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PASSENGER BUS ALERT SYSTEM FOR EASY NAVIGATION OF BLIND

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ABSTRACT

Guide cane, echo locations are all useful in navigating the visually challenged people to reach their destination, but the main objective is not reached that it fails to join them with traffic. In this project we propose a bus system using wireless sensor networks (WSNs)-(ZigBee).The blind people in the bus station is provided with a ZigBee unit which is recognized by the ZigBee in the bus. The blind gives the input about the place he has to reach using microphones and the voice recognition system this input is then analyzed by the ARM-7 which generates the bus numbers corresponding to the location provided by the blind. These bus numbers are converted into audio output using the voice synthesizer APR9600.Whenever bus has entered into bus stop buzzer will be ON to indicate the blind person. The desired bus that the blind want to take is notified to him with the help of speech recognition system. The ZigBee transceiver in the bus sends the bus number to the transceiver with the blind and the bus number is announced to the blind through the headphones. This project is also aimed at helping the elder people for independent navigation.

Keywords: ZigBee Systems, Speech Recognition System(HM2007),Voice Synthesizer (APR9600), Rfid, ARM7.

1. INTRODUCTION

Helping Hands for the Blind was founded to address the concerns, and as a vital resource for the blind. Helping Hands for the Blind is an organization of blind people who want to help other blind people. It is a problem solving organization. It is a guide that blind people can turn to in times of need. Helping a blind person through all the paperwork can literally be a life saver. Another important form of assistance is to provide a Mobility Instructor. When a blind person is new to an area, it is important that they be shown how to get around by a trained and knowledgeable instructor. There is a large and growing demand for this service. The project aims in designing a system which is capable of alerting the user if his destination is reached.The explosion in wireless technology has seen the emergence of many standards, especially in the industrial, scientific and medical (ISM) radio band. There have been a multitude of proprietary protocols for control applications, which bottlenecked interfacing. Need for a widely accepted standard for communication between sensors in low data rate wireless networks was felt. Zigbee is a low power spin off of WiFi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. The specification was accepted and ratified by the Zigbee alliance in December 2004. Zigbee Alliance is a group of more than 300 companies including industry majors like Philips, Mitsubishi Electric, Epson, Atmel, Texas Instruments etc. which are committed towards developing and promoting this standard. The APR9600 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly simplify system design. The device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications.

2. BLOCK DIAGRAM

2.1 Blind Unit

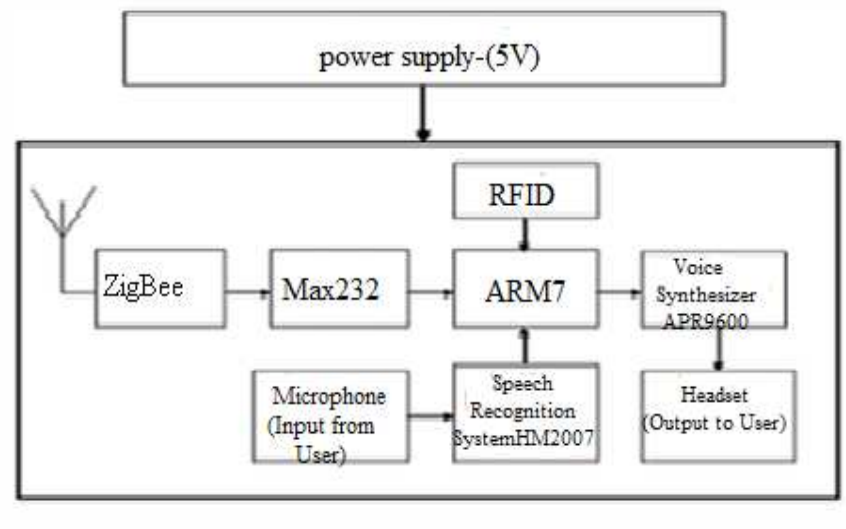


Fig 1: block diagram of Blind Unit

2.2 BUS Unit

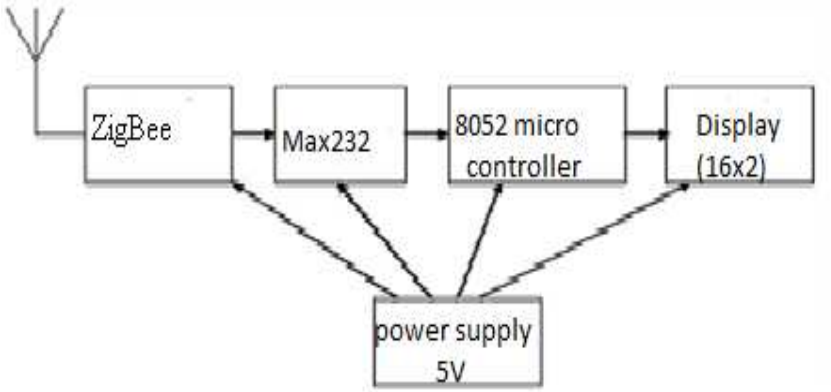


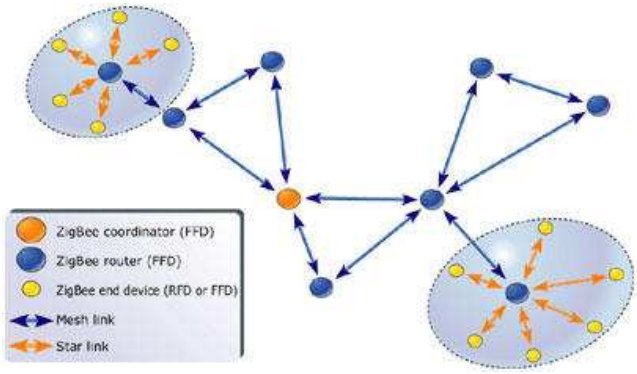
Fig 2: Block diagram of Bus Unit

2.3 Block Diagram Explaination

Bus unit consists of a ZigBee transceiver with a microcontroller which helps to find the availability of blind in the bus station and displays it. The blind unit is a mobile unit carried by the blind people which consists of ZigBee unit for identifying the corresponding bus parked in front of them, Speech recognition system (HM2007) for identifying the location provided as voice input by the user [5] and the ARM7 for analyzing the input and providing the corresponding bus number of the location specified by the blind as audio output through voice synthesizer (APR9600). Input is given through microphone and output is heard by the blind through the headset.

3. ZIGBEE SYSTEM

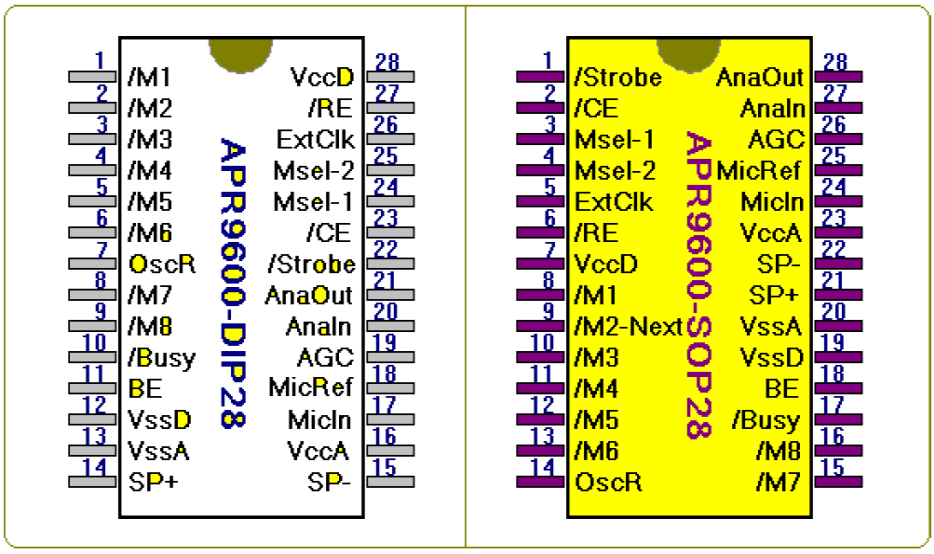
It supports two-way communication. It is based on IEEE 802.15.4 standard for WPANs. Application of Zigbee are low data rate, long battery life and secure networking. It operates at 2.4GHz. Zigbee devices can form networks with Mesh, Star and Generic Mesh topologies among themselves [2]. The network can be expanded as a cluster of smaller networks. A ZigBee network can have three types of nodes: Zigbee Coordinator (ZBC), Zigbee router (ZBR) and Zigbee End Device (ZBE) each having some unique property.



Zigbee devices find use in a multitude of areas like Industrial, commercial, toys, Computer Peripherals, Personal Health Care, Building Automation etc., virtually everything imaginable in the role of Wireless Sensor Nodes or short range communications. . The first thrust of the Alliance seemed to be Smart Energy and Home Automation. There are 5 application profiles that have been released so far involving Home Automation and Smart Energy, and others involving Building Automation and Retail Services are in the pipeline. This has met with phenomenal success and now, Zigbee has started to form strong foothold in Advanced Metering Infrastructures (AMI). Zigbee and RF4CE have made combined efforts to develop the Zigbee RF4CE specifications for consumer devices that could replace multiple remote controls with a single one.

4. VOICE SYNTHESIZER (APR9600)

This technology enables the APR9600 device to reproduce voice signals in their natural form. It eliminates the need for encoding and compression, which often introduce distortion.



PS : The APR9600 DIP & SOP is not [PIN TO PIN]

4.1 Functional Description

APR9600 block diagram is included in order to describe the device's internal architecture. At the left hand side of the diagram are the analog inputs. A differential microphone amplifier, including integrated AGC, is included on-chip for applications requiring use. The amplified microphone signals fed into the device by connecting the ANA_OUT pin to the ANA_IN pin through an external DC blocking capacitor. Recording can be fed directly into the ANA_IN pin through a DC blocking capacitor, however, the connection between ANA_IN and ANA_OUT is still required for playback. The next block encountered by the input signal is the internal anti-aliasing filter. The filter automatically adjusts its response according to the sampling frequency selected so Shannon's Sampling Theorem is satisfied. After anti-aliasing filtering is

accomplished the signal is ready to be clocked into the memory array. This storage is accomplished through a combination of the Sample and Hold circuit and the Analog Write/Read circuit. These circuits are clocked by either the Internal Oscillator or an external clock source. When playback is desired the previously stored recording is retrieved from memory, low pass filtered, and amplified as shown on the right hand side of the diagram. The signal can be heard by connecting a speaker to the SP+ and SP- pins. Chip-wide management is accomplished through the device control block shown in the upper right hand corner. Message management is provided through the message control block represented in the lower center of the block diagram. More detail on actual device application can be found in the Sample Application section. More detail on sampling control can be found in the Sample Rate and Voice Quality section. More detail on Message management and device control can be found in the Message Management section.

5. ARM7 PROCESSOR (LPC2148)

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of microprogrammed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

- The standard 32-bit ARM set.
- A 16-bit Thumb set.

The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the performance of an equivalent ARM processor connected to a 16-bit memory system. The particular flash implementation in the LPC2141/42/44/46/48 allows for full speed execution also in ARM mode. It is recommended to program performance critical and short code sections (such as interrupt service routines and DSP algorithms) in ARM mode. The impact on the overall code size will be minimal but the speed can be increased by 30% over Thumb mode.

6. MICROCONTROLLERS (AT89S52)

Microprocessors and microcontrollers are widely used in embedded systems products. Microcontroller is a programmable device [4]. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a timer embedded all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are critical. The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash [9] on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, [5] Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes [6]. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

7. SPEECH RECOGNITION SYSTEM (HM2007)

The HM2007 is the chip that uses a single CMOS transistor that analyzes the analog signal obtained from the microphone. Speech signals are captured with a microphone which are then filtered and converted into a digital signal by an analog filter. The speech signal must be filtered to remove any frequencies outside the range of normal speech. Filtering certain frequencies also reduces the bandwidth of the speech signal resulting in less required computation power. Depending on the operation of the HM2007[6] (training or recognition mode), data is either written to or read from the SRAM. The SRAM is divided into data banks where each data bank has its own unique 8 bit binary value. If the HM2007 is in recognition mode, the HM2007 will attempt to match the speech signal with the entries in the SRAM and return the corresponding data bank's 8 bit binary value on its data bus. If no match is detected, a reserved 8 bit value is transmitted.

When the HM2007 matches the received speech signal to a specific stored phrase of word, the corresponding 8 bit value will be constantly held on the eight pins of the data bus. The 8 bit value will only change when the HM2007 recognizes a different speech signal. Therefore, the voice recognition components will always transmit a signal of the last speech signal recognized.

8. RADIO FREQUENCY IDENTIFIER (RFID)

It is most suitable for indoor communication. It is used for one way communication and a very short range of identification. RFID is cost effective. In most of the systems RFID tags are used which are required in 1000s of numbers for tracking of route. The system we use is a mobile unit, weightless and economically [10]feasible.RFID tags are useful for a huge variety of applications. Some of these applications include: supply chain management, automated payment, physical access control, counterfeit prevention, and smart homes and offices. RFID tags are also implanted in all kinds of personal and consumer goods, for example, passports, partially assembled cars, frozen dinners, ski-lift passes, clothing, and public transportation tickets

9. CONCLUSION

This device is designed to provide with a greater advantage producing voice based announcement for the user i.e. the user gets the voice which pronounces his bus details as and reaches the destination. Here instead of the alerting sound the user can directly hear the location recorded by the user itself[2]. This provides information that would be needed in an emergency situation to direct emergency officials, or to phone for help when lost Assists in familiarizing with a new environment. To remove the chances of errors in finding exact location this uses Rfid technology, active tags at each and every bus stops to intimate the blind people exactly where there are.

10. RESULTS

The project "**PASSENGER BUS ALERT SYSTEM FOR EASY NAVIGATION OF BLIND**" is successfully implemented and verified. When the person reaches the bus station, he can find the buses that pass through a particular location with the help of voice recognition system and voice synthesizer. When the bus approaches the bus station, there is an indication in the bus by the beep sound of a buzzer that there is a blind person available in the bus station. This is achieved with the help of ZigBee unit both in the bus unit and blind unit. Finally when the bus reaches the station the bus number is announced to the blind through headphones.

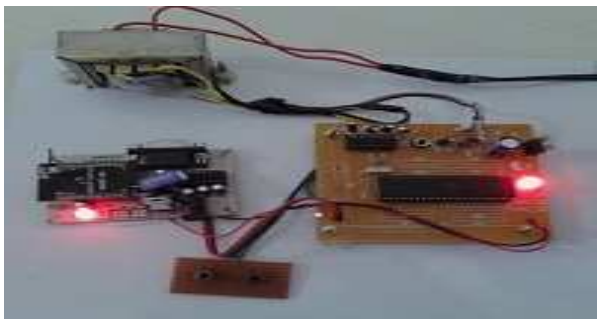


Fig 3: Bus Unit

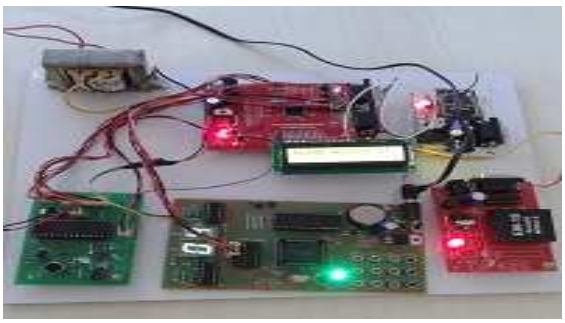


Fig 4: Blind Unit

Fig 5: LCD Display

Fig 6: Bus no 1-A

Fig 7: Bus no 9-X

Fig8: Bus stop stages-1, 2 and 3

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