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Walking Aid for Disabled Dogs

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Abstract: *Pawthetics is a device which is will help dogs suffering from hind limbs deformities. This device will provide mobility, restore dogs comfort and will bring normality to the affected dog. The current canine prosthesis market is catered towards dogs with amputations and is very expensive because of the small number of products available. The simple design and customizability of the device not only makes it cost effective but also helps the pet to adapt quickly and expedites recovery. This device is focused towards complete rehabilitation and recovery of the dogs with hind limb deformities.*
Keywords*: Pawthetics, Prosthesis, Paralysis, Cart, Amputation*

I. Introduction

The use of prosthetics to correct disabilities in humans dates back to Roman period according to the reports by Amputee Coalition. In 1858, an artificial limb dating to about 300 BC was found in Capua, Italy. Made of bronze and iron with a wooden core, the prosthesis apparently was made for a below-the-knee amputation. Since then, there have been huge achievements in the development of human prosthetics, but the same cannot be said for the animals.

Animals require prosthetics for a variety of reasons, one of the most common being neonatal injuries resulting in amputation. Trauma is another common reason for amputation, as are tumors of the extremities, especially the toes. Once a patient receives a prosthetic device, the results can be life-changing. In addition to providing improved, more comfortable mobility, prosthetics can help prevent a variety of health problems later in his life.

Although there are endless benefits to animal prosthesis, the complications in its development and production, downplays the benefits associated with it. One problem is although a prosthetic can be created perfectly to fit an animal, there may still be an issue getting the animal to use it. An enormous obstacle that presents itself with animal prosthetics is the variety of animals. Every type of animal has a different size variance, and anatomy. A final yet prominent obstacle is the accessibility of these devices for animals. Whether the prosthetics are being 3D printed or handmade they are very expensive, a single animal prosthesis can cost about thousands of dollars to its owner. For many people this is an unrealistic number so unfortunately euthanizing or fully amputating, in the case of a limb, is still the most available option for many.

Due to all the above mentioned reason the current canine prosthesis market is catered towards dogs with amputations is very expensive because of the small number of products available. Due to the variations in limb deformities, there is yet to be a customizable solution. Instead, the production of prosthesis for deformities occurs on a 'case-by-case' basis and the products are tailored to a specific user. The goal of this project is to design and fabricate a low cost device that would increase mobility and stabilize the weight of the canine while being adjustable in use making it more comfortable, customizable, sensible and efficient.

II. Problem statement

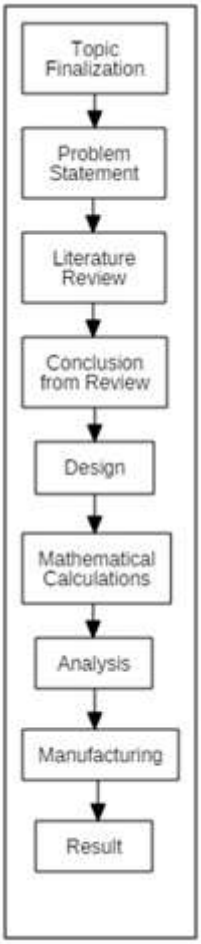
While looking for our graduation project we were made aware of the problems that dogs with amputations and different kinds of paralysis mainly with dogs left with two functioning limbs. Prosthetics available in current market are not flexible for various sizes of the dogs. Products available are very costly, bulky and hard to use. Also the spares parts are not available in a typical market. The products available are not as per the requirement of the lifestyle of an average dog and many a times they can cause more hindrance than help. Feeling that the situation needed to be addressed our group decided to design prosthesis for dogs with back limb deformities/amputation and rehabilitation.

III. Objective

We want to design products which are economic and their spare parts are easily available in the market and will be comfortable to the user and the master. We are also trying to implement new mechanisms in future

products which will help in giving more freedom to the dogs at the same time being comfortable for them to use and their caretakers to manage.

IV. Methodology

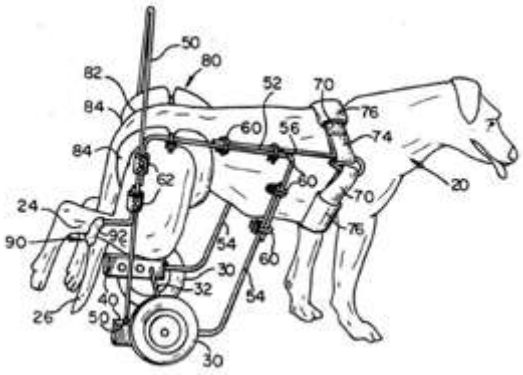


V. Design Process

The dog prosthetic model can be broadly categorised into two types of model:-

1) Cart Based Model: - It consists of a wheeled cart to which the animal is to be harnessed, the cart having a yoke that could be attached to the animal's thorax, a hip support member for carrying the animal's rear quarters, and a shin support for the animal's rear legs.

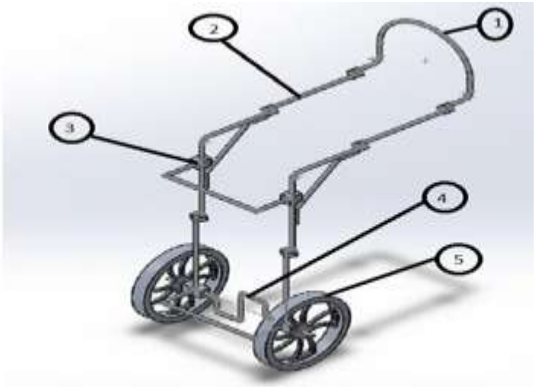
This model is light weight, extremely simple in construction, inexpensive to manufacture, easy to push, pull and turn by the animal and universal in its adaptability.



2) Artificial Limb based model: - The procedure involves implanting a rod directly into the bone at the end of the impacted limb and attaching a prosthetic foot to the protruding post. With the use of 3D scanning, this can create a more detailed image of the residual leg, making a better prosthetic fit.

The model is lightweight; tailor made for the pet but complex in construction as the margin of error is very less and expensive.

After detailed study of dogs' anatomy and comparative study of various design features such as usability, customizability, design complexity etc, we have finalised cart based model. It consists of a wheeled cart to which the animal is to be harnessed, the cart having a yoke that could be attached to the animal's thorax, a hip support member for carrying the animal's rear quarters, and a shin support for the animal's rear legs. This device will provide a prosthesis which could be adjusted to the exact dimensions of a particular animal, to support it their natural position, and to allow the maximum possible freedom of movement.



It is a lift frame that provides a mechanically adjustable support structure for restraint and skeletal support for an animal. This device was very helpful for animals recovering from injury or surgery. This model was light and versatile to facilitate use by the user a one-piece design making it simple to use while assisting the animal to walk or manoeuvre during the rehabilitation process.

1. Front Hoop: - A harness will be mounted on it, which will be used to attach animal's thorax. It will help to support and distribute weight of the dog. It is made from aluminium rod of dimension ---
2. Connecting Rod:- It is used to give the structure to the model. Slots are made in the rods to adjust lengths of the cart.
3. Connectors:- It is used to connect different body parts. It also helps in adjusting the lengths of the model.
4. Oscillatory Platform: - It is a hind legs resting platform. It is especially designed to give massage to the affected dogs. The platform oscillates which make hind leg move and it will be therapeutic in nature.
5. Wheels:- The wheels are customized as per the requirements. The choice of wheel is based on weight and height of the affected dog.

Material Used

Aluminium Alloy: Aluminium alloys are alloys in which aluminium (Al) is the predominant metal. The typical alloying elements are copper, magnesium, manganese, silicon, tin and zinc. All the structural parts are made of aluminium alloy

Leather: It has excellent resistance to abrasion and comfortable to wound on the neck. The harnesses are made of leather.

Manufacturing Process

Extrusion: Extrusion is a process used to create objects of a fixed cross-sectional profile. A material is pushed through a die of the desired cross-section. Generally rods and pipes are made from this process.

Vacuum Forming: It is a simplified version of thermoforming, where a sheet of plastic is heated to a forming temperature, stretched onto a single-surface mould, and forced against the mould by a vacuum.

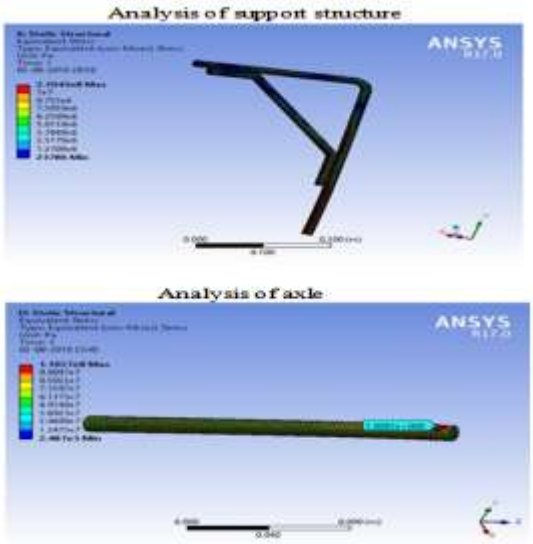
Bending: It is a manufacturing process which produces a V-shape, U-shape, or channel shape along a straight axis in ductile materials. In our case Press bending method was used in which a die in the shape of the bend is pressed against the pipe forcing the pipe to fit the shape of the bend.

Metal Cutting: It is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force.

Drilling: Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point.

VI. Calculation And Analysis

Software:-Ansys 17.0
Material:- Aluminium alloy
Density:- 2.7 g/cc
Poisson Ratio:- .33
Syt:- 270 MPa
Sut:- 310 MPa



VII. Conclusion

Animal prosthetics is definitely something more commonly seen within the last couple of years, and we think that is wonderful. Although it has its problems but we believe it can become more accessible with time. The advancements in out day and age of technology are truly amazing, the fact that a couple of years ago the best options for an impaired animal were euthanizing or full amputation. Now with the invention of various new technologies such as 3D printing, sensors, plasma cutting and advanced molding processes will improve the quality of the product. Nowadays institution like PETA and various other NGOs are funding the projects related to the betterment of the animals. Hence I believe in coming days we are going to witness some amazing devices which will be beneficial to animals with disabilities.

Acknowledgement

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