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Development of a Low Cost Device for Speech Conversion for Mute Community

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Abstract:- Normal people can communicate easily with other people by using a language. But there are a lot of people around us who are physically disabled to communicate normally. They use sign language to express their emotions, thoughts, and needs. But learning sign language is not easy for everyone. We have made a device to facilitate such a daunting task as learning sign language. Our proposed device can be used as a proper medium to convey their expressions without sign language. Our research is for reducing the communication gap between a normal and a deaf or dumb people. It is completely different from all previous devices and highly economic. It works through some specific buttons, which contain some specific words. We have used an encoder as a button, an SD card as a memory, a speaker to covert the signal in voice and an LCD to show the sentence. And this device is easily portable since there we have used lightweight equipment. In some previous devices, only LCD or mobile or laptop was used to display the output, so if a normal person is not mindful of the screen, then there was a possibility of communication gap. But we have used both LCD and speaker in our proposed device, so, even if a normal person is not mindful on screen, they will hear the sound via the speaker and hence has a very less possibility of communication gap. Using our device, a mute person is able to communicate with not only the normal person but also the blind person. Our proposed device provides more accuracy than all previous devices which is impressive.

Keywords:- *Mute, Deaf, Speak, Display, Economic, Portable.*

I. INTRODUCTION

There are too many people throughout the world who cannot speak or hear, so they cannot communicate with people normally. For this reason, they use sign language to express their demand, feelings, and needs, etc. But at present, this problem cannot bound the communication between deaf-dumb and normal people because there are some devices to mitigate the communication problem. For example, some devices have hand gloves to identify their hand gestures, some devices have a camera to capture their hand-face gestures, and some devices have a remote to specify some specific word or language, etc. These previous devices have used mobile or PC. They are associated with lots of limitations. Our device has some special features which can overcome those limitations. There is no use of android or pc in our proposed device, so this device is compact and cost-effective. Output sentences can be easily obtained by putting words according to the expression of the user. It works fast as it deals with words rather than letters. Moreover, various sentences can be formed using the same words. It is every switch contains some different and specific words. So, the user can descend any word independently to make a complete sentence, and this sentence will be converted into a voice message and displayed in the LCD.

In this device, although we have used 16 switches, we can get 30 different five-digit codes by using the 16^{th} number of switches as MSB (0 or 1) and every other (0-15^{th}) switch gives four digits. We have used an SD card for storing audio signals. So, we can easily get the audio as output via computer.

II. RELATED WORK

Kengo et al developed a system where they used a ring to convert the finger gesture to sentence and a mobile application to convert the sentence into a voice [1]. They showed that this system can be used in the communication between a deaf and normal person and a mute and a normal person. But the gestures are not be recognized properly, because of getting the dis-similarity of hand gestures or size in separate people. The average recognition rate was 85.2% for the developer and 63.1% for other persons. Kala et al also designed a flex sensor-based device which can get hand gesture and show output in an LCD [2]. They also use Bluetooth module for connecting with a mobile app which converts Letter to audio output. Their device was worked as letter by letter so much time need to express a sentence. Electronic Speaking Glove for Speechless Patients A Tongue to a Dumb developed by Ahmed et al [3]. They predefined some gestures which give specific sentence only to communicate with the doctor. Nasrany et al worked for conversion a signed letter to voice [4]. They have used a hand glove, flex sensor and a mobile application to convert the gestures into voice. So, it has less accuracy. Aarthi et al described a device where they used both camera and gloves to convert and display hand gestures in voice and LCD respectively [5-6]. So, we can say that this device is so expensive and it has less accuracy. Sridevi et al developed a system using a camera for getting a real-time video of hand gestures [7].

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III. PROPOSED DESIGN AND IMPLEMENTATION

A. *Mechanical Structure of Proposed Device*

The functional block diagram of this system is shown-

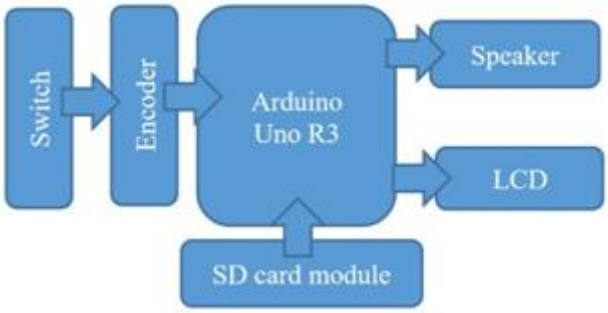

Fig. 1: Block diagram of the proposed system

In this proposed system, when we press a switch connected with the input of an encoder, the encoder gives a five-digit binary code. An Arduino is used to receive the output signal of the encoder and is also used to contain the programming of the proposed system (Data processing module).

An SD card is used as a memory. And last of all a speaker and an LCD is used as the output of the proposed system. A deaf-mute or normal person can use it by pressing the specific word by word to communicate with each other. These pressed words will be converted in voice via speaker and displayed in LCD.

B. *Working Principle*

In our proposed system, it has both hardware and software. Our device includes an encoder, relay Module, Arduino Uno R3, LCD, SD card Module and Speaker.

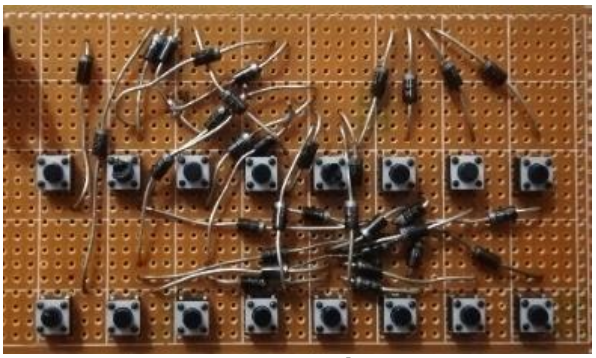

Fig. 2: An Encoder circuit

The Arduino cannot play mp3 files so we use audacity software. Audacity is used to convert audio mp3 files to 16K Hz 8bit unsigned wav files. The wav files can be read by Arduino hardware. The operation of our device can be divided into three parts, such as-

Switching the input signal via Encoder: An Encoder is used for switching the input signal. It works in binary mode, as the following data table-

TABLE 1: ARDUINO INPUT FROM ENCODER

Button	Binary Signal	Word for Reset (0)	Word for Set (1)
0	0000	-	-
1	0001	I	Buy
2	0010	We	Say
….	….	….	….
15	1111	Sleep	ing

In this proposed system, we have used manually 16 switches but we can use these 16 switches as 32 switches practically via a set/reset switch. This set/reset switch is 0 for reset, then we can use these switches as 1-15 no switch, and it is 1 for the set, then we can use these switches as 17-31 no switch. Here zero number switch has no signal and the sixteenth switch is used as set/reset switch.

Data reading and processing: When a binary input signal will be received by Arduino, it will read the data or specific word from memory or SD card. Every binary input has a specific word, so 30 binary inputs have 30 different words. A user can select any word independently via pressing the switch.

Communication via speaker and display: When data will be read by Arduino from memory then Arduino will send it in speaker and LCD as the output so that the user can communicate with other people by using this device. When it will send in speaker then the data will be converted mp3 file to 16K Hz 8bit unsigned wav file. And finally, we got an audio output. And when the data will send in LCD then it will be displayed.

A conversation between a deaf-mute person and a normal person using our device are given below-[8]

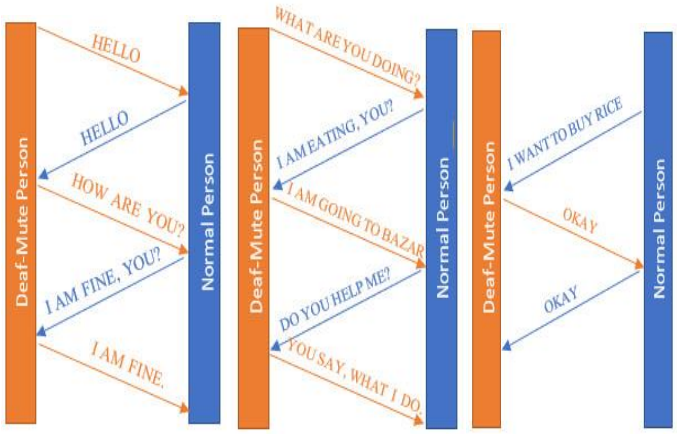

Fig. 3: Conversation between deaf-mute & normal person.

C. Cost Estimation :

TABLE 2: THE OUTLAY OF DIFFERENT COMPONENTS [9]

Item Name	Cost
Switch	$0.5
Encoder	$0.5
Relay Module	$2.7
Arduino	$5.3
Speaker	$1
LCD	$1.5
SD card Module	$1.5
Wires	$0.5
Others	$1.5
Total	$15

From the table, we can guess the cost of developing device is about $15 which is economic.

IV. RESULTS

In our device, when we press the input button of the encoder then Arduino will receive a five-digit code and get audio data from the memory by comparing this code with predefined codes. In our device we can consider the following chart-

TABLE 3: SOME MOSTLY USED WORD THAT INCLUDE IN OUR DEVICE

Subject/Object	Verb		Others	
I	am	go	To	fine
We	Is	want	Hello	How
You	are	eat	What	Where
me	have	sleep	When	Bazar
	Do	buy	Water	Rice
	help	say	Washroom	ing
	Drink	meet		

In this chart we use some word so that we can use the same word to make a different sentence, for example- I go to Bazar, I eat rice, you eat rice, etc. The LCD will display the data as the following picture-

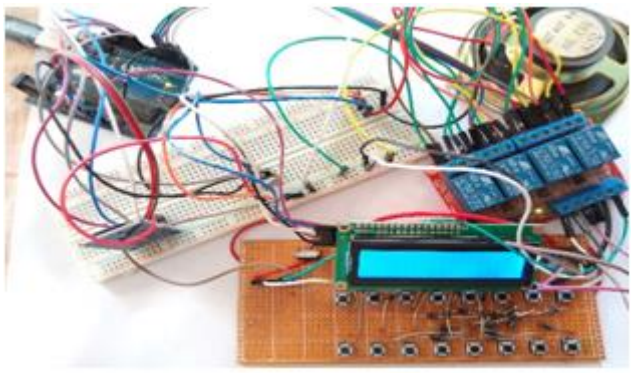

Fig. 4: Nothing Displayed, when no switch is pressed.

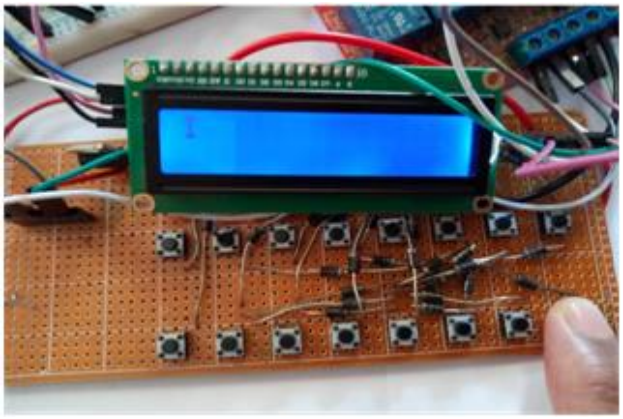

Fig. 5: “I” Displayed when switch-1 is pressed.

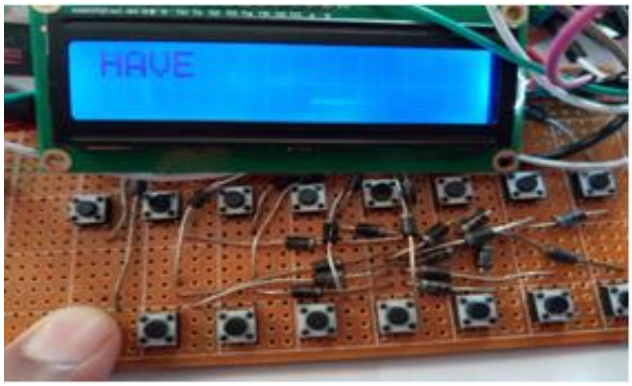

Fig. 6: “HAVE” Displayed when switch-8 is pressed.

Fig. 7: “WHEN” Displayed when switch-16 & 8 are pressed.

Fig. 8: “WASH ROOM” Displayed when switch-16 & 10 are pressed.

A deaf-mute person can communicate easily with normal people as well as blind people using our device.

V. DISCUSSION AND FUTURE ENHANCEMENT

We have thought deaf-mute people so that they can communicate with other people easily. It is a system that can convert the switching direction in voice and also can display it in LCD. Since its both voice and displaying output so it can be used by a normal person and a deaf or a mute or a deaf-mute person. If a deaf-mute person wants to communicate with other people then he can select any switch independently which contains the necessary word or sentence. This device is user-friendly, low cost, and a smaller one, etc, so it can be used easily. Ultimately this is a modified system so that a deaf-mute person can use it easily to communicate with other people.

To developed our device, we have faced some problems. When firstly we make an encoder by 74 series IC that gives wrong output if inputs are not grounded. This encoder always gives output 1. Then we build up an encoder using diodes that gives more accurate output than the previous encoding. But when Arduino read the value of encoder output is gives some error because the Arduino pin is not grounded. To remove this error, we use the relay circuit that connects the Arduino input pin with the ground when encoder output zero and connect the Arduino input pin with 5V DC when encoder output 1(one). At last, we get a device that gives a more accurate value.

At present, we developed a system by using only 30 word which is not enough to communicate properly. Using only 300-350 words, we guess a man can communicate with each other mediumly. In the future, we want to develop our devices that will work up to 800-1000 words. We want to improve the accuracy of our device by build-in PCB board. We hope our device contributes a lot to communicate deaf-mute community in the future.

VI. CONCLUSION

The lifestyle of the mute person can also be improved by providing them a successful way to communicate. The main purpose of our design is to come up with an innovative idea that can easily help in the communication of people having disabilities. Deaf-mute people face difficulty in communicating with normal people because most of the people cannot understand. This work proposes an encode-based system for deaf-mute people using encoder technology to overcome this barrier. The system consumes very low power. Having less weight, the robust model gives patients the liberty to carry it anywhere they want. This project will give a chance to deaf and mute people to express their needs just by pressing a button. The project will definitely reduce the communication gap between the normal person and the deaf-mute community. With its satisfactory accuracy, we believe that this will surely be a blessing for deaf-mute people.

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