IMPLEMENTATION OF CASHLESS BUS TICKETING SYSTEM USING IOT

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ABSTRACT

The Smart Ticketing System proposed here revolutionizes public transport by eliminating paper-based tickets, addressing the environmental concerns of deforestation and paper waste. Through RFID technology integrated with GPS modules, passengers can conveniently tap their RFID cards at entry and exit points, enabling accurate fare calculation based on distance traveled. This innovative approach not only streamlines ticketing processes but also promotes environmental sustainability. By transitioning to a rechargeable RFID card system, passengers can effectively manage fares while reducing paper consumption. Embracing digitalization and sustainable practices, this system represents a significant step towards greener, more efficient public transport systems globally.

Keywords: RFID(Radio frequency identification) Cards, RFID Readers, GPS, GSM, Embedded Computing, Embedded Device

I. INTRODUCTION

In today's era of rapid urbanization and technological advancement, the need for efficient and sustainable public transportation solutions has become increasingly apparent. Traditional paper-based ticketing systems not only contribute to environmental degradation through deforestation and paper waste but also pose challenges in terms of operational efficiency and passenger convenience. In response to these issues, the RFID-based Smart Ticketing System emerges as a revolutionary solution poised to transform the landscape of public transport.

The project, aptly named the RFID-based Smart Ticketing System, represents a paradigm shift in the way commuters access and utilize public transportation services. By harnessing the power of Radio Frequency Identification (RFID) technology, this innovative system eliminates the reliance on paper-based tickets, ushering in an era of digitalization and environmental sustainability in public transit operations.

Fig:RFID Technology

At the heart of the system lies the integration of RFID technology with GPS modules, enabling seamless and efficient fare calculation based on the distance traveled by passengers. This transformative approach not only simplifies ticketing processes but also ensures accuracy and transparency in fare calculation, thereby enhancing the overall passenger experience.

Moreover, by transitioning to a rechargeable RFID card system, commuters gain greater control over their travel expenses while significantly reducing their carbon footprint associated with paper ticket consumption. This shift towards sustainable practices not only aligns with global efforts to combat climate change but also positions public transportation as a catalyst for environmental stewardship and resource conservation.

II. LITERATURE SURVEY

Some of the previously carried out project played a crucial role for our proposed system are enlisted here.Mandeep Kaur, Manjeet Sandhu, Neeraj Mohan and Parvinder S. Sandhu [1] have presented a brief discussion of the RFID technology.This paper high-lights its advan- tages, disadvantages and gives a detailed descript-tion of different types of RFID tags used in the market.This information helped us to identify the limitations of the RFID and provide alter-natives for the same. Dr. Prasun Chowdhury, Poulami Bala, Dipta-deep Addy, Sumit Giri, Aritra Ray Chaudhuri [2] have proposed a RFID and Android Based Smart Ticketing and Destination Announcement System.This paper presents a combination of RFID and GPS technology which is further interfaced with ARM processor.This system is linked to the driver's android phone via a bluetooth.It is responsible for passing the passenger's information to the driver's phone and displaying the same on the LCD screen.To achieve these results extensive programming is required furthermore the programming language used to write these codes is dependent on the type of microcontroller used.However to simplify our system used Raspberry Pi and Arduino UNO, Raspberry Pi uses the programming language "Python" is one of the most extensively used language throughout the industries.Md. Foisal Mahedi Hasan, Golam Tangim, Md. Kafiul Islam, Md. Rezwanul Haque Khandokar, ArifUl Alam [3] proposed a RFID-based Ticketing for Public Transport System. In this system RFID is interfaced with the microcontroller and the passengers are asked to enter the source and the destination information manually via a keypad. In our proposed system, a GPS module is attached to the reader system which detects the coordinates of the source and destination without human interference. Daniel Patricko Hutabarat, Hendry Hendry, Jonathan Adiel Pranoto,Adi Kurniawan, Santoso Budijono,Robby Saleh, and Rinda Hedwig [4] have proposed a Human Tracking in Certain Indoor and Outdoor Area by Combining the use of RFID and GPS. In this system when a user enters the room, it first checks the validity of the card. The user then taps the card on the RFID Reader system and the location of the card is detected by the GPS of the android phone In our proposed system RFID and GPS module are used to get exact location of the passenger. Meghana S, Nikhil Teja V, Raghuveer Murali, Sanjana S, Vidhya R, Khurram J Mohammed [5] have proposed the Design and Implementation Of Surveillance Robots For Outdoor Security System. In this system a robot is used to detect the presence of an unauthorized person using RFID and other sensors. IR sensors have been used for obstacle detection. For interfacing purposes the key component is Arduino.Thus proving how Arduino can make the interfacing efficient, likewise in our proposed system used arduino for interfacing the different components which has simplified our system interfacing. Leo Louis [6] has used Arduino as a tool for study and research and explained the working of Arduino in detail which was

extensivelyhelpful for our proposed system, since Arduino is one of the vital component of our proposed reader system.This paper also covers various features of Arduino and its usage on multiple platforms. Not only is it an open source software but also has comprehensible environment for programming whichis what the newcomers mostly prefer being this paper Tun Mohamad Aqil Mohamad Fadzir , Hasmah Mansor ,Teddy [7].Antony fernandas.f1, lokesh.s2, harikrishnan.n3 , karthikraja.m4 . Smart bus fare ticketing system using rfid technology and gsm module, "National conference on emerging technologies for sustainable engineering & management (ncetsem'18)-2018.

III. PROPOSED SYSTEM

The RFID-based bus ticketing system represents a significant advancement in public transportation by introducing a seamless and efficient method for fare collection. This innovative system utilizes RFID technology integrated with GPS modules to revolutionize the way passengers access and pay for bus services. Here's how the project works:

Passengers are issued RFID cards, which they can conveniently tap at designated entry and exit points of buses. Upon tapping their RFID cards, the system automatically registers their boarding and disembarking times, along with the bus's current GPS location. This integration of RFID and GPS technology enables accurate fare calculation based on the distance traveled by each passenger during their journey.

The fare calculation algorithm, embedded within the system, takes into account various factors such as distance traveled, fare zones, time of travel, and any applicable discounts or promotions. By leveraging real-time GPS data and RFID transactions, the system calculates the fare for each passenger dynamically, ensuring accuracy and transparency in fare collection.

Passengers benefit from a hassle-free and contactless ticketing experience, eliminating the need for paper-based tickets and reducing queuing time at ticket counters. With a simple tap of their RFID cards, they can access bus services seamlessly while enjoying the convenience of accurate fare calculation based on their actual travel distance.

For transportation authorities and system administrators, the RFID-based bus ticketing system offers enhanced operational efficiency and data visibility. They can monitor fare transactions in real-time, track bus routes and passenger movements, generate comprehensive reports, and optimize bus schedules and routes based on passenger demand and usage patterns.

Overall, the RFID-based bus ticketing system represents a significant step towards greener, more efficient public transport systems globally. By embracing digitalization and sustainable practices, this innovative project not only streamlines ticketing processes but also promotes environmental sustainability and enhances the overall passenger experience.

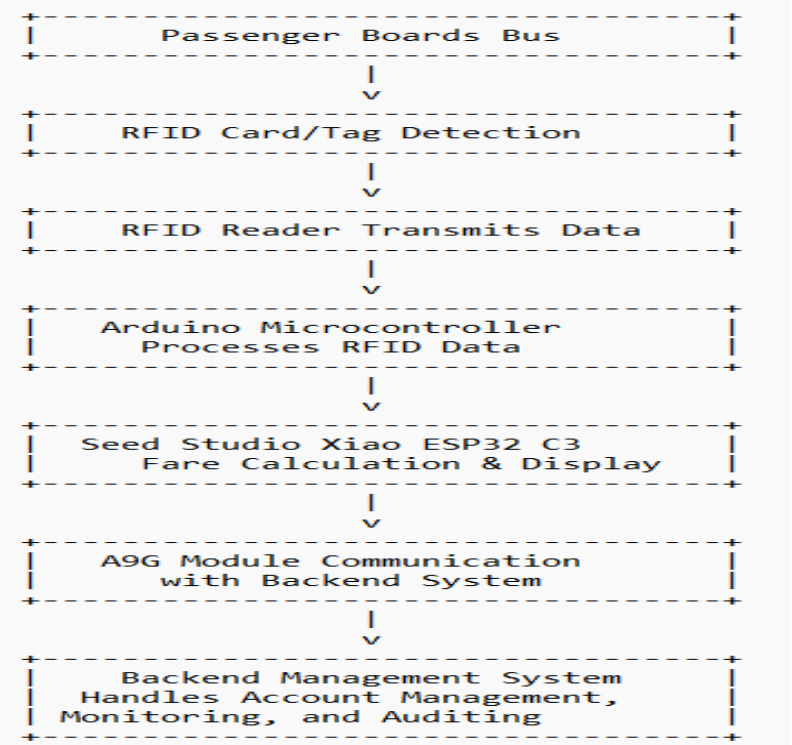

Fig : Workflow diagram

IV. IMPLEMENTATION

Door Access Control: The system controls access to a secured area using an electromagnetic lock controlled by the relay. Authorized users can unlock the door remotely via a mobile app or SMS command sent to the A9G module. Intrusion Detection: Integrated sensors such as motion detectors or magnetic door sensors detect unauthorized entry attempts. Upon detection, the system triggers an alarm using the buzzer and sends alerts to the user's mobile device via SMS or push notification.

Remote Monitoring: The LCD display provides real-time status updates on the system's operation, including door status, alarm triggers, and network connectivity. Users can also remotely monitor the system's status and receive alerts using a mobile app or web interface

User Authentication: Authorized users are authenticated using secure credentials stored in the microcontroller's memory or cloud-based authentication services. Access permissions can be managed and updated remotely to ensure security.

Event Logging: The system logs all security-related events, including door access attempts, alarm triggers, and system status changes. Users can view event logs and generate reports for security auditing and analysis purposes.
Potential Applications:

Home Security: Protects homes and apartments from unauthorized access and intrusions.
Office Security: Secures office premises and restricts access to sensitive areas.

Warehouse Security: Monitors entry points and prevents unauthorized access to warehouses and storage facilities.

V. RESULTS

The Implementation of a Cashless Bus Ticketing System Using IoT represents a groundbreaking transformation in public transportation, leveraging advanced technology to provide passengers with a seamless, efficient, and secure travel experience. This innovative system integrates several cutting-edge components and functionalities, each contributing to an overall enhancement of the public transit infrastructure.

At the heart of this system is the use of RFID (Radio Frequency Identification) cards, which passengers use to access the buses. Upon approaching the bus, a passenger simply scans their RFID card at a reader installed at the entrance. This action triggers the automatic door operation system, allowing for a smooth and hassle-free entry. The doors are designed to close automatically after a designated delay, a feature that ensures not only the safety of the passengers boarding and alighting but also prevents unauthorized access. This intelligent door mechanism exemplifies how IoT technology can streamline the boarding process, reducing the time spent at each stop and thus improving the overall efficiency of the bus service.

Fig : Scan of RFID Card

Once on board, passengers can easily manage their journey through a user-friendly interface that offers various convenient services. One of the primary features is the ability to recharge their RFID cards directly through the system. This eliminates the need for physical cash transactions or separate visits to ticketing counters, making the process quicker and more convenient. Passengers can also inquire about their card balance at any time, ensuring they are always aware of their travel credits and can plan accordingly. This level of accessibility and convenience significantly enhances the user experience, encouraging more people to use public transportation.

Fig : Inputs after the RFID Scan

A critical component of this system is its response to emergency situations, such as accidents. The bus is equipped with an A9G module, which is an advanced IoT device capable of real-time communication. In the event of an emergency, the driver can press a dedicated button to activate the A9G module. This module, which includes a SIM card, immediately shares the real-time location of the bus with emergency services and initiates calls to predefined emergency contacts. This

feature ensures that help can be dispatched promptly, significantly reducing the response time and potentially saving lives. The ability to share precise location data is crucial in emergency situations, as it allows responders to reach the scene quickly and accurately.

Beyond its immediate benefits to passengers and operators, this cashless bus ticketing system also represents a broader trend towards smarter, more connected urban environments. By integrating IoT technology into public transportation, cities can achieve greater efficiency and reliability in their transit systems. This not only improves the daily commute for passengers but also contributes to broader goals of reducing traffic congestion and lowering emissions by encouraging the use of public transport over private vehicles.

The seamless integration of these technologies sets a new standard for public transportation systems. The RFID card system alone simplifies the process of fare collection, reducing the burden on bus drivers and speeding up boarding times. Additionally, the real-time data collected through the IoT devices can be used to optimize routes and schedules, providing a more responsive and adaptable service. For instance, if certain routes are found to be consistently over or underused, adjustments can be made to better meet passenger demand. This kind of data-driven decision-making is only possible through the comprehensive deployment of IoT technology.

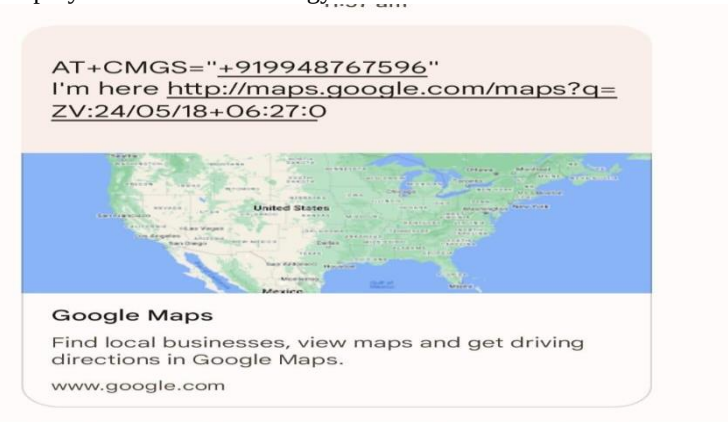

Fig 22:GPS Location of the bus

Moreover, the security and safety features of this system cannot be overstated. The A9G module's capability to provide real-time location data and immediate communication with emergency services adds a layer of security that is highly reassuring to passengers. In the unfortunate event of an accident, the rapid deployment of emergency services can make a significant difference in outcomes. Furthermore, the knowledge that such a system is in place can boost public confidence in the safety of using bus services.

From an operational perspective, the implementation of a cashless ticketing system using IoT also offers several benefits. For bus operators, the reduction in cash handling simplifies the revenue collection process, minimizes the risk of theft, and reduces administrative overhead. The ability to monitor and analyze passenger flow in real-time also enables more effective resource allocation, ensuring that buses are deployed where they are most needed and reducing idle times.

Additionally, the environmental benefits of such a system are noteworthy. By making public transportation more convenient and efficient, this technology encourages a shift away from private vehicle use, contributing to lower carbon emissions and helping cities achieve their sustainability goals. The reduction in paper ticket usage also means less waste, further supporting environmental conservation efforts.

In conclusion, the implementation of a cashless bus ticketing system using IoT is a significant step forward in the modernization of public transportation. It offers a multitude of benefits, from improving the efficiency and convenience of the transit experience to enhancing passenger safety and security. By harnessing the power of IoT technology, this system not only meets the current needs of public transportation but also paves the way for future advancements in smart city infrastructure. As cities continue to grow and evolve, the adoption of such innovative solutions will be crucial in building sustainable, efficient, and user-friendly public transit systems.

VI. CONCLUSION

The RFID-based bus ticketing system offers numerous benefits, including improved efficiency, enhanced passenger experience, and better management of fare collection. By replacing traditional paper tickets with RFID-enabled cards or tags, the system streamlines the ticketing process, reduces boarding time, and minimizes the risk of ticket fraud and revenue leakage.

Moreover, RFID technology enables real-time tracking of passenger movements, allowing transit authorities to gather valuable data for route optimization, schedule planning, and capacity management. This data-driven approach

facilitates better decision-making and enables transit operators to offer more tailored and responsive services to passengers.

Overall, the RFID-based bus ticketing system represents a significant advancement in public transportation systems, providing a seamless and convenient experience for both passengers and operators alike

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