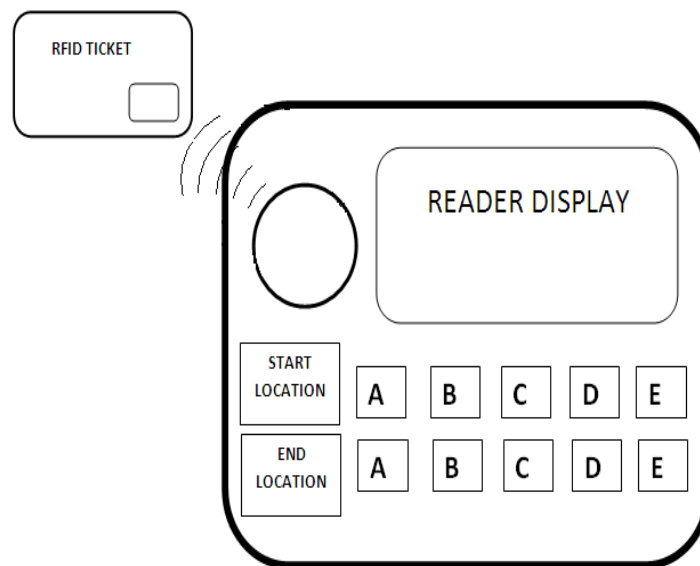


Figure 2- reader with keypad for selecting location attached to each bus

Each bus will have two tags: one is at the front door and other is at the rear door. The rear tag will inform the reader about its arrival to the bus stop whereas the front one informs its departure. Each bus will also have a reader that is connected to the main server for charging ticket fare from the passengers through a keypad attached with the reader on which the passengers give the information of their departure & destination locations. The reader sends the electromagnetic waves to the tag. The tags draw the power from this wave and return back the bus information, which are stored in its memory to reader. The readers again demodulate this wave and convert it as a digital data.

For the purpose of Ticketing, the operational feature of the cards is almost the same but here the tags are attached to special cards carried by the passengers and the reader collects the detail from them. By using RFID technology in ticketing system, allowing passengers to "tag on" and "tag off" and be charged automatically, according to how many zones they have travelled.

III. COMPARISON & BENEFITS OVER CONVENTIONAL SYSTEM

In conventional paper based ticketing, each & everyday a lot of tickets are being printed by the person sitting in the bus stoppage counter or the conductor. After finish travelling, the passengers usually through away the tickets here & there which ultimately pollutes the environment. Again large number of trees is being destroyed since the current system uses paper based ticketing and the used tickets are just wasted. But in our proposed system the RFID tagged card carried out by the passengers does everything automatically and finally eradicates the problem of pollution or degradation of environment. Some benefits of RFID based ticketing system over conventional system (both paper based tickets & magnetic tickets) are mentioned below: Using automatic ticket systems enables operators such as transportation authorities to save time and personnel costs; fare collection can be organized much more efficiently. These systems require low maintenance costs and reduced fraud-induced losses represent further advantages [11].

Actually, the RFID uses the low-end of the electromagnetic spectrum. Thus waves coming from readers are not dangerous and are similar to those waves coming from our car radio. Just as our radio tunes into different frequency to hear different channels, RFID tags and readers are tuned to the same frequency to communicate [8]. Radio waves travel through most non-metallic materials, so they can be embedded in packaging or encased in protective plastic for weatherproofing and greater durability. Like smart tickets, RFID tickets are more difficult to duplicate than magnetic tickets, reducing the possibility of fraud.[2]

RFID tickets achieve almost 100% read rate. Unlike magnetic readers, smart ticket terminals do not have moving parts. This reduces wear and tear, makes RFID terminals significantly more reliable, and leads to a reduction of operation/maintenance-time ratios of more than 40%. The paper based construction and the reduced memory size greatly reduce the tickets price compared to a Smart Card and makes migration of sectors of ticketing range onto a SMART platform economically feasible.

IV. OPERATIONAL PRINCIPLE OF PROPOSED SYSTEM

The reader will read the RFID tag attached to the rear side of the bus that is denoted as the rear tag. Thus the reader will have the idea of the bus and also the route of the bus along with the arrival time. Also the reader being connected to the main server, the data will automatically transfer to the server database. The screen in the bus will notify the next destination where the bus is going to stop as well the number of passengers sitting in the bus. All the passengers will carry a prepaid system RFID based card that will have a unique ID number. The card is rechargeable from certain even mobile recharge booths placed at almost every part of the city. The passenger trying to get on board will have to place the RFID ticket in front of the reader attached to every bus. The reader will detect the tag and require certain information from the passenger. According to the route distance between departure & destination, it will calculate the ticket fare and deduct the credit from the RFID tag based ticket electronically and automatically. The sample information stored in the database about the route distance & credit unit is sent to the server of the city. The complete detection algorithm is described in detailed in the later part.

After all the passengers get on the board, the bus will leave the stop and the reader will detect the front tag attached to the bus. The reader will send the information to the server and also to the screen showing the next destination of the bus.

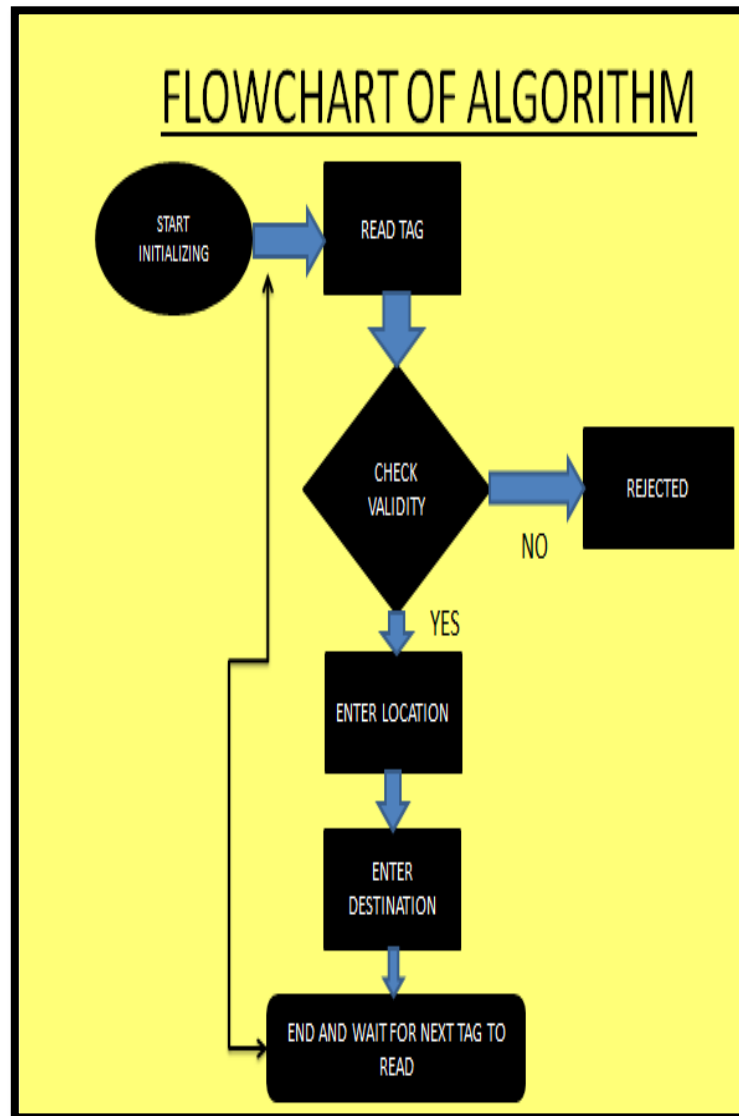
After the whole day, the individual bus reader will know how much credit has been transferred to the corresponding account and also the information can be found in the main database. Cross checking of all those information will allow better monitoring, transparency and thus reducing corruption.

Passenger ID	City ID	Ticket ID	Check Bit	Others
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Fig 4: possible data composition for RFID Ticket

V. DETECTION & PROCESSING ALGORITHM

As soon as the tag is placed before the reader attached to the bus, the tag will get energized revealing relevant information to the reader. An authenticated tag carrier will enter the start location and end location information through the keypad. The reader will accept the card if the card has required credit to travel that distance. The data acquired by the reader will be stored in its internal memory as well as transferred to the main server database.



VI. CONCLUSION

RFID technology is taking off in Transportation at an increasingly rapid pace. Though there are few transportation companies employing this technology today, but due to its customizable feature and continuing improvement the communities are beginning to get involved in its development. It is easy to envision that, the RFID tags contents will increase in power, prices are expected to decline and tag will dramatically improve its efficiency, security and accuracy. Also major concerns need to be addressed for successfully implementing this technology. So that it will change our personal and work lives in transportation and adorns the conventional transportation management with a new idea and usher for a bright future.

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