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Research paper

A Novel Approach on Communication between Blind, Deaf and Dumb People using flex Sensors and Bluetooth

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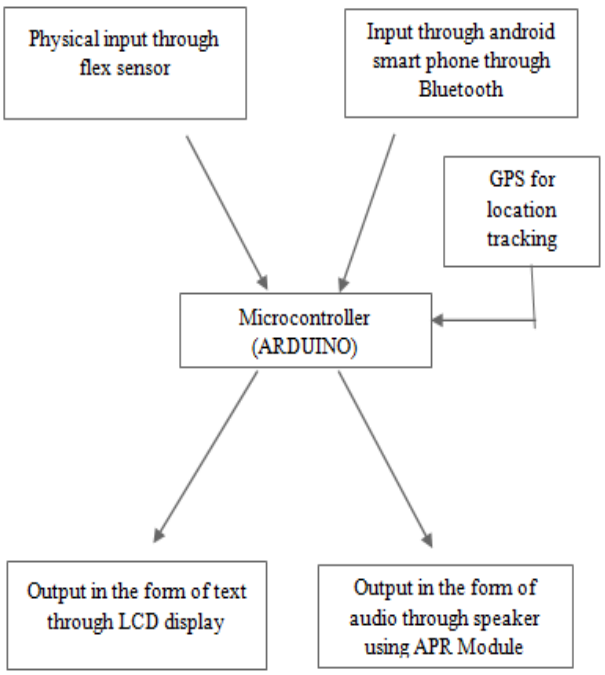
Abstract

The recent development in many technologies have been playing a major role in satisfying people's lives for their daily need. But still few people are suffering due to some problems. They are blind, deaf and dumb people who are unable to communicate properly with others or among themselves. And we know that there are millions of people who are blind, deaf and dumb in this world. And we know that they use sign language to communicate but only few people can be able to understand. So this project introduces a system that can be used to improve the communication among blind, deaf and dumb people. This project introduces an idea that communication can be done using flex sensors and Bluetooth using ARDUINO boards. Flex sensors are fixed with the gloves such that it can be bent along with the movement of fingers and then it is connected to ARDUINO. Then LCD and Audio Playback Recorder module is connected to ARDUINO and then coding is done such that if flex sensor is bent, a specified message is displayed on LCD and can be played in speaker through APR module. Here coding is done using a software ARDUINO IDE. We can also send text message through android smart phone which will be displayed on LCD, this can be done by connecting Bluetooth module to ARDUINO and message can be sent through an app by connecting to Bluetooth. We are also using GPS module to track the present location which will be displayed on LCD in terms of latitude and longitudinal degrees.

Keywords: *Flex Sensor, ARDUINO, Bluetooth, LCD, Communication*

1. Introduction

In this project, the input is given via Flex sensor and Bluetooth and the output is received through LCD and speaker. Here Flex sensors, GPS module, Bluetooth, Audio Playback Recorder and LCD are interfaced with ARDUINO. Flex sensor is a variable resistor in which the resistance increases when it is bent and hence it is also named as Bend sensor. ARDUINO plays a major role in this project and we use ARDUINO Mega 2560 which is a microcontroller with 54 digital input/output pins, 16 analog pins, 4 hardware serial ports and a crystal oscillator. ARDUINO Mega can be programmed using software ARDUINO IDE. Bluetooth module HC-05 connected to ARDUINO Mega is used to link the connection between Android smart phone and ARDUINO and hence we can able to send text through android smart phone through Bluetooth and the text will be displayed on LCD. Here LCD we use is 16x2 in which 16 characters can be displayed in each row. LCD will be interfaced with ARDUINO Mega and it acts as an output where text will be displayed. And the other source of output is speaker, which will be connected with Audio Playback Recorder. There are many Audio Playback Module and in this project we use 8 channel voice playback recorder in which 8 audios can be recorded and played through the speaker. GPS module is used in this project to detect the location and it is fixed with an antenna which is used to track the location and the location can be displayed in LCD in terms of latitudinal and longitudinal degrees.



Input and Output sources of the system

2. Related Works

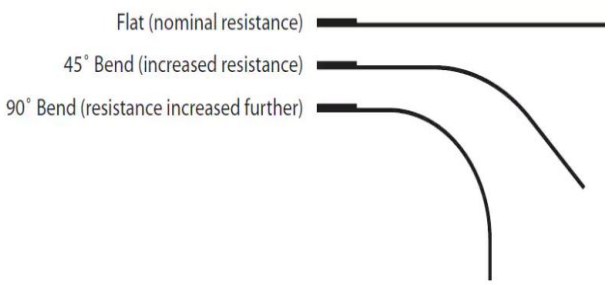
1. We know that there are many challenges in life which is faced by people, one of them is communication between deaf and blind. The challenge here involves three cases: (i) People who are not able to hear, usually does not speak in order a blind person to hear them; (ii) Deaf person cannot hear, whomever speaks with them; (iii) When a deaf person makes sign language, a blind person cannot see them. [1]Thus, Nikolaos Bourbakis Tyflos- Koufos presented a study on multi interfaces, issues and problems for establishing communication and interaction between blind and deaf persons. [1]A system-prototype is proposed in an effort for providing solutions to the challenges and cases mentioned.
2. NetchanokTanyawiwat and SurapaThiemjaru introduced a new design of glove designed to recognize the American sign language fingerprint gestures using five goggle sensors and a 3D accelerometer on the back of the hand. [2]To save the number of channels and setup area, each flex and pair of contact transmitters are combined into one input channel in the BSN node. The signal is then analyzed and redrawn by flex resources and the software contact. The glove design has become thinner and more flexible, using electrical contacts and yarn from fabric and conductive yarns. [2]ASL finger spelling gesture experiments were performed using signals collected from six people with speech deficit and normal topic validation. [2]The results have shown a significant increase in classification accuracy with the new sensor glove design.
3. M. Mohandes, S. A-Buraiky, T. Halawani and S. Al-Baiyat have shown that the sign language system's interfaces can be categorized as direct or visual devices. The direct device approach uses measuring equipment that is in direct contact with the hand, such as instrument gloves, flexible sensors, tracking devices for style and position. On the other hand, the vision-based approach reflects the movement of the hand using a camera that can sometimes help, because the user wears gloves that are painted, pointing with fingers or with hands. Their biggest drawback is that they need a lot of calculations to get their hands before analyzing the images. And in this paper, we will be discussing based on the directed-device methods.

3. Approach and Theory

In this paper, we are making an electronic system which will be helpful in improving the communication between Blind, Deaf and Dumb people. Mainly we are using Flex sensors, LCD, Audio playback recorder, ARDUINO Mega, Bluetooth Module and GPS module. Now the gloves is designed such that flex sensors are fixed in it, so that the flex sensor bends when finger is moved. Then sensors are connected to power supply and ground pins which will be present in ARDUINO Mega. Then 16x2 LCD display and Audio Playback Recorder (APR module) are connected to data pins in ARDUINO Mega 2560. Here Bluetooth module and GPS module are also connected in serial pins of ARDUINO Mega 2560. Now coding is done using a software ARDUINO IDE and it is compiled and uploaded in ARDUINO Mega 2560 such that if flex sensors are bent, a particular message will be displayed on LCD in the form of text and on speaker in the form of audio. Here Bluetooth module is used to connect android and ARDUINO through Bluetooth which will be used to send messages and it can be displayed on LCD. In this project GPS module is used to detect the present location in terms of latitudinal and longitudinal degrees which can be displayed on LCD by pressing the button that is connected to the GPS module. Here the location is tracked using GPS antenna which will be connected with GPS module.

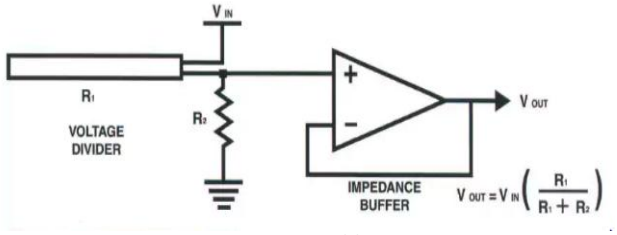
Working of Flex Sensor

Flex sensor is a variable resistor in which the resistance increases when it is bent. Hence we can say that the resistance is directly proportional to the amount of bent in the sensor and so it has another name Bend sensor. The amount of bending can be determined by the angle of bending or deflection of the flex sensor. The value of the resistance of the flex sensor will be 25k ohms when it is not bent. When the angle of deflection or bending of flex sensor is 45 degrees, then the resistance will increased to 45k ohms. The maximum bending resistance of the flex sensors will be 125k ohms. So we can say that for a flex sensor the range of bending resistance will be from 45k ohms to 125k ohms.



[8]Bending characteristics of Flex sensor

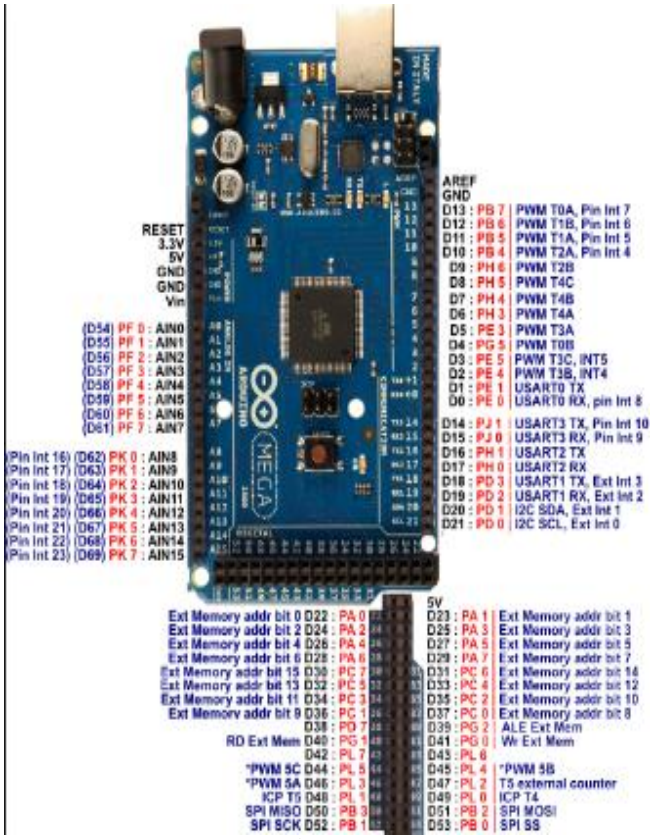
Flex sensor produces analog values as the output. Hence to make microcontroller sense the output of flex sensor, we are using voltage divider concept by connecting a resistor in between flex sensor and 5 volt supply in the microcontroller (ARDUINO Mega). The circuit diagram of flex sensor is shown below



[8]Circuit diagram of flex sensor

Arduino Mega

The microcontroller used in this project is ARDUINO MEGA. It consist of 54 digital input/output pins, 16 analog inputs, 4 UARTs, a crystal oscillator, USB connection, a ICSB header, power jack and a reset button. And we also use 15 Pulse Width Modulation (PWM) outputs from those 54 digital input/output pins present. And this ARDUINO Mega can be programmed using the software ARDUINO IDE. ARDUINO Mega can be powered through external power supply or USB connection. The range of external power supply is recommended to be 7 volts to 12 volts because if the power supply is less than 7 volts, then 5V pin may supply less than 5 volts which may lead the board unstable and if the power supply exceeds 12 volts, then the voltage regulator overheat and damage the board. The processor used in ARDUINO Mega is AT Mega 2560. AT Mega 2560 has a flash memory of 256kb for storing code, SRAM of 8kb, EEPROM of 4kb. And in 256kb of flash memory, 8kb is used for the purpose of bootloader. And the pin diagram of ARDUINO MEGA 2560 is given below

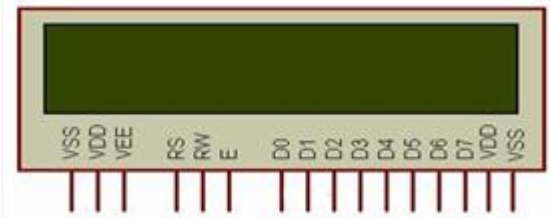


[7] Pin diagram of ARDUINO Mega 2560

AT Mega is also provided with a support of full suite programming and system development tools like C compilers, macro assemblers, evaluation kits, program simulators and in-circuit emulators.

Interfacing of LCD with Arduino

In this project, we use 16x2 display LCD in which it can display 16 characters in a single line. The characters will be displayed in 5x7 pixel matrix. LCD 16x2 display consist of 16 pins shown below



Here the data pins are connected with PWM pins so that the output will be displayed on the screen. Register Select consist of two registers, they are data register and command register. Data register is used to determine the data that is to be displayed. Command register is responsible for the commands given to LCD like clear the screen, etc. Read or Write pin is responsible for reading and writing the values of the LCD display. VDD and VSS pins are used for power supply and ground purposes.

PWM pins in the ARDUINO Mega are responsible for the brightness on the LCD display. PWM input pins are connected with the data pins of LCD display. PWM pins convert digital to analog which will be displayed in the LCD.

And then 5v pin and ground pin are connected to LCD for power supply.

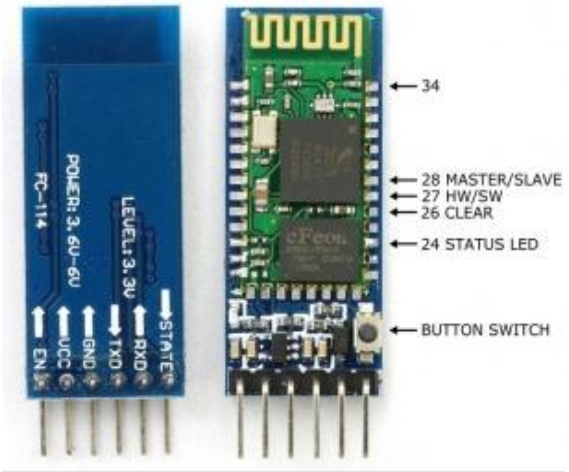
Interfacing of APR Module with Arduiuno

There are many types of Audio Playback Recorder. In this project we use 8 channel audio playback recorder in which we can able to record and play 8 types of audios through the speaker. And here we can able to record 11 minutes of audio. It consists of a MIC, apr33a3 IC, 8 switches and record/play. Now 8 pins are connected to the input pins of ARDUINO mega 2560. Then coding will be done that satisfies the condition if flex sensors are bent, particular audio will be played through the speaker.

8 channel audio playback recorder

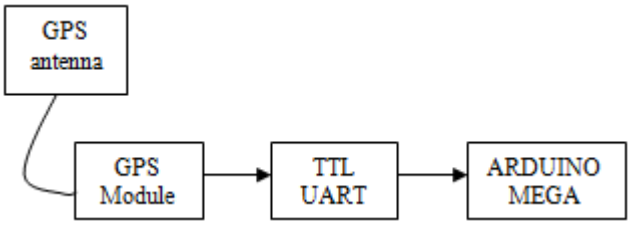
Interfacing of Bluetooth and GPS with Arduino

In this project, we also introduce the idea of process of communication through Bluetooth. Here we are using Bluetooth module HC-05.Bluetooth module is connected to ARDUINO and it is connected to android mobile using app named ARDUINO Bluetooth and AMR voice app where we can be able send comments by typing or through voice recognition. Now coding will be done such that if command is sent through the android using Bluetooth, then it should be displayed in the form of text on LCD.



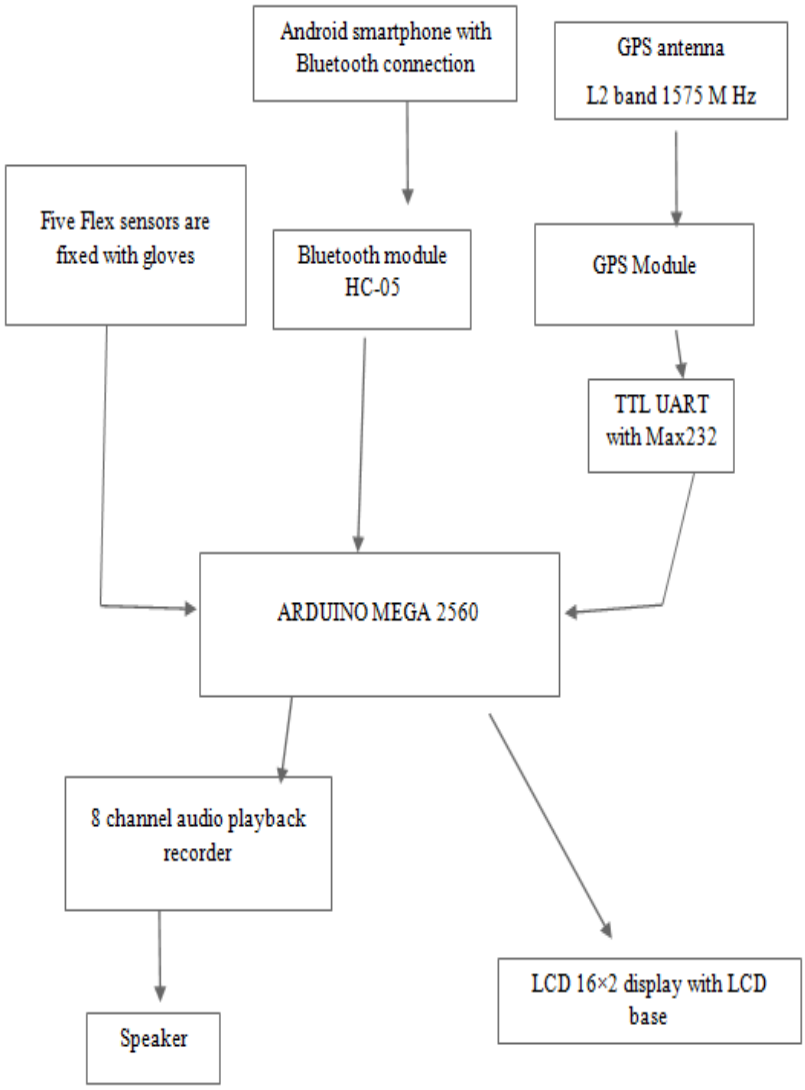
[9]Bluetooth module HC-05

In this project, GPS antenna connected with the GPS module is used to track the location. GPS module detects the location in term of latitude and longitude degrees. Here GPS module may sent a garbage value, so to remove that garbage values, we use TTL UART which will receive the location and transmit it to ARDUINO and then the location will be displayed on LCD in terms of latitude and longitude degrees. Hence TTL-UART will be connected with GPS. Button is also connected with GPS module such that if the button is pressed, the location will be displayed on LCD. TTL UART consists of transmitter and receiver ports. Here we connect GPS module to the receiver pin of TTL UART and the transmitter pin will be connected with hardware serial ports of ARDUINO Mega 2560 such that the TTL UART receives the garbage value of the location from GPS module and it transmits the filtered value of the location, to ARDUINO Mega 2560. The IC used in the TTL UART is Max232.



Interfacing GPS with ARDUINO Mega

4. System Architecture

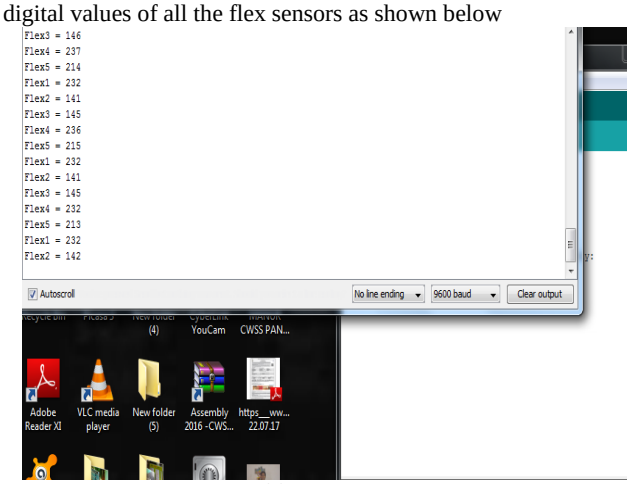


Block diagram of the system model

This paper also explains the system architecture of the project with the block diagram given above. In this project, we use five flex sensors in which it will be fixed with glove. We can say that the glove is designed with flex sensors such that if fingers bent, the flex sensors are also bent. And then it is connected to power supply, ground and analog input pins of ARDUINO Mega. Bluetooth module HC-05 is connected with ARDUINO Mega through transmitter and receiver pins of the module and Bluetooth module is also connected with power supply of ARDUINO Mega. GPS module is fixed with GPS antenna which is used to track the location through the satellite. GPS antenna tracks the location and receives as a electromagnetic signal, then it transmits to GPS module as a electrical signal suitable for the purposes. GPS module is given with the external power supply. The drawback of GPS module is that it transmits some garbage values, so to avoid that we use TTL UART module which will filter the garbage values. Now GPS module is connected with TTL UART module and then the TTL UART module is connected with ARDUINO Mega through hardware serial ports. Now we use LCD 16x2 display which will be fixed with its base. The data pins of LCD will be connected with PWM pins of ARDUINO Mega, and it is also connected with the power supply. And then we use 8 channel voice playback recorder which will be connected with a speaker. This voice playback recorder consists of 8 data pins which will connected with the input data pins of ARDUINO Mega 2560. Now the programming will be done for ARDUINO Mega 2560 through ARDUINO IDE software which will be compiled and loaded in it.

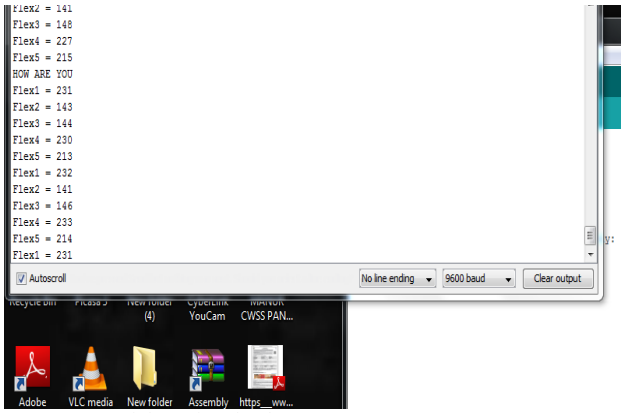
5. Experimental Results

We use five flex sensors which will be fixed with the gloves such that if the fingers are moved, then the flex sensors will be bent. Here flex sensors are connected with resistor to 5v power supply. Now programming is done using the software ARDUINO IDE such that if the flex sensors are bent, a specified message will be displayed on LCD in the form of text and on speaker in the form of audio. The digital values of the each flex sensors will be displayed on the serial monitor of the software ARDUINO IDE. The output will also be displayed on the serial monitor if the flex sensors are bent. The output is determined by using conditional statement in the programming of the ARDUINO Mega using the software ARDUINO IDE. After programming and compiling, we can upload the code in ARDUINO Mega. Now if we open serial monitor on the software ARDUINO IDE, we can able to see the digital values of all the flex sensors as shown below



Analog values of flex sensors in serial monitor

For example, if we bent a flex sensor for which the text "HOW ARE YOU" is assigned, then the output will be displayed on the LCD and also in serial monitor as shown below

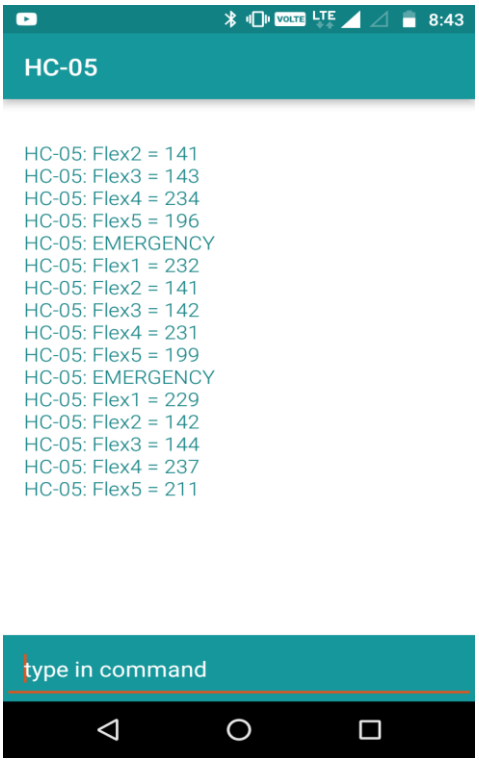


Serial monitor for the output "HOW ARE YOU"

Output displayed in LCD

And also in this project we use 8 channel voice playback recorder for the purpose of audio output which will be received through the speaker that is connected with the recorder. In this module we can able to record 8 audios that can be recorded and played. Now ARDUINO data pins are connected with the pins of the recorder module. Now the ARDUINO is programmed such that if the flex sensor is bent, the particular audio will be played through the speaker.

Bluetooth module is also connected with ARDUINO Mega through transmit pins, receiver pins and power supply. Android phone is connected through Bluetooth so that the message can be sent and it will be displayed on LCD. The messages are sent through app that is linked with ARDUINO. The analog values that will be displayed on the serial monitor of the software is also displayed on the android smart phone that is connected with Bluetooth module HC-05 through an app named ARDUINO Bluetooth as shown below



ARDUINO Bluetooth application

The application that are used to send messages through Android smart phones, are ARDUINO Bluetooth and AMR Voice. In ARDUINO Bluetooth application we can send text messages by using keyboard. AMR voice app is used to recognize the command through voice.

6. Conclusion

This paper explains the working of the project that is used to make the communication among the blind, deaf and dumb people who are unable to communicate properly. We know that the blind people cannot communicate properly with the people who cannot able to hear and talk, the people who cannot able to talk and hear will also undergo the same problem. But when they use this electronic system, they can able to communicate easily through bending of fingers with glove or through android smart phone by connecting it to a Bluetooth. So we can say that this system is proved to be an major device that can help people who are unable to connect. This system is portable and hence user can take it and go everywhere. This system also has an additional function that user can track their location through GPS module present in it. This system still can be improved by adding more flex sensors so that lot messages can be transmitted for communication purposes. This system is only satisfies the people who are unable to communicate properly with others.

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