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REHABILITATION GLOVE DEVICE DESIGN

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Abstract

In hand rehabilitation, physical therapy is applied to the hands and fingers regionally. In the treatment of hand rehabilitation, it is aimed to restore the hand function, to facilitate hand movements and to restore movement. Hand rehabilitation is not only the fulfillment of the hand function, but also the pain and seizures that occur at the same time. For the rehabilitation of the hand in work, each time the rehabilitation center or the hand movement provider instead of the different cost devices designed wearable rehabilitation gloves. It is aimed to rehabilitate the hand by making finger joint measurements of the person to be used, producing rings from the three-dimensional printer on the gloves, connecting the kevlar yarn to the servo motors, and opening and closing the fingers. The device is person-specific, portable and easy to manufacture and low cost. This feature allows the person to perform the rehabilitation of the hand wherever he is without going anywhere.

Keywords: rehabilitation, robotic glove, hand rehabilitation

1. Introduction

In the treatment of hand rehabilitation, it is aimed to gain the ability to grasp the fingers, to restore the hand function, to facilitate hand movements and to restore movement. Hand rehabilitation is not only the fulfillment of hand function, but also achieved resulting aches and pains will be eliminated.
When studies on hand rehabilitation are examined; Mousavi Hondari et. al. Features a Spatial augmented reality system for rehabailitation of hand and arm movement [1]. Mulas et. al. designed an emg controlled exoskeleton for hand rehabilitation[2]. Luo et.al. made an integration of augmented reality and assistive devices for post-stroke hand opening rehabilitation [3]. Boian et. al made a virtual reality- based post stroke hand rehabilitation [4]. Adamovich et. al. designed a virtual reality-based exercise system for hand rehabilitation post-stroke. They presented preliminary results from a virtual reality based system for hand rehabilitation that uses a CyberGlove and Rutgerd Master II-ND haptic glove[5]. Balasubramanian et.al. designe a robot assisted rehabilitation of hand function [6]. Fischer

et.al. made a study about hand rehabilitation following stroke, and a pilot study assisted finger extension training in avirtual environment [7]. Kawasaki et.al. presented a new hand motion assist robot for rehabilitation therapy[8].Ueki et.al. presented a virtual-reality enhanced new hand rehabilitation support system that enables patients exercise alone [9]. Ito et.al. designed of motion assist equipment for disabled hand in robotic rehabilitation system. Their design's structure of each mechanism is designed to achieve independent, fine motion assistance, especially, for the individual fingers [10]. Lambercy et.al. designed a haptic knob rehabilitation of hand function on. Its mechanical design based on two parallegram structures holding an exchangeable button, offers the possibility various hand sizes and finger orientations [11]. Simone et.al. designed a low cost instrumented glove for extended monitoring and functional hand assessment. They made a wearable finger flexion monitor developed to measure hand function in individuals with hand dysfunction was evaluated for feasibility, measurement repeatability and reliability, fidelity of wireless transmission, and user acceptance [12]. Connelly et.al. designed a pneumatic glove and immersive virtual reality environment for hand rehabilitative training after stroke [13]. Placidi designed a virtual glove, software based, which tracks handmovements by using images collected from webcams and numerical analysis [14]. Heo et.al. presented a comprehensive review of hand exoskeleton technologies for rehabilitation and assistive engineering, from basic hand biomechanics to actuator technologies [15].

In this study we designed a wearable hand rehabilitation glove. Thanks to this device a person who need hand rehabilitation does not have to go to the rehabilitation center every time and this device is very low cost. It is aimed to rehabilitate the hand by making finger joint measurements of the person to be used, producing rings from the three-dimensional printer on the gloves, connecting the kevlar yarn to the servo motors, and opening and closing the fingers.

2. Material and Method

2.1.Material

Materials that are used in this study and their usage aims are given in Table 1. The glove is produced as a cotton lycra mixture according to the manual measures for the comfort of the user. The rings were produced in a 3D printer using Poly Lactic Acid filament. Kevlar yarn is used because of the its abrasion resistance and strength.

Table 1. Rehabilitation hand glove materails and machines

Material	Purpose
Glove	To wear hand
PLA filament	Ring and motor place
Kevlar yarn	Motion mechanism
3d printer	To product rings and motor place
Servo motor	Motion mechanism

2.2.Method

Production process steps;

1. As shown in Figure 1, a flexible glove is woven so that the wrist is long.

Figure1. Flexible glove

2. The finger joint measurements of the person to be used are taken and the rings according to the region from the 3D printer are drawn in the CAD program and produced in the printer as seen in Figure 2.

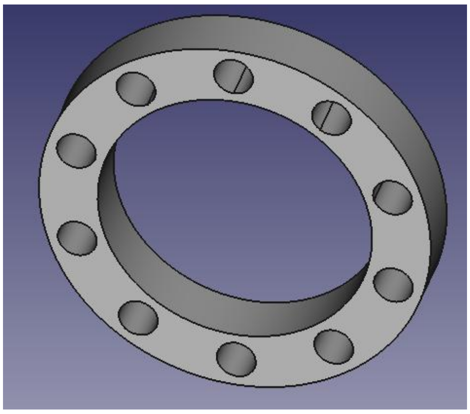

Figure 2. CAD drawing of rings

3. Rings are placed such a way as shown in Figure 3. They will not come into contact with each other in the joint area.

Figure 3. Placement of rings

4. A motor-matched component motor bed is made for the installation of the motors (Figure 4) and is produced in the 3D printer (Figure 5).

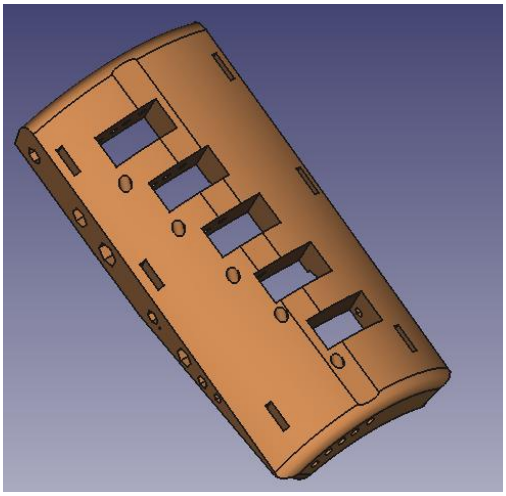

Figure 4. CAD drawing of the motor bearings

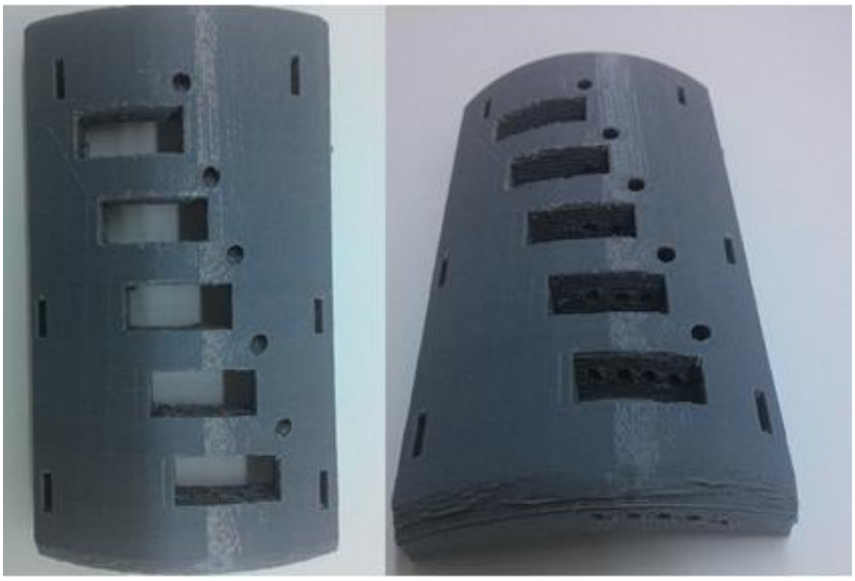

Figure 5. Motor bearing

5. As shown in Figure 6, motorsa re placed into motor bearing.

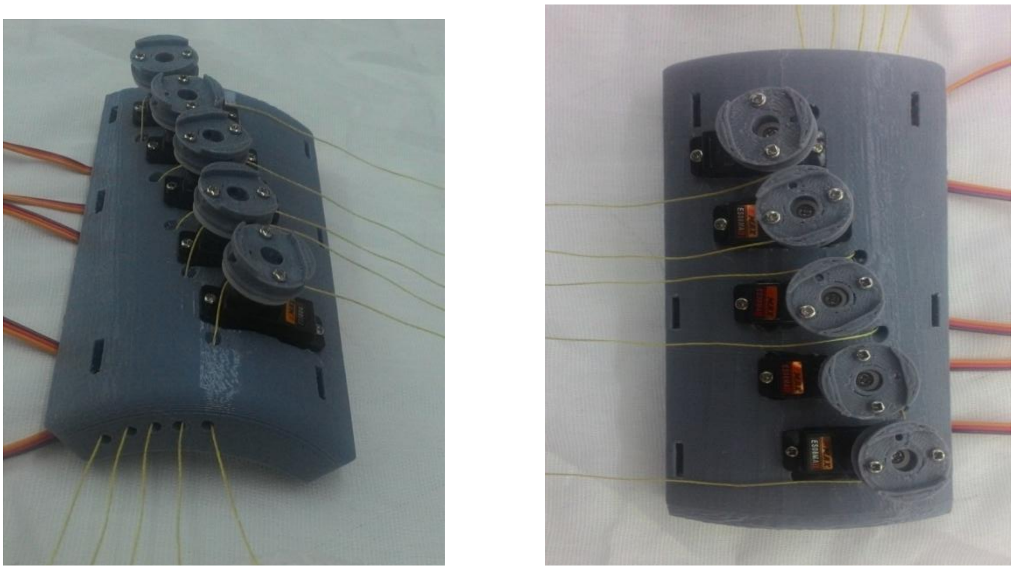

Figure 6. Motors are placed into bearings

6. Thread the kevlar yarn through the holes in the rings and connect the kevlar yarns to the servo motors as shown in Figure7.

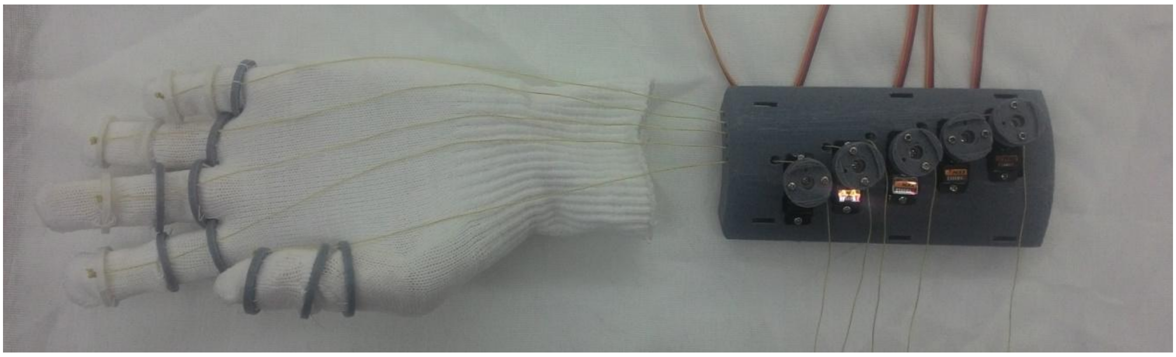

Figure 7. Final state of the rehabilitation glove

3. Conclusion

It is designed and manufactured for the purpose of applying physical therapy to hand and fingers. Advantages of the produced rehabilitation glove:

- Personalized production,
- Easy to wear, removable,
- Portable, not bulky,
- Available without assistance,
- Easy to use, without any assistance,
- Low cost,
- No need to go to the rehabilitation center.

In the study, the rings were drawn by connecting the kevlar yarns to the servo motors. Alternative to servo motors, rehabilitation gloves can also be produced by using motors with different attraction, different torques.

4. Acknowledgement

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