Hardware Based Traffic System for Visually Impaired Persons with Voice Guidance

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Abstract **- Traffic lights and traffic crossings are very common spots found in each & every corner. Due to the inability of the vision, visually impaired persons face the dilemma every day. With the integration of various techniques developed by the researchers, this complication can easily be rectified. The researchers have proposed system which infers the use of voice synthesizer with the wireless module. The blind navigator system uses the ultrasonic sensors for detecting obstacles and distance measurement of the obstacle. But these systems are not compatible according to the present scenarios as today's world need direct application with good security and strident usability. The proposed system makes use of wireless module, ultrasonic sensors, voice synthesizers and audio system. The essence of the interface of these modules is easily available. The proposed system also amends all the limitations of the system used for the integration.**

Keywords - Microcontroller AT89C51, RF Module, Ultrasonic Sensors, Voice Synthesizer, Transmitter module

1. Introduction

Individuals with visual disability face colossal restrictions as far as versatility. There are around 314 million visually impaired individuals over the world. Long white stick is the customary portability apparatus used to identify hindrances in the way of visually impaired individual. Sometimes, guide dogs can also be used which are prepared to lead these blind users around external environment. For visually impaired people there has been a wide route frame work that has evolved with advancement of technology. The same has been for visually impaired people such that they do not face any tough circumstances both in indoor and outdoor surroundings. There are basically three fundamental classifications of the frameworks,

1) Electronic Travel Aids (ETAs): These devices are generally used for the environmental information transformations that are being handed over as a structure through vision that can later on be transferred using a tactile methodology.
2) Electronic Orientation Aids (EOAs): These dives are being utilized to provide information during or before movement or travel. They can be wearable to the client and/or can be conveyed by the client
3) Position Locator Devices (PLDs): GPS (global positioning system), European Geostationary Navigation Overlay Services (EGNOS), et cetera advances are being incorporated utilizing these devices.
Electronic Travel Aids are order contingent using which how the data from surroundings are being collected and how the data are being sent to clients. Assembly of data can be done with SONARs, LASER scanners, or cameras which can be informed to the user or client by using sense related with sound or material. In some cases the clients are expected to hold the devices even after these aids offer client a wearable module. The responsible facts about the aid that uplift blind people to acquire the same are because of their properties like portable, affordable and controlling the same is easy. ETA gadgets are generally light in weight and small in size. The gadget is manufactured in such a way that even after visually impaired people not being able to clearly see the control panel, they can easily operate the gadget with lots of ease. It must be kept in mind that the gadget must be kept low in cost such that it becomes affordable for every section of population.
This work proposes a module through which blind individuals can go far in accomplishing their target by perceiving their surroundings which enhances their personal satisfaction enormously.

2. Proposed Work

2.1 Transmitter Section

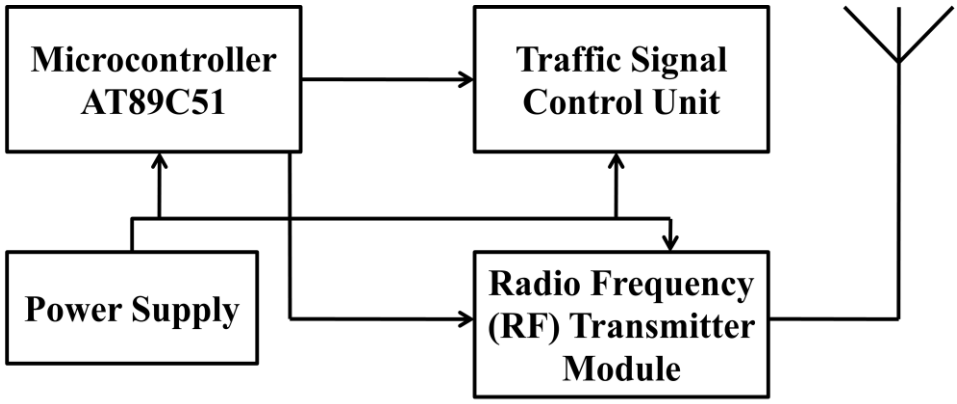


Figure 1. Transmitter module block diagram

A transmitter module is present on the traffic pole and is used to transmit the information and signals of the traffic light to the receiver module (portable) present with the user. For this wireless communication, Radio Frequency (RF) module has been used due to its wide range.

A transmitter module contains a microcontroller AT89C51, an RF transmitter module and a traffic signal control unit. As all these components works on DC voltage, power supply is applied to them of 12V with the voltage regulator chip LM7805. This regulates the 12V voltage to 5V which is suitable for the working of these components. The power supply is applied with the 12V-1A adaptor. With the new proposed system, some modifications have been applied over the traffic lights for the ease of the pedestrians. The proposed traffic light has 4 way crossing and after one cycle, gap of 5 seconds has been applied for the movement of pedestrians across the crossings. The delay of 2.5 seconds is applied in each traffic signal. There are four signals in each way: red, yellow, green & blue. Red signal indicates to stop, yellow to wait and green to go, while blue signal is used for the pedestrians to move. When the three signals are red then one remaining show green for the 2.5 seconds, then other signal show yellow and then green. Meanwhile the green becomes red and this cycle repeats with each signal. After one complete cycle, all the signals become red and blue signal glow indicating the pedestrians to move. The microcontroller has encrypted information of the traffic signals and this information is transmitted to traffic module with 16 ports of microcontroller. This information is also transmitted to RF transmitter by serial port communication from microcontroller so as to further transmit it to receiver of portable module. In this system, the transmission from RF transmitter module takes place at radio frequency level of 433.92 MHz.

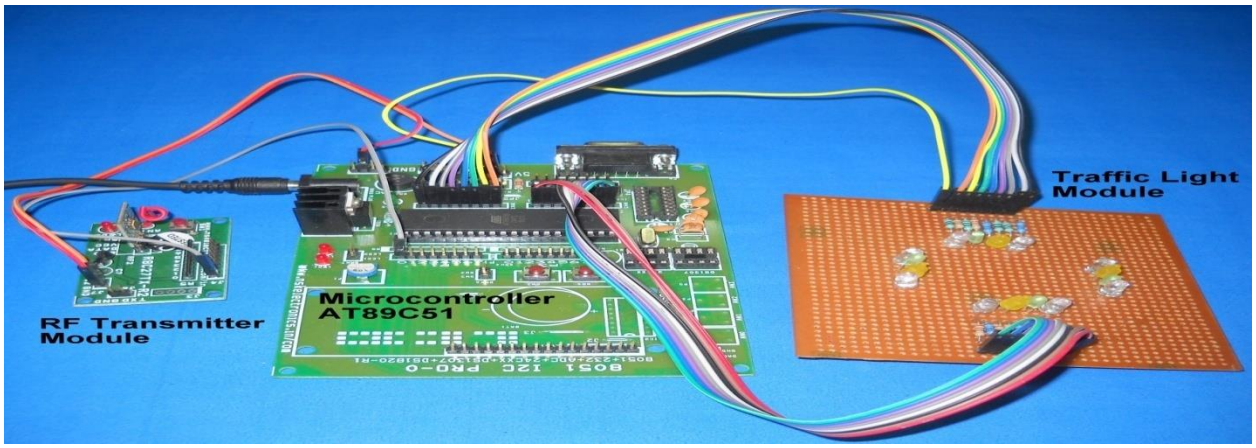


Figure 2. Hardware Implementation of Transmitter Module

2.2. Receiver Section

A receiver module has microcontroller AT89C51, RF receiver module, Voice synthesizer with speaker, ultrasonic sensors and buzzer. As all these components works on DC voltage, power

supply is applied to them of 12V with the voltage regulator chip LM7805. This regulates the 12V voltage to 5V which is suitable for the working of these components. The power supply is applied with the 12V-1A adaptor.

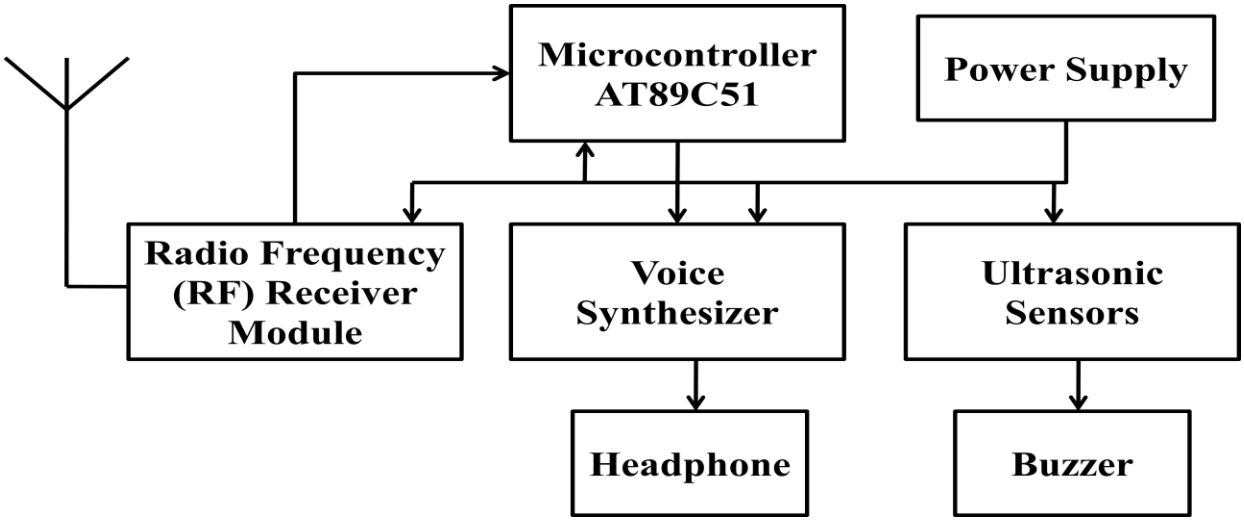


Figure 3. Block Diagram of Receiver Module

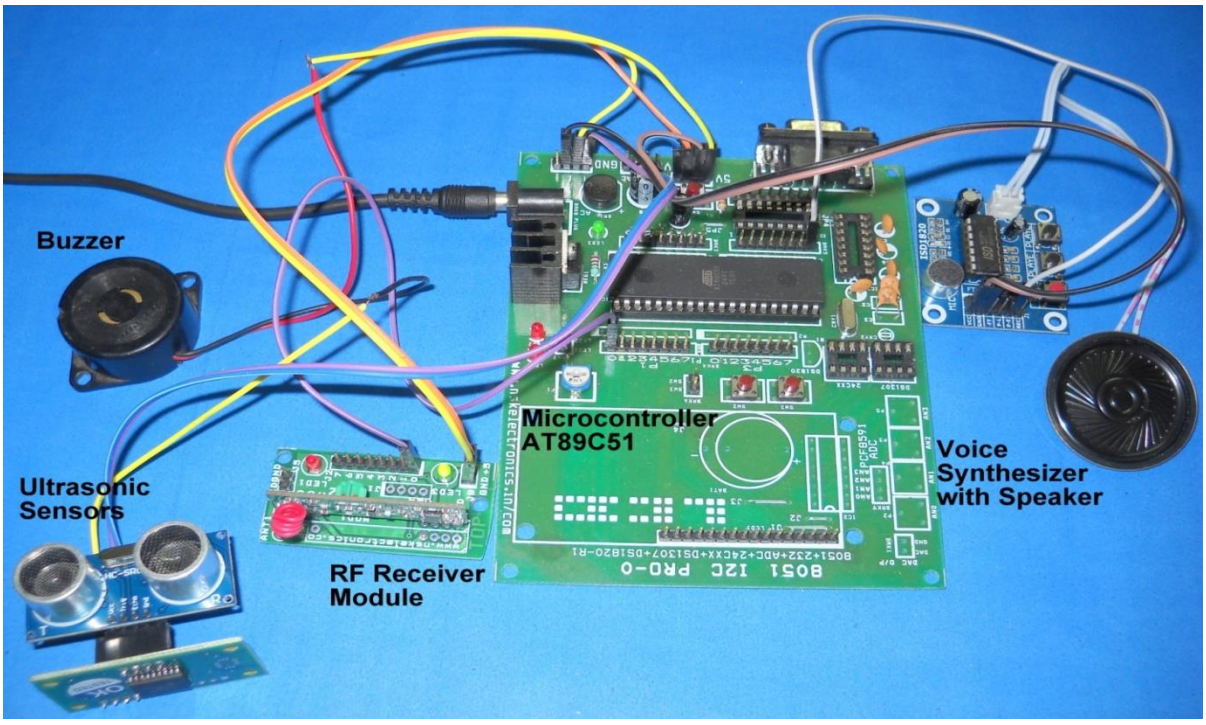


Figure 4. Hardware implementation of receiver module

With reference to the new proposed traffic light module, the information of this signal transmitted from the RF transmitter module is received by the RF receiver module available with the user. The received signal is passed to the microcontroller for the analysis by the serial port communication. The microcontroller analyzes the information and as the blue and red signal is high in the traffic module for pedestrians, it gives the signal to the voice synthesizer to generate a voice and gives output through the speaker to the user to move. The speaker gives the output in the form of voice continuously until the blue signal turns off.

Along with this feature, obstacle detection module is also introduced in this system. The ultrasonic sensors are used for the detection of objects along the way. These sensors transmit the ultrasonic waves and when the waves reflect back to the sensor, it gives high output. The output of ultrasonic sensors is indicated by the buzzer. When the output is high, buzzer turns on. As this module is compact, it is portable and can be easily used by the visually impaired user.

3. Hardware Description

3.1. AT89C51 Microcontroller

This microcontroller belongs to the Atmel's 8051 family that has 40 pins in total. It has FOPEROM (flash programmable and erasable read only memory) of size 4 Kb and RAM (random access memory) of size 128 bytes. The programming and erasing of the same can be done thousands of times.

The pins of the controller are being grouped in four parts namely P0, P1, P2 and P3. All the pins present in the defined ports are bidirectional as they can be used as both input and output and also it must be noted that since each port consists of 8 pins that is why each of the ports are termed as 8 bit bidirectional ports. It must be taken into account that pins of port P0 always require a pull up resistor being planted externally where as other pins of the other defined ports have pull up resistors being built internally. When the input being provided to the pins is 1 then internal resistors pull the pins to high and thus are used as input. These ports are also said to be the bit addressable.

When microcontroller is being patched up with and external storage system then to acquire low and high byte address separately, the use of ports P0 and P2 are done. To accomplish extraordinary tasks like serial communication, hardware interrupts, timer inputs and read/write operation from external memory port 3 of microcontroller is needed to be utilized as it contains the multiplexed pins. For serial communication there is an inbuilt UART (universal asynchronous receiver/transmitter) in microcontroller. Modification of microcontroller can be performed such that it can work on various baud rates. There is presence of six timers that includes hardware interrupts and counting two timers.

3.2. RF Module

RF modules are comprehensively utilized as a part of electronic configuration taking obligation of many-sided quality of planning radio hardware. Great electronic radio design is unpredictable because of the radio circuit's affectability and the precision of parts with formats used to execute operation at a clear recurrence. However, in RF communication circuit it is required to verify that parameters involved in execution of RF are not antagonistically influenced and this is done by cautious and appropriate investigation of generation procedure. Radio circuits being obtained or made at last require a proper testing and validation from a recognized institution, for example, European Telecommunications Standard Institute (ETSI) or the U.S. Government Communications Commission (FCC). RF modules are accessible with a few bearer frequencies for applications in experimental, modern and medicinal fields [9]. 433.92 MHz, 915 MHz, and 2400 MHz are the mentioned frequencies being utilized for information transmission. The frequencies being mentioned in the previous line are utilized by national and universal strategies that are responsible for the use of radio for communication.

3.3. Ultrasonic Sensors

Ultrasonic sensors can also be termed as transceivers because they can transmit and sense respectively. The principle of working of the sensor is that it analyzes the distance of target using the echoes of radio and sound wave which is similar to working principle of RADARs and SONARs. Therefore it can be figured out from the concept that ultrasonic sensors calculate difference of time originated during the transmission and reception of signal so as to verify the distance of the target by sending high frequency sound waves that strikes the object and an echo is being generated which is received back and sensed by the sensor. The sensor is extensively used in various industries and plants because it is also capable of detecting the kinetic objects and depicts the distance of the same as well. Some sensors have presence of ON/OFF system that which is digital in nature that depicts the object’s position during its movement or it produces an analog output proportional to distance. Ultrasonic sensors are also installed in cars so that in the parking areas it does not face any problem while reversing it. In ultrasonic people detection and also in navigation of UAV (unmanned aerial vehicles) which are automatic in nature the ultrasonic sensors are being used.

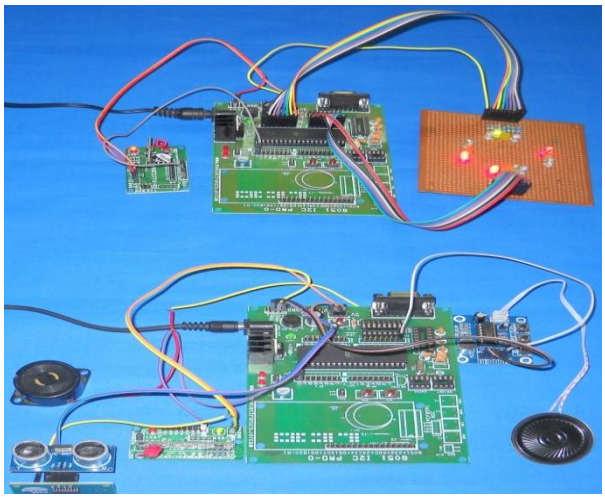
3.4. Voice Synthesizer

This module is based on ISD18B20 and it is a device which can record/play a single message. The recorded message is stored in a non-volatile memory chip which provides zero power storage. The data can be stored up to several years and various erase/record cycles can be employed with the flash memory. The possible time for recording is 8-20 seconds. There are 3 keys on the board: REC, PLAYE and PLAYL

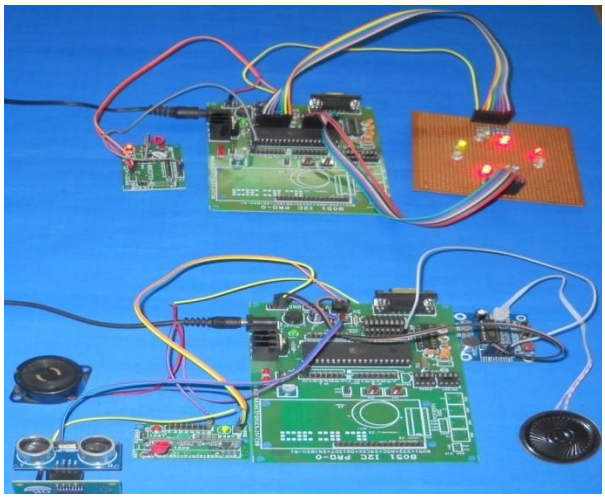
1) REC: It is used to record the message in the device.
2) PLAY: There are two modes to play the voice in the voice chip: edge activated mode and level activated mode. When a high transition is detected on the input pin, a playback cycle begins and it is called edge activated mode (PLAYE). When a low to high transition is detected on the input pin, a playback cycle begins and it is called level activated mode (PLAYL).

4. Simulation & Results

The transmitter section and the receiver section of the proposed system are simulated successfully with hardware module. The programming of the system is performed in the Keil uVision4. When the visually impaired person comes in the range of RF module, the transmitter at the traffic pole will transmit the information of the traffic light. This transmitted information is received by the receiver section and the information is converted in suitable TTL logic. This information is sent to microcontroller where user is informed about the traffic signals using voice synthesizer. When all the signals becomes red and blue signals glows, the microcontroller of transmitter module transmits the information to the microcontroller of receiver module by RF communication about the signals. The receiver section modifies this signal into the voice by voice synthesizer and gives output to the user in the form of voice by speaker to move to their respective directions.



(a)



(b)

Figure 5. Module indicating 3 red signals and 1 green signals to the vehicle to stop and move respectively. The RF transmitter with red LED and RF receiver with green LED represents the active mode of RF module (a) Represents the 3 signals in three different directions with red light and 1 signal in remaining direction with green light. (b) Represents the 3 signals in other three directions while the remaining signal with green signal in other direction.

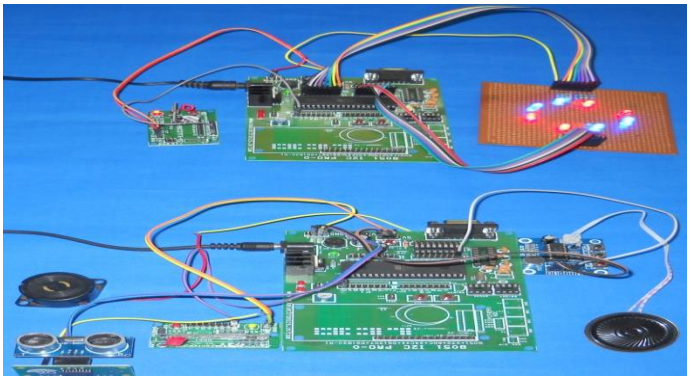


Figure 6. Module with all 4 red signals and all 4 blue signals indicates the visually impaired persons with voice synthesizer to move to their respective directions. The RF transmitter with red LED and RF receiver with green LED represents the active mode of RF module.

5. Future Work

The proposed visually guided system can become a helping hand for the welfare of the society by providing a great support in independent navigation of visually impaired persons. The transmitter and receiver module use cost efficient components and it provides control simplicity at affordable price. This module is implemented with the obstacle detector in the portable module to detect the obstacles on the way. The GPS module can also be introduced to provide a reliable positioning and navigation to the user.

Conclusion

The development & hardware implementation of the transmitter & receiver module of the proposed system in completed successfully. The transmitter module is sending the traffic signals to the traffic light control unit and to the RF module for transmission to the portable module. Similarly receiver module is receiving the signals from transmitter module and making it available to the visually impaired person using the microcontroller and voice synthesizer.

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