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Development of Sign to Speech Converter for Physically Challenged People

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ABSTRACT: Access to the communication is the fundamental human rights, and every single person deserve to be the part of the human global community. However, those who are deaf, and mute communicate differently than everyone else. They mainly language use sign in while the rest of the world communicates verbally. This puts the deaf-mute community at a disadvantage, because like a foreigner in another country, they can't communicate like everybody else. Many modern-day researches focus on addressing the issues of one of the above challenges but not all. This work focuses on finding a unique technique that aids the dump with what is represented as sign language to audio signals and it is achieved by the technique of using flex sensors. This project provides a way for the people with speech impairment communicate in audio form by sign to speech conversion technique. Vocally impaired people can convey their message by so the other persons can hear the message in a speaker. For this purpose, it has used the Arduino and Raspberry Pi as its main components for the conversion of flex values to digital and to bring them out as Audio.

KEYWORDS: Flex Sensor, Arduino Uno, Raspberry Pi, microcontroller.

I.INTRODUCTION

Approximately 285 one thousand people are judged to be visually impaired worldwide in which 39 million are blind and 246 are said have low vision. Approximately 90% of this world's visually impaired Is from the dispirited income people and 82% of people living with blindness aging persons and above. The numbers of people visually impaired from eye related diseases have been brought down in the past 20 years according to global estimated work. In which 80% of all visual restitution can be prevented or cured. India is considered to be the home for the world's largest act of blind people. In this world, about 37 million are blind, in which 15 million are from India. There are so many researches have been getting along in this universe, but the visual impairment could not be broken for good. In lodge to facilitate these people we have developed the assistive device for blind people who does not want the assistance of other neighbors. The development our project helps the multitude to experience loose and go independently.

In all around the world about 9.1 billion people are deaf and mute. In their daily life they face plenty of problems on their communication. Sign language is a linguistic process which is employed for communication among the normal people and handicapped people. Sign language relies on sign patterns such as body language of the person and movements of the arm to facilitate the discernment between the great unwashed.

The deaf and vocally impaired people don't simply have to learn the customized sign language, but the core issue is that they can communicate with the usual sort of multitude in the society. It is similarly not possible for all the masses to learn the sign language to understand whatever is said through gestures. Therefore, the communication gaps still exist between the deaf and dumb people. Dumber people can simply tilt the message by sign language which could not be understandable by other people.



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II. LITERATURE REVIEW

Literature review on a thesis means a record or current knowledge gained through substantive findings and through gaining knowledge from methodologies and theoretical contributions on a particular topic. Literature reviews are secondary sources that they never include anything new or about the ongoing projects. The researchers use it as the base on every academic field. It's just like a repository that every researcher spend time on the journals, magazines, newspapers, books and previous development related to their research

Anbarasi Rajamohan, Hemavathy R., Dhanalakshmi[1], M Proposes an idea of communications between deaf-mute and a normal person through the glove by text to speech conversion (TTS) block which translates the matched gestures i.e. text to voice output.

Nikolaos Bourbakis, Anna Esposito, D. Kabraki[2], proposes an idea for communication and interaction between blind and deaf persons using system-prototype Tyflos-Koufos, an effort for offering solutions to these challenges.

Netchanok Tanyawiwat and SurapaThiemjarus[3], proposes an idea with five contact sensors installed on the glove, in addition to five flex sensors on the fingers and a 3D accelerometer on the back of the hand, combined into the same input channel on the BSN node in order to save the number of channels. For validation, ASL finger spelling gesture recognition experiments have been performed on signals collected from six speech-impaired subjects and a normal subject.

Komal Vede, PriyankaVanjare, PradnyaGaikwad[4], proposed an idea designing a simple embedded system-based device for solving this problem.

III. EXISTING SYSTEM

In the existing system since only Arduino is used with no flex sensors instead, they have used the resistor arrays, it is not easily portable because of the complication of wires and placements in a glove. They also had to use voltage regulator to regulate the input voltage of the Arduino Board. For this same purpose, they also had to use filters and rectifiers for a continuous and efficient supply to the Arduino Board. The main limitation in here was the portability.

Transformers

Transformer is a static electrical device that transfers electrical energy between two or more circuits.

Transformers are used for increasing or decreasing the alternating voltages in electric power applications, and for coupling the stages of signal processing circuits.

In olden methods power bank was sufficient enough to run the whole component. They needed more power to run the system in order to work properly.

A transformer is a passive electrical device that transfers electrical energy from one electrical circuit to one or more circuits. A varying current in any one coil of the transformer produces a varying magnetic flux, which, in turn, induces a varying electromotive force across any other coils wound around the same core.

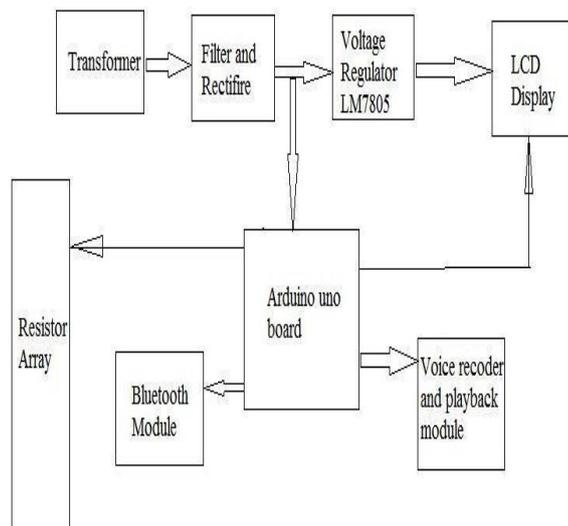


Fig 1 Block Diagram of the existing system

Voltage Regulator

A voltage regulator is a system designed to automatically maintain a constant voltage level. Voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components

Resistor Array

resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

Bluetooth Module

The Bluetooth module here is used to transfer the data to other components if required. Since Arduino UNO board doesn't have an in-built Bluetooth Module with it, the external Bluetooth Module is used. This makes the system a little more complicated and hard to port it anywhere.

IV. PROPOSED SYSTEM

This project contains two main parts input devices (Arduino, Flex Sensor), processing unit (Raspberry pi 3 B+) and output devices (raspberry pi 3 B+). The Arduino which helps to make it input and output devices as one system. In this proposed system, dump people enter the into the flex sensor by sign and fed to the raspberry pi via Arduino. Raspberry pi receives values and convert it into the speech using generic algorithm and this audio output is played in speaker.

Here the main limitation of the existing system, the portability has been overcome by using an Arduino along with the Raspberry Pi. The power supply can also be given with the help of power banks, which are available in vast in various sizes and capacity. Also a few tweaks can help control the Raspberry Pi from the mobile as the monitor screen.

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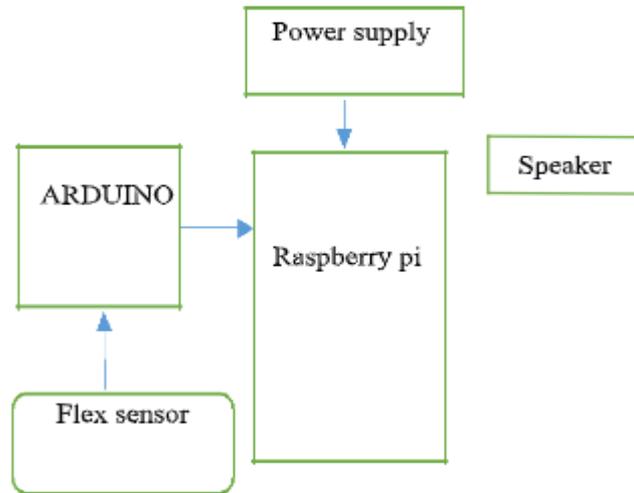


Fig 2 Block Diagram of the Proposed System

Power Supply is given to the Raspberry Pi and it is shared with the Arduino using the pins. The Flex sensor is connected to the Arduino and the Arduino UNO is wired with the Raspberry Pi 3. Now the flex sensors are moved which is connected to the Arduino converts the Analog values to digital values and it sent to the Raspberry. There we have written a program which receives those values and assumes those as inputs and produce the corresponding output in Audio form which is heard through the Speaker connected to the Raspberry Pi 3.

The circuit diagram of the proposed system is shown in the figure 3

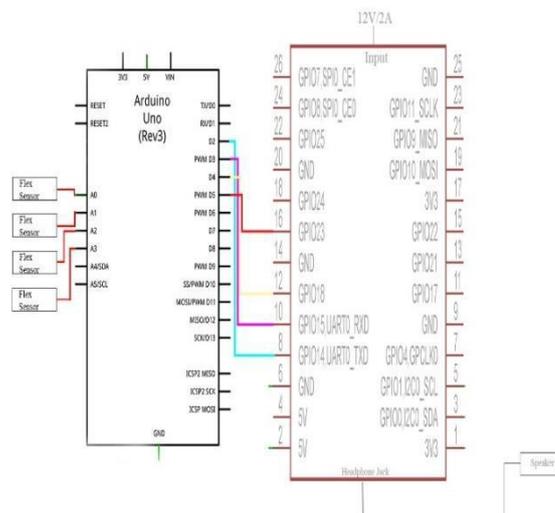


Fig 3 Circuit Diagram

The output of the Raspberry Pi program is given, which is obtained on the movement of flex sensors connected to the Arduino.



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Fig 4 Output from the Raspberry Pi 3

In the output diagram shown in figure 4, the output is not exactly what is heard in Audio, but it's the flex which is moved, in here the flex sensors are named as First Word, Second Word, and Third Word and so on. Now as the Third Flex is moved so it is indicated as Third Word. This is so done to make sure all the flex is working and hence reduces the hassle of finding the error if it's on the program like it has been corrupted or the flex sensor has been damaged.

V. HARDWARE DETAILS

Flex Sensor

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Four flex sensors are used in this project. This is so used for attaining different voltage values, which is used to get the desired output and combining them to get other output values. The flex sensors are placed in the fingers so that when it bends an output is obtained.

General Description

Spectra Symbol's flex sensor is a 4.5" bendable substrate that gives higher resistance readings as it flexes to a tighter radius. This 10 KΩ sensor has low power requirements for its output feedback. The resistance can increase up to 5-times the base or flat state reading. Users can calculate the degree of flexure or the bend radius using resistance.

When the substrate is bent, the sensor produces a resistance output correlated to the bend radius the smaller the radius, the higher the resistance value. It can be interfaced with the microcontroller unit. The output from the sensor is analog.

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Fig 5 Flex Sensors with different materials

With a typical flex sensor, a flex of 0 degrees will give 10K resistance will a flex of 90 will give 30-40 K ohms. The Bend Sensor lists resistance of 30-250 K ohms.

An unflexed sensor has a resistance of about 10,000 ohms. As the flex sensor is bent, the resistance increases to 30-40 Kilo ohms at 90 degrees. The sensor measures 1/4-inch-wide, 4-1/2 inches long and 0.19 inches thick.

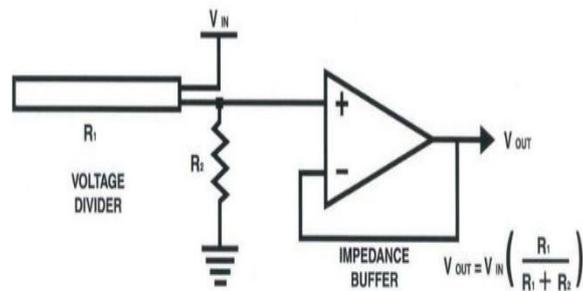


Fig 6 Basic Flex Sensor Circuit





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Fig 7 Different Gestures in Flex Sensor

Raspberry Pi 3

The Raspberry Pi is a series of small single-board computer. This is used for the main conversion program. The converted analog values to digital values are sent to the Raspberry Pi from Arduino where it converts it to a voice and text output. The program written in the Raspberry Pi does the job of converting the digital values to voice output and text output. An alternate like Arduino can also be used here for cheap and convenient work, but Raspberry pi does more than Arduino when an Accelerometer (ADXL335) is used. Using of an ADXL335 can bring the exact Indian sign language into audio output.

Speakers

Speakers are an electroacoustic transducer, which converts an electrical audio signal into a corresponding sound. Here the speakers are used for the output from the Raspberry Pi. Other than the display output, the voice output is easier than the other person doesn't require to look at the monitor when the victim speaks.

Arduino

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects. Here the flex sensors are connected to the Arduino where the analog values from the flex sensor is converted to Digital values before being sent to the Raspberry Pi 3.

VI. SOFTWARE DETAILS

The Raspberry Pi primarily uses Linux kernel-based operating systems. The ARM11 is based on version 6 of the ARM which is no longer supported by several popular versions of Linux, including Ubuntu. The install manager for Raspberry Pi is NOOBS.

The program is already written and saved in the SD Card inside the Raspberry Pi 3. So before starting the machine to work properly the program has to be run in the terminal or any other third party applications which can run a python 3 program in a Raspberry Pi 3, since the program for the conversion is written in Python 3.

This will require a monitor every time before starting. This hassle can be reduced by using the smartphones and connecting it with the Raspberry Pi 3 using the Bluetooth and so the smartphone screen now acts as a Monitor to the Raspberry Pi3.

This now can help us make any change to the program with the use of the laptop or desktop.

Arduino Programming Language (APL)

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.



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The software used by the Arduino is Arduino IDE. The Arduino IDE is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring project. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is

Also capable of compiling and uploading programs to the board with a single click.

VII. CONCLUSION

This paper is using the latest and trending wearable technology which makes it possible to carry the device easily anywhere and everywhere by the disabled person which makes this device portable. Moreover, we have not come across any such technology so far that can help to all the people who are suffering from any combination of disabilities of Deafness and Dumbness. Thus, this project has followed a general approach due to which it is possible to productize a single gadget which can solve the problems of all the people with different type of disabilities. This methodology used for differently able person only. At long time cannot use communication, but we are giving the new way by which it is possible for these people to communicate over long distances with many future scopes also.

This paper bends in ways of the user because of the easy to edit mode in the code. This can also be made remote process by altering some equipment's along with the code.

Advantages

- It is compact and portable
- It uses less power, which can be powered by a normal 2Amps power bank

Applications

- It can be used by dumb people as a mode of communication
- It can be used in machines with other sensors to indicate something

Future Scope

- It can be further more reduced to be make it more compact and can be initialized with the help of the monitor.

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