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Speaking Hand using Raspberry Pi 3

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ABSTRACT

There are some people who don't have the ability to speak or they lose it in an accident. They find it difficult to express their thoughts or to convey their message to other people. This project can be a medium between dumb-deaf people and society. Dumb people throughout the world use sign language to communicate with others; this is possible only for those who have undergone special trainings. Common people also face difficult to understand the gesture language. To overcome these real time issues, we are developing this system. This reduces the communication gap between dumb and ordinary people. In our project we are using glove with sensors to recognize gestures. The goal of the project is to design a fully functional and useful real world system that efficiency translates hand gestures into words. In our proposed model we have used flex sensor, an accelerometer, processing unit, speaker unit and display unit.

Keywords: *Sign Language, Accelerometer, Flex sensor, Atmega16, Bluetooth, Raspberry pi 3.*

1. INTRODUCTION

This paper presents how to lower the communication barrier between the deaf-dumb communities with the general public. It is based on the need of developing an electronic device that can translate sign language into words in order to make the communication. A Wireless data gloves is gloves fitted with flex sensors and accelerometer along the length of each finger. Mute people can use the gloves to perform hand gesture and it will be converted into speech so that normal people can understand their expression. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for a character. We are in process of developing a prototype using this process to reduce the communication gap between differentially able and normal people. The first Hand Talk glove was designed by Ryan Patterson in the year 2001. He began his mission with his Sign Language. The main disadvantage with this model was that a computer or a laptop was always required for its functioning which made it less portable.

2. LITERATURE SURVEY

1) Data glove or gesture sensing glove

In human communication, the use of speech and gestures is completely coordinated. Therefore we have chosen 'Gesture' as key thing in our project. Machine gesture and sign language recognition is about recognition of gestures and sign language. Gesture recognition is classified into two main categories: i) Vision Based ii) Data glove Based. We use Data glove based method in our project. The Data glove is hand glove fitted with sensors to detect gesture. Sensors such as flex sensors and accelerometer are used in data glove. Micro-Electromechanical system accelerometer can be used to detect gesture of hand. Bend sensor is a variable resistance sensor and it varies depending upon the bend. Flex sensors are normally attached to the fingers of glove. Flex sensors are used detect the bending of finger. Depending on orientation of fingers and hand, sensors will produce analog voltages. These analog voltages are fed to ADCs of atmega16, which convert this data in particular letter or number using embedded c program.

2) Atmega16 and Bluetooth technology

Atmega16 has Advanced RISC Architecture along with 131 Powerful Instructions, of which most are provide single-clock cycle execution. It also has 8 ADC pins with resolution of 10bit. Atmega16 can be programmed using Atmel studio software. Embedded C code in Atmega16 assign particular character to the particular input provided by gesture sensing gloves. When space (space is also a character) is detected, obtained letters are interpreted as a single word.

The word formed is transmitted to Raspberry Pi3 module using Bluetooth HC05 Transmitter and Receiver. Bluetooth is a specification (IEEE 802.15.1) for the use of low power radio communication to link phones, PCs and other devices over short distances without wire. The Bluetooth system operates in 2.4 GHz ISM (Industrial Scientific Medicine) band.

3) Raspberry pi 3

Raspberry pi3 is a small single-board computer with Linux or Raspbian or other OS on bootable SD card. It supports Python language along with any language which will compile for ARMv6. Using Raspberry pi3, a text-to-speech module can be developed in various accents. The word received via Bluetooth is provided to TTS (text-to-speech) module developed using python language. There are various TTS modules available for various OS such as espeak, festival, gTTS (google text-to-speech), etc.

a) Audio output of word:

Raspberry pi 3 model B has 3.5mm audio jack for audio output. Small speaker or headphone can be connected to 3.5 mm jack to get speech form of word. So the normal person can hear the word which differentially able people trying to convey.

b) Visual output of word:

Raspberry pi 3 modelB has 40 GPIO pins to which a 16*2 LCD can be interfaced. On this LCD text form of word is displayed, this will further clarify the communication.

3. DESIGN OF PROJECT

Design of this project is very simple. It requires very cheap components for implementation such as: Raspberry pi 3 model b, Atmega16 controller, Bluetooth HC05, Flex sensors, Accelerometer, 16*2 LCD and Audio speaker with 3.5 mm jack.

But first we have to select a suitable sign language for the project. Different countries have their own sign languages but English sign language is considered as universal language. So we can make use of English sign language for all alphabets to convert them into words by this prototype. Following image shows various gestures for all alphabets in English sign language.

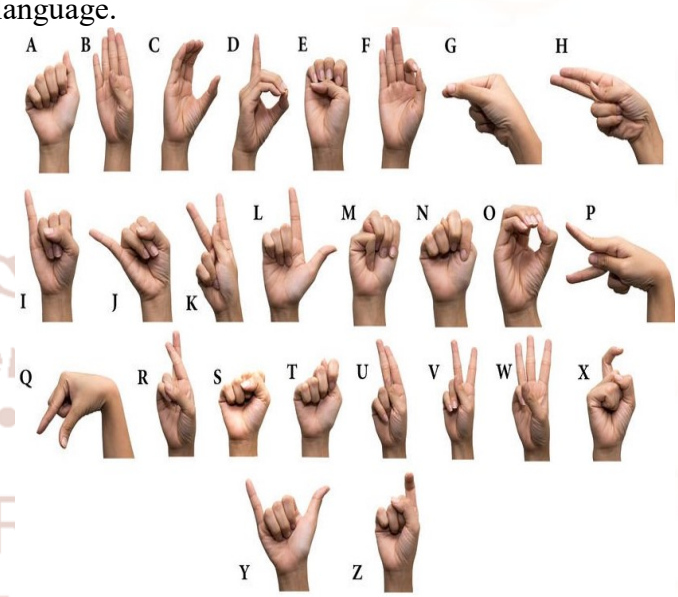

Fig.1 English sign language [6]

We have chosen 'Gesture' as key thing in our project. Sensors in the glove pick up gestures and are processed in Atmega16 to form a word. Then word is transmitted wirelessly via Bluetooth to a Raspberry pi which runs Text to Speech software developed using Python. The sensor data are converted into text and then to voice output. This illustrated in Block diagram of Project given below. The direction of arrows shows the direction of workflow in project.

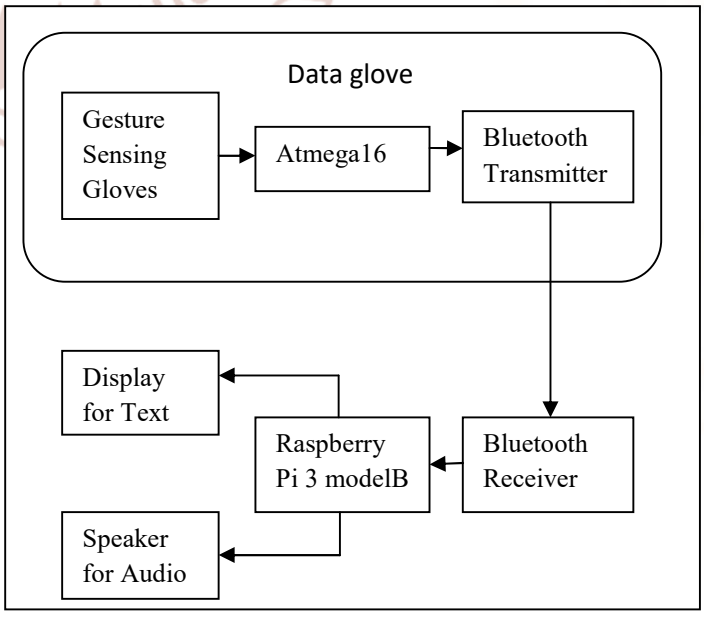

Fig.2. Block diagram of Project

A person not knowledgeable in Sign language can listen via the speakers what the other person is saying in Sign language form. The main advantage with this design is its simplicity and the cheap components used to create this amazing and truly interactive glove that could help to improve greatly the communication barrier between deaf persons and people.

4. CONCLUSION

We proposed a simple yet powerful shape based approach for hand gesture recognition. Dumb deaf people can make use of hand gestures for communication as the accelerometer and flex sensor glove based automated system has been presented which would be very helpful. As the flex sensor value was within a small range, only few combinations can be brought into actual practice. A hardware set up has to be done to validate this technology. Translation of sign language in various languages and dialects can be possible with help of Raspberry pi3 due to its advanced tech.

Future work regarding this project can be done in various ways. Using Advance Sensors, this Gesture sensing Gloves can be reduced to mere a wrist-band or wristwatch. Marketing model of this project can be made much smaller in future by developing Smartphone app.

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