Abstract: Nowadays the public transportation system like the metro are well advanced. Passenger safety, convenience and the need to improve the performance of existing public transportation is driving demand for intelligent transportation system in the market. The paper based ticket system for collecting the bus fare has been found to be a source of major financial loss in India. It is difficult to assure the purchase of ticket by each and every passenger. A paper ticket becomes useless to the passengers when the destination is reached. Even the count of many unsold tickets per day is very high. In the era of technology, India must focus on inculcating an automated system for collecting bus fare. Hence, this paper proposes an automated card driven system using RFID and GPS for bus journeys in India. Different scenarios concerning the implementation of this system are discussed in this paper.

Key Terms: RFID, GPS, Public transport, Bus Fare.

1. Introduction

Today, everything in the world is smart and digitalized. Many advances have been made in the transportation sector too. However, public transport buses in India have always been an area where such new advances have turned their faces out. Work Intelligent vehicle for public transport is one of the research areas. Here global positioning system plays an important role to find positions. In certain urban areas there may be some errors to find the location so an alternative approach is visual odometry [1].

Where vision based algorithms are proven to track the position of the vehicle over a long distance using sequence of images without prior knowledge about the environment. But the results have some disadvantages in alternate weather conditions so GPS holds best when compared to others. Control strategies based on expert rules and fuzzy logic are used to control the departure time, interval between two vehicles and delay occurred due to traffic. The parameters of fuzzy controllers were tuned through a particle swarm optimization algorithm [2].

Another alternative approach to GPS is the use of PTN operator with positioning sensors to give on-trip personalized navigation information [4]. Here unknown destination location for infrequent users can be found using positioning sensors. This proves to be a motivational driving factor for the public to prefer it over other modes of transportation. Mobile ticketing model comprises of a registered mobile subscription either prepaid or post-paid [5]. By scanning mobile phone number at the entrance or exit of the vehicle the traveller identity is known then according to the distance travelled by the passenger the amount is reduced from the balance in the mobile. The affecting factor of this system is the use of smart phone. People with normal phone cannot use this technology.

2. Existing System

In general way, every bus is controlled by a conductor. The conductor will collect money from each passenger and issue ticket. Initially, printed papers or tokens are used as tickets. Nowadays, handheld machines are used to print tickets. This system has many disadvantages. The passenger have to carry the ticket till the reaching their stopping, the conductor should ensure that everyone has got the ticket, the time taken for ticketing is comparatively more and more amount of paper is needed to print the Ticket. For example, if a passenger wish to travel in bus. He has to carry money with them. Then conductor will collect the money and he will give ticket. This has to repeat for all passengers. This will take more time and waste of human resource as well as energy. The data relate to an AFC system integrated with an automatic vehicle location system that records a transaction for each passenger boarding a bus, containing attributes regarding the route, the vehicle, and the travel card used, along with the time and the location where the journey began. Some of these are recorded for the purpose of allowing on board ticket inspection but additionally enable innovative spatial validation features introduced by the methodology.
3. Proposed Methodology

The proposed methodology introduces a Contactless Fare Media Technology (CFMT) and an Automated Fare Collection System (AFCS) to bring up the public transportation bus system in India to the world standard along with novel features. The prevailing ticketing system had many malfunction, malicious argument among public and corruption. It also aims to reduce fare-related fraud and revenue loss through open standard, secured transaction technology.

In this paper “GPS based automatic bus fare collecting system using electronic Ticket” explained that a system that uses the same RFID-based location information give the navigation indications depending on his current location; provided that the user has indicated beforehand the places he intends to visit. Collected data can be used to predict bus moment timing in order to provide better service. By using smart card instead of RFID with GPS, we can find the location of the passenger enter and exit. Using the location we can find the distance travelled and amount. The amount can be withdrawn from the smart card. A microcontroller can be used to program this system by interfacing GPS and smart card. By implementing this system the usage of loose cash can be reduced and efficient ticketing can be implemented.

The objective of this paper is to count the passenger using IR sensor and calculating the distance travelled by passenger automatically using motor and u-slot sensor, and the corresponding amount is debited from RFID card. When passenger crosses the signals received will be interrupted and fare collection is done automatically. Here RFID tag is rechargeable one, where as it can be recharged in bus depot or nearest retail shop.

A. The Internet of Things in Automatic Fare Collection

An Automatic Fare Collection System (AFC) is one of basic station equipment that consists of automatic gate machine, a ticket vending machine and the ticket checking machine. In this application, a stable and integrated platforms are necessarily to keep passenger flow run smoothly at an a peak hours; at the same time, all data will be gathered and transmitted into server.

B. RFID Based Automatic Bus Ticketing

In Recent advancements in various technologies have made remarkable developments in various fields for public welfare and public transport is one such area [6] - [9]. In near a future public transport bus system with advanced technologies like Radio Frequency Identification Device (RFID), and RF modules will gain spotlight due to their advantage of higher convenience and greater life standards as compared to the conventional bus systems. The study brings out improved solution in terms of cost, convenience, user satisfaction and future implementation.

GPS is the latest technology used in various fields such as navigation, tracking and also in some of surveillance applications. Here we are going to use this GPS to calculate the distance travelled by the passenger. GPS module can configured to generate the latitude and longitude of the current position of the bus.

Figure 1. Flow Diagram
The position of the bus can be monitored continuously using this GPS module. The flowchart shown in fig. 1 clearly represents the calculation and detection of fare system. Smart cards can provide identification, authentication, data storage and application processing. These smart cards can be used as passenger identifications. Every passenger carries a smart card. The smart card has the information such as user identification number, available balance and status register. These smart cards should be capable of recharging, so that the passenger can use it again and again. Combining GPS technology and smart cards we can design a complete bus ticketing system. Ticketing system without human resource-Conductor is implemented using RFID tag which is rechargeable one.

4. Hardware & Software Tools

A. Microcontroller: Arduino is an open source, computer hardware and software company and a user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. It consists of a physical programmable circuit board and an integrated development environment which is run on the computer and is used to write and upload computer code to the physical board. In this project, Arduino is used for interacting with the GPS and the GSM module.

B. RFID reader: A RFID reader is a device which is used to interrogate an RFID tag. It reads the unique number from the RFID cards and sends it to the microcontroller.

C. RFID card: This is one of the most important part of the project. RFID cards are used for applications as access control in security system, cashless payment etc.

D. WIFI Module: The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

E. Power Supply: This unit will supply the various voltage requirements of each unit. This will be consists of transformer, rectifier, filter and regulator. The rectifier used here will be Bridge Rectifier. It will convert 230VAC into desired 5V/12V DC.

5. Design Methodology

This implementation is aimed at a real time usage of Automatic Fare Collection system and does not compromise on the security. It guarantees us that the proposed project is simple, efficient and cost effective.

There are a number of reasons why Wi-Fi might be the real pick.
1. Wi-Fi technology is economical.
2. Users compatibility is considered and given more preference

![Figure 2. Block Diagram](image)

Fig. 2 shows the block diagram of the proposed system. RFID has been an emerging technology in recent years. RFID consists of two components, RFID Tag and RFID Reader. RFID Tag contains information such as name, address and mobile number. RFID reader reads the above information’s from the RFID Tag. IR sensor is used to count the number of persons entering into the bus. Internet of Things define the concept of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes.

IOT is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. An Internet of Things allows objects a sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and the computer-based systems resulting in improved efficiency, accuracy and economic benefit. Each thing is uniquely identifiable by its embedded computing system but is able to inter-operate within the existing Internet infrastructure.

6. Hardware Implementation

Fig. 3 shows the hardware implementation of the proposed system.
After loading the database, the system was tested with two passengers. The outputs were displayed in Fig. 4. First passenger has entered the bus at Town Hall and got down at Malumichampatti. The distance travelled was calculated using GPS as 9kms. The cost for travel is Rs. 12. The same works well with the second passenger.

7. Conclusion

The manual fare collection system has many issues which are overcome by our proposed system. Automated fare collection system for public transport using GPS is an innovative idea which reduces man power. The manual fare collection system has many issues which are overcome by our proposed system. Automated fare collection system for public transport is an innovative idea which reduces man power. It is believed that by implementation of these system problems such as underutilization of buses fleet will be reduced. So both passenger and bus station administrators will benefit from the system as Real time information are provided. The ticketing systems using RFID can be merged to solve the above mentioned problems. This project actually suggests a much more public friendly, automated system of ticketing with the use of RFID based tickets. This smart Embedded System can be implemented in the transport system, which will perform the fare collection automatically. This system is suitable for megacities like Chennai and Bangalore where a large no of customers avail public transport system daily.

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