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A Review Paper on Communicating Gloves

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Abstract:- Communication People with voice and hearing impairments and those without them frequently have communication problems. Although sign language is essential for persons with disabilities, it can be confusing for non-disabled individuals. Furthermore, disabled people frequently require ongoing help. We suggest using Internet of Things-based Smart Assistance Gloves for people with disabilities to address these problems. Compared to current solutions, our developed gloves provide a straightforward but efficient alternative. We recognize finger motions using flex sensors, and an Android app with voice output shows the correct instructions. Wireless serial port modules provide safe data transfer between the Arduino Uno and ESP modules, which are the two modules used in the implementation of the suggested system.

Keywords:- *Vocal, Hearing, Gloves, IOT, Communication, Flex Sensors, Wireless Serial Port Module, GSM.*

I. INTRODUCTION

Recent studies conducted in India have revealed that up to 2.4 million people have difficulty speaking and hearing. Individuals with impairments face challenges in their everyday communication, finding it difficult to connect with people and communicate their emotions. Despite the fact that people with disabilities frequently use sign language to communicate, it can be difficult for both them and people without disabilities to comprehend. Opinion expression and socialization are hampered by this communication barrier. People who are paralyzed experience comparable difficulties since they are unable to move or speak properly. Our invention of gloves provides a solution, allowing people with impairments to speak on their own. Our disability assistance glove is superior to current methods because to its quicker and more intelligent reaction time.

There are two types of gesture recognition systems: vision-based and data glove-based. Recognition based on vision.

II. LITERATURE SURVEY

Bend sensors, hall effect sensors, an accelerometer, and machine learning algorithms for gesture recognition are all part of the system described in reference [1]. The bend sensors' outputs are sent to an analog multiplexer (NXP Semiconductors' HEF4051B). In order to obtain values from various sensors one at a time and temporarily store them in an array, the CPU first sends signals to the multiplexer. Using a UART connection, the computer receives these stored values for additional processing and decoding. The process of obtaining data from the sensors for new motions and delivering them consecutively to the computer repeats again. A gesture is represented by a 14-tuple. Every cycle of the procedure detects a fresh gesture made by the user.

The Hidden Markov Model is employed in reference [2] to identify hand motions. They consider hands, fingers, and bones as distinct locations and motions, tracking and identifying them using a jump motion gadget. Finger direction is one of Leap Fingers' key characteristics. Certain motion gestures are recognized by the leap motion gadget. It makes use of a Raspberry Pi that has a speaker installed. Said words are translated into text using the Google API for Speech to Text conversion. After that, this text is transferred to the Raspberry Pi's TFT screen over Bluetooth for display. The transformed text may be accessed and shared over Bluetooth on the phone, and it is saved in the cloud. The information is received and displayed on the Raspberry Pi's TFT screen.

R. Senthil Kumar illustrated in reference [3] how the proposed paradigm helps paraplegic patients as well as deaf and dumb people. It has a speaker for vocal output and shows output commands on an Android app. Wireless serial port modules enable secure and quick data transfer. GSM notifies the specified person by alert message in an emergency. These data-based gloves simplify algorithms and lessen noise disturbances when compared to vision-based approaches.

Sambhav Jain and Sushanth D used an Intel Movidius Neural Compute Stick, a microphone, and a webcam in reference [4] to identify and track objects. Microcontrollers or processors with a powerful Graphics Processing Unit (GPU) can be used to increase the processing speed of video frames. In addition, the distance to the desired item can be determined using a camera equipped with a depth sensor. The problem of locating and approaching things in an interior setting is addressed by their suggested prototype. The glove is equipped with five micro-vibrating motors to achieve this.

Mahaveer Penna and Shivashankar demonstrated in reference [5] how a system functions by tilting a sensor that is placed on a crippled person's hand, enabling them to control gadgets. Tilting in different directions corresponds to distinct messages. This prototype encourages self-reliance by enabling the impaired person to walk around freely and transmit an alert message. For disabled people, the gesture-based home automation system is a useful tool in their everyday life.

A deafblind person's smart communication glove was introduced by Oliver Ozioko, William Taube, Marion Hersh, and Ravinder Dahiya in reference [6]. In order to improve deafblind people's access to information and communication technologies, a basic device was developed to aid in communication with mobile device users. This group of folks may be able to learn and play games with the smart glove they built. It's crucial to remember that the method they suggested is limited to the English alphabet, numerals, and frequently used special characters.

Abhijith Bhaskaran K and Anoop G Nair proposed a system in reference [7] that makes use of an IMU module, a Raspberry Pi, a voltage divider circuit, and an ADC in addition to five flex sensors. The hand's movements are tracked by the Berry IMU, which is mounted on the forearm. They also talked about the gloves' possible uses in the gaming business, for controlling robotic arms, for remote medical procedures, and as a support tool for people with cerebral palsy.

Shanthi D L, Keshava Prasanna, and colleagues developed a system in reference [8] with inexpensive hardware, specifically a Raspberry Pi and an MPR121 capacitive touch sensor module. People with disabilities can wear gloves with sensors that identify characters. A character waits if it is not pressed. Following recognition, the characters are processed and delivered to an Android application. With this program, an ordinary user can convert the text to speech. An SMS is sent to another user's chosen number when the glove's send button is touched.

Reference [9] describes a system developed by Santiago Aguiar, Andres Erazo, and Sebastian Romero that makes use of the CMU Sphinx tool to allow text-to-speech capabilities in a glove. They selected this instrument due of its low rate of mistake in voice recognition. The algorithm used is good at picking up on a speaker's words; it seldom makes mistakes when a hearing-impaired person speaks to a hearing-normal person.

A system containing five flex sensors, a 3-axis accelerometer, an Arduino Nano microcontroller, a 16*2 LCD display, a Bluetooth module, a buzzer, and an Android smartphone was proposed by Mr. Vishal P. Bhujbal and Dr. K.K. Warhade in reference [10]. The master and slave modes of this system are interchangeable. It receives data from Arduino over Bluetooth and converts it to voice using an Android app. The sensor data for the eight channels is array-stored when a particular hand gesture is made. After that, the algorithm contrasts this data with gesture templates that it has already saved. The buzzer beeps and the LCD panel displays the recognition results if a valid gesture is detected. Furthermore, the Android phone is used to play the matching voice.

Lorenzo Monti and Giovanni Delnevo developed a wearable gadget in reference [11] to facilitate communication between people who are deaf-blind and those who are not. One-to-one and one-to-many communication is made possible by the device. An Android app converts a message typed in the Malossi alphabet by a deaf-blind person wearing a glove into text. Tuple space is the name of the new component of the system. The client list is obtained and the client registration process is handled by the server in the same way. However, tuple space is now used for client-to-client communication rather than direct communication. Tuple space interaction takes the place of peer-to-peer communication in the same way that clients and servers interact.

Oliver Ozioko, Prakash Karipoth, Marion Hersh, and Ravinder Dahiya developed a novel method of communication for deafblind individuals in reference [12] by employing a customized tactile interface based on finger Braille. A module containing sensors and actuators that can detect and produce vibrations is part of this interface. They produced six of these gadgets, which they then assembled to provide deafblind people with a communication aid. The actuators could generate steady vibrations with input signals from 10Hz to 200Hz, and the sensors they made performed best under ordinary loading conditions at 2.5Hz. With a 150mA input, the highest vibration happened at 40Hz, which is within the human Pacinian corpuscle's sensory range.

In their study, Gunasekaran K and colleagues [13] presented a system that makes use of the data glove technique. Flex sensors in the system are used to identify finger motions, which are subsequently transmitted to a PIC microcontroller for processing. In order to generate a signal showing the orientation of hand movements, gyro sensors are also utilized. The PIC microcontroller recognizes the movements made by the user and plays the corresponding audio file for each gesture. The APR9600 is a single chip with a 40–60 second playing duration that is intended for non-volatile flash memory and high-quality voice recording. Multiple messages can be sent in a random or sequential fashion with APR9600, and designers can modify the storage duration to suit user requirements. Pre-recorded voice signals are essentially employed.

A glove design was created by Vajjarapu Lavanya and colleagues [14] utilizing a copper plate. Tiny metal strips are affixed to each of the five fingers of the glove. A copper plate is attached as the ground on the palm. A single ground plate is preferable over separate metal strips for the ground because it offers a greater contact surface and facilitates finger position identification. When the copper strips are at rest, they display a logic 1 voltage level. But when they come into contact with the ground plate, the corresponding voltage is drained, and they display a logic zero voltage level. The required gestures are formed during this process.

Pallavi Verma and associates [15] presented a system in their publication that uses a pair of gloves with flex sensors on each finger, thumb, and arm to record user movements. With the use of the voltage divider rule, the flex sensors allow the locations of the finger, thumb, and arm to be measured in voltage. Data from the flex sensors is converted from analog to digital format using a PIC microprocessor, among other uses. The digital data is then transmitted after being encoded using an encoder. The data is decoded by a decoder upon reception, and the gesture recognition system then compares the received data with data that has been preloaded. If a match is discovered, the voice section is used to communicate the information to a speaker.

Krishnamurthy Bhat and Chayalakshmi C.L. have developed an inexpensive way to help deaf and mute persons communicate better with speaking people in reference [16]. They used inexpensive technology, such as readily accessible Android phones and inexpensive, efficient flex sensors, to develop a glove. Text and spoken translation from sign language can be done with an Android app. They included Node MCU in order to keep it reasonably priced and wearable. This Android-based smart glove serves as a useful tool for bridging the communication gap between people who can and cannot talk. It functions as a "device to give voice to the voiceless," enabling deaf and mute people to communicate more effectively.

Five flex sensors, aluminum foil, and an Arduino UNO were used by Drs. Anupama H S and Usha B A in reference [17] to construct a subsystem made up of three separate components. These devices are used to detect rotational movement, finger bending, and finger contact. For implementation, the K-Nearest Neighbor (KNN) method was used. A PC makes up the output subsystem, which is USB-connected to the processing subsystem. Based on the output from the subsystem, the PC shows the text representation of the recognized alphabet or short phrase. A Google text-to-speech API is integrated to instantly translate the content that is shown into speech. Most of the English alphabet letters have been successfully identified by the established approach. It sticks out as a reasonably priced and easy-to-use gadget.

In reference [18], Nikhita Praveen and Naveen Karanth presented a smart glove as a test model to investigate the feasibility of using smart gloves for sign language recognition. This prototype conveys messages through body language, facial expressions, and hand gestures. The novel method makes use of a wearable smart glove that can decode sign language. An LED-LDR pair is located on each finger of the glove, which detects signing motions and transmits analog voltage to a microprocessor (MSP430G2553). The microcontroller uses ZigBee to wirelessly send the ASCII code of the indicated letter after converting these voltage values to digital samples. The associated audio plays and the computer displays the letter that corresponds to the ASCII code upon reception.

Drs. Akey Sungheetha and Rajesh Sharma R presented a proposed system in reference [19] that is intended to take pictures of people with disabilities and identify the hand movements they make. The model is an Augmentative and Alternative Communication (AAC) system designed specifically for hand gesture language. It consists of a bend sensor, microcontroller, and communication medium device. This AAC technique does, however, have certain drawbacks. The controlling unit plays a key role in controlling sensor output when it is connected to a smart glove via a microcontroller. Conversion devices that translate the bend sensor's voltage output into text for the detecting process are included into the controlling unit. Additionally, an Android version of the system with Bluetooth connection capabilities has been developed. This piece of software is essential for transforming text.

Alapati et al. conducted a study in reference [20] that examined the application of various flex sensors—such as conducting, optical, and capacitive ink variants—in a variety of fields, including geology, musical instruments, and human-machine interfaces. Flex sensors were used to detect landslides remotely and to create musical instruments that could be bent and deformed to produce sound. These sensors were also utilized to detect dents in steel panels. Hand gestures were an efficient way to communicate with machines thanks to the Human Machine Interface device.

III. CONCLUSION

In exploring diverse applications of sensor-based gloves, researchers have unveiled a spectrum of innovations catering to different user needs and disabilities. From bend sensors to accelerometers and machine learning algorithms, these systems embody a fusion of technology and human-centric design. Gesture recognition, speech conversion, and tactile feedback mechanisms empower users to communicate, navigate, and interact with their environment effectively. The integration of multiplexing techniques, microcontrollers, and wireless connectivity enhances the versatility and accessibility of these glove systems. Targeting specific user groups like the deaf-blind, paraplegic, and mute, these solutions exhibit a profound commitment to inclusivity and empowerment. Furthermore, the utilization of low-cost components and open-source platforms underscores a democratization of assistive technologies. Through continuous innovation and collaboration, these glove systems hold promise in revolutionizing communication and interaction paradigms for individuals with diverse abilities. Ultimately, they exemplify the transformative potential of technology in fostering independence, connectivity, and inclusion within our society.

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