

A Low Cost Artificial Hand By Using Flex Force Sensor, Arduino And Servo Motor

Kalyani Khot¹, Prof.S. G. Shinde²

^{1,2}Dept of Electronics and Telecommunication Engineering

²Professor, Dept of Electronics and Telecommunication Engineering

^{1,2}TPCT'S College of Engineering, Osmanabad, Maharashtra, India

Abstract- *In this paper, an artificial hand is designed using solid work to simulate a hand model action. A human hand is a very complex grasping tool which can handle object of different sizes and shapes. Most part of this research are dedicated to control of multi finger grippers with emphasis on the finger tips or finger joint. In this paper the mechanism and design of a new humanoid type hand or artificial hand with human like manipulation abilities is discussed. The ideal end-effector for such an artificial arm or a humanoid would be able to use the tool and objects that a person uses when working in the same environment. This includes the number of fingers and the placement and motion of the thumb, the proportions of the link lengths and the shape of the palm. It can also perform most part of human grasping types.*

Keywords- Flex force sensor, human hand, power supply, signal amplifier, arduino UNO, and servo motor

I. INTRODUCTION

Robot of the current generation has been used in field isolated from the human society. They suffer major shortcoming because of their limited abilities for manipulation and interaction with human. This high stroke incidence in combination with an aging population, which implies future increases in incidence, greatly strains national healthcare service and related costs. In this majority of these cases, patients experience either partial or total absence of hand motion ability, and this loss of functionality can greatly restrict activities and task specific upper limb treatment consisting of active, highly repetitive movement is one of the most effective approaches to arm and hand function restoration is labour intensive and required one-to-one manual interaction with therapists. These systems are typically expensive and are designed for in clinic use as they are generally not portable. An intelligent prosthetic hand is defined as a hand that the natural movements of the human hand.

II. LITERATURE SURVEY

S. G. Shinde, K. R. Khot.,” Proposed a survey of artificial hand by using flex sensor. In this a glove with flex sensor attached is use to control the artificial hand.

Shruthi k,” A low cost prosthetic hand using flex sensor and servo motors. International journal of engineering research and technology, ISSN: 2278-0181 NCESC- 2018. In this paper the research goal is try to develop an affordable five degree of freedom robotic hand and two joints in each finger.

S. M. Mane, R. A, Kambli, F. S. Kazi, N. M. Singh,” hand motion recognition from single channel surface EMG using wavelet and artificial neural network.” *Procesia computer science*, vol. 49, pp58-65.2015.

M. Ariyanto et al.,” finger movement pattern recognition method using artificial neural network based on electromyography sensor.” 2015 international conference on automation, cognitive science, optics, micro electro-mechanical system, and information technology, bandung, 2015, pp.12-17.

Most of the designs and research efforts in developing artificial hands for grasping purposes follow the direction established by Cutkosky . In his paper, he classified the grasping constraints as task, object and gripper constraints, and developed the taxonomy of grasps

See also for an overview on grasping and dexterous manipulation issues, for a study on the grasp quality measure, for a study of the grip force distribution in the natural hand, and for a study of under actuated grippers for grasping diverse objects. The study of grasping from the geometric and static point of view has been extensively studied; recently. Bicchi [4] presents a survey of the different trends in hand design based on three types of requirements: dexterity in manipulation, grasping capabilities and human operability. See also [5], [2]. For dynamic grasping,].

III. BLOCK DIAGRAM AND IMPLEMENTATION

Fig.1. shows the block diagram of artificial hand or humanoid hand. In this a glove with flex sensor attached is used to control the prosthetic hand. Each flex sensor will be used to control one servo motor. Signals from flex sensor are sent to the Arduino UNO kit to process and control servo motors. The fishing lines are attached to the fingers as tendons to help them move. An arduino combined with servo SG90 to control the action of the prototypes.

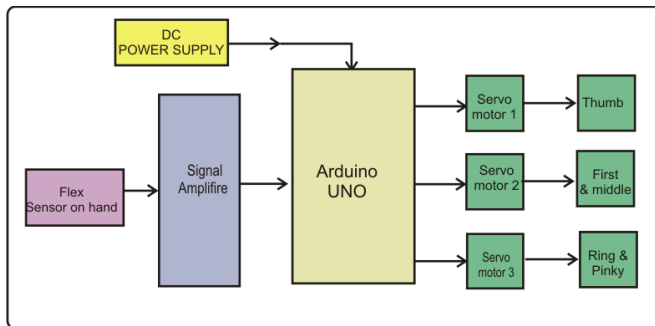


Figure 1. Block diagram of artificial hand

Signal Amplifier

Most analog signals require some form of preparation before they can be digitized signal amplifier is the manipulation of a signal in a way that prepares it for the next stage of processing. Many applications involve environmental or structural measurement, such as temperature and vibration, from sensors, switches.

Arduino

Arduino is an open source hardware and software. Most arduino boards consist of an Atmel 8-bit AVP microcontroller with varying amounts of flash memory, pin, and features. The 32-bit arduino due, based on the Atmel SAM3X8E. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. Arduino board designs use a variety of microprocessors and controllers.



Figure 2. Arduino board

The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Many arduino compatible and arduino derived boards exist. Some are functionally equivalent to an arduino and can be too interchangeable. The basic arduino by adding output drives, often for use in school- level education, to simplify making buggies and small robots. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple, and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the LilyPad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions.

Servo motor

Servo motor is an electrical device which can push or rotate an object at some specific angles or distance then you use servo motor. It just made up of simple motor which run through servo mechanism. If a motor is used in DC powered motor then it is called DC servo motor, and if it is used in AC powered motor then it is called AC servo motor.



Figure 3. Servomotor

Artificial hand

This part of the paper is the real show-stopper. This is the Artificial hand's frame. It can be made from a lot of things like wood, plastic, metal, etc. It is the part that drives the main motive of the project. A 3D printed frame is the most suitable for this paper since it is easy to make, light weight and cheap. Almost any design specification can be met using 3D printing techniques.

- Other than these main components we need jumper wires for connections.
- We need a bread board for converging all the connections into one place.
- A 7.4v 2200 mAh Lithium-Poylmer battery to power the servo motors and 9v Nickel- Cadmium battery for powering the ARDUINO.
- Fishing nylon wires for the movements of the hand frame.

Working

The Fig 4 shows the flow of data through various hardware components used in the paper. It starts from the Flex sensors , passes through the ARDUINO, goes to the servo motors and finally terminates in the hand frame simulation.

- The first step is to make sure all the connections are proper and ensure that there are no loose connections.
- We also verify whether all the servo motors are getting enough power from the battery.
- When the user wears the gloves, that have flex sensors attached to it and moves the hand, there is a change in the voltage due to the change in the resistance caused to the particles in the flex sensor.

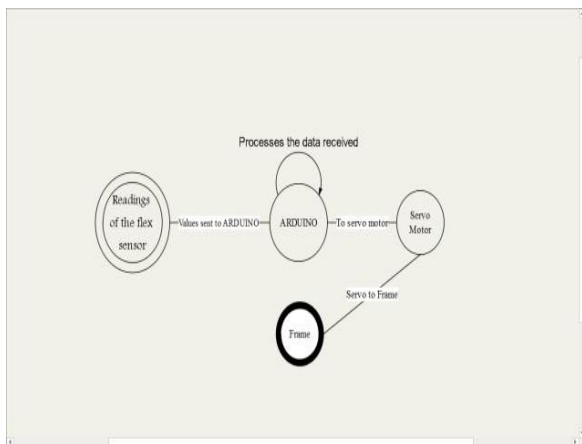


Fig. 4 Data Flow diagram

- These voltage values are read as analog values from analog pins and given as input to the Arduino.
- These analog values must be converted to angles, which the servo motor will take as input. A function called 'map' is used for this.
- Once the values are in angles, they are given as the input to the servo motors. The value indicates the amount (angle) by which the servo motor must rotate.
- The flex values are converted in such a way that the amount of bend of the flex sensor in the glove is same as the amount by which the servo turns.

- This is done by lots of trial and errors and by extensive calibration.
- Doing this will ensure that the hand frame bends just like the hand of the user.
- The servo motors and the hand frame is connected using fishing nylon wire.
- When the servo motor rotates it pulls the string and hence the hand frame.
- Since the motor is a 180° non-continuous motor, the rotation can happen in both clockwise and anti-clockwise direction, and the hold and release simulation of the fingers of the hand can be achieved.
- When folded the motor turns in the clockwise direction and vice versa when released.

IV. RESULT

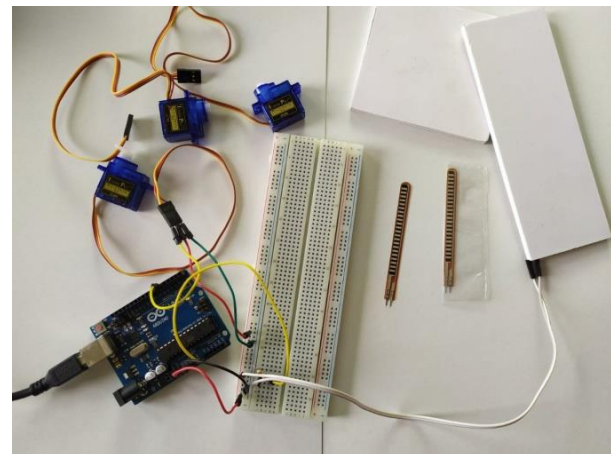


Fig. 5 snapshot of project implementation

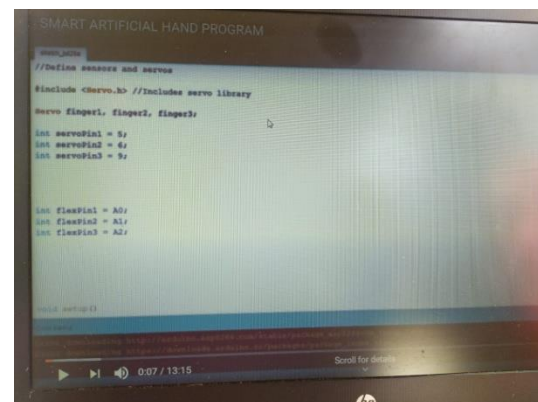


Fig. 6 screenshot of arduino software compile the code

V. CONCLUSION AND FUTURE SCOPE

Conclusion

In this paper we presented the mechanical design concept and experimental result of the smart artificial hand or

humanoid hand. The humanoid hand is able to hold objects with the finger and palm by adapting the grip to the shape of the objects, through a self-adjustment functionality. The hand is driven by only one actuator.

Future scope

This is greatly useful to simplify the hand control system. With some modification we can use make it for three direction.

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