Pneumatic Power Suit

Pawar Rajesh S.[1], More Shailendra S.[2], Nevase Amit S.[3], More Santosh S.[4] ,Bade Vikas B.[5]
Department of Mechanical Engineering
[1, 2, 3, 4, 5] Yashoda Technical Campus,Satara

Abstract- *This prototype is a fully functional wearable exoskeleton which operates on 5/2 DCV which allow two desired motion of inlet and outlet at actuator valve. Thanks to this device the user will no longer feel any fatigue in carrying heavy loads for long time periods. Light and enduring materials are used in this project in order to fulfill safety and environmental concerns. The motion of the arms is controlled using actuators which is operated using compressed air. A pressure control valve which reduces pressure of air at required pressure for safety of working conditions. The exoskeleton can be used for lifting light and medium loads in workshops, small factories etc. This exoskeleton can be used instead of crane as initial cost of crane is not affordable. Small workshops cannot afford the high initial and maintenance cost of crane. Therefore this power suit can be used.*

Keywords-Actuator, Compressed air, 5/2 DCV, Pressure valve

I. INTRODUCTION

This project consists of four pneumatic actuators which arehaving 8 bar capacity for allowing that required motion. It also includes 5/2 DCV which allows two desired motion of inlet and outlet at actuator valve. The main function of this suit is to assist the wearer by boosting their strength, endurance and durability. This suit can be used in workshops and small industries.

Moving to the technical part the suit structure is made mainly iron bars . Compressed air flows through a pipe of bore dia 8-6mm. This pipe carries pressurized air through the reservoir to actuator.

The suit includes following components:

1) Actuator
2) 5/2 DCV
3) Flow control valve
4) Pressure guage
5) Connectors
6) FRL unit
7) Hoses
8) Air compressor

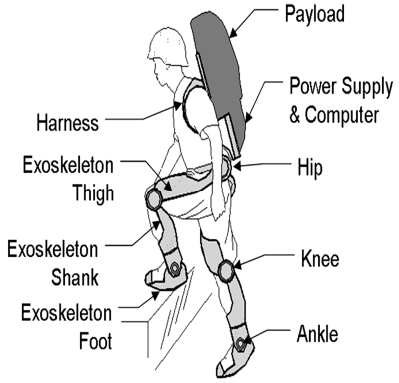

Fig: Conceptual sketch of a lower extremity human exoskeleton.

II.WORKING

Working of this project is as simple as shown in sketch as u can see the movable joints provided to this iron bar skeleton which allow to get that desired up and down motion with help of pneumatic actuator. Two bands are provided to wear that exoskeleton.ic actuator fixed to body of exoskeleton.

As u can see these pneumatic actuator fixed to body of exoskeleton. When we offer pressurized air to actuator it gets actuated.(Actuation is nothing but motion by means of electrical or other energy source).

Actuators are actuated due to pressurized air supplied to it and total load is located to joint because of actuators rods are connected to this joint. So we cant sense any kind of load on body.

As you can see when load is lifted by worker while doing work. This load is totally located on the entire structure.

Objectives-

1) To minimize cost of crane used in small scake industries.
2) To minimize the work load causing on the labour.
3) To obtain more output in less amount of energy.
4) To lift largequantity of load with safety.

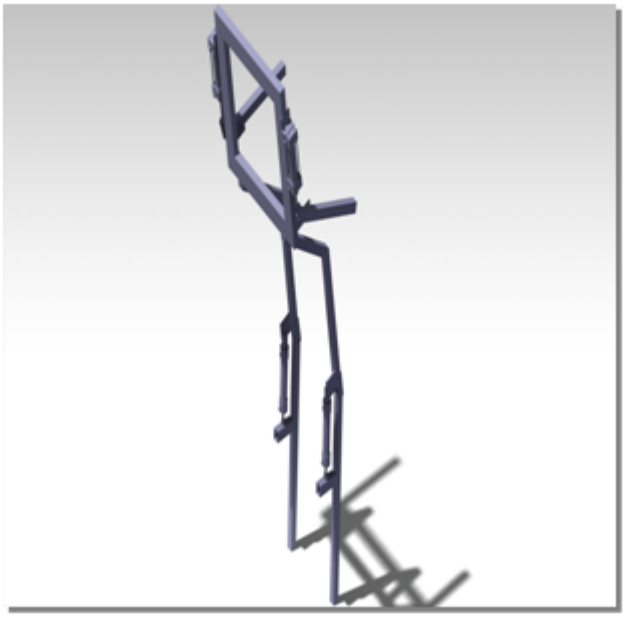

Fig: cad model of pneumatic power suit.

III. LITERATURE SURVEY

The first research paper that we used for study of our project is "The Pneumatic Fluidic muscles based Exoskeletons Suit inUAE". The suit structure is simple box shaped which fits on back of human body. This suit works on pneumatic power. Pneumatics are used instead of hydraulics to keep wt of suit less. In case of hydraulics more accuracy can be obtained, but there isproblem of leakage & more complicated structure is required. As this suit has to be used on human body it is essential that wt of suit should be kept less. Limited joints are kept & simple design helps to reduce wt of the overall structure.[1]

An exoskeleton was designed by paraplegics by Seireg. Seireg created an exoskeleton systems for paraplegics unit consisting of battery powered direct motor pump & accumulator.[2]

A bank of servo valves drives the actuators at knee and hip. The device was controlled to follow a set of joint trajectories without use of any sensory system from the operator. Later on, university of Tsukuba developed hybrid assisted limb (HAL). A 15 kg battery powered suit that detects muscle myoelectric signals from skin surface by sensors and sent to a computer that translates nerve signals into signals of its own for controlling electric motors of exoskeleton.[3]

In addition to the electromyography signals, the exoskeleton also includes potentiometers for measuring joint angles, force sensors for measuring ground reaction forces, a gyroscope & accelerometer for measuring angle of the torso.[4]

Complex systems of actuators are controlled based on information sensed & integrated by internal & external sensor systems. Unlike the robotic applications in other industries, many tools & assistive devices need to be independent from connecting cables. However battery packs necessary to supply energy for actuators represent heavy load.[5]

IV.CONCLUSIONS

From this project we conclude that due to use of pneumatic power wt of suit is less and efficiency is increased. Due to less wt it is comfortable to use. Hydraulics have high initial cost and maintenance is very difficult.

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