JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Hand Gesture Recognition System for Dumb and Deaf People

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Abstract : Considerable progress has been made in recent years with the development of Handheld Gesture Recognition (HGR) technology, whose success is due in large part to the seamless integration of mechanical systems Physical gesture with ground a it seems in reality has emerged as a common and natural way of communicating between humans and personal computers. By recognizing the potential of this form of communication, our project aims to pioneer a sophisticated design. This algorithm is not only dedicated to identifying moving hands; Instead, it wants to understand, explain, and even simulate the complexities of human emotions. The cornerstone of this effort is the use of Computer Vision (CV), a revolutionary project that allows machines to derive higher levels of understanding from visual information in our case, CV is a gesture recognition technology. The system analyzes these gestures through the lens of a camera that captures the live image and makes decisions based on complex algorithms that are fine-tuned to recognize subtle human details. In today's connected world, effective communication is a basic need for everyone. However, individuals with hearing and speech impairments face unique challenges in expressing their thoughts and feelings. Recognizing this communication gap, our work takes bold steps towards inclusion We envision new programs that act as a bridge between sign language, Deaf and Deaf community communication in particular, and the word a they swear This pioneering program aims to empower individuals by providing them with a fluid and expressive way to engage with the wider community.

I.INTRODUCTION

The challenges faced by visually and hearing-impaired individuals in a heterogeneous and densely populated society like India highlights the importance of innovative communication solutions. With an estimated 40 million visually impaired and 242 million hearing impaired while able to speak, the need for effective communication tools is paramount Sign language emerges as an option especially through which these individuals can interact with the wider community. However, the complexity of sign language presents challenges, and comprehensive planning is required. To address this communication gap, our system has introduced a state-of-the-art system, optimized with a combination of computer technology and cameras. This system boasts a sophisticated algorithm developed in Python, harnessing the power of visualization to better recognize and interpret sign language gestures This technological innovation is not only a communication aid but a proof-of-concept that we are committed to allowing everyone to speak their mind in society. This issue extends beyond communication barriers and includes education for individuals with visual impairments. Strategies designed to meet the unique needs of blind students are needed, echoing the sentiments of Louis Braille who emphasized access to communication if access to knowledge, only 12.3 million people in India suffer from hearing loss differed from Although, an important underprivileged group is still finding innovative solutions to foster conversations between those who can't speak and don't listen and their peers. Among the many solutions, a standout initiative is an interactive translation system for deaf and dumb people. Equipped with flex sensors, tactile sensors and accelerometers, the device aims to prevent communication gaps by translating gestures. The inclusion of an Arduino for gestures and Text-to-Speech (TTS) blocks for translation underscores the commitment to building complete communication solutions. Although traditional devices such as Braille and advancements such as Braille technology for smartphones is available through with their unique challenges The existing landscape of the s It is limited. In this context, our work stands as a beacon of innovation, seeking not only to break communication barriers but also to empower people with disabilities through advanced technology. It embodies the belief that everyone should find a way to communicate effectively regardless of their abilities, creating a picture of a more inclusive and empathetic society

II. LITERATURE SURVEY

[1]The literature review by B. Rajapandian, V. Harini, D. Raksha and V. Sangeet brings to light the severe challenges faced by people with disabilities, especially the deaf and dumb, in communication. Communication has been identified as an important way to share ideas and messages, but individuals who are deaf or hard of hearing have greater difficulty communicating effectively the study highlights the common issue of social isolation highlighting their independence from individuals with disabilities, highlighting the profound impact of communication barriers on their everyday souls. Traditional communication methods such as sign language or text-to-speech are recognized as valuable but not universally applicable or fully effective for individuals with specific disabilities Furthermore, the literature review examines broader social issues, recommending the recognition of disability as an equality issue. The authors emphasize the importance of social awareness, understanding and inclusion to meet the unique challenges faced by individuals with different abilities in response to these challenges, proposed work introduces a new system model that uses portable technology and Arduino circuit boards. This innovative approach seeks to deliver technologically advanced and practical solutions, aimed at facilitating communication between individuals with visual, hearing and speech impairments Not as a business not only addresses immediate communication challenges but promises to enhance the overall quality of life of individuals with disabilities.

[2] For Speech-to-Text conversion, this algorithm uses MFCC for feature extraction and HMM as recognition method. Fifty audio files are captured and analysed in the speech database, generating feature vectors. These factors were originally modelled in the HMM. The test word utterance is then processed through the new algorithm of the HMM. The simulation results clearly show that an average recognition rate of 87.6% is achieved in five countries (N=5), indicating high accuracy compared to other national systems It is worth mentioning that too many states may lead to insufficient detection per state during model training, which may deteriorate system performance and therefore the number of states selected in the HMM is an important factor in recognition accuracy This work highlights the increased accuracy and reliability of the system performance by incorporating endpoint detection.

[3] The Deaf and Mute Communication Program uses the use of sign language, communicating through hand and finger signs, to communicate with individuals with hearing and speech disabilities who do not face these challenges. The main goal of this program is to develop a device that facilitates two-way communication without the need for an interpreter. The system has two main features: hand signal recognition and speech recognition. In the hand signal recognition phase, a web browser is used for image recognition, connected to a microcontroller unit, a display device connected to the controller, and a Bluetooth module These system devices can interpret hand gestures and signals. On the other hand, the speech recognition component deals with digitized signals, using mathematical models and matching techniques for recognition Speech recognition is embedded in an easy-to-consume Android application process, ensuring a complete communication solution. The implementation of this design on mobile and embedded platforms is made possible by high performance and energy efficiency ARM Cortex A8 Processor board Image classification in the hand gesture recognition section is implemented by necklace classification, when a 1-D Hidden Markov Model (HMM) is used for language change r -Includes communications (HCIs), robotic controls, and home automation.

[4] Sign language plays an important role in facilitating communication for the deaf, posing a challenge when communicating with those who do not know sign language. Often, deaf individuals struggle to get their message across, especially in an emergency situation when immediate communication is needed. To address this issue, sign language is converted into audible human voice. There are two main methods for recognizing hand movements or gestures: vision-based and vision-based methods. The vision-based approach uses a camera to recognize gestures, while the nonvisual approach uses sensors. This work takes a non-vision-based approach. Considering that many deaf individuals are also deaf, the system not only translates their sign language into the language they hear, but it is also capable of converting the utterances of ordinary people into sign language In emergency situations the system automatically sends messages to deaf relatives or friends

[5] Sign Language provides information by using hand gestures and other body parts for projecting thoughts and meanings. This paper presents an SMS generator designed for the deaf using Indian Sign Language in particular. There are three main tools in the system:

[6] View interface has been improved to make it easier for the user to insert icon sequences.

[7] Language translator to perform sequences of words in sign language to English for SMS communication.

[8] System for translating SMS messages into speech.

[9] The use of graphics enables users to describe a series of symbols through a variety of tasks, providing effective communication for individuals who are deaf An animation module has been added for playing the sign actions through the GIF file.

III. PROPOSED SYSTEM

This program is specifically designed for individuals who are deaf and hard of hearing. Users' gestures will be recorded with the camera and transmitted to the controller. The controller is equipped with existing graphics corresponding to the output of a particular gesture. Once an image has been captured, the system will analyze it and compare it with the stored data to determine matching gesture results. This approach ensures that gestures are correctly recognized and interpreted, facilitating simple communication for individuals with speech and hearing impairments.

The main purpose of the system is to help the deaf and dumb communicate, removing communication barriers between the disabled and the general public, in addition to the need for interpreters, the device is a valuable tool for teaching sign language to nondisabled individuals. It allows spoken answers to be converted into visual text for the deaf and dumb through an Android application. The device also finds applications in various industries such as human-computer interactions (HCIs) and home automation. The process of manual detection module requires the use of a camera module directly connected to the controller board which is used prior to performing steps including skin colour removal, amplitude reduction by blurring so, RGB to binary conversion, and edge detection.

Then, after obtaining the contour, calculating the centroid, identifying the rudder and fault point, feature extraction is performed to give the final numerical value of the number of fingerprint recognition fingerprints by matching it with the database created in training phase in the 19th century. Key features performed during preprocessing include skin colour removal, image blur for amplitude reduction, pixel value smoothing, RGB to binary conversion (thresholding), and edge detection Blurring is a sketch of an amplitude reduction function aimed at reducing noise, achieved by applying a filter to the signal. Commonly used types of filters include linear filters, where the value of the output pixel is the input pixel values weighted using a kernel of coefficients The kernel acts as a window with the coefficients leading to the image in smoothing process the inside.

The sophisticated design of the handwriting recognition module enhances its ability to seamlessly capture and interpret gestures in real time. Intricately connected to the controller panel, the camera module captures intricate hand movement details, ensures accuracy in gesture recognition Skin colour extraction, blur for dimension reduction, binary transform and RGB together help with image refinement and separation of objects need : it will. Then there are complex steps in the feature extraction process, including contour acquisition, centre point calculation, hull and fault point identification These steps together contribute to a numerical value that accurately represents the number and configuration of fingerprints. The enhanced database in the training phase plays an important role in high fingerprint recognition accuracy.

Beyond its initial application for the deaf and dumb, this versatile system finds applications in human-computer interfaces (HCIs) and home automation, demonstrating its ability to influence a variety of technical issues The adaptability and multitasking of the device not only differently abled It positions itself as a transformational tool for but also for a population seeking innovative solutions for communication, learning and communication

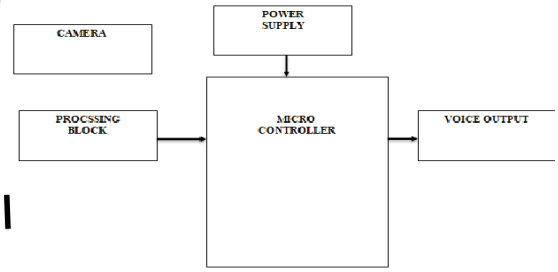


Fig.1(a) Functional pattern of Hardware unit

This program is designed specifically for individuals who are deaf and hard of hearing. The camera captures the user's gestures and sends them to the controller, containing pre-defined images that correspond to specific behaviors. After capturing an image, the system analyses it, compares it to the stored data, and displays matching manual results. This approach ensures accurate gestural recognition and interpretation, facilitating seamless communication for those with speech and hearing impairments

The main purpose of this program is to break down communication barriers for deaf and dumb types, eliminating unnecessary interpreters. In addition, this device is a valuable tool for teaching sign language to individuals without disabilities.

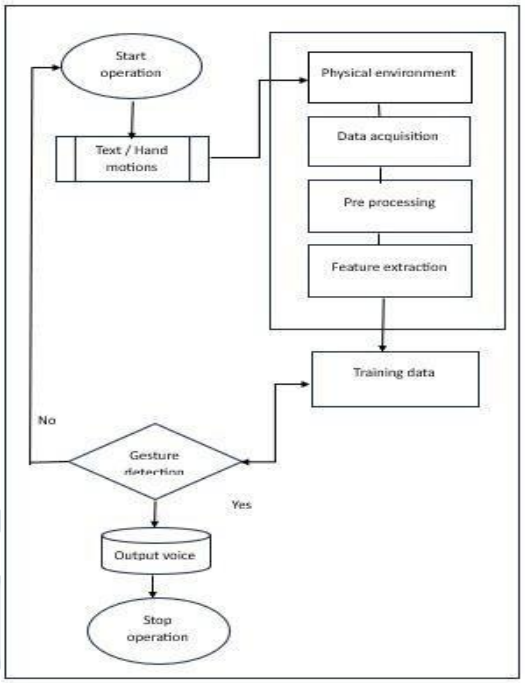
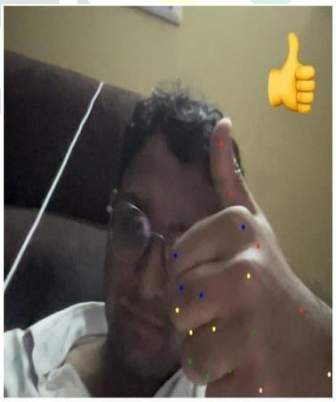


Fig. 1(b) Functional Flowchart of Hardware Unit

IV. RESULT AND DISCUSSION

The gesture recognition system described in this work shows considerable progress in recent years, demonstrating its effectiveness in coordinating devices Physical gestures have become a common method a it is used to communicate between humans and personal computers in a virtual realm. The project focuses on developing an algorithm that can recognize, interpret, manipulate and simulate human gestures, using advanced computing to create humanized digital interactions Applications using computer vision (CV) for gesture recognition represent a remarkable development. A real-time image captured by the camera is generated for gesture analysis, allowing the system to make real- time decisions and recognize gestures. This technology has great potential to improve communication in today's connected world.



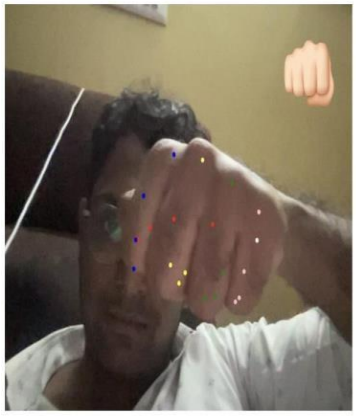
Left Hand

Idx	Finger	Curl	Direction
0	Thumb	No Curl	Diagonal Up Right
1	Index	Half Curl	Diagonal Up Right
2	Middle	Full Curl	Diagonal Up Right
3	Ring	Full Curl	Diagonal Up Right
4	Pinky	Half Curl	Diagonal Up Right

Right Hand

Idx	Finger	Curl	Direction
0	Thumb	No Curl	Diagonal Up Left
1	Index	Full Curl	Horizontal Left
2	Middle	Full Curl	Horizontal Left
3	Ring	Full Curl	Horizontal Left
4	Pinky	Full Curl	Horizontal Left

Fig.2(a) Detection of hand gesture 1



Left Hand

Idx	Finger	Curl	Direction
0	Thumb	No Curl	Vertical Down
1	Index	Full Curl	Vertical Down
2	Middle	Full Curl	Vertical Down
3	Ring	Full Curl	Diagonal Down Left
4	Pinky	Half Curl	Diagonal Down Left

Right Hand

Idx	Finger	Curl	Direction
0	Thumb	No Curl	Horizontal Left
1	Index	Half Curl	Horizontal Left
2	Middle	Full Curl	Horizontal Left
3	Ring	Full Curl	Horizontal Left
4	Pinky	Full Curl	Horizontal Left

Fig.2(b) Detection of hand gesture 2

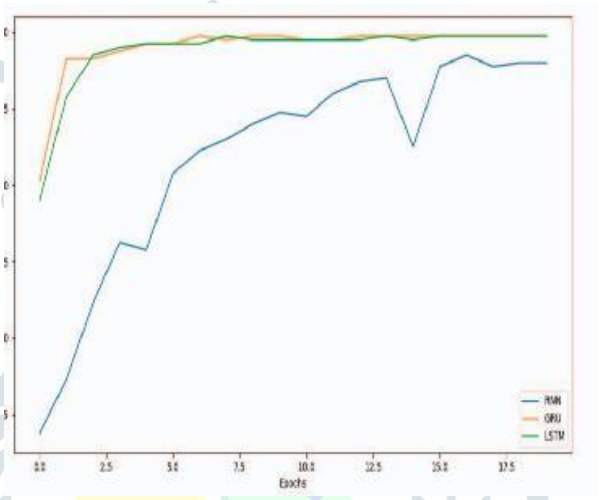


Fig.2(c) Accuracy

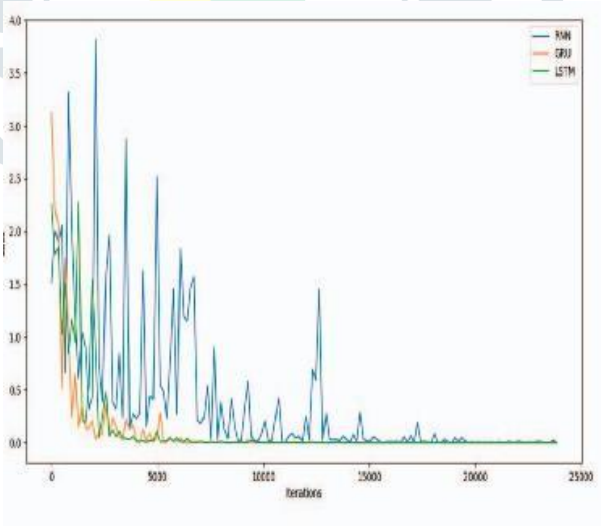


Fig.2 (d) Training Loss

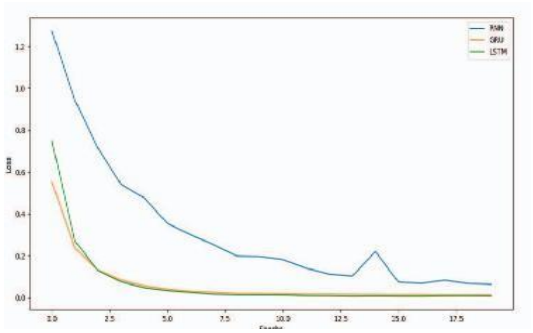


Fig. 2(e) Test Loss

V. CONCLUSION

This work includes hands-on detection using a Raspberry Pi controller. Sign language is the primary means of communication for individuals with hearing and speech impairments. Many of these physically disabled people rely on sign language interpreters, which makes them uncomfortable. To address this, we developed a system that is able to recognize the body language and gestures of deaf individuals. The handwriting recognition system is implemented using an ARM Cortex development board. Its purpose is to identify the sign language used by deaf and mute people, so that messages can be delivered to individuals without distorting this format in many applications, such as assisting deaf individuals with muteness and how they function as a tool for learning sign language.

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