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Hand Gesture Recognition and Patient Monitoring System with Automated Bed and Voice Control

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Abstract: ***The speech impaired people experience challenges often at public places while expressing themselves to other people. The solution to this problem is proposed in this paper. The hand gestures can be used to represent various signs with the help of the flex sensors. The gesture representation includes the movements such as angle bends and direction changes. The flex sensors which are fitter over fingers acquire their dynamics. The voltage signals corresponding to the bend of flex sensors will then be processed by microcontroller. This processed signal will be sent to voice module and produce the appropriate voice words with the help of the speaker. In this society the number of disabled patients are increasing and there is no one to take care of them. A patient required a caretaker to continuously monitor which is not always possible due to social or financial circumstances. So, to minimize care takers requirement and increase the comfort level of the patients here, we have proposed an automatic bed position control system for disabled patients. The bed positioning is also controlled by different hand gestures. The system also contains a continuous patient monitoring system that monitors various parameters such as temperature and pulse rate. If any of these any parameter crosses safe minimal level, this unit sends an alert signal to the doctor by sending an SMS.***
Index Terms: Flex sensors, Arduino, Heart rate sensor, Temperature sensor LM35, GSM Module

I. INTRODUCTION

The speech and hearing impaired uses Sign Languages to represent themselves. One of the main challenges speech and hearing impaired people faced while communicating with normal people were social interaction, communication disparity.
As a result they may find it very difficult to convey their messages to the normal people.
As a solution to this problem hand gestures made by the speech impaired with the help of fingers for different sequence of words are captured by the flex sensors and produces a voice output with the help of a speaker.
This paper proposes a model that will be a helping hand to stroke patients as well as speech impaired people.
A bed system used in various cases such as for disabled persons, paralyzed patients, and accident and old age people is also developed. The aim of this bed is to minimize the requirement of caretakers by providing two movements such as up and down movements thereby increasing the patient comfort level.
The bed is designed in such a way that the position of the bed is automatically controlled as per the requirement of the patients by using hand gesture recognition. A DC motor along with the help of the DC motor driver is used to control the bed.
A continuous patient monitoring system that contains the sensor nodes such as heart rate sensor and temperature sensor, these are capable of sensing the analog biomedical signal is also incorporated.
These signals are then processed by using Arduino board.
There is an alert system that comes into action if any abnormal condition found in patients' health. This is performed by sending a stored message to the respective doctors of particular patient using GSM module.
This gives the efficiency and services in medical sector.

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II. PROPOSED SYSTEM

A. System Overview

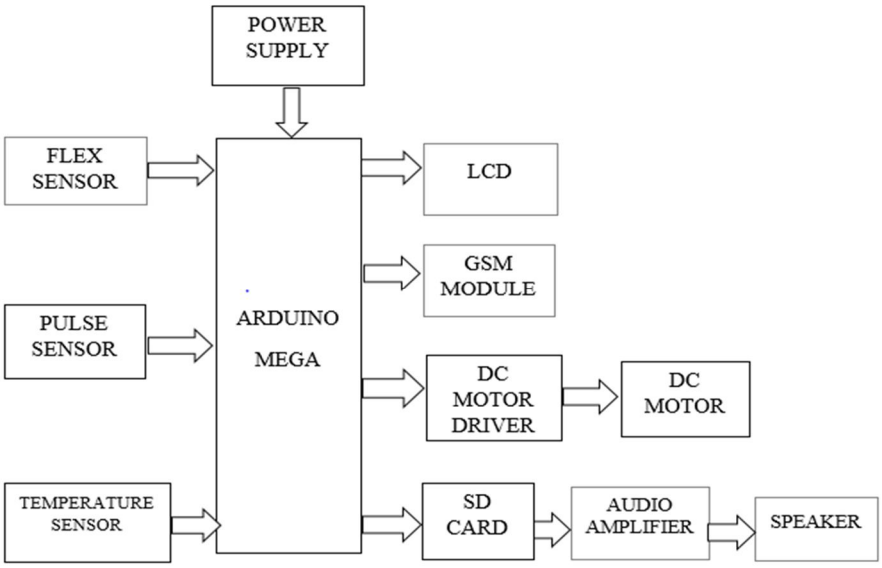


Fig.1 Block Diagram

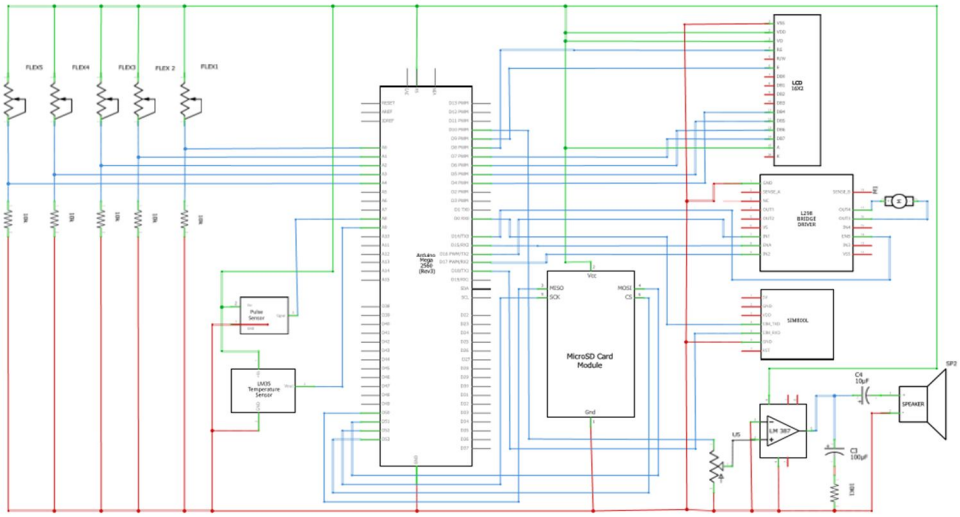


Fig.2 Circuit Diagram

It mainly consists of 5 flex sensors of 2.2” each which are fitted to the glove. When the finger bends, the shape of the flex sensor changes and as a result the resistance value changes. The outputs of the flex sensors are given to the analog input pins of the ARDUINO Mega. The ADC in the ARDUINO converts the analog inputs into digital output and a specified value is assigned to each gesture. In accordance with the digital value received the microcontroller selects the corresponding words stored in the SD card and these words are played through the speaker after amplification using an audio amplifier.

The flex sensors are also used to control the dc motor for positioning of the bed. When the corresponding flex sensor is bend it produces a digital value that controls the motor. The DC motor is connected to the ARDUINO through DC motor driver. The system consists of biomedical sensors such as temperature sensor and pulse rate sensor. Pulse rate sensor is used for measuring the functioning of heart by blood flow through finger while temperature sensor is used to measure the body temperature through external skin. The sensor readings are then given to microcontroller which process the data. These medical parameter that been measured using sensors will be carefully monitored and if any abnormalities are found, SMS will be sent to the doctor using GSM module. Here the measured physiological parameters such as pulse rate and temperature are also displayed using an LCD.

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III. RESULTS

The data glove fitted with flex sensors were first tested. The flex sensor readings for different values of angle of bending are shown in Table I. The Fig. 3.shown is the experimental setup of the project used for hand gesture recognition and automatic bed positioning system for continuous patient monitoring.

Table I Variation Of Voltage And Resistance With Respect To Bend Angle

Bend Angle (in degrees)	Resistance (in KΩ)	Voltage (in Volts)
0	9.7	3.5
10	10.9	3.1
20	11	3.02
30	12	2.93
50	13.2	2.6
60	13.5	2.5
90	16.5	2.35
120	18	2.18
150	19.	2.12
180	20	2.04

The above results shows that the resistance of flex sensor ranges from 9.5 kΩ to 20 kΩ and that the maximum voltage when the sensor is straight is 3.5 V even for a 5V supply. It is also seen that greater angle of flexion leads to greater resistance of the sensor. The data glove fitted with sensors after testing was connected to an ARDUINO MEGA 2560, then to a voice module and speaker to hear the voice signals.

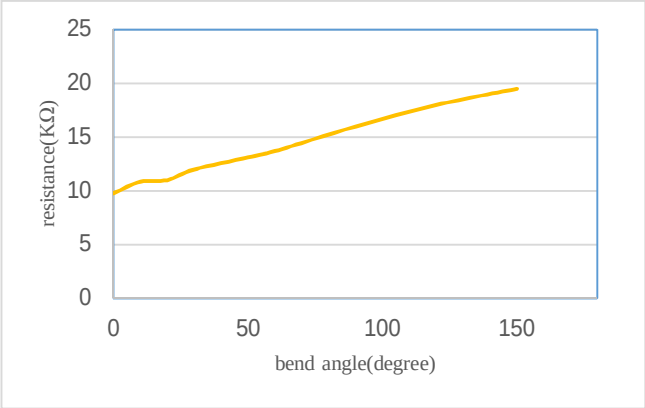


Fig.4 Resistance vs. Bend angle

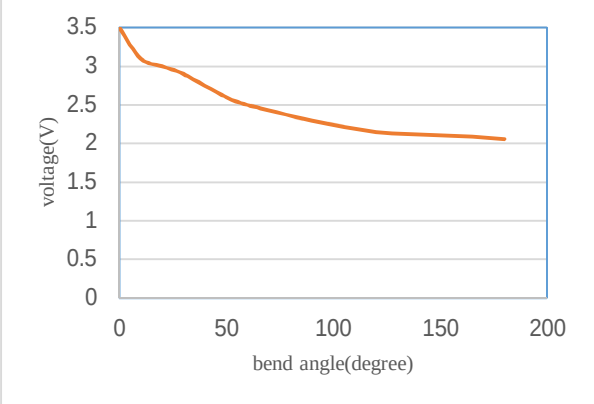


Fig. 5 Voltage vs. Bend angle

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Every bend of the sensor (finger) produces an analog voltage which when fed to the ADC channels of ARDUINO gives a unique ADC value. The selected four words were Food, Water, Medicine and Washroom is given as voice output when the corresponding ADC value is triggered.

The gesture for bed positioning gives a corresponding value which is used to control the dc motor. Through Arduino, DC motor driver controls the car speed. It also provides a connection for motors power supply.

The sensors sense the parameters and collect the data which is compared with threshold values specified by doctor. Depending on the patient these ranges varies and respective modifications can be done in code. If the parameters exceeds the threshold then it sends an alert SMS to the doctor. A heart rate less than 120/80 mmHg is normal. A heart rate of 140/90 mmHg or more is too high. People with levels in between 120/80 and 140/90 have a condition called prehypertension, which means they are at high risk for high heart rate. The pulse rate sensor gives the heart rate in beats per minute (bpm). The pulse rate of a normal person is about 72 bpm. If the pulse rate is above 80 bpm or below 50 bpm then it is an abnormal condition.

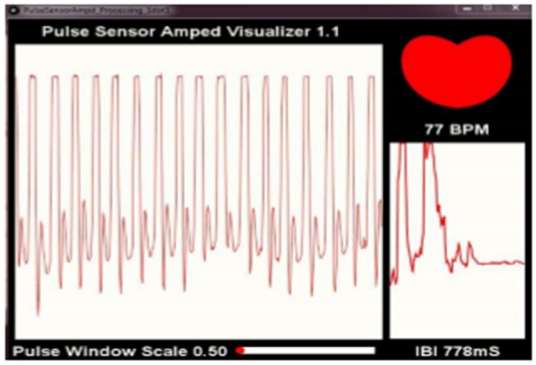


Fig 6 Normal pulse rate graph shown in visualizer

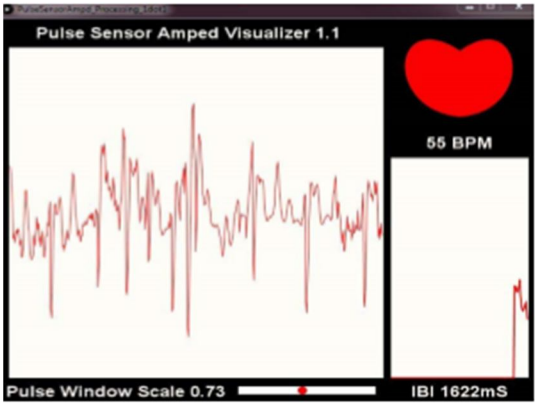


Fig. 7 Abnormal pulse rate graph shown in visualizer

IV. CONCLUSION

The expression of words have been made successfully by this work for the speech impaired people. This project also helps the patients itself to adjust the bed on their comfort. The wireless smart health monitoring system project is designed to give a better healthcare service. This system is really assisting them in not spending much time with each of the patients for monitoring

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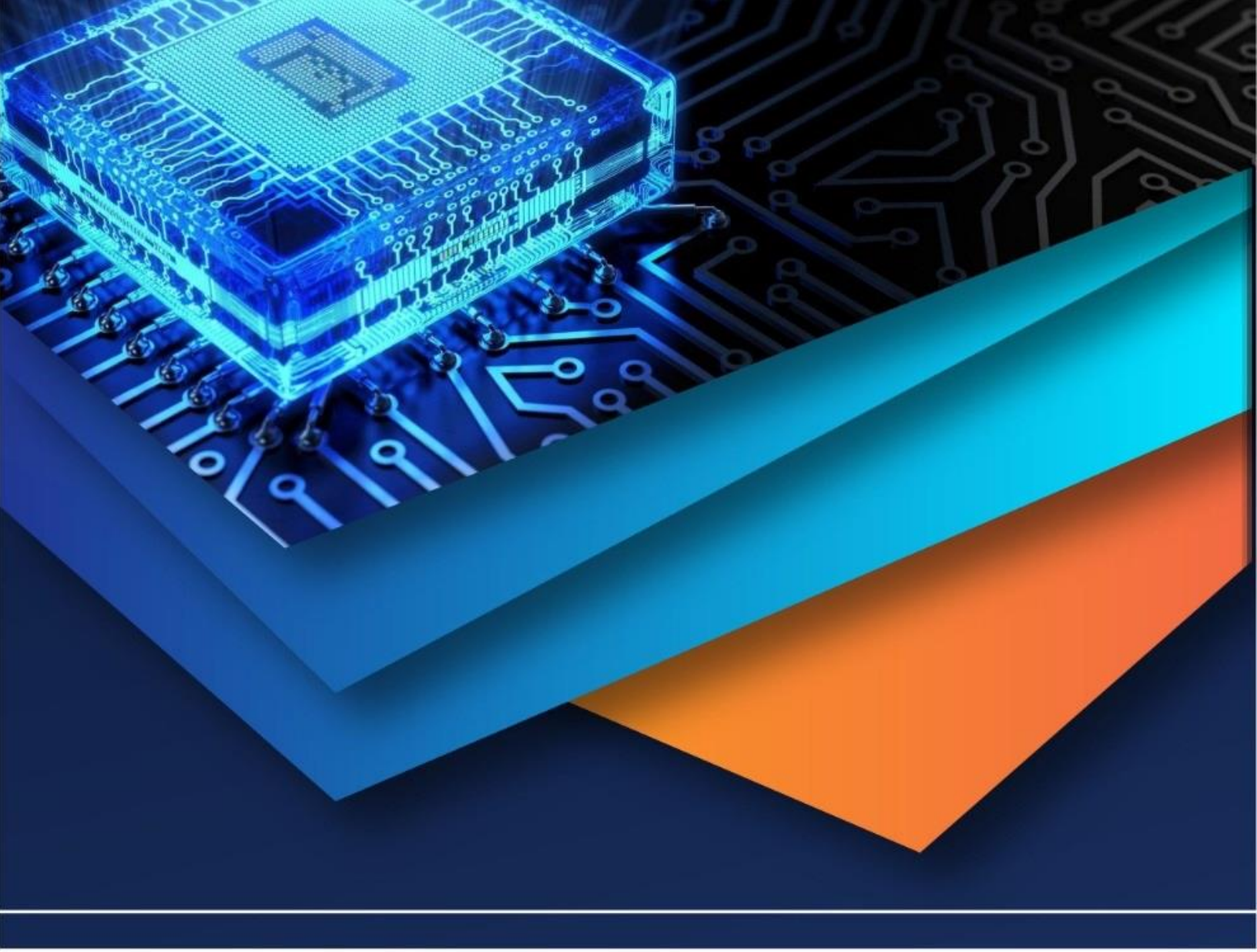


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