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Glove Operated Robotic Hand

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Abstract:

Robotic hand can perform the various operations and can replace in the form of prosthetic limbs with the help of a microcontroller programming. This designed work is a concept as robotic control is an exciting and high challenge research work in recent year. This hand can perform the various operations and can replace in the form of prosthetic limbs with the help of a microcontroller programming. This designed work is a concept as robotic control is an exciting and high challenge research work in recent year. The two main goals were making a anthropomorphic hand and making an efficient manipulator.

I. INTRODUCTION:

Robotics is a current emerging technology in the field of science. A number of universities in world are working in this field. Robotics is the new emerging booming field, which will be of great use to society in the coming years. These days many types of wireless robots are being developed and are put to varied applications and uses. The author has developed a robotic arm, with his own learning and resources, which is operated & controlled wirelessly with the help of hand gestures which transmits signals to the robot through an auto device fixed on the gloves put on hands rather than controlling it manually through a conventional remote controller.

The Robot moves and acts in the manner depending on the gestures made by the fingers and hand from a distance. The robot moves in up, down, left or right directions and picks up objects from one place and keeps at another desired place as directed by the movements of fingers and hand. It is a TYPE – C Robot, Programmable, servo controlled with continuous or point to point trajectories. The basic components of the hand and glove are the hand itself, the servos, the Arduino, the glove, and the flex sensors. The glove is mounted with flex sensors: variable resistors that change their resistance value when bent. They're attached to one side of a voltage divider with resistors of a constant value on the other side. The Arduino reads the voltage change when the sensors are bent and triggers the servos to move a proportional amount.

II. CONTROLLER MODULE:

It means controller module assembly components carry the person responsible for controlling the movements of the robotic hand. These components are housed either in the glove, as the sensors, the battery and the integrated circuit, or subject to the forearm and the plate Arduino, he shield and card XBee.

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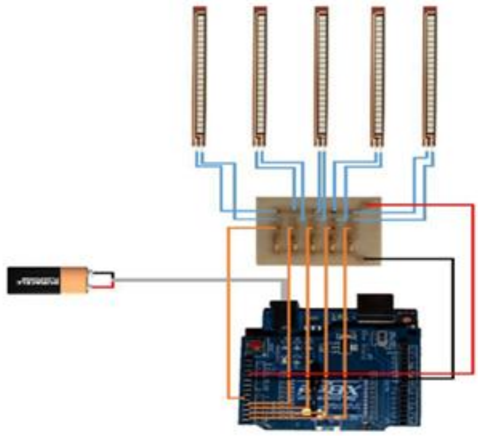

Fig 1: Scheme controller module connections

As seen in Figure 1, the glove has five sensors bending (or flex sensors), One for each finger, connected to an integrated (or PCB circuit). This circuit has a resistance sensor to form the voltage divider to generate a readable voltage plate Arduino, signal to be received via their pins analogy input A0, A1, A2, A3 and A4. Despite the absence of a single connection order, yes it is imperative that the sensors and actuators are connected in the same, so that if the servomotor controlling the thumb is positioned in its first shield, The thumb sensor must also be the first plate Arduino controller module, ie the input A0. Due to the limited space available in the robotic arm, the order of connection of the servos will determine the sensor, so that the author has chosen to follow the following order: thumb, index, middle, ring and pinky. PCB also come two wires from power supply, as shown in the figure, consists of a 9V battery connected to the plate Arduino. The last element to be highlighted in Figure 1 is the XBee Module that will allow wirelesslysend data to the robot arm, which will have another XBee that you receive.

Flex sensors

To measure the bending of each finger they were used 5 flex sensors of the Brand Spark Fun, Using patented technology Spectra symbol. A bending sensor is a kind of potentiometer, idea resistor whose resistance varies depending on the degree of flexure to which it is subjected.

More specifically, the model used will increase its strength from its nominal value of 10KΩ to between 60 and 110 when flexion is maximum (a few lines below these values will colour). Bending sensors have a width of 0.25 "(6.4mm) and length of 4.5 "(11.4 cm), of which 3.75 "(9.5 cm) Are active surface.

Fig 2: Flex sensor

Servo Motor

Flexion and extension of the fingers is possible thanks to the action of 5 servomotors, one finger. As seen in Figure 3, it is mounted on the shaft of each servo consistent accessory into two arms located at 180, with a hole at the end of each, which is inserted fishing line green, which will connect the servo with the tip of each finger. Two threads per finger are necessary because one of them will oversee flexure, while the other is its extension. The only difference between them is that one is attached to the last joint of the finger at the top, while another is at the bottom. Thus, when the actuator pulls the first finger tends to shrink, whereas when does the same with the second finger stretch.

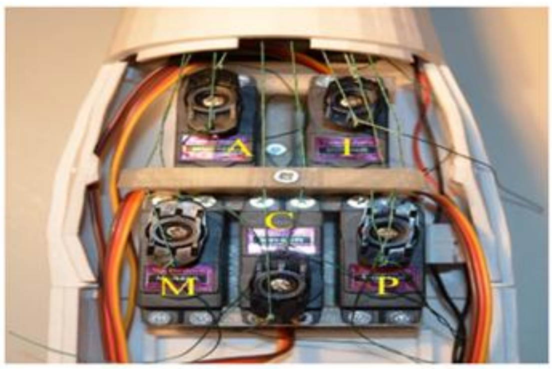

Fig 3: Top view of the servos, marked with the initial finger control

As shown in Figure 3, it has chosen to place 2 servomotors in the front of the forearm and 3 immediately behind due to space limitations existing in the forearm.

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Furthermore, for clarity and a lower loss of tension in the wires of the servos the rear has included a piece between the two rows of servos that serves as a guide for the 6 threads of Greater length.

III. MOUNTING:

In the following two paragraphs shall be made available to the reader Experience gained by the author to try to carry out the assembly, both the controller module and the robotic arm, in the most efficient way possible.

Mounting the glove

Solder wires to the ends of the flexion sensors. It has to take special care that there is no contact between the two wires, because the current would not pass through the variable Resistance bending sensor. Put on the glove (and with sensors on it), place the PCB in the bottom of the back of the glove, bend your fingers, place each wire over the hole that would correspond in the PCB, according to what is indicated in Figure 1 , and mark the points where we have to cut each. Remove the glove and cut each cable by the mark made. You should always leave at least one centimeter margin to prevent the cables are too tight and can be switched off during use. Soldering the ends of the wires from the sensors to the holes bending (pads) for the PCB, following the wiring diagram shown in Figure 1.

Fig 4:Glove completed

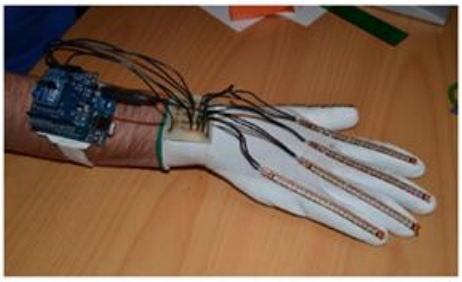

Fig 5: Module mounted controller

IV. ROBOTIC ARM

Screw the covers palm and thumb. Coating the back of the hand is made by 3 pieces: the largest covers approximately the dorsum of the piece Palma1 and two children, the two pieces called Palma2. Thumb, meanwhile, has cover charge itself, which can be seen in the foreground in Figure 6. All of them are fixed with screws 2.5mm in diameter and 16mm long but, because the depths of the holes are different in some cases be necessary to cut with the aid of pincers, part of the screws to suit the length of each hole. Specifically, there will be cut in August mm of the two screws used for two small pieces that line the part of the hand closest to the little and ring fingers and 2 mm screw used for the nearest whole fingers cover charge larger.

Fig 6: Hand assembled (without covers)

Mounting the forearm

Paste the wrist to the hitch using the epoxy glue described above. As in this case the fastening by clips is not possible, this has been done using two elastic bands. Attach the forearm with the hand using a metric screw 8 and 6 cm length connecting parts Palma1 Y Hitch, as seen in Figure 7.

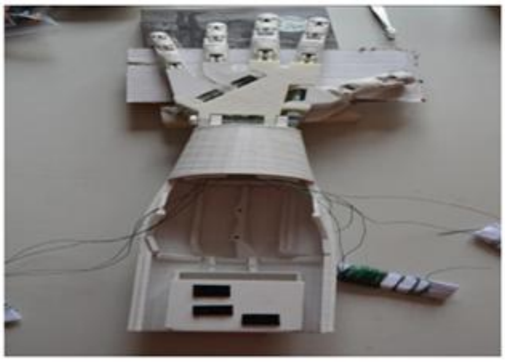

Fig 7: Forearm, with all its installed fixed parts, joined hands

Anlage central servo and immediately then anchoring the servo placed on the side of the support. Fixings will be out the same way as the other 3 servos: with 4 screws 3 mm in diameter and 2 cm long for each servomotor.

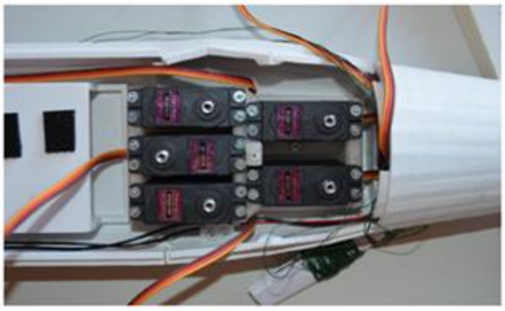

Fig 8: Servos mounted on its support on the forearm

Latest connections and placement of carcasses and fingertips:

Cut the excess thread after the knots of the last phalanx of each finger and glue the tips of the fingers on them. This step has decided to connect the wires after the servos so that, if the thread is too short, it is broken or have any other problems; it could be replaced without too much complication.

Fig 9: Hand fully assembled

Disconnect shield plate Arduino. Disconnecting servos not necessary shield as this simply momentarily it departs to a side. While not disconnect the battery 6 is required of the shield Yes it is recommended to turn off by the switch which has in its housing. Load sketch Arm_robotico the microprocessor. Fit again shield on Arduino (With servos and power already connected) and place on it the module XBee. Join the party Forearm servos with its corresponding housing. This can be done in two ways: using two metric screws 3 and 1cmlong or simply gluing the two parts together with epoxy glue of two components. However, the author strongly advises against this second option as it would prevent subsequent access to the servomotors. Attaching the casing that covers the forearm that hosts the plate Arduino.

In this case, the only two options available are: placing the housing on the part Forearm Arduino without any additional fixing or join both parts with epoxy glue. None of them is ideal, because the first not allowed to operate the arm with the housing placed in virtually any other position than the horizontal, while the second would not allow removal of the housing under any circumstances, so the components under it They are totally inaccessible. That is why the author recommends to anyone who wants this project to endow the two parties involved in a Screwed, similar to that designed for housing forearm servomotors. Connect the supply 9V to Arduino, Turn the switch 6V and ... the robotic arm is ready for use!

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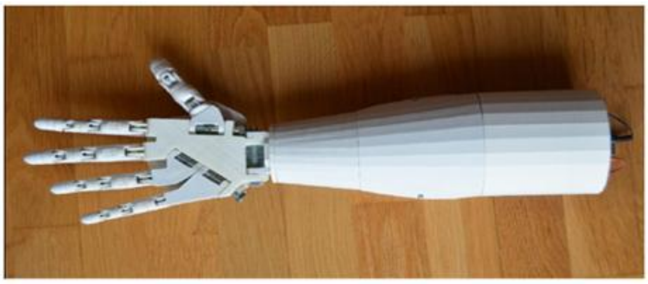

Fig 10: complete robotic arm

V. CONCLUSION:

There is many experiments conducted on robotic arm. We tested all the sensors and moved all fingers of the robotic hand. We also designed the glove and submitted the PCB designs for printing. Finally, we applied the last experiment to get the entire system to work with all fingers and we used the PCB designs instead of the breadboards. When the robotic hand fingers mimicked the glove movement and vibrations were delivered, the project was deemed a success.

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