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**RESEARCH ARTICLE**

# DESIGN OF AMULTIPURPOSE ORTHOSIS ASSISTANT AND PROSTHETIC LIMB.

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## *Abstract*

The solution proposed in this paper aims to improve the quality of lifestyle of physically challenged people who are struggling hard to carry out even their daily work. As these disabilities cannot be treated, even if it is done, it is way more costly than a normal human being can actually afford. Our solution cannot treat it medically but can be carried out very well in a different way. This possible solution is done with the involvement of "**Orthosis and Prosthesis**". This paper aims to design an easily affordable prosthetics / orthotics that can become a solution to these problems and this can be made by using complex robotic systems. The presence of robotic system in today's world may lead to complex technical robotic system problems. In the current scenario we need a reliable, efficient and an affordable product which these disable people can use in their daily lives. We are making this possible by taking in suggestions from some of the renowned orthopedics and doctors.

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## Introduction:-

The type of engineering work involved is called as rehabilitative engineering. The main objective of such class of engineering work is to reduce or to eliminate the negative impact of the non-reversible physical disabilities in the quality of life of these patients. It is a multipurpose limb that can be used in case of orthosis and prosthesis. The objects designed are generic in order to increase the field of its usage.

The paper justifies the usage of prosthetics in the lives of normal people in various house hold task which involves lifting heavy loads, carrying out their daily task it even help laborers who struggle to lift these heavy loads, army soldiers for carrying heavy weapons, with the use of our design they can easily lift these weapons, bombs, heavy bags etc. The technology used in development of limbs is a complete open source. This allows other people to further develop it.

## Mechanicaldesign:-

Thedata of length of arm and its joints is collected from 10 test subjects of age group 20-40 and a mean of that data is taken as standard for the designing with scope for small adjustments.

**Table I:-**Length of arm.

| Length of shoulder to elbow | Elbow to wrist | Wrist to fingers | Total mean length |
|---|---|---|---|
| 150 | 250 | 120 | 520mm |

The human arm is very complex in its operation and no current technology is even close to its replication. So the design philosophy is centered on at just giving the bare minimum functionality to the amputee.

**The basic functions of arm:**
1. Picking and placing.
2. Holding an object by hand.
3. Rotating and revolving.
4. Providing support to body.
5. Stability to the body while walking.

From all the above functionality, the no. 4 and 5 are the very basic and must be addressed first. The no. 2 and 3 are advance functions that are good to have but are not basic. No. 1 is the function that is the second to basics.

The property of an arm to pick and place an object is most desired and used by the humans.
**The different elements of the design of the limb are:**
1. Body support.
2. Upper arm support.
3. Lower arm support.
4. Gripper to pick an object.

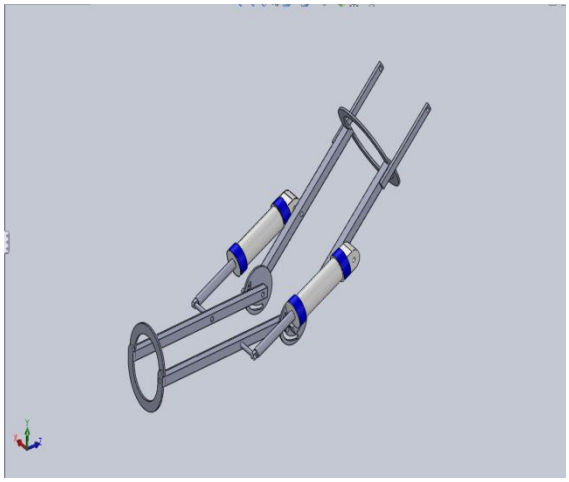

**Figure 1:** Design of parts.

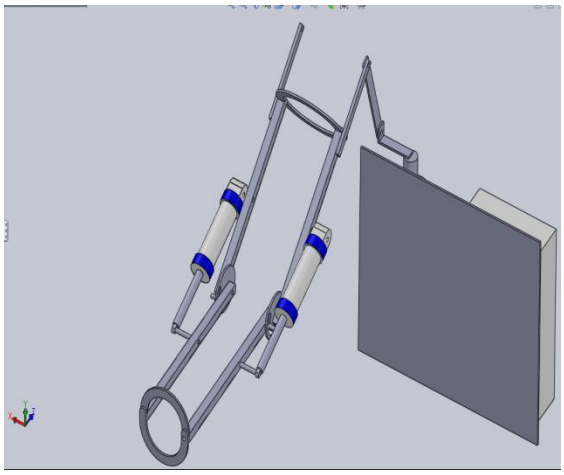

**Figure 2:** Design of parts

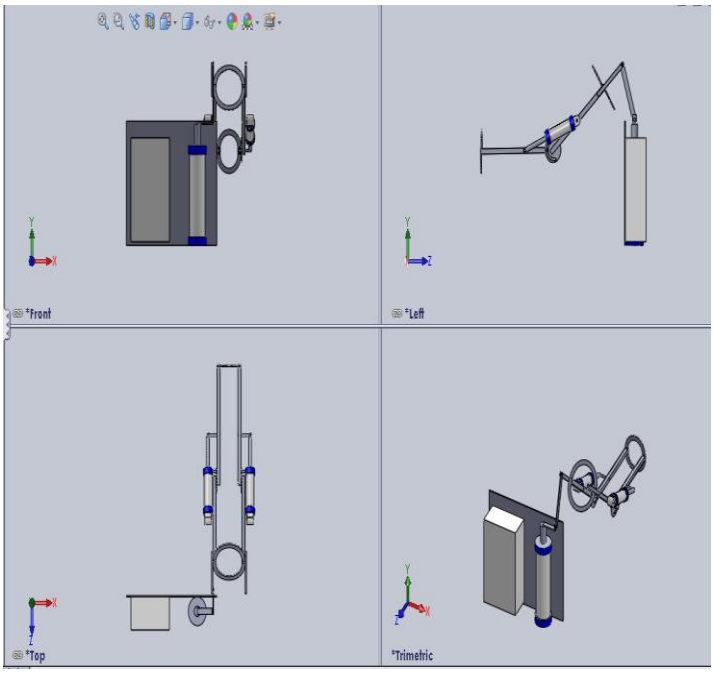


**Figure 3:** Design of parts.

## Electronics involved:-

**Circuit design:** -The design involves self-designed circuitry with onboard controller. It is designed keeping in mind the compatibility issuewith almost all the controllers which makeit possible in meeting our vision of contributing to the open source development.

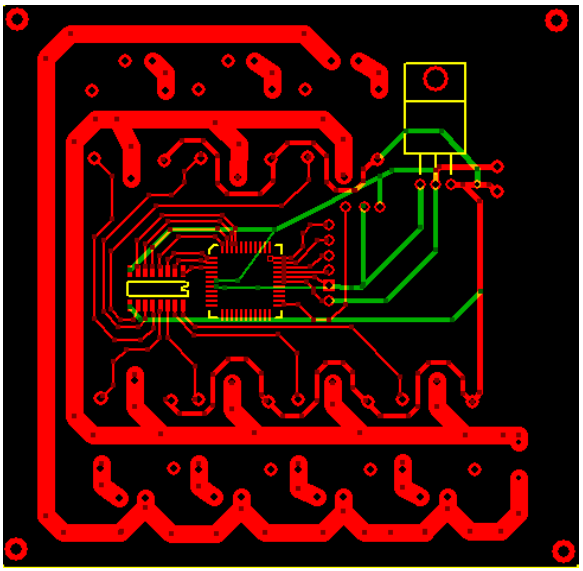

**Figure 4:**Self-design PCB file of the circuit.

**Dc geared motors:** -These types of motors provide sufficient amount of TORQUE as well as RPM**.**

**FSR:** -It is Force Sensing Resistor which will be placed in the palm of the user in order to provide the actuation signal to the motors.

**Atmega 16:-** It is the integrated circuit of the microcontroller used in the project. It is an 8 bit microcontroller. The reason behind choosing this MCU is as follows:

- High performance, Low Power consumption.
- AdvancedRISC architecture
- High endurance and nonvolatilememory segments
- 32 programmable lines
- Operating Voltage :2.7 – 4.5
- Power consumption
  - ACTIVE : 1.1mA
  - IDLE MODE: 0.35mA
  - POWER DOWN MODE :< 1µA.

**ULN 2004:-** It is also called as Noise Bridge. These are high voltage, high current Darlington drivers comprised of seven Darlington pairs. Features of this IC are:

- Output current : 500mA
- High sustaining voltage output is 50v minimum.
- Output clamp diodes.
- Inputs compatible with various types of logics.

**VoltageRegulators:-**Since the power source is DC hence the voltage regulators of class 78XX has been used in this circuit.

**Relays: -**There are some motors in the multipurpose limb which doesn't require any speed control; hence they are controlled using relays. These are electromagnetic switches which doesn't have any fixed actuation polarity. The type of relay which we have used is SPDT i.e. Single Pole Double Throw.

**Cost evaluation:-**

Cost is the deciding factor of the success of the prosthetic arm for the masses. An expensive arm is practically non feasible and will not be in the favor of the masses. Various vendors are contacted and quotations were collected from the on the basis of minimum orders of 1000 pcs.

The price comparisons of them are:

**Table II:-** Price Comparisons.

| Vendor | cost | Life cycle (days) | Labor cost |
|---|---|---|---|
| A | 7000 | 3500 | 2500 |
| B | 6800 | 3200 | 3000 |
| C | 6500 | 3000 | 3200 |

The basis of selection of the vendor is QFM (quality for money) the quality of product delivered with respect to the laborcost, multiplied by the no. of days of operation.

The formula used is:-QFM = cost at quality*life cycle /labor cost

**Table III:-**QFM.

| Vendor | QFM |
|---|---|
| A | 9800 |
| B | 6375 |
| C | 6093 |

As seen from table, the QFM factor of vendor is highest. So vendor is selected for the manufacturing of the prosthetic arm.

## Conclusion:-

There is a great need for the enhancement in prosthetics. This project is just a step towards making the lives of several people affected by various disabilities easier. Advancement in this technique will help them live their lives normally.

## Reference:-

1. "A Brief History of Prosthetics" in Motion: A brief History of Prosthetics, November-December 2007.Retrieved 23 November 2010
2. Jump up to: a b c "How artificial limb is made- Background, Raw materials, The manufacturing process of artificial limb, Physical therapy, Quality control". Madehow.com 1988-04-04. Retrieved 2010-10-03
3. Smit, G; Bongers RM; Van der Sluis, CK; Plettenburg, DH (2012). "Efficiency of voluntary opening hand and hook prosthetic devices: 24 years of development?" Journal of Rehabilation Research and Development 49(4): 523-524
4. Open Prosthetics Website Cheng,V (2004) A victim assistance solution http://www.ispo.ca/filesbicycle-prosthesis.pdf