HAND TALK ASSISTIVE TECHNOLOGY FOR DEAF & DUMB PEOPLE USING ACCELEROMETER

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Abstract: Communications between deaf-mute and a normal person have always been a challenging task. The project aims to facilitate people by means of a glove-based deaf-mute communication interpreter system. Each glove is internally equipped with a gesture. For each specific gesture, the gesture module produces a proportional change in resistance and accelerometer measures the orientation of hand.

The processing of these hand gestures is in Controller. The glove includes two modes of operation – training mode to benefit every user and an operational mode. The concatenation of letters to form words is also done in Controller. In addition, the system also includes a text to speech conversion (TTS) block which translates the matched gestures i.e. text to voice output.

The hand gesture is one of the typical methods used in sign language for non-verbal communication. It is most commonly used by people who have hearing or speech problems to communicate among themselves or with normal people. Various sign language systems have been developed by manufacturers around the globe but they are neither flexible nor cost-effective for the end users. This paper presents a system prototype that is able to automatically recognize sign language to help normal people to communicate more effectively with the hearing or speech impaired people

Key words: Disabled people,Hand gesture,Aurdino,LCD display,Speaker

I.INTRODUCTION

Speaking is the main way of communication for every normal human being. But think about a speech impaired person who can't able to communicate frequently with a normal person. Because speech impaired people use sign language for their communication. And most of the people don't understand sign language. So it puts the speech impaired person in a difficult situation. In recent years, researchers have been focusing on hand gestures detections and been popular for developing applications in the field of robotics and extended in the area of artificial or prosthetic hands that can mimic the behavior of a natural human hand. This project although utilizes a similar approach for the detection of the movement of fingers, however we have tried to extrapolate the idea in a slightly different perspective and have come up with a small yet significant application in the field of bioengineering. The main objective of this project is to design an electronic speaking system in the form of a glove to lessen this communication problem. This device benefits a speech impaired person to communicate with a normal person as well as with a hearing impaired person. The main component of this project is a glove with five flex sensors that are connected to Arduino Nano which is the main control unit of this project. This device has a feature of user input. So speech impaired person can easily use his/her own chosen commands for specific gestures.

II.LITERATURE SURVEY

S. Sidney Fels and Geoffrey E. Hinton, 1997[1]¬ proposed a system which translates hand gestures to speech through an adaptive interface. Hand gestures were mapped continuously to ten control parameters of a parallel formant speech synthesizer. The mapping allowed the hand to act as an artificial vocal tract that produces speech in real time. The system have used several input devices like

Cyber glove, Contact Glove, three-space tracker, and a foot pedal a parallel formant speech synthesizer, and three neural networks. The gesture-to-speech task was divided into vowel and consonant production by using a gating network to weight the outputs of a vowel and a consonant neural network.

Chin-Shyurng Fahn and Herman Sun, 2005 [2]¬ presented the development of a data glove system using magnetic induction coils as finger movement sensor. These are small sensor coils, the magnetic field intensity varies with respect to time. It has capability of measuring ten degree of freedom of a hand with only five sensors which were arranged on the palmer surface.as these sensors are arranged on the finger phalange positions, there is no contact point between the sensors and the finger joints. Due to these the shape of the sensor does not change as the finger bends, which would maintain the quality of measurement and lifetime of the sensor. To make the use of gloves convenient, simple and efficient calibration process which consist of two steps is also provided, so that all required parameters can be determined automatically. They also adopted time division method to prevent the interference among the generator coils and the sensor. The experimental results of the sensors performing linear movement and bending angle measurements were directly carried out using an oscilloscope in less noisy environments. As in this paper they have magnetic coils as sensors the systems is more immune to electromagnetic interference.

Michiko Nishiyama and Kazuhiro Watanabe,2009,¬ [3]. presented a wearable sensing glove with embedded hetero-core fiber-optic nerve, which uses hetero-core fiberoptic nerve as sensors that detect finger flexion to achieve unconstrained hand motion monitoring. As shown in fig.1 The sensor Hetro core consist of a transmission fibre line whose diameter is 9µm. single mode of transmission is used in Hetro core fiber sensor e back of the hand such that they are not affected by wrinkles in the glove joints.A laser diode of wavelength 1.31µm and an optical power meter are used to measure the transmission loss. Splicing machine is also used. The sensor after calibration is able to detect the joint angles of the fingers with differences in hand size and the hetero-core sensing technique allows the sensing glove to be constructed with a minimum number of sensor points. The hetro core sensors reveals monotonic chareteristic of optical loss performance with respect to the flexion angle of joints. But regardless of this some optical fiber loss can be observed using these sensors

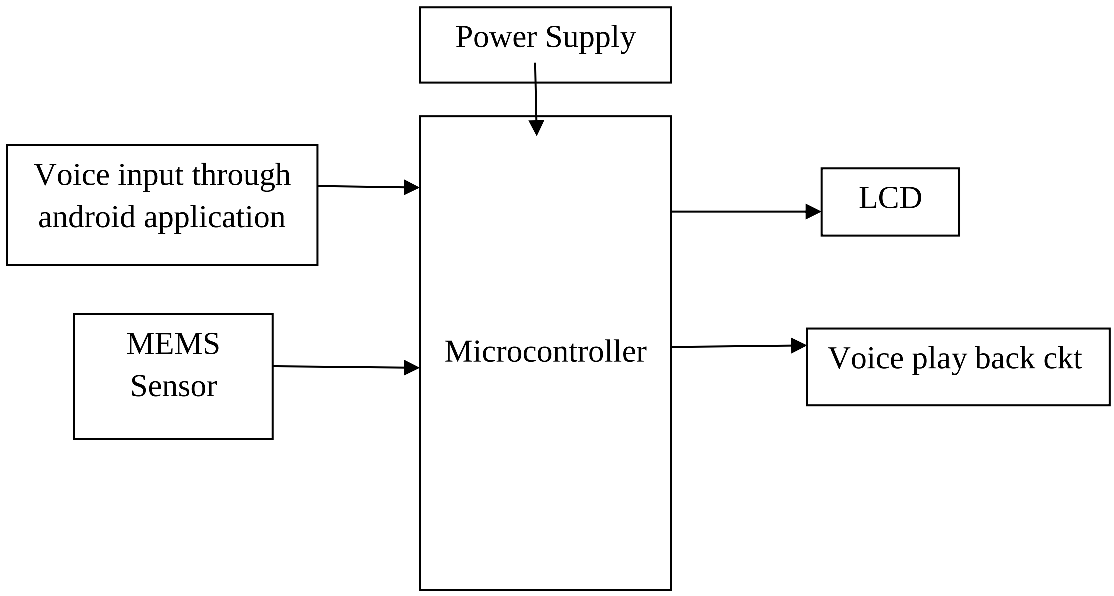
Kotaro Tadano, Masao Akai,2010[8]¬ proposed a grip Amplified glove using pneumatic artificial rubble muscles (PARMs) as shown in fig 3 . The PRAM is suitable with total 10 degrees of freedom and consist of four units. To achieve power assist motion ,a PI control, which is based on pressure value from a balloon sensor is performed .balloon sensor makes the the applied part free from the electricity. EMG patterns of muscles are measured to evaluate the power assist performance. The system becomes more complicated and bulky.

III.PROPOSED WORK

This paper presents a system prototype that is able to automatically recognize sign language to help normal people to communicate more effectively with the hearing or speech impaired people. This project consists of an Arduino controller interfaced with flex sensors and Voice play back circuit. By using flex sensors we can produce different gestures, for each gesture we coded a voice track .so other normal persons will easily understand the impaired person .

In addition to it we using a Bluetooth communication device. By using Bluetooth and Android application we can convert the voice commands into Text. This Text commands will display on LCD which is useful for deaf persons also.

BLOCK DIAGRAM:



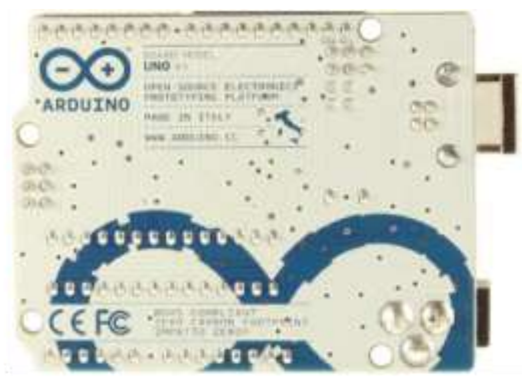
HARDWARE REQUIREMENTS:

- Power Supply
- MEMS Sensor
- LCD
- Play back Module
- Arduino Controller

HARDWARE DESCRIPTION

4.1 Arduino Uno

Arduino Uno R3 Front



Arduino Uno R3 Back

Overview:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, 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 Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

Revision 3 of the board has the following new features:

pin out: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board.

In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform;

Schematic & Reference Design

EAGLE files: arduino-uno-Rev3-reference-design.zip (NOTE: works with Eagle 6.0 and newer)

Schematic: arduino-uno-Rev3-schematic.pdf

Note: The Arduino reference design can use an Atmega8, 168, or 328, Current models use an ATmega328, but an Atmega8 is shown in the schematic for reference. The pin configuration is identical on all three processors.

Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

- **VIN:** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- **5V:** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- **GND:** Ground pins.

Memory

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode(), digital Write(), and digital Read() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 Kohms. In addition, some pins have specialized functions

- **Serial: 0 (RX) and 1 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- **External Interrupts: 2 and 3.** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt ( ) function for details.
- **PWM: 3, 5, 6, 9, 10, and 11.** Provide 8-bit PWM output with the analog Write ( ) function.
- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).** These pins support SPI communication using the SPI library.
- **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference ( ) function. Additionally, some pins have specialized functionality:

- **TWI: A4 or SDA pin and A5 or SCL pin:** Support TWI communication using the Wire library. There are a couple of other pins on the board:
- **AREF:** Reference voltage for the analog inputs. Used with analog Reference ( ).
- **Reset:** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

See also the mapping between Arduino pins and ATmega328 ports. The mapping for the Atmega8, 168, and 328 is identical.

IV.RESULTS AND DISCUSSION

This project is a useful tool for speech impaired and partially paralyzed patients which fill the communication gap between patients, doctors and relatives. In this project we are using MEMS accelerometer sensor is a low power, low profile capacitive micro machined accelerometer and ATmega328 microcontroller. The accelerometer would give the output of a varying voltage values depending on the variation in the resistance values due to the bending of fingers. This analog output is converted to digital output by the A to D converter inside microcontroller and the results are stored in 2 different registers as a 16 bit output. Depending upon this decimal value, the output appeared as test on LCD display and voice from voice play back module which takes input as voice from android application.

V.CONCLUSION

The final system designed is portable since the whole operation is performed on the microcontroller and it consists of a glove which is used for gesture recognition. The accelerometer sensors are connected inside the glove .In this way, the circuit developed is quite easy and its connection is relatively simple. So the disabled person only has to carry the hand glove and the microcontroller board which is light in weight and consumes low power up to 5volts. A volume control enables the disabled person to adjust the volume of the speaker. Here, the data is pre-stored of different sign conventions in the memory of microcontroller. Here, special care of the connections is considered because any distortion in the connection will cause the system failure. So one way to avoid such scenario is to seal the microcontroller properly. By virtue of this device the communication of the deaf and dumb person with normal person is made possible. This device also eliminates the need of the interpreter and also avoids miscommunication. Thus, the final system will not be much expensive making it accessible to every needful person. .With proper planning this system can be used in different organizations. Different types of sign conventions (ISL OR ASL) can be stored in the device

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