Bus identification and obstacle detection for blind using RF Communication

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Abstract- *Many studies have established the need and utility of accessible urban transport system for visually impaired persons. However, most public transportation systems, especially in the developing countries, are not accessible and this is often listed as one of the major bottlenecks for social and economic inclusion of visually impaired. On Board, the bus identification and obstacle detection have been developed to address these needs. There are two units generally called as bus unit and blind unit which are placed in the bus and kept by the blind respectively. A radio-frequency based system will be placed at the bus and also kept by the blind. An ultrasonic sensor is using to detect the obstacles that present in the path of the blind. The bus information is send to the blind person as a voice output by using radio communication. This system will allow blind people to safely catch buses with the help of vibrating device. This interactive RF communication aid system is a valid and a low cost device for assisting the visually impaired people to use city buses and to detect the hindrances in their path.*

Keywords: RF communication, ultrasonic sensor, visual impairment, Public transportation.

1. Introduction

1.1 For a significant number of visually impaired persons especially in the developing world, public transport is, often, not a matter of choice but an absolute necessity. Helping visually impaired people use public transport can increase their chances of education and employment and reduce the financial burden on their families. [1,2]. In most physical environments, the visually impaired have difficulty accessing information about transport stops, terminals, vehicles, schedules, maps, and directories, which prevent them from using public transport effectively. According to a survey in Taiwan on the living demands of disabled people, using public transport was the most critical problem for the visually impaired, amounting to 71.04% of 602 visually impaired people. The survey results showed that only 14% of visually impaired people used public transport (city bus, mass rapid transit, train, etc.).

1.2 Knowing the location of the bus stop and the time when the bus arrives are two common difficulties faced by the visually impaired persons. The visually impaired person may also face difficulties while moving from place to place because of the presence of obstacles in their way. These problems that are faced by them should be overcome by some ideas or solutions. In that point, this proposed system will help the blind person for detecting the buses and to find the hindrances the path. There are many existing methods that help the blind for boarding buses and for the obstacle detection. In such methods, a technology called zigbee will be used to give to information about the bus which is coming within the range of 30 to 50 meters.

1.3 VIP (Visual impairment person)

285 million people are estimated to be visually impaired worldwide. 39 million are blind and 246 have low vision. About 90% of the world's visually impaired live in low-income settings. 82% of people living with blindness are aged 50 and above. Globally, uncorrected refractive errors are the main cause of moderate and severe visual impairment; cataracts remain the leading cause of blindness in middle- and low-income countries. The number of people visually impaired from infectious diseases has reduced in the last 20 years according to global estimates work. 80% of all visual impairment can be prevented or cured.

1.4 DEFINITION:-

There are 4 levels of visual function, according to the International Classification of Diseases -10 (Update and Revision 2006):

- normal vision
- moderate visual impairment
- severe visual impairment

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. In addition, as the population ages, the number of VIPs has increased. At present, statistic showed that 285 million people are visually impaired worldwide: 39 million are blind and 246 have low vision. As of India, around 8 million people in India are blind. India is now home to the world's largest number of blind people with 20% of the whole world.

2. Hardware Description:

There are many hardware components that are used in this design. They are,

- RF transmitter modules
- RF receiver modules
- Ultrasonic sensor (HCSR04)
- Vibration motor
- PIC microcontroller(PIC16F877A)

PIC Controller:

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer.

- A timer module to allow the microcontroller to perform tasks for certain time periods.
- A serial I/O port to allow data to flow between the controller and other devices such as a PIC or another microcontroller.
- An ADC to allow the microcontroller to accept analogue input data for processing.

RF Transmitter and Receiver Modules:

RF Transmitter: It is an ideal for remote control applications where low cost and longer range is required. The transmitter operates from a 1.5-12V supply, making it ideal for battery-powered applications. The transmitter employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance. Output power and harmonic emissions are easy to control, making FCC and ETSI compliance easy.

RF Receiver: It is an ideal for short-range remote control applications where cost is a primary concern. The receiver module requires no external RF components except for the antenna. It generates virtually no emissions, making FCC and ETSI approvals easy. The super-regenerative design exhibits exceptional sensitivity at a very low cost.

Ultrasonic Sensor: Ultrasonic sensor emit ultrasonic pulses, and by measuring the time of ultrasonic pulse reaches the object and back to the transducer. The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.

Encoder (HT12E): The HT12E encoder is a CMOS IC built especially for remote control system applications. It is capable of encoding 8 bits of address (A0-A7) and 4 bits of data (AD8-AD11) information. Each address/data input can be set to one of the two logic states, 0 or 1. Grounding the pins is taken as a 0 while a high can be given by giving +5V or leaving the pins open (no connection). Upon reception of transmit enable (TE-active low), the programmed address/data are transmitted together with the header bits via an RF medium.

Decoder (HT12D): The HT12D is a decoder IC made especially to pair with the HT12E encoder. It is a CMOS IC made for remote control system application. The decoder is capable of decoding 8 bits of address (A0-A7) and 4 bits of data (AD8-AD11) information. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from programmed encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The decoders are capable of decoding information that consists of N bits of address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

Voice record/playback module: WTV-SR is provided with mp3 mode, Key control one by one, parallel interface, one-line serial interface, three-line serial interface. Therefore, WTV-SR module is suit for many occasions. It can be changed different control modes by setting I/O, which on the bottom of WTV-SR. It gives a Flexible power supply by either supply module or supply solution, so it is a effective recording solution.

The recorded voice can be uploaded to the system. It also supports download voice from PC and play recorded voice with high quality. It can record up to 252 segment voice (including fixed voice) and recording time up to 1600 seconds. It supports audio recording at 10 KHz or 14 KHz sample rate.

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Vibration motor: A vibrator is a mechanical device to generate vibrations. The vibration is often generated by an electric motor with an unbalanced mass on its drive shaft. There are many different types of vibrator. Typically, they are components of larger products such as cell phones, pagers and so on.

LCD display: Liquid crystal cell displays (LCDs) are used in similar applications where LEDs are used. These applications are display of display of numeric and alphanumeric characters in dot matrix and segmental displays.

LCD consists of two glass panels, with the liquid crystal materials sandwiched in between them. The inner surface of the glass plates is coated with transparent electrodes which define in between the electrodes and the crystal, which makes the liquid crystal molecules to maintain a defined orientation angle. When a potential is applied across the cell, charge carriers flowing through the liquid will disrupt the molecular alignment and produce turbulence.

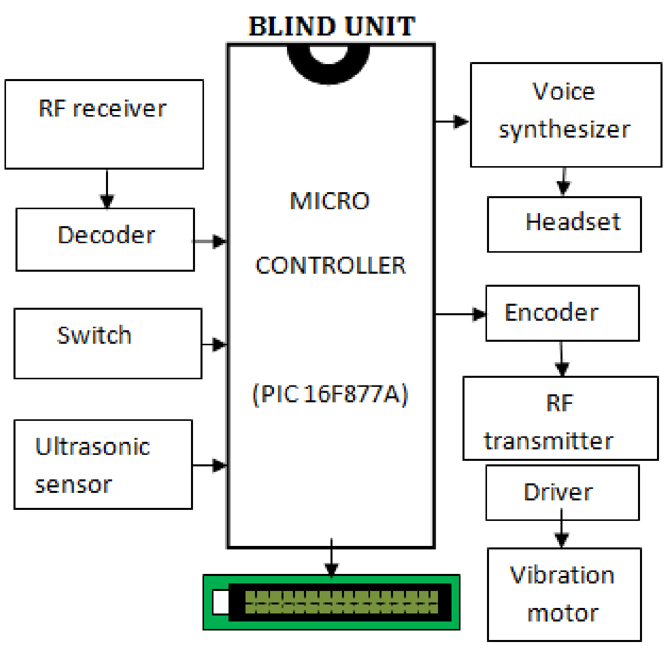

Diagram Description: When the blind reaches the bus stop, the signals from the buses in the distances of 500 meters will be received by the blind. Now the voice synthesizer will produce the information of the bus i.e, where the bus is going to. If it is the bus needed by the blind, then the signal from the blind unit will be sent to the bus unit. As soon as the reception of the signal from the blind unit, a buzzer will be played to indicate that the blind is waiting in the next stop and also it is shown through the display device.

Obstacle Detection: The ultrasonic sensor will produce the ultrasonic sound waves (4 MHZ) for a time period of 1micro second from the trigger pin.

This wave will be struck by the obstacle if any in the path of the person and will be received through echo pin in the ultrasonic sensor (HCSR04). HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground correspondingly. This sensor is a very popular sensor used in many applications for measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

The echo pin will generates a pulse of width having the time period which is equal to the time required between the transmission and reception of the sound wave. Depending upon this time period of the pulse, the distance connecting the person and the obstacle will be calculated. The person may in the motion, and so another wave is also formed to get the average distance of the obstacle. As mentioned above, the obstacle in the path of the blind is detected and it will help them to move in the path safely.

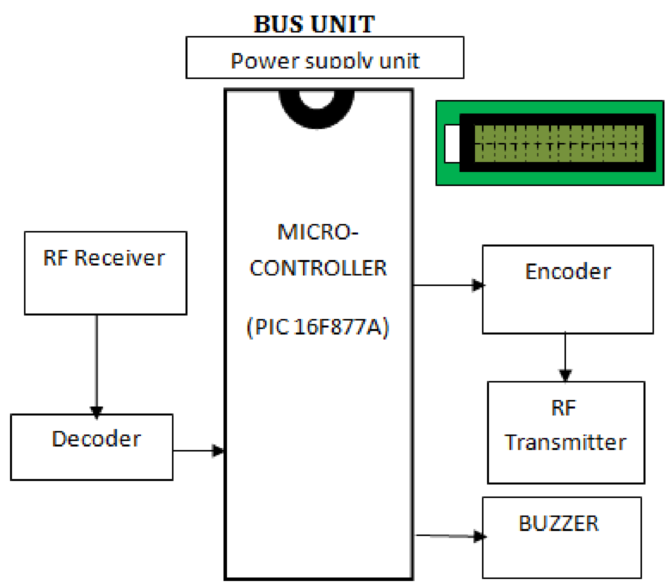

Diagram Description:

When the bus reaches into the range of the blind, the transmitter module in the bus will send the terminal point information of the bus to the receiver module in the blind unit. If that bus is needed by the blind, he should press the switch which is present the system.

When the switch is pressed by the blind at the bus stop, the signal from the blind unit is reached to the RF receiver in the bus unit. At once, the buzzer in the bus will alert the driver in the bus. The driver can identify the presence of blind in the next station by reading the message displayed in the LCD display. Then, the driver will give some more time to make the blind to board the bus.

Advantages of the proposed system:

In the previously existing system, the range of the coverage will be 30 to 50 radial meters and also in the olden methods, the information of the buses that comes within the coverage range will be commonly told through the speaker in the bus stop.

Through this system, the drivers could not come to know about the blind who is waiting in the bus stop. This is a drawback in the previous methods. And in the previous aids that help the blind to find the obstacles in their path uses tactile devices. Tactile devices are the devices where the information can be understand by touching and sensing the dots present within them. It takes more time for the blind to know about the obstacles. This is also a greater disadvantage in the olden methods. In such a way to overcome those drawbacks in the previous system, the proposed system is designed. In this system, each of the blind is provided with a separate system for knowing the information of the terminal points of the bus. Since this proposed method uses the voice synthesizer to generate the information required for the visually impaired person, it will reach the blind faster than that of the olden methods which makes the blind person to be.

Conclusion:

The results are obtained by testing the factors such as whether the communication quality is good, and whether the correct bus identified by the visually impaired person and are tabulated as follows. This system is very useful for the blind in order to take the public bus and to find the obstacle in the path for ensuring their safer motion from one place to other. This system is very useful for the blind in order to take the public bus and to find the obstacle in the path for ensuring their safer motion from one place to other.

Results:

Participants	Experimenter1	Experimenter 2	Experimenter 3	VIP A	VIP B
communication	100	100	100	100	100
Bus detection	Nil	Nil	Nil	100	100
Boarding correct bus	Nil	Nil	Nil	100	100

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