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Navayana: Intelligent Public Transport Alert and Guidance System for The Blind Passenger

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Abstract

Visually impaired people face very much of a challenge in using the public transport, especially in recognizing buses and knowing routes. Public Transport Assistance System is proposed as a novel in this paper. This was a challenge for Blind People to tackle. There are two main components of the system: the blind user's system and the bus system. The system of the blind user senses RFID cards placed on buses using an RFID reader. A buzzer It informs the user of the bus nearness and an IR sensor can be used to do the bus detection with high precision. When the RFID card is scanned, the user is directed properly by the voice module which speaks out the name of the bus route from the speaker. There is a panic button on the system to ensure safety which retrieves the user's real time location and sends the same to the authority via a GSM module in case of an emergency. The bus system consists of RFID card and a card reader to pick up the cards and activate a voice module. The blind users are guided as well as the other passengers by the name of the present bus stop, which is read aloud by the module. The system suggested encourages the mobility and accessibility of blind people in public transportation. It also offers safety by means of monitoring live location. The final paper is a user centric, extendable solution to make public transport easier and safer for blind people.

Key words — Public Transport Assistance System, RFID Reader.

I. INTRODUCTION

Public transportation is the only mode of transportation for millions of people worldwide. However, it remains a difficult environment for the visually impaired tourist, who has to struggle to locate the correct bus and determine its route or stops. Such a lack of accessible systems means that they must depend on other individuals, and thus they are less mobile and independent.

One of the goals for Blind People is to create an accessible and easy to use system, which helps in the accessibility, and also provides security for blind users. The modern technologies like radio frequency identification (R FID), voice modules, GSM communication are all used in this system. They serve as sensors to bridge the accessibility gap. The system includes two main parts, the system of the blind user and the bus system. For blind user, the system is designed to read the user when a bus arrives through the voice (buzzer) module. They not only provide an audible alarm but will also help in identifying the bus route by using RFID cards and a voice module. Also included is a default panic button to provide security by providing the user's location in real-time to authorities during emergency situations. On the bus side, RFID cards and voice modules are integrated to provide audio announcements of bus stops, which give enhanced support to blind users and other travelers. The system not only assists in navigation but also reduces dependency on others by enabling blind users to identify and board the right bus independently.

II. LITERATURE REVIEW

An Outdoor Navigation Assistance System for Visually Impaired People in Public Transportation" This paper [1] offers a system for Visually impaired blind people in the use of public transportation. The proposed system uses Bluetooth Low Energy technology for location and communication purposes. The BLE beacons are installed on buses and the mobile application which tracks them and provide a relevant information about destination, next stop, and current location of the users. This system tested under both controlled conditions and in a real environment this showed that the system is 97.6% effective. The system is capable of working when there is no internet connections and this provides an greater confidence and independence compared to GPS- based systems for VIBP.

"Smart Bus Tracking for Blind and Visually Impaired" [2]. Saloni Redij and colleagues proposed a system for Visually impaired people using AI and GPS technology. App will be installed on the driver's mobile phone, this app uses GPS technology to track the buses. The app assists the Visually impaired passengers by providing audio guidance. The users can tell their starting and destination and the app will assist the users with audio information about available buses and arrival time. The app also connects with bus driver's app and sends the notification when a Visually impaired passenger exits. This will ensure the safe ride of blind passenger.

"Assistive Mobile Software for Public Transportation" [3]. Computer Science Communication and research Centre researchers proposed a system to track the current locations of the visual impairment passengers. They developed prototype which runs on an Android OS device with Global Positioning system (GPS). This was not only designed to blind users, but also for the people with low vision. This system was tested by visual impaired persons and it concludes that it is easily accessible by blind people.

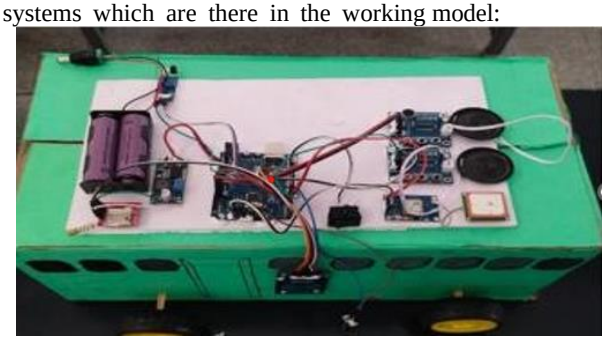
"Innovation in Public Transportation and Improving Accessibility for the Blind"[4]. This paper is focused on developing a new system which help for blind people to recognise the public transport on their own. This system includes zigbee technology bus monitoring system. In this proposed system as to detection system one for blind people and one for buses. The blind passage and model detect the bus route and and the bus segment through voice message. The bus system will identify the blind person near the station and give the message to the bus driver.

III. SYSTEM OVERVIEW

The Public Transport Assistance System for Blind People is designed to integrate modern technologies such as RFID, voice modules, IR sensors, and GSM communication to create an accessible and safe solution. The system is divided into two parts: the Blind User's System and the Bus System, each working cohesively to ensure smooth operation.

The **Blind User's System** is equipped with an RFID reader, a buzzer, and a voice module. When a bus approaches, its RFID card is detected by the user's RFID reader, triggering the buzzer to notify the blind individual of the bus's arrival. An IR sensor ensures the bus is in close proximity before the RFID card is scanned. Upon scanning, the corresponding voice module plays a pre-recorded message announcing the bus route name, helping the user identify the correct bus. The system also includes a panic button for emergencies; when pressed, it uses a GSM module to fetch the user's live location and sends it to authorities, ensuring quick assistance.

The **Bus System** includes RFID cards and a voice module. RFID readers on the bus detect these cards at specific stops, triggering the voice module to announce the stop's name, keeping passengers informed. This system ensures real-time notifications, route guidance and safety, empowering Visually impaired individuals to use public transport independently and securely. These are the two systems which are there in the working model:



(a)

(b)

(c)

Fig.1: Working Model

IV. METHODOLOGY

The fig.2 Illustrates the block structure of a Bus module System.

Parts of the System:

RFID Tag: A small tag attached to a bus or bus stop that stores information.

RFID Reader: A device that reads the information on the RFID tag and triggers actions.

Arduino Uno: The brain of the system that controls everything and makes decisions.

Voice Recording Module: Stores pre-recorded voice messages that are played to passengers.

Battery: Gives power supply to all the parts of the system.

Output: A speaker that plays the voice messages to passengers.

Description:

An RFID card and a reader make up the bus system. RFID cards of specific bus stops. The reader can detect this and, as a result, makes a voice module announce the current stop to the passengers including blind users. Auditory guidance and emergency support to visually impaired users is ensured real time, yet this system also empowers visually impaired users. It helps impaired people travel free and securely. By integrating accessibility features and the proposed system provides scalable and inclusive public transport solution while maintaining the safety measures.

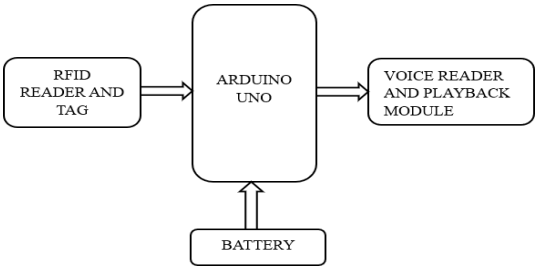


Fig.2: Block diagram of the Bus unit

The fig.3 Illustrates the Block Diagram of Blind modules for an Arduino-based system.

Main Parts: Main Authority: Arduino Uno board - controls everything and makes decisions.

Input Parts:

RFID Reader: Scans information from special tags.

GPS Module: Gives location information.

Output Parts:

Voice Module: Plays recorded voice messages.

GSM Modem: Sends messages through phone networks.

Output Indicator: A generic output, like a screen or indicator.

Power Supply: Gives energy to all parts.

Blind User's System

The blind user is equipped with an RFID reader and a buzzer. RFID cards attached to buses are detected when a bus arrives, and the buzzer alerts the user. An IR sensor ensures accurate proximity detection of the bus. When the user scans the RFID card, a voice module announces the bus route name through a speaker, enabling the blind individual to identify and board the correct bus. To enhance safety, the system includes a panic button that sends the user's live location to authorities via a GSM module in case of emergencies. This feature provides a reliable mechanism to address safety concerns during travel.

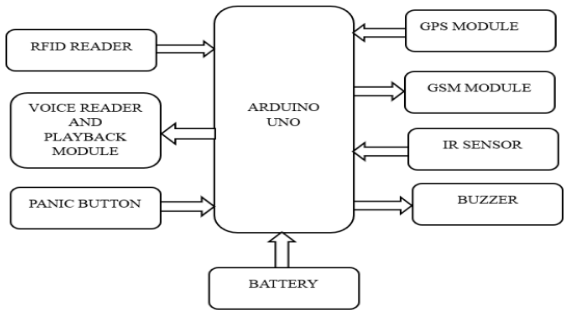


Fig.3 Accessible Interface for Visually impaired users

V. RESULT ANALYSIS

Navayana: Intelligent Public Transport Alert and Guidance System for Blind Passenger successfully demonstrated its potential in improving Public Transportation services. During testing, the system reliably read RFID tags and processed the data to accurately identify bus routes. The Arduino Uno microcontroller matched the scanned RFID tag identifiers with pre-programmed bus route information, displaying the route name on the Serial Monitor and announcing it through the voice playback module. This dual output method provided clear and immediate bus route information to all users, especially for those with visual impairments. Additionally, the system responded accurately to button presses, further enhancing user interaction, and ensuring the correct route information was displayed and announced. This system also provides the live location of the users through message and when the users pressed panic button the notification sent to the caretakers through message and call. Overall, the paper proved that integrating RFID technology with Arduino-controlled components can significantly enhance the accessibility and efficiently of public transportation systems.

These are the results displayed in serial monitor:

- The upcoming stops are announced through the speakers, while the stops names are showed in the serial monitor.
- The alert notifications are sent to the care takers through messages and call. Which this is also observed through serial monitor.
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The results that are observed in phone:

The live location of the blind person sent to the care tacker phone; it also makes a phone call to alert the caretakers. Locations are trapped using the google maps.

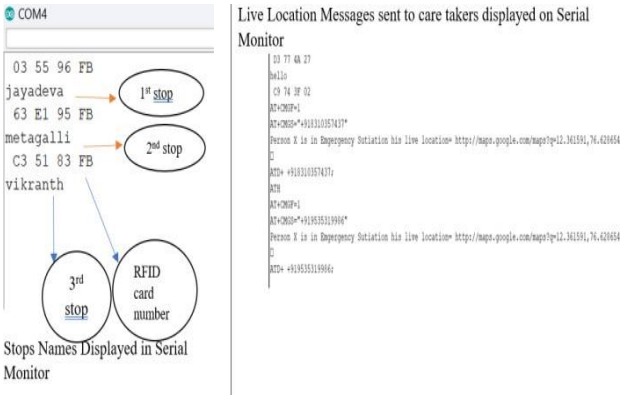

Fig.4: Output observed in Serial Monitor

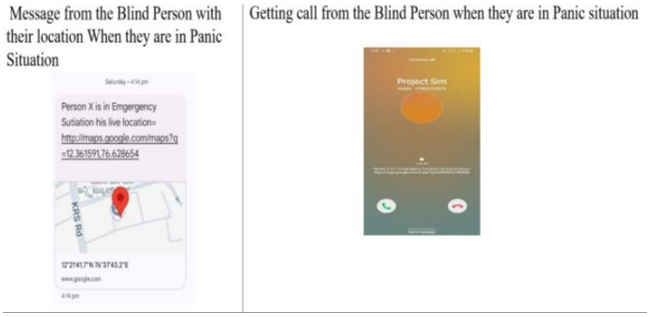

Fig.5: Messages and calls are sent to the care tackers.

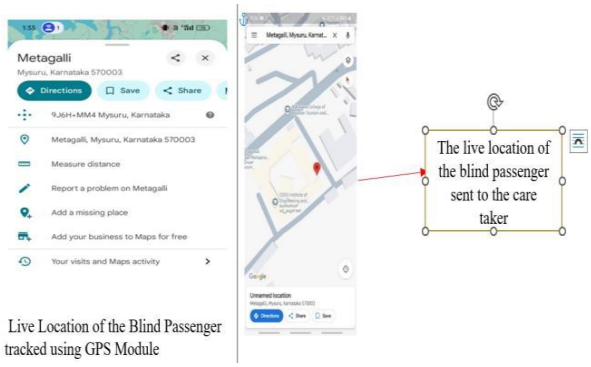

Fig.6: Location trapped through GPS.

Table of the solutions and outcomes:

Requirements Identified	Solution Build	Outcome
Identifying Arrival of New Bus	"Did the bus arrive?" "YES" "You want to go from *Name of the bus*to?" CBS to Srirangapattana	Alerts given for bus stops
Finding bus	Case 1: "The arrived bus is the JP Nagar bus; do you want to go from CBS to JP Nagar?" "NO" Case 2: "The arrived bus is the 307 bus; do you want to go from CBS to Srirangapattana?" "YES"	Helping to find the desired bus without assistance
Finding upcoming bus stops	Stop1: "The First stop is JAYADEVA" Stop2: "The Second stop is METAGALLI" Stop3: "The Third stop is VIKRANTH"	Information about the upcoming stops through speakers
Emergency Situation	Message – "The Person x in the Emergency Situation"	Alert the caretakers by sending messages and calls
Location of the Blind Passenger	Live Location= http://maps.google.com/maps?q=12.361637,76.629211	Live location of the users sent to the caretakers so they get to know whether user reached is destination or not
The bus has reached the destination of the passenger	"You have reached your destination: Did you exit?" "YES"	The person reaches to his/her destination

VI. CONCLUSION

The Public Transport Assistance System for Blind People provide an innovative, practical, and inclusive solution to the challenges faced by visually impaired individuals in navigating public transport. By using technologies such as RFID, it facilitates blind people identifying and improving independence, safety and accessibility. Autonomously they offer emergency support, buses and route s as required. There are some limitations, such as dependency on infrastructure and hardware maintenance. This is a major step to make public transportation more inclusive. Future advancements, such as GPS integration and smartphone apps, will further expand the system's capabilities, making it an integral part of smart, accessible transportation networks. Ultimately, this system aims to create a more equitable public transport environment for visually impaired individuals, empowering them to travel independently and safely.

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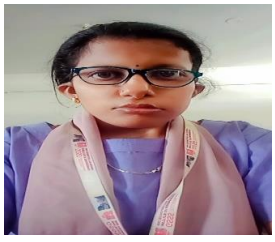

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