3D-PRINTED ROBOTIC HAND EXOSKELETON

TECNOLOGÍA PATENTADA

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RESUMEN

The group of **Engineering Design and Technological Development (DIDET)** from the ArtefactosLAB laboratory of the University of Alicante has developed a robotic hand exoskeleton to transmit movement to the user who has little or no movement due to neurological and/or physiological disorders. This device is manufactured with flexible material, breathable and resistant to liquids through a 3D printer and under some parameters of economic, environmental and social sustainability. The group is looking for companies or institutions interested in continuing this work of social innovation by developing the device or in designing and manufacturing new ones.



INTRODUCCIÓN

Currently, there are different systems to help people who cannot move their fingers. On the one hand, there are the conventional hand exoskeletons, consisting of rigid materials and with a complex mechanism for their operation, which makes their volume very large and heavy and, therefore, not very functional for the user. In addition, their mechanism and volume causes dirt to remain on the components and makes it impossible for the user to use the exoskeleton until the cleaning of each component.

On the other hand, there are rehabilitation gloves that detect muscle signals, but only allow for the movement of three fingers: thumb, index and middle. Another system is the pneumatic exoskeleton, which presents a common problem to the previous systems as it is its high cost, rendering it as a non-very accessible product, besides having a complex technology and assembly for

the user.

For all the above, the need for a flexible, portable and economic exoskeleton is sought, and which can be perfectly adapted to the user in a personalized way. The objective is to help those people who have little or no muscle tone, due to neurological disorders, chronic pathologies or any type of accident that has left the member without mobility.

DESCRIPCIÓN TÉCNICA

The exoskeleton consists of an external structure that fits the shape of the hand and consists of electronics, sensors and a drive mechanism. Movement can be transmitted by reading myoelectric signals from another functional muscle.

The ergonomic shape and the flexible material help to position the robotic exoskeleton in the user's hand. The exoskeleton comprises the following parts (*see Figure 1*):

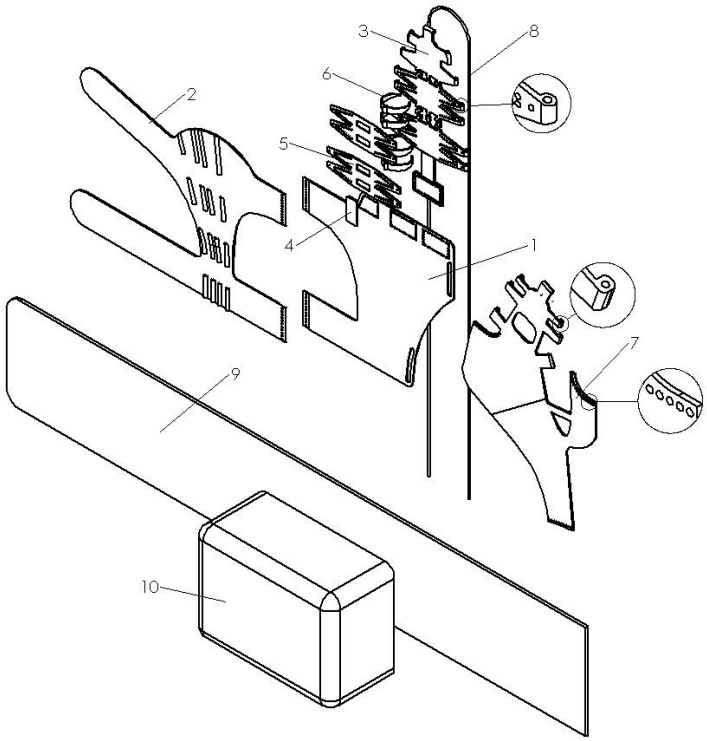


Figure 1.*- Exploded perspective view of the socially responsible portable flexible robotic exoskeleton with thumb and index finger Top part (1), bottom part (2), finger part (3), piece of elastic material (4), cover part (5), ring part (6), thumb part (7), tensioning part (8), bracelet (9), control box (10).*

VENTAJAS Y ASPECTOS INNOVADORES

The present invention presents great advantages:

- The exoskeleton is manufactured in flat, obtaining a minimum thickness to make it as less bulky and more ergonomic as possible for the user. This flat shape also gives it great resistance.

- Ergonomic design, due to the type of flexible material used, adapting easily to the shape of the hand and fingers of the user.

- It allows the user to use the product, even if he or she lacks muscle tone or mobility.

- It can be operated with any functional muscle involved in the movement.

- The exoskeleton can be easily connected and disconnected from the electrical part according to the type of use, thus facilitating cleaning and hygiene without damaging this part.

- Low-cost materials are used and are accessible to everyone, saving a complex manufacturing process, which considerably reduces the cost of the assembly.

- The material is resistant to liquids so it is washable.

- The material is breathable, which facilitates its prolonged use and avoids problems of skin infections and bad smell from the skin.

- Its high durability allows for efficient and continuous use by the user.

INNOVATIVE ASPECTS OF TECHNOLOGY

Both the design and the manufacturing process of the exoskeleton have been optimized so that it can be produced using a 3D printer which, together with the use of three-dimensional models, has become an alternative manufacturing process to the conventional one. Its application within assistive technologies opens up endless possibilities to improve the quality of life of people with functional diversity due mainly to four factors:

- Low cost of materials and necessary equipment.

- Speed in manufacturing.

- Freedom of design that allows to approach the personal needs. This means that from a generic model of the exoskeleton, it can be scaled to a specific size, starting with the measurements of the user's hand and without the need for a new design.

- Manufacturing in any part of the world, giving the user or the professional rehabilitator the possibility of self-manufacturing and personalizing their own device, which also means savings in logistics and distribution.

In addition, this 3D printing allows the exoskeleton to be modular, that is, each part is printed separately and allows its subsequent coupling with the others, thus achieving greater adaptability to the user.

ESTADO ACTUAL

The current device is the result of the participation of different people with functional diversity with whom the dimensions and performance of the exoskeleton have been tested and adjusted. Therefore, it is a device that perfectly meets the objectives set.

APLICACIONES DE LA OFERTA

Fundamentally, it is aimed at the sector of assistive technologies and improving the quality of life of people. 3D printing is a technique that can be applied to meet any need, in any field, that a person may have. It is especially useful for those people with functional diversity with very personal problems in fields such as medicine, education, work or mobility.

COLABORACIÓN BUSCADA

From ArtefactosLAB, DIDET group is looking for companies or institutions interested in supporting the development of the exoskeleton or in the design and manufacture of other new devices with social purposes.

DERECHOS DE PROPIEDAD INTELECTUAL

This technology is protected by a **patent application**.

- Patent title: “Exoesqueleto robótico flexible portátil socialmente responsable”.
- Application number: P201931145
- Date of application: 20/12/2019

SECTORES DE APLICACIÓN (3)

Education
Engineering, Robotics and Automation
Medicine and Health