Review Paper of Exoskeleton Arm

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Abstract— The arm exoskeleton is widely used in medical and industrial areas because of its assistant ability. Many universities and institutes do some relevant works describes a robotic-arm exoskeleton that uses a parallel mechanism inspired by the human forearm to allow naturalistic shoulder movements. The patients who survived a stroke and the elderly who do not have enough strength to move their limbs freely present the development of the exoskeleton system for amplifying human strength.

Keyword: Exoskeletons arm, Anatomy of the human upper limb

1. INTRODUCTION

A familiar definition for an exoskeleton in general is an artificial external structure. In other words, exoskeletons are wearable machines. These machines that can be used can be controlled using different types of power sources such as: electromechanical, pneumatic or hydraulic. Exoskeletons are systems that are considered human-robot systems. The preferred goal of exoskeleton development is to enhance the person or provide physical improvement. An exoskeleton would aid in the lifting process to improve lifting capacity or perhaps provide the ability to move faster while carrying a load.

From research on the many upper body exoskeletons already on the market, it has been concluded that the best frame to have for an exoskeleton would be made of tubes. It is based on the fact that ease of manufacture is a priority as well as the cost of manufacturing the frame.

The main objective of this thesis is to formulate a methodology that would facilitate the definition of the best cross-section of the tubes used as the body frame for the body of the exoskeleton being manufactured, while considering the parameters relevant to the design and exoskeleton.

State-of-the-art exoskeleton designs are now being developed for haptic, tele-operation, rehabilitation and power enhancement applications. Tele-operation is a system in which the slave robot is controlled, at a distance, by the movement of the force and the movement of the user with the help of the exoskeleton arm. Haptic interface is the interaction of the exoskeleton with the operator through human touch that can be used to control the virtual reality environment. Power enhancements are applied to exoskeleton devices to help people lift or carry large weights.

Exoskeletons are a type of skeletal structure that surrounds the wearer instead of creating a traditional interior. Exoskeleton-wearing robots follow the same principle of having vital parts outside the user that allow the system to function as a suit. Similar exoskeleton structures can be used as input devices for easy human control of various procedures, as they are applied to surgical procedures that allow remote control of special equipment, and interactive interactions with the environment. the user can interact within the digital device. Such exoskeletons are called Rehabilitation Robots. An exoskeleton can reduce the number of therapists required by allowing even a disabled patient to be trained by one therapist, where many currently exist. Training can also be uniform, easy to review and can be customized for each patient. Nowadays, there are many projects that create training aids for rehabilitation.

2. Literature Review

1)"Design, Analysis, and Experiment of A Non-humanoid Arm Exoskeleton for Lifting Load",
Xin Li, Zhengwei Jia, Xiang Cui, Lijian Zhang Research Center of Human Performance Modification Technology Beijing Institute of Mechanical Equipment Beijing, China Published in 2018 The International Conference of Intelligent Robotic and Control Engineering.[4]

2)"Design of Exoskeleton Arm for Enhancing Human Limb Movement "
Thunyanoot Prasertsakul, Teerapong Sookjit, and Warakorn Charoensuk Published in: Proceedings of the 2011 IEEE International Conference on Robotics and Biomimetics December 7-11, 2011, Phuket, Thailand.

3)**"Improvement of Upper Extremity Rehabilitation Robotic Exoskeleton, NREX "**
Won-Kyung Song and Jun-Yong Song Department of Rehabilitative and Assistive Technology, National Rehabilitation Center, Published in:2017 14th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI) June 28 - July 1, 2017, at Maison Glad Jeju, Jeju, Korea.[10]

4)"Design of Exoskeleton Robotic Hand/Arm System for Upper Limbs Rehabilitation Considering Mobility and Portability "
Yong-Kwun Lee Department of Biorobotics, Kyushu Sangyo University, Fukuoka, 813-8503, Japan Published in: The 11th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI 2014) Nov. 12-15, 2014 at DoubleTree Hotel by Hilton, Kuala Lumpur, Malaysia[8]

5)"The RETRAINER Light-Weight Arm Exoskeleton: Effect of Adjustable Gravity Compensation on Muscle Activations and Forces"
Markus Puchinger, Nithin Babu Rajendra Kurup, Thomas Keck, Johannes Zajc, Michael Friedrich Russold and Margit Gföhler 2018Published in:2018 7th IEEE International Conference on Biomedical Robotics and Biomechatronics (Biorob) Enschede, The Netherlands, August 26-29, 2018.[1]

6) "Exoskeleton Arm ", Pooja Jha, KinjalSavla, Dishant Shah, Department of Electronics and Telecommunication D. J. Sanghvi College of Engineering Mumbai, India.[14]

In this paper, we propose the design of an efficient and comfortable option for commercial exoskeletons. Exoskeleton here refers to any wearable framework on the human body which eases and supports the muscles to perform work with lesser strain and greater comfort, using mechanical actuators and electrical power. The design proposed shall be capable of sensing the incentive to perform basic work procedures and routines making it natural and comfortable for the user to interact with and utilize this device, increasing its effectiveness and efficiency.

6) "Design of a Haptic Arm Exoskeleton for Training and Rehabilitation"
Abhishek Gupta, Student Member, IEEE, and Marcia K. O'Malley, Member, IEEE.[6]

CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

2) Upper Limb Anatomy and Design Challenges

The purpose of the exoskeleton is to reproduce human kinematics and strength Musculoskeletal structure and thus supports the movement of the body, which is difficult and current trends and movement patterns. Because of the complicated anatomical structure, there is no A unified kinematic model for the human upper body is available in the biomechanics literature. that can help us create an exoskeleton. Also, the materials that make up the exoskeleton are very dangerous depending on the target application. Therefore, it is necessary to analyze the anatomy of the human foot to design an exoskeleton by considering end-use applications. The human upper limb has a complex skeletal structure, as shown in Figure 1A of including the shoulder joint, knee joint, wrist joint, and finger joint. Shoulder composition of four joints (called glenohumeral articulation, acromioclavicular, sternoclavicular, and scapulothoracic) formed between three bones including the clavicle (or collarbone), scapula (or shoulder). blade), and the humerus (or upper arm bone) [18]. The glenohumeral joint is commonly referred to as a ball socket joint, formed between the outer surface of the humeral head and the glenoid socket [19]. Many

In the study only the glenohumeral joint has been considered to demonstrate the three degrees of freedom (DOF) shoulder system

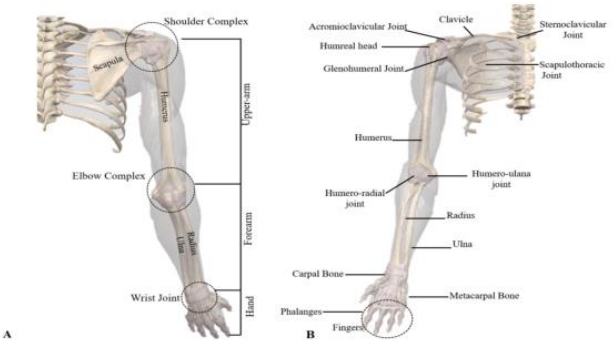

Fig. 1 Anatomy of the human upper limb: (A) upper limb segments and (B) shoulder, elbow, and wrist skeletal structure.

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