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Novel Approaches for Robotic Control Using Flex Sensor

Sangeetha.P*, Deepika R**, Chethana Gosal S***
*Department of E&C, KNS Institute of Technology, Bangalore, India
**Department of E&C, KNS Institute of Technology, Bangalore, India
***Department of E&C, CiTech Bangalore, India

Abstract
The aim of the project is to develop the Prosthetic robotic hand using flex sensor for amputees. The main aim of the project is to develop the robotic hand that performs pick and place activities. Here we are using flex sensors to sense the signals from artificial hand signal is transmitted and that signal is used to drive the mechanical hand. Stroke is the third leading cause of the death. Nearly 7, 00,000 people suffered from stroke last year and 2/3 rd of them survived but were left with many number of disabilities; one such disability is upper extremity hemiplegia. If the hand and the arm do not have therapy immediately after stroke, it will lose its power and muscle control, resulting in a claw like appearance and loss of function. Activities of the patient, daily living activities will be significantly affected.Prosthetic hand must resemble human hand in size and shape and must perform like human hand.

I. Introduction

The task proposed in this project is to design an intelligent prosthetic hand. An intelligent prosthetic hand is defined as 'a hand that mimics the natural movements of the human hand.' In order to appropriately mimic the motion of the human hand, we must study its natural motions. For instance, the distal phalanx (finger tip) must rotate about its joint as the middle phalanx rotates. It is very difficult and unnatural to bend the finger at the proximal joint, while keeping the distal joint stiff. The motions of these two joints are linked and must move together. On the other hand, the knuckle joint is not linked to any other joints. The knuckle is able to move the entire finger with no motion in the proximal or distal joints. This means that the finger can remain straight while bending at the knuckle. The thumb is a very different digit. It only has a knuckle joint and a proximal joint. These joints in the thumb are unlinked and can move independently of each other. Once the natural motions on the human hand are defined, the design of a prosthetic that can imitate them can occur. In the design of this prosthetic, space is a very important constraint. The size of the prosthetic must also resemble that of the average human hand. This means that there is not much space to fit actuators and motors. The fingers themselves are very small and there will not be any room for actuators that are powerful enough to accomplish everyday tasks. This must be accounted for in the prosthetics design. Some areas where actuators may be placed are in the body of the hand or in the forearm of a full arm prosthetic. The scope of this project allows for placement of actuators and motors in the forearm since the hand is being designed for a full arm prosthetic. With preliminary research such as stated above, concepts for the design can be developed to fit the criteria.

II. Design

The first step taken when designing the prosthetic hand was to decide on the best control mechanism for finger movement. The goal for the design was to minimize the number of actuators necessary to control the movement of the finger and simplify the equations needed to describe the motion of the finger. There are very many ways to do this and we explored as many options as possible. There were several preliminary designs we dealt with before choosing it was the best approach. The first proposal, which was the tension controlled model, consisted of the three joints of the finger, with a cable attached to a fixed point on each link of the finger which was run back through the finger to an actuator mechanism at the hand or behind the wrist.

Figure 1.1 Multiple Tension Cable Design Proposal

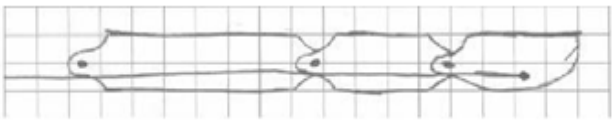
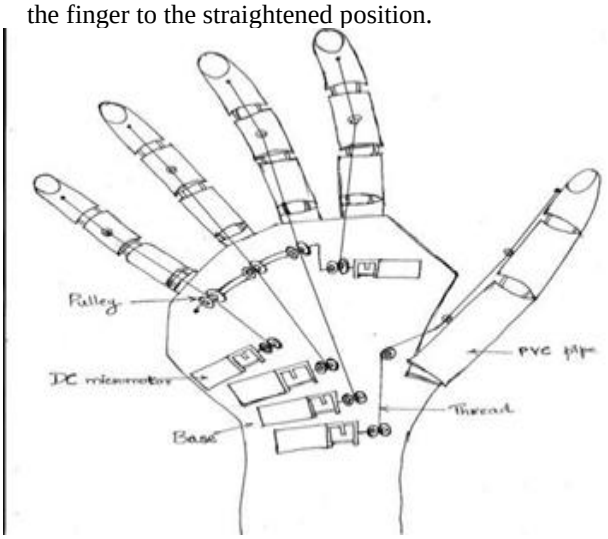


Figure1.2 Single Tension Cable Design Proposal

There were two main approaches to this design. The first, as shown in Figure 1.1 consisted of cables run over the joints between each link of the finger,

which would pull the links upwards when tension was applied to each cable. For this model, each joint would have a compliant mechanism which forced the resting state of the links to be in the bent position. The second approach for this design has the complaint mechanisms such that the resting state for the links is in the straightened positions systems to drive the. In this proposal small tubes could be used to fill with either air or liquid to actuate the finger. This proposal was eliminated early on in our design process due to the noise inherent with pneumatic systems. The noise would create the same discomfort life-like prosthetics. The third proposal for the finger design was a pulley system to control each joint independently. Pulley's would be placed at each joint in the finger, and would be independently controlled by its own wire. Fig shows two approaches to this method. In the second figure, the finger uses compliant devices to keep the finger straightened at rest. Therefore, when the actuator is active, the fingers will bend and hold their positions. When the actuator becomes inactive, the compliant mechanism would return the fingers to their straightened positions. This eliminates the need for two actuators per joint, and is thus preferable to the method shown in Figure, which requires one actuator to bend the finger downwards, and a second actuator to return the finger to the straightened position.



III. Implementation

Based in the basic design a hand model is created, it is controlled using a Data Glove on which the flex sensors are mounted and the mechanical hand is controlled wirelessly using RF transmitter and Receiver which is driven by Microcontroller. Depending on the bend of the flex sensors the hand is controller and it is using to pick up objects

IV. Result

The different positions of the flex sensors their digital values are given to the controller and motion of the motors either in clockwise or anticlockwise direction makes the hand to grasp and pick up things.

V. Conclusion

A step-by-step approach in designing the microcontroller based system for measurement and control of the parameters has been followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The hand glove, which is used to control the robotic hand is normal glove fitted with flex sensors along the length of each finger .The flex sensors output a stream of data that varies with degree of bend, the output from the flex sensor is analog values, it is converted to digital and processed by using arm processor and then it will be used to control the device. Further improvements will be made as less expensive and more reliable sensors are developed for use in agricultural production. This project is merely a demonstration of what we can do with if Microcontroller and wireless communication technology in unison.

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