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Hand Gesture-Based Speaking System for Mute People

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***Abstract*—-**People who cannot hear or speak find it difficult to communicate. But these people are able to use sign language for communication. So there is a need to express their feelings in a better way using sign language. In this paper, a model for converting hand gestures to speech. With the usage of a Node MCU, accelerometer, audio playback recorder, speaker. Human hand gestures captured and recognized provide an intelligent and convenient way for use in applications ranging from the humanmachine interface (HMI) and human-computer interaction (HCI) to deaf and dumb people. The wearable gloves are worn by the human hand to ensure that the sensors are accurately attached to the human joints for accurate measurement of joint movements of the human hands and fingers. The experimental results of hand gesture capture and recognition validate the efficacy of the proposed methods, and the results are uploaded to the cloud for ordinary people to interact with. This paper proposes a method for simplifying programming using visual sensors that detect human motions. A vocabulary of body and hand gestures is defined, allowing the movement of fingers in different directions and motions. An external controller application is used for the transformation between a normal person and a deaf or dumb person with the help of a speaker and LCD. The proposed model is tested practically to see if it can identify the different hand gestures and convert them to speech.

***Keywords – Pico Microcontroller*, Accelerometer, Audio Playback Recorder, Speaker, LCD, Power Supply.**

I. INTRODUCTION

Communication is an essential aspect of human life. However, individuals with speech disabilities, such as those who are mute, often face challenges communicating with others effectively. Sign language is an excellent communication method for mute individuals, but it is not universally understood and can be difficult to learn. The speaking system for mute people using hand gestures provides an alternative communication method that is intuitive, practical, and easy to use. It works by detecting and interpreting hand gestures through an accelerometer sensor, which are then translated into spoken words through an audio playback recorder. The system's various components, including the Pico microcontroller, LCD, speaker, voltage regulator, rectifier, and TF transformer, work together seamlessly to provide a reliable and accessible communication method for mute individuals.

II. RELATED WORK

Several existing communication aids are available for mute individuals, including electronic devices, text-to-speech systems, and sign language interpretation tools. Electronic communication devices, such as tablets and smartphones, can be customized with apps that enable communication through text, symbols, or images. Text-tospeech systems, on the other hand, translate typed or written text into spoken words, allowing mute individuals to communicate audibly. Sign language interpretation tools, such as video relay services and remote interpreting services, enable communication through sign language by providing access to interpreters via video or telephone. While these existing systems have proven to be effective in improving communication for mute individuals, they also have limitations. Electronic communication devices may not be accessible to all individuals due to their cost or lack of technical skills. Furthermore, these existing systems may not be intuitive or efficient, which can be a barrier to effective communication. For example, typing or selecting symbols on an electronic device can be time-consuming and may not be practical in fast-paced conversations. Similarly, sign language interpretation tools may not be practical in noisy or crowded settings. Therefore, there is a need for innovative and intuitive communication aids that are accessible and practical for all mute individuals. The speaking system for mute people using hand gestures is one such solution that has the potential to improve communication and reduce barriers to inclusion.

III. THE PROPOSED MECHANISM

The proposed speaking system for mute people using hand gestures is an innovative communication aid that addresses the limitations of existing systems. The system uses an accelerometer sensor to recognize hand gestures, which are then translated into spoken words through an audio playback recorder. The system's various components, including the ATmega328 microcontroller, LCD, speaker, voltage regulator, rectifier, and TF transformer, work together seamlessly to provide a reliable and efficient communication method. The speaking system for mute people using hand gestures is intuitive and practical, allowing mute individuals to communicate quickly and efficiently in various settings. By using hand gestures to translate spoken words, the system provides an accessible communication method that is widely applicable. The system's various components are readily available and cost-effective, making the speaking system for mute people using hand gestures an affordable solution that can be used in a range of settings. The proposed system has several advantages over existing communication aids, including its intuitive and practical design, its accessibility, and its cost-effectiveness. The speaking system for mute people using hand gestures has several potential applications in education, healthcare, workplaces, and social settings. The system can assist mute individuals in participating in classroom activities, communicating with healthcare providers, performing job duties, and socializing with friends and family. The proposed system has the potential to improve the quality of life for mute individuals and reduce barriers to communication and inclusion.

IV. HARDWARE IMPLEMENTATION

Raspberry Pi Foundation is well known for its series of single-board computers (Raspberry Pi series). But in January 2021 they launched their first micro-controller board known as Raspberry Pi Pico. It is built around the RP2040 Soc, a very fast yet cost-effective microcontroller chip packed with a dual-core ARM Cortex-M0+ processor. M0+ is one of the most power-efficient ARM processors. Raspberry Pi Pico is a low-cost but flexible RP2040 development platform officially designed by Raspberry Pi. It is a wireless upgrade version of Raspberry Pi Pico.

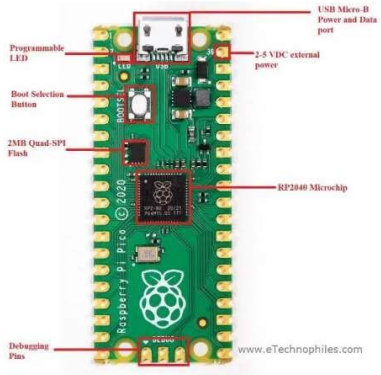

Figure 1. Raspberry Pi Pico

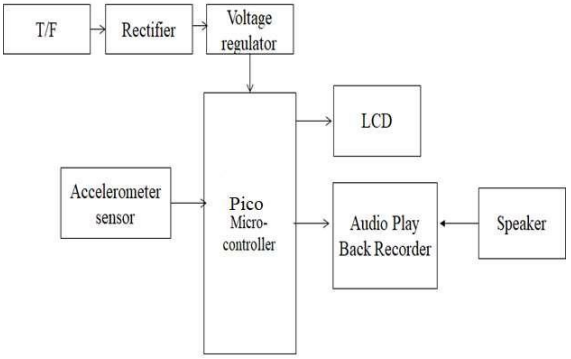

Figure 2. Block Diagram of Speaking System

In this the Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts. A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground. The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts. For ICs, microcontroller, LCD 5 volts, For alarm circuit, op-amp, relay circuits 12 volts.

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid 22 crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as pre-set words, digits, and 7-segment displays as in a digital clock.The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in batterypowered electronic equipment.

Figure 3. LCD Display

Figure 4. Audio playback recorder

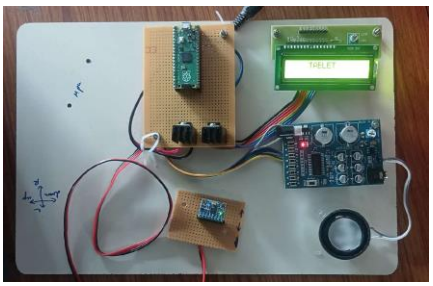

Figure 5. Hardware Kit

V. CONCLUSION

A smart speaking system for speech-impaired people is designed and implemented with some common gestures. Each gesture specifies basic needs such as "Water," "Food", "Tablet", and "Help". When compared to other proposed systems, this system is more user-friendly, lightweight, efficient, and reliable. It minimizes the communication problem as the output is in the form of speech, which is easily understood by others. This system will assist speechless people in expressing their needs using gestures. This project is aiming to fulfill the communication gap between these people and the normal ones. The system has various components, including the Raspberry Pi Pico, LCD, speaker, voltage regulator, rectifier, and TF transformer, work together seamlessly to provide a reliable and accessible communication method for mute individuals. It works by detecting and interpreting hand gestures through an accelerometer sensor, which are then translated into spoken words through an audio playback recorder. The accelerometer is of 4 axes, so it is very accurate for very small movement also. If a speechless person is hungry, he/she will do some movement with their hand containing accelerometer sensor and it will convert it into speech through audio playback recorder, then it will send these spoken words to speaker. The system provides a reliable, effective, and simple yet important solution to various issues faced by mute peoples when they are communicating with others.

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