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Passenger Bus Navigation and Assistance Providing System for Blind People

[1]Gaurav K Zala and [2]Hiren M Shah,
[1,2]Department of Electrical Engineering, M.S University, Baroda, India

Abstract-- In this paper we propose a passenger bus navigation system using Wireless Sensor Network (WSNs). This System comprises of three Units: Bus Station Unit, Bus Unit and Blind Unit. The Blind people on the Bus Station are provided with a Blind Unit. The blind speaks his destination on the microphone provided on the Bus Station Unit. When the desired bus stops at the station for the Blind, then via voice synthesizer the recorded indication is made for blind to reach on the bus. After reaching on the bus, if Blind wants any help like medicine, water or any specific need then there are Push Buttons available on the Blind Unit. By pressing this Push Buttons Blind person can get assistance from available options. Now when bus reaches at any station, it will check at every station for blind person's destination. Whenever match occurs then Blind will be notified via recorded voice via voice synthesizer. This system is also useful for the elder people.

Key words-- *Wireless sensor Networks (WSNs), Zigbee, Voice Recognition System, RFID, Voice Synthesizer*

I. INTRODUCTION

Artificial vision is the most important part of human physiology as 83 % of information human being gets from the environment is via sight. The Statistics by the World Health Organization (WHO) in 2011 estimates that there are 285 Billion People in the world with Visual Impairment, 39 Billion of people which are Blind and 246 with Low Vision. Especially India has highest number of Blind People amongst the world. Most of this people uses traditional and old-fashioned way for navigation using Walking Cane or Guided Dog. But this assistance has some limitations. Guided dogs and walking canes allow for a more independent means of travelling, but they are limited in unfamiliar environments. Guided dog has price as new car and their Average working time is round about 7 years. This people get troubled themselves in travelling through a passenger bus or trains. Moving through an unknown environment becomes a real challenge when we can't rely on our on eyes. 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. The work we present in this paper is based on the use of New Technologies to improve Blind people mobility. There are other Technologies also available but these devices at the Blind end are too costly. So here we tried to make the device at the Blind end cost-effective.

A. Flow-Chart:

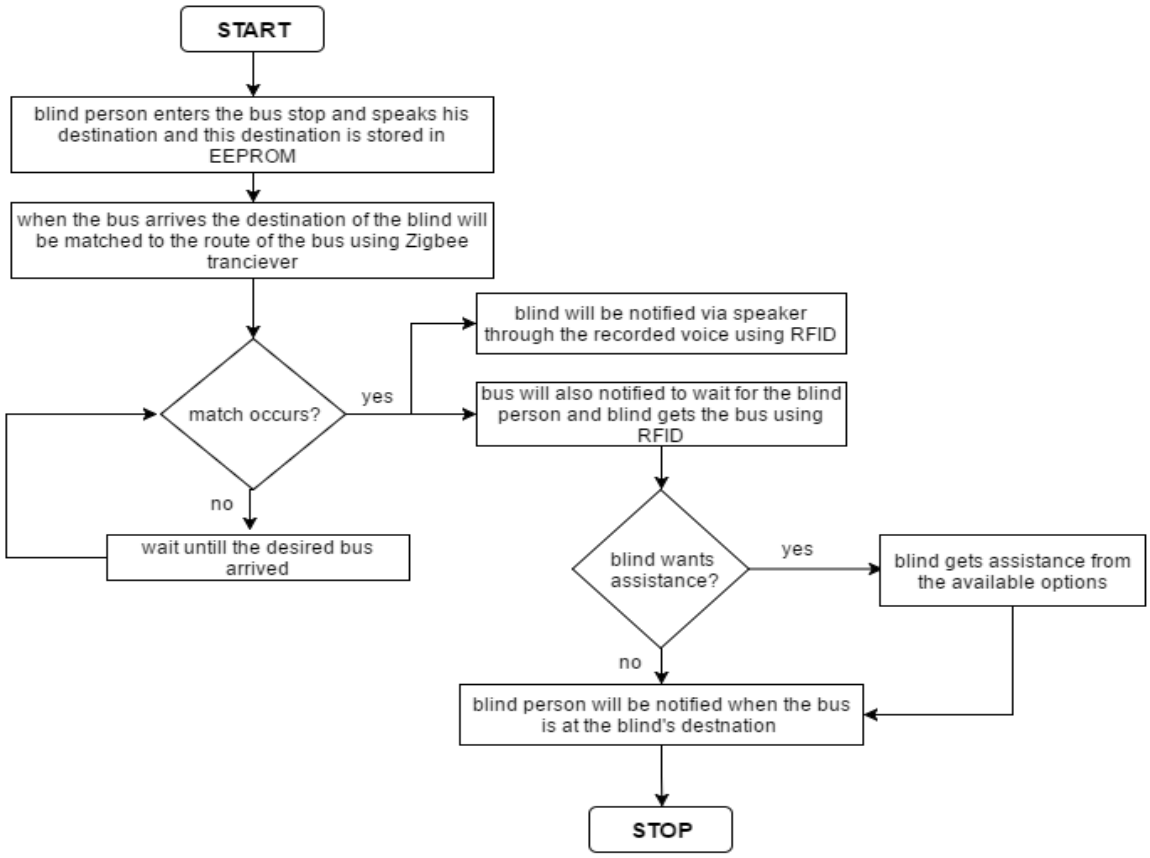

Figure 1: Flow chart of the overall system

II. MATERIALS AND METHODS

A. Voice Recognition System

Speech recognition system is used to help the blind to know the particular buses for a given location. When the blind speaks through the microphone on the Bus Station Unit, the speech recognition system analyse the input which is then processed by the microcontroller, and then produces the required output in the audio format which is heard by the user through the speaker on the Bus Station Unit. The speech recognition system here we use is HM2007. It is a single chip voice recognition LSI circuit with on the chip voice analysis, recognition process and system control functions. It may consist of microphone, keyboard, RAM and some other components []. The word length select pin is used to control the length of word we are providing as input. When the pin WLEN is set high, 1.92 sec is selected. In this way only 20 words can be recognized. DEN pin is used to enable the data. When the recognition process is complete the chip will place its response on the data bus DO - D7 and which can be latched on to the microcontroller by this pin. When the device is ready for the voice input in training or recognition mode, a low signal is sent by the RDY pin. If the chip is busy then a high signal is sent. When the waiting control input pin is set Low, the chip will enter the waiting state and do not accept the voice input until the pin is set to High. There are two modes of operation. During the power on the chip will start its initialization process,If the wait pin is Low the chip will do the memory check and if the pin is High then the chip skips the memory check. After the initialization recognition is done. Ready pin is set low to allow the voice to be recognized. Once the voice input is detected the ready pin is set high and recognition begins. We should train the word pattern before the beginning of the recognition process. After the process is completed the result will appear on the Dbus with the activation of DEN pin. To train or clear a voice pattern, we must select the word number to process first. The number of word is composed of two digits. The digits are entered one digit at a time through keypad. When number key is pressed, the number of key will be echoed to the D-bus. When the word number is entered press the function key to choose the operation function. If the function key CLR is pressed the word pattern is cleared. If the function key TRN is pressed training process begins. To clear the entire patterns key 99 is entered and clear is pressed.

B. ZigBee

ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices. WPAN Low Rate or ZigBee provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life. ZigBee makes possible completely networked homes where all devices are able to communicate and be controlled by a single unit. The ZigBee Alliance, the standards body which defines ZigBee, also publishes application profiles that allow multiple OEM vendors to create interoperable products. The current list of application profiles either published or in the works are: Home Automation, ZigBee Smart Energy and Telecommunication Applications. Zigbee can be used as transceiver. So we can use it as transmitter as well as receiver. According to the Zigbee protocol, it has modes varies from model to model. Generally we use is for transmit/receive or sleep mode. Zigbee devices are actively limited to a through rate of 250Kbps, compared to Bluetooth's much larger pipeline of 1Mbps, operating on the 2.4 GHz ISM band, which is available throughout most of the world. However The specified maximum range of operation for Zigbee devices is 250 feet (76m).

C. RFID

A given RFID system consists of two fundamental components: tags and readers. The reader and the tag communicate via the transmission of electromagnetic waves. A reader is what the user interfaces with to transmit information to and from the tag, and tends to be much larger than the tag. Tags store and process information, and can be extremely small, on the order of 3 mm. The key differences between the different types of tags on the market today lie in the power source and maximum range. A passive tag is solely dependent upon the reader for power, whereas an active tag has an internal battery that provides power. Correspondingly, this is why active tags tend to broadcast over long ranges than passive tags. Another difference between the two types of tags is the way the signal is transmitted. Passive tags rely on the signal from the reader to transmit information, whereas active tags are able to transmit information to the reader independently. Here we are using RFID to identify bus to the station and blind to the bus. Whenever there is a bus which has destination of blind at the station will be identified by Bus-stop unit. And bus will also be notified that there is a blind who wants to go to the destination where bus is headed.

D. Voice Synthesizer System

The aPR33A series are powerful audio processor along with high performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). The aPR33A are a fully integrated solution offering high performance and unparalleled integration with analog input, digital processing and analog output functionality. The aPR33A series incorporates all the functionality required to perform demanding audio/voice applications. High quality audio/voice systems with lower bill-of-material costs can be implemented with the aPR33A series because of its integrated analog data converters and full suite of quality-enhancing features such as sample-rate convertor.ssor along with high performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). The aPR33A series are a fully integrated solution offering high performance and unparalleled integration with analog input, digital processing and analog output functionality. The aPR33A series incorporates all the functionality required to perform demanding audio/voice applications. High quality audio/voice systems with lower bill-of-material costs can be implemented with the aPR33A series because of its integrated analog data converters and full suite of quality-enhancing features such as sample-rate convertor.

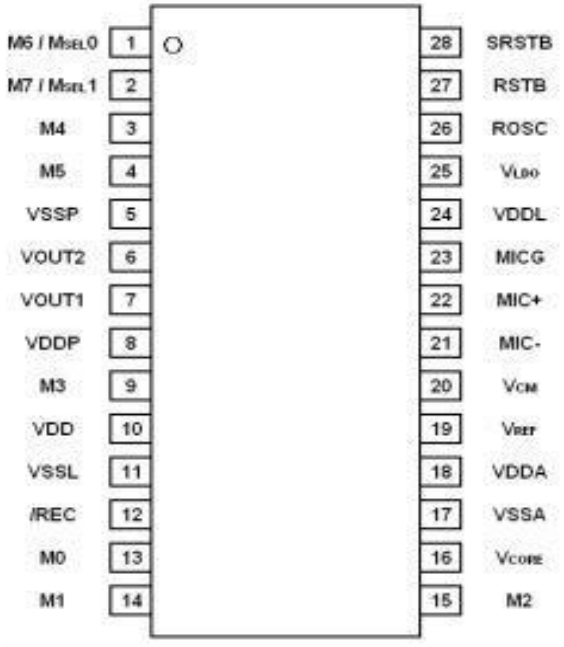

Figure 2: Pin configuration of aPR33A series

The aPR33A series C2.0 is specially designed for simple key trigger, user can record and playback the message averagely for 1, 2, 4 or 8 voice message(s) by switch, It is suitable in simple interface or need to limit the length of single message, e.g. toys, leave messages system, answering machine etc. Meanwhile, this mode provides the power-management system. Users can let the chip enter power-down mode when unused. It can effectively reduce electric current consuming to 15uA and increase the using time in any projects powered by batteries.

E. AT89C52 Micro-controller

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's highdensity non-volatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pin-out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly-flexible and costeffective solution to many embedded control applications. The AT89C52 has 8K Bytes of In-System Reprogrammable Flash Memory. It comes with 256 x 8-bit Internal RAM, 32 Programmable I/O lines, Three 16-bit Timer/Counters, Eight Interrupt Sources, Programmable Serial Channel, Low-power Idle and Power-down Modes.

BLOCK DIAGRAM:

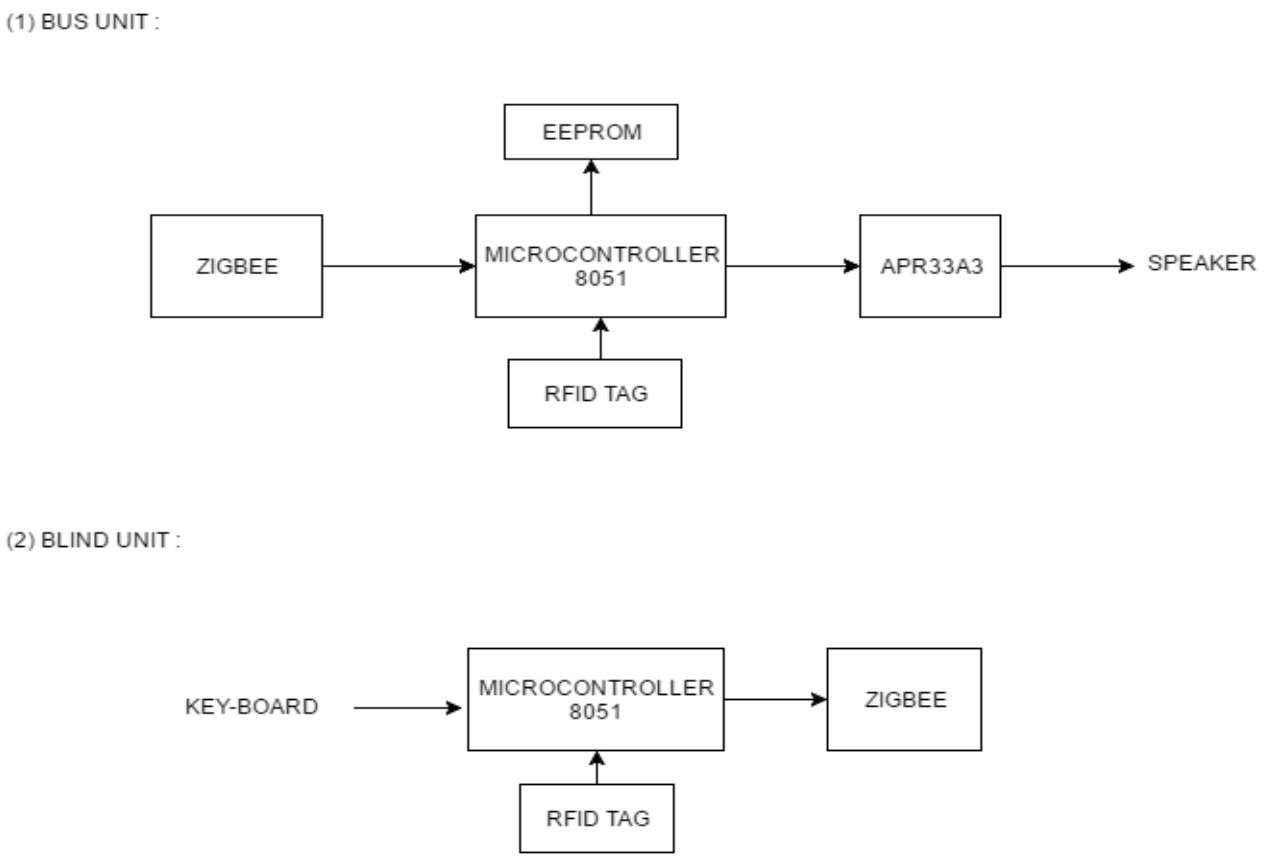

Figure 3: Functional Block-Diagram of Bus Unit and Blind Unit

F. ARM7TDMI (LPC2148) Microcontroller

The LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148

are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTs, SPI, SSP to I2Cs, and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems. The LPC2148 incorporate a 512 kB Flash memory system, respectively. This memory may be used for both code and data storage. Programming of the Flash memory may be accomplished in several ways: over the serial built-in JTAG interface, using In System Programming (ISP) and UART0, or by means of In Application Programming (IAP) capabilities. On-chip Static RAM (SRAM) may be used for code and/or data storage. The on-chip SRAM may be accessed as 32-bits. The LPC2148 provide 32 kB of static RAM, respectively. Nowadays ARM7TDMI is widely uused for many applications like Industrial control, Medical systems, Access control, Point-of-sale, Communication gateway, Embedded soft modem, General purpose applications.

(3) BUS-STOP UNIT :

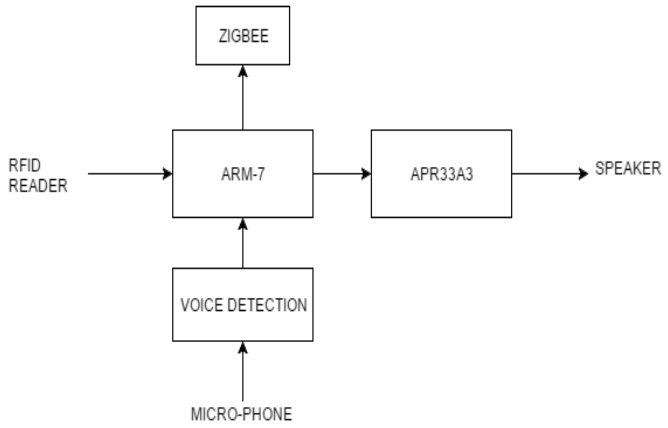

Figure 4: Functional Block-Diagram of Bus-stop Unit

G. EEPROM

An EEPROM, or electrically erasable programmable read only memory, like a regular ROM chip, uses a grid and electrical impulses in order to create binary data. However, the difference between ROM chips and EEPROM chips is that EEPROM chips can be reprogrammed without removing them from the computer, contrary to basic ROM chips which can only be programmed one time. A localized charge from an electrical field is all that is needed in order to erase the EEPROM chip. Also, the entire EEPROM chip does not need to be erased at one time, which therefore allows specific changes to be made. Other erasable programmable ROM (EPROM) chips must be entirely erased if any data is to be erased. EEPROMs are constructed as arrays of floating-gate transistors. Here we are using EEPROM which works on the I2C Protocol. I²C is a multi-master protocol that uses 2 signal lines. The two I²C signals are called 'serial data' (SDA) and 'serial clock' (SCL). There is no need of chip select (slave select) or arbitration logic. Virtually any number of slaves and any number of masters can be connected onto these 2 signal lines and communicate between each other using a protocol that defines:

– 7-bits slave addresses: each device connected to the bus has got such a unique address;
– data divided into 8-bit bytes
– A few control bits for controlling the communication start, end, direction and for an acknowledgment mechanism.

The data rate has to be chosen between 100 kbps, 400 kbps and 3.4 Mbps, respectively called standard mode, fast mode and high speed mode. Some I²C variants include 10 kbps (low speed mode) and 1 Mbps (fast mode +) as valid speeds.

III. RESULTS

When the Blind person arrives at the bus stop. The blind person can speak his destination through the microphone on the Bus-stop Unit. The destination is stored in the EEPROM. Whenever the bus arrives at the bus-stop, the destination of the Blind person will be matched with the route of the bus. If match occurs, then Blind will be notified via speaker on the Bus-stop Unit and Bus Unit is also notified via speaker on the driver's cabin. So bus will wait until the Blind gets inside the bus. After catching the bus, Blind will get assistance like Water, Medicine or other service which can be available at the bus by transport service by pressing the button on the key-board.

CONCLUSION

Primarily, the blind person in the bus station is identified with RF communication. The blind informs the location he needs through the microphone which is given to the voice recognition system which produces the output of bus numbers in the voice synthesizer unit which is heard in headset. Then this location is transmitted to the transceiver in the bus. If the names in the transceiver in the bus matches with that of the name send by the blind, then blind is notified for his bus at the Bus-stop Unit and bus will also notified via speaker at the Bus Unit. There are many efficient systems available for the blind people which are successful too. But the overall cost of the system is very high. So, it will be provided by government or personalized by the Blind person it become unaffordable. In this system, the blind unit is minimized without affecting the goal of the overall system.

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