Gesture Recognition by Using Flex Sensor for Patient Monitoring

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Abstract

Generally parallelized person cannot communicate with the normal person so we are developing a glove, in which the parallelized person can give the sign through wearable glove which helps to communicate with normal persons. The main objectives of this project are to detect the position of fingers and give command to the doctor. It consists of a glove in which flex sensor are attached to an electronic conditioning circuit. The glove can have several other applications such as: (1) The recognition of sign language, (2) The diagnostic measured of the finger movement at a distance and (3) The interaction with virtual reality. This paper focuses on studying and implementing a system for measuring the finger position of one hand. It can be used in rehabilitation purpose and here we focus on biomedical application which exhibit coordination between parallelized patient and doctor. So this is a simple and moderate system.

Keywords: Flex sensor, Graphical User Interface, Rehabilitation, Sensorized glove, Wireless communication.

Introduction

In our daily life we utilized our hand to do many tasks. Application like robotic, design/manufacturing, art and entertainment, information, visualization sign language understanding, medicine/health care etc. Every year, millions of people worldwide experience problems because of traumatic brain injuries degenerative disease articulation traumas. Rehabilitation aims to restore patient's physical, sensory and mental abilities affected by injuries, diseases and disorder, and to support the patient to compensate the deficit that is not medically treatable.

In recent year, researchers have been focusing on hand gestures detections and been popular for developing applications in a field of robotics and extended in the area of artificial or prosthetic hands that can mimic the behavior of a natural human hand. The adoption of robotics system would reduce the healing time and in the future would allow the tele-rehabilitation management giving the patient the ability to perform exercise at home.

This project all the utilizes a similar approach for the detection of the movement of the finger, 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. This project can be used for the speechless patients with half of their bodies paralyzed and who are not able to speak but are able to move their fingers. The aims and objectives of this project to develop an economical and simple solution for the detection of finger gestures using the sensorized glove permits to measure 10 joints of one hand.

Methodology

This system is made out of transmitting section and receiving section. The transmitting section comprises of glove including five flex sensors (one for every finger and number of sensor may be change) join with microcontroller. The management of sensor estimation is allotted to the ATMEGA16 microcontroller that performs information transformation. The output of ATMEGA16 is displayed on 16*2 LCD. The finger movement are detected or not will be displayed on LCD on
transmitter side. Power supply of 5v is used to trigger ATMEGA 16. The output of ATMEGA 16 is given to CC2500 for wireless communication.

The receiving section, which consist of power supply section ,CC2500, wireless module,ATMEGA16 ,GUI, motor driver(I293d IC) and robotic arm . the power supply of 5v is given to ATMEGA16. The transmitted information through wireless module CC2500 is given to the receiver side cc2500 wireless module. The output of wireless module is given to theATMEGA16. For displaying the data from CC2500 wireless module receiver on pc. We have used the c# software using this c# software; we created the graphical user interface (GUI). The information on ATMEGA16 is transmitted to motor driver (I293d). In ATMEGA16, port B directly connected to I293d (motor driver IC/ dc motor). To drive motor driver IC we require 400ma of current. Motor driver IC drive the motor, robotic arm by giving suitable commands like open arm, close arm, up and down by using c# programming.

Features
- Size: approx 0.28" wide and 1"/3"/5" long
- Resistance Range: 1.5-40K ohms depending on sensor. Flex point claims a 0-250 resistance range.
- Lifetime: Greater than 1 million life cycles
- Temperature Range: -35 to +80 degrees Celsius
- Hysteresis: 7%
- Voltage: 5 to 12 V

(B) ATMEGA16
- High-performance, Low-power Atmel® AVR® 8-bit Microcontroller.
- Advanced RISC Architecture.
- High Endurance Non-volatile Memory segments.
- 16 Kbytes of In-System Self-programmable Flash program memory.
- 512 Bytes EEPROM.
- 1 Kbyte Internal SRAM.
- Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes.

Hardware and Software

(A)Flex Sensors
The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value.
• One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture.
• Mode.
• 8-channel, 10-bit ADC.
• Programmable Serial UART.

(C) CC2500

CC2500 is wireless transmitter receiver developed by Texas instruments which is used in 2400-2483.5 MHz ISM/SRD band systems. In this project, the input present at PORTD of transmitter atmega8 is transmitted wirelessly to the PORTD of receiver atmega8. This project shows how to configure registers of CC2500, how to give commands to CC2500 and how to activate transmission or receiver mode of CC2500 via SPI interfacing with AVR microcontroller. The CC2500 RF module is a low-cost 2.4 GHz transceiver used in very low power wireless applications. The RF transceiver is integrated with a highly configurable baseband modem. It support OOK, 2-FSK, GFSK, and MSK modulations. It works in voltage range of 1.8 - 3.6V. Two AA batteries are enough to power it. It has 30m range with onboard antenna. It is always used with microcontroller which supports SPI communication.

Results

In this paper we measure the angle of the finger. At transmitter section we attached the sensor with glove. For displaying the data from RF module receiver on PC we have used the C# software. Using this C# software we created a Graphical User Interface (GUI).

Fig. (A) (B) (C)

Fig.(d) GUI ToolBox1
Fig. (e) GUI ToolBox2

Fig (a) showing flex sensor attached with glove. Fig.(b) & fig.(c) showing the gesture of hand according to that result will be shown in GUI ToolBox in fig.(d) & fig. (e)

Conclusion

This project is useful for speechless and paralyzed patient with any language which fills the communication gap between patient and doctor. This system gives the voice command as well as gestures to the receiver side. It is portable device and it requires less power for operation. This system has application in robotic, gaming, sign language etc. Here we are working on biomedical application.

References


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