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Robotic Hand Using Arduino

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Abstract: **This paper highlights the use of a robotic hand using wireless technologies like Xbee-S2 transreceiver and open source development board like Arduino-UNO. The main purpose of this project is to highlight the uses of a robotic hand in various fields where wireless applications are necessary but human dexterity is still required. The product is implemented using a control glove,Arduino board and a xbee transreceiver shield.**

Keywords: **XBee-S2, Arduino-UNO, XBee shield, flex sensors, micro servo motors.**

I. INTRODUCTION

Animatronics was developed by Walt Disney in the early 1960's. Essentially, an animatronic puppet is a figure that is animated by means of electromechanical devices. Animatronics is the cross between the animation and the electronics. It can be remotely controlled or pre-programmed. Animatronics is a subset of anthropomorphic robots which are designed drawing inspiration from nature. The humanoid robots will be equipped with anthropomorphic multifingered hands very much like the human hand. We call this a humanoid hand robot. Humanoid hand robots will eventually supplant human labour in the execution of intricate and dangerous tasks in areas such as manufacturing, space, the seabed, and so on. Further, the anthropomorphic hand will be provided as a prosthetic application for handicapped individuals. Many multifingered robot hands (e.g., the Stanford–JPL hand by Salisbury et al., the Utah/MIT hand by Jacobsen et al., the JPL four-fingered hand by Jau , and the Anthrobot hand by Kyriakopoulos et al., Robonaut hand by lovchik, Gifu hand by Jacobsen and Kawasaki) have been developed. These robot hands are driven by actuators that are located in a place remote from the robot hand frame and connected by tendon cables. The elasticity of the tendon cable causes inaccurate joint angle control, and the long wiringof tendon cables may obstruct the robot motion when the hand is attached to the tip of the robot arm. Moreover, these hands have been problematic commercial products, particularly in terms of maintenance,

due to their mechanical complexity. A mechanical arm is robotic, usually programmable, with similar functions to a human arm. The links of such a manipulator are connected by joints allowing either rotational motion (such as in an

Articulated robot) or translational (linear) displacement. The links of the manipulator can be considered to form a kinematic chain. The business end of the kinematic chain of the manipulator is called the end effecter and it is analogous to the human hand. The end effecter can be designed to perform any desired task such as welding, gripping, spinning etc., depending on the application.

II. BAGROUND WORK

A flex sensor is a mechanical device that provides a varying value of resistance when sensor is bent. By passing fixed amount of voltage through a flex sensor into an analog input on Arduino-UNO board, it is possible to measure the value of resistance produced by a flex sensor. 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 material. When the substrate is bent, the sensor simply produces a resistance output relevant to the bend radius. The smaller the radius, the higher the resistance value. At the receiver side, micro servo motor is used. Servomotor is basically a rotary actuator that allows for precise control of angular position, angular movement, velocity as well as acceleration. Micro servo motor consists of a suitable motor coupled to a sensor through XBee-S2 (placed on the XBee-s2 adapter) for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors

are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed loop control system. XBee-S2 stands for series-2 ZigBee protocol. It has a small wired antenna placed on it. Before using this XBee-S2, it is mandatory to first configure it and then use for a wireless communication; so that you may allow your XBee to update the firmware on the radios. This configuration can be done easily by using X-CTU software.

III. IMPLEMENTATION

A. DESIGN:

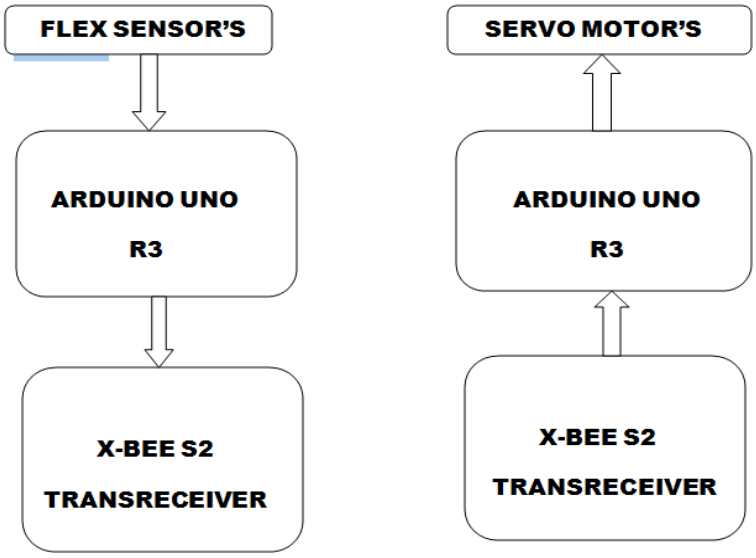

FIG. BLOCK DIAGRAM

The Flex sensor's on the control glove send the value of resistance according to their bend radius in analog form to the arduino board on sender side. The arduino then sends the information to the xbee-s2 shield which later transmits this signal to the second receiver side xbee-s2 shield. This received signal is then given to the receiver arduino which further transmits it to the micro servo motors which move accordingly.

B. ALGORITHM:

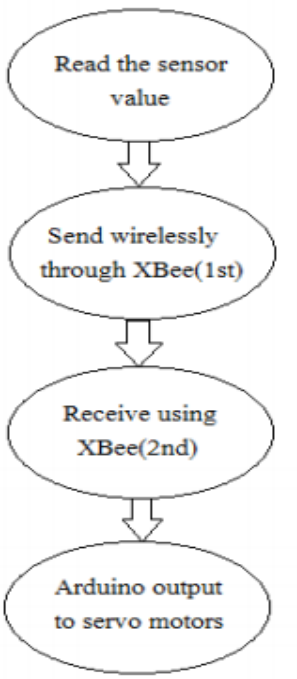

FIG. ROBOTIC HAND USING ARDUI NO

C. WORKING OF FLEX SENSOR:

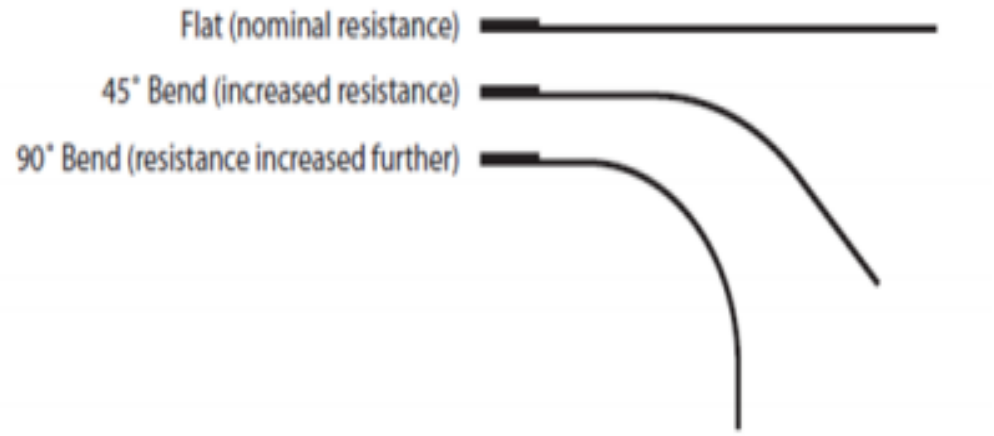

FIG. FLEX SENSOR BENT ANGLES

Uni-Directional Flex Sensor is a unique component that changes resistance when bent. An unflexedsensor has a nominal resistance of 10,000 ohms . As the flex sensor is bent in eat direction the resistance gradually decreases. Sensor is also pressure sensitive, and may be used as a force or pressure sensor. The flex sensor operating temperature is -45F to 125F.The sensor measures 3/8 inch wide, 4 1/2 inches long and only .038 inches thick. flex sensor is used for finding the motion of hand. According to the output of flex robotic hand is working.

D. ANGLE MEASURMENT OF SERVO MOTOR:

Servo Motors have usually three wires, Red and Black are used to given power and the third wire is used to give control signals. Red is used to provide DC Supply in the range of 4.8V to 6V. Voltage rating will be give as one of the specification by the manufacture. Black wire is to provide ground. For better efficiency, the supply voltage must be closer the operating voltage prescribed by the manufacture. It is better to use a regulator for supplying power to increase the efficiency. Like ordinary DC Motors, reversing polarity does not reverse the rotation instead of it may damage the control circuitry. The colour of the third wire used to provide control signals may be yellow, brown, white etc varies for different manufactures.

FIG. SERVO MOTOR

E. INTERFACING AN ARDUINO WITH XBEE:

The series 2 ZigBee protocol of 1Mw with wire antenna is used for a wireless communication. It is better for a point-to point, multipoint as well as for mesh networks. It is must to use an adapter to place this Xbee because spacing of pins of this XBee is smaller than the normal spacing of breadboard. Normally, the pins on XBee are of 2mm spacing and not 0.1". Series 2 is different as it use ZigBee wireless stack of the 802.15.4. Due to this, it becomes better for a low power usage and advanced users who want many XBees in a spread-out configuration. XBee adapter module kit has a 250mA, 3.3V regulator. XBee comes with a wire antenna. It is needed to set up a "coordinator" module. So that they are not plug-and play. To configure this XBee module, software named X-CTU is used here.

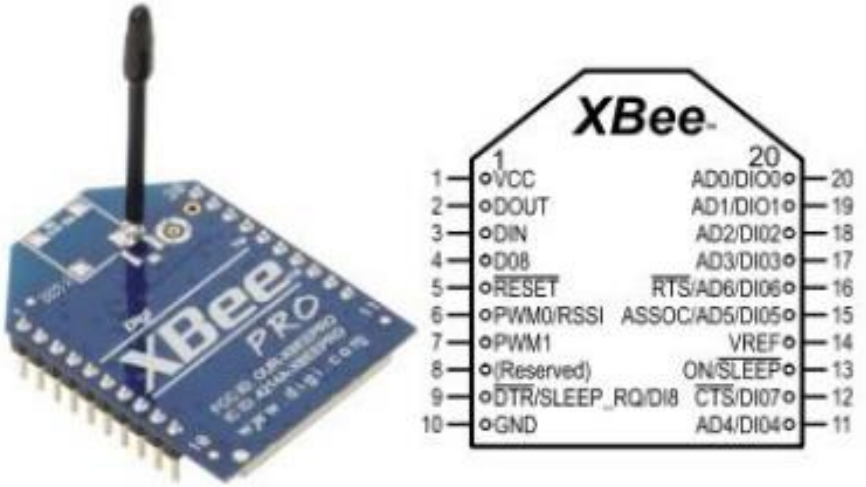

FIG. XBEE S2 SHIELD

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

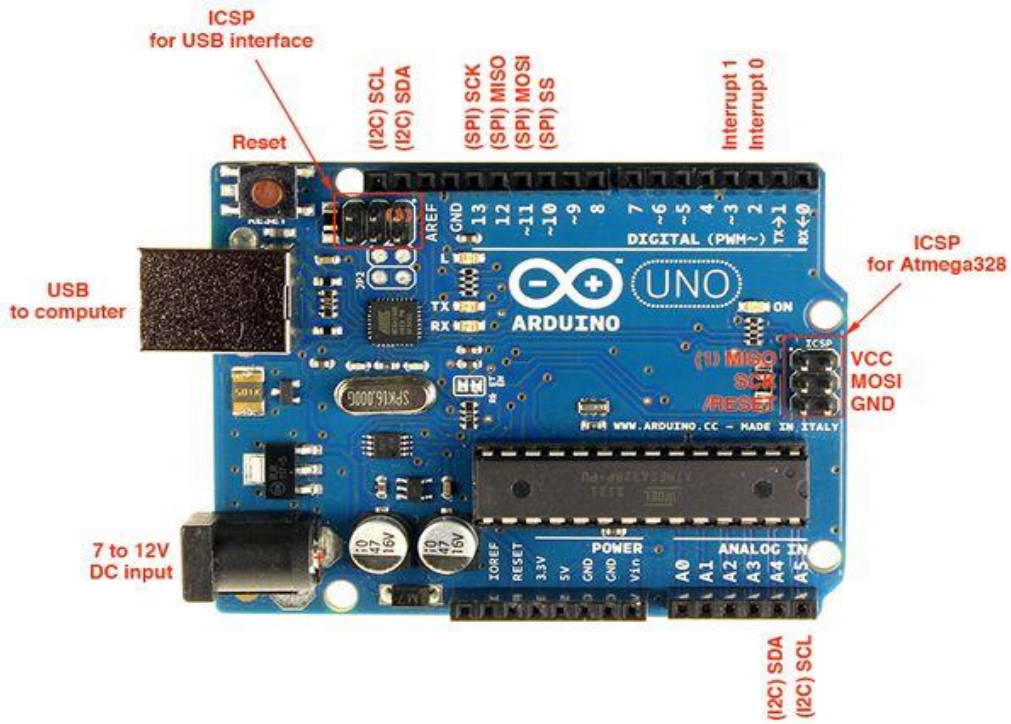

FIG. ARDUINO UNO R3

IV. CONCLUSION

Thus we focused on the mechanical characteristics of hands, without treatment of sensing, controls, electronics, and power requirements and techniques. Since a hand, like any other tool, has many uses, sufficient performance for one application might not be appropriate for another. It is therefore difficult to establish exact mechanical and performance requirements. Ultimately the selection of hand characteristics and specification is a choice between tradeoffs in complexity, dexterity (achievable grasps), weight, and control methods.

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