International journal of imaging science and engineering

ISSN: 1934--9955 www.ijise.net
Vol-20 Issue-01 April 2025

IOT BASED SMART NAVIGATE BUSASISTANT FOR ELDERS AND BLINDPEOPLE

M. Uma Priyanka[1], P. Nagarjuna [2], R. Siddu Naik[3], Mr. G. Poshamallu [4]
[1,2,3] UG Scholar, Department of ECE, St. Martins Engineering College, Secunderabad, Telangana, India, 500100
[4]Assistant Professor, Department of ECE, St. Martins Engineering College, Secunderabad, Telangana, India, 500100
umapriyankamuthayala@gmail.com

Abstract:

A bus detection system using RFID technology is designed to ease the traveling and movement of blind people by providing real-time information about buses. The proposed system consists of two detection subsystems, one installed on buses and the other at bus stations, along with a website for real-time updates. In the bus detection subsystem, nearby stations will be automatically detected, and a voice announcement will be made inside the bus to inform passengers about the upcoming stops. In the bus station subsystem, approaching buses will be detected, and their details will be announced at the station to alert blind individuals about the available buses, ensuring they can board the correct one. The system will also provide essential bus details, such as bus number, route, and estimated arrival time, which will be posted on the website using IoT technology for better accessibility. This solution aims to enhance the independence of blind individuals by enabling them to travel smoothly and confidently without requiring assistance. The entire project will be monitored through an LCD display using a 16×2 module, ensuring real-time status updates. The system is designed using an ESP32 microcontroller, programmed through Arduino IDE, and operates on a 5V regulated power supply to maintain stable performance. The implementation of this system is carried out using embedded C programming language, ensuring efficient data processing and communication between the detection subsystems, the website, and the user interface. By integrating RFID, IoT, and voice-assisted announcements, this innovative system significantly improves the accessibility and mobility of visually impaired individuals, making public transportation more inclusive and user-friendly.

Keywords: RFID Technology, Voice Announcements, IoT (Internet of Things), Blind Accessibility, ESP32 Micro controller.

1. INTRODUCTION

Visually impaired individuals face significant challenges when navigating public transportation, especially buses. Identifying buses, reading bus numbers, and estimating arrival times can be difficult, making it hard for them to travel independently. Traditional methods, such as relying on auditory announcements or asking for help, are often unreliable and inconvenient. This lack of accessibility in public transportation systems limits the mobility of visually impaired passengers and affects their ability to live independently.

To address these challenges, we propose an IoT and RFID-based bus identification system that enhances accessibility for visually impaired passengers. The system integrates RFID tags, which are given to visually impaired passengers, with RFID readers installed at bus entrances and stations. As a passenger boards the bus, the RFID reader detects the tag and verifies whether they are on the correct bus. If they are, a voice alert is triggered, providing essential information such as the bus number, route, and destination. This real-time voice notification enables visually impaired individuals to confidently navigate public transportation without needing assistance from others.

In addition to the voice alerts on the bus, the system includes an LCD display at bus stops, which provides real-time information about buses for all passengers. The display shows bus numbers, routes, and estimated arrival times, helping blind passengers track the approaching bus. Moreover, a buzzer inside the bus confirms that the passenger has boarded the correct bus, adding an extra layer of reassurance. All of these components are managed by an ESP32 microcontroller, which ensures smooth communication between the RFID readers, voice alert system, and LCD displays.

This IoT and RFID-based bus identification system significantly improves the independence, confidence, and mobility of visually impaired individuals. By providing real-time updates, voice alerts, and verification, the system ensures that blind passengers can navigate public transportation more easily and safely, enhancing their overall quality of life.

2. LITERATURE SURVEY

Debasish Bal. [1]
"New York City's transportation primarily relies on the MTA's subway and bus systems" with ridership recovering post-pandemic. Road networks, managed by NYSDOT, and commuter rail are also vital. Key data on ridership and infrastructure are available from the MTA and NYSDOT websites. Available from: public transportation-to- commute-in-New-York-New-York. Accessed 25 November 2015.

Hersh, M.A., [2]

"Assistive Technology for Visually Impaired and Blind People" Springer, 2008. Assistive technology for visually impaired and blind individuals is a growing field, focused on enhancing independence and quality of life. Innovations range from advanced mobility aids like sensor-equipped canes and GPS navigation, to information access tools such as screen readers and Braille displays. AI and computer vision are driving progress, with smartphones and wearables playing key roles. Publishers like Springer contribute by disseminating research and fostering collaboration. This technology aims to bridge accessibility gaps, enabling greater participation in daily life.

Miesenberger, [3]

"Computers Helping People with Special Needs", LNCS, vol. 4061 Springer Berlin / Heidelberg, 10th International Conference, ICCHP 2006, Linz, Austria, July 11-13, 2006. It showcases computer science research dedicated to assisting people with special needs. "Computers Helping People with Special Needs, LNCS" presents a range of assistive technologies, accessible software, and hardware solutions. LNCS, as a publication platform, facilitates the dissemination of this vital research. The work focuses on improving independence and inclusion, addressing various disabilities. Topics span visual and auditory aids to cognitive support, often incorporating AI and HCI advancements. Ultimately, the goal is to leverage technology to bridge accessibility gaps.

Sanchez J., [4]

"Subway mobility assistance tools for blind users", LNCS, vol. 4397, pp. 386-4042007. For blind users, subway mobility relies on a combination of infrastructure and technology. Tactile paving and Braille signage provide physical guidance, while audio systems deliver real-time information. Navigation apps, like Navi Lens, use QR codesfor detailed, audio-based directions within stations.

Jerry T., [5]

"Accessible Bus System: A Bluetooth Application," Assistive Technology for Visually Impaired and Blind People, pp. 363-384, 2008. "Accessible Bus System: A Bluetooth Application" proposes using Bluetooth technology to improve bus accessibility for people with disabilities. A mobile app would provide real-time audio announcements of bus arrivals, routes, and stops. It could also offer features like requesting priority seating and navigation assistance. By integrating with other assistive technologies, this app aims to enhanceindependence and mobility within bus transit systems.

Noor, M.Z.H [6]

"Bus detection device for the blind using RFID application," 5th International Colloquium on Signal Processing & Its Applications, pp. 247 – 249.2009. An RFID-based bus detection device helps blind individuals identify approaching buses. RFID tags on buses are detected by a user's reader, which then provides audio information about the bus's route and destination. This technology enhances independence and safety by enabling accurate, real-time bus identification, reducing reliance on others for assistance.

Quoc T., [7]

"Wireless Sensor Network apply for the Blind U-bus System," International Journal of u- and e- Service, Science and Technology Vol. 3, No. 3, September, 2010. A Wireless Sensor Network (WSN) for a "Blind U-bus System" uses interconnected sensors at bus stops and on buses to provide real-time information to blind users. Sensors detect bus arrivals, locations, and route details, which are relayed wirelessly to a user's device. This system enhances navigation, safety, and independence by providing up-to-date information, enabling blindindividuals to confidently use the bus system.

Chris Muchibwa, [8]

"Assessment of Contemporary Methods and Data-Enabled Approaches for Early Cataract Detection", Contemporary cataract detection is undergoing a significant transformation with the integration of data-enabled approaches. Traditional methods, like slit- lamp examinations, are now being augmented and, in some cases, enhanced by artificial intelligence (AI) and machine learning (ML) algorithms.This evolution aims to improve diagnostic accuracy, enableearlier intervention, and increase accessibility to cataract screening, particularly in underserved populations.

Najeeba Afreen, [9]

"Glaucoma Detection Using Explainable AI and Deep Learning", AI and deep learning are transforming glaucoma detection. Deep learning models analyze retinal images, while explainable AI clarifies their diagnostic reasoning. This combination enhances accuracy and builds clinician trust, leading to earlier and more reliable glaucoma detection.

3. PROPOSED METHODOLOGY

The proposed system is an innovative IoT and RFID-based bus identification solution, designed specifically to enhance accessibility for visually impaired individuals in public transportation. This system builds upon the existing framework by integrating advanced features and technologies to overcome the limitations of the current system. It addresses the challenges faced by visually impaired individuals when navigating public transportation, such as the inability to easily identify buses, access real-time information, and plan journeys independently. One of the key enhancements of the proposed system is its advanced voice alert system. This system uses a combination of IoT, RFID, and voice recognition technologies to provide real-time information about approaching buses, including their route numbers, destinations, and estimated arrival times. Additionally, the system can announce details about nearby landmarks, bus stops, and other points of interest, helping visually impaired individuals navigate more effectively.

3.1 Block Diagram:

International journal of imaging science and engineering
ISSN: 1934--9955 www.ijise.net
Vol-20 Issue-01 April 2025

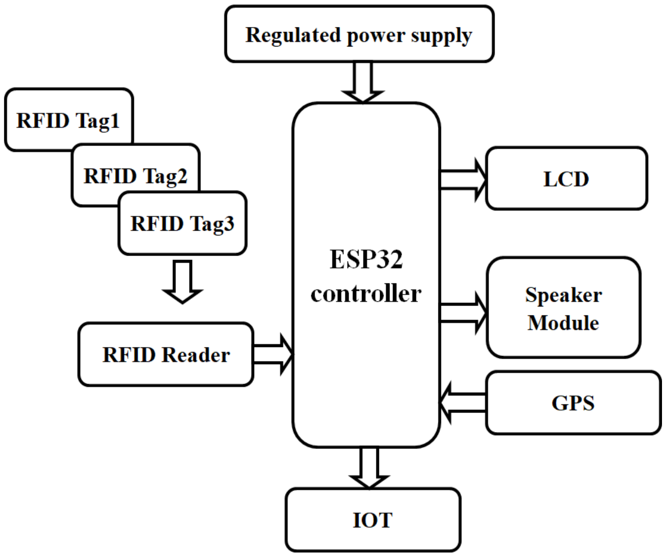


Fig – 3.1 Block Diagram of Circuit

The voice alert system can be customized based on individual preferences, allowing users to receive alerts for specific bus routes or at specific times of day. As shown in the figure-3.1, This feature is particularly useful for individuals with varying mobility needs or those who may prefer alternative transportation options.

The proposed system significantly enhances public transportation for visually impaired individuals by integrating GPS technology to provide real-time information about their current location and nearby points of interest, reducing reliance on external assistance. A mobile app offers a user-friendly interface to access bus routes, schedules, and personalized notifications, ensuring a seamless transportation experience. This system empowers users to plan their journeys more independently and confidently.

At the heart of the system are IoT devices and RFID technology, with each bus equipped with an RFID tag containing unique identification information. RFID readers placed at bus stops detect approaching buses and transmit identification information to a central system via IoT connectivity. This system processes the data in real-time, comparing it with a database of bus routes, schedules, and destinations to accurately identify the bus and provide relevant information to visually impaired individuals, enabling them to navigate public transportation safely and independently.

Overall, the project represents a significant step forward in leveraging technology to create inclusive and accessible public transportation systems. By harnessing the power of IoT, RFID, and voice alert technology, the system enhances the mobility and independence of visually impaired individuals, fostering a more inclusive society whereeveryone can participate fully in daily activities such as commuting with ease and confidence.

3.2 Project Working:

Start:

4. EXPERIMENTAL ANALYSIS

The Bus Identification system comprises five modules: Controller, RPS, Input, Software, and Output. The RPS module plays a crucial role by converting 230 volts AC to 12 volts DC and further to 5 volts DC, which powers all other modules. The RFID Reader, the sole input module, detects and transmits bus information to the central system, facilitating real-time updates and voice alerts essential for visually impaired users. The microcontroller, ESP32, is pivotal in collecting data from input sensors and processing it to be sent to the output modules. These output modules include an LCD for displaying information, a Bluetooth app that provides voice alerts to passengers and displays the bus route, and IoT technology that stores the data on a web server, enhancing the system's overall efficiency and accessibility for visually impaired individuals.

3.3 SCHEMATIC DIAGRAM

ISSN: 1934--9955 www.ijise.net
Vol-20 Issue-01 April 2025

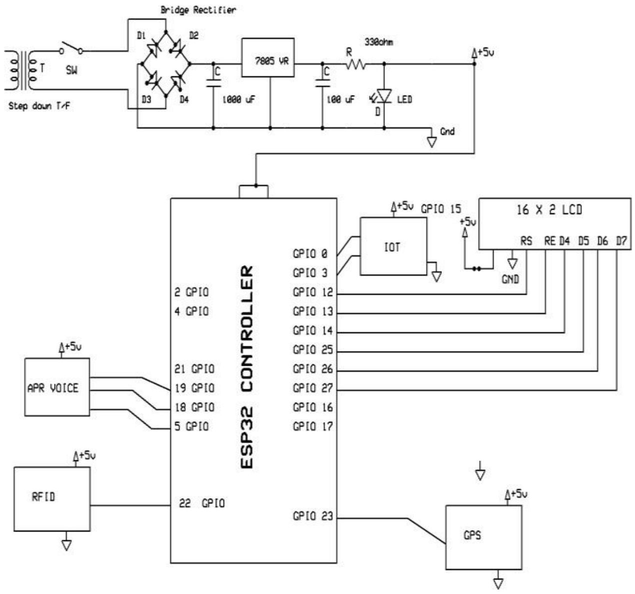


Fig-3.3 Schematic Diagram of ESP32 Controller

This is the pin diagram where all the hardware components are connected. The ESP32 microcontroller has multiple GPIO pins. The step-down transformer, bridge rectifier, capacitors, resistors, and LED are connected in the regulated power supply, which provides 5V to the ESP32 and all input/output modules. Connections can be seen in the above fig-4.3.

- The 16*2 LCD Monitor relates to the digital pins 12, 13, 14,25, 26, 27.
- Wi-Fi is connected to the digital pins 0, 3 internal transmitterand receiver pins.
- The RFID Reader is connected to the 22 pins.
- The APR Voice Module relates to the digital pins 5, 18 and19.

International journal of imaging science and engineering

ISSN: 1934--9955 www.ijise.net
Vol-20 Issue-01 April 2025

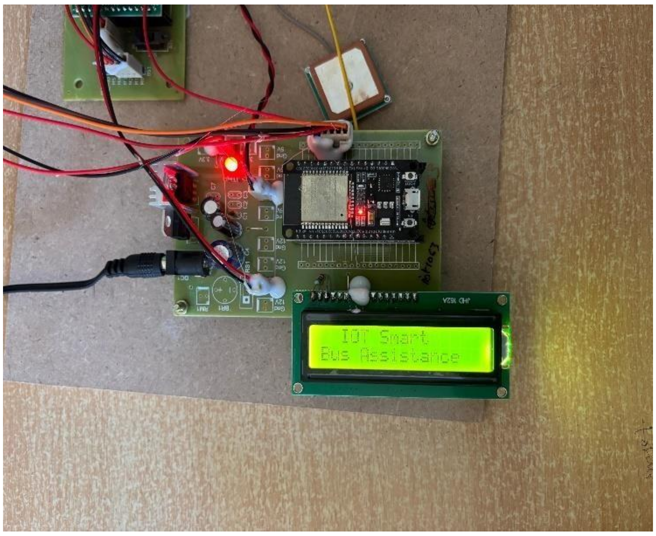


Fig- 4.1 Turning on the Circuit

The LCD displays "IoT Smart Bus Assistance", indicating that the system is powered on and initialized. The GPS module is visible, ensuring real-time tracking. The ESP32 microcontroller is managing all components, such as RFID, GPS, and audio output. This stage represents the startup phase of the IoT bus assistant. As shown in the Figure – 4.1.

Getting GPS Location:

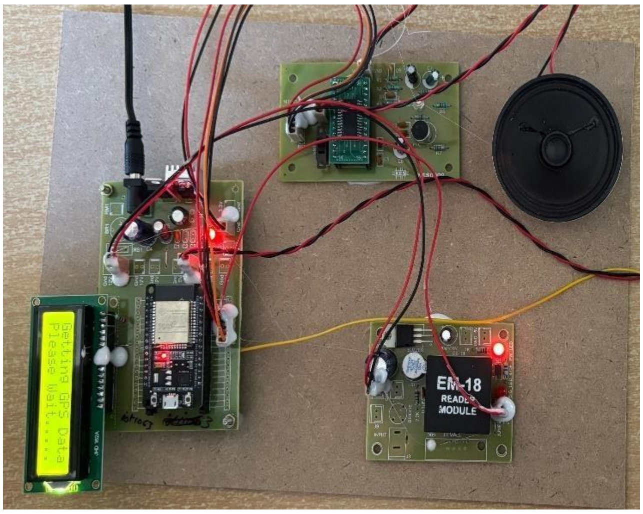


Fig- 4.2 GPS Location

The LCD reads "Getting GPS Data, Please Wait," indicating that the system is acquiring the bus location using the GPS module (visible in the Fig – 4.2). The ESP32 controller is processing the GPS data and will provide location-based voice announcements. The system ensures that users, especially the visually impaired, receive real-time updates about their location.

International journal of imaging science and engineering
ISSN: 1934--9955 www.ijise.net
Vol-20 Issue-01 April 2025

Swipe Card:

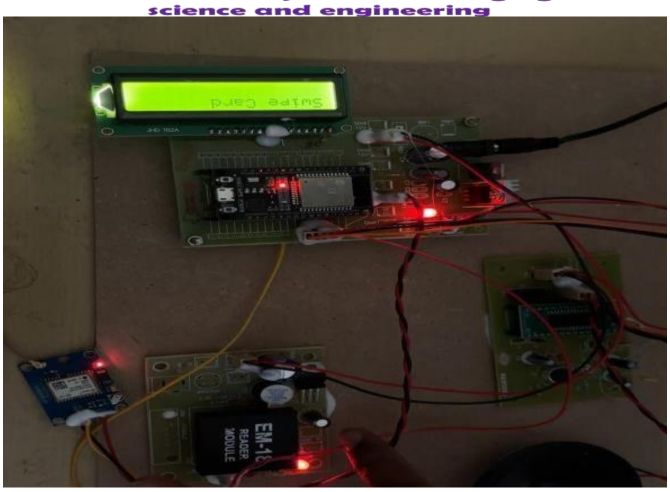


Fig –4.3 Swiping RFID Card

The LCD prompts "Swipe Card", Shown in the Fig – 4.3, meaning the system is waiting for an RFID card to be scanned. The RFID module (EM-18) is actively scanning, as indicated by the red LED.A person's finger is visible near the RFID reader, suggesting they are interacting with the system. This step likely enables ticketing, identity verification, or personal preference detection (e.g., bus stop alerts for the visually impaired).

4.4 Bus Announcement:

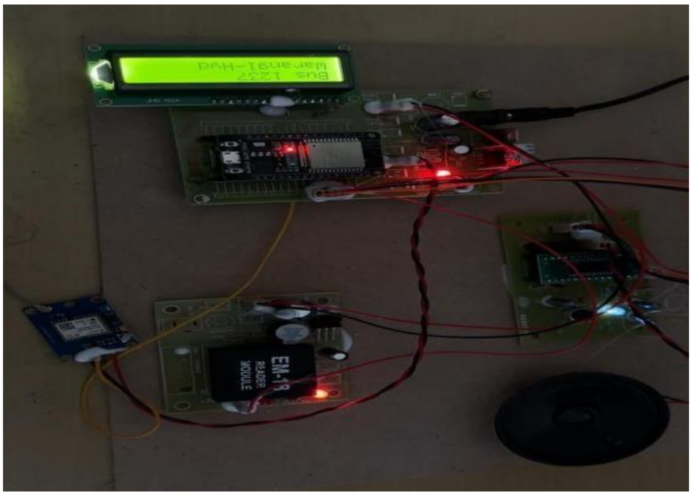
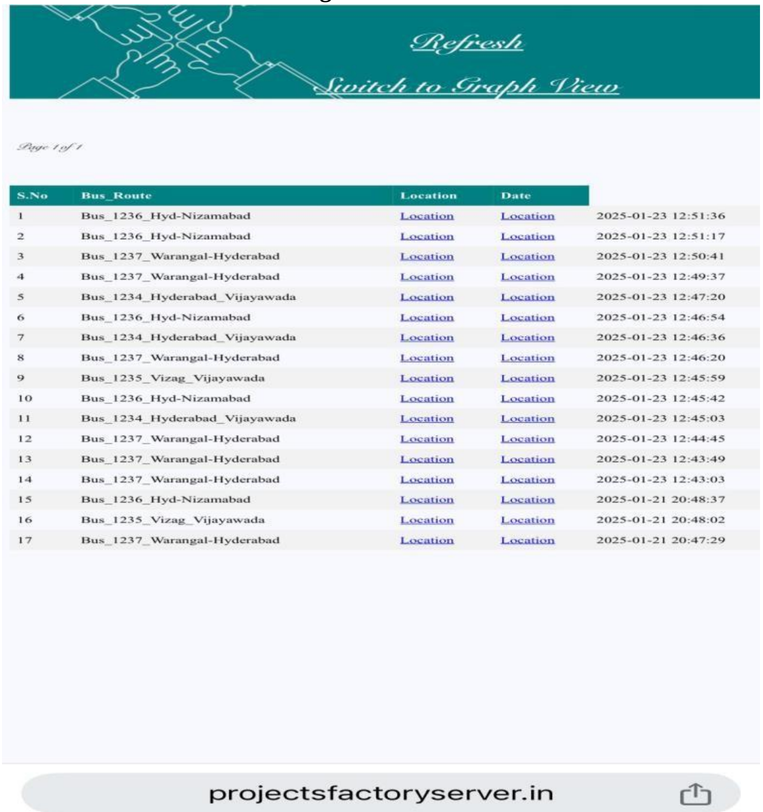


Fig – 4.4 Bus Announcement

The LCD display shows information related to the bus navigation system. The RFID module (EM-18) is active, scanning a card to assist with ticketing or identification. The ESP32 microcontroller is processing the data, indicated by the red LED lights. The speaker module is present, likely for voice announcements. This stage likely represents a bus arrival announcement or user verification. Bus information can be seen in the lcd in fig – 4.4.

Web based tracking System:

Fig 4.5 Web Server



S.No	Bus_Route	Location	Date	
1	Bus_1236_Hyd-Nizamabad	Location	Location	2025-01-23 12:51:36
2	Bus_1236_Hyd-Nizamabad	Location	Location	2025-01-23 12:51:17
3	Bus_1237_Warangal-Hyderabad	Location	Location	2025-01-23 12:50:41
4	Bus_1237_Warangal-Hyderabad	Location	Location	2025-01-23 12:49:37
5	Bus_1234_Hyderabad_Vijayawada	Location	Location	2025-01-23 12:47:20
6	Bus_1236_Hyd-Nizamabad	Location	Location	2025-01-23 12:46:54
7	Bus_1234_Hyderabad_Vijayawada	Location	Location	2025-01-23 12:46:36
8	Bus_1237_Warangal-Hyderabad	Location	Location	2025-01-23 12:46:20
9	Bus_1235_Vizag_Vijayawada	Location	Location	2025-01-23 12:45:59
10	Bus_1236_Hyd-Nizamabad	Location	Location	2025-01-23 12:45:42
11	Bus_1234_Hyderabad_Vijayawada	Location	Location	2025-01-23 12:45:03
12	Bus_1237_Warangal-Hyderabad	Location	Location	2025-01-23 12:44:45
13	Bus_1237_Warangal-Hyderabad	Location	Location	2025-01-23 12:43:49
14	Bus_1237_Warangal-Hyderabad	Location	Location	2025-01-23 12:43:03
15	Bus_1236_Hyd-Nizamabad	Location	Location	2025-01-21 20:48:37
16	Bus_1235_Vizag_Vijayawada	Location	Location	2025-01-21 20:48:02
17	Bus_1237_Warangal-Hyderabad	Location	Location	2025-01-21 20:47:29

This above Fig - 4.5 represents the IoT Smart Bus Navigation Assistant's web-based tracking system, where bus location updates are recorded and displayed on a server. The system logs real-time bus route details, allowing users or administrators to track buses efficiently. The table consists of columns for S. No (Serial Number), Bus Route (Route name), Location (Live tracking link), and Date (Timestamp of last update). The bus route names indicate different journeys, such as Hyderabad- Nizamabad, Warangal-Hyderabad, Hyderabad-Vijayawada, and Vizag-Vijayawada. Each bus has multiple location updates with timestamps, showing that the system is continuously receiving GPS data. The clickable "Location" links suggest that users can access live tracking details of each bus, ensuring real-time navigation assistance. This integration is crucial for public transport management, especially for visually impaired or elderly passengers, as it ensures that buses are tracked efficiently. The presence of the domain "projectsfactoryserver.in" at the bottom indicates that this system is hosted on a dedicated server, makingit accessible online for real-time tracking.

ISSN: 1934--9955 www.ijise.net
Vol-20 Issue-01 April 2025

5. CONCLUSION

In conclusion, the IoT and RFID-based bus identification system with voice alert feature stands as a pivotal innovation in enhancing accessibility for visually impaired individuals. By seamlessly integrating IoT technology and RFID tags within buses, this system enables real-time identification and tracking of buses, significantly easing the navigation process for visually impaired commuters. Moreover, the incorporation of voice alerts further enhances accessibility by providing auditory cues, ensuring that individuals with visual impairments can effortlessly locate and board the correct buses independently. This system not only fosters inclusivity by empowering visually impaired individuals to navigate public transportation systems with greater ease but also sets a precedent for leveraging technology to address accessibility challenges in transportation infrastructure.

Furthermore, the successful implementation and adoption of this system underscore the potential of technology to bridge accessibility gaps and foster greater independence for individuals with disabilities. Beyond its immediate benefits to visually impaired commuters, this innovative solution sets a precedent for the integration of inclusive design principles in the development of smart city infrastructure. By prioritizing accessibility and inclusivity, stakeholders can leverage IoT and RFID technologies to create more equitable and user-friendly environments for all members of society. Ultimately, the IoT and RFID-based bus identification system with voice alert feature represents a significant step towards creating a more inclusive and accessible urban landscape, where technology serves as a catalyst for positive social change.

REFERENCES

[1] New York Transportation Statistics. Available from: http://transportationmodes-city.findthedata.org/q/1447/1033/How-many-people-use-publictransportation-to-commute-in-New-York-New-York. Accessed 25 November 2015.

[2] Hersh, M.A., Johnson, M.A. Assistive Technology for Visually Impaired and Blind People, Springer, 2008.

[3] Miesenberger, K. [et al.] [eds.] Computers Helping People with Special Needs, LNCS, vol. 4061 Springer Berlin / Heidelberg, 10th International Conference, ICCHP 2006, Linz, Austria, July 11-13, 2006.

[4] Sanchez J., Maureira E., "Subway mobility assistance tools for blind users", LNCS, vol. 4397, pp. 386-4042007.

[5] Jerry T., Goh H., Tan K., "Accessible Bus System: A Bluetooth Application," Assistive Technology for Visually Impaired and Blind People, pp. 363-384, 2008.

[6] Noor, M.Z.H., Shah A. ; Ismail, I. ; Saaid, M.F. "Bus detection device for the blind using RFID application," 5th International Colloquium on Signal Processing & Its Applications, pp. 247 – 249.2009.

[7] Quoc T., Kim M., Lee H. and Eom k., "Wireless Sensor Network apply for the Blind U-bus System," International Journal of u- and e-Service, Science and Technology Vol. 3, No. 3, September, 2010.

[8] on the Bus Public Transport. Available at: http://www.onthebusproject.com,Accessed November 2015.

[9] IEEE std C95.1, 2005, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields 3 kHz to 300 GHz.

[10] New York Transportation Statistics. Available from: http://transportation-modes-city.findthedata.org/q/1447/1033/Howmany-people-use-public-transportation-to-commute-in-New-York- New-York. Accessed 25 November 2015.

[11] I EEE std C95.1, 2005, IEEE Standard for Safety Levels with Respectto Human Exposure to Radio Frequency Electromagnetic Fields 3 kHzto 300 GHz. Available from: http://standards.ieee.org/findstds/standard/C95.1-2005.html. Accessed25 November 2015.