

DESIGN OF REAL TIME 3D PRINTING PROSTHETIC ARM

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Abstract: In recent years the 3D printing technology became very popular, and that 3D printer can be used in a way such that one can make their own things like toys, prosthetic hands, arms etc. In this paper we would like develop a low cost, prosthetic arm for those who are handicapped. In addition to that we would like to develop a body-powered prosthetic arm for a boy with a hand disorder. This boy has no fingers on his right hand since his birth. The Advancements in this 3D printing and additive manufacturing technologies have introduced new ways of designing and manufacturing prosthetic hands, arms, toys etc. and also other artificial devices at very low price. The final movement of the fingers is done with the motor through pulley mechanism. Without the usage of actuator these hands will work. Hence, these hands, arms can be made at less priced, light in weight, and easy to handle, these features can be considerable for the child prosthetic.

I. INTRODUCTION

If a person is suffering or becomes a limb disorder then the one definitely faces many problems like emotional problems, financial problems etc. In medical sciences, a prosthesis or prosthetic devices is a man made device that replaces or extends a missing body part, which may be lost through accident or disease or it is a condition during birth. This disorder will definitely impacts, the quality of life and also it leads to the disabilities such as outreaching, holding, identifying through the sense of touch or hand sign communication. For this purpose, these prosthetic arms, hands etc may support their life in many means by somehow reducing these effects and would make one's life simple to live. These prosthetic devices can be simply made as an artificial extension to the missing part of the body. The prosthetic device is replaced in the missing body parts such as the lower and upper parts i.e arms, hands and legs.. Cosmetic, body-powered, electric-powered are types of these prosthetics. Person with this problem has the choice to choose the type of prosthetic device. Although these prosthetic device group of classification too have some benefits and flaws which must be kept in mind. Although people go with prosthetic devices, they too have some difficulties like heavy in weight, high priced, unattractive or difficult to understand and study or to deal with, these are the usual reasons why customers do not show interest in buying these prosthetic devices. So, we focus mainly on this part to make the device low-cost, light-weight, easy to control, also not to look weird, so to satisfy the users. In this we would like to develop a prosthetic arm for a young child who has no fingers on his right hand since his birth. The prosthetic hand must fulfill some of the requirements: low priced, less in weight and easy handling and attractive device.

II. Brief Discussion

The main goal of this paper is to create a less priced, light in weight, efficient and reliable prosthetic arm. To reduce the cost of the arm we are using 3D printing technology integrating with thinker cad. So, initially we design a arm/hand i.e., suitable to the body part, that designed file is directly given to the 3D printer after converting to its suitable file which is .stl file. Then the 3D printer prints the arm/hand using PLA (Polylactic acid) simply it is a polymer. By using this thinker cad we design whatever shape/design we like and that can be printed using 3D printer and if we want different colors in the design we can get it in this printer.

III. Working Principle:

It basically works on the principle that, when a design is given to the 3D printer it uses PLA (Polylactic acid) to create that design and by using rafting, it prints the design. The designed hand works on the principle Pulley Mechanism, which means opening and closing of fingers is done using pulley and that pulley is connected to the motor for faster movement. While coming to the 3D printer the case material used is powder coated steel and MK10 single extruder is used. In addition to this the Nozzle diameter is 0.4mm and Filament diameter used is 1.75mm along with this the Layer Thickness and Resolution is 0.1mm to 0.5mm and ± 0.10 mm respectively. Printing speed of this printer is 30-60mm/min and extruder temperature extend to 240°C from 180°C.





The above figure is the Wanhao i3 duplicator mini which is the 3D printer used and another figure is the Polyactic acid (PLA) used to create the prosthetic devices i.e., prosthetic Arm

A. WHAT IS 3D PRINTING?

3D printing otherwise called as manufacturing of additional of polymer because it adds on the material to create a object and it is a process of manufacturing three dimensional solid objects from a digital file using PLA (Polylactic acid). This creation of object is done through addition of polymer in successive layers of material till the whole object is completed. In this we can see these layers as a thinly sliced horizontal cross-section of the eventual object. We can say that this 3D printing is an opposite to the subtractive manufacturing which means removing or cutting off or hollowing out some layers of material of the object with some milling machine. This 3D printing enables us to create or produce complex and required shapes with less priced and material used is also less with advanced/standard fabricating methods.

B. HOW 3D PRINTING USED?

Basically, it begins from a 3dimensional design in which the one is required. Then you can create your own design which you require by using thinker cad or you may download it from a 3D repository. When creating it yourself you can choose to use a 3D scanner, app, haptic device, code or 3D modelling software.

C. Advantages of Prosthetic Arm:

- This 3D printing material and making of this prosthetic arm is economical and available for all types of manufacturers and also to the household utilizers.
- This prosthetic arm is of light weight because the material used is very light weight.
- The prosthetic arm designed is of with highly efficient characteristics and reliable to every one.
- We can make these prosthetic devices in different shapes, colours, designs etc.
- Ease of controlling these devices and simple to access.

D. Disadvantages:

- Only disadvantage of this 3D printing is material might break in the printer and some material is wasted for initializing rafting but this can be overcome by using some advanced techniques in 3D printer.

IV. Problem Statement

We can observe that in real time there are many of them with no limbs. The cost for making of the artificial hands is very high in general. But using 3D printing the cost can be reduced to a great extent and can be provided to a larger category of people.

RESULTS:



Fig 1: 3D View of Fingers

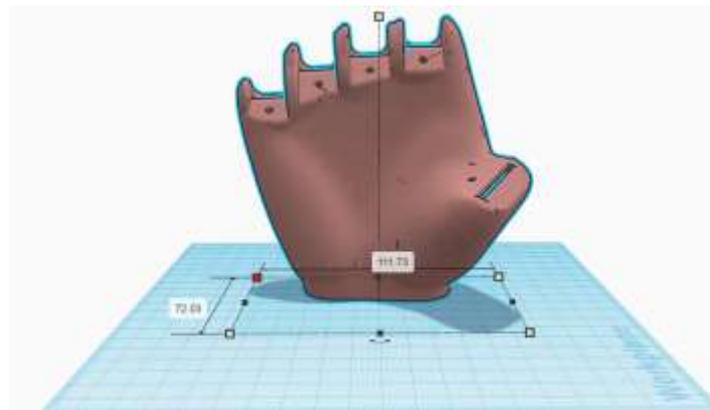


Fig 2: Full view of Arm

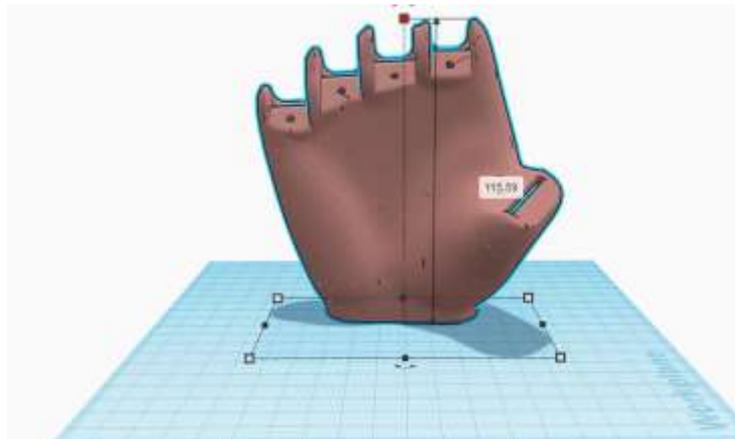


Fig 3: Height of the Arm



Fig 4: Whole View of the Arm



Fig 5:

CONCLUSION:

This 3D printer let us, to make prosthetic arm that is suitable for our client at low cost and the material PLA (Polylactic Acid) is highly efficient. This Prosthetic arm is can be controlled easily and reliable arm to the hand for the boy. The pulley mechanism helps the boy, to easily close and open the fingers. In addition to this if government supports economically, then we can make this device more robust with even less cost. Further with this funding we can develop the design in better way that everyone likes.

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