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Robotic 'power boost' arm wins James Dyson Award

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A battery-powered robotic arm that boosts human strength has won the 2013 James Dyson award.

The Titan Arm, designed by four mechanical engineering students from the University of Pennsylvania, could help people with back injuries rebuild and regain control of muscles.

It can also be used by people to lift heavy objects as part of their work.

The team, who spent eight months creating the exoskeleton, will share a prize of £30,000 ($48,000).

"Titan Arm is obviously an ingenious design, but the team's use of modern, rapid - and relatively inexpensive - manufacturing techniques makes the project even more compelling," said Sir James Dyson.

"We are ecstatic," team member Nick Parrotta told the BBC. "It was totally unexpected - just incredible."

'Inexpensive aluminium'
The team produced its prototype for £1,200, which they say is a 50th of the typical cost of similar exoskeletons currently on the market.

"We wanted Titan Arm to be affordable, as exoskeletons are rarely covered by health insurance," said Mr Parrotta, 23, currently studying for a masters in mechanical engineering.

"This informed our design decisions and the materials we used. Most structural components are machined from inexpensive aluminium."

Academic and commercial interest in wearable robotics is growing according to Conor Walsh, Professor of of Mechanical and Biomedical Engineering at the Harvard School of Engineering and Applied Sciences.

But costs will have to continue falling if robotics are to feature more often in daily life, he said.

"Reducing cost will be critical for commercial systems, however the total cost is not just the cost of the hardware but also the added cost associated with research and development, quality assurance and regulatory compliance."

The Titan arm incorporates a rigid back brace to maintain posture, a shoulder featuring rotational joints, and sensors that can track motion and relay data back to doctors for remote prognosis.

It can augment human weight-lifting strength by 40lbs (18kg), say the inventors, while the batteries can last for up to eight hours, depending on intensity of usage and workload.

Electrical signals
The current prototype is operated by a separate joystick, but future versions may incorporate electromyography technology, said Mr Parrotta, which picks up electrical signals produced by muscle tissue, thus allowing users to operate such prosthetics almost without thinking.

All of the inventors who took part in the competition used 3D-printing to develop and produce their prototypes much more cheaply than would have been possible before.

"Prototyping technology, previously reserved only for companies with big research and development budgets, is enabling young inventors to develop sophisticated concepts at university," said Sir James.

"They can revitalise industries on a small budget - it is a good time to be an inventor."

The second prize went to a Japanese team who created Handie, a prosthetic hand with sensors that can read brain signals.

A 3D-printed plastic cast for broken limbs, invented by a team from New Zealand, took the third prize.

The James Dyson Foundation runs the annual award across 18 countries with the aim of encouraging problem-solving inventions.

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