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HAND TALK ASSISTIVE SYSTEM

A.A.Markad[1], A.L.Borkar[2]

[1] Student, [2] Asst Professor, Department of Electronics and Telecommunication,
M.S.S.C.E.T., Jalna, Maharashtra, (India)

ABSTRACT

About nine billion people in the world are deaf and dumb. The communication between a deaf and hearing person poses to be a serious problem compared to communication between blind and normal visual people. This creates a very little room for them with communication being a fundamental aspect of human life. The blind people can talk freely by means of normal language whereas the deaf-dumb have their own manual-visual language known as sign language. Sign language is a non-verbal form of intercourse which is found amongst deaf communities in world. The languages do not have a common origin and hence difficult to interpret. The project aims to facilitate people by means of a glove based communication interpreter system. The glove is internally equipped with five flex sensors. For each specific gesture, the flex sensor produces a proportional change in resistance. The output from the sensor is analog values it is converted to digital. The processing of these hand gestures is in Arduino Duemilanove Board which is an advance version of the microcontroller. It compares the input signal with predefined voltage levels stored in memory. According to that required output displays on the LCD in the form of text & sound is produced which is stored is memory with the help of speaker. In such a way it is easy for deaf and dumb to communicate with normal people. This system can also be use for the woman security since we are sending a message to authority with the help of smart phone.

Keywords: Arduino Duemilanove Board, Deaf And Dumb, Sign Language, Flex Sensor.

I. INTRODUCTION

In general, deaf people have difficulty in communicating with others who don’t understand sign language. Even those who do speak aloud typically have a “deaf voice” of which they are self-conscious and that can make them reticent. The Hand Talk glove is a normal, cloth driving glove fitted with flex sensors along the length of each finger and the thumb. The sensors output a stream of data that varies with degree of bend. The output from the sensor is analog values it is converted to digital and processed by using microcontroller and then it will be transmitted through wireless communication (RF), then it will be received in the receiver section and processed using responds in the voice using speaker. In this project flex sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. They convert the change in bend to electrical resistance - the more the bend, the more the resistance value. They are usually in the form of a thin strip from 1"-5" long that vary in resistance from approximately 10 to 50 kilo ohms. They are often used in gloves to sense finger movement. Flex sensors are analog resistors. They work as variable analog voltage dividers. Inside the flex sensor are carbon resistive elements within a thin flexible substrate. More carbon means less resistance. When the substrate is bent the sensor produces a resistance output relative to the bend radius.

With a typical flex sensor, a flex of 0 degrees will give 10K resistance with a flex of 90degrees will give 30-40 K ohms. The Bend Sensor lists resistance of 30-250 K ohms. In this system we use Radio Frequency Signal to transmit the signal from transmitters to Receptors, in this project we have used microcontroller, a speech IC and also a speaker to produce the output.

1.1 Assistive Technology - Efficiency and Services

Assistive technology is any device that helps a person with a disability to complete an everyday task. If you break your leg, a remote control for the TV can be assistive technology. If someone has poor eyesight, a pair of glasses or a magnifier is assistive technology. Assistive technology is technology used by individuals with disabilities in order to perform functions that might otherwise be difficult or impossible. Assistive technology can include mobility devices such as walkers and wheelchairs, as well as hardware, software, and peripherals that assist people with disabilities in accessing computers or other information technologies [1].

To develop a methodology based on a holistic approach, including end-user preferences, quality of life and social values, for a comprehensive assessment of assistive technologies and services. To support decision making about assistive technologies and services through the dissemination of project results. To compile and develop a methodology for the comprehensive assessment of assistive technologies and services, including user benefits, quality of life and costs [1].

1.2 Definition of Gestures

Outside the human computer interaction (HCI) framework, hand gestures cannot be easily defined. The definitions, if they exist, are particularly related to the communicational aspect of the human hand and body movements. Webster's Dictionary, for example, defines gestures as "The use of motions of the limbs or body as a means of expression; a movement usually of the body or limbs that expresses or emphasizes an idea, sentiment, or attitude." Psychological and social studies tend to narrow this broad definition and relate it even more to man's expression and social interaction. However, in the domain of HCI the notion of gestures is somewhat different. In a computer controlled environment one wants to use the human hand to perform tasks that mimic both the natural use of the hand as a manipulator, and its use inhuman-machine communication(control of computer/machine functions through gestures) [2].

1.3 Various Methods of Gesture Creation

1. Image processing - Hand gestures are captured by camera and according to algorithm image processing takes place. It needs several ideal situations such as sufficient light and plane background. It's not possible all the time. Another challenge in image and video processing includes variant lighting conditions, backgrounds and field of view constraints and occlusion. The sensor based technique offers greater mobility.

2. Using pot and mechanical assembly -It required very precise assembly and it is bit delicate. A pot is connected to various strings connected to fingers. This whole assembly is placed on palm. As per finger moment position of pot varies. Resulting in variable voltage. But this mechanism is uncomfortable and inconvenient for daily use. Also precision required is more but system does not provide enough accuracy to match the requirement.

3. Using Smart Phone - Various gestures can be made on touch screen. These can be converted to sound by various inbuilt software. But this is not convenient as user must be educated which is not possible all the time.
4. Using Sensors - The interpreter makes use of a glove based technique comprising of flex sensor, tactile sensor and accelerometer. For each hand gesture made a signal is produced by the sensors corresponding to the hand sign the controller matches the gesture with pre-stored inputs. The device not only translates alphabets but can also form words using made gestures.

II. LITERATURE SURVEY

American Sign Language Interpreter System for Deaf and Dumb Individuals is proposed by Sruthi Upendran and Thamizharasi A.[3]. This paper presents a new scheme to recognize ASL alphabets from an image input. This system extracts Principal Component Analysis (PCA) features from the ASL hand pose. The PCA features extracted can be used to classify the ASL alphabets using the k-NN (k- Nearest Neighbour) classifier.The system is divided into two phases,
1. Training Phase-Training is the first phase of the system. A huge dataset of s ample images of all static ASL alphabets will be stored, which is called as the training dataset. Various experimental procedures are carried out in order to extract features from the images. PCA features generated are stored in the form of column matrix and are useful further in the feature comparison process during classification.
2. Testing Phase-The second stage begins when a user submits his query image representing an ASL alphabets for recognition.
Jeonghee Kim, Hangue Park, and Maysam Ghovanlo proposed Tongue-Operated Assistive Technology with Access to Common Smartphone Applications via Bluetooth Link [4]. In this paper they developed the Tongue Drive System (TDS) for people with severe disabilities to control computers and their environment using their tongue motion. TDS translates the user’s volitional tongue movements into commands, which is then interfaced to external devices. They also have developed iPhone apps as a key controlled device by TDS to dial phone numbers and as interface to control the powered wheelchairs (PWC) using tongue motion. To implement the mouse function on the Smartphone, they emulated a mouse sensor inside a commercial Bluetooth mouse using TDS commands. The new interface introduced in this paper allows the external TDS (eTDS) headset to communicate with the Smartphone and relay the sensor data to the signal processing algorithm, running on the Smartphone, and turn the raw data into control commands for computers, Smartphone’s, and PWCs.
S.R.Aarthi Avanthiga and V.Balaji presented A Design Prototypic Sarcastic Gadget Technology for Perceptual Disabilities [5]. This system is for indian sign language. Pallavi verma, S.L.Shimi and S. Chatterji proposed Design of Smart Gloves [6]. Solanki Krunal presents Microcontroller Based Sign Language Glove [7]. Electronic Speaking Glove for Speechless Patients:A Tongue to a Dumb is proposed by Syed Faiz Ahmed, Syed Muhammad Baber Ali, Saqib Qureshi [8]. Deaf-Mute Communication Interpreter is proposed by Anbarasi Rajamohan, Hemavathy R, Dhanalakshmi M. [9]. Switching Rate Changes Associated with Mental Fatigue for Assistive Technologies was developed by Ashley Craig, Yvonne Tran, Nirupama Wijesuriya, Ranjit Thuraisingham and Hung Nguyen [10]. Richard M. Goff, Janis P. Terpenny, Mitzi R. Vernon, William R. Green, and Clive R.Vorster proposed Work in Progress-Interdisciplinary Design of Assistive Technology for the Third World [11]. Maysam Ghovanloo developed Tongue Operated Assistive Technologies [12]. Real Time

Malaysian Sign Language Translation Using Color Segmentation and Neural Network proposed by Rini Akmeliawati, Melanie Po-Leen Ooi and Ye Chow Kuang [13]. Al-Jarrah, A. Halawani proposed Recognition of Gestures in Arabic Sign Language Using Neuro-Fuzzy Systems [14]. Antzakas, K. & Woll, B. proposed Hand Movements and Negation in Greek Sign Language [15].

III. PROPOSED SYSTEM

3.1 Data Acquisition Methods

To start with our research, on obtaining a bio-signal from the fingers, which require obtaining a signal proportional to the movement of the fingers. Fingers are able to interpret different hand gestures, research showed that many haptic devices used in prosthesis utilized the conventional method of using EMG signals. Following is the list of possible methods which could be used to sense the hand's movements (discussing each one of them in detail will be beyond the scope of this paper). • Flex Sensor

• EMG (Electromyography)
• MMG (Mechanomyogram)
• Load cell
• Wearable conductive fiber
• Deterioration of fiber optic cable
• Sliding fiber optic cable
• Strain gauge tactile sensor

After analyzing all of the above methods for signal acquisition the best solution to use flex sensor in this project as it is comparatively reliable and a cost effective solution

3.2 Block Diagram of Proposed System

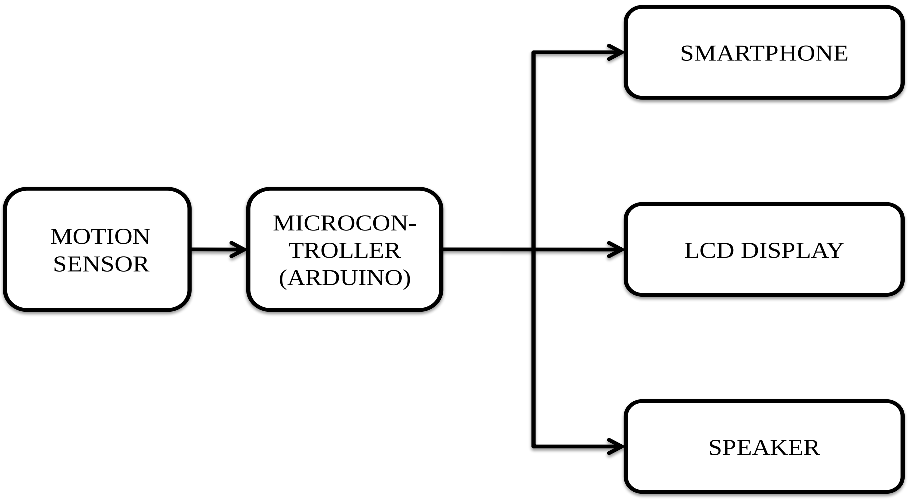

Fig -1: Block diagram of proposed system

Main components of the system are:

1. Motion Sensors (Flex Sensor)
2. Microcontroller (Arduino Duemilanove Board)
3. Smart Phone
4. LCD display
5. Speaker

1. Motion Sensors (Flex Sensor) - The flex sensors are the sensors that change in resistance depending upon the amount of bend on the sensor. They convert the change in bend to electrical resistance. They can be unidirectional and bidirectional. Available in thin strip form. 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 the smaller the radius, the higher the resistance value. Flex sensors has the length from 1 inch to 5 inch i.e. near about 73mm in length and 6.35mm in width. The resistance of the flex sensor varies above or below 550Ω. The main difference between unidirectional flex sensor and bidirectional flex sensor is that, as the unidirectional flex sensor is bent, the resistance increases, while when a bidirectional flex sensor is bent, the resistance decreases. At rest or 0^0 bend, the resistance of the unidirectional flex sensor is 10KΩ.As it is further bent at 45^0 , the resistance increases according to the bent. At 90^0 bent, the resistances of the unidirectional flex sensor ranges from 30KΩ to 50KΩ.

Fig -2: Image of flex sensor

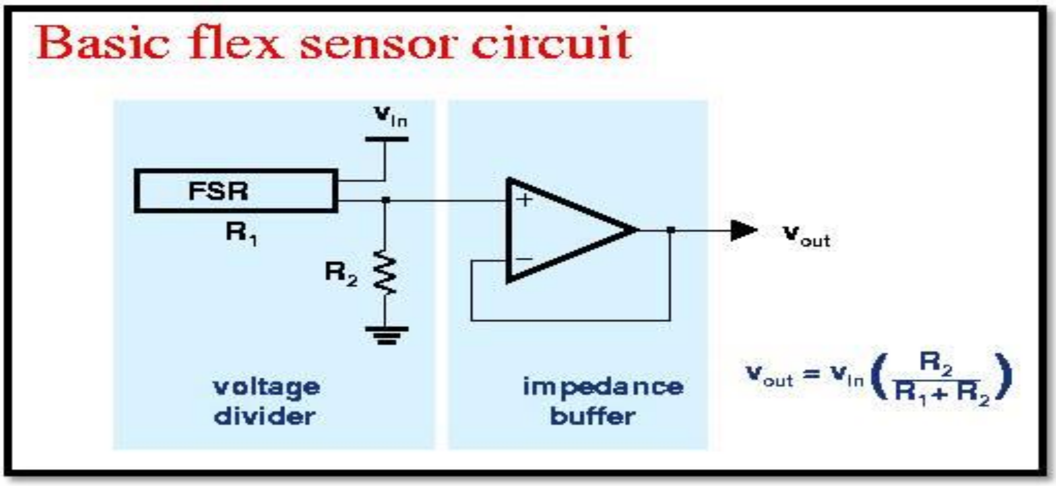

Fig -3: Basic Flex Sensor Circuit

The impedance buffer in the (basic flex sensor circuit) is a single sided operational amplifier used with these sensors because the low bias current of the operational amplifier reduces error due to the source impedance of the flex sensor as voltage divider. Electrical impedance the measure of the opposition that a circuit presents to a current when a voltage is applied. It is the ratio of the voltage to the current.

2. Microcontroller (Arduino Duemilanove Board) features

Table-1

Microcontroller	ATmega168
Operating Voltage	5V
Input Voltage (Recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40Ma
DC Current for 3.3V Pin	50 Ma
Flash Memory	16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by boot loader
SRAM	1 KB (ATmega168) or 2 KB (ATmega328)
EEPROM	512 bytes (ATmega168) or 1 KB (ATmega328)
Clock Speed	16 MHz

3. LCD 2x 16 modules

Innovati's LCD 2x16 A Module provides versatile display functions. Through its simple connections, it can be controlled by Innovati's BASIC Commander for a wide range of LCD applications. In this module, two display lines, each with 16 characters on each line can be displayed. By using the cursor control command, the position of the character to be displayed on the screen can be arbitrarily changed. In this module, the backlight function can be used to change the backlight to allow the message to be read easily.

3.3 Working and Flowchart of Proposed System

The Flex sensors are mounted on the hand gloves. This hand gloves are worn by the person. The sensors can detect the hand movement done by the person. And the sensors can convert these movements into the electrical signal. The voltage and resistance range for each movement is recorded and it is programmed in the microcontroller as a reference voltage. The output coming from the sensor is given to the microcontroller for the comparison with the reference voltage. After comparison, the measured voltage would lie in the particular range as programmed in the microcontroller. The sentence belonging to that range would be displayed on the display by using particular software such as Terminal software. The entire system works on 5V supply. Arduino software is being used to burn the program on the microcontroller IC (ATmega8) which is mounted on the Arduino Duemilanove board.

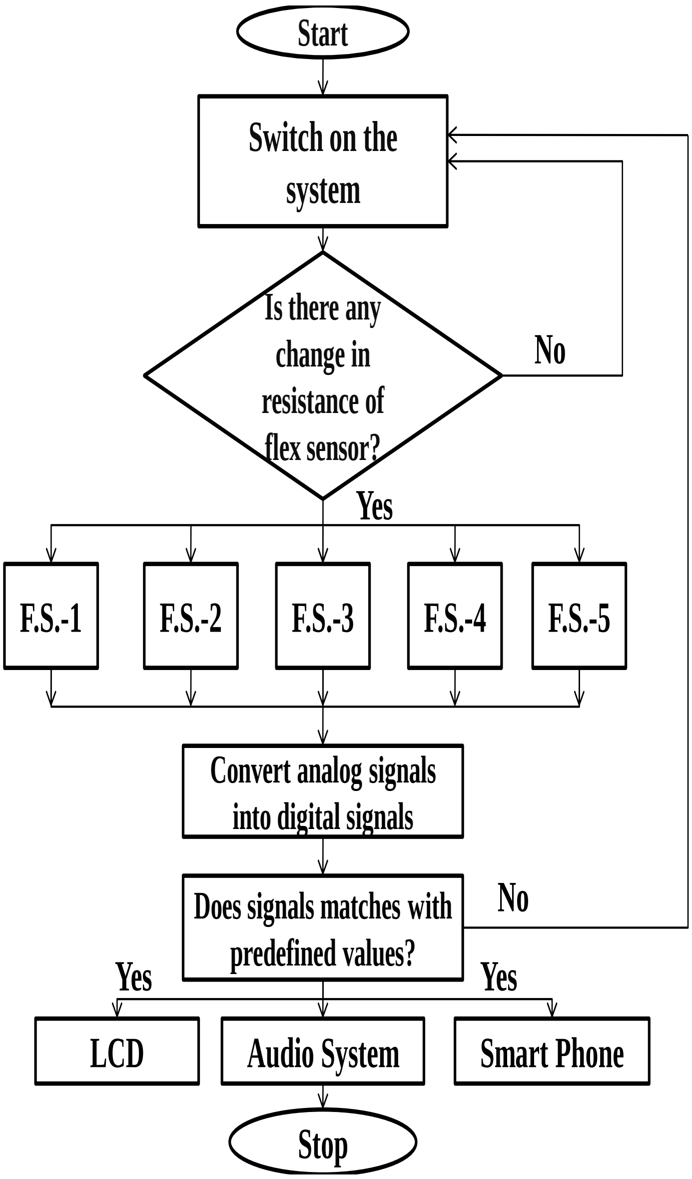

Fig -4: Flowchart of proposed system

IV. CONCLUSION

- This project is a useful tool for speech impaired and partially paralyzed patients which fill the communication gap between patients, doctors and relatives.
- As it is portable, requires low power operating on a single lithium-ion rechargeable battery and having less weight and robust gives patient liberty to carry it anywhere at their will**.**
- This project will give dumb a voice to speak for their needs and to express their gestures.
- Hence this project is an attempt to make it easy to understand the actions of the dumb people by getting the output in the form of text and voice.
- The text is also forwarded as SMS via Bluetooth or modem for better convenience and for security purposes.

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