EMBEDDED BASED HAND TALK ASSISTING SYSTEM FOR DUMB PEOPLE

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Abstract - Introducing an innovative approach towards assisting individuals with speech impairments, specifically targeting the deaf and mute community. The proposed system, entitled "Embedded Based Hand Talk Assisting System for Dumb People on Android Platform," leverages embedded technologies and the ubiquitous nature of Android devices to facilitate communication for those who rely predominantly on hand gestures for expression. The system comprises two primary components: a wearable embedded device equipped with sensors to capture hand movements and an Android application designed to interpret and translate these gestures into meaningful text or speech. By harnessing the power of embedded systems, the device can accurately recognize a wide array of hand gestures commonly used in sign language. Through the Android application interface, users can input gestures seamlessly, allowing for real-time translation into spoken language or text on the device screen. Additionally, the system incorporates features such as customizable dictionaries and learning modules to enhance its adaptability and user-friendliness. The project holds immense significance due to its ability to individuals encountering challenges in vocalization. By offering an efficient and easily accessible communication platform, it equips them with the tools to express themselves effectively. By bridging the gap between sign language and spoken language, this system opens up avenues for enhanced social interaction, education, and employment opportunities for the deaf and mute community
Keywords: Embedded Systems, Hand Gesture Recognition, Android Platform, Assistive Technology, Speech Impairment, Sign Language, Communication, Bluetooth Module

1 INTRODUCTION

Communication is fundamental to human interaction, serving as the cornerstone of social relationships, education, and professional endeavors. However, for individuals encountering challenges in vocalization, such as those who are deaf or mute, traditional modes of communication may pose significant challenges. In particular, the deaf and mute community often relies on sign language as their primary means of expression. While sign language is rich and expressive, it can present barriers to communication with those who are not proficient in its interpretation.

To address these challenges, we present a novel solution in the form of the "Embedded Based Hand Talk Assisting System for Dumb People on Android Platform." This project aims to empower individuals with speech impairments by providing them with a user-friendly and accessible tool for communication. By leveraging embedded technologies and the widespread adoption of Android devices, our system offers a practical and efficient means of bridging the gap between sign language and spoken language.

The core functionality of our system revolves around the recognition and interpretation of hand gestures, which are central to sign language communication. Through the integration of sensors, our system can accurately capture and translate a wide range of hand movements into spoken language or text. This real-time translation capability facilitates seamless communication between individuals with speech impairments and those who may not be proficient in sign language.

Furthermore, our system is designed with usability and versatility in mind. The wearable embedded device is lightweight and non-intrusive, allowing users to carry it comfortably throughout their daily activities. The accompanying Android application provides an intuitive interface for gesture input and offers additional features such as customizable dictionaries and learning modules to enhance user experience. The significance of this project lies in its potential to enhance the well-being of individuals facing speech impairments. By providing them with a reliable and accessible means of communication, our system empowers them to participate more fully in social interactions, educational settings, and professional environments. Moreover, through advocacy and fostering inclusiveness, our project actively supports the overarching aim of cultivating a society that embraces diversity and ensures equal opportunities for everyone, irrespective of their capabilities or challenges.

2 RELATED WORK

This method presents the development of a "SENSor Foto-Electrico Aplicado al movimien to de losdedos de las Manos," focusing on the application of a photoelectric sensor to detect finger movements. While this work is not directly related to sign language recognition, it provides valuable insights into sensor-based approaches for capturing hand movements, which are relevant to the development of gesture recognition systems. [1]

In this method, the authors describe an "Interprete de lenguaje design osenespañolmultid is c positivo," which translates to a multi-device Spanish sign language interpreter. This work explores the development of a system for interpreting sign language gestures using multiple devices. While the focus is on Spanish sign language, the principles and methodologies presented in this study can inform the design and implementation of gesture recognition systems for other sign languages.[3]

The authors present "Glove-Talk: A neural Network Interface Between a Data-Glove and a Speech Syntetizer." This study introduces a system that interfaces a data glove with a speech synthesizer, enabling users to generate speech output through hand gestures. Although the application differs from sign language recognition, it demonstrates the potential of gesture-based interfaces for communication. [5]

3 METHODOLOGY

1. Power Supply:
   - Power is supplied to the system through a Hi-Watt 9V Battery, ensuring continuous operation.

2. Flex Sensors:
- A simple flex sensor 4.5" in length. As the sensor is flexed, the resistance across the sensor increases.
- The resistance of the flex sensor changes when the metal pads are on the outside of the bend (text on inside of bend).

3. MEMS Accelerometer:
- The structure is suspended by polysilicon springs which allow it to deflect smoothly in any direction when subject to acceleration in the X, Y and/or Z axis.
- Deflection causes a change in capacitance between fixed plates and plates attached to the suspended structure.

4. Arduino Nano:
- The Arduino Nano operates on the ATmega328 SMD chip and boasts 14 digital input/output pins, with 6 available for PWM output. Additionally, it features 8 analog inputs, 1 UART (hardware serial port), a 16 MHz crystal oscillator, a USB connection, and a reset button.

5. Bluetooth Module:
- The HC-05 module serves as a user-friendly Bluetooth SPP (Serial Port Protocol) module, facilitating seamless establishment of wireless serial connections.
- With its versatile Master or Slave configuration options, the HC-05 Bluetooth Module offers an ideal solution for wireless communication needs.

6. Android Bluetooth App:
- It is an Android App which converts Text to Speech received from Arduino Nano through HC-05 Bluetooth Module.

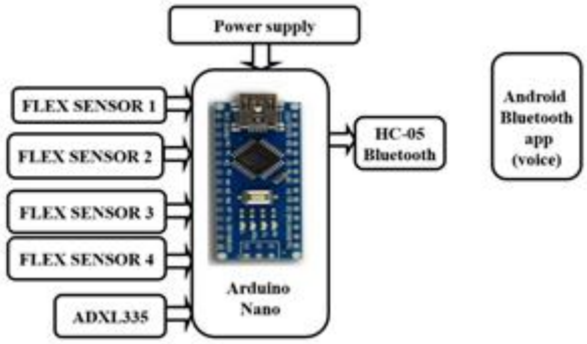

Fig 3.1 System Architecture

4 PROPOSED ARCHITECTURE

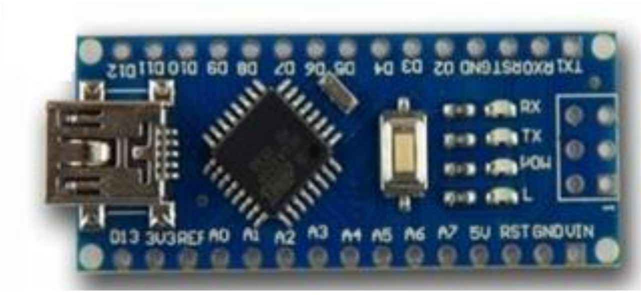

Fig. 4.1 Arduino Nano

- Arduino serves as the central control unit for the entire system.
- The glove integrates 4 Flex sensors, a MEMS sensor, and an HC-05 Bluetooth module, all interfaced with Arduino.
- These components are securely positioned on the glove, worn by the user.
- Through intuitive hand gestures, users communicate their requirements, such as water or food.
- Commands from Arduino are transmitted to the Bluetooth application via the HC-05 module, which vocalizes the commands and displays them as text.

Fig. 4.2 Flex Sensor

- Flex sensors, characterized by their resistive nature, exhibit variations in resistance when subjected to bending or flexing. Comprising a slender strip of pliable material, like a printed circuit board (PCB) or plastic film, they contain conductive components.
- The act of bending the sensor modifies the spacing between these conductive elements, thereby affecting the flow of electrical current within the sensor. This adjustment in resistance correlates directly with the magnitude of the bend, enabling precise detection and measurement of flexion.

5 RESULT AND DISCUSSION

This device has been developed where hand gestures are meticulously catalogued in a database, each associated with a specific message. This database is housed within the Arduino Nano, with motion sensors embedded in gloves to detect hand movements. When a gesture is performed, the motion sensors detect the corresponding acceleration and transmit the signal to the Arduino. In real-time, the Arduino matches this signal with entries in the database, retrieving the associated message. This message is then conveyed both as text and through speech output via a speaker.

Essentially, the system interprets hand gestures, retrieves their meanings from the database, and communicates them audibly.

The Gesture Vocalizer project was conceived as a solution to enhance communication accessibility for individuals experiencing physical disabilities. This innovative system allows users to wear a device on their hand, enabling them to articulate basic needs such as water, food, or medicine through simple hand movements. These gestures trigger vocalized responses, which are simultaneously displayed on an Android mobile device.

The following are some of the snapshots of different signs made and their results.

Fig. 5.1 Final prototype of the project

Fig. 5.2 Gesture made: I Need Emergency

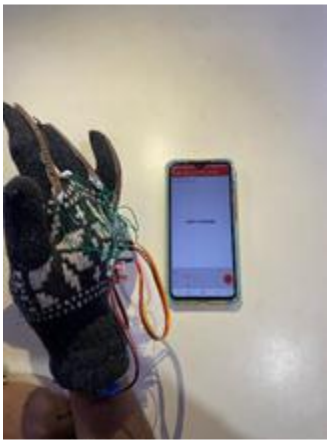

Fig. 5.3 Gesture made: I Need Medicine

Fig. 5.4 Gesture made: I Need Water

Fig. 5.5 Gesture made: I Need Food

6 CONCLUSIONS

This initiative has not only significantly improved the quality of life for individuals who face challenges with speech but also acts as a vital means of communication for those who are visually impaired, mute, or encounter difficulties in verbal expression. Through the development of an efficient gesture recognition system, the aim is to bridge the communication barrier between mute individuals and the wider community. This project serves as a prototype to evaluate the practicality of gesture recognition technology, with the overarching objective of empowering those without a voice and supporting individuals with hearing impairments. The implementation of this technique has yielded impressive results in terms of accuracy and cost-effectiveness.

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