

Interactive Wireless Communication System for Easy Conveyance of Visually Challenged

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Abstract: Visually impaired people have difficulty accessing information about public transportation systems. Several systems have been developed for assisting visually impaired and blind people to use the public transport system. Most systems provide only one-way communication and require high-cost and complex equipment. The purpose of this project is to reduce the difficulties faced by visually impaired people when using public transportation system; this is achieved by using an interactive wireless communication system. The system comprises of three modules: a user module, a bus station module and a bus module interconnected to each other. The connection between the modules is established via ZigBee. The blind person in the bus station is provided with a ZigBee unit which is recognized by the ZigBee in the bus station. . The blind gives the input about the place he has to reach using microphones and the voice recognition system. The bus unit gives information of the buses parked inside the bus station to the bus station unit. The bus with nearest time slot would be acknowledged to the blind unit of the blind man by the bus station. . This input is then passed to the bus station module and the bus numbers corresponding to the location provided by the blind is generated. These bus numbers are converted into audio output using text to speech converter in the blind module. The blind then select the bus in which he wants to travel. Whenever bus has entered into bus station; the bus module notifies the bus station module. Then ZigBee transceiver in the bus station module notifies the blind person that the bus has reached the station. The bus station also notifies the bus driver, the presence of a blind person in the station via its Zigbee module.

Keywords: ZigBee Systems, Speech Recognition System (HM2007), Text to Speech Converter.

I. INTRODUCTION

Blindness is a state of lacking the visual perception due to physiological or neurological factors. 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.

Here we design an electronic guidance system for the blind to help him to find the buses available to his destination. The blind person in the bus station is provided with a ZigBee unit which allows communication to buses. When a blind man arrives at a bus station, he notifies his destination using microphone. The bus station unit displays the details of the destination with time he have to go. The bus unit gives information of the buses parked inside the bus station to the bus station unit. The bus with nearest time slot would be acknowledged to the blind unit of the blind man by the bus station. The popular Microcontroller PIC 16F887 from MICROCHIP CORPORATION is used here as the microcontroller in the blind unit and bus unit. PIC microcontrollers are widely used now because of their low cost and rich peripheral features. Arduino Uno is used in the bus station to display

the details of the buses available there. The ZigBee unit is used for communication to transmit information to blind, from buses to bus station and blind to bus station. ZIGBEE has been developed to meet the growing demand for capable wireless networking between numerous low-power devices. Due to its low power output, ZIGBEE devices can sustain themselves on a small battery for many months.

II. METHOD OF IMPLEMENTATION

A short overview of the components used in the device is given below:

A. Voice Recognition Unit

HM2007 is a single chip CMOS voice recognition module. It is an on-chip analog front end large-scale integrated circuit with voice analysis, speech recognition and voice recognition system control processes. HM2007 can be operated in two modes: manual mode and CPU control mode.

In manual mode of operation, the voice recognition module HM2007 is used to build simple recognition system by connecting components such as keypad, SRAM of 8Kbyte memory and other components. If power is on, then the HM2007 starts an initialization process and, if the WAIT pin is L, then the HM2007 checks external memory: 8Kbyte SRAM – whether it is perfect or not. But, if the WAIT is H, then the memory check process will be skipped by the HM2007. After this initialization process, the HM2007 moves into recognition mode. In the

recognition mode, if the WAIT pin is H, then the HM2007 is ready to accept the voice and begins recognition process. If the WAIT pin is L, then the HM2007 doesn't accept the voice that is to be recognized. Then training new pattern by clearing trained pattern are the two operations performed using function keys: TRN and CLR. All the patterns in the HM2007 can be cleared by entering number key 99 and pressing CLR.

B. Text to Speech Converter

A text to speech (TTS) converter converts normal language text to speech; other systems render symbolic linguistic representations like phonetic transcriptions to speech. Synthesized speech can be created by concatenating pieces of recorded speech that are stored in a database.

A text-to-speech system (or "engine") is composed of two parts: a front-end and a back-end. The front-end has two major tasks. First, it converts raw text containing symbols like numbers and abbreviations into the equivalent of written-out words. This process is often called text normalization, pre-processing or tokenization. The front-end then assigns phonetic transcriptions to each word, and divides and marks the text into prosodic units, like phrases, clauses, and sentences. Phonetic transcriptions and prosody information together make up the symbolic linguistic representation that is output by the front-end. The back-end—often referred to as the synthesizer—then converts the symbolic linguistic representation into sound. Here the bus numbers are converted into audio output using text to speech converter in the blind module. The blind then select the bus in which he wants to travel to the destination.

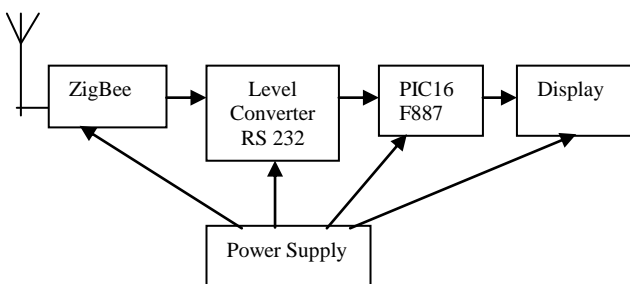


Fig1. Functional Block Diagram of Bus Unit

C. PIC Microcontroller

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC16F887 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller".

In our system two controllers are used. One is in the bus unit and other in the bus station unit. Microcontroller is connected to the level converter, speech recognition system and ZigBee. LCD display is connected to the output of controller in bus unit. The coding is done using embedded C language and Hi-tech C compiler. The output of the microcontroller is connected to the voice synthesizer in blind unit.

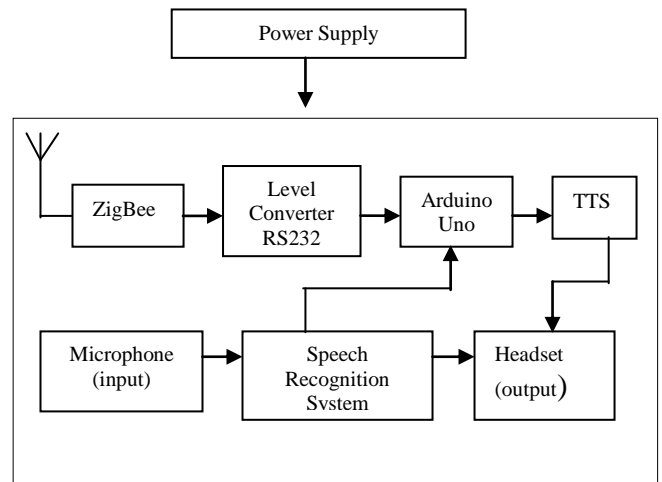


Fig2. Functional Block Diagram of Blind Unit

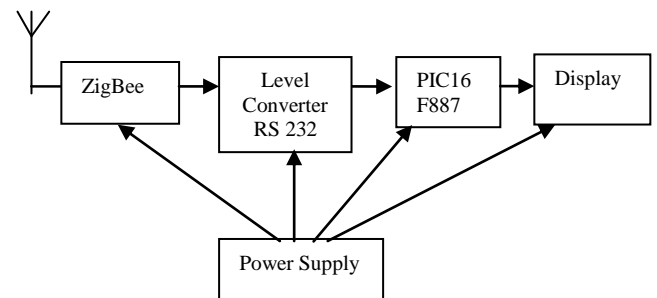


Fig3. Functional Block Diagram of Bus Station Unit

D. ZigBee

ZigBee is wireless technology developed by IEEE 802.15.4 - 2003 standard for low cost, low power, wireless sensor networks that is used for Low-Rate Wireless Personal Area Network (LR- WPANs). The standard takes full advantage of IEEE 802.15.4 physical radio specification that requires a low data rate, long battery life and secure networking. ZigBee is present with the blind people and in the bus which is the used instead of RFID. The ZigBee with the blind recognizes the bus which is few meter distance away from blind and gives intimation to the blind who is carrying it. The intimation is given through the headphones. The ZigBee in bus receives the signal from blind people and stops in bus station. If the blind gets the required bus, he gets into bus or else he waits for the bus which he desires to get into to reach his destination. The advantage over of ZigBee over RFID is that it is less cost than RFID tag and RFID reader. Secondly, it has two-way communication that is to send and receive signal at higher speed without interfering other signals like radio waves.

E. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with

a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The project is based on microcontroller board designs, manufactured by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on the Processing project, which includes support for the C and C++ programming languages.

III.CONCLUSION

The blind man in the bus station notifies his destination using microphone. The bus station unit displays the details of the destination with time he have to go. The bus unit gives information of the buses parked inside the bus station to the bus station unit. There are currently available systems for the outdoor navigation but they will not assist in travelling to unfamiliar areas. Some systems use PDA which is not so economic and cannot be afforded by all. In most of the systems RFID tags are used which are required in thousands of numbers for tracking of route. Also it provides only one way communication.

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