Design and Fabrication of Exoskeleton

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Introduction

Objective

Exoskeletons can be used in wide range of areas like medical, army, manufacturing, etc. Exoskeletons are designed to assist and protect the user. Depending on the situation they may be used to help soldiers and construction workers, aid the survival of people in dangerous environments, or assist patients in rehabilitation. In this Project we have designed and manufactured an Exoskeleton which is durable and efficient to lift weights without much effort. We have used Pneumatic Cylinders as muscles for this Exoskeleton.

Origin of Exoskeletons

General Electric developed the first exoskeleton device in the 1960s called the Hardiman, it was a hydraulic and electrical bodysuit, however, it was too heavy and bulky to be of military use. Currently, exoskeleton development is being done by DARPA (Defense Advanced Research Projects Agency) under their Exoskeletons for Human Performance Augmentation Program.

Methods

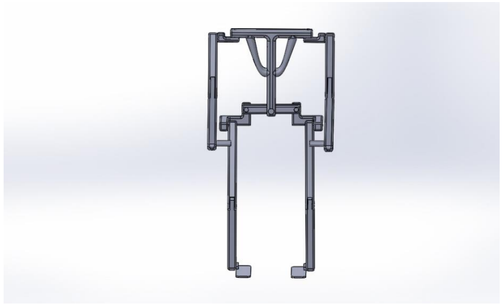
Methods and Materials

Materials used: Hollow square mild steel bars, nuts and bolts, hose 6mm, Pressure regulator, Pressure splitting valve, Solenoid, Nipple fittings, Mufflers, Pressure controlling valves, Pneumatic cylinders (25X100mm) Max. pressure 10 bar or 1 MPa.

Methods used: Cutting, Arc Welding, Drilling.

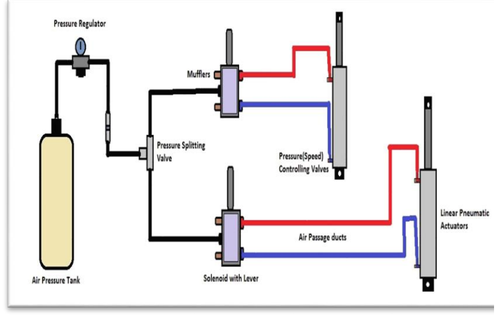
Block Diagram, Flowchart, Models, Results

Designed in Solidworks



Initially we have started designing a basic frame for exoskeleton and go on improvising the design to get the perfect final output.

Actuator Control System



We have used an air pressure tank to power the actuators. The pressure will be high in air pressure tank, so we have used air pressure regulator to decrease the pressure up to 1 MPa and from there the pressure will be splitted using T-junction pressure splitter the splitted air pressure will be passed through hose to Solenoid with lever (used to control flow of pressure.) for controlling actuators.

Manufacturing

It was built with hallow square mild steel bars. The frame was made by using arc welding to make weld easy and strong and we have made joints using nuts and bolts. And then we have assembled all the parts like pneumatic cylinders, pressure regulator, hose, etc.

Result

Conclusion

Discussion

In this project we have manufactured a low-cost exoskeleton which is wearable and used to lift weights. We have used pneumatic cylinders to power the exoskeleton.

Limitations

This prototype can be able to lift weight approximately 20kgs. More DOF can be added, high quality and more powerful actuators can be used to improve flexibility and lift more heavy weights.

Future Scope

Exoskeletons will play a major role in future. It can be used by employees in manufacturing field, assist patients in rehabilitation, army soldiers can lift heavy guns easily, it can also be used by astronauts in space journey, and aged people, etc.

References and Affiliations

References

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