IoT-Based Passenger Authentication System For Transportation Services

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***Abstract*— E-bus booking and transportation processes are becoming common nowadays because most of the working people are staying away from their native places. Concentrating our work for these people, Internet of Things (IOT) enabled bus booking is implemented. In the proposed system, the user will register their details on our website and their details will be stored in a database for future processing. User information like name, address, source, destination, phone number, email id, and other personal information is gathered, and five general personal questions of users are asked, and their answers are collected which will be utilized during the authentication process. Once the registration process gets over unique ID will be generated in the form of a Radio-Frequency Identification (RFID) tag. This is mandatory while entering the bus because this tag will act as an authentication factor. By scanning the tag, a question will be shown to the user among the random question collected during registration. While answering One Time Password (OTP) will be generated to the registered mobile number and by entering this, the door will be opened to enter into a bus. Our system provides efficient authentication and secures processing of user information and maintaining these data will be utilized for the personalization process of regular customers.**

Keywords—Bus Authentication, RFID, OTP, and Arduino UNO.

I. INTRODUCTION

The travel sector is always changing. The requirement to digitize all transactions becomes urgent as the sector develops. This project, which uses RFID for secure identification, is built on the IOT platform. This bus reservation system is simple to set up and incorporates a database for quick authentication.

A user-friendly automated ticketing authentication system proposed in this study also verifies the user's identity via RFID and OTP in addition to automatically allocating tickets based on registration. This essay addresses the identification and ticketing of bus passengers [1].

A web page is created specifically for registration purposes and includes user information such name, address, phone number, source, and destination. After registration, the page receives a unique ID. Users are given this ID, which is implanted in an RFID card, to authenticate themselves. Users must provide additional information for privacy verification, although often, there are just 5 questions to answer. The user should respond appropriately. As an example, **"**What is your favorite food?**"**. The information submitted by the user will be kept in a database and used to grant a discount if the passenger is a repeat client. These questions will be used throughout the authentication procedure.

In recent years, RFID has become an emerging technology. Because to its propensity for effectiveness, RFID technology may be successfully used in a variety of applications. Regarding its use, it has been a common instrument for tracking transit transportation. The reader circuit and tag-details of which are covered later—make up the basic elements of an RFID system. Since that RFID is regarded as a key component of IoT, using it provides several benefits [2].

A web-based program called Bus Booking System is linked to an extensive database. The database contains details about buses, such as their availability, number of seats, occupancy, and price ranges, as well as automatic report and bill production [9].

II. LITERATURE SURVEY

In this paper [3] the author exhibited a smart camera and radio waves would be used to detect individuals or things. There are two basic components to this system: hardware and software. Hardware for the system consists of an RFID reader, an Arduino, and a smart camera. A serial to Universal Serial Bus (USB) converter cable is used to link the RFID reader to the host computer. The Smart School Bus Security System offers system operations such live ID tag transactions display, ID registration, entry recording, and other small tasks. The parent will be alerted by SMS or letter when their kid boards or departs the bus. An ESP-32 camera module is used for face recognition, which provides added security. As a result of Python and Computer Vision (CV), this system can be used to identify whether students are boarding and disembarking to their respective stops along with the RFID card, preventing evil and proxy from occurring and preventing unauthorized people from entering the bus.

Here [4] the author proposed a system of automated identification and authentication that could be used at building entrances to authenticate authorized employees. Anybody attempting to enter the building must key in the correct code number on the keypad. An access control keypad

can only grant admission when the correct code is entered instead of a card reader. Another name for this approach is the barcode system. As a result, every structure, including offices and schools, needs a door security system. A door lock in this system might be controlled by an RFID card. An access control system can be made using a wireless technology known as radiofrequency identification (RFID). An electronic system is intended to design and implement a monitoring and locking system for building rooms across a campus that will enable security and administration to keep an eye on potential emergency situations. By using this approach, not only is the authentication system less expensive, but it is also more reliable and easier to maintain.

RFID-based user identification system for registering, monitoring, and controlling an access permit for security reasons (2018). The suggested system consists of software that keeps track of, records, and displays user data as well as system status, as well as a gate entrance control circuit. The user card number, username, arrival time, and the number of times the card has been used can all be read by the application. Additionally, it can save all of this data in a text file and in a Lab View-created and configured Graphical User Interface (GUI). The system generates a special pass for VIP users that enables access at any time. The control circuit is linked to a Global System for Mobile Communication (GSM) modem module, which may SMS a master control mobile phone in the event of intruders or unauthorized entrance [5].

The advancement of technology helps to address the threat of insecurity. In response to the persistent issue of insecurity, various techniques have been utilized with the continuous progress of technology. These techniques vary from traditional systems such as door locks with handles to more modern solutions such as automated doors. The created system entails the construction of a door access control prototype that will manage employee's entry to a place or office utilizing speech recognition and Radio Frequency Identification (RFID) authentication methods. The moment a person moves, the system recognizes it and asks them to confirm it. If verified by voice or RFID, the door automatically opens and shuts after a 5-second delay. This designed system seeks to limit access to an office or place utilizing speech recognition authentication and radio frequency identification, providing protection for people's lives and property [6].

This paper suggests a computerized system for transport ticketing that uses RFID tags in the Public Transport System. The RFID tags would enable passengers to be recognized, and fares would be automatically deducted based on GPS technology, which would determine the distance traveled. This system is more precise, prevents corruption, minimizes human errors and is more efficient than the conventional paper-based system. Moreover, the use of RFID tags makes tickets reusable, which minimizes waste and the expenses related to paper-based ticketing [7].

III. OBJECTIVES

The main objectives are as follows:

- To design effective authentication of a user during bus door activation.
- To ensure the registered passenger is travelling by bus by efficient authentication.
- To support a smart transport system.
- To avoid illegitimate people travelling using authorized user reserved tickets.

IV. METHODOLOGY

Internet bus ticket purchasing, and travel are getting more popular, and it is the ideal way to save time when traveling. If our suggested technique accomplishes, online bus ticket purchasing, and OTP verification are already accessible. By offering an IOT-based authentication procedure coupled with the web application, effective authentication promotes frequent use of the transportation facility.

STEP 1:

Initially, the user needs to register their detail in our web application to get a unique ID. The registration process includes username, address, phone no, email ID, and other personal information. After entering these details user will get his/her unique ID in the format of an RFID Card described in Fig. 1. This card is utilized for the authentication process in the transport vehicle. When a tag is within a few millimeters of an RFID reader, the reader procedure retrieves the data from the tag [13]. Data received from the tag is transmitted by the reader to the database for authentication, and if authenticated, it is stored for future usage. When a request is made by the reader, the central server checks the database and retrieves the necessary information. The next step in the procedure is to verify the tag's information. If the user does not have any previous record registered to the database, the upcoming process will not be moved further, thus unauthorized entries will be avoided, which makes the verification process faster and more efficient than manual methods. RFID technology is highly accurate and reliable, which helps to prevent errors and reduce the risk of fraudulent activity [10].

Fig. 1. RFID Card

STEP 2:

The next phase of the authentication process is during the registration time, a few questions are asked in general and answers are collected which will be used in the authentication process. In our project we implement the static type of questions. When a user registers, they must respond to static security questions [12]. The responses to these questions must match the predefined answers to proceed to the next authentication step. The main purpose of security question authentication in the traveling system is to verify the identity of the traveler and ensure that only authorized individuals are allowed to perform certain actions related to

their travel. In addition, security question authentication can also help to reduce the risk of fraud and other security threats, as it adds an extra layer of protection against unauthorized access to travel-related information and services. Overall, security question authentication is an important security measure that helps to protect both the traveler and the travel company from potential security risks. The advantages of this authentication process are security questions should be memorable so that users can recall the answers when needed and should be unique to each user and not easily guessable. Security questions should be kept secret and not easily accessible to others to prevent unauthorized access and this is personal to the user, such as their favorite food name or the name of their first pet.

STEP 3:

The third authentication is the OTP verification process. It reads the data from the OTP entered in the keypad connected to Arduino UNO and activates the servo motor driver based on the data received by the user through OTP. In our project, we used the Subscriber Identity Module 800LGSM module Fig. 2 send the OTP to the registered mobile number [8]. The SIM 800L is a compact Global Systems for Mobile/General Packet Radio Service (GSM/GPRS) module that allows for voice and data communication over the GSM network. The 850 - 1900MHz quad-band GSM/GPRS frequencies are supported by this module. It also supports Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP) and Transmission Control Protocol/Internet Protocol (TCP/IP) protocols, which enables it to be used in various IoT applications. It is designed to be power-efficient, with a standby power consumption of less than 1mA. It also has a low voltage range of 3.4Vto 4.4V, which makes it suitable for battery-powered applications [11].

Fig. 2. SIM 800L

V. Arduino UNO

Figure. 3 depicts how the full authentication mechanism is implemented using an Arduino UNO R3 micro controller. It is designed to be used for a range of activities, including handling simpler electronic projects and more complex ones that demand greater processing power. There are fourteen digital input and output pins, reset button, a power jack, six analogue inputs, a 16 MHz crystal, an In-Circuit Serial Programming (ICSP) header, and a USB connector. It comes with everything needed to support the microcontroller; all that is needed to start it running is the insertion of a USB cable, Alternating Current-to-Direct Current adaptor, or a battery [14].

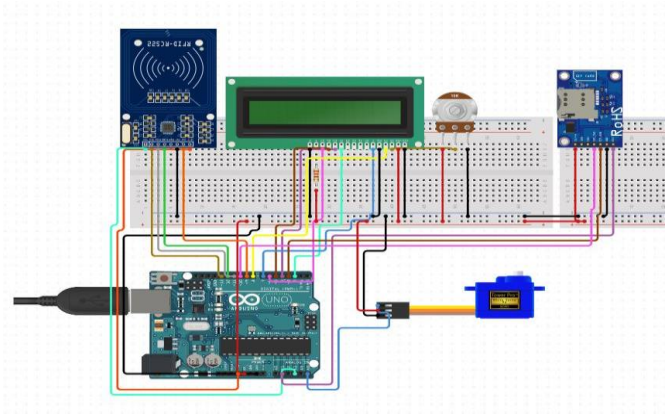

Fig. 3. Arduino UNO R3

VI. Process Flow Of The Proposed System

When an RFID tag is scanned by an RFID reader, an OTP is generated and sent to a registered phone number. Simultaneously a random question will be asked to the user among the 5 questions asked during registration. While answering the question OTP will be generated for the user. If the answer is wrong red light will glow with an alert buzzer otherwise green light will glow, then the bus door will get open, and the particular user can board the bus. Fig. 4 shows the process flow.

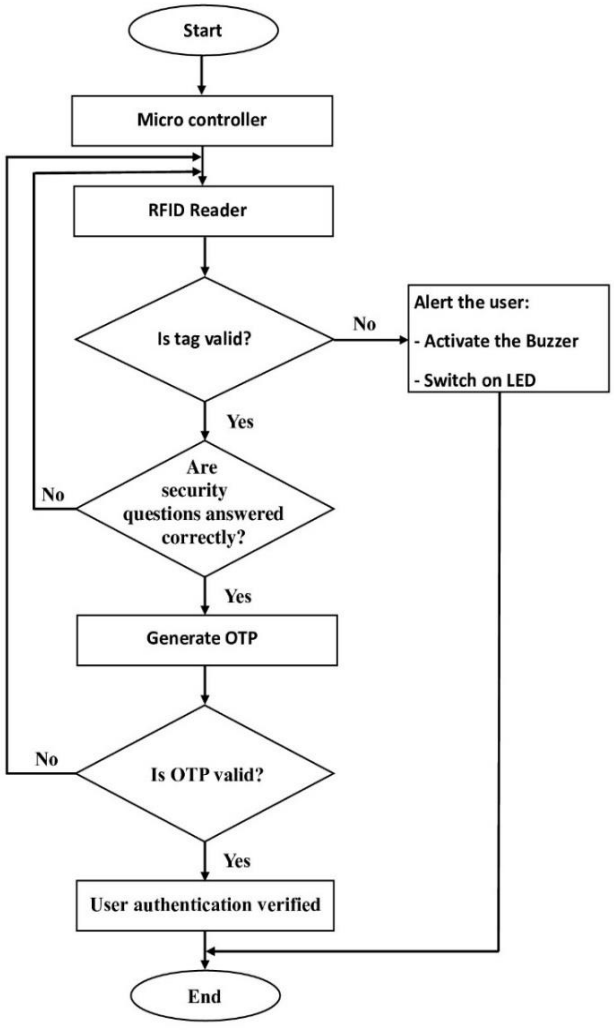

Fig. 4. Process flow of the proposed system

The RFID system enables passengers to scan their cards and board the bus quickly and easily without the need for manual verification, making the boarding process faster and more convenient. In our project we have been using the digitalize verification not using the manual id proofs. The use of security questions in addition to the RFID and OTP verification adds an extra layer of security to the system which makes it robust. This ensures that only authorized users who know the answers to the security questions can board the bus.

VII. Result And Discussion

The screenshot of a few of the outputs is shown in Fig. 5. The working principle of the proposed system has been implemented successfully, and the results demonstrate that after the RFID card has been validated, an SMS will be sent to the user with their unique OTP. The SMS received on a registered mobile number to the user's smartphone, Received OTP will be entered into the proposed system by entering it through a keypad connected to a microcontroller. After verifying OTP, the bus door will get open, and the authorized user can board the bus. Hence secure and effective authentication system is implemented successfully. Information collected from users is stored in a database that will be utilized for future concession preferences if the user is identified as a regular customer. The comparison of existing and proposed system shown in Table I.

TABLE I. Comparison Of Existing And Proposed System

Author (Year)	B.Garg, A. Job (2021)	C.S.Okafor, S.U. Nnebe (2022)	Proposed Method
Methodology	RFID with Facial recognition authentication.	RFID with voice recognition authentication.	RFID, Security Questions with OTP to authentication.
Security	Less secure as facial recognition technology	Less secure as voice recognition technology	More secure as OTPs are generated on the passenger's device and are valid for a single use only
Convenience	Inconvenient as facial recognition can be affected by changes in lighting, facial hair	Inconvenient as voice recognition can be affected by background noise or changes in tone	More convenient as passengers can generate OTPs on their mobile devices or via SMS
Cost	More expensive as facial recognition technology requires high-end cameras	More expensive as voice recognition technology requires high-quality microphones	Less expensive as OTPs can be generated using inexpensive mobile devices or via SMS

The success rate of my proposed work is more than 50 times have been properly executed, although there may be occasional delays of a few seconds in receiving the OTP.

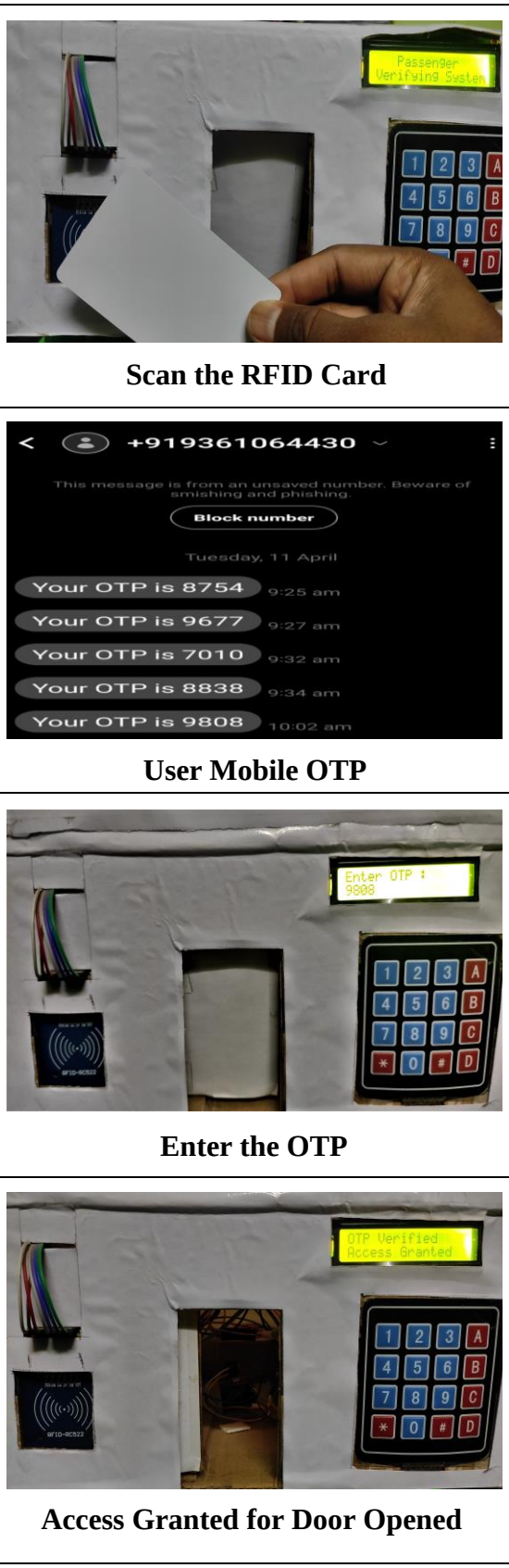

Fig. 5. Output screenshots

VIII. Conclusion

The designing and implementation of the proposed work has been done successfully. In this work we have been using

the Arduino Uno microcontroller to execute the our project. The efficient authentication process of users for bus transport has been implementation with the support of IOT instead of a manual ticket verification process. This is a key step for smart transport. To efficiently authenticate authorised users, OTP verification and question-answering stages has been incorporated in this work. Keyboard, buzzer, light, display, Arduino UNO, RFID, and other crucial parts are employed in the suggested system. RFID-based door security mechanism is implemented with web application support to obtain high performance. The proposed technique can be used in any authentication field for security reasons.

This system is robust enough to authenticate a person inside a bus but still there is some insufficiency in the work like time to get the OTP for verifying a person. In the future time latency will be taken care off.

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