Controlling Robot By Fingers Using Flex Sensors

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***Abstract* — *In our project we are developing the robot which is controlled by fingers using flex sensors. Flex sensors are placed on fingers and the movement of the fingers creates motion in robots and that performs the pick and place activities. The main motto of our project is to use artificial hand in the place where human hand is required. Mainly, in hazardous places by using this we can perform any operation from far distant places. So we can save the peoples life.In this we are using ardiuno board based on AT MEGA 328 micro controller. This is based on embedded systems and also embedded c language. Embedded is the combination of hardware and software. For dumping the code in micro cont*roller we go through Arduino IDE software.

Keywords — *Robots, Flex Sensors, MEGA 328 micro controller, Arduino.*

I. INTRODUCTION

The human hand is undeniably a work of wonder.this version of hand is result of millions of years of evolution and adaptation. It has 34 sets of muscles which move the fingers and thumb.our aim is to design a robotic hand that is basically a mechanical hand with five fingers,that gives ability to grasp object of various shapes which will be is mutually controlled by another human hand with a distance.in simple words this mechanical hand will always copy my hand movements.this type of systems is very crucial in fields of medical,defense and industrial works where delicate and dangerous task can be done from a distance with out actually touching it .Sensor plays an important role in robotics sensors are used to determine the present state of system. It is having high degree of repeatability, precision and also reliability. By using this flex sensor we can achieve great degree of accuracy. Fingers are very flexible part in the body. So we can move (or) turn our fingers in Omni directions (many ways). So we can easily control the robot using fingers. The moving direction of our fingers can be efficiently controlled by using micro controller programming. As robot control is an exciting and highly challenging work.

In this interesting project we are using the components like power supply, MC ATMEGA 328 processor, Glove, flex sensor, buzzer, L293D motor, motors and also wires. By using these electronic components we can control the robot by fingers and using flex sensor. Firstly, we are using DC power supply which is connected above to the microcontroller. The input to the micro controller is taken from the flex sensor. Here we are using glove in which flex sensor are placed. By our finger movements the flex sensor forms the command and it is given to the processor.

Then micro controller understands the command given by the flex sensor. By using three flex sensors the command is based and it is in binary language which is in the form of 0's and 1's. These are the input commands (000,001,010,011,100,101,110,111). For each command we are having a unique action. 0 is for closing our fingers and 1 is for stretching our finger. For example 000 is used for stop. 001 for moving towards front and so on etc. And also we use buzzer as output and while performing an action then the buzzer will also work and we can easily understand by sound. The main application using this is we can play video games by using our hand not by any remote. And it can be used in a place where actual human hand is required; it can be used in dangerous to use them. It can be used in medical, military, industrial and also in household applications.

II. SYSTEM ARCHITECTURE

The robot is controlled by using flex sensors and sensors are attaché d to the glove which can be wear on our hand .
flex sensors are placed on fingers and the movement of fingers creates motion in robot . In the designing we are using power supply, flex sensors ,atmega328 micro controller, motor drive(m1,m2), buzzer.dc power supply is given to micro controller an the same power supply is given to other peripheral devices. flex sensors are given to gloves which is given input as a micro controller.

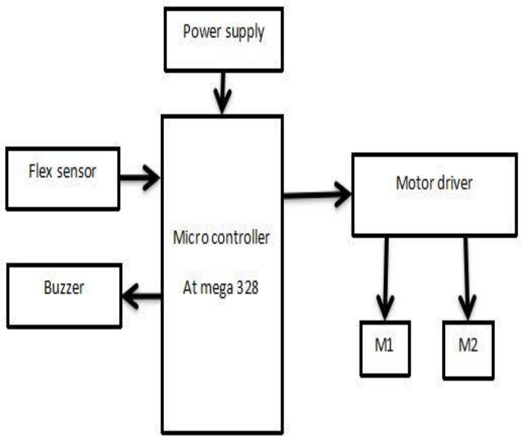

Fig 1: Block diagram of Controlling Robot By fingers Using Flex Sensors

In the designing using 3 flex sensors so the probability of outcomes is in the form of(000,001,010, etc) up to 7(2^3=8). sensor works depending on our input .commands like 000:stop,001:forward direction like that .

Micro controller output is given to motor driver which drives the overall circuit .the motor driver consists of two motors these are accepting the commands and process the commands given to the output device which will be a buzzer .

In this project we will use flex sensors to sense the motion of the fingers.We will be using 3 such a sensors that will be arranged in a hand glove which will make the sensors comfortable to wear.the other part i.e mechanical hand will consist of five fingers that will be controlled using stepper motors.all together will be one hand consists of 3 flex sensors depending on the commands The robot will works.bend of fingers is analysed using one of At Mega 328via serial communication and also generates appropriate PWM signals for controlling stepper motors.

The readings of each fingers where measured in the form of voltage ,while the movement of each fingers will be given with respect to angle.thus to relate voltage with respect to angle we plot the graph of each and then we get a linear graph .by calculating equation of each line we can relate each other easily.then by knowing only one of the value we can calculate another value very easily .this equation will be then feed to code of micro controller connected in sensor unit.then it will generate appropriate angle for respective finger.

III. SYSTEM REQUIREMENT SPECIFICATION

A. Hardware Requirements

- Flex Sensors
- Motor driver
- Stepper Motor
- At mega 328 micro controller

Flex Sensors

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface. Since the resistance is directly proportional to the amount of bend it is used as goniometry, and often called flexible potentiometer. Flexion sensors, (from Latin flexure, 'to bend') also called bend sensors, measure the amount deflection, from strain-gauges to hall-effect sensors

Fig 2: Flex Sensor

Motor driver

The L293D motor driver is available for providing User with ease and user friendly interfacing for embedded application. L293D motor driver is mounted on a good quality, single sided non-PTH PCB. The pins of L293D motor driver IC are connected to connectors for easy access to the driver IC's pin functions. The L293D is a Dual Full Bridge driver that can drive up to 1Amp per bridge with supply voltage up to 24V. It can drive two DC motors, relays, solenoids, etc. The device is TTL compatible. Two H bridges of L293D can be connected in parallel to increase its current capacity to 2 Amp

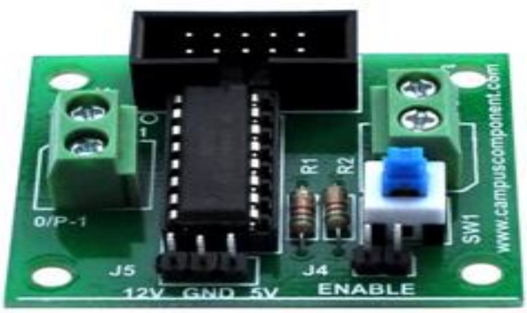

Fig 3. L293D Motor driver

Stepper Motor

Stepper motors are DC motors that move in discrete steps. They have multiple coils that are organized in groups called "phases". By energizing each phase in sequence,the motor will rotate, one step at a time.

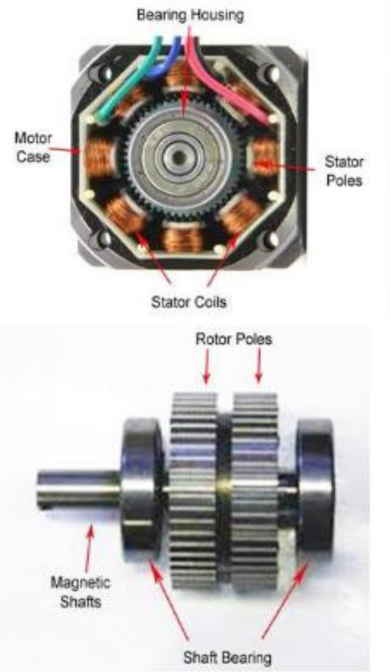

Fig: 4. stepper motor

With a computer controlled stepping you can achieve very precise positioning and/or speed control. For this reason, stepper motors are the motor of choice for many precision motion control applications.

At mega 328 micro controller

The Atmel AVR® core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The ATmega328/P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6- channel 10- bit ADC (8 channels in TQFP and QFN/MLF packages) , a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes.

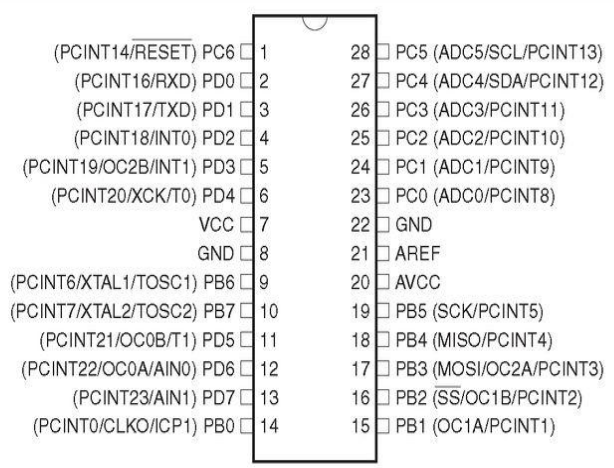

Fig: 5. At Mega 328 Microcontroller

B. Software Requirements

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Arduino Uno R3 Front

Fig: 6. Arduino board

IV. LITERATURE SURVEY

Embedded System

The very simplest embedded systems are capable of performing only a single function or set of functions to meet a single predetermined purpose. In more complex systems an application program that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded system. The ability to have programs means that the same embedded system can be used for a variety of different purposes. In some cases a microprocessor may be designed in such a way that application software for a particular purpose can be added to the basic software in a second process, after which it is not possible to make further changes. The applications software on such processors is sometimes referred to as firmware. The simplest devices consist of a single microprocessor often called a chip.

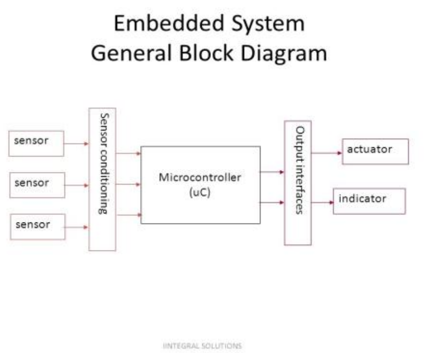

Fig: 7. Block Diagram Of Embedded System

Characteristics Of Embedded System

An embedded system is any computer system hidden inside a product other than a computer.
They will encounter a number of difficulties when writing embedded system software in addition to those we encounter when we write applications

Throughput – Our system may need to handle a lot of data in a short period of time.

Response–Our system may need to react to events quickly.

Testability–Setting up equipment to test embedded software can be difficult.

Debugability–Without a screen or a keyboard, finding out what the software is doing wrong (other than not working) is a troublesome problem.

Reliability – embedded systems must be able to handle any situation without human intervention.

Memory space – Memory is limited on embedded systems, and you must make the software and the data fit into whatever memory exists.

Program installation – you will need special tools to get your software into embedded systems.

Power consumption – Portable systems must run on battery power, and the software in these systems must conserve power.

Processor hogs – computing that requires large amounts of CPU time can complicate the response problem.

Cost – Reducing the cost of the hardware is a concern in many embedded system projects; software often operates on hardware that is barely adequate for the job.

Embedded systems have a microprocessor/ microcontroller and a memory. Some have a serial port or a network connection. They usually do not have keyboards, screens or disk drives.

V. CONCLUSIONS

Our model could be used for small scale surgical procedures in case of an emergency but currently, the major limiting factor that was stunting the development of our model was “latency” which is the time delay between the instructions issued by the surgeon and the movement of the robot which responds to the instructions. With the current level of technology, the surgeon must be in close proximity.Robot control refers to the way in which the sensing and action of a robot are coordinated. There are infinitely many possible robot programs, but they all fall along a well-defined spectrum of control.No single approach is "the best" for control of robots; each has its strengths and weaknesses. The accuracy and efficiency of surgeries have improved greatly because of the application of robotics in the field. However there are still some problems that need to be addressed. Research is still being carried out to improve the wireless transmission of signal and reduce the delay and for the simultaneous movement of two servo.

Thus the control of a robotic arm was achieved wirelessly using flex sensor given by the use.

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