

Design Analysis and Fabrication of Automated Human Prosthesis Walker

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Abstract—In this fast moving world there is a wide range of technology available to satisfy the need of the physically challenged people. Disability in their body restricts them to enjoy the pleasure of this world. One of the basic needs of physically challenged people is to move from one place to another. For this enormous equipment's are available but that equipment does not give a complete satisfaction to some people. This paper is prepared from the analysis of drawbacks of such equipment's. This Automated walker will satisfy the persons who has disability in their leg, spinal cord and it can suitable even for physically abled persons. From the analysis of a number of physically disabled people, this model is developed to give more satisfaction and it is economical and user friendly. This paper is mainly focused on fulfilling the drawbacks of the above problems and to give an alternate solution.

Keywords—Equipments : Disability ; Spinal cord

I. INTRODUCTION

Now a days people suffer a lot from disability. In this paper we prepare a walker for the people who have an injury in their spinal cord. It looks like a skating shoe. We Use a motor to give motion for a wheel to make the patients move. The shoe also has a prosthesis setup up to their chest. It helps them to hold the patients to maintain the center of gravity on their hip portion. The hand holder is attached to the shoes for a balancing purpose for the patients. The motion of the shoe is like as human walk. Its total motion is automated by embedded systems. The battery can be used to give power supply for the motors. This battery is placed in the bag that can wear by the patients. Battery and motor connections are wired and embedded system along with operating switch is wireless. The shoe can move turn to give the required motions. Each shoe contains four wheels. The two shoes are interlocked by prosthesis setup on their bottom of hip. The controlling can be given in the hand holder. The turning can have a limit of 180 degrees.

II. METHODOLOGY

A. Motor Specifications

Dc motor has been used in this walker. Its speed is 30 RPM and voltage required is 12volts and the power required is 18 watts. $P=I*V$. $P=12*18$, it requires 1.5 amps from this the H.P of the motor is 0.2414. The torque of the motor is 5.72 N-m. While in rest condition the motor doesn't rotate since we have used DC geared motor

B. Shaft , Wheel And Base Plate

According to motor specifications the shaft wheel and base plate has been designed. The shaft material is mild steel and its allowable shear stress is 42MPa. From the allowable shear stress and motor torque the shaft diameter is 8.85mm. It is near to the standard size 9mm.

The wheel used is rubber wheel and it gives a better friction for motion. The wheel diameter is 150mm it is the standard size

and it is selected according to the torque of the motor and diameter of the shaft.

The base plate used is MS as it gives high strength and can withstand up to 150kg. In this front and back the holding clamp has fixed to control the leg placing motion of the patients.

C. Ball Bearing Specification And Design

In this paper we have selected a ball bearing and their specification are selected from PSG data book. Here,

Radial load of ball bearing(F_r)=700N

Thrust load of ball bearing(F_a)=300N

Service factor (S) = 1.2

Hours in use per week = 3.5

No, of years = 3

Speed N = 500rpm

Diameter of shaft = 15mm

Life of bearing:

- Total life of bearing = $35*3*52 = 5460$ yrs.
- Equivalent load = $p = (XFr + YFa)$
- Load factor = $X = 0.56$
- Trust factor = 1.4
- $P = ((0.56*700) + (1.4*300)) = 812$ N
- Loading ratio = $C/P = 6.2$
- $C = 880\text{kgf} = 8800\text{N}$

Since,

$$C = 8800 > 5034,$$

Selected Ball Bearing = SKF6302.

D. Battery and controlling system

$B_{AH}/C_I = 19$ hrs. The battery has 18 volts and. The current is 1.5 amps .The battery can work up to 1 hour continuously.

E. Embedded System

Embedded system is used to control the motion of the motor and can run with our respective requirements. The 8085-time controller microprocessor is used to run the motor for our need. It can run one by one like the movement of the human leg.

F. Controlling System

The motors in the shoes can be controlled by the 8085 microprocessor. The motor can give the motion by the program dumped in the processor. The whole controlling system is placed in the bag and it can be wear by the patients. It is a wireless module and their motions can be changed for our needs. Two legs are independent on the design and fabrication. It depends on their program and motion.

The battery supplies the power to the motor and also is controlled by the microprocessor. The timing for the motor and the battery life was found by trial and error method in which the microprocessor can control the power supply of the motor to deliver the motion for each leg.

G. Switch Control

- There are four switch for their controlling legs motions.
- First switch is for controlling the forwarding motion of right and left leg.
- Second switch is for controlling the reverse motion of right and left leg.
- Third switch is to give the neutral motion on forwarding in right leg control. By this the patients can stand like human leg in the same order. The neutral motion is to avoid the patient's uncomfortable and unbalancing motion. The neutral motion also maintains the center of gravity in their same order like their hip portion.
- Finally, fourth switch is also for giving the same as third switch's neutral motion but the only difference is it gives reverse motion for the left leg control.

III. FUTURE WORK AND RESEARCH

This walker gives comfort to patients but it does not satisfy all the possibility as same as like human leg. It can satisfy only up to a certain limit only. The further research work is going on this walker to give the all possibility as same as a human leg.

It is also required to develop the sitting and outside travelling, to reduce the manual control of inputs, to give the all variable degrees of freedom in rotations.



Advantages

- It helps the people to move like a human being .
- Easy way of replacement of the walker.
- Low cost when compared to other re-walkers.
- Assembly is very easy. So no need of any other services are shop work.
- User friendly to the patients.
- It is fully safe for patients. Design is based on the safety requirements only.
- Rpm is slow so the patients can walk easy like human so no unbalancing.
- Inertia force is very less.

CONCLUSION

Thus our rewalker is to provide the necessary movement and makes the person to move from one place to another place. The future work for this type of walker is going on to make the walker rotate and to turn from the same place. The next is to make the walker to give its complete work without any pain to the patients and to give a long battery life to the system and to provide the utmost satisfaction to the patient

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