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A framework for communication between visually impaired, hearing impaired and speech impaired using arduino

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Abstract. A long time ago our society accepted the notion of treating people with disabilities not as unviable and disabled but as differently-abled, recognizing their skills beyond their disabilities. The next step has to be taken by our scientific community, that is, to normalize lives of the people with disabilities and make it so as if they are no different to us. The primary step in this direction would be to normalize communication between people. People with an impaired speech or impaired vision or impaired hearing face difficulties while having a casual conversation with others. Any form of communication feels so strenuous that the impaired end up communicating just the important information and avoid a casual conversation. To normalize conversation between the impaired we need a simple and compact device which facilitates the conversation by providing the information in the desired form.

1. Introduction

Communication, being the very basis of human co-existence, is difficult for the people who are blind, deaf or mute. According to the statistics given by the World Health Organization, about 285 million people in the world are blind, 300 million are deaf, 1 million are mute and many more suffering from one or more of the above mentioned physical disabilities. There are a few means of communication like the Braille Language for communication with the blind and the Sign Language for communication with the mute and the deaf. There also exist certain technological solutions achieved by the scientific community to normalize communication between people with disabilities such as the Data Entry Glove, and the Multi-modal interfaces. This paper concentrates on the above-mentioned facts and strives to develop a model solution which can help differently-abled people to communicate easily. The model we propose uses Arduino to make transfer of message between differently abled people possible for both face to face conversation and long-distance conversation. We use Arduino Uno as the central controller, flex sensors for sign language, speaker and mike for audio and voice, LCD for text and GSM for text and long-distance communication [1].

2. Related Works

This research investigates a new way that can be productize so that a new gadget can be developed that can bridge the gap in communication among differently abled people who suffer from any of the possible combinations of disabilities of blindness, deafness and dumbness. For this we are looking some sort of technology that can satisfy our purpose. Some of the present technologies in concern with our idea are:



2.1 Data Entry Glove

The data Entry glove was invented by Mr. Gary Grimes from Bell Telephone laboratories in 1983, and it exponentially raised its popularity. The very first data entry glove was originally designed as an alternative to the keyboard, and made it possible to generate 96 printable ASCII characters from 80 different figure positions. The glove was made out of cloth and had flex sensors along the figure, tactile sensors on the figure tips. The distribution of sensors was specified with the aim of recognizing the single hand manual alphabet for the American Deaf. With each degree of movement of finger or any measure of angle by gloves sensor, the resultant was reported as a particular sign. These signs could be understood by attached device and converted to the corresponding letter. This lead to formation of all together a new way of communication.



Fig. 1. Data Entry Glove

2.2 Multi-modal Interface

This project was proposed in order to achieve the need to convert different modalities into common medium shared and understandable by deaf and dumb individuals. This project gave a prototype that considered of cameras attached to dark glasses along with the speaker and microphone [3].



Fig. 2. Multi Modal Interface

2.3 Limitations of existing Method

The limitations of existing technology were the high sensitivity of model. Generally, the data entry gloves are unable to provide us with exactly desirable output. The main reason behind this is that a one degree change and to degree change result in different values. The chances of making standard errors are quite high. On the other hand to overcome these drawbacks, one need to buy costly equipment. The precision-cost issue leads to systematic risk of the model.

2.4 Proposed model

The method is proposed by taking care of all the possibilities and combinations of the three disabilities namely Blindness, Deafness and Dumbness from which a person can suffer. Moreover, it also considers distance as a major barrier in communication for which it uses a technique that will remove the barrier of distance between communications of such people [4],[5]. The working of the model for transmission of a message from one disabled person to another is described in the following steps:

2.5 Wearable technology

The model we are using is a type of wearable technology and thus it is wearable on the wrist of the user. First, a person's mobile phone is connected via the Bluetooth module to the Arduino device. The android application developed helps in searching Bluetooth device in the nearby vicinity. Once searched, the device is paired to the Arduino through Bluetooth modular. Through this modular and Arduino connection, the message can be delivered from one device to other free of cost. The device is set so that it can take input and give output as per the requirements of the user. The message to be sent by the user is taken as an input to the gadget. The input can be text or audio. The gadget has a Microphone to take the audio input and Sensor Glove for text input.

2.6 Audio to text convertor

If the message to be delivered by the sender is in the form that is acceptable and understandable by the receiver and the communication is a direct type of communication, then the message is transferred directly to the receiver via Bluetooth. For long distance communication, the input message is converted into audio message independent of the initial form and then it is transmitted through Wireless GSM Network to the receiver. For long distance communication, the sender must have the phone number of the receiver.

Now, our framework also entails text to speech conversion through Arduino. The text input received from Bluetooth or GSM will be converted into audio (.wav) format and played on the speaker attached to Arduino. Also, vice versa, the audio input received from a microphone would be converted to text and converted to text which would be in turn displayed on the LCD screen. Speech Conversion* can also be utilized for conversion from one form to the other.

2.7 Sign language

In case of sign language, the flex sensors help in recognizing the angle measurement among different group of sensors placed on hand to know the desired input. Then this input is converted to braille language and this input can be read through braille convertor. The sign language is finally converted to normal text format and then through previously described text to audio convertor, the language can be converted to the audio. This audio can be given as output through the speakers which are connected to the analog pin of the Arduino system. The text displaying LCD is connected to the digital pin of the Arduino system as the text is generated in quantized form [2].

3 ARDUINO UNO

This project entails the usage of one of the latest hardware systems available, Arduino. The Arduino board chosen for developing this framework is Arduino Uno. It consists of a microprocessor along with a internal memory which is used to store the code and run independent of the IDE. Along with the Arduino based setup we have also developed an Android app which would allow our developed framework to connect and communicate with any device that runs the Android OS and has our app installed, be it a smart watch or a smart phone. Our Android to Arduino communication is done using a blue tooth module. We also have used a GSM module for long distance communication. To display the messages received via blue tooth or via GSM we have used a 16x2 LCD screen connected through an LCD board.

The process of conversion from analog to digital and vice versa is done through flat coding on the Arduino board in which the Arduino is connected through a computer and a pre written code using library liquid crystal can be loaded on the Arduino. This loaded code prevents the rewriting of code every time we connect a device and every time an input form is converted to another output form. The device is grounded by connecting the GND pin to the device to prevent the short circuiting.

This whole setup is to be a wearable device to be worn as a glove on one hand. The display, the hardware devices to be neatly arranged at the hem of the glove. One of the various major advantages of the framework that we successfully suggest hear is that it provides a common solution for all the three disabilities that we target. In this way, our framework is unique.

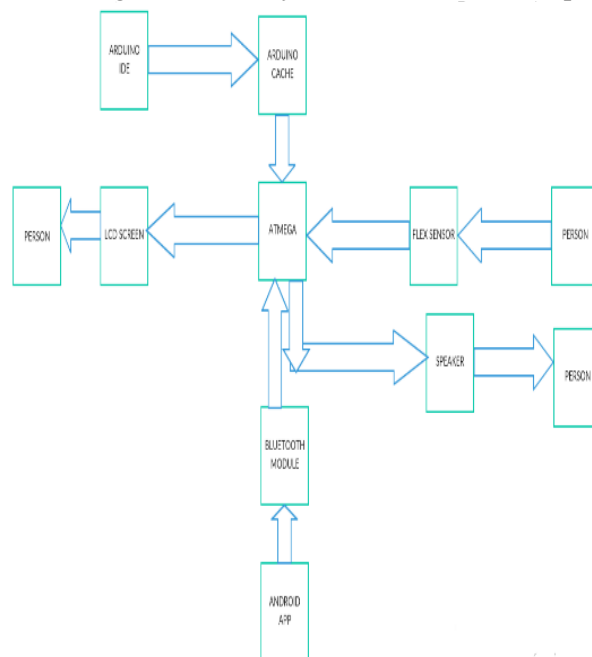


Fig. 3. Data Flow for communication

3.1 Experimental setup

The basic setup of the Arduino board along with all its wires and pins, the LCD screen and other components would look like the following figure.



Fig. 4. Experimental Setup of Arduino board

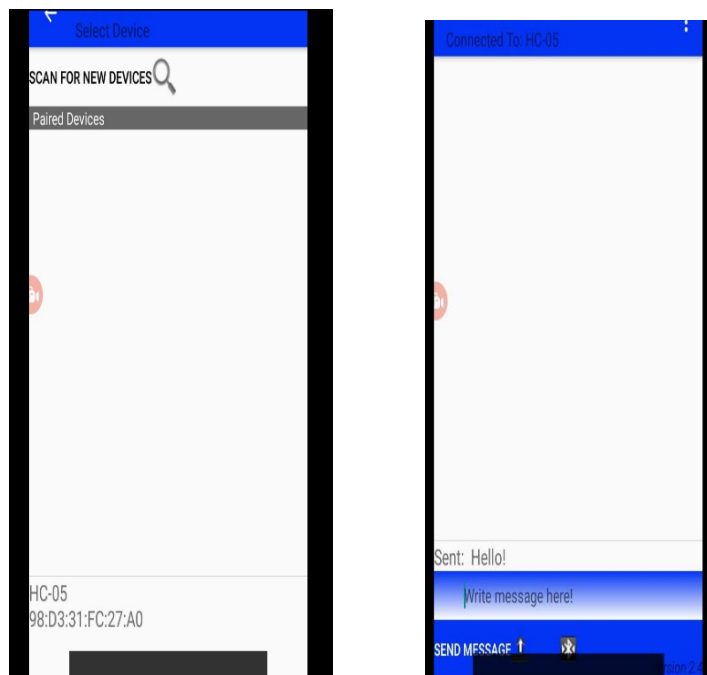


Fig. 5. (a)Bluetooth pairing (b)Bluetooth message transfer

Moreover, the setup could vary depending on the pins to which the device is connected. For example, analog pins and digital pins vary from A0 to A13 and D1 to D6. Among all these pins, several permutation and combination are possible for different setup. The important thing to remember is that quantized data will be generated from analog pins whereas the continuous data form will be generated from digital pins. Analog includes text, braille language etc. whereas continuous includes audio.

4. Results

The results generate step by step working flow. The primary step includes the connection of Arduino to a mobile or relevant device via Bluetooth. On the Figure 5(a), the device is searched

among several devices and paired with a specific code. On figure 5(b), the paired device send a message which can be further transferred.

The one of several outputs where text will be generated on LCD display for dumb or deaf to read will be as follows.

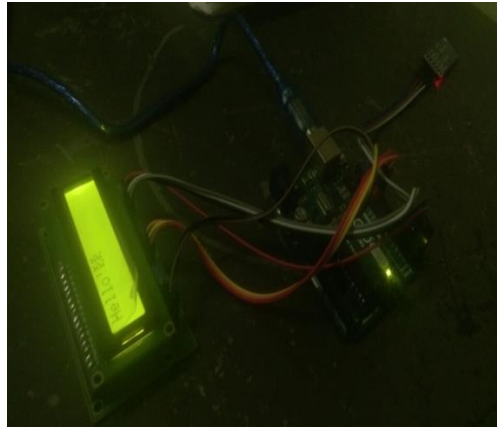


Fig. 6. Display on LCD

Figure 6 represents the same message as sent by the user through Bluetooth connection. Similarly, further an audio can be generated through speakers, braille through braille convertor etc. and give desirable output.

5. Conclusion

In this paper, we are developing a wearable technology that has no data transmission charges and can help in communication of differently abled people. This will ease out the difficulty in everyday life of these people and moreover help them in living a normal life. The use of technology at its best can aid and change life of many people. This is secure and portable device which could be of great help to differently abled people.

6. References

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