Ticketless Transportation System using RFID Technology

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A B S T R A C T

A prepaid ticketless transit system that makes use of RFID technology. The method eliminates the need for traditional paper tickets and cash payments, making transit more efficient and streamlined. Travelers can buy and load money onto RFID-enabled devices Because the tickets, which are made of paper, they contribute to deforestation, and they are useless after the passenger exits the bus. Travelers should also keep their tickets safe until they get at their destination. Thus, in order to overcome all of these challenges, we have to give tickets to travelers, and a smart ticketing system is proposed. In our work, we employ RFID cards to ensure the precise identification of passengers and transactions. A microcontroller is used to interface with RFID cards, and an LCD is used as a display device. The proposed system is a prepaid ticketless transportation system that utilizes Radio Frequency Identification (RFID) technology. which will recognize the passenger automatically and subtract the passenger's fare based on the distance traveled. The RFID (Radio Frequency Identification)cards are reusable, they are far more convenient than the paper-based ticketing system. RFID cards are being distributed to the general public. The RFID cards' unique IDs are kept in an internet database along with personal data, creating accounts for each person. The system eliminates the need for traditional paper tickets and cash payments, allowing for a more efficient and streamlined transportation experience. Passengers can purchase and load value onto an RFID-enabled card or device, which can be used to tap into and out of transportation services.

Keywords: prepaid, RFID card, RFID reader, GSM, STM32 Microcontroller, LCD 16*4 Display.

1. Introduction:

While many people believe that going paperless is more expensive in terms of software and hardware requirements than the traditional paper-based method, a Smart Ticketing system has its advantages. Becoming paperless not only has a big impact on the environment, but it also saves money on ink, paper, and labor costs. Taking the aforementioned characteristics into account, a smart ticketing system utilises a combination of RFID technology. RFID has shown to be one of the most promising technologies in recent years, and it can be effectively used in a variety of applications because it is a cost-effective and frequently used instrument for tracking and locating. This Reader System is a combination of RFID Readers, which detect RFID cards carried by passengers, Microcontrollers, and GSM technology. The STM32F103C6T6 microcontroller in this system is in charge of interacting with the RFID reader. A unique identifying number is encoded onto each RFID card. The RFID cards in this system are passive RFID tags, as opposed to active RFID tags, which require an internal power supply. The read range of these tags is up to 10m. The RFID Reader MFRC 522 has a frequency of 13.56 MHz and a read range of 10 cm - 1 m. The reader detects these cards using electromagnetic fields formed between them. However, in our proposed method, the RFID-tagged card carried by the passengers manages everything automatically, reducing the previously mentioned complexity. A Smart Ticketing system has its benefits while many people may argue that a switch to a paperless will be more expensive, in terms of software and hardware requirements than the traditional paper-based system. Going paperless not only has a huge impact on the environment but also saves costs of ink, paper, and labor costs associated with it.

2. Literature Survey:

People's preferred mode of transportation is public transportation. According to a recent National Sample Survey Organization report, approximately 62-66% of people utilize the bus as their form of transportation. The goal of the public bus tracking system is to provide users with real-time bus status via an automated system. This study describes a real-time bus-tracking system with IoT capabilities. In this work, a bus monitoring mobile phone app is built, allowing people to precisely locate the bus status and time of arrival at the bus stop. This study employs high-frequency RFID tags on buses and RFID receivers at bus stops, and real-time RIFD tagging (bus running) data is gathered and sent to the cloud using NodeMCU[1]. This paper describes a real-time bus-tracking system with IoT capabilities. In this work, a bus-tracking mobile phone app is created, which allows people to precisely locate the bus. The status of the bus and the estimated time of arrival at the bus stop. This work employs high-frequency RFID tags on buses and RFID receivers at bus stops,

and real-time RIFD tagging (bus running) data is collected and uploaded to the cloud via NodeMCU.Users can use the mobile app to get real-time information about the bus's location and status from the cloud.[2] "An Approach for RFID Ticketing used for Personal Navigator for a Public Transport

System" This paper is based on ticketing and identification of passenger in public transport. In a metropolitan city like Mumbai, and Kolkata we have a severe malfunction of public transport and various security problems. The entire network comprises of three modules; Base Station Module, In-Bus Modules and Bus Stop Module. The In-Bus Modules consists of two Microcontrollers, GSM Modem, GPS, Zigbee, RFID, LCD and infrared sensor. RFID for ticketing purpose. The Zigbee module is also interfaced with the microcontroller which is used to send the bus information to bus stop and to get the information from the bus stop to bus[3]. "public based public transport ticketing system", prevailing in the megacity Dhaka (Bangladesh), introduces severe malfunction in the system, malicious argument among public, corruption and most of all traffic jam. 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 consistency among various bus agencies 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[4]. , An automated ticketing system for the Public Transport System (PTS) that is based on passenger identification. This system will automatically identify the passenger and deduct the appropriate fare based on the distance travelled. The RFID card, or radio frequency identification card. Being reusable, the cards are far more practical than the paper-based ticketing system. Individuals are given out RFID cards. Each person has an account because of their individual ID from their RFID card, which is saved in an online database with other personal information[5]. This paper describes a real-time bus tracking system with IoT capabilities. In this work, a bus-tracking mobile phone app is created, which allows people to precisely locate the bus.The status of the bus and the estimated time of arrival at the bus stop. This work employs high-frequency RFID tags on buses and RFID receivers at bus stops, and real-time RIFD tagging (bus running) data is collected and uploaded to the cloud via NodeMCU.Users can use the mobile app to get real-time information about the bus's location and status from the cloud[6].)-People's preferred mode of transportation is public transportation. According to a recent National Sample Survey Organization report, approximately 62-66% of people utilise the bus as their form of transportation. The goal of the public bus tracking system is to provide users with real-time bus status via an automated system. This study describes a real-time bus tracking system with IoT capabilities. In this work, a bus monitoring mobile phone app is built, allowing people to precisely locate the bus status and time of arrival at the bus stop. This study employs high frequency RFID tags on buses and RFID receivers at bus stops, and real-time RIFD tagging (bus running) data is gathered and sent to the cloud using NodeMCU[7]. Looking at the current ticketing system in public transportation, it is extremely time and money consuming. Our project saves time, takes less man power, and solves the problem of ticketing. Apart from buses, this concept can be used in a variety of other public transportation services such as railways and metros.

3. Architecture:

3.1 Radio Frequency Identification (RFID) :

RFID (Radio Frequency Identification) is a wireless system that consists of two components: tags and readers. The reader is a device with one or more antennas that broadcast radio waves and receive signals from RFID tags. Tags can be passive or active, communicating their identity and other information to nearby readers via radio waves. Passive RFID tags do not have batteries and are powered by the reader. Batteries are used to power active RFID tags. RFID is a type of wireless communication in which electromagnetic or electrostatic coupling in the radio frequency section of the electromagnetic spectrum is used to uniquely identify an object, animal, or human.

3.2 RFID tags:

RFID tags can store information ranging from a single serial number to several pages of data. Readers can be mobile and carried by hand or mounted on a post or suspended from the ceiling. Reader systems can also be constructed.

Figure 1: RFID Tags

3.3 RFID reader:

An RFID (Radio Frequency Identification) reader is a device that uses radio waves to wirelessly communicate with RFID tags or transponders, which are attached to or embedded in objects, products, or living beings. The reader sends out a radio signal or query, which activates the RFID tag and receives its unique identification data or other information stored in the tag's memory. This data is then processed and used by the reader to perform various functions, such as inventory management, access control, tracking and tracing, authentication, and asset protection, among others. RFID readers can operate at different frequencies and power levels, and can be handheld, fixed, or integrated into other devices.
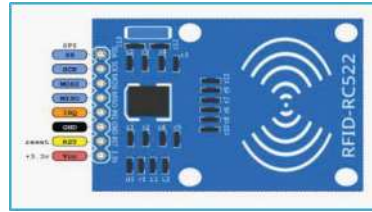
Figure 2: RFID-RC522 module

3.4 STM32F103C8 Microcontroller:

The STM32 series are some of the most popular microcontrollers used in a wide variety of products. STM32 microcontrollers offer a large number of serial and parallel communication *peripherals which can be interfaced with all kinds of electronic components including sensors, displays, cameras, motors.*
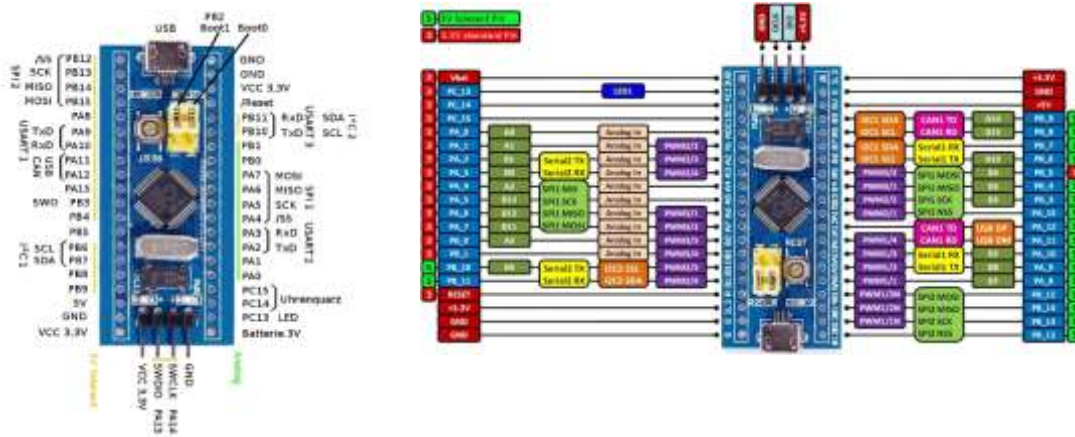

Figure 3: STM32f103C6T6A microcontroller

4. Methodology:

4.1 RFID Technology:

RFID technology involves the use of electromagnetic fields to automatically identify and track tags attached to objects. RFID tags contain electronically stored information and can be read by RFID readers. The first step would be to select the appropriate RFID technology to be used in the transportation system.

4.2 RFID Tagging:

Once the RFID technology has been selected, the next step would be to tag the vehicles with RFID tags. The RFID tags would contain information such as the vehicle type, registration number, and other relevant details.

4.3 RFID Readers:

RFID readers would be installed at the entry and exit points of the transportation system. The RFID readers would be able to read the RFID tags attached to the vehicles as they pass through the entry and exit points.

4.4 Database:

A database would be set up to store the information collected by the RFID readers. The database would contain details such as the time and date of entry and exit, the vehicle type, registration number, and any other relevant details.

4.5 Payment System:

A payment system would be set up that would calculate the fare based on the distance traveled by the vehicle. The fare would be deducted automatically from the passenger's account, which would be linked to their RFID tag.

4.6 Monitoring System:

A monitoring system would be set up to track the movement of the vehicles and ensure that they are operating within the designated areas.
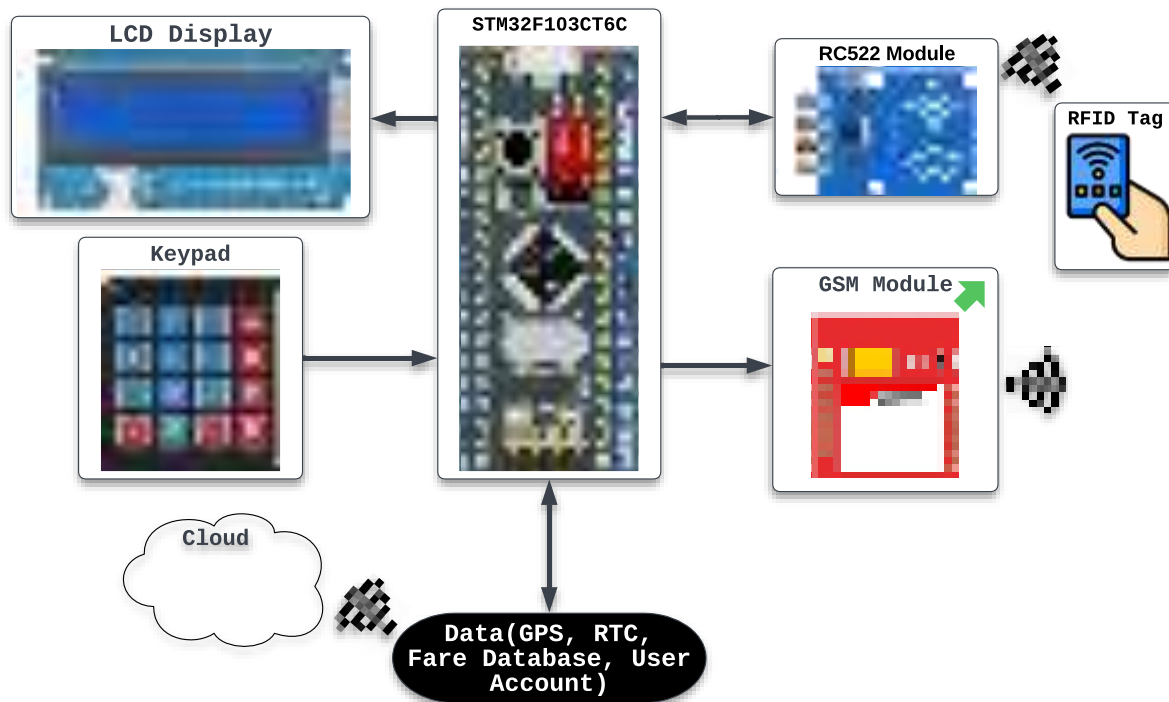
5. Block diagram:

Figure 4: Block diagram for the proposed project

6. Advantages:

- Increased efficiency: Passengers can quickly and easily accessible transportation services without the need for physical tickets or paper receipts, which can reduce wait times and increase throughput.

- Reduced costs: The elimination of paper tickets and manual ticketing operations can reduce printing, processing, and distributing costs.

- Improved passenger experience: Passengers can enjoy a more convenient and hassle-free transportation experience with reduced waiting times and a more streamlined process.

- Better tracking: RFID technology allows for accurate and real-time tracking of passengers and transportation assets, which can improve transportation planning, operations, and security.

- Reduced fraud: Prepaid ticketless systems can help to reduce fraud by eliminating the possibility of counterfeit tickets or duplicate use of a single ticket.

7. Conclusion and Future hope:

This proposal is based on an RFID-enabled bus ticketing system. The main purpose is to make extensive use of retarded technology. Decrease the amount of paper that is thrown away. While some may claim that going paperless is more expensive in terms of software and hardware requirements than the previous paper-based method, a Smart Ticketing system has advantages. The system should be completely automated, dependable, transparent, and easy to use. The complete system can be used in highway cars, toll payment systems, and railway ticketing systems with few or no adjustments. The cards are

significantly more convenient than paper-based ticketing systems because they are reusable. When it comes to time and money, the current ticketing system in public transportation is quite problematic. This system saves time and needs fewer people while also resolving the ticketing issue. Besides buses, this initiative may be implemented in other modes of public transportation such as trains and metros.

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