A20-252 **APPLICATION GROUP**

作品名稱

可適性仿生機械義肢的開發

The Development of Adaptability Bionic Mechanical Prosthetic

隊伍名稱

義肢終結者 Prosthetic Terminator

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作品摘要

本團隊創作的想法是來自如果一個人突然失去了他的手，這會對他的生活造成不便利性、影響到他的工作，甚至他的內心受到傷害因為一般人常投以另類的眼光。圖 1 所示為本創意作品「可適性仿生機械義肢」，是以能幫助肢體缺陷的朋友，以解決其生活的不便性及重拾自信心而設計。傳統的義肢一般只具備外型的裝飾，而近年來的發展已演變為具可動性功能；然而，其價格都普遍昂貴，卻不一定能符合配戴者的需求。

本團隊研究機械義肢已有兩年多。先前我們使用簡易的材料如吸管與筷子等，製作出第一代概念設計的機械義肢。為了提高剛性，我們更以電腦繪圖搭配 3D 列印，製作出第二代機械義肢，並使用搖桿控制。我們發現配戴在腰間的搖桿不易控制，因此第三代我們使用聲音控制，使用者可以透過口說的方式改變機械義肢的手勢，輔助端盤、倒水、抓取物品，以及拿筆寫字等；然而，我們發現聲音控制容易受到環境噪聲的影響，並影響解釋的準確性。另外，截肢者需要前臂的佩戴空間。

承上所述，本次的作品著重於可適配性設計。在控制的部分我們以肌肉訊號貼片，設置於手臂之肱二頭肌以及肱橈肌，肌肉訊號可用於更直觀地操控手臂。為了騰出前臂的空間，我們將馬達從前臂的部分移至手掌內部。新的手掌設計增加了五指與虎口開合的靈活度設計，並且在手指與手掌會與物品接觸的摩擦面，增加摩擦片與導電高分子材料，使本作品兼具省力抓取物品及可滑動 3C 產品的能力。此外，為了減輕使用者肌肉的負擔，這本作還設計了一個開關，使穿著者可以在保持握住物品的同時放鬆肌肉。這些新穎的功能是現今義肢所沒有的。

借助兩組肌肉信號，使用者可以靈活地控制拇指的角度，以及五個手指的打開和關閉，並成功抓住飲料杯、寶藏瓶、爆米花罐、講義夾、塑料椅等物品。此設計中的開關功能成功的幫助使用者在肌肉放鬆的同時保持物品，手指也可成功的滑動 3C 產品。我們的團隊將持續精進此作品，近期目標是與使用者或佩戴者建立聯繫，以收集該義肢的建議反饋並進行調整。長遠的規劃是在機械義肢增加力量回饋的感知器，讓義肢在抓取的過程中不會造成物品的損壞，這大大的增加了它的適用性。

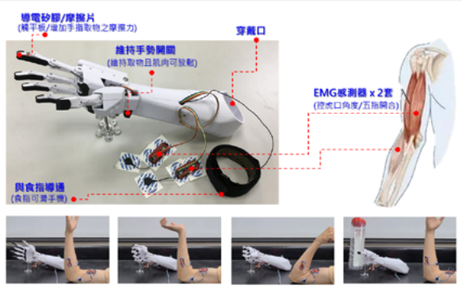

圖 1. 可適性仿生機械義肢

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Abstract

Our idea is from if a man who suddenly loses his hand. It will inconvenience in his life, affects his work, even his pride will get hurts because ordinary people will look at him curiously. Figure 2 shows the creative work "Adaptable Bionic Mechanical Prosthetics", which is designed to help friends with physical defects to solve their inconveniences in life and regain their confidence. Traditional prostheses generally only have the appearance of decoration, and the development in recent years has evolved into a movable function. However, their prices are generally expensive, but they may not necessarily meet the needs of users.

Our team has been studying mechanical prosthetics for more than two years. Earlier, we used simple materials such as straws and chopsticks to create the first generation of mechanical prostheses. To increase rigidity, we used computer graphics and 3D printing to create the second-generation mechanical prosthesis and controlled it with a joystick. We found that the joystick worn on the waist is not easy to control, so our third generation uses voice control, users can change the gesture of the mechanical prosthesis by mouth, assist pick up the dish, pour the water, grab the object, and hold the pen and writing, etc. However, we found that sound control is susceptible to environmental noise and affects the accuracy of interpretation. In addition, the amputated user needs the space of forearm to wear.

With the two sets of muscle signals, the user can flexibly control the angle of thumb, and the five fingers opening and closing, and successfully grab the drink cup, treasure bottle, popcorn jar, handout clip, plastic chair and other items. The switch function in this design successfully helps the user to keep items while the muscles relax. The finger can also successfully slide 3C products. Our team will continue to improve this prosthesis. The near-term goal is to establish contact with the user or wearer to collect feedback and make adjustments to the prosthesis. The long-term plan is to increase the force feedback sensor in the mechanical prosthesis, so that the prosthesis will not cause damage to the items during the grasping process, which greatly increases its applicability.

As mentioned above, this work focuses on adaptability design. In the control part, we set the muscle signal patch to the biceps and brachial muscles of the arm. Muscle signals can be used to control the arm more intuitively. In order to free up the space of the forearm, we moved the motor from the forearm to the inside of the palm. The new palm design increases the flexibility of thumb opening and closing, and conductive friction polymer materials are added to the fingers and palm. Therefore, the new palm has easy grip and slide 3C product functions. In addition, in order to reduce the burden on the user's muscles, this work also designed a switch so that the wearer can relax the muscles while holding the held item. These novel functions are not available in prosthetics today.

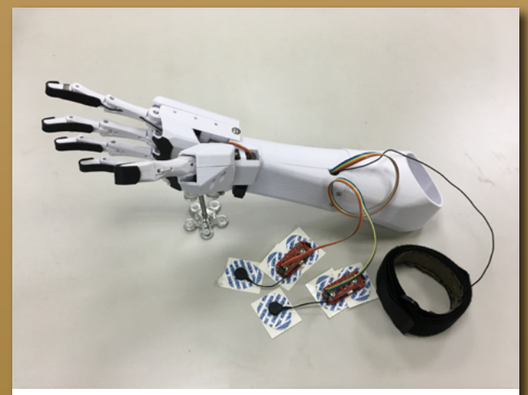

Fig. 2 The adaptable bionic mechanical prosthetics