Gesture Vocalizer For Paralyzed People

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Abstract- *This study introduces an innovative and budget-friendly portable gesture vocalizer system specifically designed to empower individuals with paralysis to express their essential needs and desires effectively. At the heart of this system is an Arduino microcontroller, which skillfully interprets finger gestures detected by flex sensors. When a gesture is recognized, the system activates pre-recorded audio responses that are stored on a DF Player Mini MP3 module. This functionality enables users to "speak" predetermined phrases simply by making hand movements, with the audio output delivered through a speaker.*

To further enhance the user experience, the system incorporates a 16x2 LCD display that provides real-time visual feedback, ensuring users can easily understand the system's responses. This groundbreaking solution not only offers a cost-effective and accessible alternative to traditional, expensive assistive communication technologies but also significantly enhances the independence and overall quality of life for individuals with physical disabilities. By bridging the communication gap, this system represents a meaningful advancement in assistive technology, fostering greater autonomy for its users.

Keywords- Microcontroller, Methodology, Flex Sensor, LCD Display and DF player mini.

I. INTRODUCTION

Effective communication is essential in contemporary society, as it underpins social, medical, and personal interactions. Nevertheless, individuals who suffer from paralysis or severe speech impairments frequently face considerable challenges in articulating their fundamental needs and emotions. In many developing countries, conventional assistive communication devices—such as eye-tracking systems or speech-generating tablets—are often too expensive, overly complex, or simply unavailable. Gesture-based communication systems offer a promising alternative to address these issues. These systems allow users to express specific intentions nonverbally through hand or finger movements that activate pre-defined messages. Flex sensors provide an efficient and rapid means of detecting these gestures, as they change their resistance when bent.

By integrating a microcontroller like Arduino with a voice playback module such as the DF Player Mini, it is feasible to develop a comprehensive gesture-to-voice system that is both affordable and straightforward in terms of hardware requirements.

The initiative titled "Gesture Vocalizer for Paralyzed" seeks to create a wearable communication device that utilizes flex sensors to detect finger movements, employs an Arduino for input processing, and includes a DF Player Mini module to playback pre-recorded audio messages. The goal is to design a compact, reliable, and cost-effective solution that empowers individuals with limited speech or motor abilities to regain their independence and dignity.

II. MICRO CONTROLLER

An open-source platform for creating electronics projects is Arduino. Arduino is made up of a physical programmable circuit board, also known as a microcontroller, and software called an IDE (Integrated Development Environment) that runs on your computer and is used to write and upload computer code to the board.

For good reason, the Arduino platform has grown in popularity among those who are new to electronics. In contrast to the majority of earlier programmable circuit boards, the Arduino can be updated with new code using a USB cable instead of a separate piece of hardware known as a programmer.

Furthermore, the Arduino IDE makes programming simpler by using a condensed version of C++. Last but not least, Arduino offers a standardized form factor that separates the microcontroller's functions into a more manageable package.

III. COMPONENTS AND DESIGN

A. FLEX SENSORS

A sensor that gauges the degree of deflection or bending is called a flex sensor or bend sensor. Typically, the sensor is adhered to the surface, and the surface is bent to change the resistance of the sensor element. It is used as a

goniometer and is also known as a flexible potentiometer because the resistance is directly proportional to the amount of bend.

Flex sensors are resistive parts that become more resistant when bent. To measure the amount of deflection, these sensors are affixed to the fingers. The playback system is controlled by particular gestures that are mapped to the variation in resistance.

The below figure 1, represents the bending of flex sensor

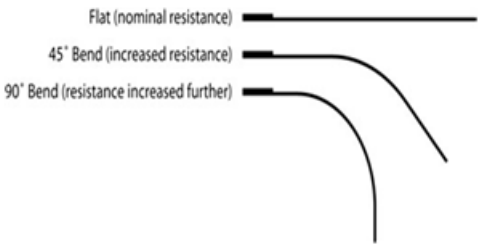

Figure 1: The bending of flex sensor

B. DF PLAYER MINI

A small MP3 playback module for embedded systems is the DF Player Mini. It has UART communication and can play music straight from a microSD card. It interfaces directly with a speaker and can operate separately or in conjunction with a microcontroller, like Arduino.

Compact and powerful, the DF Player Mini MP3 Player can be integrated into a variety of embedded systems and do-it yourself electronic projects, or it can be used as a stand-alone module by connecting the power, speaker, and buttons directly.

The below figure 2, represents the DF player mini

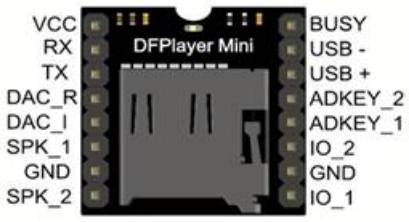

Figure 2: DF Player Mini

C. LCD DISPLAY

A 16x2 character LCD module displays gesture information and system status. Controlled via Arduino, the LCD provides textual feedback for each recognized gesture, improving user interaction and system transparency.

LCD 16×2 is a type of electronic device used to display data and messages. As the name implies, it has 16 columns and 2 rows, allowing it to display a total of 32 characters (16×2=32), each of which is composed of 5×8 (40) pixel dots. Therefore, 32 x 40 pixels can be used to calculate the total number of pixels in this LCD; otherwise, 1280 pixels.

The below figure 3, represents the lcd display

Figure 3: LCD Display

D. POWER SUPPLY

The system is portable for wearable applications because it can be powered by an external battery pack or a USB connection.

E. BLOCK DIAGRAM

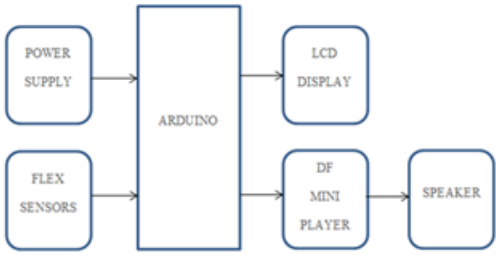

Figure 4: Block Diagram

F. SCHEMATIC DIAGRAM

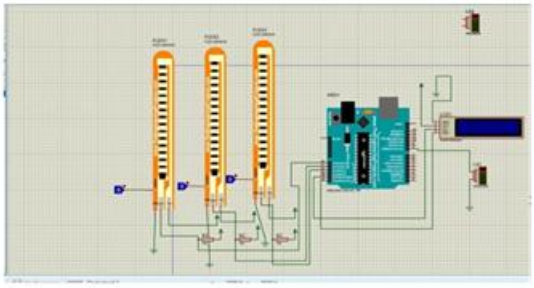

Figure 5: Schematic Diagram

IV. EXISTING PROJECT

The people who cannot hear and speak feel difficult to communicate. But these people are able to use the sign language for the communication. So there is a need to express their feelings in a better way using sign language. In this paper a model to convert hand gesture to text in the first part later the text is converted to the speech is proposed. With the usage of microcontroller based boards, flex sensor, Bluetooth modules and text to speech converters the communication can be improved in an effective manner. The proposed model is tested practically whether it is able to identify the different hand gestures and convert to speech. As text to speech conversion process is a preloaded trained program it can be used to convert the gesture text to different languages.

V. METHODOLOGY

Flex sensors, an Arduino microcontroller, a DF Player Mini MP3 module, and an LCD display are all used in the proposed Gesture Vocalizer system to translate finger gestures into vocal output. The system is being developed in phases, which include voice output generation, gesture mapping, and hardware integration.

A. SYSTEM ARCHITECTURE

The following are the main parts of the system:

Flex Sensors, These sensors, which are worn on the fingers, gauge how much the fingers bend. The degree of deflection affects each sensor's resistance, which is used to identify particular gestures. The Arduino Uno is the central processing unit that receives analog data from the flex sensors, decodes gestures using preset thresholds, and communicates with the LCD and DF Player Mini. The DF Player Mini is a small MP3 player that plugs into a speaker and plays voice responses that have been recorded and saved on a microSD card.

16x2 LCD Display, Provides users with visual feedback by displaying the name or category of the gesture that was performed.

B. GESTURE DETECTION

A distinct set of finger bends corresponds to each gesture. Flex sensors are calibrated to produce analog values that correspond to the various degrees of bending they detect. To determine which gestures are legitimate, the Arduino code compares these values to predefined threshold ranges.

C. VOICE OUTPUT

A particular MP3 file is played back by the Arduino when it recognizes a gesture and transmits a serial command to the DF Player Mini. Every file is associated with a word or phrase that reflects the user's intended message, such as "Thank you," "Help me," or "I need water."

D. DISPLAY FEEDBACK

To verify that the system has recognized the gesture, the LCD module simultaneously shows the name of the triggered message. This guarantees openness and assists caregivers in verifying the correspondence.

E. PROGRAMMING AND SOFTWARE TOOLS

EasyEDA:

EasyEDA is an easy-to-use desktop and web-based EDA tool for designing PCBs, schematics, electronic circuits, and 3D previews. It has a large library of components and SPICE simulation for smooth production. It provides cloud storage, cross-platform compatibility, and simple collaboration, making it perfect for both novices and experts.

ARDUINO IDE:

Code can be written, compiled, and uploaded to Arduino boards using the Arduino Integrated Development Environment (IDE). We mostly use a simplified version of C++ that is easy for beginners to learn while still utilizing its capabilities for more complex applications. With integrated libraries for smooth hardware integration, the IDE offers an easy-to-use interface

VI. RESULTS

An Arduino Uno, DF Player Mini, flex sensors, and a 16x2 LCD were used to successfully design, develop, and test the Gesture Vocalizer system. In a controlled setting, the system showed precise gesture recognition and real-time audio playback.

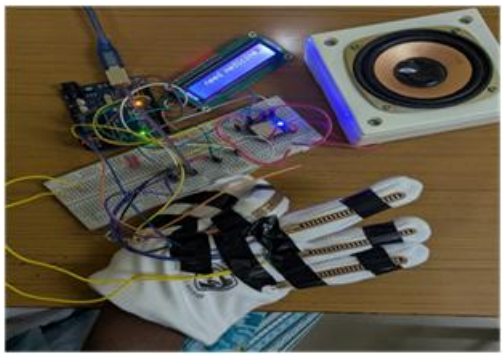

Figure 6: Gesture 1

Figure 7: Gesture 2

Figure 8: Gesture 3

Figure 9 : Output

VII. CONCLUSION & FUTURE SCOPE

For people with paralysis or speech impairments, the suggested Gesture Vocalizer system offers an affordable, portable, and easy- to-use communication tool. The system successfully closes the communication gap for users with limited motor functions by using flex sensors to detect simple finger gestures and the DF Player Mini to convert them into audible voice messages. Real-time gesture recognition and dependable voice output are made possible by the use of Arduino, which streamlines software development and hardware interface. Experiments revealed excellent user feedback, low response times, and high gesture recognition accuracy. The system is a flexible solution in the field of assistive technology since it can be tailored to meet the needs of various users. There is a lot of room for improvement and practical uses for the Gesture Vocalizer system. Future versions of the system could be improved by adding wireless communication modules like Bluetooth or Wi-Fi, which would enable caregivers to receive notifications remotely or integrate with smart home appliances. The accuracy and adaptability of gesture recognition could be increased by incorporating machine learning algorithms, which would allow the system to accommodate various users' hand movements and disabilities. The system might also be extended to accommodate more languages, which would enable it to be used in a variety of linguistic context.

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