Robotic Arm Controller by using a Tmega16 Microcontroller

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Abstract

In our daily life, there is an increasing need to create artificial arm where human interaction is difficult or impossible. Its application is used to diffusing bomb by using active volcano. In this we are built robotic arm controlled by natural human arm movement using dc motor. The development is based on ATMEGA-16 with a personal computer for signal processing. The application of this robotic arm is in military operation, manufacturing industries, motels, work places etc. Finally the robotic arm is used for moving object from one place to another. This report deals with a robotic arm whose objective is to imitate the movements of a human arm using DC motor and flex sensor for natural arm movements. So in this paper we are presenting a moderate system.

Keywords: Robotic Arm, DC Motor, Flex Sensor, Wireless Communication, Graphical User Interface, Sensorized Glove

I. INTRODUCTION

In this days, robots are increase in need at working place to reduce the man power. These robots are currently used in many fields of application including office, military task, hospital operation, dangerous environment and agriculture. The things which are difficult or dangerous for human can easily done by robots such as picking up explosive chemicals, diffusing bomb to pick and place in industries.

Researchers search for knowledge through analysis of hand trajectories to handle things and man-machine correspondence for motion acknowledgment. This data is then used to imprecise the standard activities and mechanized activities in gestural cooperation with social robots. Accordingly, in the previous 30 years, various advances were created to help researchers to proceed with their studies. Those innovations are named as data glove based system. They are basically gloves instrumented with sensors used to perform data attainment. Therefore, a robot can be replaced human to do work.

II.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.

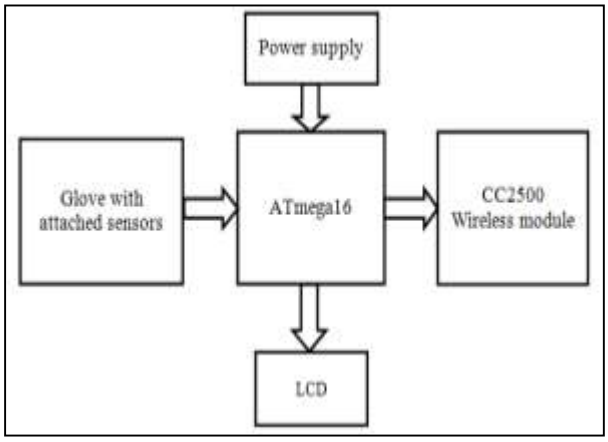


Fig. 1: Transmitting section

The receiving section, which consist of power supply section, CC2500, wireless module, ATMEGA16, GUI, motor driver (l293d 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(L293D). In ATMEGA16, portB directly connected to L293D (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.

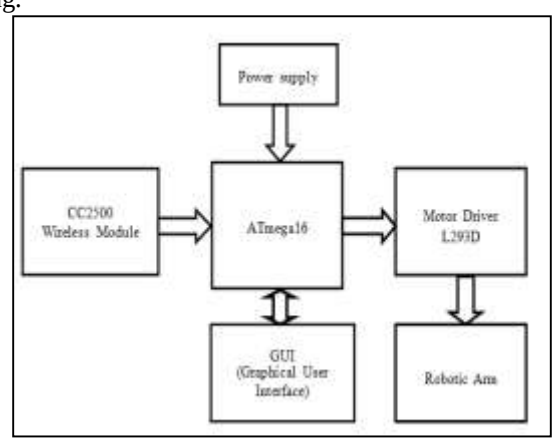
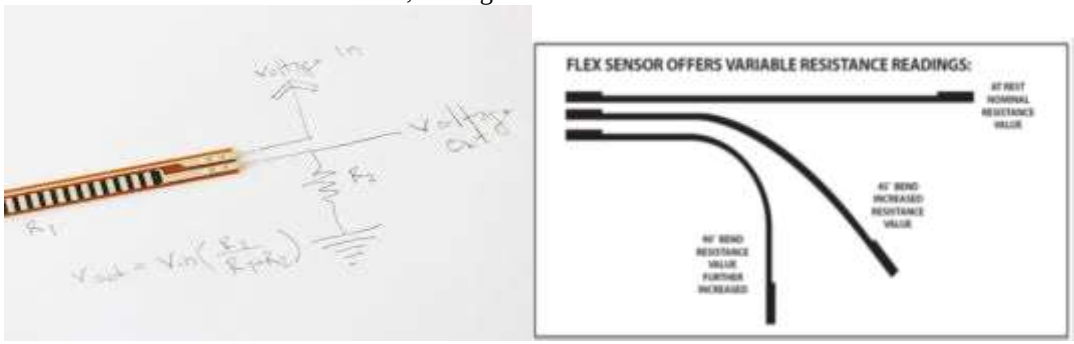


Fig. 2: Receiver Section

III. 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.



(a) (b)

Fig. 3: (a)&(b) flex sensors

1) 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.
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture.
- 8-channel, 10-bit ADC.

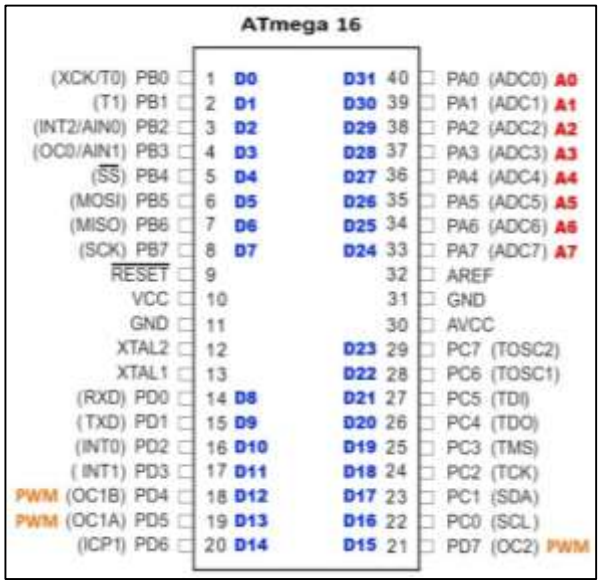


Fig. 4: ATmega16

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 support SPI communication.

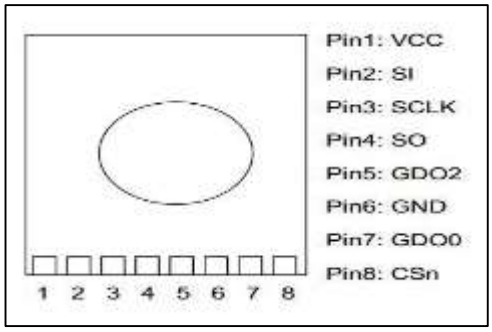


Fig. 5: cc250 pin diagram

D. DC MOTOR

The basic principle of dc motor is that in any electric motor operation is based on simple electromagnetism. The speed of a DC motor is directly proportional to the supply voltage, so if we reduce the supply voltage from 12 Volts to 6 Volts, the motor will run at half the speed. The speed controller works by varying the average voltage sent to the motor. It could do this by simply adjusting the voltage sent to the motor, but this is quite inefficient to do. A better way is to switch the motor's supply on and off very quickly. If the switching is fast enough, the motor doesn't notice it, it only notices the average effect.

Fig. 6:

E. Robotic arm

Robotic arm is a programmable device which acts as a similar in function like human arm. For movement of joint of hand rotational motion is required .The end effector can be designed to perform any desired task such as welding, gripping, spinning etc. depending on the application .The robotic arm controlled automatically or manually to perform task with great accuracy. The robotic arm can be fixed or mobile and can be designed for industrial or home application.

IV. RESULT

In this paper, we measure the angle of the finger. At transmitter section we attached the sensor with glove. For displaying the robotic arm movement as a output through CC2500 module of receiver using C# software. We created a Graphical User Interface (GUI) using this C# software .

V. CONCLUSION

The objectives of this project has been achieved is that the developing the hardware and software for DC motor controlled robotic arm. From observation it clearly shows that its movement is precise, accurate, and is easy to control and user friendly to use. The robotic arm has been developed successfully as the movement of the robot can be controlled precisely. This robotic arm control method is expected to overcome the problem such as placing or picking object that away from the user, pick and place hazardous object in a very fast and easy manner.

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