Smart Transportation using Scheme Card for Automatic Fare Collection System in Public Bus Services

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ABSTRACT

A new methodology to estimate bus fare automatically without disturbing passenger during their journey using a simple scheme card integrated with Radio Frequency Identification (RFID) technology is described. Using sensors and automatic vehicle location we record details related to transaction of passenger boarding on a bus, location where journey begins, time, bus details and much more. The major purpose of this record is to estimate cost for individual journey in specific buses and additional benefits are availed for concession to senior citizens, bus pass tariffs like monthly passes, student free pass and so on using automatic evaluation and reduced from their fare. Scheme card offered to passenger can be recharged in different categories using unique RFID number provided like SIM card used anywhere in city for pay as you go scheme. Initially, passenger should furnish their details to create separate area for their records in our system and make records of their transaction. This technology paves way to Bus Transit System and promotes transportation using information generated and gathered through this system.

KEY WORDS: RFID technology, Automatic Fare Collection (AFC), Automatic Vehicle Location (AVC), Origin-Destination pair (OD).

1. INTRODUCTION

More populated country use public transportation more frequent than other countries, passenger who use these services suffer from some kind of issues nowadays such as getting boarding ticket with correct sum of amount and much more. To overcome these problems faced by passenger we introduce new method of fare collection without disturbing them.

The concept of Automatic Fare Collection (AFC) already exists in Andante system (Antonio Nunes, 2016) in which it allows Pay-per-use and creates transaction record every time a passenger taps a travel card on a reader. Some terminologies used for this automation are travel card, various boarding points, vehicle number, direction of travel and timestamp. However it is automatic, estimation of destination is time based hence probability of wrong estimation is more.

In this system they use travel card that has unique number which is converted to a serial number and used for faring purpose for unique identification. Here we use RFID integrated in a card and it is called as smart card here. Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves.

It's grouped under the broad category of automatic identification technologies. This paper aims to develop a solution to calculate the probability of each route chosen for an OD pair, which can be used to estimate the passengers flow at a granularity of buses of each line.

The transaction records from AFC can reveal the Origin (O) and the Destination (D) of every passenger's trip, as passengers are required to tap their smart cards or RFID based tickets each time they enter the O station or exit the D station. Passenger's flows can be coarsely demonstrated by OD (origin-destination) pairs. AFC records are still not able to show which bus a passenger takes.

Public transport agencies that are able to take advantage of this massive amount of data to anticipate and actively react to the changes in the transport environment and passenger behaviors would earn an utmost advantage to attract customers. With the same level of transit journeys at regular times and places. Incentives and personalized service can be given to passengers of regular usage to encourage passengers to use public transport.

The observation of the travel pattern also benefits operational strategies such as transfer coordination and origin-destination (OD) demand management by monitoring and inferring passenger movements through their travel habits.

For the test of this paper, we discuss the related in Section II. The overview of this study is given in Section III discusses the solution in details. We present system design and the algorithm implementation on a cloud platform in Section V. Section VI presents the experimental studies. Finally, Section VII concludes the paper.

Related Studies: Andante is an entry-only AFC system with a Distance-based fare structure that covers the metropolitan area of Porto. Although the proposed methodology applies to AFC systems of similar characteristics, each will have specifications that must be understood and considered for the extraction and preparation of data.

In addition, this may happen when a passenger cannot remember tapping the card and repeats it in the same journey stage. The large amount of smart card data in a long period provides us a great opportunity to analyze passenger's transit behavior and evaluate transit service.

The literature considered the potential usage of smart card data for travel. The literature analyzed users' travel behavior using data mining technology, which clustered users into four groups according to their temporal travel patterns. Our recent work studied individual passenger is also spatially regular. These device enable online monitoring of operations and systematic analysis of the fleet, the distance and schedules achieved.

Automatic Fare System: Initially passenger information, bus information with route, cost from one to many boarding station are gathered.

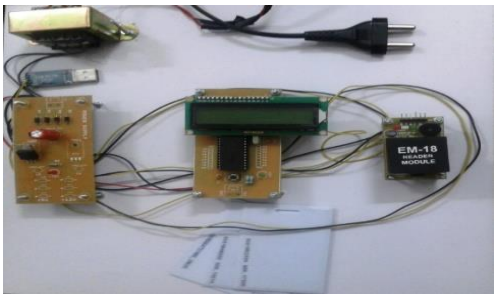

Figure.1. RFID Reader

Transportation planning: Passengers boarding and alighting on bus stops: gather data on bus stops and diagnose the reasons for buses unable to board passengers at bus stops.

Frequency of buses and passengers in a route: Diagnose the attendance of passengers on a given bus line through data collection at both ends of this route (initial and final) in a given period of time, recording schedules of buses, number of passengers boarding and alighting, and passengers with denied boarding. Also bus turnstile data should be recorded for each trip.

Password boarding and alighting: Identify the highest passenger loads sectors of a given route, recording the bus stop where each passenger board or alight. A password is given to each passenger at boarding and alighting stops.

Origin and Destination: Diagnose how a bus line attends passenger movement needs associating both trip and passengers origins and destinations. Data is obtained interviewing passengers on their trip origins and destinations, and may include other bus lines or transportation modes used, frequency, times and reasons, etc.

User's waiting times: Verifies service levels based on waiting times at bus stops, including terminals.

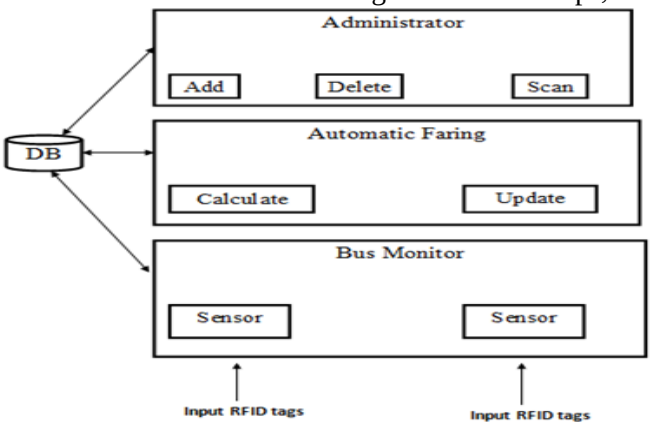

Figure.2. Architecture Diagram

Implementation: Internally, the bus has installed a reader device capable of managing a number of data collection antennas. The number of antennas depends on the size of the vehicle and the number of doors. Through the antennas, an RFID reader can transmit radiofrequency waves. Records thus collected through smart card tags will allow identifying the passenger approaching the bus for boarding, during its trip in the bus, and when it alights the bus and moves away.

This technique is carried out in three important steps:

- Administrator
- Bus Monitoring
- Automatic Faring

Administrator: The first stage is to register scheme card with a serial number allotted for its unique number of the card for verification and processing purpose. At this stage the location and positioning of antennas within the bus framework will be defined. The provision of auxiliary data to compose main information such as time (day, hour, minute, second) and location (longitude and latitude) obtained both from the bus Automatic Vehicle Location (AVL).

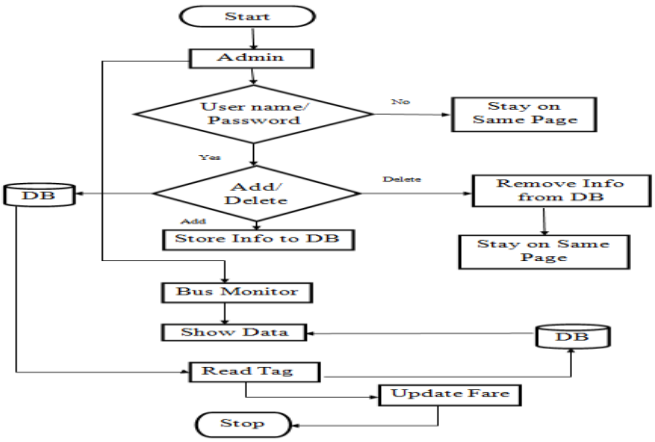

Figure.3. Flow Chart

This process creates new record for passenger transaction record. Authentication of performing such process by providing password protection is necessary with multiple administrators over different regions. Tackling much more features can be achieved and handled only through administrator permission.

Figure.4. Existing User Login

Bus Monitoring: The second stage involves real bus and passenger using their scheme card. Here when passenger enters bus through sensor fixed doorways it automatically identifies serial number and stores in database with auxiliary data like date & time system also location from AVL. When passenger exits in a certain location this scheme card hits sensors again and now this passenger details are wrapped for further processing. Not registered RFID tags will not be recognized through sensors located in bus, this can be detected using an alert sound preferred to identify passenger smart card hits sensor. This enables to monitor number of passenger currently inside bus with their details like serial number, boarding station and much more.

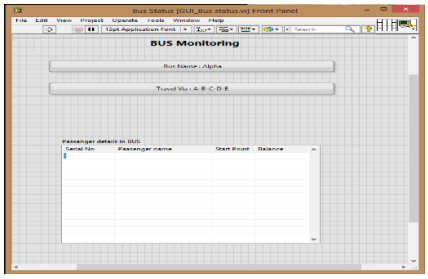

Figure.5. Bus Monitoring

Automatic Faring: The third stage will be the definition of the computational model for treating and processing of data collected. The data collected is to be sent constantly by the bus AVL through GPRS communication to a central processing center. In central processing center, passenger balance is subtracted with fare amount of each transaction and thus generated new balance.

If records are available off-line, the processed data will be useful for other actions based on the statistical records expectation of the passenger displacements. Analysis of these records paves way for further improvement in bus faring, timing and so on which leads to efficient transportation

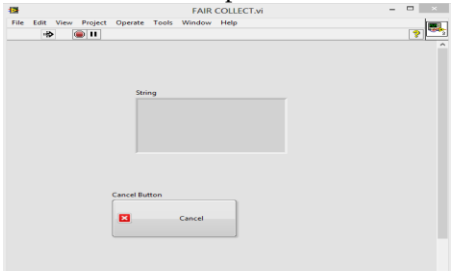

Figure.6. Fair Collection

2. CONCLUSION

This paper proposes a methodology to make passenger journey over public transport in a comfort and effective manner. Computations also used to integrate government schemes with actual fare so that no one should stand for services in a long queue and thus create a cashless economy. Not only that, it automatically count passenger in a bus for management of bus services.

Future Enhancement: This proposal can be extended to the hands of passenger by providing facility to access data about their journey, current bus location and much more. And also recharge their card through net banking with debit and credit cards. Additional provision for passenger feedback, queries and help can be involved through web publishing facility.

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