Android Based Blind-Navigation System using Arduino Microcontroller

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Abstract : Today human machine interaction has become more common in our daily life. We can try to make user interaction process friendly in our day today life. There are few technologies which help to design and develop particular system. The primary goal of this innovative project is to permit specially abled persons to explore autonomously in the outside world. Ordinary path navigation systems in the outdoor environment are costly and its manufacturing is time consuming. The developed system is based on Arduino microcontroller and sensing the surrounding environment via ultrasonic sensor. It is economically cost effective and easily implemented. This makes the product easily affordable and it will serve these specially abled people of the society.

***IndexTerms* – Arduino-microcontroller, Android Navigation, Blind Navigation system, wireless.**

I. INTRODUCTION

Nature provides us a lot of things. We perceive this colorful nature through our eyes. We can't imagine life without eyes. But for some people it is reality. Yes we are talking about people who don't have eyes to see. The person with vision can walk on the road very easily but this is not easy task for persons without eyes. In real they are specially abled people.

This project is one step towards making life somewhat easy for those people using technology support. The project uses Ultrasonic technology for the navigation of specially abled people. The device will be mounted on the hand on specially designed gloves. This device will detect the obstacle, stairs and ditches and give signal to the person and he can easily walk on the road.

The device uses ultrasonic module, Bluetooth, vibrator and Arduino kit. The programming for the device is done in the Arduino software IDE.

II. PROPOSED METHODOLOGY

Transmitter is located on the hand. Which transmits the information of real time situation to the Android application which generates different ringtone on the basis of situation and on the basis of condition vibrators are vibrate. On the device three vibrators are placed. The first vibrator is placed at the top which indicates the stair on the floor. The second vibrator is placed at the middle of the hand which indicates, there is object in front of user and the third vibrator is placed at the bottom of the hand which indicates that there is a pothole or manhole occurred.

Arduino microcontroller plays very important role in this system. It sends the real time information to the Android application through Bluetooth module (HC-05). This Bluetooth device is automatically connected to the Android mobile when Blind_Navigation application runs.

The block diagram of system is given below:

Figure 1 Internal Block Diagram of System

III. HARDWARE IMPLEMENTATION OF PROPOSED SYSTEM

3.1 Arduino-Uno Kit (Atmega328PU)

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Atmega328PU microcontroller is used in Arduino Uno Development board. It has 14 digital I/O's (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal is used, a USB connection, a power jack, an ICSP header, and a reset button.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter [1].

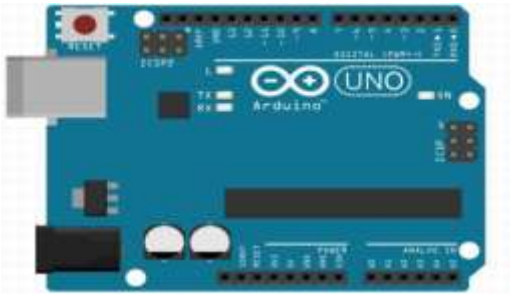

Figure 2 Arduino-Uno Development Board

In this system Arduino-Uno Board plays an important role. It takes all the decision and sends all the required data to the Android mobile application and output device (Vibrators).

3.2 Ultrasonic Module (HC-SR04):

Ultrasonic module HC-SR04 provides 2cm - 400cm non-contact measurement of distance. The accuracy can reach to 3mm. The module includes ultrasonic trans-receiver and control circuit.

The basic principle of working [2]:

(-) Using IO trigger for at least 10us high level signal.

(-) The Module automatically sends 40 kHz signal and detect whether there is a pulse signal back.

(-) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

The formula for finding accurate distance is as follows:

Distance = (high level time × velocity of sound (340M/S) / 2 Eq. 1

Figure 3 Ultrasonic Module (HC-SR04)

In this system there are two Ultrasonic Modules used. It provides the very accurate distance to the Arduino microcontroller. First ultrasonic module detects the front object and sends information to microcontroller. The second module indicates the ditches and stairs in front of the user.

3.3 Vibrator (Model Number 310-101):

Vibrator is an output device. It is operated on 3V DC power supply. The size of 310-101 model vibrator is 10mm in diameter and 3.4mm in length. Its rated speed is 12200 rpm. Typical operating current is 63mA [3].

Figure 4 Vibrators (Model Number 310-101)

In this system three vibrators are used for the sensation to the user. This provides the real world information to the user if they are not using android application. Top vibrator indicates the stair condition, middle vibrator indicates obstacle in front of the user and lower vibrator indicate the ditches on the road [4].

3.4 HC-05 Bluetooth Module:

HC-05 module is an easy to use Bluetooth module, designed for transfer wireless SPP (Serial Port Protocol) serial connection. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation. The working frequency is 2.4GHz radio transceiver and baseband [5].

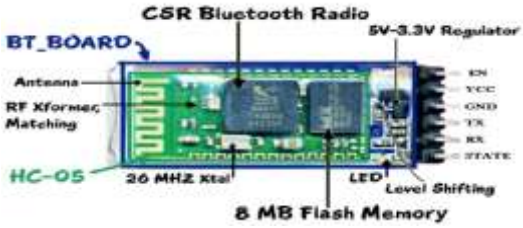

Figure 5 HC-05 Bluetooth Module

Bluetooth module HC-05 is automatically connected to the android application when Blind_Navigation application is run on mobile device. It sends the information to the mobile device and the device will play the different ringtones on mobile. On the basis of stair, front obstacle and ditches condition.

IV. SOFTWARE IMPLEMENTATION OF PROPOSED SYSTEM

4.1Arduino IDE Software

Arduino is an open-source platform based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

Arduino-Uno Application Flow

Step 1: Initialized pins in proper I/O configuration.
Step 2: Wait for Input Switch. If switch is pressed then set the ground level value in Variable.
Step 3: After ground level setting. Check the ground level ±4cm.
Step 4: If value is more than +4 then top Vibrator vibrates and sent this value to Android application.
Step 5: If value is less than -4 then lower Vibrator vibrates and sent this value to Android application.
Step 6: Check front distance. If distance is less than 30cm Middle Vibrator vibrates and sent this value to Android application.
Step 7: Repeat steps from step 4 continuously.

3.2 MIT Application Inventor

MIT App Inventor is visual programming environment that allows everyone to build fully functional apps for smart phones and tablets. Those new to MIT App Inventor can have a simple first app up and running in less than 30 minutes. And what's more, in this blocks-based tool facilitates the creation of complex, high-impact apps in significantly less time than traditional programming environments. The MIT App Inventor project seeks to democratize software development by empowering all people, especially young people, to move from technology consumption to technology creation [6].

Blocks-based coding programs inspire intellectual and creative empowerment. App Inventor consists of the **Designer** and the **Blocks Editor**. These are described in detail below.

Figure 6 Design the App's User Interface

Program the app's behavior by putting blocks together.

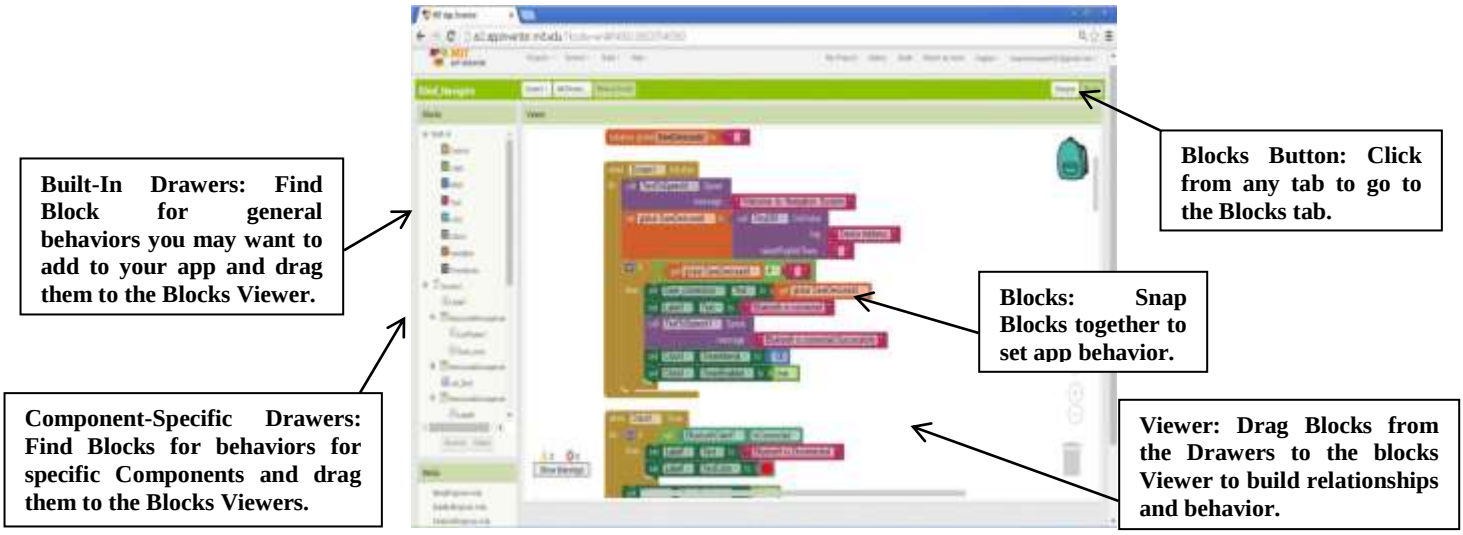

Figure 7 Design the Blocks for User Interface

IV. RESULTS AND DISCUSSION

Table 1 Result on the basis of Real Time Conditions

Sr. No.	Result		
	Condition	***Vibrator***	***Android mobile***
1	Front obstacle	Middle	Beep sound
2	Ditches	Lower	Bubble sound
3	Stair	Upper	Guitar sound

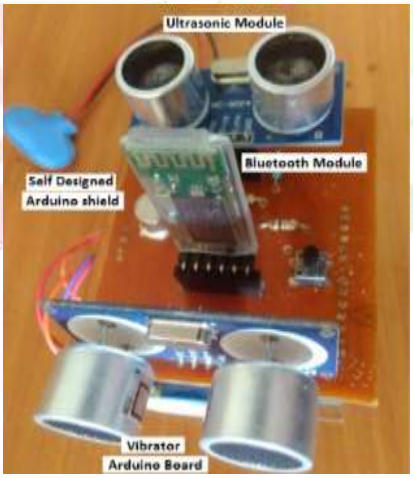

Figure 8 Developed Hardware

Figure 9 Developed Android Application

V. CONCLUSION

The system is designed to bring light which would lighten the darkness in the lives of the blind.

VI. ACKNOWLEDGMENT

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