Hand Gesture Vocalizer for deaf and dumb

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Abstract: Communication plays an important role for human beings. Communication is treated as a life skill. Keeping these important words in mind we present our paper to help in improving the communication with the deaf and dumb people using flex sensor technology. This proposed system also checks pulse rate of the person hence it also provides health monitoring facility. Dumb people communicate using sign language but it is a difficult process in communicating with others.

Index Terms – Hand Gesture, Microcontroller, Bio medical sensor, Heart beat sensor

1.Introduction
In this paper we present the concept of data transmission through a wireless data gloves is used which is normal cloth fitted with flex sensors along the length of each finger and the thumb. Dumb people can use the gloves to perform hand gesture and it will be converted into speech and text so that normal people can understand their expression. In this system there are two sections, the transmitter part and the receiver part [1,2]. The transmitter part receives inputs from flex sensor used to determine gesture and from heart beat sensor used to measure the pulse rate. The input received is recognized and transmitted wirelessly to the receiver section where the text relevant to the gesture is displayed on LCD and corresponding voice played through speaker. There is a need of monitoring health of speech impaired and paralyzed patients too so heartbeat sensor is mounted in a hand gloves which is convenient and reliable to use, which measure pulse rate. The intension of the sign language translation system is to translate the normal sign language into speech and to make easy contact with the dumb and it is made portable. Proposed system avoids PC intervention for processing and all operations are controlled by microcontroller. Another study states that nowadays embedded system emerging as an important trend in all applications [3, 4].

2. EXISTING MODELS
A literature survey shows the various analysis and research made in this field and the results project. Deaf people have used sign languages throughout the history. One of the earliest written records of a sign language is from fifth century BC [5,6]. In 2019, “Reduction of letters and art for teaching mute people to speak” which is considered as the first modern treatise of sign language Phonetics. In order to overcome the gap of communication between dumb and normal person we have come up with this novel idea [7, 8]. Some papers present “Sign Language Interpreter” a recognition system for the vocally disabled. In the recent years, there has been tremendous research on the hand sign recognition. The technology of gesture recognition is divided into two categories- Vision-based and Glove-based, in comparison with these two, vision based system faces many problem it is not convenient for user to use whereas glove based is convenient and simple method. One more study proposes that the system must be capable of recognizing the gestures continuously without any manual indication. The system must recognize the gestures accurately between 80 to 90 percent. There is a need of designing of wireless transceiver system for „Microcontroller and Sensors Based Speech Converter [9, 10]. There is a need of monitoring health of speech impaired and paralyzed patients too so heartbeat sensor is mounted in a hand gloves which is convenient
and reliable to use, which measure pulse rate. The intension of the sign language translation system is to translate the normal sign language into speech and to make easy contact with the dumb and it is made portable [11, 12]. Proposed system avoids PC intervention for processing and all operations are controlled by microcontroller. Another study states that nowadays embedded system emerging as an important trend in all applications [13]. More recently developed embedded applications are changing our lifestyle in a smart way. The development of speech converter by using RF trans-receiver to send data to recorder leads to an effective use of a device.

3. PROPOSED MODEL

Our hardware requires 5V DC, hence using regulated power supply which comprises step down transformer, bridge rectifier, capacitor filter and a voltage regulator. Step down transformer converts 230V AC to 12V. Bridge rectifier converts 12V AC to 12V pulsating DC. A capacitor filter removes ripples present in it and a voltage regulator of 7805 will convert it into 5V DC. A crystal oscillator with 12MHz is used which provides clock frequency to the microcontroller. Electrolytic and Ceramic capacitors are used which removes the ripples and cancels noise. The main electric board will contain a microcontroller that handles the program used to detect the analog voltage levels captured from the sensors, converts them to digital using the ADC of the microcontroller, makes the recognition of the letter signed. Microcontroller will compare the input voltage with predefined program voltage and accordingly it will display the output characters on the LCD screen.

TRANSMITTER

At the transmitter side, flex sensors play a very important role as they are fitted on hand gloves so as to trace the correct movement of the fingers. For each flex sensor the required voltage will be supplied initially. According to the movement of the fingers there will be a voltage drop associated with it. The voltage thus obtained will be analogy in nature. This analog voltage is converted to digital using an Analog to Digital Converter (ADC) and converted digital voltage is fed to microcontroller AT89s52. Microcontroller not only receives this but also receives pulse rate count input from heart beat sensor connected directly to it, received data is processed at this stage and corresponding values will be sent to receiver through RF transmitter as shown in figure 1.
Figure 1: Block diagram of proposed model

**RECEIVER**
At the receiving side, transmitted values are received in microcontroller through RF receiver and compared with the predefined values in the microcontroller and produces the appropriate data to be displayed on the LCD and to be announced by the speaker.

**POWER SUPPLY**
In power supply circuit the DC pulsating is removed by electrolyte capacitor. Our hardware requires 5V DC and hence a voltage regulator of 7805 series is used. A crystal oscillator with 12MHz is used which provides the microcontroller with frequency clock pulse. The microcontroller process the data received and makes the recognition of the gesture signed. The Microcontroller recognizes the predefined letter for a particular gesture and feeds to the RF transmitter through serial data communication where RF antenna transmits the data wirelessly. At receiver section, the transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The received data is fed as an input to the microcontroller Microcontroller will compare the input data i.e. letter with predefined program data and accordingly it will display the output characters on the LCD screen and also simultaneously sends signal to the APR33A3 which plays prerecorded message using speaker. The device is portable and handy device.

**DATA GLOVE**
Data glove is a normal hand glove to which 5 flex sensors are attached along the length of fingers. Sensors are attached to glove either by threading or by glue. Hand gestures are made such that the sensors attached to the glove bends properly and gives out proper voltage drop such that the controller can sense correctly.

**FLEX SENSOR**
Sensor refers to a transducer which converts physical energy into electrical energy. Flex sensor is a resistive sensor which changes its resistance as per the change in bend or curvature of it into analog voltage. More the bent, more will be the resistance experienced. When the sensor is kept straight with no force acting on it, it has a flat resistance of around 10 kohms and experiences minimum 2 times greater than the flat resistance at 180° pinch bend. Inside the flex sensor are carbon resistive elements within a thin flexible substrate where more carbon means less resistance as shown in figure 2. The dimensions of the sensor are ¼ inch wide, 2-1/5 inches long and 0.19 inches thick. The sensors connect to the device via three pin connectors (ground, live and output).
HEARTBEAT SENSOR
Heart beat sensor is designed to give digital output of heart beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse. For further information please refer to its datasheet.

FEATURES
1. Microcontroller based SMD design
2. Heart beat indication by LED
3. Instant output digital signal for directly connecting to microcontroller
4. Compact size

APPLICATIONS
1. Digital Heart Rate monitor
2. Patient Monitoring System

MICROCONTROLLER AT89S52
The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes in-system programmable Flash memory. The device is manufactured using Atmel’s high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out as shown in figure 3. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.
Features are:
• 8K bytes of Flash
• 256 bytes of RAM
• 32 I/O lines
- Watchdog timer

**Figure 3: microcontroller AT89S52 pin diagram**

- Two data pointers
- Three 16-bit timer/counters
- A six-vector two-level interrupt architecture
- A full duplex serial port
- On-chip oscillator and Clock circuitry

In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes.

**ANALOG TO DIGITAL CONVERTOR (ADC)**
ADC is an electronic circuit that converts a continuous physical quantity like voltage or temperature to a digital number that represents the quantities amplitude so that the microcontroller can read the data. The ADC0808 data acquisition component is a monolithic CMOS device with an 8-bit analogy-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256r voltage divider with analogy switch tree and a successive approximation register. the 8-channel multiplexer can directly access any of 8- single-ended analogy signals. The design of the adc0808 has been optimized by incorporating the most
desirable aspects of several A/D conversion techniques. An un-decimated wavelet transform can be merged with neural network to reduce the size of the power system circuit.

4. RESULTS AND DISCUSSIONS
When the flex sensors connected to the glove are bent with the help of the fingers, the required predefined output is generated. The output generated will be in the form of voice which is obtained with the help of the speaker and the voice command will be displayed on the LCD.

![Figure 4: Final proposed model](image)

5. CONCLUSION
The proposed method translates sign language to speech automatically and satisfy dumb by conveying thoughts on their own. The system overcomes the real time difficulties of dumb people and improves their lifestyle. System efficiency is improved with the help of microcontroller and APR33A3, also integrated with RF wireless transmission is help in long distance communication. By implementing this system speaking dream of dumb people becomes true. Compared with existing system it is possible to carry this system to any places. The main advantage of this approach is less computational time and fast response in real time applications has been achieved. Due to the wireless data transmission to the LCD and recorder, makes the user to handle it freely. It can be used in public places very conveniently. The proposed system is producing less noise in antennas, cloud computing devices, switch gear rods, mining equipment. It is very much suitable for IOT applications.

References


