

Using 3D printing to promote recovery in spinal-cord injury patients



Glasgow University PhD student Nina Petric-Gray uses HP 3D printing technology to help rehabilitate spinal-cord injury patients

INDUSTRY

Medical technology

SECTOR

Prototype and component printing

OBJECTIVE

Create a customised prototype specifically for patients with spinal-cord injuries

APPROACH

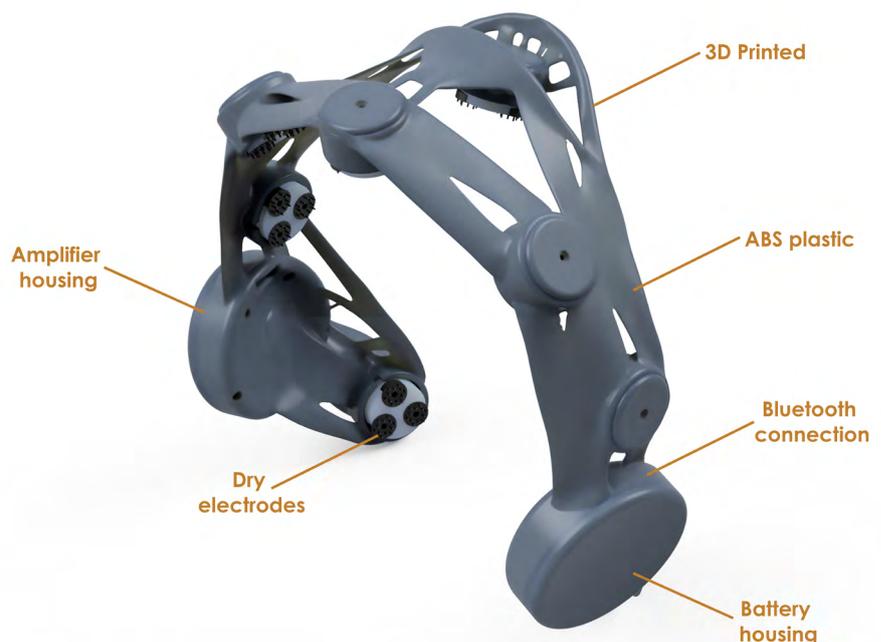
Use HP world-leading 3D printing technology to create a headset that was light enough and strong enough to be used in promoting recovery

TECHNOLOGY | SOLUTION

HP Jet Fusion 4200 Industrial 3D Printing Solution

MATERIAL

HP 3D High Reusability PA 11, HP 3D High Reusability PA 12, HP 3D High Reusability PA 12 Glass Beads, ESTANE® 3D TPU M95A



Introduction

At present, recovery for the UK's estimated 50,000 SCI patients takes place within hospitals due to the complexity and bulk of existing technology. As part of the therapeutic process, clinicians use brain-computer interface (BCI) devices that rely on technology that uses functional electrical stimulation (FES).

Although it promotes the recovery of functions lost during the accident, this technology involves a lot of set-up. This can be a time-consuming and trying process for patients. This insight inspired PhD student Nina Petric-Gray to take on the job of designing a lightweight, inexpensive and easy-to-use headset that patients could take home. Made using the HP Multi Jet Fusion (MJF) 4200 3D printer, and Autodesk Fusion 360's Generative Design software, the headset would help restore hand function.

The new headset leverages Functional Electrical Stimulation (FES) - low-energy electrical pulses to artificially generate body movements in individuals who have been paralysed due to central nervous system injuries.

This would allow patients to do the set-up work in the comfort of familiar surroundings. It would also free NHS time and resources, allowing clinicians to spend more time on the high-value-add therapeutic part of the treatment and less time on preparatory work which patients could do themselves.

To make this happen, and realise these benefits, Ms Petric-Gray had to find a manufacturing technology able to produce the headset at the right cost and make it durable and strong enough.



Challenge

In early iterations of prototyping, the PhD student behind the project, Nina Petric-Gray, modified gaming headsets with electrodes to record patients' brain activity. However, the adjusted models were unsuitable as they did not allow for accurate electrode placement and were often too heavy and uncomfortable.

The need for a bespoke prototype was clear. Autodesk's Fusion 360 software helped Nina to transform her idea into a highly functional and bespoke 3D model that allowed for optimised electrode placement and increased usability. To overcome this challenge, Ms Petric-Gray turned to the HP Jet Fusion 4200 Industrial 3D Printing Solution.

Solution

As the design became more complex, Nina turned to HP 3D Multi Jet Fusion (MJF) printing to bring the product to life. HP MJF printing technology allows the headset to be fully customisable to the patient, ensuring that the electrodes are connected to the correct area of each person's head. It also offers a fast and cost-effective approach to prototyping as updates to the design can be printed without having to create a new mould for each version, in turn reducing waste.

Polyamide (PA 12) was the chosen material for the device as high quality print was needed, due to the detail and complexity of the headset shape. PA 12 also provides sufficient strength to support the loads on the headset from daily use and lends itself to wearable devices as it is biocompatible.

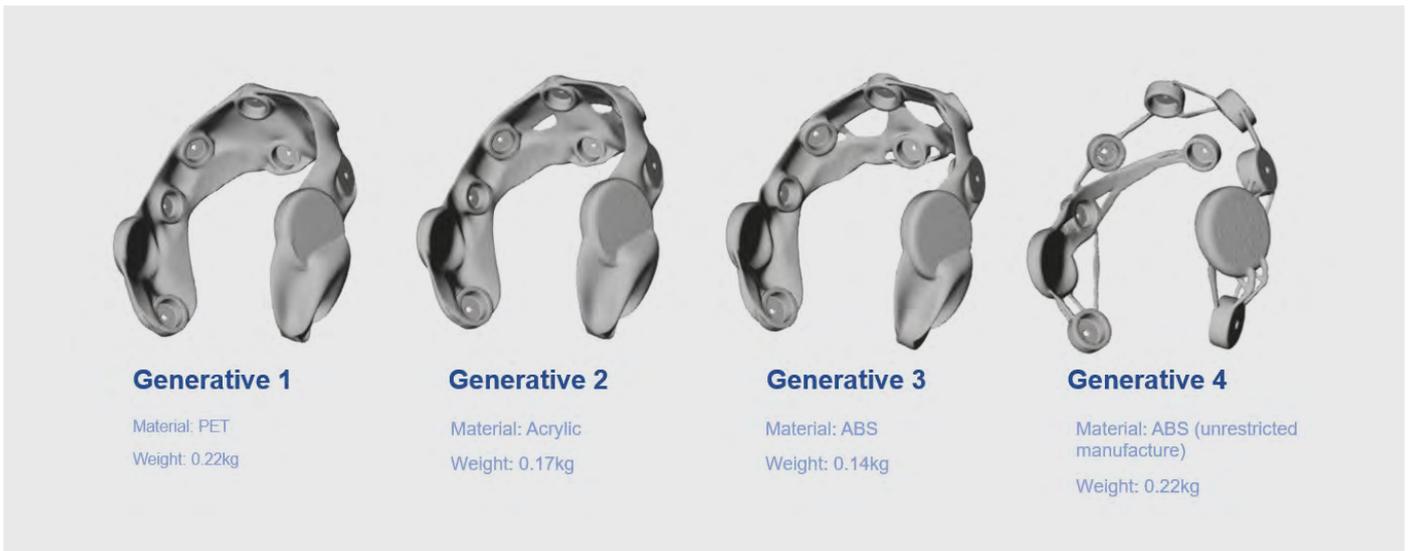
"As the headset model evolved into something quite complex, it became clear that FDM printed models would no longer be suitable owing to the vast amounts of processing they required," said Petric-Gray. "The first time I saw the HP MJF printed headset I was blown away, it showed real progress from earlier models. It was perfect right out of the box, where others needed post-production touch ups."

MD for UK & Ireland at HP, George Brasher, said: "This is a fantastic example of the possibilities and potential of 3D printing in the health sector. We're proud to be part of a project which aims to help aid the recovery of patients suffering with spinal-cord injury and look forward to supporting Nina's team in the coming stages of testing and manufacturing."

"Although we're only in the prototyping phase, 3D printing absolutely has the necessary advantages to be the means of end-product manufacture".

- Nina Petric-Gray, PhD student





Result

Lightweight, strong and entirely bespoke, the portable headset enables the patient to recover in the comfort of their own home, reducing the number of visits to the hospital for treatment, and relieving potential strain on the NHS' rehabilitative wards.

“Although we’re only in the prototyping phase, 3D printing absolutely has the necessary advantages to be the means of end-product manufacture,” explained Nina Petric-Gray. The ability to produce something bespoke to the patient and in such a short timeframe is a win-win in manufacturing terms. The technology gives us the potential to print a headset that’s integrated, with both frame and electrodes printed as one unified part, without having to construct anything afterwards”.

The project is currently being trialled with patients in Glasgow, Scotland, and the next stage is to print additional, fully customised, headsets for end users, using HP Multi Jet Fusion technology.

As well as benefiting the patients with spinal-cord trauma and the clinical teams that treat them, the project was also a successful part of Ms Petric-Gray’s PhD thesis. She is now Dr Petric-Gray.

This is a fantastic example of the possibilities and potential of 3D printing in the health sector. We’re proud to be part of a project which aims to help aid the recovery of patients suffering with spinal-cord injury and look forward to supporting Nina’s team in the coming stages of testing and manufacturing.”

- George Brasher, UK&I Managing Director at HP

Sign up for updates