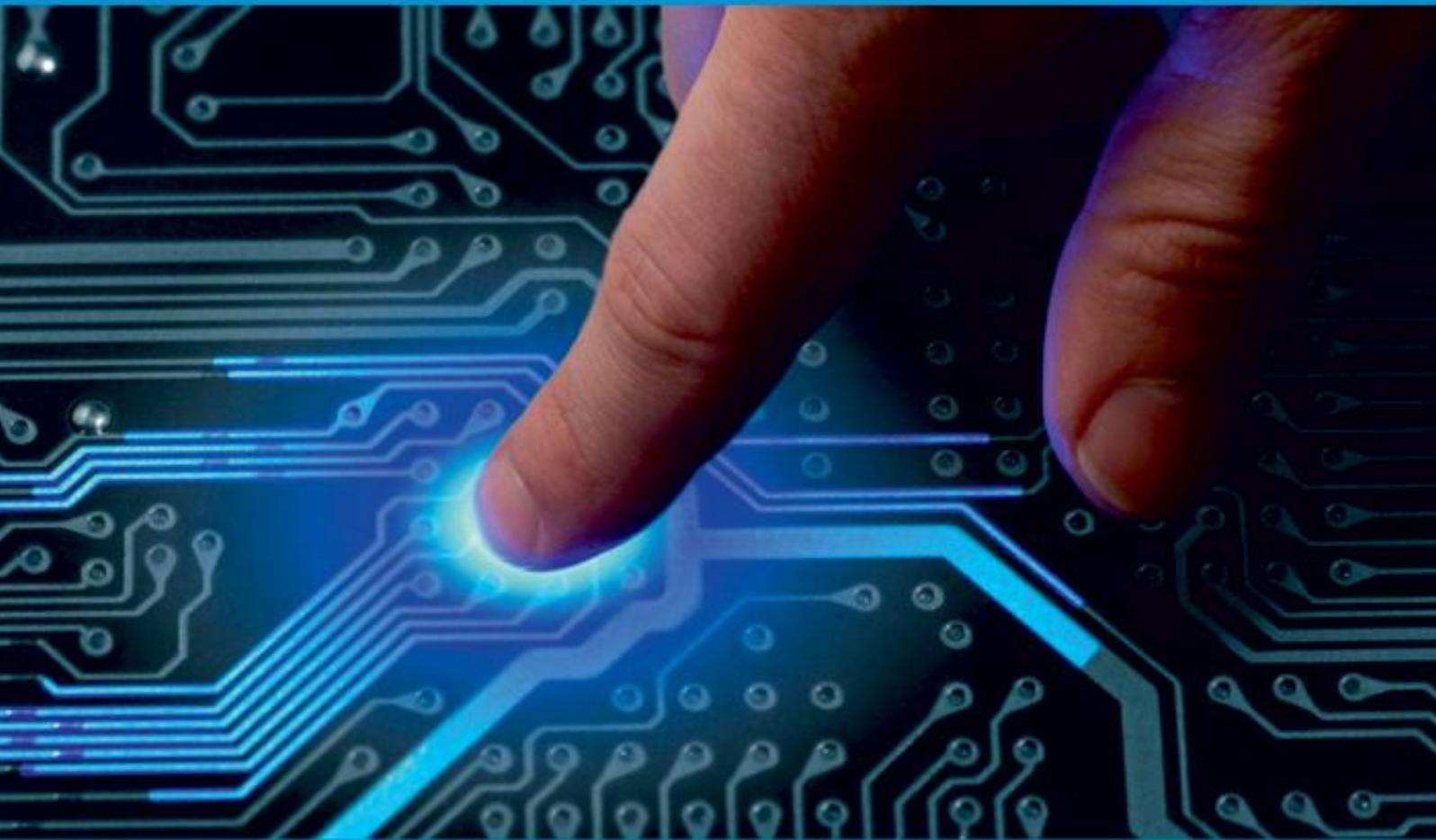




**IJIRCCCE**

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 2, April 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 8.379**

 9940 572 462

 6381 907 438

 [ijircce@gmail.com](mailto:ijircce@gmail.com)

 [www.ijircce.com](http://www.ijircce.com)

# Smart Train Ticketing System: Enhancing User Experience with Bluetooth and Mobile Integration

Sarulatha S, Monica S, Swetha V, DR.K.UMA MAHESWARI

SRM TRP Engineering College, Tamil Nadu, India

SRM TRP Engineering College, Tamil Nadu, India

SRM TRP Engineering College, Tamil Nadu, India

Associate Professor, Department of ECE, SRM TRP Engineering College, Tamil Nadu, India

**ABSTRACT:** Smart train ticket booking system that integrates Arduino, GPS, Bluetooth, WiFi and a mobile Android application. The system aims to automate the ticket booking process and enhance user experience by generating tickets based on the user's location and destination selection. It achieves this by detecting the user's departure from a station using Bluetooth, identifying the last station visited using GPS, and automatically generating a ticket from the last station to the selected destination. The Smart Train Ticketing System (STTS) presents a novel approach to revolutionize the traditional ticketing process by integrating Bluetooth technology and mobile applications. This system aims to enhance user experience, efficiency, and security in train ticketing operations. By leveraging Bluetooth connectivity, passengers can seamlessly purchase, validate, and access tickets using their smartphones, eliminating the need for physical tickets and minimizing queues at ticket counters. The integration of mobile applications empowers passengers with convenient features such as real-time schedule information, seat selection, and digital ticket storage. Additionally, the system offers personalized notifications and alerts to keep passengers informed about delays, cancellations, or platform changes, thereby improving overall travel experience and reducing stress associated with unforeseen circumstances. Overall, the Smart Train Ticketing System represents a significant advancement in modernizing railway transportation, offering a seamless and user-friendly experience that enhances convenience, efficiency, and security for all stakeholders involved.

## I. INTRODUCTION

In an era defined by rapid technological advancements and the seamless integration of digital solutions into everyday life, the realm of transportation stands poised for transformation. With the aim of revolutionizing the commuter experience, we proudly introduce the "Smart Train Ticketing System: Enhancing User Experience with Bluetooth and Mobile Integration." Gone are the days of cumbersome ticketing processes and long queues at station counters. Our innovative system leverages the power of Bluetooth technology and seamless mobile integration to streamline the ticketing experience for passengers, setting a new standard in efficiency and convenience. At its core, the Smart Train Ticketing System aims to address the pain points faced by commuters in traditional ticketing systems. By harnessing the ubiquity of smartphones and the versatility of Bluetooth connectivity, we empower passengers to effortlessly purchase, validate, and manage their train tickets with just a few taps on their mobile devices. This cutting-edge solution offers a plethora of benefits, ranging from eliminating the need for physical tickets to providing real-time updates and notifications. With the integration of Bluetooth technology, passengers can seamlessly access ticket gates, eliminating the hassle of fumbling for paper tickets or navigating through complex validation procedure. Moreover, our system is designed with a user-centric approach, prioritizing simplicity and accessibility. Whether it's a seasoned commuter or a first-time traveler, our intuitive mobile interface ensures a hassle-free experience for all users, thereby enhancing overall satisfaction and loyalty. Beyond enhancing the commuter experience, the Smart Train Ticketing System also offers unparalleled insights and analytics for transportation authorities. By harnessing data analytics capabilities, operators can gain valuable insights into passenger behavior, demand patterns, and operational efficiencies, enabling informed decision-making and optimization of services. In summary, the Smart Train Ticketing System represents a paradigm shift in the way we approach transportation, seamlessly blending technology and convenience to enhance the commuter experience. With its user-centric design and transformative capabilities, this

innovative solution heralds a new era of efficiency, accessibility, and satisfaction in public transportation. Welcome aboard the future of commuting.

## II. LITERATURE SURVEY

### 1. Ticketing System Using AES Encryption Based QR Code Nirmitt Gangurde; Subendu Ghosh; Akash Giri; Swapnil Gharat. 4th International Conference on Smart Systems and Inventive Technology (ICSSIT) IEEE-2022

Current ticket reservation system is based on use of QR Code, which contains the details of the ticket records such as train timings, its arrival timings, departure timings and passenger reservations details. The printed ticket consists of information which includes all train details with QR Code Information. The Ticket reservation system involves three main factors the database, online passenger and dataset. In the proposed system GUI is developed for the users through which users book their tickets and the ticket generated will be in the form of QR code which is generated after booking confirmation. The QR Code will be generated on the basis of encrypted data entered by the user. For encryption, using AES encryption algorithm QR Code will be generated as per passenger/user's and train details. The required data is then generated through patterns that are present in both horizontal and vertical components of the QR code. Hence, the QR generated will be secured and end to end encrypted which ensures data security while reserving ticket. Apache kafka is used in the system for messaging purpose. A mobile application is designed to scan the encrypted QR Code

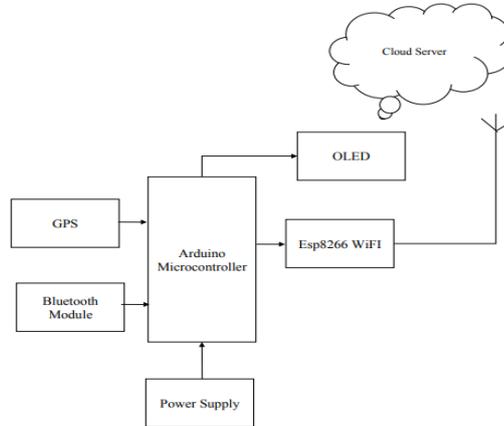
### 2. Integrated Information System Based on Google Maps APIs: Design of Surabaya Public Transportation System. Farah Zakiyah Rahmanti; Oktavia Ayu Permata; Khodijah Amiroh; Philip T Daely; Anas Ittaqullah; Dimas Bagus Saputro. International Conference on Computer Science, Information Technology, and Electrical Engineering (ICOMITEE) IEEE-2019

Public transportation is a passenger transportation service that can be used by the public, managed and operated on a designated route, and charged for each trip. Public transportations with fixed route often used by the people of Surabaya are share taxis (Angkutan Kota), city buses, bus rapid transit system (Suroboyo Bus), and commuter trains. There are many transportation modes in Surabaya, but there is no integrated information system of it. We propose a system designed to help passengers feel ease to access and choose any public transportation in Surabaya. The proposed system offers information to help passengers know the easier travel route, monitoring vehicle position, ticket price, and visualization on the map. A positioning device is installed on every public transportation, where it will send the vehicle's position to the server. The integrated information system is based on Android. It can help passengers who want to travel to find the best route, cheap ticket price, and arrival time while using public transportation in Surabaya. Outcome of this research is a mockup of the system.

### 3. Prototype for intelligent ticketing system using NFC. Anita Chaudhari; Brinzel Rodrigues; Pratap Sakhare; Caston Fernandes. International Conference on Green Computing and Internet of Things (ICGCIoT) IEEE-2015

Development in technology enabled us to use virtual money for online transaction. It is proven through a developed technology, when transaction can be done not only using real money but also virtual money. This technology is also supported by NFC. This paper gives an overview of NFC technology for generating tickets using intelligent NFC based android phone. We will see how through machine learning and NFC technology tickets can be generated in a more faster way as compared to the existing systems. This system uses QR code Technique for verification of ticket. The Paper also analyzes what will be future implementation of this System.

**BLOCK DIAGRAM:**



**COMPONENTS:**

(i) Arduino Microcontroller Mega 32:

The integration of Arduino microcontrollers, particularly those based on the ATmega32 chip, in automotive train ticketing systems provides a multitude of benefits that cater specifically to the demands and requirements of such applications. Primarily, the ATmega32's affordability makes it an ideal choice for automotive train ticketing solutions, allowing for cost-effective deployment across various vehicles within a train network. This cost efficiency is particularly crucial for large-scale implementations where the goal is to equip multiple vehicles with ticketing capabilities while keeping overall expenses manageable. Furthermore, the compatibility of the ATmega32 microcontroller with a diverse range of sensors and modules is invaluable for automotive ticketing systems. Arduino's ecosystem supports integration with components such as RFID/NFC readers, GPS modules for location tracking, and communication interfaces for data exchange. This compatibility facilitates the implementation of advanced features like contactless ticketing and real-time passenger information systems, enhancing both the efficiency of ticketing processes and the overall travel experience for passengers. Moreover, the ease of prototyping and development offered by Arduino's open-source platform accelerates the design and implementation of customized solutions tailored to the unique requirements of automotive train ticketing. This agility enables developers to rapidly iterate on designs, experiment with different configurations, and incorporate novel functionalities, ensuring that the ticketing system meets the specific needs of train operators and passengers alike. In addition, the reliability and stability of the ATmega32 microcontroller make it well-suited for automotive environments where robust performance is essential. Its ability to handle critical tasks such as data processing, sensor interfacing, and communication with peripheral devices ensures smooth and uninterrupted operation of the ticketing system even in challenging conditions. The scalability of Arduino-based solutions allows for seamless expansion and integration with existing automotive infrastructure. Additional Arduino boards can be easily deployed in other vehicles within the train network, facilitating centralized control and coordination while enabling efficient data sharing and synchronization between different components of the ticketing system.





(ii)GPS:GPS allows for accurate real-time tracking of the train's location. This information is crucial for passengers as it enables them to know precisely when the train will arrive at their station. This reduces uncertainty and waiting times. Train operators can use GPS data to optimize train schedules and routes. By analyzing historical GPS data, operators can identify patterns and adjust schedules to improve efficiency, reduce delays, and manage resources more effectively.

Calculation.



(iii) Bluetooth module: Bluetooth modules facilitate seamless contactless ticketing. Passengers can effortlessly validate their tickets or passes using their smartphones, eliminating the need for physical tickets or smart cards and reducing boarding times. Moreover, these modules enable automated fare collection by connecting with mobile ticketing apps. Bluetooth technology allows for proximity detection, enabling operators to track passenger flow and occupancy levels within the train. Bluetooth modules support personalized services and targeted notifications based on passengers' locations or travel history. Overall, the incorporation of Bluetooth modules in smart ticketing systems for trains revolutionizes ticketing processes, enhances passenger convenience, and empowers operators with valuable insights for optimizing service delivery..



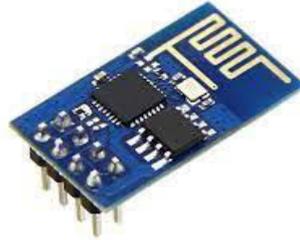
(iv)OLED:

OLED (Organic Light Emitting Diode) displays play a pivotal role in enhancing the functionality and user experience of smart ticketing systems for trains. One of the primary reasons for leveraging OLED technology is its exceptional visibility. Whether in well-lit train stations or dimly lit environments within trains, OLED displays ensure that vital information remains easily legible to passengers, facilitating seamless navigation through the ticketing process. Additionally, OLED displays offer energy-efficient operation, a crucial consideration for sustainable transport solutions. By eliminating the need for a backlight, OLEDs consume less power, contributing to reduced energy

consumption and lower operating costs for train operators, all while maintaining high display quality. Moreover, the slim and flexible design of OLED displays enables their integration into various form factors, including ticketing machines, turnstiles, and handheld devices used by train staff for ticket validation. This versatility in design allows for sleek and modern interfaces, enhancing the overall aesthetic appeal of the ticketing infrastructure. Furthermore, OLED displays provide wide viewing angles, ensuring that passengers can easily read ticketing information from different positions and perspectives. This enhances accessibility and usability for passengers of diverse heights and mobility levels, promoting inclusivity within the transport system. In terms of durability and longevity, OLED displays boast a longer lifespan and better resistance to image burn-in compared to some alternative display technologies. This durability ensures consistent performance even under continuous usage in high-traffic environments like train stations. Lastly, the vibrant colors, high contrast ratios, and fast response times of OLED displays contribute to an immersive and engaging user experience. Clear and visually appealing interfaces streamline the ticket purchase process, reducing passenger frustration and enhancing overall satisfaction. In conclusion, OLED displays are indispensable components of smart ticketing systems for trains due to their visibility, energy efficiency, slim design, wide viewing angles, durability, and ability to enhance the user experience. Leveraging OLED technology ensures efficient and user-friendly ticketing processes, ultimately contributing to the seamless operation of train services.



(v) ESP8266 WIFI: ESP8266 facilitates seamless connectivity to Wi-Fi networks, enabling smart ticketing devices onboard trains to stay connected to the internet. This connectivity is essential for real-time communication with central ticketing servers, ensuring accurate ticket validation and updating passenger information promptly. Moreover, the ESP8266's microcontroller functionality empowers ticketing devices with the capability to interact with various sensors, input devices, and displays. This allows for the creation of sophisticated ticketing terminals capable of handling diverse ticket types, payment methods, and passenger queries. The versatility of the ESP8266 extends to its programming flexibility, accommodating a range of development environments such as the Arduino IDE and MicroPython. This enables developers to customize and optimize ticketing systems according to specific requirements, ensuring seamless integration with existing infrastructure and protocols. Furthermore, the ESP8266's support for web server and client functionalities is instrumental in facilitating secure and efficient communication between ticketing devices, central servers, and passengers' mobile devices. This enables features such as remote ticket purchase, real-time updates on train schedules, and personalized notifications, enhancing passenger convenience and satisfaction. The low power consumption of the ESP8266 is particularly advantageous for smart ticketing systems onboard trains, where energy efficiency is paramount. This ensures that ticketing devices can operate reliably for extended periods without draining onboard power resources excessively. The ESP8266 Wi-Fi module serves as a cornerstone technology in smart ticketing systems for trains, offering reliable connectivity, advanced functionality, and programming flexibility. Its integration empowers operators to deliver seamless ticketing experiences to passengers while optimizing operational efficiency and resource utilization.



(vi)Power supply: power supply is necessary to ensure continuous functionality of ticketing terminals, validators, and other electronic devices installed onboard trains. These devices require a stable source of power to operate effectively and process transactions efficiently throughout the journey. Moreover, a dependable power supply enables the implementation of various advanced features and capabilities in smart ticketing systems. For instance, it supports the integration of display screens, touch panels, and communication modules, facilitating interactive ticket purchasing interfaces and real-time passenger information updates

Cloud server:Cloud servers provide a scalable and reliable platform for storing and processing vast amounts of ticketing data generated by onboard systems. This includes transaction records, passenger information, and real-time updates on train schedules and availability. By offloading data storage and processing to the cloud, train operators can effectively manage and analyze ticketing data without the need for extensive on-premises infrastructure, moreover, cloud servers facilitate seamless integration and communication between onboard ticketing devices, central ticketing servers, and passenger-facing applications. This enables real-time synchronization of ticketing information, ensuring that passengers have access to accurate and up-to-date information throughout their journey. Whether purchasing tickets, validating passes, or checking train schedules, passengers benefit from a seamless and interconnected ticketing experience. Furthermore, cloud-based ticketing systems enable remote management and monitoring of onboard devices, allowing operators to perform software updates, troubleshoot issues, and analyze system performance from a centralized location. This streamlines maintenance procedures and reduces downtime, ensuring continuous availability of ticketing services for passengers. Additionally, cloud servers provide enhanced security features, including data encryption, access controls, and automated backups, to safeguard sensitive ticketing information and protect against unauthorized access or data loss. This helps ensure compliance with regulatory requirements and build trust with passengers regarding the confidentiality and integrity of their personal data. leveraging cloud infrastructure offers cost efficiencies by eliminating the need for upfront investment in hardware infrastructure and reducing ongoing maintenance and operational costs associated with traditional on-premises systems. Cloud-based solutions offer flexible pricing models, allowing train operators to scale resources according to demand and optimize cost-effectiveness.

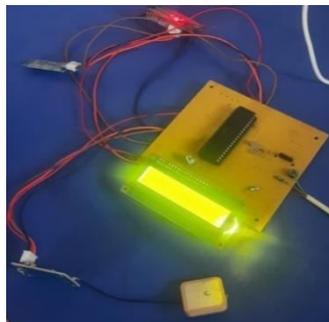
COMPONENTS TABLE:

S.NO	COMPONENTS	COST
1	Arduino Microcontroller Mega 32	900
2	GPS	500
3	OLED	309
4	ESP8266 WIFI	380
5	Bluetooth Module	200

III. METHODOLOGY

The smart train ticketing system described revolutionizes the passenger experience by seamlessly integrating various cutting-edge technologies. At its core is an Android app that provides passengers with an intuitive interface to effortlessly select their destination from a comprehensive list of options. This user-friendly interaction significantly streamlines the ticketing process, enhancing overall convenience and satisfaction. As passengers embark on their

journey, the system employs a sophisticated combination of Bluetooth detection and GPS location tracking to monitor their movements in real-time. Bluetooth connections are continuously monitored to accurately detect instances when a user departs from a station. This real-time detection mechanism serves as a robust means of tracking passenger movement and determining station departures, ensuring precise journey data capture. Simultaneously, GPS technology is leveraged to precisely monitor the user's whereabouts and movements throughout their journey relative to the train network. By integrating GPS modules, the system can accurately pinpoint the user's current location, facilitating seamless navigation and ticketing processes. This integration of Bluetooth and GPS technologies ensures comprehensive tracking of passenger journeys, enabling precise ticket generation and fare calculation based on the travel route. Upon detecting a Bluetooth disconnection signaling the user's departure from a station, the system intelligently utilizes GPS data to identify the last station visited by the passenger. This intelligent mechanism ensures accurate tracking of passenger journeys, enabling the system to generate tickets automatically from the last station visited to the selected destination. The automated ticket generation process, powered by Arduino microcontrollers and WiFi connectivity, optimizes efficiency and minimizes the need for manual intervention, enabling swift issuance of tickets tailored to individual travel requirements. Subsequently, ticket details, including the passenger's journey information and fare calculation, are seamlessly transmitted to the server via WiFi for booking and confirmation. This seamless integration with server-based booking systems ensures that passengers receive timely confirmation of their ticket bookings, further enhancing the hassle-free travel experience. The smart train ticketing system described represents a comprehensive and efficient solution that enhances passenger convenience and operational efficiency. By combining user-friendly interaction, robust Bluetooth detection, precise GPS location tracking, intelligent last station identification, automated ticket generation using Arduino, and seamless WiFi-based booking integration, the system sets a new standard for modern ticketing systems in the transportation industry.



## IV. RESULT AND DISCUSSION

The proposed train ticket booking system represents a significant advancement in the realm of transportation technology, promising a reliable, efficient, and user-friendly solution for passengers worldwide. By harnessing the power of automation and leveraging modern technologies, this innovative system aims to streamline the ticketing process, enhance user satisfaction, and revolutionize the experience of train travel. At the heart of this system lies a sophisticated integration of various cutting-edge technologies, each playing a pivotal role in ensuring its seamless operation and effectiveness. Arduino, a versatile open-source microcontroller platform, forms the foundation of the system, serving as its central processing unit. With its robust capabilities and flexibility, Arduino enables the system to execute complex tasks with precision and efficiency. One of the key components enhancing the functionality of the system is GPS (Global Positioning System) technology. By incorporating GPS modules into the infrastructure, the system can accurately track the location of trains in real-time, providing passengers with up-to-date information regarding schedules, delays, and arrival times. This not only improves the overall efficiency of train operations but also helps passengers plan their journeys more effectively, minimizing inconvenience and uncertainty. Bluetooth technology plays a crucial role in facilitating seamless communication between the system and passengers' mobile devices. Through Bluetooth connectivity, passengers can easily pair their smartphones with onboard terminals or ticketing kiosks, enabling swift and hassle-free ticket purchases. This eliminates the need for physical tickets and traditional queuing systems, streamlining the booking process and enhancing user convenience. Furthermore, the integration of WiFi capabilities ensures continuous connectivity throughout the passenger's journey. Whether onboard the train or waiting at the station, passengers can stay connected to the system's network, enabling them to access real-time

updates, make bookings, or modify their travel plans as needed. This ubiquitous connectivity not only enhances the passenger experience but also opens up opportunities for additional services such as onboard entertainment or in-transit internet access. Central to the user experience is the dedicated Android application developed as part of the system. This intuitive and feature-rich mobile app serves as the primary interface for passengers, allowing them to search for trains, check schedules, and book tickets with ease. Leveraging the power of GPS and WiFi, the app provides users with personalized recommendations, real-time notifications, and seamless integration with other travel-related services, such as hotel bookings or transportation arrangements at their destination. In addition to facilitating ticket purchases, the Android app also serves as a digital boarding pass, eliminating the need for printed tickets and minimizing paper waste. Through secure digital ticketing mechanisms, passengers can simply present their smartphones for verification, speeding up the boarding process and enhancing overall efficiency. Overall, the proposed train ticket booking system represents a significant leap forward in the realm of transportation technology. By harnessing the capabilities of Arduino, GPS, Bluetooth, WiFi, and a dedicated Android application, the system offers a reliable, efficient, and user-friendly solution for passengers, simplifying the booking process, enhancing convenience, and ultimately transforming the experience of train travel. With its emphasis on automation, connectivity, and user-centric design, this innovative system has the potential to revolutionize the way we perceive and interact with public transportation systems, setting new standards for efficiency, reliability, and passenger satisfaction in the digital age.

## V. CONCLUSION

The proposed train ticket booking system represents a transformative approach to modernizing the passenger experience in train travel. Leveraging advanced technologies like Arduino, GPS, Bluetooth, WiFi, and a dedicated Android application, it aims to address common pain points and streamline the ticketing process for passengers. Automation lies at the core of this system, simplifying tasks such as ticket issuance and validation, reducing errors, and enhancing operational efficiency. Arduino serves as the central processing unit, ensuring seamless interaction between components and enabling prompt responses to user inputs. GPS technology provides real-time location tracking for trains, empowering passengers with accurate schedule information and enabling operators to optimize service delivery. Bluetooth facilitates quick and convenient ticket purchases via passengers' smartphones, while WiFi ensures continuous connectivity for accessing system services and information. The Android application offers an intuitive interface for users to search for trains, check schedules, and book tickets seamlessly. In conclusion, the proposed system promises to redefine convenience and satisfaction in train travel through its innovative integration of modern technologies.

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