BUS DETECTION AND LOCALIZING SYSTEM FOR VISUALLY IMPAIRED PEOPLE USING ZIGBEE

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Abstract

This paper targets the use of RFID in assisting the visually impaired people using voice. Each visually impaired individual faces a unique and different set of challenges based on their specific level of vision. RFID has the potential to further standardize using RFID tags and improvement of current RFID readers. Our system consists of two different units. One inside the bus system and another outside the bus system. Inside system consists of RFID reader, Microcontroller, Zigbee transmitter. Outside system consists of the RFID reader, Buzzer, LCD, Speaker, Zigbee transmitter and keypad. Visually impaired peoples can verify their designation via Speaker module. All the RFID reader data's are stored in the PCs through Zigbee transmitter.
Keywords: *RFID; Zigbee; Programmable Interrupt Controller; LCD*

I. Introduction

This paper outlines implementation of RFID for a bus detection mechanism to help visually impaired in travelling from one place to another. Several solutions have been proposed like walking stick or white cane, guide dogs and GPS guidelines to deal with this difficulty. Although some of them have shown to be useful in real scenarios, they involve an important deployment effort or use artifacts that are not natural for visually impaired users. Therefore, this paper aims to develop a bus detection prototype using Radio Frequency Identification (RFID) for Visually impaired.

Radio Frequency Identification (RFID) has been an emerging technology in recent years. In the recent few years there have been a lot of advancements in the field of RFID. The application of RFID technology have been numerous and the usage of this technology has led to many application specific designs and models that are today being used in many control system. The purpose of this paper will be to develop a design and propose a plan to implement RFID technology that will help the visually impaired people navigate in outdoor environment. This system will help us to understand and develop a prototype model which will be used as a system by people to fulfill their requirement of navigation and identification. This will bring into the market the application of RFID technology towards a social cause, which will have its own economic future.

For visually impaired people, outdoor pedestrian mobility is very difficult and often dangerous. The visually impaired commonly rely on a cane or walking stick and a guide dog to assist them in efficiently reaching a desired destination without harm. However, this approach is successful only if the majority of the path to the destination is already known to the Visually impaired (or to the guide

dog). Buses play an important role for the transportation. For a majority of Visually impaired and visually impaired persons, public transport is the only viable mobility option to seek social connectivity. Those people live in a limited environment and have difficulty to sense what happen around them, which reduces their activities in several fields, such as education and transportation since they depend only on their own intuition. Hence, we need to make their lives more comfortable by introducing a system that helps them enjoy transportation services independently and freely like ordinary people, without relying on others. Thus to help the visually impaired people and to make them to gain confidence to move around freely is to make use of RFID.

II. Related Work

Several systems had been proposed for guiding Visually impaired people. Here, we will just mention the most related ones to the theme of our system. One of these systems is a central announcement system based on Bluetooth technology [11]. In this system, Bluetooth devices are installed in both the bus and the bus station which are connected to a processing subsystem. When a bus approaches the station, the two Bluetooth devices of the bus and the station will connect to each other. After that, the bus Bluetooth device will transmit a message containing bus information to the station's processing subsystem. The trans-mitted message will be read by a text to speech converter which is interfaced with the processing subsystem in the bus station. Then, an announcement message that contains the bus information will be generated through a speaker. But there are two disadvantages in this system: it allows connection of only two devices at once and the connection between devices may be lost under certain conditions.

An RFID-based system to assist the Visually impaired is described in [12]. Here, each bus has RFID tag which contains information about the bus number and the coming destinations. Likewise, each Visually impaired person should have a portable device. The portable device contains RFID reader, headset, and control subsystem. The main idea of this system is that the RFID reader of the portable device will detect the approaching buses to retrieve the bus information from their tags. The bus information will be used to generate an individual audio message about the arrived buses for each Visually impaired person through the headset. Un-fortunately, in this proposed system the driver has no idea about the Visually impaired people existence in the station. Moreover, no alternatives are provided in case the Visually impaired person forgets his portable device.

An assistive system which uses Wireless Sensor Network (WSN) is described in [13]. This WSN-based system operates in two phases: the discovery of Visually impaired people and the interaction between the bus and the bus station. The bus station is divided into two areas, one for the normal passengers and the other for Visually impaired people. The Visually impaired people area has two sticks in the door in order to link a switch to show if someone is there. When the system detects Visually impaired people in the station, the station will announce that to any existing bus in the radio frequency range. Once the bus detects the message, it will announce its number using microphone before a few meters of the station. Moreover, the bus has a light system to indicate the existence of the Visually impaired people in the station. If the light is red, a Visually impaired exists and if it is blue, no Visually impaired is there. One disadvantage of using this WSN system is the

difficulty of recognizing if the person within the Visually impaired people zone is Visually impaired or not; people may sit in the wrong specified area. Moreover, the sensor cannot detect when a Visually impaired person leaves the specified place, which will be a waste use of the system from the point view of unnecessary computation and power consumption. In addition, the system provides only the bus number information which is not enough to give a clear idea about the next stations [13]. In our proposed system, there is no need to have a special area for the Visually impaired persons.

Another assistive system is an android application called On- The Bus [14] which helps people with special needs in mobility using voice notifications and can be used by all the passengers. This application depends basically on the GPS system and it can use the compass of the smart phone and 3G network. It has two modes; one for normal people and the other for people with special needs. Visually impaired people can interact with the application through voice commands. Then, the application will list the available pathways to the destination and the user can choose the suitable one. From the application, the user can know the nearest station to the present place and then the time required for the bus to arrive. After boarding the bus, the application will tell the user the number of bus stations ahead before reaching the required destination. A disadvantage of this system is that it needs initial setup phase to accommodate the needs of the Visually impaired. However, if there were a malfunction, the Visually impaired will have difficulty in re-setting the application. In our proposed approach, the Visually impaired does not need to go through any setup phase. He simply needs to carry an RFID-based ticket.

III. Existing System

The existing system has bus stop system and bus system. The bus stop section consists of PIC16F877A microcontroller, 16*2 LCD, Zigbee transceiver and buzzer. The Zigbee transceiver is for the wireless transmission of data and for alerting the Visually impaired persons. If the bus system is within a certain range then the bus stop section will alert the persons by using buzzer interfaced with the microcontroller. The bus system consists of PIC16F877A microcontroller and Zigbee transceiver. The Zigbee transceiver is used for communication. The drawback of this system are the existing system has no monitoring section. The driver cannot know the destination spot of the Visually impaired person.

IV. System Requirements

A. Marketing Requirements

- The proposed system should meet the following marketing requirements:
- The system should generate a clear guidance message about the buses arriving at the station.
- The system should be useful for non-Visually impaired people (besides the Visually impaired people).
- The system should generate a clear guidance message about the approached station
- The system should be safe to use

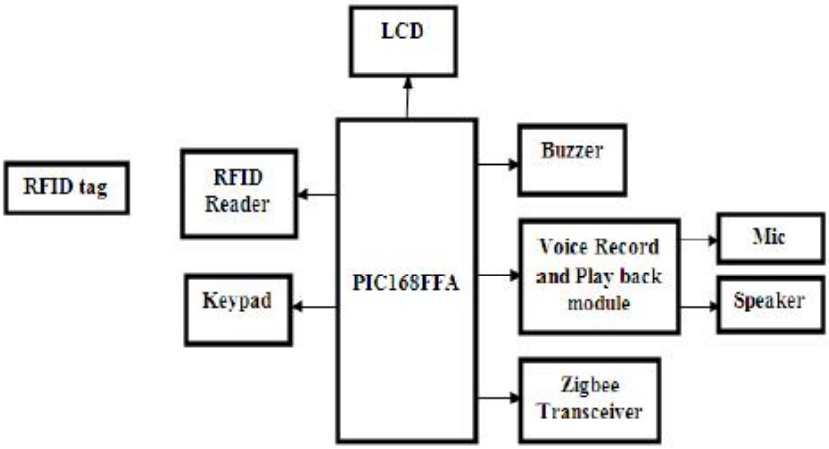

Fig. 1. Bus Stop System Block Diagram

B. Engineering Requirements and Design Constraints

In order to achieve the marketing requirements mentioned above, we need to base our system on engineering view by defining engineering requirements. Our engineering requirements are as follows:

- The system will be flexible to be used everywhere by changing the language settings.
- The system will use unlicensed radio frequency bands reserved internationally for ISM applications including RFID.
- The system will produce an accurate and a clear voice message within frequency range 250Hz-8 kHz.
- The system will inform the users of the next bus arriving at the station.
- The system will notify the bus passengers about the next coming stations.
- The system will display for the bus driver the number of Visually impaired people in the station with their required destinations.
- This system uses voice guidance for confirmation, using voice playback module.
- The visually impaired person are alerted using buzzer.

V. System Design

The proposed system consists of PIC16F877A Microcontroller, RFID Reader, RFID Tag, LCD 16*2, Zigbee transceiver, Voice record and playback module, and Buzzer. The Visually impaired people in the bus stop has to place the RFID in the RFID reader. The RFID reader reads the RFID number and sends it to the microcontroller. The microcontroller then transmits the data through Zigbee transceiver. Then the Visually impaired person has to press the button in the keypad to enter the destination spot. The voice will be given for confirmation through voice record and play back module. We can record the voice and store it in the voice record module and when the Visually impaired person press the corresponding button, then the stored voice will be played back. The person entered and the corresponding destination spot will be shown in the PC through Visual basic.

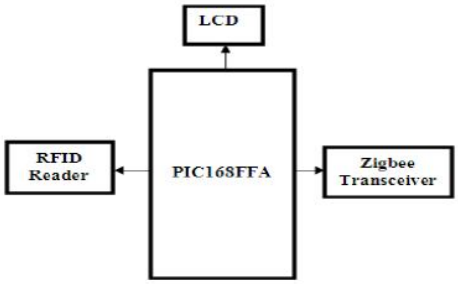

Fig. 2. Bus System Block Diagram

The data will be received through the Zigbee transceiver interfaced with the PC. The bus system consists of RFID reader, PIC16F877A, 16*2 LCD and Zigbee transceiver. The Visually impaired person has to again place the RFID on the RFID reader for confirmation. The data will be given to the microcontroller and is transmitted through Zigbee transceiver. Then it is shown in the PC (VISUAL BASIC).The bus stop system alerts the Visually impaired person if the bus is within a certain range through buzzer. The advantages of this system are the system uses voice guidance for confirmation, so people with vision impairment can use this system. The system also alerts the Visually impaired person by using buzzer.

VI. Proposed System

The proposed system consists of two systems: a bus system and a bus stop system. They are both connected to a database. The two systems are used to detect the arrival of buses, approaching bus stations, and visually impaired people in the station. Both the system RFID reader. Moreover, each blind person in the station has an RFID tag that is linked to visually impaired person details (e.g. name, age, etc...) via the system database.

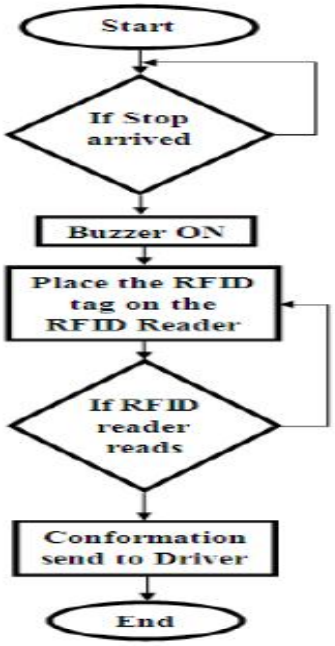

Fig. 3. Bus Stop System Flow Char

This information is inserted in the database during the ticketing process. Two separate announcement systems are used in this design; one in the bus stop to announce the arrival of buses and the other in the bus to announce the upcoming stations that are in the bus route. In addition, the bus driver will be provided with information about visually impaired people who need the bus

A. Bus Stop System

Bus Stop System consists of a RFID Reader, an announcement system and RFID tag. In our system, each blind person will be given a RFID tag which is linked to the information about the Persons name, age etc., via the system database. This information is inserted in the database when the tag is issued to the blind person. Fig.3 shows the Flow chart of the Bus Stop System which starts by checking for bus arrival. If bus ID tag is detected then the visually impaired person get alerted using buzzer. Then, the station control subsystem will check if this bus is going to stop in this station or not. If yes, the bus number and its route will then be announced in the station using a voice announcement. The same scenario is repeated again when a new bus approaches the station. The detail also displayed in LCD display.

B. Bus System

It consists of a RFID reader, a LCD display, an announcement system and RFID tag. The flow chart of the bus subsystem is shown in Fig.

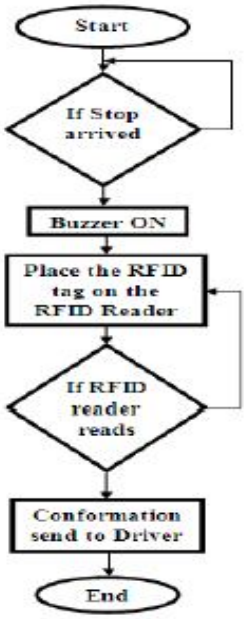

Fig 4 Bus Flow Chart

While the bus is approaching the station, the operation starts by detecting tags' IDs of the station and blind people in the station. Depending on the RFID tag detected (if any), the system reacts for each case as follows:

1. If person tag detected then the information stored in the system database regarding the tag, the system can determine if the blind person requires the bus or not. If yes, the number of

blind people that requires the bus and their destinations will be shown on a display positioned next to the driver so that he will be aware about the number of blind people and their destinations.

2. If Bus Stop tag is detected then the bus subsystem will first check if the station is in the bus route or not. If yes, a voice announcement will be generated inside the bus about the coming station name.

C. Monitoring Section

The visually impaired people place the RFID tag on the RFID reader located on the bus while entering the bus. Which transmitted the detail about that the visually impaired people entered the bus or not.

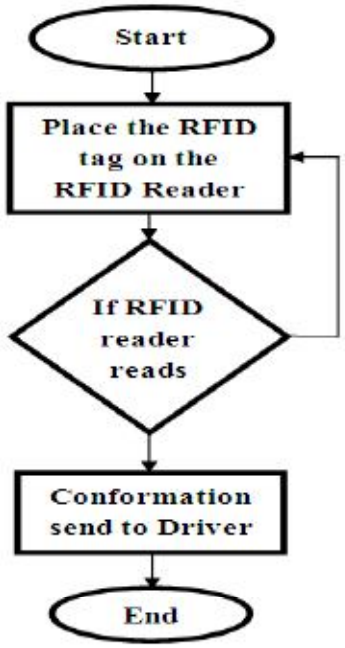

Fig. 5. Monitoring Section Flow Chart

Thus the system has provided with monitoring section. Which helps the driver to know about the visually impaired people entered the bus or not. This information was transmitted using Zigbee technology.

VII. Implementation

The first step in our testing was to establish communication from PC with the reader. In the following, we present our prototype implementation and testing results for various parts of the system.

A. Bus Stop System

The Bus Stop System is used for bus detection and it consists of RFID reader, RFID tag, PIC168FFA Microcontroller, buttons, LCD display. buzzer, voice recorder and play back module

and a zigbee transceiver. RFID reader, buzzer, LCD display, voice recorder and play back module and zigbee transceiver is connected to PIC168FFA Microcontroller. Each visually impaired person has a RFID tag which contains the information about their name, age, etc., When the RFID tag is placed on the RFID reader located on the bus stop then the detail of the visually impaired person will updated to the database. Which is displayed in the LCD. Using buttons destination will be selected by the visually impaired person which was confirmed by voice recorder and play back module. All the information are sent to driver using zigbee. When bus arrived in their certain range then the buzzer turn on and alerted the visually impaired people.

B. Bus System

The Bus System concists of RFID reader, PIC168FFA microcontroller, Voice recorder and play back module and a LCD display. RFID reader is located on the bus entrance. When the visually impaired person place the RFID tag on the RFID reader which is located on the entrance of the bus during entered the bus. Which is monitored by the driver using VISUAL BASIC software. Inside the bus, LCD display, Voice recorder and play back module are connected to the PIC168FFA microcontroller. The coming stations will be announced by the voice recorder and play back module.

C. Monitoring Section

The visually impaired person waiting for bus in the bus stop and the visually impaired person entering details are monitored by driver using VISUAL BASIC software

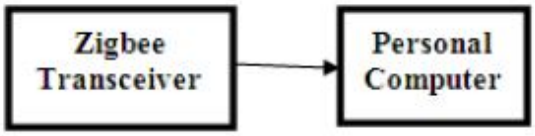

Fig. 6. Monitoring section block diagram

Fig. 6 shows the block diagram of the Monitoring section. Zigbee transceiver transmits the information to the PC. Which is monitored by the driver.

VIII. Conclusion

There are 40 to 45 million visually impaired people in over the world. Some special services should be provided to them to right to live as others do. In this paper we presented a bus detection and localizing system for visually impaired people using zigbee technology. We provide a convenient service for visually impaired people and also for non visually impaired people. This system is very efficient and helps visually impaired people to board bus without any help. Alerting the visually impaired person about bus arrival and its status.

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