SIGN LANGUAGE TRANSCRIPTION: SMART GLOVE ASSISTANT FOR PHYSICALLY IMPAIRED

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Abstract: The main objective of the paper is to provide an assistive device for the Speech and Hearing (physically) impaired by converting sign to speech using IOT, which lowers the communication gap between the subject and the normal people. The device also helps the subject to handle the emergency situation by notifying the guardian. The Smart Gloves assists the physically impaired to operate the home appliance such as light. The Smart Glove provides accurate results and detects the gestures with good accuracy.

Index Terms: Sign Language, Assistive Device, Speech and Hearing (physically) Impaired, IOT, Audio Play Record (APR), Arduino UNO, Android Application, Emergency Notification, Home Appliances.

I. INTRODUCTION
The biggest challenge faced by deaf and mute people is to communicate with normal people. Sign language is a language through which communication is possible without the means of acoustic sounds. Sign language relies on sign patterns, i.e., body language, orientation and movements of the fingers to facilitate understanding between the people. In all around the world about 600 million people are deaf and mute. To fill the communication gap between mute and normal people we have introduced a Smart Glove connected with flex sensors for the Physically Impaired which act as an Assistive device by converting “Sign to Speech” using IOT which reduces the communication gap between the normal people and disabled people. The device converts sign to speech with the help of flex sensors. The system is capable of detecting gestures with good accuracy. There is an emergency input sign which is given by the subject i.e. Speech and Hearing (physically) Impaired, if the person is stuck in some emergency situation where he/she is not able to speak or ask help, at that point of time the subject can give the sign from the flex sensor glove and the guardian gets a message through GSM which is then converted to speech and the guardian can even track the location of the subjects through GPS and find whether the subject is in any problem or not. The Smart Gloves can also be used by Physically Impaired to control the Home Appliance such as light.

II. RELATED WORKS
Komal Vede, Priyanka Vanjare, Pradnya Gaikwad [1] Autonomous Gesture Reorganization system that converts sign language to speech with the help of variety of sensors like flex sensor, Gyroscope & accelerometer in order to successfully determine the position & orientation of the hand gesture. This system also aims at integrating the results of the sensors with a smart phone that map the sensor reading to a corresponding sign which is stored in a data base.

T. Yamunarani and G. Kanimozhi [2] Processing and classifying hand gestures in the Vision based techniques. The system consists of mainly four processes i.e. Image acquisition, Image pre-processing, Feature extraction and Image classification.

Shahrukh Javed, Ghousia Banu S, J Aarthi Suganthi Kani and Ateequeur Rahman [3] The gloves could be used to control a robotic arm with incorporation of haptic feedback, the glove -robotic arm interface could also be used in bomb diffusion.

K. V. Fale, Akshay Phalke, Pratik Chaudhari, Pradeep Jadhav [4] In order to improve and facilitate the more gesture recognition, motion processing unit can be installed which comprises of Gyroscope as well and with the help sensor fusion technique to accommodate a number of other gestures as well for better and efficient communication.

Ashvini Butte, Sarita Jadhav, Sayali Meher [5] The system consists of designing and building up an intelligent system using image processing, machine learning and artificial intelligence concepts to take visual inputs of sign language’s hand gestures and generate easily recognizable form of outputs.
III. METHODOLOGY:

A gesture in a sign language which can be defined as a movement of part of the body, mainly hand, fingers or the head, to express an idea or meaning. Facial expressions also count toward the gesture, at the same time. There are more than hundred sign languages in the world today for example the American Sign Language (ASL), the British Sign Language (BSL), International Sign Language and so on. Research have been done on Sign Language detection and techniques to convert sign to text by using American Sign Language and International Sign Languages which uses English alphabets as an input.

Many people around the world are not familiar to English language, which is less accurate which acts as barrier for the application of the system. To fill the communication gap between mute and normal people we have introduced a Smart Glove connected with flex sensors for the Physically Impaired which act as an Assistive device by converting “Sign to Speech” using IOT which reduces the communication gap between the normal people and disabled people. The device converts sign to speech with the help of flex sensors.

Therefore the Figure 1 shows how a specific voice message is pre-recorded for a specific sign input given by the subject using flex sensor glove and is stored using Audio Play Record APR module and is played when that particular input message is requested by the subject in-order to communicate with the other people using the speakers which makes the device more accurate and user friendly.

PROPOSED SYSTEM

![Fig. 2: Proposed System](image-url)
Figure 2 depicts the proposed system which fills the communication gap by converting sign to speech using Smart Glove Recognition System for Physically Impaired using IOT, where the subjects can give the input in two different modes i.e. if the subjects is at home then the system act as an indoor mode, and when the subjects is outside then the system act as an outdoor mode, the inputs are specific with respect to the modes. The main aim is to design and set up a system for speech and hearing impaired which lowers the communication gap between them and normal people using Internet Of Things. The system even consists of Emergency input which is given by the subjects, in case if the subjects is in chaos, where the emergency notification is sent to the guardian in speech form, irrespective of silent, vibrate or general mode of the mobile phone. Once the emergency signal is sent, the guardian can track the location of the subject through the GPS and can also request image of the subject’s surrounding using the android application. The Physically Impaired can even operate the home appliance such as lights with the help of the Smart Glove.

The proposed system consists of the following Objectives:

- Lower the barriers in communication of deaf and dumb people.
- Easy understanding of mute communication by common people without the knowledge of sign language using wireless data gloves fitted with the flex sensors.
- Eliminate the middle men who generally act as a medium of translation.
- Handle emergency situations of the deaf and mute by tracing their location and notify the guardian in speech form, irrespective of silent, vibrate or general mode of the mobile phone.

IV. SYSTEM ARCHITECTURE

Figure 3 depicts the system architecture of the proposed system. The flex sensor smart glove assistive device is worn by subject i.e speech and hearing (physically) impaired who are not able to communicate in continuous stream. Sign language is a language through which communication is possible without the means of acoustic sounds which is difficult to understand by the common people so in order to convert sign to speech this system is proposed. This device is designed keeping in the mind of all types of speech and hearing impaired (i.e disabled and also old age people).

The flex sensor’s analog input data generated by the bend which causes the variation in the resistance are sent to Analog to Digital Converter (ADC) of the Arduino UNO where analog signals are converted to digital signals which is then processed by the microcontroller Arduino UNO. Arduino UNO is provided with a 12v power supply that is then regulated by the voltage regulator to 5v. After conversion of analog to digital input if the input has reached the pre-set threshold resistance value then the Arduino UNO takes the necessary action required for the given input.

Here the input can be given in two modes, i.e indoor mode and outdoor mode, switching between modes is done through a switch.

- In the indoor mode the subject can give 4 inputs, they are
  - Input 1: I’m feeling sick call doctor
  - Input 2: Need Tablets?
  - Input 4: Indoor Emergency.
In the outdoor mode also the subject can give 5 inputs, they are:

Input 1: Where is the Washroom?
Input 2: Where is the near by bus stop?
Input 3: Can I get water to drink.
Input 4: Outdoor Emergency.

The sign to speech conversion of the given input here is based on the principle sign language transcription i.e. the respective voice message for the corresponding sign input is prerecorded using Audio Play Record (APR) module and is played through the speakers. If the processed input is operating the electronic appliances then relay acts as a switch to control the appliance such as light. If the processed input is emergency then handling emergency situations of the physically impaired by the guardians is through using an android mobile application.

The notification is sent to the guardian in the form of speech through their mobile speakers, irrespective of silent, vibrate or general mode of the mobile phone using GSM module. In case of outdoor emergency the guardian can then request for the image and the location of the subject where the image is captured through the subject’s mobile camera and the location is traced using GPS module and is sent to the guardian through the android mobile application.

V. Data Flow Diagram

![Data Flow Diagram](image)

Figure 4 depicts the data flow diagram of the proposed system. The system consists of three important phases namely: data collection, data computation and the action taken. The data collected by flex sensors are sent to the Analog to Digital Converter (ADC) of the Arduino UNO where analog signals are converted to digital signals and are then processed by the micro-controller Arduino UNO. If the processed input is a message to be conveyed to the guardian in indoor mode or emergency then notifying the guardian in the speech form through their mobile speakers, irrespective of silent, vibrate or general mode of the mobile phone using GSM module and handling emergency situations of the physically impaired by tracing their location using GPS module and capturing images by the camera of the mobile at the time of emergency else if the processed input is a message conveyed to the outsiders then the respective voice message is played through the Audio Play Record module (APR) using speaker with the conversion of sign to speech. Else if the input is switching of home appliance such as light Switching on/off the lights according to the input. Else the sensor collects the data again from the subject and the cycle is repeated.
VI. RESULTS

Fig. 5: Android Application for Guardian

Fig. 6: Location of the Subject accessed by the Guardian

Fig. 7: Photo of the Subject’s surrounding accessed by the Guardian

Figure 5 depicts the application accessed by the guardian when the subject gives the Emergency sign, Figure 6 shows the location of the subject when he/she is in emergency situation and the emergency message for the guardian is sent in speech form, irrespective of silent, vibrate or general mode of the mobile phone and the Figure 7 depicts the image captured by the subject’s mobile when the photo request is sent by the guardian to the subject’s application and the captured image is sent to the guardians mail id.
Figure 8 shows the android application used by the physically impaired Figure 9 shows the output displayed on LCD, where the input sign given by the subject is simultaneously displayed on LCD and is played through the speaker. This makes the system more accurate and user friendly.

VII. CONCLUSION

Sign language is an expressive and natural way for the deaf and mute (physically impaired) people to communicate with other normal people. The project provides a feasible smart glove which gives a real time gesture recognition system which can be operated in two modes i.e indoor and outdoor modes using a switch by converting sign to speech for physically impaired people and to lower the communication gap between the mute community and the standard world. At the time of emergency handling the message can be sent to the guardian and they can know the location of the subject through GPS and also request for the image of the subject using IoT, where in immediate action can be taken by the guardian. The gloves can also be used for operating household electronic devices such as light.

REFERENCES

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