ADVANCED EXOSKELETON POWERSUITE TECHNOLOGY: ENHANCING STRENGTH AND MOBILITY

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INTRODUCTION

It is the type of upper body skeletal structure which is worn over body to perform the function in field. The various components studied while studying the entire mechanical course, by using such components like pneumatic actuators, compressor, valves, circuits, etc. this product is designed. This type of design creates the natural interaction between human and machine where by using such machine the human being can lift the heavy loads easily. It is the system combination of pneumatic cylinder (Double acting), Direction control valve, check valve, flow control valve, compressor and frame. Using this system, the handicapped person can also lift or move the limb which is disabled. It can be also use by soldiers to carry heavy load like missiles etc. All the components are positioned at the back of the structure so that the user feels no restrictions in the motion. Mechanical designs should therefore consider the possibilities of unpredicted erroneous operation of the device controller when the device is actively actuated. Limits to the range of motion can be set using a mechanical stopper or corresponding structural designs. So that the power suit cannot force the wearer's body to move in an excessive range of motion.

AIM & OBJECTIVES

To reduce the human effort while carrying the heavy loads.

To give the limb movement for physically challenged person in daily work.

To give the option for user to adjust the frame according to need or size of arm.

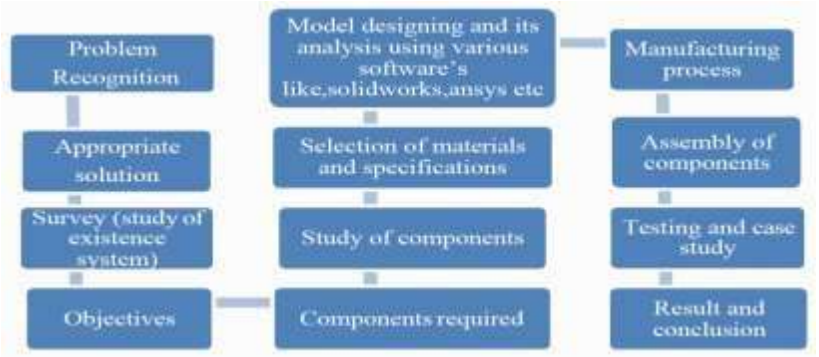
Controlling the stroke of piston rod according to application of user.

Use of material for frame which is economic and light in weight.

Study and analysis of various links involved and their failures.

Case study.

METHODOLOGY



The above objectives are achieved using:

Design and modeling of a system will be done for stress behavior and analysis of solidmodel of pneumaticpower suit by using suitable analysis software like ANSYS.

Analysis of prepared model will be done by applying the boundary conditions and varying different parameterlike angle, loading condition, position etc

LITERATURE REVIEW

Nikhil P. Shinde1, Daji S. Shinde1. [1] studied about "Exo-Skeleton Arm Using Pneumatic Cylinder"

The concept of the pneumatic exo-skeleton and its benefits was summarized; it is a type of device which canbe worn over the human body and carry the load or reduces the human effort. The exo-skeleton arm structure was made mostly from a combination of steel and aluminium. They described application of robotic devices inrehabilitation, robotic system and its main subsystems. This exoskeleton arm is light in

weight and has low cost. It uses a aluminium material for frame. It consists pneumatic cylinder, direction control valve and compressor power supply. The main objective of this project is to help workers to carrying heavy load. Such type of robot creates natural interaction between machine and man. One of the important usesof exoskeleton enabling a soldier to carry heavy object while climbing stairs or running. They aluminium material is used for frame manufacturing to reduce the weight of material. The compressor used in this projectrequires 4-8 bar capacity and the ability of compressor to lift weight up to 5- 20kg load. In these four cylinders are used for the operation having stroke length 120mm. The main objective of this project is to develop inexpensive and user-friendly system for carrying heavy job in industries.

Gopal Krishna U B1, Prajwal Hosmutt H R2 [2] studied about "Design And Fabrication Of PneumaticPowered Exoskeleton Suit For Arms"

It says all about the powered suit for shoulder rehabilitation. Design process, kinematics actuators, fluid circuits and analysis. The type and process of selection of actuators, which is going to help us lot in this project. This project shows that it is simple in construction, design and cheaper. It gives quick response and flexible compared to hydraulic and electrical type powered suit. It makes physically disabled people to carry weights in their daily life. In industrial application it requires more human resources for daily work and load carrying process. The important parts used in this suit is compressor unit, solenoid valve, double acting cylinder. Direction control valve is used to control the direction of the pressurized air in this pneumatic system. In this project 5/2 fabricated solenoid valve is for right hand. They used mild steel material for the manufacturing of frame. They used hollow pipe with diameter 25mm, actuator having diameter 25mm. They used solenoid valve having three port and two positions. They used air compressor having pressure limit 4-8 bar and controller AC or DC. The capacity of pump used in this suit is 4-8 bar. This project show that it is simple in construction, design and cheaper. It gives quick response and flexible compared to hydraulic and electrical type exoskeleton. It makes physically disable people to carry weight in their daily life.

Abdulla Almomani, Faisal Miqdadi. [3] studied about "The 1st Pneumatic Fluidic muscles-based Exoskeleton Suit"

The exoskeleton arm structure was made mostly from a combination of steel and aluminium. The Power system was delivered by a set of fluidic muscle. They also described the application in various fields like civil,medical, society, etc. Provide the proper information of material to be use and motions with human comfort. They provide three degrees of freedom for suit. It carries heavy load for long time of period. In this suit used recyclable, light,and enduring material used. They used fluidic muscles in this

suit. This muscle is made up of, fluidic tubes are of elastomers, it is rainforced with aramid fiber, a manmade organic polymer. This suit can be used for military use to help solders carry heavy load, firefighters, and other rescue workers survive dangerous environment. It is also use in medical field to allow nurses to heavy patients. In suit they utilized a combination of controllers, sensors and actuator. The defense department of the US expressed their interest in development of power suit of armor. They used electromyography(EMG) signals, potentiometers for measuring joint angles, force sensors for measuring ground reaction force, a gyroscope and accelerometer for measuring angle.

SCOPE OF PROJECT

We can add the different sensors & controllers for increasing the feasibility and improve the efficiency. This powered suit have wide area of application according to its application we can makes modifications in it. This project will definitely used in civil engineering, various industries, society, medical field. It can be used in military to help the solders carry heavy load, firefighters, other rescue workers. If we modify it by using various sensors and controllers the system is become simpler and easier. This system has a wide area of application as shown in following fig.

RESULT & CONLUSION

From this project we can conclude that, If we use pneumatic power suit while carrying heavy load in small scale industries, we can avoid the accidents of workers and we can reduce the injuries of workers. It is economical and simple system as compared to other techniques such as hydraulic, electric system etc.This system also useful for physically challenged person for limb movement in daily work. While during manufacturing of the project we studied about the human ergonomics and care should we taken while carrying heavy load .In this project we use weighted point method for material selection.In this project we effectively used various software like, we use CAD software **SolidWorks** for 3D model design during this design we studied different parameters like part modelling tools, assembly tools, rendering etc. in software during design a product.We use **FlexSim** software for design a pneumatic circuit. It is stimulated software for design a pneumatic circuit. We also understand different pneumatic components and its specification.

For the purpose of the calculation we used **Matlab** software. By using programming we make our calculation easier and simpler.

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