Hand talk

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***Abstract* - Communication through talking is a natural way of life. However, due to various causes some persons are not able to communicate in this manner e.g. deaf and dumb persons. These differently abled persons need assistance to fulfill their daily routine task. Today's technology can be effectively utilized to come to their rescue. Most often differently abled persons are not treated as the part of the society. To provide them an opportunity to be like a normal person, we have developed a hand gesture based prototype named "HANDTALK".**

***Index Terms*- Hand gesture recognition, Flex Sensor, Arduino, and GSM**

I. INTRODUCTION

Gestures are natural and intuitive forms of interaction and communication used to convey messages using hand shapes, hand movements and orientations. Technology has always been of great help to the disabled and given them a helping hand to allow them to live a normal and healthy life like others. We have come up with a novel idea of a glove named HANDTALK that will convert the hand movements (gestures) into a corresponding message and allow the individual to express themselves better.

A sensor equipped glove needs to be worn on the hand. The heart of the system i.e. Flex Sensors fixed on a hand glove pick up signals generated by the gesture made by the individual and with the help of Arduino the analog inputs are converted into digital for various gestures and for every particular gesture there is specific output which is converted in to a specific message. When the person perform a particular gesture, the predefined message for that gesture is displayed on the LCD along with a beep (sound) and that specific message is also transmitted in the form of text or call with the help of GSM module to the various registered numbers.

Handtalk converts a hand gesture made by the wearer to the corresponding message. Sensors in the glove pick up gestures and transmit the data wirelessly to the mobile phone via SMS/Call with the help of GSM module and to the LCD display with the help of Arduino. The glove is completely independent of the LCD display section i.e. the receiver section can be placed anywhere according to the requirement either on doctor's chamber or in the one's who is concerned with that person. That means the person just needs to wear a weightless glove and is having to perform effortless gestures to express his needs all his needs on finger tips. Moreover, he can also control the basic home appliances like AC's, Light etc., all by just performing few predefined gestures. Example,If the patient performs a gesture of fist (most often we people form the fist in case of fear, pain, stroke, emergency, etc.) there would be a message displayed on the LCD"CRITICAL SITUATION" or "EMERGENCY" along with a beep and the particular message will also be sent to the doctor's phone or to the relative's. Another example is, if the wearer performs a gesture of "V" (victory symbol, predefined), then the lights will be ON, and by performing the same gesture again the light will be OFF. Similarly, we can do the same in the case of AC, Fan or any other devices.

In addition to this in HANDTALK pulse sensor is added to monitor the heartbeats of the person and displaying it on the LCD, so that the doctor can continuously monitor the heart rate easily and as per requirements different more sensors can be configured to judge the various parameters of the body. Now in case, the heartbeat is getting too low or too high, the doctor will get the alert too by a SMS and call.

II. LITERATURE REVIEW

The first Hand Talk glove was designed by Ryan Patterson in the year 2001[4]. He began his mission with his Sign Language. Sign Language Translator consists of two separate components, a leather golf glove that has ten flexible sensors sewn into it which monitor the position of the fingers by measuring the electrical resistance created by the fingers as they bend[4]. A small microcontroller on the back of the hand converts the change in the electrical current into digital signals and transmits them wireless to a computer. The

computer then reads the numerical values and converts them into the letters which appear on the screen. The main disadvantage with this model was that a computer or a laptop was always required for its functioning which made it less portable[4].

III. BLOCK DIAGRAM OF PROPOSED SYSTEM:

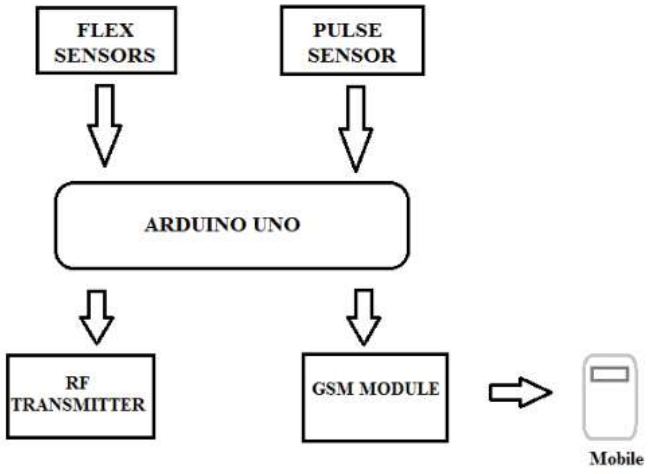


Fig 1: Block diagram of Transmitter Section (Hand Glove Section)

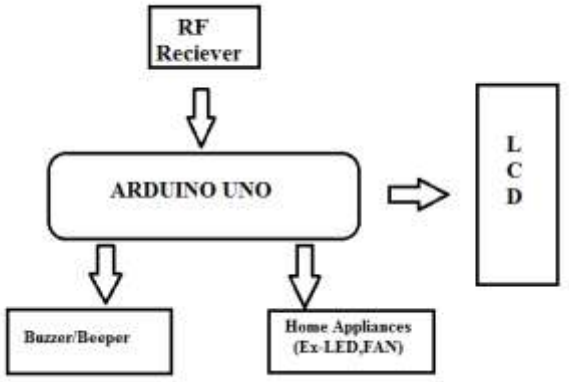


Fig 2: Block Diagram of Receiver Section

IV. REVIEW OF SYSTEM COMPONENTS

Arduino Nano

Arduino is an open source platform based on simple microcontroller board. The controller used in the device is Arduino NANO with inbuilt atmega328 in it. Atmega328 has 32KB on-chip flash memory for storing codes of which 2KB used for boot loader. It also includes a 2KB of SRAM and 1KB of EEPROM. The program that is developed is to be stored on the flash memory of the controller. The Arduino software also includes a serial monitor which allows data to be sent to or from the Arduino board. It has 8 analog pins and 14 I/O digital pins.

Microcontroller Atmega 328p

The ATMEGA 328p is 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. It is developed by Atmel. In this system this microcontroller is used in receiver parts for controlling the LCD, Buzzer, LCD and Motor.

Flex sensor

Flex sensors are resistive carbon elements. When bent, the sensor produces a resistance output correlated to the bend radius [9].The variation in resistance is approximately 10 to30 K Ohm's. An unflexed sensor has 10Kohm resistance and when bent the resistance increases to 30Kohm at 90o [3].The sensor is about ¼ inch wide, 4-1/2 inches long[].

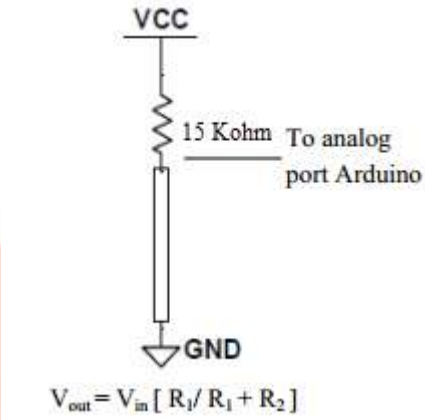


Fig 3:Voltage divider circuit (as of flex sensor)

The sensor is incorporated in device using a voltage divider network. Voltage divider is used to determine the output voltage across two resistances connected in series i.e. basically resistance to voltage converter. The resistor and flex forms a voltage divider which divides the input voltage by a ratio determined by the variable and fixed resistors.

RF Module (Receiver and Transmitter)

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. RF module can be easily interfaced by Arduino and other microcontrollers.

GSM/GPRS Module

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc.) for computer. GSM module uses the AT Commands for performing different task like Sending SMS, Call, and Data Connections etc. In this system we have used sim900A GSM Module which is interfaced with Arduino Nano.

Pulse Sensor

The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. Also, it sips power with just 4mA current draw at 5V so it's great for mobile applications. Simply clip the Pulse Sensor to your earlobe or

fingertip and plug it into your 3 or 5 Volt Arduino and you're ready to read heart rate! The 24" cable on the Pulse Sensor is terminated with standard male headers so there's no soldering required. Of course Arduino example code is available as well as a Processing sketch for visualizing heart rate data.

V. WORKING PRINCIPLE OF THE SYSTEM

Working of Transmitter section

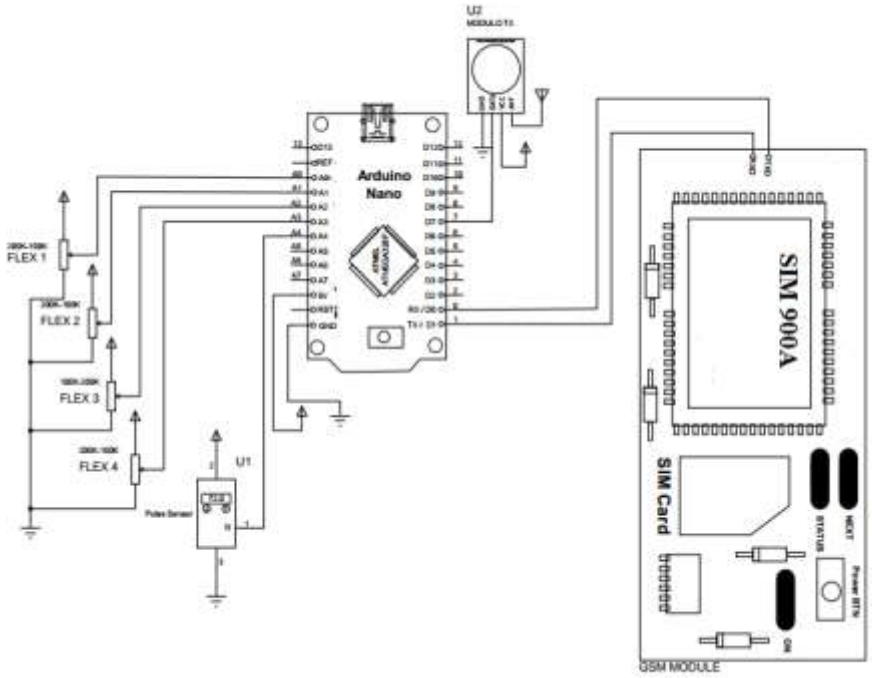


Fig. 4: Circuit Diagram of Handglove end (Transmitter)

In this Schematic Four PIR sensors named as P1, P2, P3, and P4 to the analog pins A0, A1, A2, and A3 are connected with Arduino Uno. The generated code for the sensor output is given to the RF transmitter module for transmission to the receiver via TX pin of Arduino Uno (Digital Pin 1).LED is connected with pin no. 13 of the Arduino. A +5v regulated supply is used as power supply for Arduino Uno, RF module and sensors.

This section is the primary part of the system. It consists of hand glove (Flex sensors and Heartbeat module), GSM module, RF Transmitter and Arduino UNO as a Controller. All the gestures made by the hand glove (with Flex sensor) are converted into different messages and commands for the operation of different devices. For example, if we want to start a fan, a command is sent to the receiver end by the microcontroller with the help of RF module to the receiver end and the fan is easily controlled by the corresponding gestures. Another example is if we need water then make the corresponding gesture with hand glove and this gesture is converted into text message and sent to the other person through the GSM module. Now using the Android app we can convert the text messages into voice also.

The Heart beat module is used for the heart rate monitoring of the patient .If there is any problem in heart rate then a message is also sent to the doctor or family members. In this project currently we are using seven gestures and can add about 250 gestures.

Working of the Receiver Section

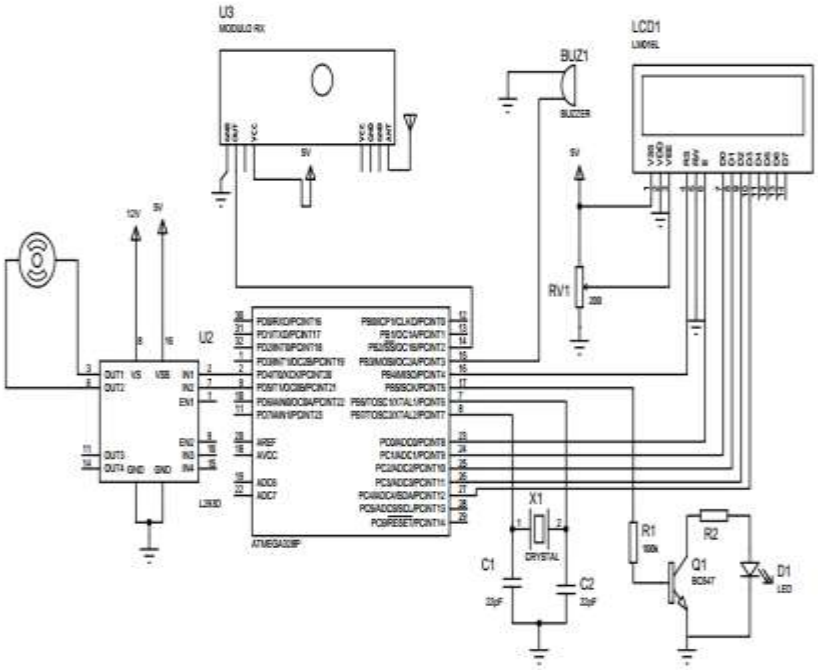


Fig. 5: Circuit Diagram of Reciver end

In this section, Microcontroller ATMEGA 328P is used with RF Receiver, Buzzer, Motor Driver Module and LCD. The buzzer is connected via transistor BC547 to Microcontroller. Motor driver is interfaced with Pin no 8 and 9 of the microcontroller. The targeting control system by LED which is connected on digital pin 13 of the microcontroller and Alarming System is connected with pin no. 12.Wholw circuit is operated with 5V power supply .This section is mainly for the output, the massages which is sent by the GSM Module and Emergency alerts are shown in the LCD with a short beep by buzzer. LCD and Motor can be controlled by making gesture through glove, these sections shows how we can control any devices wirelessly by making gestures.

VI. RESULTS AND DISCUSSIONS

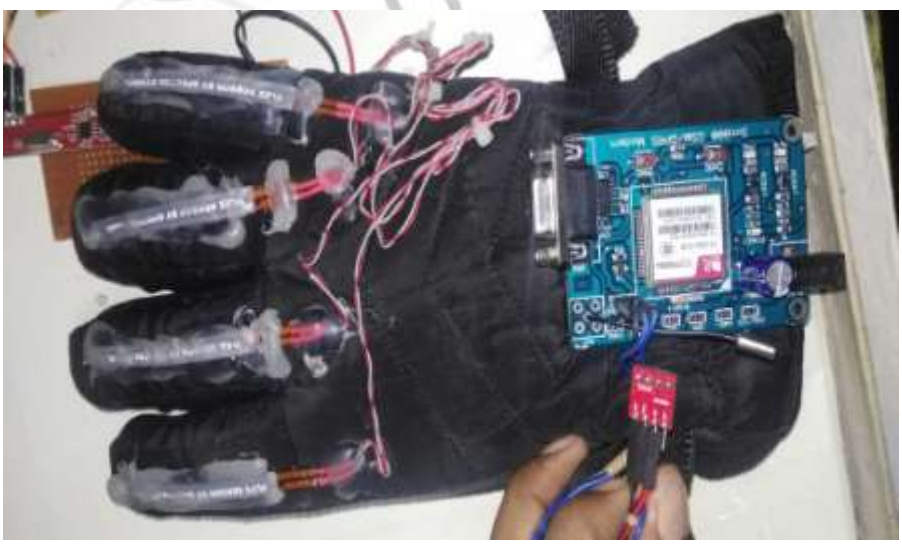


Fig. 6: Hand glove (Transmitter End) of proposed system

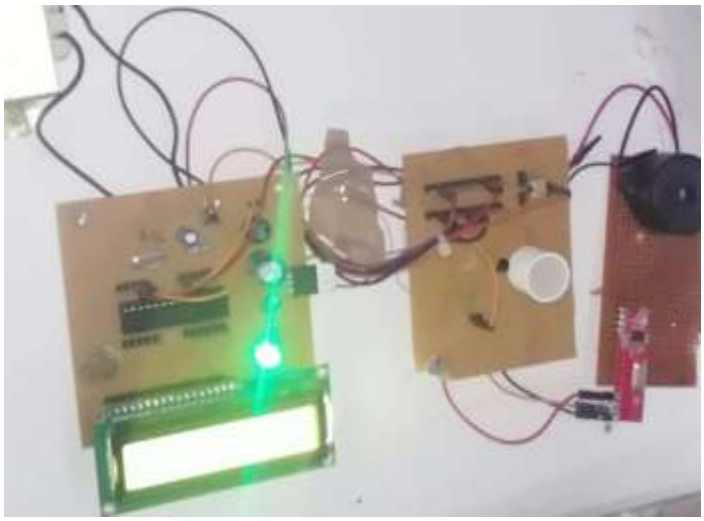


Fig.7: Receiver End of Propose System

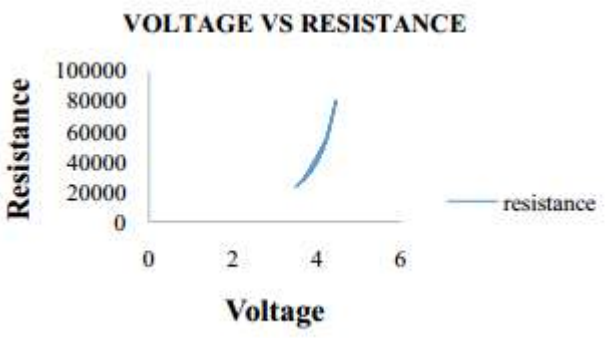
Figure 6 and 7 shows the hardware system of the project. Figure 6 is of Hand Glove with Flex Sensor, GSM Module, Arduino Nano and RF Module acting as Transmitter end. Fig. 7 is receiver end which is controlled by At mega 328p microcontroller, this part is only for displaying the output and performing the actions like light on ,fan on or for alert.

The evaluation of HANDTALK was carried out for 6 Massages (i.e. - Water Required by Patient, Food Required by Patient, Emergency Situation etc.) Sentences are preloaded by program; the output is depending upon the gestures and combination of gestures. Example the analog value of the sensors are 255,230,215,220,then the output as a text will be "Food required by Patient" and same massage will be sent to family members also. Similarly, other massages are depends upon combinations of analog values of the flex sensors. Table 1 shows the Output voltage across a voltage divider network with constant resistance of 22Kohms, the digital value and the corresponding resistance for different bending angles of flex 2.5" mounted in thumb and pinky fingers.

TABLE 1: RESISTANCE AND CORRELATEDBENDING – FLEX 2.5"

DEGREE	VOLTAGE (ANALOG)	DIGITAL	RESISTANCE (OHMS)
0	4.001	255	30020
15	4.100	240	31001
30	4.315	230	36010
45	4.400	225	40562
60	4.750	215	48552
75	4.950	200	56000
90	5.100	190	62500

The value of resistance increases with increase in degree of bending as in figure 4 and the output voltage of the voltage div ider network also increases with increase in resistance as in figure below.



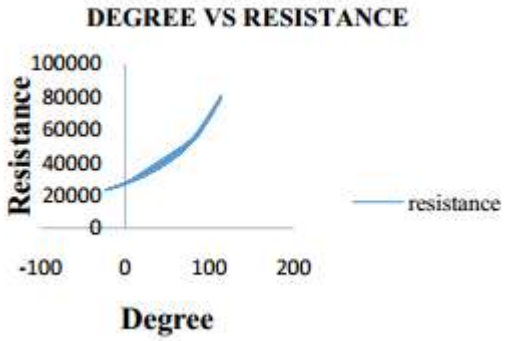


Fig 8: V-R characteristics Fig 9: Plot of degree vs. resistance of flex 2.5”

Figure below shows the output results of different gestures.

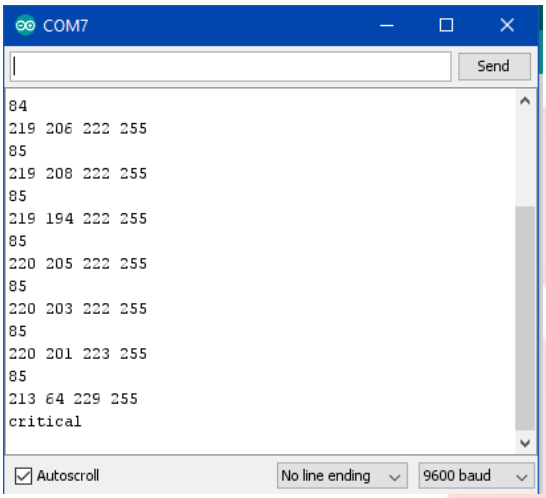


Fig. 10: Serial output on Arduino IDE

Fig. 11 :Output on LCD

Fig. 12: Result on Mobile

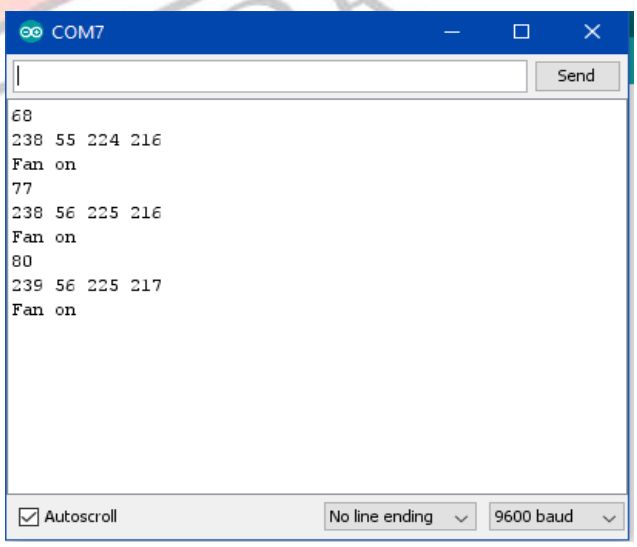


Fig. 13: Serial output for gesture of Fan On

As per the figure 10,11 the gloves in the normal condition shows the value of (220,201,223,255), as soon as the operator performs a particular gesture the values changes to (213,64,229,255) that corresponds to the message "CRITICAL" and the same message will also get transmitted in the form of text or call via GSM module as show in figure 12.

Similarly, for all other gestures we can opt for text or call as per the requirements.

As per figure 13, when the values of the flex sensors are nearly (238, 56,225,216) the resultant message would be "FAN ON"

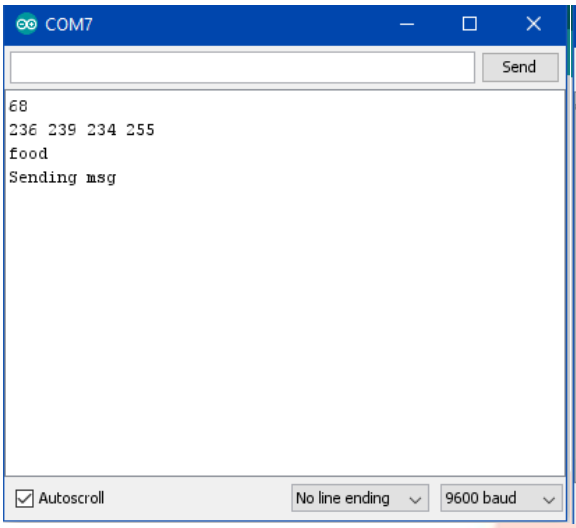


Fig.14 : Output for the FOOD

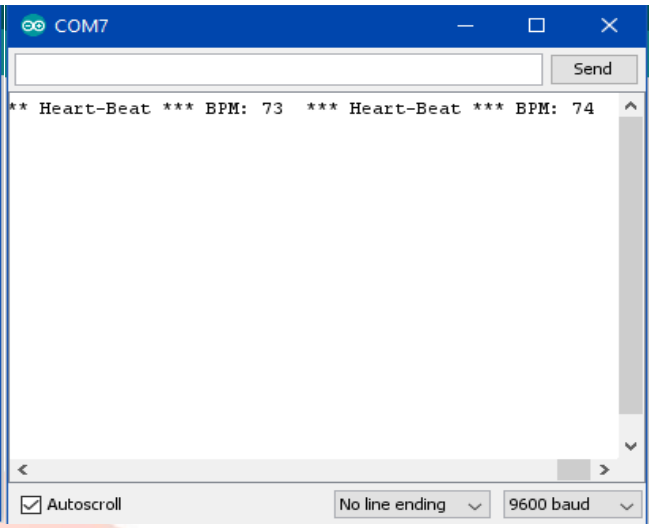


Fig 15: Heartrate Output

As per Fig.14, when the values changes to (236,239,234,255) the message displayed would be "FOOD" and also the same message will be transmitted in the form of text or call.

Fig. 15 is showing the Heart rate of the patient and continues to change and display as per the patient's Heart Beat. When Heart beat is above or normal condition then system will send alert message also to the relative's mobile numbers.

VII. CONCLUSION

The project proposes a translational device for deaf-mute people using glove technology. The proposed technique has enabled the placement of four flex sensor, heartbeat sensor and GSM Module on to a glove. The RF Module and GSM Module is provide wireless connectivity to system and it helps to control the other system. Further the device will be an apt tool for deaf mute community to learn gesture and words easily. The project can be enhanced to include accelerometer's to capture the orientation of hand movements once the gesture is made. This will expand the capability to translate larger gesture.

VIII. ACKNOWLEDGMENT

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