Interaction Control on Robotic Wrist

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Abstract— Now a days in this fast growing industrial age every company needs speed in manufacturing to cope up with the customer's requirements. Our project can be used in the application of grasping as per the object nature. A superior control feedback approach used to develop proper functioning of robotic wrist using two sensors. The force sensors is placed on palm of prosthetic hand, change in value results in change of movement which is detected by the sensor. The axis sensor also controls the movement in varying directions while grasping object to hold firmly. Then these sensor feedback are fed to arduino board and servo motor to control the speed of the motion.

Key words: Interaction Control on Robotic Wrist, Robotic Wrist

I. INTRODUCTION

Prosthetic hand are designed to restore normal lifestyle to amputees. The robotic arm of this generation may be developed humanlike features and superhuman capabilities in it. Recent advancements in plastics and other materials, such as carbon fibre have allowed artificial limbs to become stronger and lighter. The major factors limiting prostheses today are due to the severe weight, power, and size constraints of hand systems as well as the difficulty in finding a sufficient number of appropriate control sources to control the degrees of freedom. The major drawback is the lack of independent control sources that imposes the most severe impediment to the development of today's prosthetic hand. The product is automated with programming as it function dependent on sensor feedback. So we develop a low cost artificial hand that can be used to provide versatile grasp is controlled by sensors. Here the servo motor assisted by force sensor programmed in arduino aid the limb control. This simple designing and low cost of materials will bring revolution in prosthetics.

II. BLOCK DIAGRAM

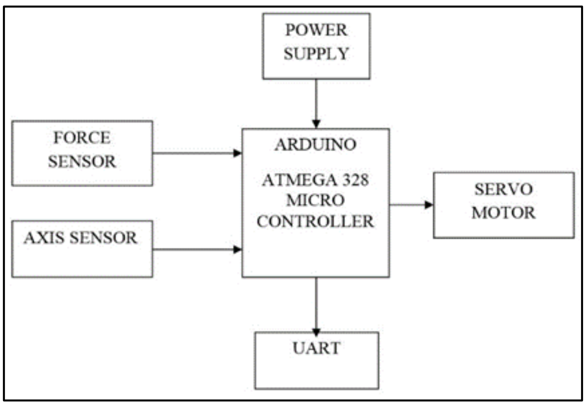

Fig. 1: Block diagram

The proposed system is used to control the movement using force sensor and axis sensor. Force sensor is a sensor which is used to control servos to actuate. If the patient is elder person or nervous they don't know about the precision control. In this technology, the sensor will send the feedback signal to the servos and then the finger moves accordingly. In this system Arduino, a microprocessor can be used for programming the servos to function properly. Also the sensors control the precision feedback and adjust the finger movement accurately.

The power supply is delivered to microcontroller to function the device properly. The microcontroller sends the automation process data to rotate the servos as the sensors provide control feedback for devices. The UART act as communication interface between computer (user) and arduino module. (See Fig. 1)

A. Axis Sensor (3 Axis – Gyroscope)

A gyroscope sensor is a sensor chip in which the axis of rotation is free to assume any orientation by itself. When rotating, the orientation of this axis is unaffected by tilting or rotation of the wrist, according to the conservation of angular momentum. Because of this, these sensor are useful for maintaining orientation and stability.

B. Force Sensor

The touch controlled load switch sensor is designed for controlling any load by touch sensitive switch. The human body induced action is used for developing voltage on touch plate. Thus, force-sensing resistors are used as pressure-sensing buttons and have applications in many fields, including artificial limbs. Thus, this feedback output is used to control servo motor for better precision movement and accuracy.

C. Servo Motor

A servo motor is an electrical device which can push or rotate an object with great precision. If you need to grab an object at some specific angles, then prefer servo motor. It is just made up of simple motor which run through servo mechanism. We can get a very high torque servo motor in a small and light weight packages. The position of a servo is decided by pulse width signal and it resembles finger movement. It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the motor is assisted by control feedback signal generated by sensors.

D. Arduino Uno

The Arduino UNO board features an Atmel ATmega328 microcontroller that can execute programs and create interface circuits to read switches, force and axis sensors, and to control servos with very little effort. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for interfacing to the host computer (user) and a DC power jack for connecting an external 6-20 V power supply. It has a special feature that once the program is created and executed to board, then the board automatically functions without the host computer. These programs are sketched by Arduino IDE (V 1.8.4).

E. Circuit Diagram

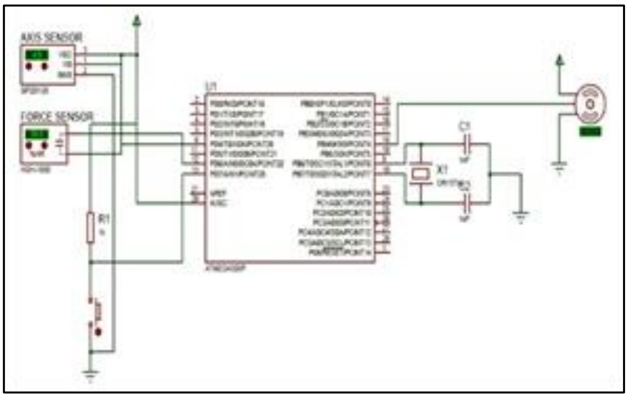

Fig. 2: Circuit diagram

The first pin of two sensors are connected to VCC of the microcontroller.

The axis sensor VO pin is coupled with force sensor and connected to PD4 of the microcontroller. The force sensor positive terminal is connected to PD6 of the microcontroller. If the touch plate is triggered, then the output drives relay feedback for a fixed time duration. The servomotor is connected to PB4 of the microcontroller and rest are grounded. A power supply is given to microcontroller dc jack and it provides the required voltage to function the hardware. (See Fig. 2)

All motors have three pins coming out of them. Out of these two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the microcontroller. Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires from microcontroller. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction from its neutral position. The force sensor makes it possible to actively control the contact force or to compensate the positioning error during operation. The axis sensor is useful for axis rotation to assume orientation by itself and thereby providing better stability.

III. RESULT

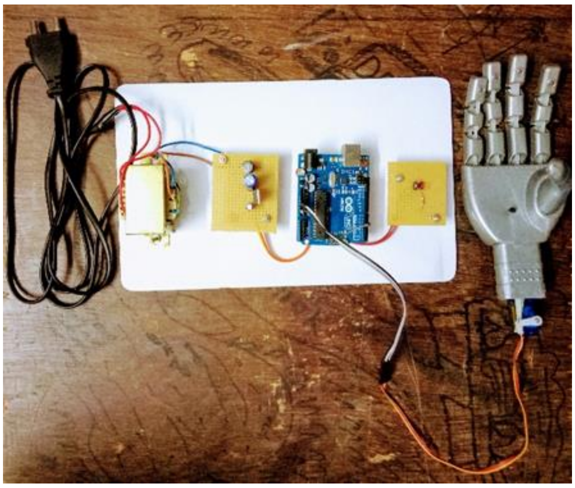

Fig. 3: Sensor based robotic wrist for adaptive grasping.

If any object is given to our designed product, it can automatically adapt for the same by the use of axis sensor and force sensors. (See Fig. 3)

IV. CONCLUSION

A low cost artificial wrist that can be used to provide versatile grasp is developed with the help of arduino assisted by force sensors and axis sensor. Hence, the robotic wrist has been designed which adapts to change in object during grasping to control servo motor. Thus the grasping ability of an object has been enhanced by the use of force sensor and axis sensor.

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