

# LASER CUTTED PROSTHETIC HAND WITH SINGLE MOTOR

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**Abstract** – The loss of a limb can be a life-changing event that can cause grief and decreased self-esteem. The ability to restore functionality and cosmetic results to a limb deficient person can be a challenging yet rewarding pursuit. The conventional Prosthetic Hand is of five motors connected to one finger each. The goal of this research is to develop a hand that enables the user to pick up and manipulate small objects. This research contains a prosthetic hand which can be manufactured by LASER Cutting and works on single motor. Our goal is to develop a lower cost alternative for those who may be unable to afford expensive, state of the art prosthetics. This research presents the mechatronic design of prosthetic hand.

**Keywords**— LASER Cutting, Single Motor, Low Cost, Lead Screw mechanism.

## 1. INTRODUCTION

Over the years, there have been advancements in artificial limbs. New plastics and other materials, such as carbon fiber, have allowed artificial limbs to be stronger and lighter, limiting the amount of extra energy necessary to operate the limb.

In addition to new materials, the use of electronics has become very common in artificial limbs. Myoelectric limbs, which control the limbs by converting muscle movements to electrical signals, have become much more common than cable operated limbs. Myoelectric signals are picked up by electrodes, the signal gets integrated and once it exceeds a certain threshold, the prosthetic limb control signal is triggered.

They provide smooth handling but current prosthetic hands are very costly and not affordable by most of the people.

## 2. OBJECTIVE

Prosthetic hand should be affordable to general public. It should satisfy the needs of physically challenged person. The time required for manufacturing and assembly is less. It should be light weight without compromising strength.

## 3. SELECTION OF MATERIAL

As per our objectives of fast production, affordable to general public, we decided to use LASER cutting as manufacturing method. There are many different materials available for LASER cutting. We require low weight and high strength so Acrylic sheet was selected for laser cutting.

Acrylic sheet advantages: - Low Cost, low moisture absorptivity, less susceptible to oxidation, Lightweight, Easy Availability.

Because of all this advantages we find Acrylic sheet was better option for manufacturing of Prosthetic hand.

## 4. MECHANISM

To meet the required torque, to convert Rotary motion of motor to linear motion, self-locking capability, easy to assemble and low cost.

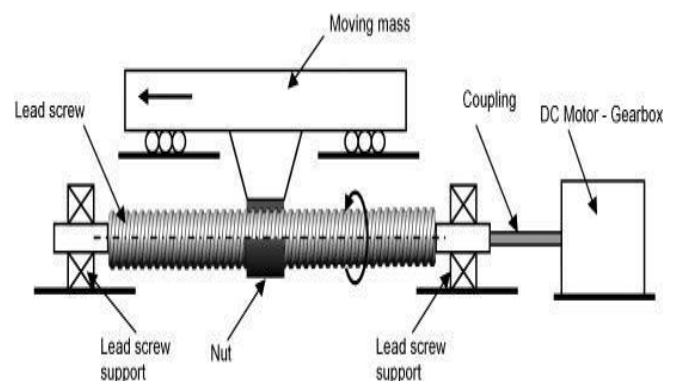


Fig.1 Lead Screw Mechanism

Because of all these advantages we selected Lead Screw mechanism.

A leadscrew (or lead screw), also known as a power screw or translation screw is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms.

### 5. CAD MODEL

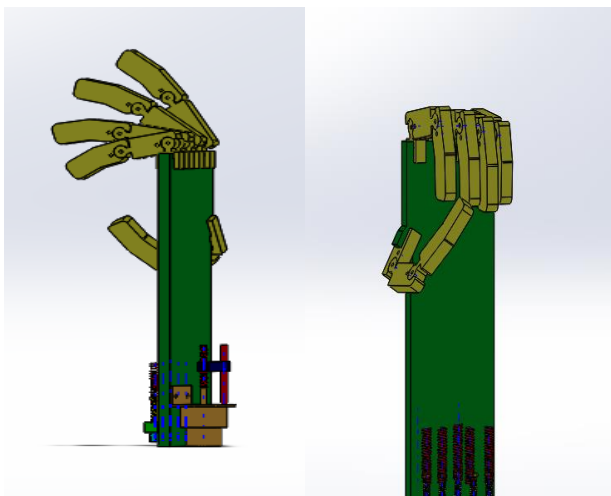


Fig. 2 CAD Model of Assembled Hand

### 6. ELECTRONICS

After finalising with selection of material and mechanism, last step but not least is to select electronic components and design the proper circuit.

- Arduino NANO board
- Relay
- Resistors
- DC motor
- QRD 1114 sensor
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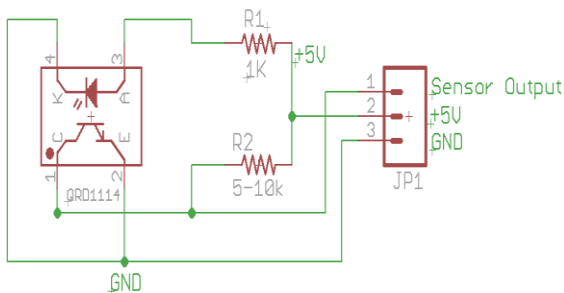


Fig. 3 Sensor Circuit

### 7. WORKFLOW

The growing market of India is a well-known market for Prosthesis, which took all the attention to develop a product which is low cost, innovative, easy to manufacture to grab market attention in order to introduce a product in Indian market.

- 1) The first task was to analyze the market.
- 2) Lot of research on Prosthesis Technology.
- 3) Prosthetic hand is available in every market and every part of the world but they are costly.
- 4) A Prosthetic hand with low cost and new features was the aim.
- 5) Then next task is to select material and manufacturing process.
- 6) This was then concluded with the use of Acrylic sheet as a material and LASER cutting as manufacturing process.
- 7) Numerous designs were tried using softwares like AutoCAD, Solidworks.
- 8) The design was analyzed.
- 9) Model of the design were prepared and visual idea of the model shape were studied.
- 10) Laser print model, 3D assembled model were the models prepared and studied.
- 11) HDPE tests were also done to check the toughness of material which was also a choice amongst the materials used for Prosthetic hand.
- 12) In order to reduce the use of material which can make it cost effective, the concept of making the model low weight without affecting strength was considered.
- 13) Then Electronic components were selected and proper circuit was designed.
- 14) Final assembly was made by assembling Mechanical and Electronic component, also proper insulation was given where it is required.

### 8. CONCLUSION

Variety of Prosthetic hand designs were reviewed in this paper. This review will enhance the understanding of previously designed prosthetic hands. This report will provide a way to conceptualize the optimum designs with better performance. The following section summarizes the design aspects of Prosthetic.

- The factors such as low cost, attractive design, ease of manufacturing are the important features of our design.
- The performance of the prosthetic hand gets affected by design parameters like spring, motor, shape, size, material used, electronics used.

For every individual, design will change as required hand size changes.

Because of such prosthetic hands rural people will also be benefitted.

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