AUTOMATED PROSTHETIC LEG

PROJECT REFERENCE NO.: 40S_BE_1464

COLLEGE : AMC ENGINEERING COLLEGE, BENGALURU
BRANCH : MECHANICAL ENGINEERING
GUIDE : PROF.MADHUMOHAN.R
DR.GIRISHA.C
STUDENTS : MR. VENKATESHPAVAN.M
MR. PURUSHOTHAM.J
MS. ANUSHA.P.S
MR. ABHILASH.P

Abstract:

A prosthetic is an add on, that is provided to the amputees, replacing the missing limb. This helps the patient to perform the day to day activities. Prosthetics are available only for patients with amputated limbs, while patients with dysfunctional lower limbs use the help of crutches or wheelchairs. This requires a lot of upper body strength to travel. An automated prosthetic leg helps patients to move around with dysfunctional limbs without that limb being amputated.With the use of electromechanical devices and sensors, the movement the patient is controlled based on the motion of the functional limb.

Introduction:

Prosthesis is an artificially made substitute for a limb lost through a congenital defect, such as polio. Polio patients generally have a functional femur but a dysfunctional tibia. Therefore, they require below knee prosthetic devices. This project concentrates on such patients. With the use of automation and a prosthetic device, the patient will be able to walk without much effort. Prostheses are highly functional and have little or no cosmetic disguise; artificial legs, designed to be covered by pants, are sometimes little more than metal rods and wires. A person's prosthesis is designed and assembled according to the patient's appearance and functional needs.

In practice, there are four common types of prosthetic limb, which replace either a partial or complete loss of the leg:

Below the knee (BK, transtibial): A prosthetic lower leg attached to an intact upper leg.
Above the knee (AK, transfemoral): A prosthetic lower and upper leg, including a prosthetic knee.

Above knee prosthetic device:

Socket:

The socket is used to contain the residual limb (amputated limb) and transfer the weight of the body to the rest of the prosthesis, this may also contain liners to act as padding and provide suspension.

Socket Adaptor:

Used to connect the socket to the other components of the prosthesis and used to align the prosthesis. May come in a number of configurations.

Tube Clamp Adaptor:

Connects the socket to the pipe, used to align the prosthesis.

Pipe:

Used to transfer the weight of the body, must be adjusted to obtain the proper height of the prosthesis, and used to align the prosthesis.

Endoskeletal Finish:

Covers entire prosthesis protecting internal components from moisture, dust and dirt.

Ankle:

Attaches foot to prosthesis, allows motion to assist in proper gait pattern.

Foot**:** Provides base of support, transfers weight to ground, fits in regular shoes, adapts to ground surfaces.

Prosthetic Socks:

Used to adjust fit of prosthesis, absorb perspiration and provide padding within the socket. These come in different thicknesses called plys.

Prosthetic Sheaths:

Nylon sheaths provide a moisture barrier and control friction between the skin, the sock and the prosthesis.

Shrinker Socks:

Help reduce swelling and volume of residual limb on a daily basis and are used for shaping before prosthetic fitting.

Suspension:

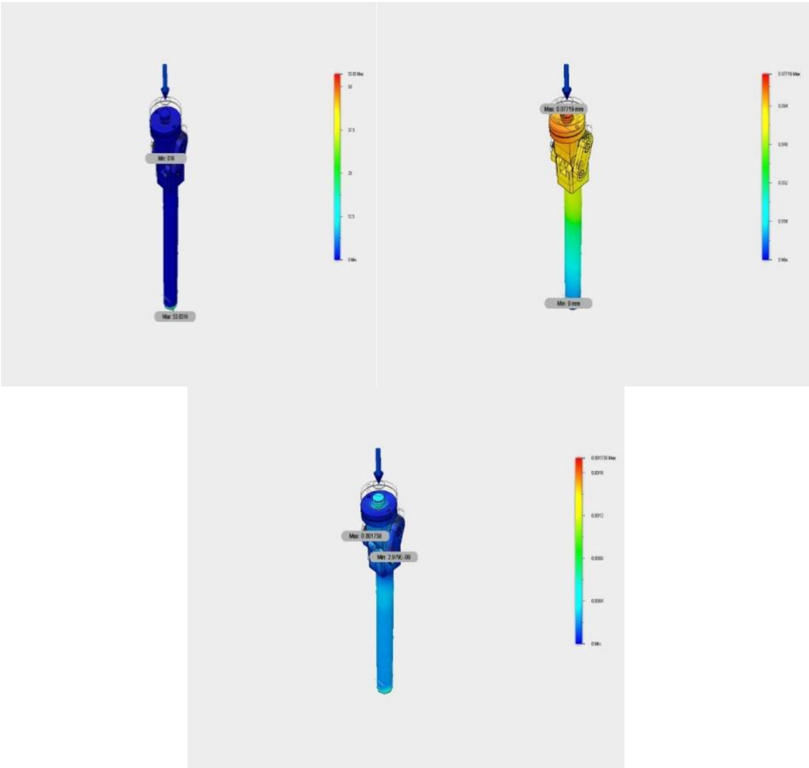
Used to hold the prosthesis on the body. Can be obtained by straps,liners, sleeves or suction and may require additional components such valves,clutches and ICEROSS (Icelandic Roll On Suction Socket).

Methodology:

The conventional method of below knee prosthesis involves amputation of the leg below the knee and replacing it with an artificial limb. This project concentrates on the use of prosthesis without amputation.

This is a case study and customized design in development of economic automated prosthetic add on whose application is real time. Any prosthesis process does not involve the working or assist principle once worn by the patient. The working of this automated prosthetic add on is, it extends the supporting function of add on locomotive assist automatically.

General robotic limb replacements to the patient is generally costing high and also is dangerous in working as it involves nerve impulse tapping as input. Here we are using interpreted current signal and easy feedback system for working of automated prosthetic add on. Input parameters considered for this case study are load cells depending on the loading condition of limb displacement depending on transverse motion of linear actuator. to cover distance and input considered by flex sensor, condition is assumed based on the decision of the flex sensor is when the angle of femur is more that the threshold difference on the prosthetic add on stiffens or locks the linear actuator. When the angle of the femur changes, linear actuator is activated and moves and hence travels.



Analysis:

Result:

The patient is able to walk without the help of crutches using the automated prosthetic leg. The comfort during walking was increased as compared to that on using crutches.
Since the dysfunctional limb is not amputated, patients will not undergo trauma or phantom pain.

The weight of the body is withstood by the cup and the prosthetic leg.

Conclusion:

The automated prosthetic leg helps patients with dysfunctional limb to walk without the limb being amputated.
The use of upper body strength is eliminated and hence walking is not as much tiring as when crutches are used.

There are two types of prosthetics, the low end add on and high end prosthetic. Existing automated prosthetics called bionic legs are expensive making is unaffordable.

Therefore, a gap exists between the low and the high end prosthetics. This project being a cross-over of low and high end prosthetics makes is cost effective and affordable. The automation reduces the effort exerted by the user during walking.

The steps taken during walking are small due to which the time taken to travel in slightly increased.

References:

[1]. http://www.oandplibrary.org/al/1969_02_043.asp

[2]. http://www.hangerclinic.com/limb-loss/adult-lower-extremity/Pages/Below-knee-Prosthetics.aspx

[3]. Muzumdar, Ashok (2004). Powered Upper Limb Prostheses: Control, Implementation and Clinical Application. Springer. ISBN 978-3-540-40406-4.

[4]. "Rehabilitation Institute of Chicago Firstto Develop Thought Controlled Robotic Leg"..

[5]. Reinkensmeyer David J (2009). "Robotic Assistance For Upper Extremity Training After Stroke" (PDF). Studies in Health Technology and Informatics. **145**: 25–39. PMID

[6]. Kuiken TA, Miller LA, Lipschutz RD, Lock BA, Stubblefield K, Marasco PD, Zhou P, Dumanian GA (February 3, 2007). "Targeted reinnervation for enhanced prosthetic arm function in a woman with a proximal amputation: a case study". .