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Speaking and Controlling System for Speech Impaired People

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Abstract*: Sign Language is the only way to communication for dumb peoples. But normal people sometimes can't understand this language, so it will be complicated for a speech impaired person to get interact with them. In this project an electronic speaking system was developed to ease the communication process for speech impaired people. A hand glove is developed that is consisting of flex sensors. When a gesture is made with the glove, the change in resistance of flex sensors fed into the Arduino Mega 2560 and specific prerecorded audio command for that gesture is played through speaker and the text command for that gesture is displayed on the LCD. This device not only helps a speech impaired person to communicate with a normal person via audio commands but also helps him/her to communicate with a hearing impaired person by displaying the text commands on the LCD. It also help them to control light and door with the help of this system.

Keywords: Speech impaired, gesture recognition, command displaying, message conveying, controlling applianc, Flex sensor and Glove.

I. INTRODUCTION

Speaking is the main way of communication for every normal human being. Sign language is the language used by deaf and mute people to convey their message meaning simultaneously combining hand shapes, orientations and movement of the hands, arms or body and facial expressions to express fluidly a speaker's thoughts. Out of those, more than 1.5 million deaf people in India uses Indian Sign Language (ISL) as a mode of communication as shown in fig below.

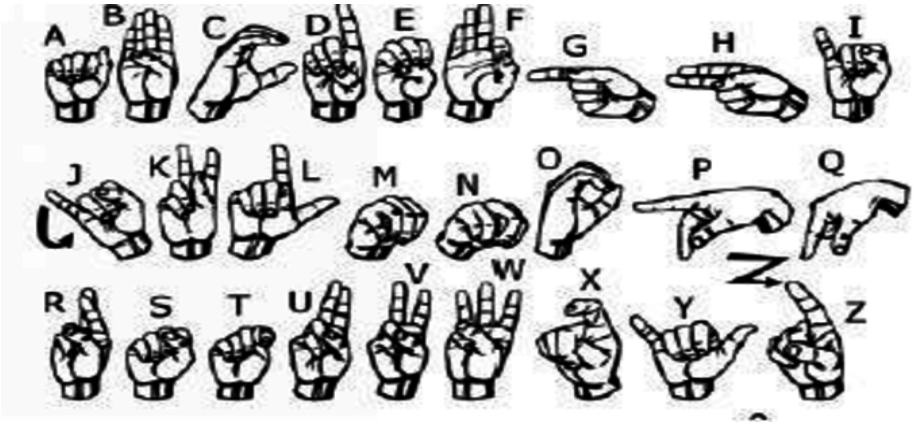

Fig 1:Indian sign language

Most of the people don't understand sign language. So it puts the speech impaired person in a difficult situation. In recent years, researchers have been focusing on hand gestures detections and been popular for developing applications in the field of robotics and extended in the area of artificial or prosthetic hands that can mimic the behavior of a natural human hand. This project although utilizes a similar approach for the detection of the movement of fingers.

The main objective of this project is to design an electronic speaking system in the form of a glove to lessen this communication problem. This device benefits a speech impaired person to communicate with a normal person as well as with a hearing impaired person. The main component of this project is a glove with five flex sensors that are connected to Arduino which is the main control unit of this project. This device has a feature of user input. So speech impaired person can easily use his/her own chosen commands for specific gestures. These particular command is displayed on LCD ,can be audible through speaker, can be conveyed their message to the mobile phone and also used in controlling purpose.

II. RELATED WORK

Using the concept of gestures, few attempts have been made in the past to recognize the gestures made using hands but with limitations of recognition rate and time which include:

A. Using CMOS Camera

CMOS camera transmits image data via UART serial port. The UART performs serial-to-parallel conversions on data received from a peripheral device (CMOS camera in this case) and parallel-to-serial conversion on data received from the CPU (Micro controller in this case).

Hand gestures were detected using camera by 3 steps

- Capturing the image of the gesture
- Edge detection of that image
- Peak detection of that image

Disadvantage: Highly expensive, latency and each image occupies 50KB of memories.

B. Leaf switches based glove

These are similar to normal switches but these are designed in such a way that when pressure is applied on the switch, the two ends come into contact and the switch will be closed. These leaf switches are placed on the fingers of the glove such that the two terminals of the switch come into contact when the finger is bent.

Disadvantage: After prolonged usage, the switch instead of being open when the finger is straight, it will be closed resulting in improper transmission of gesture.

C. Copper Plate Based Glove

In this prototype, a copper plate is fixed on the palm as ground. The copper strips indicate a voltage level of logic 1 in rest position. But when copper strips come in contact with the ground plate, the voltage associated with them is drained and they indicate a voltage level of logic 0.

Disadvantage: The use of copper plate makes the glove bulky which makes it unsuitable to use it for a long time.

D. Flex sensor based Glove

It is developed in April 2016, where gestures is recognized using flex sensors that helps in conveying message in the form of analog audio signal. It has a disadvantages because of analog values as it could provide inaccurate result.

III. PROPOSED WORK

A. Block diagram description

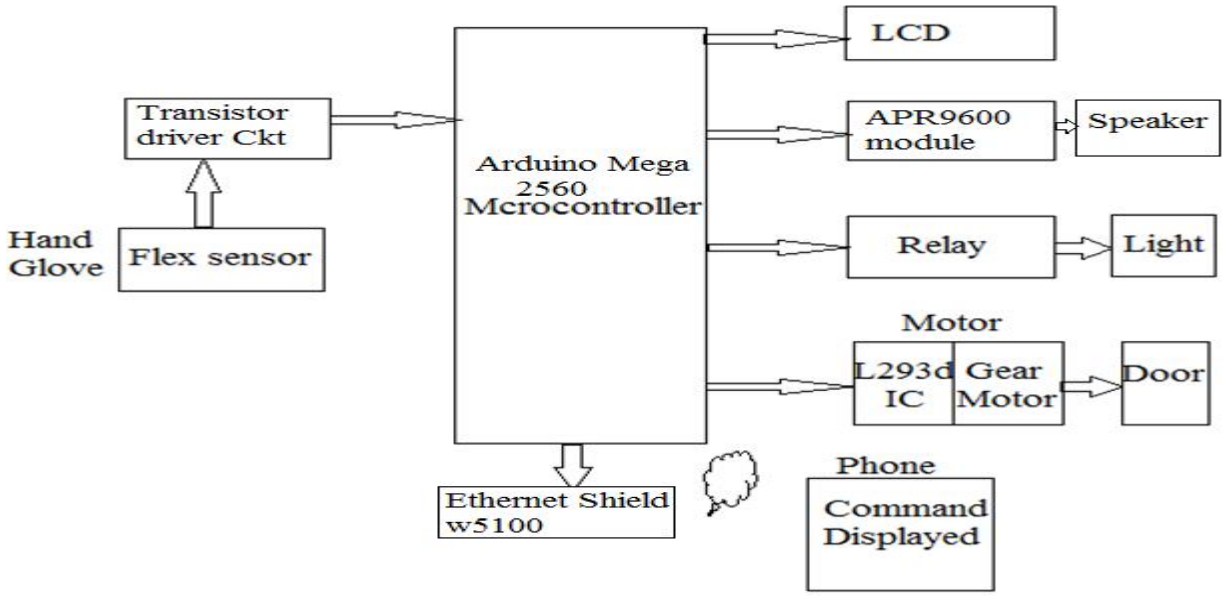

Fig 2: Block diagram of speaking system

This electronic speaking system has two way of communication. First one is audio through the speaker and another one text command displays on the LCD. And also it helps in controlling. Flex sensors are resistive carbon parts. When bent, the device develops a resistance output correlative to the bend radius. These change in resistance is get connected with the transistor driver circuit to obtain an output for the respective bent of a particular flex sensor. The output voltage will be in the form of digital i.e. 1 for the flex sensor bent and 0 for the no movement of finger or flex sensor comprised on gloves using an arduino. The pre stored command for particular gesture made is analyzed and get displayed on LCD and can be audible through speaker. This message can also be conveyed through a web server using http request.

B. Hardware & Software description

1) Flex sensor: Flex sensors are passive resistive devices that can be used to detect bending or flexing as shown in fig 3. The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius. These sensors are placed on a glove in present prototype to sense the finger bending. Five flex sensors are mounted on glove and glove is allowed to make gesture.

Fig 3: flex sensor

2) Transistor driver circuit: Connecting a resistor of some minimum safe value to the base of the transistor in serially with flex sensor .Next, connect an LED and a resistor to the collector of the transistor. The LED will provide you with immediate visual information regarding the happenings with the circuit. The collector resistor again ensures that the UCEO is kept within the specified limits, safeguarding the transistor as well as the LED. Initially Flex sensor of particular finger is bent ,which allows change in resistance, Apply a DC potential across the flex sensor, and will find the LED of respective flex sensor is coming ON immediately. This happens because a small part of the voltage reaches the base of the transistor and switches ON its collector to ground and allows the voltage to complete, illuminating the LED. These voltage is assumed to be in the form of Logical conditions.

3) Arduino Mega 2560: The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs),16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains every thing needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove. It is used to recognize the gesture made.

4) LCD: Liquid crystal Display is used to display the commands for that particular gesture made. LCD of 16*2 dimension is used in this prototype.

*5) APR9600 module:*APR9600 is a low-cost high performance sound record/replay IC incorporating flash analoguestorage technique. Recorded sound is retained even after power supply is removed from the module. The replayed sound exhibits high quality with a low noise level. It act as an interfacing between the speaker and the arduino. It is known to be as a speaker driver circuit.

6) Speaker: It is used for hearing the voice which is recorded using APR9600 module. The command stored for the particular gesture made is audible through speaker.

7) Relay: Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electro magnet. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. Here the relay is used to switch the light ON and OFF

8) *L293D IC:* A motor driver IC is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver ICs act as an interface between controller and the motors. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. L293D has 16 pins.
9) *Gear motor:* The motor is used here to control a load from the particular gesture i.e. pre stored.
10) *Ethernet shield W5100*: The Arduino Ethernet Shield connects your Arduino to the internet in mere minutes. Just plug this module onto your Arduino board, connect it to your network with an RJ45 cable. Here the shield is used to convey a message to the web page.
11) *K. Web server:* A web server is a computer system that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer to the entire system, or specifically to the software that accepts and supervises the HTTP requests. Here to convey a message other than LCD and speaker, a web page is created that defines the person state depending upon the gesture made. For a particular router the respective IP address is entered as a http request to open a web page. Router is used here to get a path for the message to reach a particular defined IP address destination.

IV. RESULT

The gesture recognition system using glove for the help of dumb people to get communicate with the normal or deaf person is shown in Fig 4, that defines the hardware setup, where message to be conveyed is displayed on LCD, webpage and also be audible through speaker.

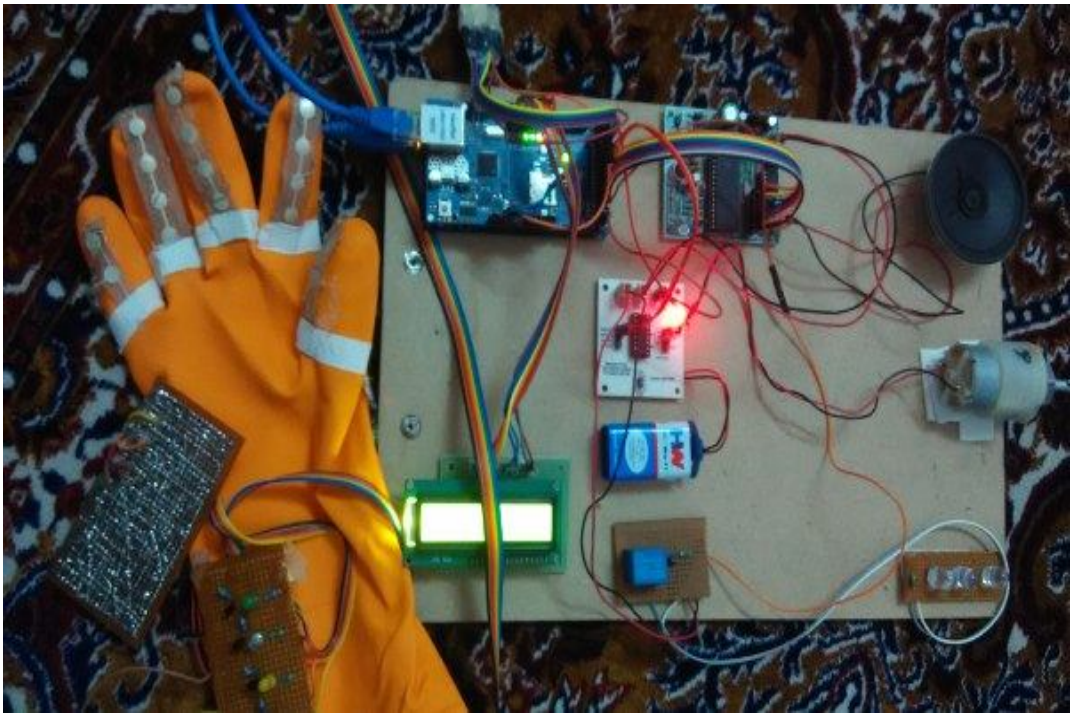

Fig 4:hardware setup of the gesture recognition system

Following are some commands defined for the particular gesture made.





V. CONCLUSION

This electronic speaking system can help the speech impaired people to communicate with normal people in the real world. A data gloves is finally developed for the speech impaired patients. Now they don't have to face any kind of problem with their communication. The project proposes a translational device for deaf-mute people using glove technology. The proposed technique has enabled the placement of five flex sensor on to a glove to detect the gestures of a person. As this system is having its voice output in regional language, it can be used as a translator to communicate with people of different regions easily.

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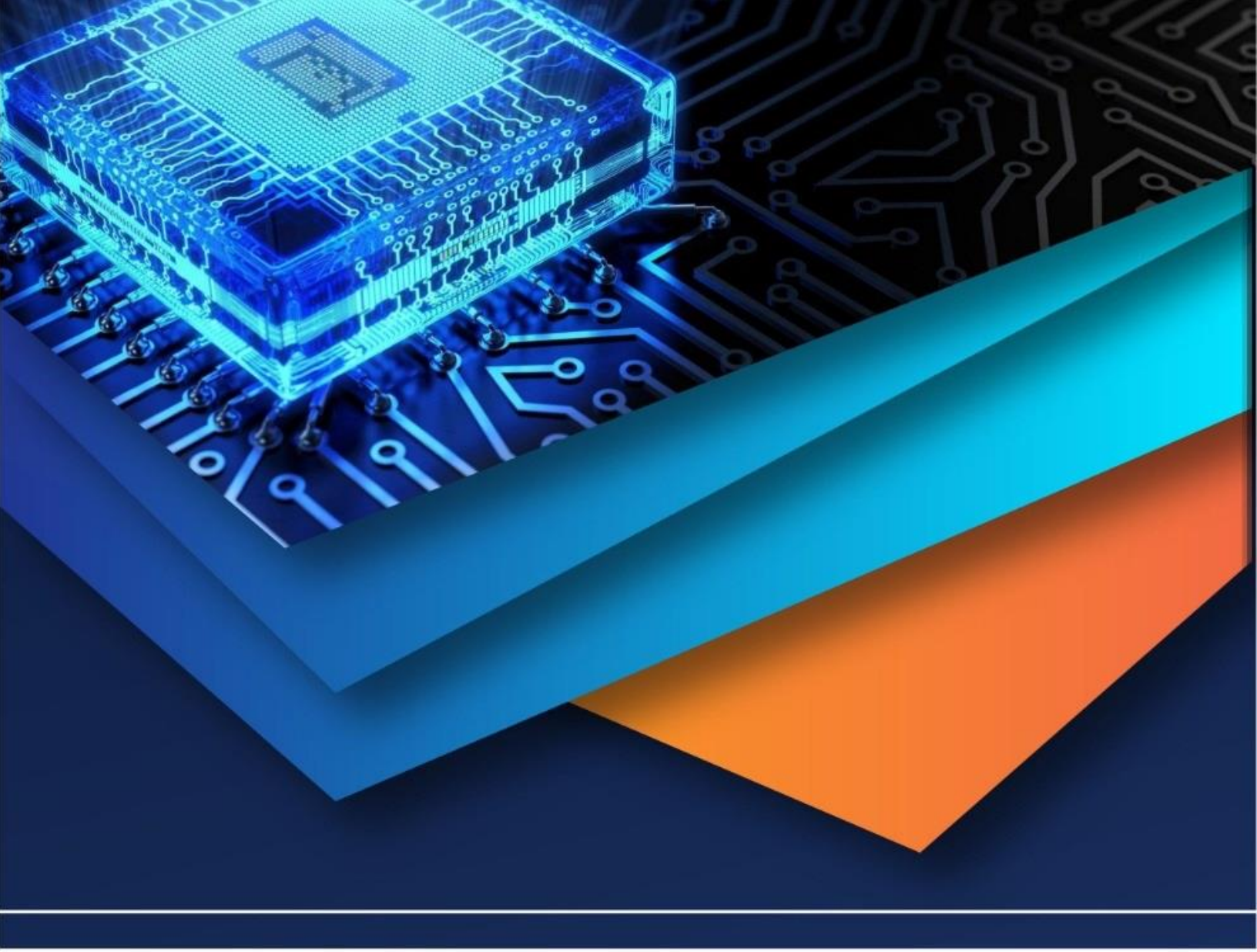

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