An Audio Based Bus Proximity Indicator For Visually Challenged People

Thamodhiran. V, Ponvannan.V, Jino James Joseph, G.V.Jason Jebasingh

Abstract: It is always good to know a bus commuter waiting at a stop gets to know how far a bus is. Based on the investigation about daily activity characteristics and modes of the blind, the study found that the main difficulties encountered in a trip of the blind included walking on the road, finding way, taking a bus and looking for usual life-area. If his route of travel happens to be common for more than one bus- route number, it is even better for him to know which is the nearest bus or the earliest arriving bus. This will enable him to opt for the bus or some other mode of commuting. This becomes very useful for the physically challenged commuter, as after knowing in advance the bus arrival he/she will be ready to accommodate in the bus. A thought of project Bus Proximity Indicator is the best solution for the above situation and is best suitable for the visually challenged people. In this a wireless RF linkage between a certain bus and a bus stop can be used for determination of the bus proximity that help's commuter to know how far his bus is and to identify the bus number through audio signal from audio playback recorder.

Keywords: transmitter, receiver, microcontroller, bus proximity, encoder, decoder.

I. INTRODUCTION

Blindness is the condition of poor visual perception. Total blindness is the complete lack of form and visual light perception and is clinically recorded as NLP, an abbreviation for "no light perception." The World Health Organization defines low vision as visual acuity of less than 20/60 (6/18), but equal to or better than 20/200 (6/60), or visual field loss to less than 20 degrees, in the better eye with best possible correction. Blindness is defined as visual acuity of less than 20/400 (6/120), or a visual field loss to less than 10 degrees, in the better eye with best possible correction. Some of the causes for blindness are cataract, glaucoma, age-related macular degeneration (AMD), corneal opacities, diabetic retinopathy, childhood blindness, trachoma and onchocerciasis. The causes of avoidable visual impairment worldwide are all the above except for AMD.

II. PROBLEMS FACED BY VISUALLY IMPAIRED PEOPLE

In the bus transport system the route number is only displayed, so the visually challenged person has to rely on sighted assistance. Difficulty during non-office hours and at less-frequently used bus stops. Further inconvenience when no one is around. Even after identification the user is unsure about the physical location of the bus and needs sighted assistance in navigating towards the bus. An announcement device at the bus stop is not always feasible. Because this creates too much noise pollution. The user cannot trigger auditory clues trying to reach the bus, since there is no technology for the guidance of the visually challenged people for getting into their bus to reach their destination.

- *Thamodhiran. V, Ponvannan.V, Jino James Joseph, G.V.Jason Jebasingh*
- *U.G.Students, Department of Biomedical Engineering, Alpha College of Engineering, Chennai.*
- *Assistant Professor, Department of Biomedical Engineering, Alpha college of Engineering, Chennai.*
- *rajavelthamu@gmail.com, ponvannan.vh@gmail.com*

So far, the available techniques are using Radio Frequency Identification RFID, wireless and mobile communications technologies that enable the blind people to know their location, condition of roads, vicinity buildings, and inquire about the optimal routes to their destination and available vehicles. But this system could not help to identify the buses and detect places by delay in message queue. Another technique called Voice Assisted Embedded Navigation System for visually impaired people, helping them to detect and avoid obstacles while walking. But, while walking in a new or changed environment, it is hard for them to guess where they are. Also it will be a problem when they lose memory of locations and places.

III. PROPOSED SYSTEM

In our system we use a transmitter and receiver circuit, transmitter circuit is inbuilt in the bus. The receiver circuit is carried by the blind. The transmitter consists of Radio frequency (RF) unit. The receiver can be with the visually challenged people. The Bus Proximity Indicator which is embedded in the transmitter section uses Radio Frequency of 434 MHZ. The prefixed code of the bus is generated by the encoder. The receiver detects the radio frequency signal and the bus identification is done by decoder present in the receiver side. This tells the blind about the Bus number and destination through an RF signal which is converted to an audio signal by Audio Playback Recorder chip. The KEIL C51 Cross Complier is an ANSI C written specifically to generate fast, compact 8051 microcontroller family. So when the blind who stand in the bus stop receives the audio signal from the bus using wireless communication system. By this the blind able to know the arrival of bus that he needs to travel & to reach the destination.

IV. METHODOLOGY

The Radio Frequency transmitter of the system is designed using KEIL software. The low level routines are written using PIC C compiler. The embedded application utilizes Microcontroller PIC AT89C51 considering its ease in developing, debugging and testing rapid prototypes. Control Unit contains the RF antenna/reader to read tag information, the RF receiver which may be carried by the blind to provide a user interface for selection, PIC AT89C51 and a buzzer for generating beeps to reach the

desired object easily, while the LCD is used for malfunctioning or configuration purposes.

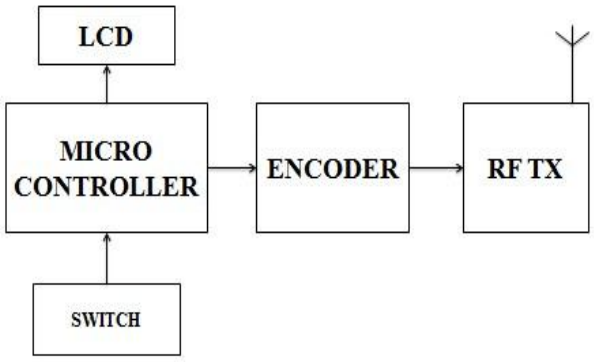

Fig .1 *Block diagram of Transmitter*

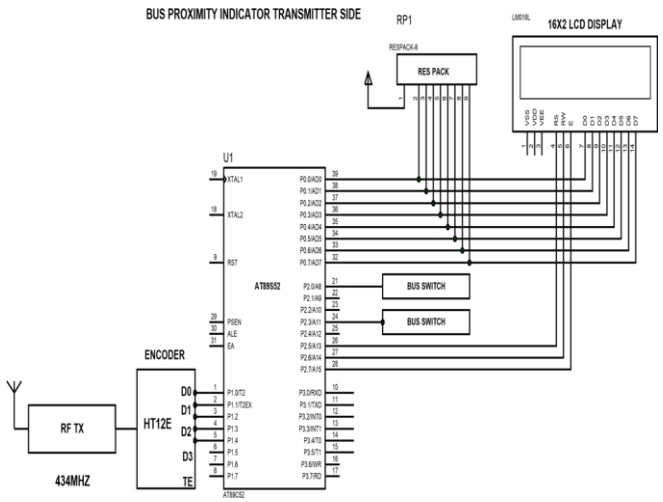

Fig.3 *Transmitter circuit diagram*

The above Fig .1 shows the transmitter circuit which is in the bus. When the switch in the bus is ON, the signal from the switch goes to the microcontroller. The microcontroller AT89C51 is used to control the signal and it will transmit the input data to the encoder. The HT12E encoder encodes the parallel data into the serial data. Thus the serial data from the encoder is transmitted to the RF receiver with the help of RF transmitter through the antenna. The transmitter circuit also connected with LCD. The LCD is used to display the bus number and the destination.

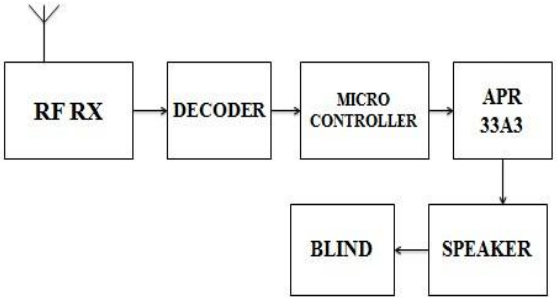

Fig.2 *Block Diagram of Receiver*

Fig.2 shows the Receiver Block diagram. In this the serial data is received and it is again converted into parallel data. The Audio Playback Recorder (APR), the parallel data is converted into a decibel value. It 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. Hence, either by speaker or headset, the patient can hear the particular bus name with destination in the bus stop while the bus is nearest to him. The receiver circuit will be carried by the blind. The RF receiver receives the serial data from the transmitter. The HT12D decoder converts the serial data into the parallel data. The converted parallel data is send to the microcontroller AT89C51 which controls the signal and gives to the audio playback recorder APR33A3 in which the stored voice signal reaches the blind through the speaker.

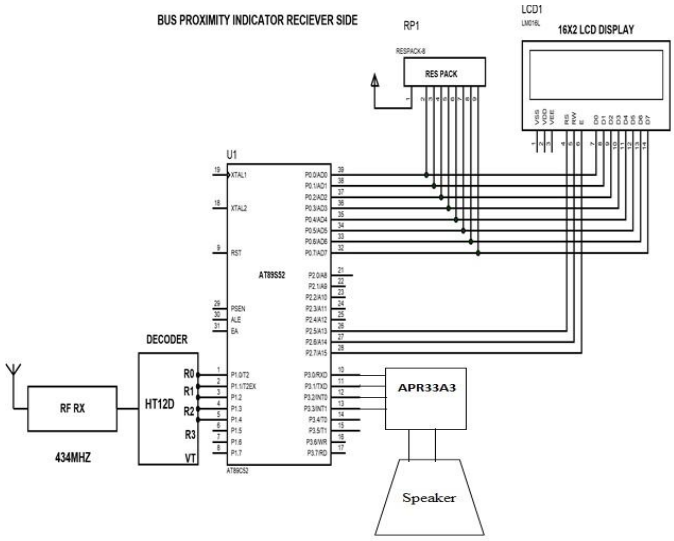

Fig.4 *Receiver circuit diagram*

V. PRINCIPLE OF AN AUDIO BASED BUS PROXIMITY INDICATOR

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz and 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter and receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

VI. ATMEL MICROCONTROLLER

AT89C51 is an 8-bit microcontroller and belongs to Atmel's 8051 family. ATMEL 89C51 has 4KB of Flash programmable and erasable read only memory (PEROM) and 128 bytes of RAM. It can be erased and program to a

maximum of 1000 times. In 40 pin AT89C51, there are four ports designated as P1, P2, P3 and P0. All these ports are 8-bit bi-directional ports, i.e., they can be used as both input and output ports. Except P0 which needs external pull-ups, rest of the ports have internal pull-ups. When 1s are written to these port pins, they are pulled high by the internal pull-ups and can be used as inputs. The ports are also bit addressable and so their bits can also be accessed individually. Port P_0 and P_2 are also used to provide low byte and high byte addresses, respectively, when connected to an external memory. Port 3 has multiplexed pins for special functions like serial communication, hardware interrupts, timer inputs and read/write operation from external memory. AT89C51 has an inbuilt UART for serial communication. It can be programmed to operate at different baud rates. Including two timers & hardware interrupts, it has a total of six interrupts.

VII. ENCODER

HT12E is an encoder integrated circuit of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits. HT12E has a transmission enable pin which is active low. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. Transmission is enabled by providing ground to pin14 which is active low. The control signals are given at pins 10-13 of HT12E. The serial data is fed to the RF transmitter through pin17 of HT12E.

VIII. DECODER

HT12D is a decoder integrated circuit that belongs to 212 series of decoders. This series of decoders are mainly used for remote control system applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 212 series of encoders. The chosen pair of encoder/decoder should have same number of addresses and data format. In simple terms, HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously.

IX. RADIO FREQUENCY MODULE

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (TX/Rx) pair operates at a frequency of 434MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. To summarize, on each transmission, 12 bits of data is transmitted consisting of 8 address bits and 4 data bits. A single RF transmitter can also be used to control different RF receivers of same frequency. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E - HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

X. WORKING OF RF WIRELESS COMMUNICATION

This circuit utilizes the RF module (Tx/Rx) for making a wireless remote, which could be used to drive an output from a distant place. RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate. A receiver can receive these signals only if it is configured for that frequency. A four channel encoder/decoder pair has also been used in this system. The input signals, at the transmitter side, are taken through four switches while the outputs are monitored on a set of four LEDs corresponding to each input switch. The circuit can be used for designing Remote Appliance Control system. The outputs from the receiver can drive corresponding relays connected to any household appliance.

XI. AUDIO PLAYBACK RECORDER

The APR33A3 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. APLUS integrated achieves these high levels of storage capability by using its proprietary analog/multilevel storage technology implemented in an advanced Flash non-volatile memory process, where each memory cell can store 256 voltage levels. This technology enables the APR33A3 device to reproduce voice signals in their natural form. It eliminates the need for encoding and compression, which often introduce distortion.

XII. RESULTS

A. Radio Frequency Transmitter

The transmitter circuit output using RF of 434MHz which transmit the data via HT12 Encoder. The 230V AC supply is step down by using the transformer to 12V AC and is converted into 12V DC by using the bridge rectifier. Then by using the voltage regulator the output of the power supply

will be 5V. So the transmitter circuit works in 5V power supply. Thus the output of the transmitter circuit is given to the receiver through an RF antenna.

B. Radio Frequency Receiver

The receiver output using audio playback recorder interfaced with RF receiver and HT12 Decoder. The receiver circuit also works in 5V power supply. The RF receiver gets the serial data through antenna. Then the serial data gets converted into the parallel data by using HT12D decoder. Hence the data gets controlled by using the microcontroller AT89C51. The Audio Playback Recorder APR33A3 is an integrated chip used to store the prerecorded voice and it converts digital signal into analog signal. It supports both sequential and random access to the received signal. Hence an audio signal is obtained and given to the blind through speaker.

XIII. CONCLUSION

Our project 'An Audio Based Bus Proximity Indicator' is a new technique to assist the visually impaired people to board the bus independently without any human guide to reach their destination. The blind person who is standing at the bus stop receive the audio signal when the bus is 100 meter away from the bus stop. Thus our system is the best solution for the blind people to know the bus arrival in advance through Wireless Radio Frequency Technology. This system will improve the blind navigation. In the proposed method the technology is only implemented for the visually impaired people. In future this technology can be developed by interfacing with braille reader so the visually challenged people can also be benefited by this techniques. This will help the impaired people to travel independently and more easily find their destination.

XIV. REFERENCES

[1] Bus Proximity Indicator (An Intelligent Bus Stop) Prof. A.P. Thakare, Mr.Vinod H. Yadav International Journal of Scientific & Engineering Research Volume 2, Issue 4, April-2011

[2] S. Alghamdi and R. van Schyndel, "Accurate positioning based on a combination of power attenuation and a signal strength indicator using active RFID technology," in 2012 International Conference on Indoor Positioning and Indoor Navigation; Paper, Sydney, Australia (November 2012).

[3] M. Meints, "D3. 7 a structured collection on information and literature on technological and usability aspects of radio frequency identification (RFID)," FIDIS deliverable, vol. 3, no. 7, 2007.

[4] P. Magrassi and T. Berg, "A world of smart objects: The role of auto identification technologies," 2001.

[5] Sin Murad, Abdullah Rehman, Arif Ali Shah, "RFAIDE – An RFID Based Navigation and Object Recognition Assistant for Visually Impaired People", IEEE, 2011.

[6] A. R. García, R. Fonseca. A. Durán, "Electronic long cane for locomotion improving on visual impaired people. A case study", IEEE, 2011