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Data-Glove as a Sign Recognition System

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ABSTRACT

The sign language is important to people who are Mute or Deaf generally have hearing and speaking deficiency. It continues to be the preferred tool of communication among them. It is the well-structured code of hand gestures, where these gestures have the specific meaning, used to convey the information. The aim of this paper is to propose a system and methods for recognizing the different signs which are Indian Sign Language. The proposed system translates gestures into speech and text format. This system, in particular, is designed to convert Kannada sign language. We have designed and implemented a data glove, which includes a set of sensors and a Wi-Fi communication module with microcontroller ATMEGA2560. Hand sign is constructed, Classification into final text and speech transformation and follow interpretation. This system is portable, offering a neat translation of Kannada sign language on any android platforms on the connection. Thus, allowing someone with no knowledge of a Kannada sign language to be able to understand and interact.

Key Words: *Android platform, Deaf, Mute, Hand Gesture, Kannada sign language, Wi-Fi, ATMEGA 2560.*

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1. INTRODUCTION

Historically Deaf-Mute is a term which was used to identify a person who was either deaf or both using a sign language. The term was used to refer to deaf people who cannot speak oral language or have a degree of such speaking ability. Such people communicate using sign language. The sign language history records in western societies starting in the 17th century, as a visual language or method of conventional gestures, to mimic hand signs and finger spelling, plus the use of hand positions to represent the letters of the alphabet. Signs can also represent complete ideas or phrases, not only individual words. There are many impaired people in the world. The number of deaf-mutes in the world are roughly calculated to be from 7milloin to 9million, and of these 63%, are said to be born deaf, the others losing their hearing by different accidents. According to the Abbe Lambert and other authorities, the causes of deaf-mutism are, damp atmosphere, bad air in dwellings, the age of the parents, either when one or both are too young, or in cases where the mother is of older than the father, developing in, rarely the first, but often in second and third generation. India alone make 2.4 million of deaf and mute population. These people lack the formats to interact, which a normal person should have. This is impacting the ratio literacy and employed deaf and mute population. The sign language is commonly developed in deaf or mute communities. Most sign languages are naturally developed languages, different in construction from that of oral languages used in proxy to them, and are employed mainly by deaf people in order to communicate. Sign language is a communication skill which uses gestures and expressions instead of sound or written components to convey a meaning –

simultaneously combining hand patterns, orientation, movement of arms, facial expression or shapes to express the speaker's thoughts.

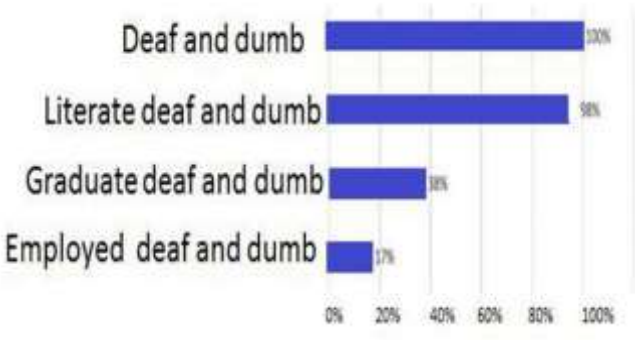

Figure 1: Employment analysis of Deaf-mute

2. BACKGROUND

Gesture recognition is a language technology with the goal to interpret human gestures via mathematical algorithms. Gestures can originate from any limb motion or body state but commonly originate from the face or hand. Current focus is on the field that includes emotion recognition from face and hand gesture recognition. Users can use simple gestures to interact or control with devices without physically touching them. Gesture recognition can be seen as a way for computers to understand human body language, thus building a bridge between machines and humans, then primary text user interfaces or even graphical user interfaces, which still limit the majority of input to keyboard and mouse. A wired glove or a data glove is an input device for human–computer interaction worn like a glove. Data gloves are devices with a set of sensors for obtaining information about the movements of hand and its fingers. Various sensor technologies are used to capture physical data such as bending of fingers. Often a motion sensor, is attached to capture the global position or rotation data from the glove. These movements are then interpreted by the software that is programmed into the glove, so one movement can mean any number of things. This gestures are then categorized into useful information, to recognize sign language or other symbolic functions. Expensive high-end wired gloves can also provide haptic feedback, which is a simulation of the sense of touch. This allows a wired glove to also be used as an output device. Traditionally, wired gloves have only been available as an input device, with the finger bend sensors.

Figure 2: Hand signs

3. METHODOLOGY

3.1 Hardware

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, Max MSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux). The Arduino Mega is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 R3 also adds SDA and SCL pins next to the AREF. In addition, there are two new pins placed near the RESET pin. One is the IOREF that allow the shields to adapt to the voltage provided from the board. The other is a not connected and is reserved for future purposes. The Mega 2560 R3 works with all existing shields but can adapt to new shields which use these additional pins. ESP8266EX (simply referred to as ESP8266) is a system-on-chip (SoC) which integrates a 32-bit Ten silica

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microcontroller, standard digital peripheral interfaces, antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules into a small package. It provides capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), Inter-Integrated Circuit (I²C), analog-to-digital conversion (10-bit ADC), Serial Peripheral Interface (SPI), I²S interfaces with DMA (sharing pins with GPIO), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM). The flex sensor is a variable resistor. The resistance of the flex sensor increases as the body of the component bends. Sensors like these were used in Nintendo power glove. They can also be used as door sensors, robot whisker sensors, or a primary component in creating sentient stuffed animals. Flex sensors are available in two sizes: 2.2inch long and 4.5inch long. Left flat these sensors will look like a 30kohm resistor. As it bends, the resistance between the two terminals will increase to as much as 125kohm at 90degree angle. An accelerometer is a device that measures changes in gravitational acceleration in a device it may be installed in. Accelerometer are used to measure acceleration, tilt and vibration in numerous devices. To sense motion in multiple directions, an accelerometer must be designed with multi axis sensors. Three linear accelerometer are adequate to measure movements in three dimensions.

3.2 Experimental setup

The translation of any sign language begins with the glove which is the main part of this project. The glove is built with 5 flex sensors, three axis accelerometer. The architecture of the system is shown in Figure 3. To test the effectiveness of our proposed system, we collected data from the flex sensor and accelerometer with the help of Arduino, which is programmed to read an analog signal from the these sensors and analyze it to the using preset conditions for every particular gesture outputs. The stored data is accessed using then sent to android device which displays the content in form of text. We used multiple trials and collected data for different cycles of gestures to achieve accuracy. Glove data is then manipulated and processed into speech signal at microcontroller and the sound signal is output from speaker which follows from the audio playback recorder.

Figure 3: System architecture

4. CONCLUSION

Recently, Ministry of Social Justice and Empowerment, Government of India has launched First Indian Sign Language Dictionary of 3000 words. With the help of this dictionary we could implement and advance in future for many desperate disables. To ease the communication between deaf, mute sign Language is a useful and even with the normal people who do understand the language. Yet there is a communication gap between these group to normal people as most of them do not learn or know the language. Therefore, there is need to develop an electronic device that can translate the sign language into sound or words in order to make the communication take place. With this project the deaf and mute people can use the glove to perform Kannada sign language and it will convert that into speech and text, so that normal people can understand their expression. This application tool is a desirable interpreter which translates sign language to synthesized text and voice. With this proto-type people can perform gestures to form speech developed conversation. This standalone system is easy to learn about and use.

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