Sign O Speech Automata

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ABSTRACT

This paper reveals an innovative idea of a two-way system to convert sign language into speech and vice versa, with tools and technology that has characteristics of increasing adaptability to enhance its purpose. This system is constituted of a hand gestures recogniser (for reading and analysing the hand movements), speech recogniser (for recording the spoken words), language translator (for converting the signs of the sign language into an effective words and vice versa), effective data extractor (for reading and searching data from the database with accuracy and optimisation) and an interactive animation module (for playing back the sound or the sign language) - MUMBOLA. After years of research and development the accuracy of sign language to speech translation system and its feasibility remains one of the important research challenges. This paper presents an idea of converting the sign language to speech and vice versa covering the main challenges discussed above as well as the challenges including availability, integrity and authentication. Our aim is to bring down the wall between the deaf-mute people and the outside world as "EVERY PERSON LIVING IN THE WORLD HAS THE RIGHT TO LIVE PEACEFULLY, AND NO ONE CAN SNATCH IT FROM THEM, NOT EVEN THEIR HEARING OR SPEAKING IMPAIRMENT."

General Terms

Depth Imaging, Hand Gesture Recognition System, Google Wristband, Rings and Bracelets, Electronic Gloves,

Keywords

Sign O Speech Automata, depth imaging, Pattern Recognition, 3-D capturing, Data extraction, Data Mining, Language translation, Speech and Text conversion, and Animation module (MUMBOLA).

1. INTRODUCTION

We believe it is not possible for deaf-mute people to make a normal conversation. As people with a hearing and speaking impairment cannot use a normal communication mean relying only on speech or audio. They are excluded from basic amenities of life, or even from using a phone, audio-video players, or even some functions of computer. Software solutions that include video chat can be used if only deaf people or people knowing sign language are talking to each other. But for people not knowing sign language even the video channel is of no help either. Text based chats could be a solution, and we believe that they are often used. Nevertheless they have the disadvantage, that typing is much slower than talking and text do not reflect the emotions or sentiments of a person efficiently as talking does. However Sign language (fig
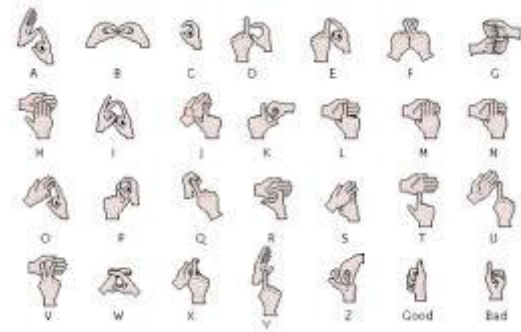

Fig 1:- An example of sign language

1. Can, to some extent, help in expressing the deaf and mute person's points and sentiments, as sign language covers some non-verbal techniques too. An automated translation between this sign language and audio (to listen to) or text (to read) is prime goal. We are in the process of making a Technology never designed before that is cheap, handy, and affordable and has the ability to convert sign language used by dumb people into speech and vice- versa. This can work as a solution to their communication problem and bring a change in the life of all those who are deaf and mute.

2. BACKGROUND

As per official estimates, there are around 3,000,000 deaf children in India and around 25,000 such children take birth every year. [2] As high is the percentage of deaf-mute persons, higher is their percentage of communication problems associated with them. The failure of communication results in demoralization, demotivation, depression, fear of outside world, and even sometimes hatred towards self in them. To help these people with their communications among themselves as well as the outside world, an effective Sign language was developed. Sign language is a language used by deaf and dumb people with hearing and speaking impairment to communicate with others using a manual communication and body language. In the recent decades, researchers have developed some technologies that can work for the cause. Some of them include Electronic Gloves, Ring and Bracelets, and Wrist Bands. They all have been able to convert sign language into speech but have their counterpart on feasibility and accessibility. Our technology covers these parts very effectively and hopes to help for the cause by bringing an ultimate solution. Our technology acts as an interface where the required person has to just use it by simply performing his/her hand gestures in front of Sign O Speech Automata System, and the rest will be done automatically. (Fig 2).
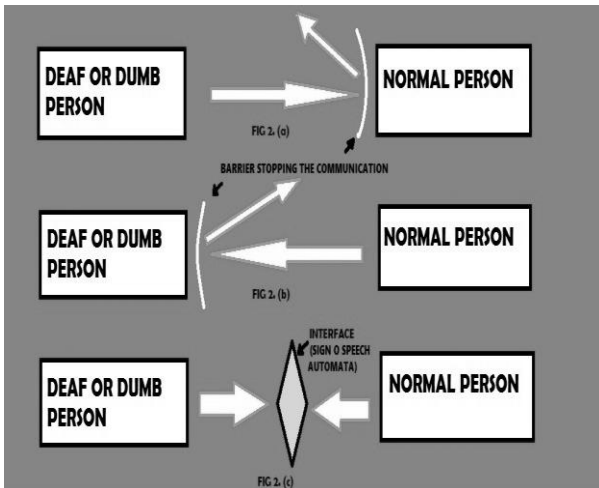
Fig 2(a) & 2(b):- Communication failure between a deaf-mute person and a normal person

Fig 2(c):- Communication established by using the Sign O Speech Automata System as interface

3. PRE-DEFINED TECHNOLOGIES

To remove the previously discussed problems, various technologies have been proposed from people all around the world. But for one reason or the other, they have failed to provide the solution to the hearing-speaking impairment people's agony. The bitter fact is these people in the counties like ours, India, are unaware that even such a technology exists that can help them them rise up, because of the technologies' uneasiness. A brief discussion of previous technologies is discussed below.

3.1 Electronic Gloves

The first invention was done by a group of Ukraine students that converted sign language into speech. [3] These gloves (Fig 3), named as Enable Talk, are fitted with an accelerometer, gyroscope, compass, and 15 flex sensors along the fingers, thumb and palm that determine the position of the glove in space. Data from the glove is then transmitted via Bluetooth to a mobile device that translates the signs into speech using the Microsoft Speech API and Bing API. [4] The project was a finalist at Microsoft's Imagine Cup held in Sydney Australia, created by the QuadSquad team.
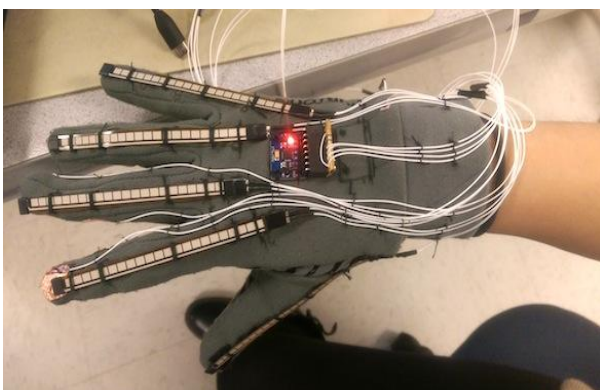

Fig 3:- The gloves made by the Ukraine students

The major drawback associated with this project was that the external design of the technology was too complex to make one feel it handy and comfortable. Also this was not a two way technique making it of no use for the deaf people. The

device costs US$1200 made it unsuitable to be in a reach of one and all. [5]

3.2 Google Wristbands

Fig 4:- Google Wristbands [6]

A team of students working in Google came up with an idea of converting sign language to speech with help of a wristband that would monitor the muscle reflexes made in the wrists in making the hand gestures. The working of their device was shown in the fig 5.
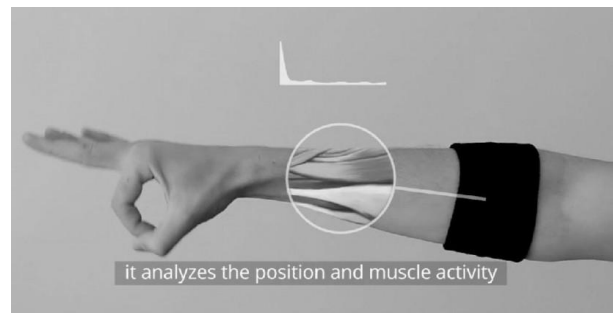

Fig 5:- Working of Google Wristband. [7]

However, the idea submitted is completely fictional and no work or update have been made or attempted yet. [8]

3.3 Rings and Bracelet

The students of Asia University came up with an idea of converting the sign language into speech using motion sensor technique. This technology comprised of 6 rings and 2 bracelets. The rings, 3 to be wore on each hand fingers, and the bracelet on each wrist as shown in the fig 6 below.
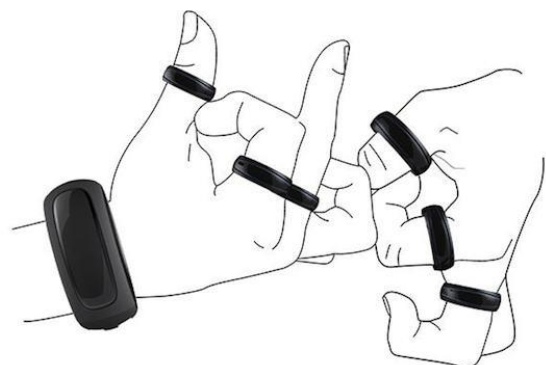

Fig 6:- Rings and Bracelet technology [9]

The rings have motion sensors installed in them to read the motion made by the fingers made during sign language and then the microphone in the bracelets signaled out the audio with help of installed speakers. However, this technology is also just an idea with no working or launching. [10]

4. OUR TECHNOLOGY- SIGN O SPEECH AUTOMATA SYSTEM

Sign O Speech Automata that works on the basic principle of depth imaging, 3-D capturing, Data extraction, Data Mining, Language translation, Speech and Text conversion, and Animation module (MUMBOLA).

The basic working is explained in Fig 7. Our technology can effectively convert sign language to speech, sign language to text, speech to sign language, and text to sign language. The working of each is described below.

4.1 Sign Language to Speech Conversion System

For accomplishing this, the deaf-mute user will have to just do all his gestures in front of the camera of our device. Sign O Speech Automata system will read the gestures and then search in the database for the pre-defined meaning of each gesture. Then it will sum up all the extracted data to form the sentence, the user wanted to say. This data will be then forwarded to the audio creation system. The created audio will be delivered to the user then using a 3-d animation module avatar, known as Mumbola.

4.2 Sign Language to Text Conversion System

This conversion is similar to the conversion process of sign language to speech. Only in this, after the data is sum up, it is converted to a text format and displayed on the screen of the sign o speech automata device.

4.3 Speech to Sign Language Conversion System

In this process, the user will have to only speak in the audio recorder of the Sign o Speech Automata device. Then the speech will be searched for its words in the database. After the searching, the sign language for the searched data will be shown on the screen by the avatar- Mumbola

4.4 Text to Sign Language Conversion System

In this system, the user will have to give input in the form of text, and then the process similar to that of Speech of Sign Language conversion system will be done. The resulting Sign Language will be displayed on the screen by the 3-D avatar- Mumbola.
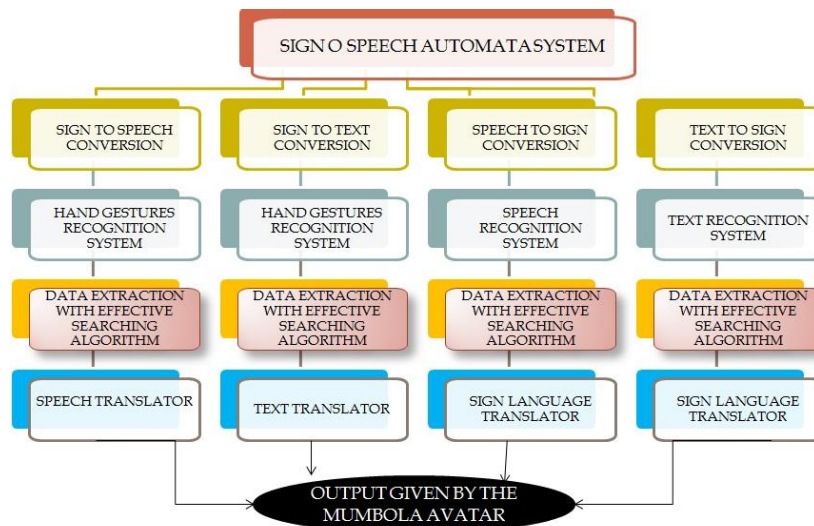

**Fig 7:- Basic working model of Sign O Speech Automata System**

5. FUTURE SCOPE

As our technology will advance towards its successful launch, it will open very wide doors for research and development in its field. By using our technology, following are the advancements that can be made in the upcoming future:

- Any deaf-mute person can make phone calls with any person, as our technology will help convert the audio signal into sign language and vice versa.

- Any deaf-mute person can watch a video as the voice of the video will be automatically converted into sign language by our avatar.

- If any deaf-mute can wants to video chat, he/she can very easily fulfil his requirement using our technology, as our avatar will help in easy language conversion.

- As discussed earlier, our technology will be able to convert speech to sign, sign to speech, text to sign and sign language to text very easily and effectively.

- In the further advancement of our technology, a deaf-mute person will be able to communicate with person of any country talking any language will the help of Sign O Speech Automata system.

- Further, a Smart Eyed Goggle can be developed with Sign O Speech Automata system installed in it. With this, the conversion process will be done automatically without any bothering of the user and the result will be displayed or heard by the person wearing the goggles automatically.

Any further can be and will be discovered by the launch of this epic technology.
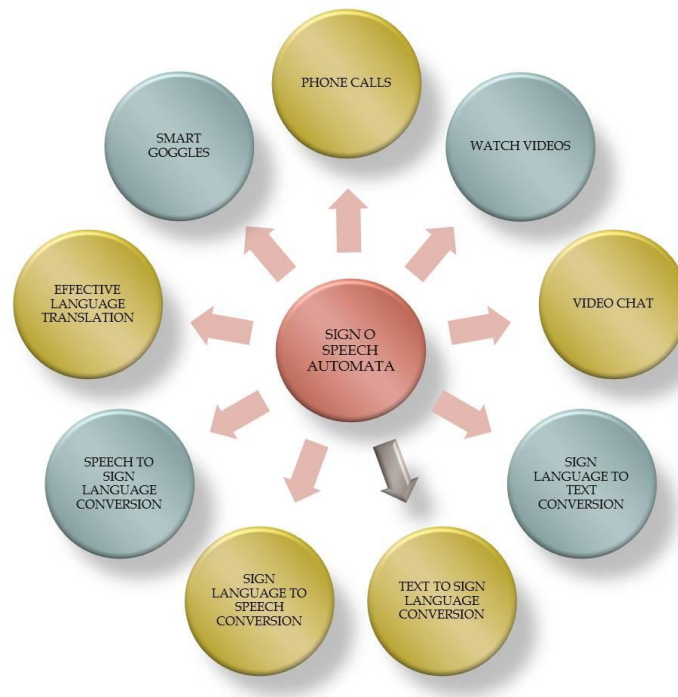
Fig 8:- Future Scopes of Sign O Speech Automata System

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