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Ultrasonic Navigation System for the visually impaired & blind pedestrians

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ABSTRACT: *The main aim of this paper is to expand the electronic travel aid for the blind and visually impaired pedestrians by emerging into the ultrasonic technology. The paper represents an innovative project design and implementation of an Ultrasonic Navigation system in order to provide fully automatic obstacle avoidance with audible notification for blind pedestrians. This blind guidance system is safe, reliable and cost-effective.*

Keywords - *Ultrasonic, Microcontroller, Proteus, Sensor, signal.*

I. INTRODUCTION

Blindness is a condition of lacking the visual perception due to physiological or neurological factors partially or fully. The main concept of the paper is to provide an electronic aid as guidance to overcome the lacking of their visualization power by proposing a simple, efficient, configurable electronic guidance system for blind and visually impaired pedestrians.

Ultrasonic Sensor is the proposed electronic aid which senses the obstacles in its path by continuously transmitting the ultrasonic waves. When an obstacle appears in its vicinity then the ultrasonic waves gets reflected to the system immediately. And then ultrasonic receiver senses these ultrasonic waves. This method supports the microcontroller to obtain the information from ultrasonic waves and then it alerts the blind pedestrians through voice message. The advantage of our proposed system is its voice based announcement for easy navigation which can assist a blind pedestrian to pass through a busy road. Moreover, this system is an auditory guidance system for the visually impaired pedestrians using ultrasonic-to-audio signal transformation [1], [3].

II. OVERVIEW OF THE PROJECT

2.1 Block diagram of the project:

In this project, the system is designed in such a way that it gathers data about the environment via ultrasonic sensors and extracts the visual information from that data. This visual information is then transformed into an audio signal immediately and the blind pedestrian can recognize the environmental information through binaural sound generated by the system [2].

The whole operation of the project can be described by using block diagram which is a graphical method for explaining the concept of the system without the presence of the individual components within the project. Figure 1 represents the basic block diagram of the whole system of project.

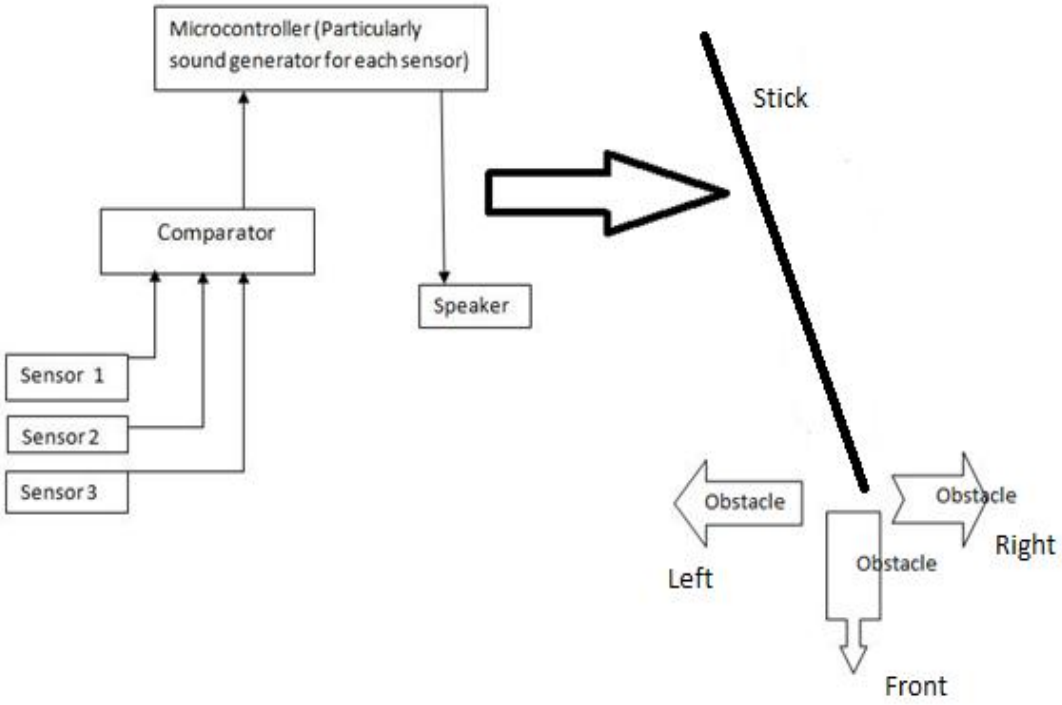


Fig 1: Basic Block Diagram of proposed ultrasonic navigation system for blind pedestrian

In order to describe the whole operation of the project, it is required to explain the block diagrams of Figure 1. The ultrasonic sound sensor is placed in the stick so that the buzzer could only be activated when the system detect any obstacle. So the visually impaired person can easily understand which side is obstacle-free. And different types of sound beep will be produced for different sides. Blind pedestrian should be aware of the sound beep for different sides (left/right/front) before.

The range of detecting obstacle can be controlled in high or low range by the variable resistor (POT) up to 5 meter. So there will be no difficulty for either crossing the road or walking in the stairs for a visually impaired person.

2.2 Flow chart

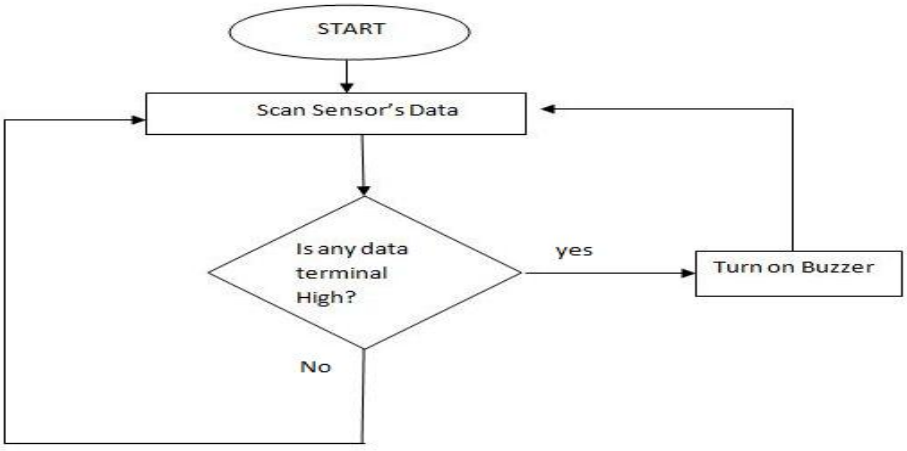


Fig. 2: Flow Chart

2.3 Algorithms

1. Start
2. Scan sensor's data terminal
3. is any data terminal high?
4. If yes, turn on the buzzer. Then go step-3
5. If no, go to step-3

III. SIMULATION AND RESULT ANALYSIS

3.1 Proposed circuit Design

Proteus is the effortless and most essential software with latest technology for circuit implementation and simulation. It has ISIS which is used for circuit designing with simulation and ARES which is used for PCB designing. Including necessary components with corresponding information from its library it can be simulated after building the circuit. Microcontroller needs to include the hex file for the implementation of whole project. Proteus combines circuit simulation to facilitate co-simulation of complete microcontroller based designs.

The authors have built the circuit to simulate project using Proteus v7.8 which is shown in Fig. 3. The authors are using this software because this is very much user friendly to design and simulate any circuits instead of using other software's.

The equipments used for design and implementation of the following circuit are Microcontroller, OP-Amp, diode, voltage regulator, capacitor, crystal oscillator, transistor, variable resistor, ultrasonic sound sensor, and buzzer.

Figure 3 shows three reflective signals that were produced as follow: from front obstacle sensor, right obstacle sensor, and from left obstacle sensor. All signals are inputs for ADC on a PIC microcontroller. After digitizing these signals are used as inputs to a specific program implemented in real time within PIC microcontroller and according to some internal instructions it will produce an output which will be transferred from the PIC to the buzzer and aware the blind pedestrian about the barriers blocking his way.

3.2 Result Analysis

Result part presents two important cases here. Those are:

- When any obstacle is detected
- When more than one obstacle is detected.

3.2.1 When Any Obstacle Is Detected

When a sensor in the data terminal detects any obstacle, the buzzer automatically turns on. Hearing the loud sound of the buzzer the visually impaired person will be able to decide at which side there is an obstacle.

3.2.2 When More Than One Obstacle Is Detected

When more than one sensor of the data terminal detects obstacle, the buzzer automatically turns on and make different kind of noises. Hearing the difference of the sound of the buzzer the visually impaired person will be able to decide at which sides there are obstacles.

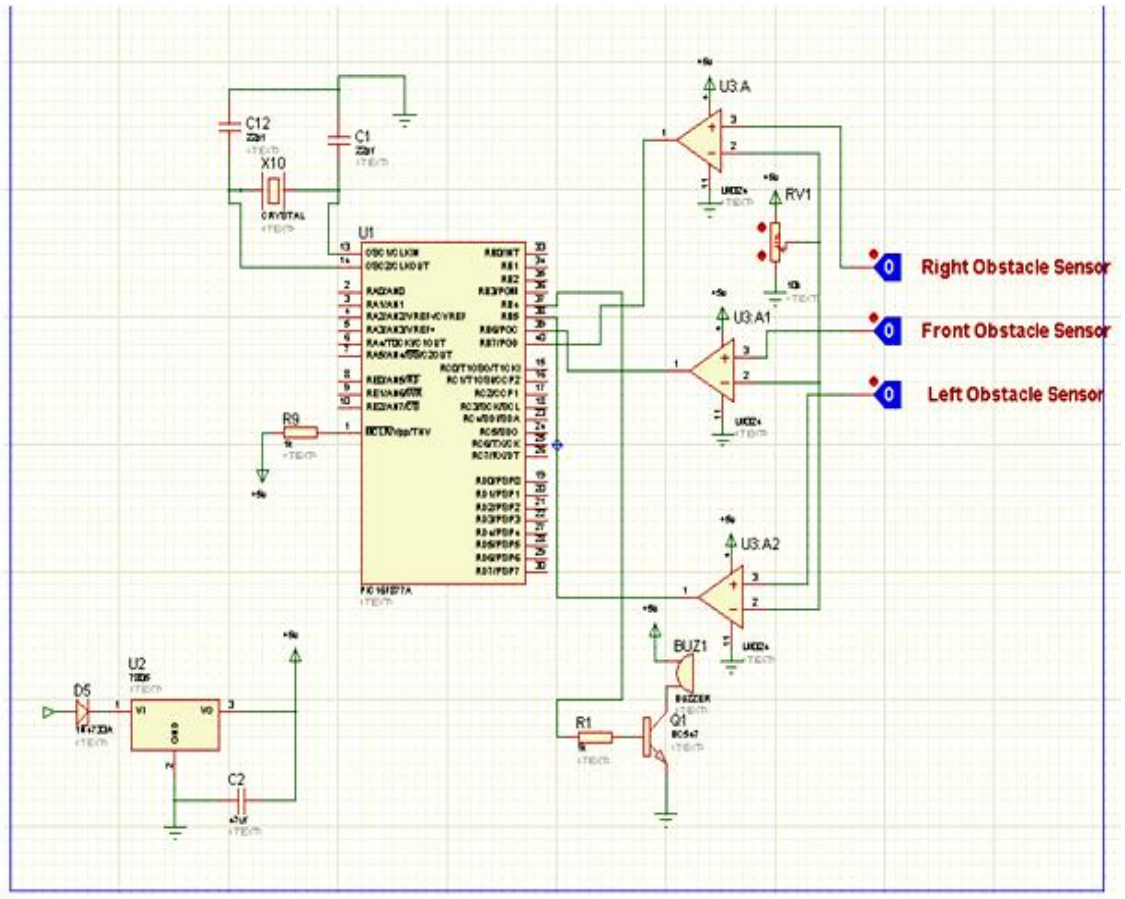
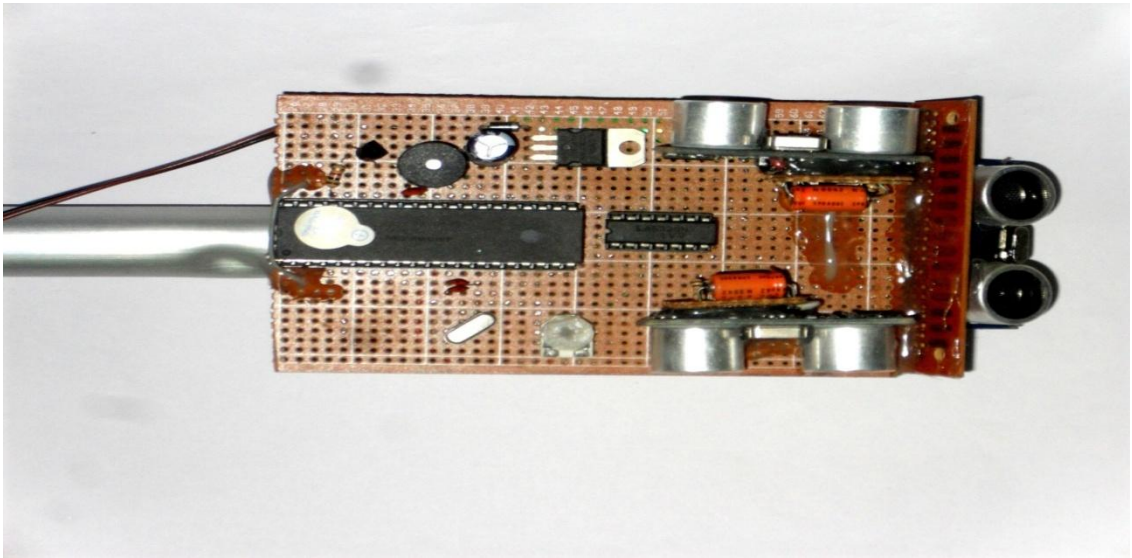


Fig 3: Schematic Diagram of the circuit

IV. HARDWARE DESIGN

The design prototype of the whole project was accomplished after the hardware implementation. Figure 4 shows the hardware implementation of the whole project.



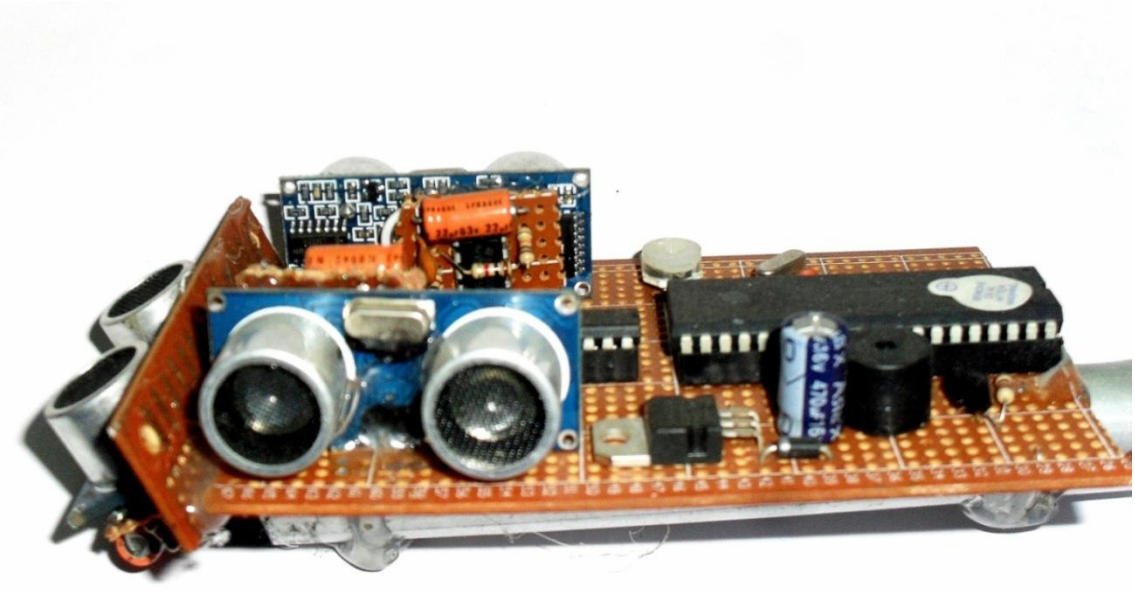


Fig 4: Hardware Implementation

V. CONCLUSION

The main focus of the paper is designing a system to transform visual information to auditory information by the ultrasonic sensors which will be aid for blind pedestrian. The authors expect that the project will be very useful for blind pedestrian where Ultrasonic sensors are used to detect the object or obstacle in path and navigate the blind person by the use of audio instructions.

It is well-estimation from our project that the designed ultrasonic navigation system will ease the road crossing for blind pedestrians with its excellent navigation feature. More powerful sensors can be integrated in the project to provide the detection of obstacles in a wider range.

Appendix:

```
void play_01()
        {
        rb0_bit=0;
        delay_ms(5000);
        rb0_bit=1;
        }
void play_02()
        {
        rb2_bit=0;
        delay_ms(5000);
        rb2_bit=1;
        }
void play_03()
        {
        rb4_bit=0;
        delay_ms(5000);
        rb4_bit=1;
        }
void main() {
ADCON1 = 7;                 // all ADC pins to digital I/O
CMCON    =   7;             // Turn off comparators
INTCON = 0;                 // disable all interrupts
```

```
trisa=0b000111;
porta=0b000000;
trisb=0b00000000;
portb=0b11111111;
while(1)
      {
       if(ra0_bit)
              {
              play_01();
              }
       if(ra1_bit)
              {
              play_02();
              }
       if(ra2_bit)
              {
              play_03();
              }
      };
      };
```

Hexa File

```
:020000006A286C
:0E000600831203132108A00200882000800DC
:1000140083120313061621 30FC007630FD00FD0B1D
:100024001128FC0B1128000006121130FC003A3094
:0E003400FD00FD0B1B28FC0B1B280000080024
:1000420083120313061607 30FB005830FC005930A8
:10005200FD00FD0B2A28FC0B2A28FB0B2A28000096
:1000620000000612113 0FC003A30FD00FD0B37286B
:08007200FC0B37280000080018
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:10008A00FD00FD0B4628FC0B4628FB0B462800000A
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:00000001FF
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