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DESIGN AND IMPLEMENTATION MSART MITTEN FOR DEAF AND DUMB PEOPLE USING ARDUINO

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ABSTRACT

This paper presents a smart glove designed to facilitate communication between speech-impraired individuals and those without such challenges in their daily lives.Approximately 70 million people are born deaf, and and additional 230 million experience hearning impariments or sppech difficulties due to conditions like autism or stoke. To address this issue, research has been initiated that employs flex sendors and an accelerometer to detect gestures, an Auduino UNO for processing inputs, and a web interface to display the corresponding text output.

I.INTRODUCTION

Major difficulties faced by hearing and speech impaired people are listed and analyzed to give better solution to overcome this problem. In this world communication is the most important tool to express one's ideas and thoughts. Expressing one's ideas or thoughts reveals about their intelligence and creative thinking. But the problem is that not all people can communicate to each other. There are some people who has some serious problem in speaking, hearing or perceiving things. These people always suffer a lot, and this defect makes them feel isolated from the normal people that cause some mental depression. As this the 21st Century, technology can provide a better solution for all kind of problem. Similarly, there is a solution to solve this problem and make those people merge with the normal world and do their routines. Specifically for hearing impaired people sign language is the only way of communication with external world. Sign languages are languages that use visual modality or hand gestures to denote the meaning of particular words There is a standard sign language for speech and hearing-impaired people are available which is used worldwide.

Standard sign languages were followed all over the world because it would be easy if every country follows the same sign language and avoids a clash of various country's sign language. It uses hand gestures to represent a letter or a word. Hand gestures can be expressed in two different ways: 1) Static Gesture 2) Dynamic Gesture In static gesture, gestures do not change, or it do not have any sequential order for its representation. In dynamic gesture, certain sequential order must be followed to get the information. Mathavan Suresh Anand et al. [2] explained the effective way for hand gesture recognition system. This hand gesture recognition system has many applications like sign language analysis, medical training, and virtual prototyping. The working of this hand gesture recognition system has three modules: Pre-processing, Feature Extraction and Classification. In the pre-processing stage, hand gesture is captured and noises in the frame is removed. Then, the important feature in the frame is extracted using Discrete Wavelet transform technique for the better and accurate classification. A simple KNN classifier is proposed to be used for sign recognition based on the extracted DWT features. The framework is mainly used for extracting features and classification. Finally, the Classifier is used to recognize the sign language. Walid K A Hasan and Nadia Naji Gabeal [5] proposed a solution where the hardware components are used to identify the sign language to get precise output. The Microcontroller used is Arduino UNO. To get the orientation and positions of fingers, flex sensors are integrated with gloves and Arduino. Based on the data from the flex sensors, Arduino can classify the sign and convert it to either text or speech. Along with the flex sensor, accelerometer is used to identify the tilt angle of hand for classification. The controller uses the data collected by the two flex sensors to send commands according to the gestures. These sensors are attached to ADXL335 which is a glove that has a built in gesture recognition system. Using hardware for sign recognition system can avoid errors in classification and give the better result. Nakul Nagpal et al. [1] proposed a theoretical solution to develop a communication aid for deaf and dumb to interact with normal people. A way of representing the gesture is of two types: Static and Dynamic. In static, gestures do not change, or it does not have any

sequential order but in dynamic where the sequential order must follow to extract the information. Alphabets are best examples of Static gestures and Actions, or representation of activity is the example of Dynamic gesture. The proposed solution covers both the static and dynamic gestures for sign language recognition. Various sensors like accelerometer, electromyographic(SEMG), piezoresistive sensors are used to measure the hand gesture, orientation, and movement for analyse of dynamic gestures.

II.LITERATURE SURVEY

Nakul Nagpal, Dr. Arun Mitra, Dr. Pankaj Agrawal, "Design issue and proposed implementation of communication aid for deaf & dumb people", International Journal on Recent and Innovation Trends in Computing and Communication., vol. 3, issue. 5, pp. 431-433, May 2015

Hand gesture is one of the methods used in sign language for non-verbal communication. It is most commonly used by deaf & dumb people who have hearing or speech problems to communicate among themselves or with normal people. Various sign language systems had been developed by many makers around the world but they are neither flexible nor cost-effective for the end users. Hence, it is a software which presents a system prototype that is able to automatically recognize sign language to help deaf and dumb people to communicate more effectively with each other or normal people. Dumb people are usually deprived of normal communication with other people in the society, also normal people find it difficult to understand and communicate with them. These people have to rely on an interpreter or on some sort of visual communication. An interpreter wont be always available and visual communication is mostly difficult to understand. Sign Language is the primary means of communication in the deaf and dumb community. As a normal person is unaware of the grammar or meaning of various gestures that are part of a sign language, it is primarily limited to their families and/or deaf and dumb community. Sign language is the mode of communication which uses visual ways like expressions, hand gestures, and body movements to convey meaning. Sign language is extremely helpful for people who face difficulty with hearing or speaking. Sign language recognition refers to the conversion of these gestures into words or alphabets of existing formally spoken languages. Thus,

conversion of sign language into words by an algorithm or a model can help bridge the gap between people with hearing or speaking impairment and the rest of the world. Vision-based hand gesture recognition is an area of active current research in computer vision and machine learning. Being a natural way of human interaction, it is an area where many researchers are working on, with the goal of making human computer interaction (HCI) easier and natural, without the need for any extra devices. So, the primary goal of gesture recognition research is to create systems, which can identify specific human gestures and use them, for example, to convey information. For that, vision-based hand gesture interfaces require fast and extremely robust hand detection and gesture recognition in real time. Hand gestures are a powerful human communication modality with lots of potential applications and in this context we have sign language recognition, the communication method of deaf people.

Hand gesture recognition for human computer interaction is an area of active research in computer vision and machine learning. One of its primary goals is to create systems, which can identify specific gestures and use them to convey information or to control a device. Though, gestures need to be modelled in the spatial and temporal domains, where a hand posture is the static structure of the hand and a gesture is the dynamic movement of the hand. There are basically two types of approaches for hand gesture recognition: vision-based approaches and data glove approaches. This work main focus is on creating a vision-based system able to do real-time sign language recognition. The reason for choosing a system based on vision relates to the fact that it provides a simpler and more intuitive way of communication between a human and a computer. Being hand-pose one of the most important communication tools in humans daily life, and with the continuous advances of image and video processing techniques, research on human-machine interaction through gesture recognition led to the use of such technology in a very broad range of applications, like touch screens, video game consoles, virtual reality, medical applications, and sign language recognition. Although sign language is the most natural way of exchanging information among deaf people it has been observed that they are facing difficulties with normal people interaction. Sign language consists of

vocabulary of signs in exactly the same way as spoken language consists of a vocabulary of words. Sign languages are not standard and universal and the grammars differ from country to country.

Mathavan Suresh Anand, Nagarajan Mohan Kumar, Angappan Kumaresan, "An efficient framework for Indian sign language recognition using wavelet transform", Circuits and Systems.,vol. 7, pp. 1875-1883, June 2016.

Hand gesture recognition system is considered as a way for more intuitive and proficient human computer interaction tool. The range of applications includes virtual prototyping sign language analysis and medical training. In this paper, an efficient Indian Sign Language Recognition System (ISLR) is proposed for deaf and dump people using hand gesture images. The proposed ISLR system is considered as a pattern recognition technique that has two important modules: feature extraction and classification. The joint use of Discrete Wavelet Transform (DWT) based feature extraction and nearest neighbour classifier is used to recognize the sign language. The experimental results show that the proposed hand gesture recognition system achieves maximum 99.23% classification accuracy while using cosine distance classifier. The sign language is a fundamental communication tool among people who suffer hearing impairments. In recent years, many tools are designed for sign language recognition using human gestures particularly using hand gestures In this section, some recent techniques are reviewed. A new approach for hand gesture recognition is discussed in [1] for ISLR. It is composed of three stages: pre-processing, feature extraction and classification. At first, brightness and contrast of the captured images are adjusted in the pre-processing stage followed by RGB to gray scale conversion. Discrete Cosine Transform (DCT) features are extracted from the segmented skin region, where pixel-based or region based extraction method is used. Finally self organizing map based neural network classifier is employed for sign and numeral recognition. Wavelet transform based ISLR system is implemented in [2] using video sequences. In pre-processing the given RGB video is converted into gray colour space and high frequency noises are removed by Gaussian low pass filter. Then, segmentation is performed using canny edge detection, DWT and Otsu's thresholding. Elliptical

Fourier descriptors are employed for hand gesture feature extraction. Finally, sugeno type fuzzy inference system is used for hand gesture recognition by using extracted features. KNN search based sign language recognition is described in [3]. Initially, the given hand gesture image is transformed into gray colour space. Then, edge detection is performed using canny and the discontinuities among the edges are joined based on KNN classifier. Finally fuzzy rule set is used for sign recognition. Generic Cosine Descriptor (GCD) based Taiwanese sign language recognition is discussed in [4]. To extract hand shape representation, Generic Fourier Descriptor (GFD) is used as region based descriptor. GCD is generated by using DCT instead of DWT in GFD. Finally Euclidean distance classifier is exploited for sign language recognition. Arabic sign language recognition is reviewed in [5] by means of automatic gestures translation into manual alphabets. In the pre-processing stage, the video sequences are converted into video frames, then skin and background regions are differentiated. Edge detection is done for selected frame followed by feature vector calculation, where distance between the orientation points is calculated as feature vectors. Two different classifiers, namely minimum distance classifier and multilayer perceptron neural network classifier are employed for recognition. Adaptive Neuro Fuzzy Inference System (ANFIS) based Arabic sign language recognition system is implemented in [6] Initially, image denoising is performed using median filter and iterative thresholding is used to segment the hand gesture and then smoothed by Gaussian smoothing. Translation, scale, and rotation invariant gesture feature are extracted to train ANFIS for classification. Vision features based sign language recognition is designed in [7]. Three vision features are extracted from four components such as hand shape, place of articulation, hand orientation, and movement. To obtain features from hand configuration and hand orientation, kurtosis position and principal component analysis are employed. Hand movement is represented by motion chain code. Hidden Markov model classifier is used to recognize the corresponding sign language.

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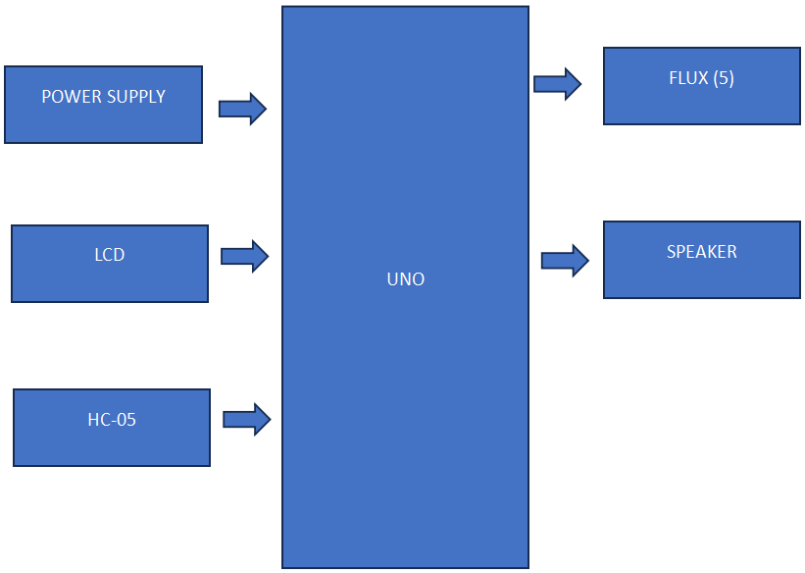
Block diagram



III.PROPOSED SYSTEM

The proposed system focuses on developing a Smart Mitten that assists individuals with hearing and speech impairments in communication by converting hand gestures into text or speech. This assistive device integrates various sensors and technologies, with the Arduino microcontroller at its core, to enhance interaction and facilitate effective communication. The **hardware components** of the smart mitten include an Arduino microcontroller, which acts as the central processing unit, handling data from various sensors. Flex sensors are embedded in the mitten to detect finger movements and hand gestures, translating these into actionable data. An accelerometer is included to track the hand's orientation and movements, improving gesture recognition accuracy. For communication, a Bluetooth module enables the mitten to connect wirelessly with smartphones or computers. Additionally, vibration motors are incorporated to provide tactile feedback to the user, alerting them to specific actions or responses. The system is powered by a battery pack or rechargeable battery.

On the **software side**, the Arduino is programmed to interpret signals from the sensors, recognize predefined gestures, and convert them into text or speech. A gesture recognition algorithm is used to process data from the sensors and identify different gestures, which can be based on machine learning or predefined mappings. The Bluetooth module facilitates communication with an external application, which receives the data, displays it as text, or converts it into speech.

Implementation involves integrating the sensors into the mitten and configuring the Arduino to process the sensor inputs. The Bluetooth module is set up to communicate with an associated application, which is developed to receive data from the mitten, display the corresponding text, or produce speech output. The system undergoes extensive testing and calibration to ensure accurate gesture recognition and reliable performance, with adjustments made to

improve sensor sensitivity and overall functionality.

In **operation**, when a user performs a gesture, the flex sensors and accelerometer detect and send this data to the Arduino. The Arduino processes the data using the gesture recognition algorithm and transmits the interpreted gesture via Bluetooth to the connected application. The application then displays the text or generates speech, facilitating effective communication between the user and others.

Overall, this smart mitten aims to provide a practical and intuitive solution for individuals with hearing and speech impairments, enhancing their ability to communicate and interact in everyday situations. The use of Arduino technology ensures that the system is both cost-effective and customizable, ultimately improving the quality of life for its users.

IV.CONCLUSION

A disable individual communicates using sign language, nad this system traslates those gestures into text and speech, facilitating seamless interaction. Smart gloves play a cuucial role in breaking down communication barries for people with disabilities, empowering them in their carrers and solutions this system is more reliable, efficient, user-friendly, and lightweight. It effectively connects speech-impaireed individuals with others, allowing them to express themselves through gestures.Additionally , the speech output can be customized to any language based on the user's preferences.

V.REFERENCES

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