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Speech Recognition Based Passenger Bus Alert System

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Abstract

In this era of digitalization, the new technology is being designed and developed which helps the day-to-day livelihood of common man. The technological assistance has improved the efficiency with which the common man completes his/her assigned task in every aspect. Several systems/modules have been developed to assist the visually impaired people to use public transport system. The objective of the paper is to provide a system which is easy to implement and require low cost and common equipment using wireless communication system. This proposed system is useful not only for the blind person but also for the people who have recently shifted to the city and has no idea about the public transport system. This system will result in easy and convenient public transport system for the citizen of the city. The proposed system can be improvised by using machine learning techniques and algorithms to estimate the vacant seats in the bus before bus reaches the bus stop and many more features can be implemented.

Keywords: *Android, bluetooth, microcontroller, Radio-frequency identification (RFID), renesas*

INTRODUCTION

Of all the 6.7 billion people who live in the world, approx. 161 million are visually impaired. These individuals face a lot of problems in performing their daily chores. In order to make their living less dependent, there are several support-based organizations who put in efforts to make a difference in the life of such people. But even then, the problems of navigation for the blind is very complex and problematic. Especially, if they have to walk in the neighbourhood or navigate from one place to another by the means of public transportation. Since these people are visually challenged, they are always dependent on others to read the bus routes or even the numbers written on them [1].

Tags on all environments will contaminate the environment and find the resistance of many citizens. We will design user-friendly, easy to use android application which will help the visually impaired individuals to get to the correct bus by analysing the audio input which depicts the location where the blind person has to travel and converting to text, so that the microcontroller can match it with the already stored data in its database. The wireless sensor network (WSN) incorporates sensors that consistently screen conditions and send their information to the fundamental system. The transport number stopped before the visually impaired is sent to the microcontroller [2]. The blind unit will be provided with the number of the bus which will take him/her to the destination and in the same way, the bus unit will notify the bus driver that there is a blind person in the bus station. In the event that the transport number and the number produced by the microcontroller matches the ringer in the transport unit alerts and tell the driver that there is visually impaired in the bus stop [3]. Here, we use android voice input and output and also for communication purposes.

OBJECTIVE

The objective of this work is to overcome the disadvantage of not able travel from one place to another within city limits due to various problems and develop a transport acknowledgement system that helps to solve the problems faced by the citizens.

- To develop Easy-to-use, user-friendly, convenient application/ interface to help the person using the public transport.
- To develop a system that is cost effective and can be implemented with least tools requirements.
- To assist the blind people about bus details for their navigation to the destination.
- To develop the system that is not limited to just visually impaired person it likewise helps senior citizen or even to person who is new to the city.

RELATED WORK

Some of commonly used means like long canes are used by the blind community as a primary node of identifying obstacles. The long canes are now being upgraded by adding travel aids such as laser, and ultrasonic obstacle avoiders were also used. Indeed, even with these gadgets, the outwardly weakened individual has the absence of opportunity to go without help and for productive route through new places/condition depends on the data past this innovation. The visually impaired person can also rely on the guide dogs. But this is approach is not feasible. All these methods have limitations; hence GPS enable mobility system was introduced, which would help the traveller or visually impaired person reach the destination. Although it indicates orientation it still posses many disadvantages like unfavourable weather conditions and skyscraper which can interfere the signal reception, another major drawback of GPS system is it cannot alert the visually impaired person about a rise or depression in the ground level. The utilization of battery causes the GPS empower versatility framework compact and the battery to can fall flat without cautioning the individual utilizing it. In this way, the outwardly impeded individual can't utilize the GPS framework for route [4]. The solution to the GPS system is a navigation system for visually impaired person using ZigBee. One of the advantages of using Zigbee system is the range of the ZigBee is high. In real case scenario, the bus can stop where the ZigBee unit is detected, which will help the visually impaired person to reach the destination without any hindrance. But it has major disadvantage that is the ZigBee unit has certain physical dimension and weight which makes this unit difficult to carry by the visually impaired person [5].

In India, the Pune was the principal city to execute Bus Rapid Transit framework. It comprises of highlights like tickets at transport stops, programmed entryways and data of transport landings in transport stops, however there was no component that could have helped the outwardly disabled individual travel starting with one spot then onto the next.

To overcome the drawbacks of existing navigation system, few researchers came up with new idea of introducing navigation system based on RF module. The blind person is provided with a RF unit which is identified by the RF module installed in the bus station. When the blind person enters the bus station, the RFID tags stores the information of the location of the visually impaired person. The bus station is provided with ARM 7 controller which generates signals and send it to the bus unit. The RFID tags with the visually impaired is detected by the RFID reader circuit as soon as, he reaches the bus station. When the bus enters the bus station, the LED is turned on in the bus, to

indicate that there is a blind person in the bus stop. Using the switches, the bus driver notifies the blind person, the bus route through voice synthesizer. This overcomes all the disadvantages of the existing system. The only disadvantage with the proposed system is that, if the blind person forgets to carry the RFID tags, he/she won't be able to travel in the public transport. Even if the tag is misplaced while travelling, then the blind person has to face lot of problems. To overcome the problem of losing the RFID tags, we have proposed a navigation system using the concepts of Android, RFID, Bluetooth. Android smartphones are mostly used smartphones as form of communication. In present day scenario, each and every citizen of the world, owns a smartphone. The smartphones provide a lot of features and it also allows the developers to implement new ideas through application development that is supported by the android operating system. The project proposed by us, using the android smartphones as the visually impaired person unit. The Renesas microcontroller is used as the bus station unit. The Renesas is used instead of ARM7 is because Renesas is cost effective and provides more features when compared to ARM 7. There are basically three units: the bus station unit, bus unit and the android application (user unit). An application is developed which converts voice input into text. The app receives the voice input from the visually impaired person, the voice input is mostly the location where blind person wants to travel. App will convert the voice into text and the text is transferred to microcontroller via Bluetooth. The input data is stored in the microcontroller. As soon as the bus enters bus station, the RFID reader connected to microcontroller, reads the information about the bus route from RFID tag installed in each and every bus. Microcontroller compares the input from the app with the RFID tag details and compares whether the bus goes to the particular location or not. If the bus takes the route the desired location, then the microcontroller alerts the blind person by sending audio note via Bluetooth. The app receives the output from microcontroller and is played to the blind person through headphones or speakers.

PROBLEM STATEMENT

With expansion in movement and populace of the city areas the blind people have to face a great deal of obstacles while moving out from one place to another place. Because of this most of the visually impaired people are forced to stay inside and sacrifice their objectives, dreams and goals it might include travelling from one place to another to achieve what they want to do and this way costing them their future and their profession. Hence, our project mainly focuses on helping the visually impaired people to travel from one place to another and also to help locate the bus which leads to the destination.

By using the voice recognition system, which converts speech to text, we can help them to specify the destination they choose to go. This software allows the user to control the computer functions by using the voice to dictate the text. The system mainly consists of two components, the first is for processing the acoustic signal which will be captured by the microphone and the second is used to interpret the processed signal and then mapping of the signal into words. Once, this is done, route traversal comes into the picture. It provides audible instructions in the form speech to the user so that he/she can navigate independently. Object detection must also be specified which uses sensors to notify the blind that they can mobile to places without any difficulty, making their lives more sustainable.

METHODOLOGY

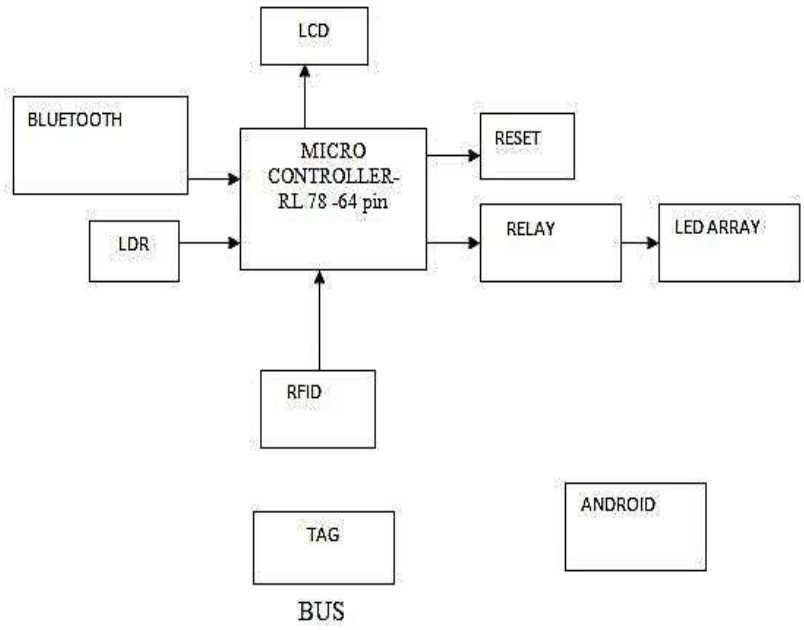

Figure 1: *Bus alert system block diagram.*

According to the block diagram (Fig. 1), there are three units, namely the bus station unit, bus unit and the android application (user unit). The bus station unit and the user application communicate with each other using Bluetooth.

Microcontroller in the bus station unit is used to control other components and the microcontroller is also used to store the predefined locations of the bus station in the city. The android is the user application which takes input from the visually impaired person through microphone and converts the voice into text. The converted text along with current location of the person is stored and passed to microcontroller through Bluetooth. This input is analysed by the microcontroller which generates the corresponding bus numbers. When the bus station unit receives the details of the destination from the user application, it matches with location already present in the microcontroller and if it is valid location, then the destination is displayed on the LCD. The RFID is used to communicate with incoming or outgoing buses in the bus station. The tag in bus unit is the id which stores the details of the bus such as the final destination, the bus number etc. When the bus enters the bus station, the bus station checks the details of the bus and if it matches the input, it notifies the blind person through Bluetooth that the bus has arrived and he can board it. Android application is designed in such a way that it is simple and easy to use for the visually impaired person. When the passenger reaches the destination, the microcontroller informs the application that user has reached the destination and has to get down at the destination.

The below block diagram shows the working of the mobile application designed for visually impaired person, the application is designed to receive the voice input from the user. The voice receiver (microphone) is used to receive the input from the visually impaired person. The received input is converted to text using google APIs for speech to text. The current location of the user is taken as the input

using GPS, which is inbuilt in most of the smartphone. The current location of the user is stored in the application for further use. The path finder logic is used to find shortest and better path to reach destination specified by the user. To determine the shortest path to reach the destination we have to include the current location of the user. Along with the pre-calculated shortest path and the current location of the user, the voice output is used to output received from the microcontroller (Fig. 2).

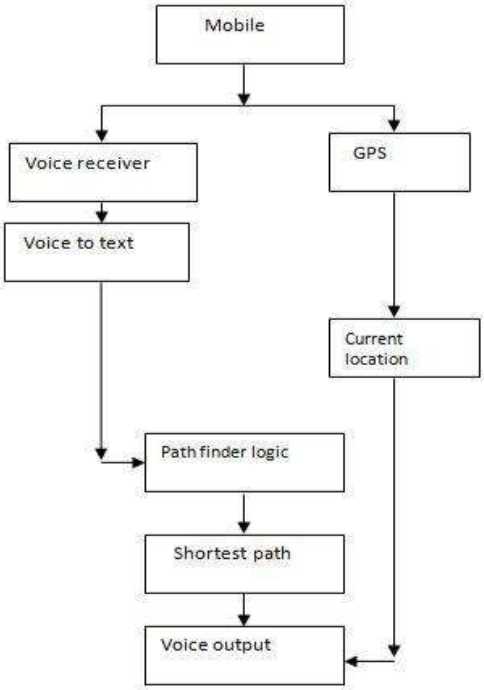

Figure 2: *Android application block diagram.*

DESCRIPTION

Acquisition of Destination Information

Whenever, the visually impaired person has to travel from one place to another. He uses the application installed in his/her smartphone and tries to give the voice input of the required place where he/she has to travel and also specifies the time within which he/she has to reach the destination.

Intake of the Current Location of the Visually Impaired

This application uses the GPS unit in the smartphone to depict the exact location of the visually impaired person and the location data obtained is stored in the database.

Processing of Input Signal

The input given by the blind person about the destination is converted to text using google API and API translates the voice into the text and sends it to the given microcontroller.

Processing of the Given Bus Information

Once, the voice is converted to text, it passed on to microcontroller via Bluetooth. The microcontroller stores the destination of the blind person. As the bus enters the bus station, the RFID reader in the bus station reads the bus RFID tag. The RFID tag stores the details of the bus route number and other necessary details. The details of the bus are stored temporarily in the microcontroller installed in the bus station.

Audio Output for Signal Interaction

Once, the signal is decoded, a voice playback module has to be interfaced for redesigning the blind about different information, for example, getting on to a bus and off of it at the bus stop. In this, we might use GPS to notify the blind person that his stop has arrived. The microcontroller sends message to the application through Bluetooth that the bus has arrived to the bus station, which lead the visually impaired person to the destination. The bus unit interacts with the blind person's application and notifies that the bus has reached the destination and the person can get off the bus. The application notifies the blind person through headphones.

HARDWARE REQUIREMENT

The following are the hardware components being used:

Renesas Microcontroller

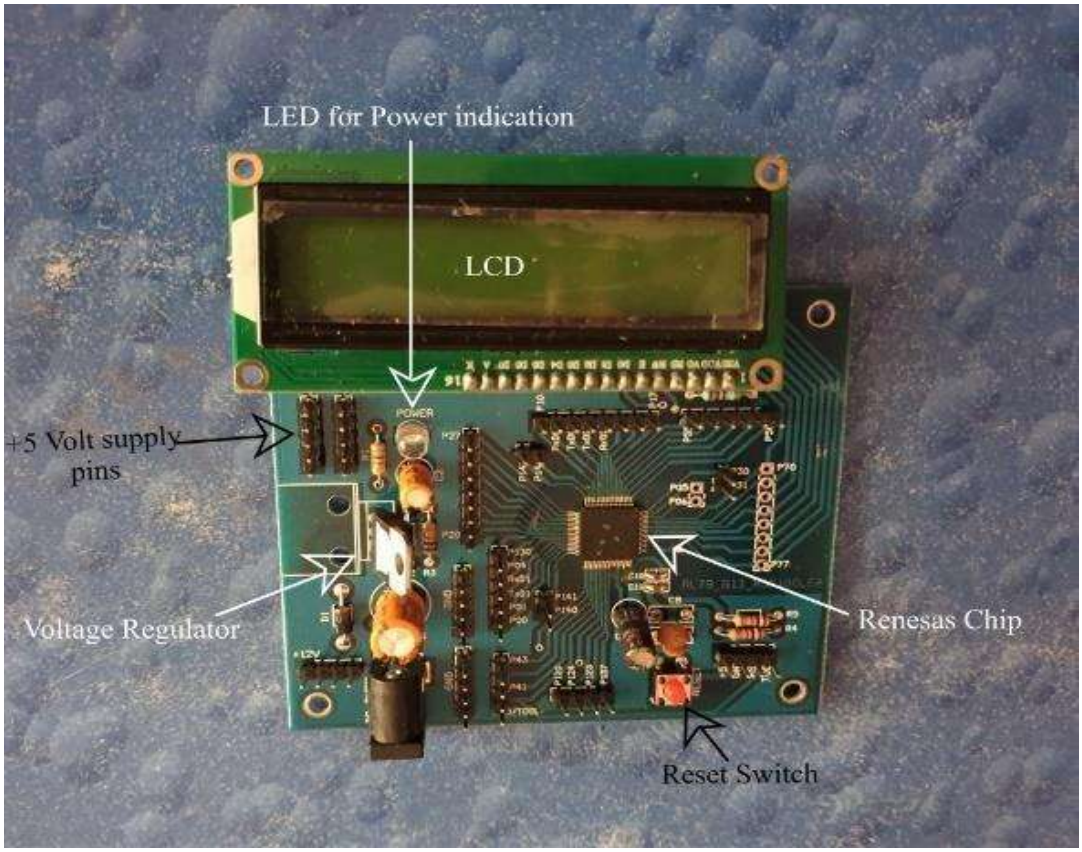

Figure 3: *Pin Renesas microcontroller board.*

Renesas belongs to RL78 family. The IC used is R5F100LE (Fig. 3).

Renesas microcontroller has 3 sections – Power, Control and Communication.

Features of the Renesas microcontroller are:

- 16-bit microcontroller.
- 64 pins, out of which 58 are General Purpose I/O pins.
- ROM capacity is 64KB and RAM is 4KB.
- Has 11 ports.
- Operating voltage is 5V.
- Voltage regulator converts from 12V to 5V.
- 8x10 bit ADC pins.
- Rx and tx Connections which are serial.
- 41 MIPS (Multiple instructions per second]).

Bluetooth
It is a wireless technology standard used for exchanging data over short distances between mobile devices and building personal area networks (PANs).

RFID

Figure 4: *RFID.*

The RF module (Fig. 4), operates at a given Radio Frequency. The corresponding frequency range may vary between 30 kHz and 300 GHz. Transmission through RF (radio frequency) is better than the IR (infrared) signals. As RF can travel through larger distances making it suitable for longer range applications. These RF signals can travel even when there is an obstruction between the given transmitter & the receiver. This type of transmission is much stronger and reliable. RF communication uses a specific frequency.

LCD
A liquid-crystal display (LCD) is just used for visualization (Fig. 5).

Figure 5: *Liquid-Crystal Display (LCD).*

LDR and RELAY
To detect the light condition where the system will be placed. The LDR is turned on during night.

Software Designing
The modules are required to be programmed for the proper functionality of the renesas microcontroller. In this project, embedded C programming is used

by utilizing Cubesuite+ software. This is popular software that helps us to write embedded c programs, source code debugging and compiling, and even execution of the programs can be done in same single environment. The code developed is dumped into the microcontroller memory by the programmer by the help of Flash Magic application.

The app is developed for the communication of the visually impaired person with the bus station unit. Java is used to develop the application with the SDK and other app development tools. The app is developed in such a way that it is easy to use.

CONCLUSION

The thought behind this task is to help the outwardly weakened to explore effectively with the use of remote sensor systems. This avoids accidents and dependencies on others during travel. While the difficulties looked by the visually impaired is quickly expanding, open doors are given to astonish these people to arrive at their separate goals with no problem while utilizing the open transportation framework.

The design scheme of the bus alert system is based on the Internet of Things. This system will be able to locate and monitor the bus running status in real time, provide the buses running information to the required station and also improve the efficiency and quality of the services provided by the bus. Different attributes are added to the system which makes it advantageous.

The proposed project is implemented using Android and embedded systems which includes GPS system for tracking the bus location. Also uses basic measurement of distances between two given locations and provides the required details to the visually impaired.

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