



BIONICS AND IoT

What are bionics, and how they are connect to
the field of IoT

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Historical review

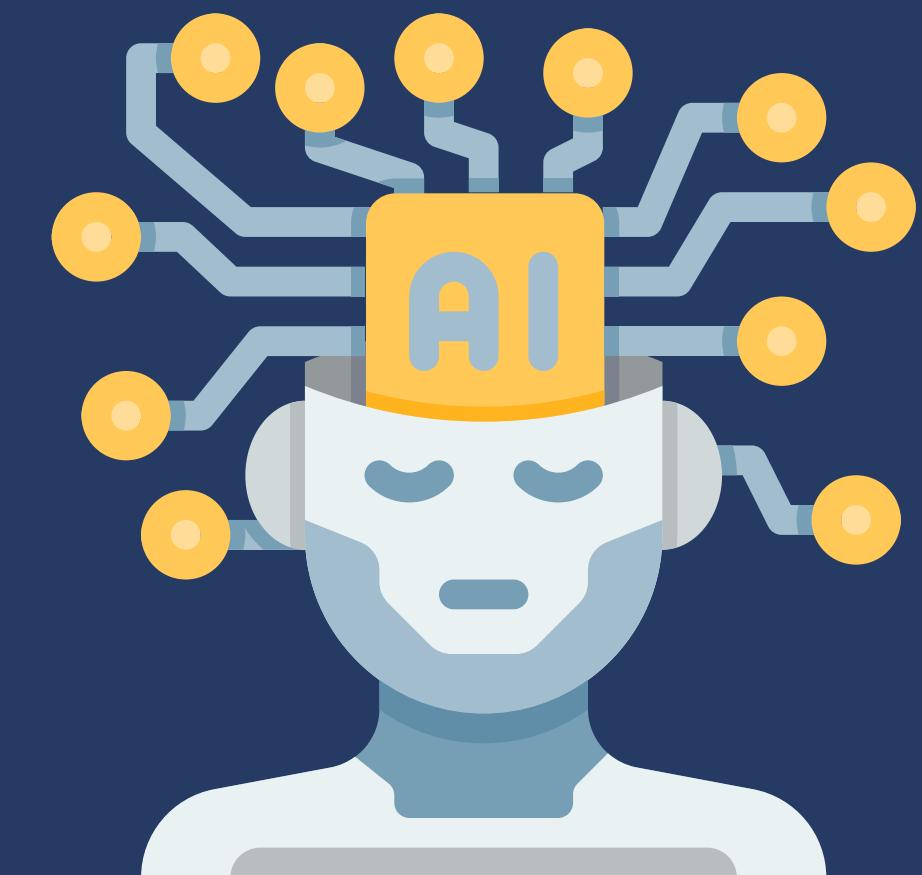
Bionic Arms

Connection To IoT

AI In Bionics

Emerging Technologies

Hugh Herr





What is the problem?

CHANGE LIVES FOR THE DISABLED

“Every person should have the right to live without disability if they so choose... the right to live without depression... the right to see a loved one if they are seeing impaired, or the right to walk or to dance.”

Hugh Herr, TED 2014





The History Of

PROSTHETICS AND AMPUTATIONS

- 3,000 YEARS AGO - WODDEN TOW IN EGYPT.
- 500 YEARS AGO - PROSTHETIC HAND WITH A MECHANISM FOR MOVING THE FINGERS.
- 61 YEARS AGO - ROBOTIC HAND.
- 56 YEARS AGO - REGAIN THE HEARING SENSE THAT HAD BEEN LOST.
- 40 YEARS AGO - ARTIFICIAL HEART.
- 13 YEARS AGO - TRUE BIONIC LIMBS FOR WAR VETERANS.

5.18 million
Limb amputees in USA
and EU

6 different options
for prosthetic for upper limb
amputees





THE WAVE OF IOT

- There are expected to be more than 64B IoT devices worldwide by 2025.
- By the end of 2020, 5.8 billion automotive and enterprise gadgets were on IoT.
- By 2022, 100% of the global population is expected to have LPWAN coverage.
- IoT has the potential to generate \$4T to \$11T in economic value by 2025.
- The main revenue driver for 54% of enterprise IoT projects is cost savings.
- The wearable devices market will be worth \$1.1 billion by 2023.
- The IoT in banking and financial services market size is expected to grow to \$2.03B by 2023.





Astounding ways IoT is

CHANGING LIVES FOR THE DISABLED

Sign Language Decoders

Bionic Ears

Bionic Exoskeletons



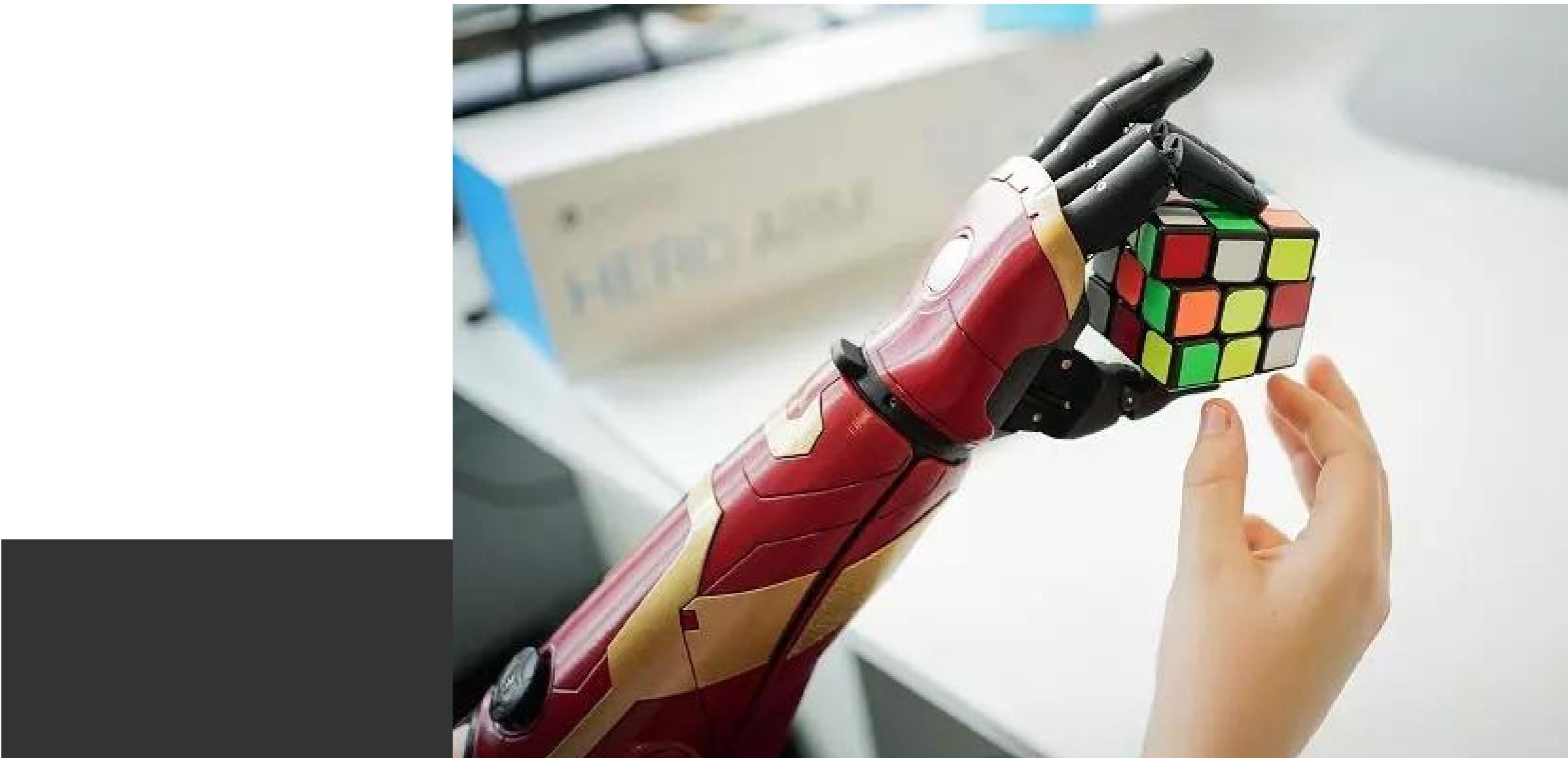
Bionic Eye

Bionic Finger





BIONIC ARMS



THE IDEA BEHIND



Bionic arms are intuitive artificial limbs that use cutting-edge technology to connect with the body.

They use special sensors to detect and convert naturally generated electrical signals from muscles into movement



TYPE OF PROSTHESES

- Nonfunctional limbs that serve a cosmetic purpose.
- Body-powered limbs that use cables or pulleys.
- Traditional prosthetics that require manual intervention to work.
- Myoelectric prostheses, which have a custom socket with sensors that contact the skin and detect electrical signals from muscles, converting those signals to motorized movement.
- Osseointegrated prostheses which have mounts and wiring surgically attached to the bone and nerves.





HOW IS IT WORKING?

Bionic limbs and prosthetic technology connect the mind to the prosthesis through sensors that detect muscles' electrical signals and translate those contractions and signals to various movements.



Pick up specific electrical impulses from muscles and translate them to actions such as grasping motions.

Connections to nerves are improving precise function and the ability to sense motion and other feedback, such as grip on an object.

The bionic arm's sensors are electrodes that touch the skin and record muscle activity through a process called electromyography.

Most bionic arms are battery-powered.



THE CONNECTION TO IOT

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

IoT Ecosystem

Web-Enabled smart devices that use processors, sensors and etc.... to connect, send, and act on data they acquire.

AI with IoT

Use AI to aid in making data collecting processes easier and more dynamic.

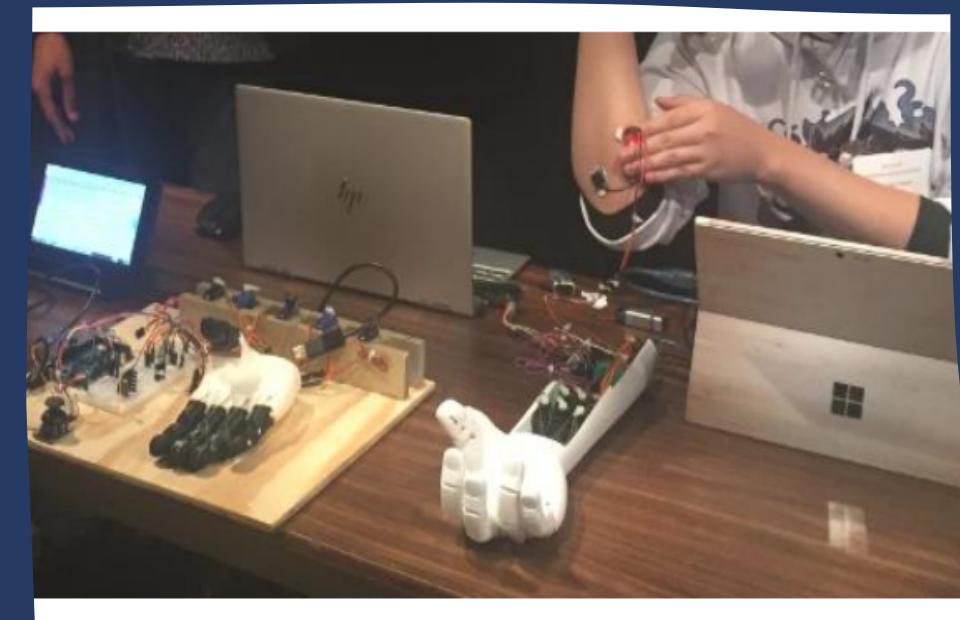
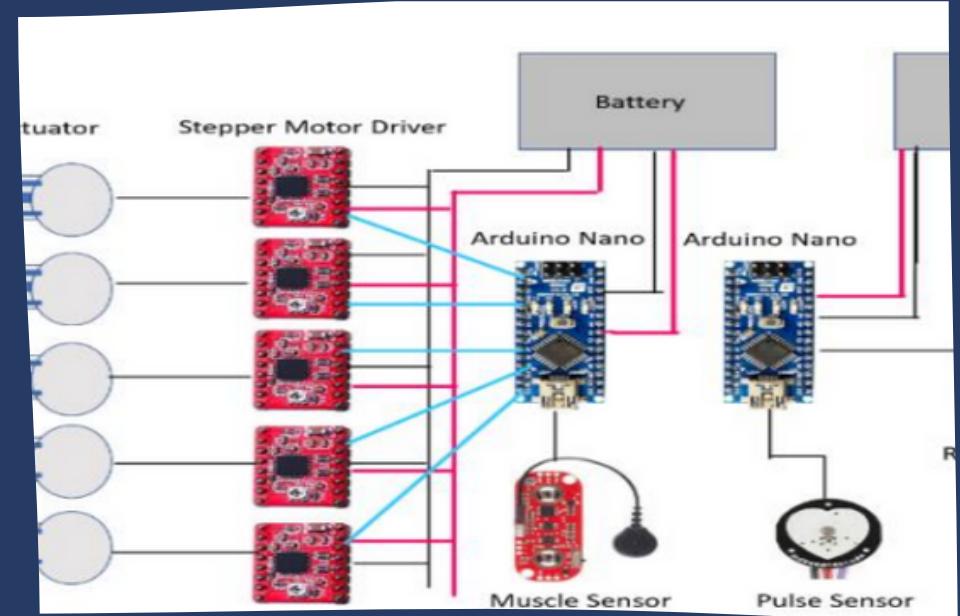
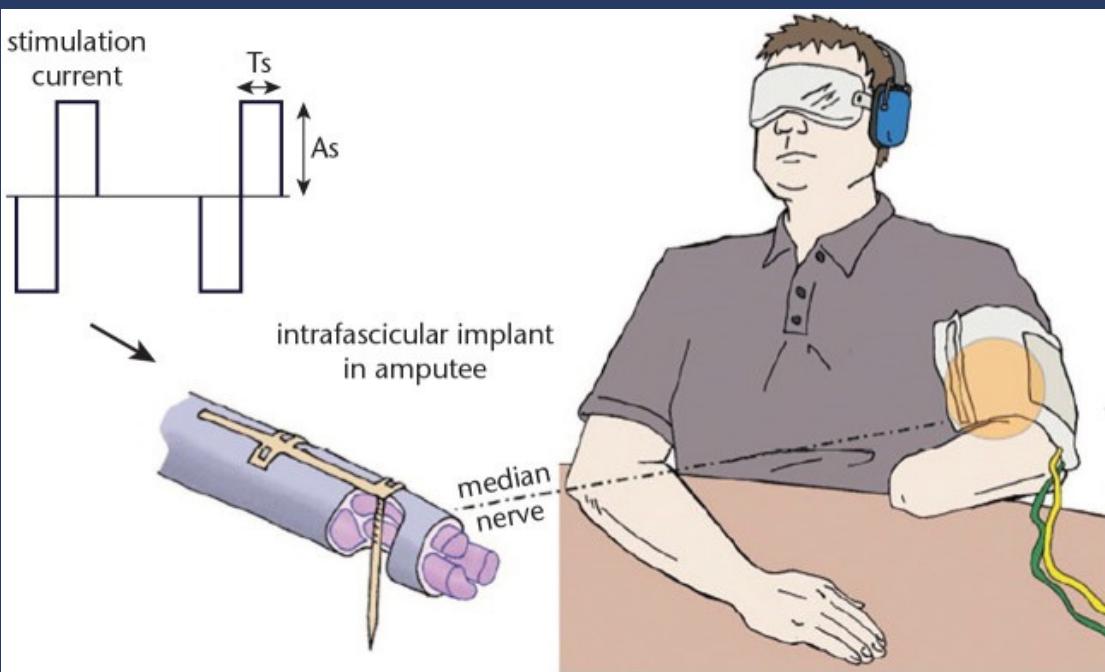




Innovative Solution

USE OF IOT IN PROSTHETIC LIMB

Control movement through an Arduino Mega, which is connected to the muscle, pulse, and temperature sensors. The Arduino Mega is also connected to a Raspberry Pi 3 model B to transfer data from/to an online web application.





AI IN BIONICS AND IOT

Using regenerative peripheral nerve interface and machine learning algorithms in order to perform subtle movements.

convolutional neural network has been found to be useful to get more accurate and faster movements of the limbs.





EMERGING TECHNOLOGIES

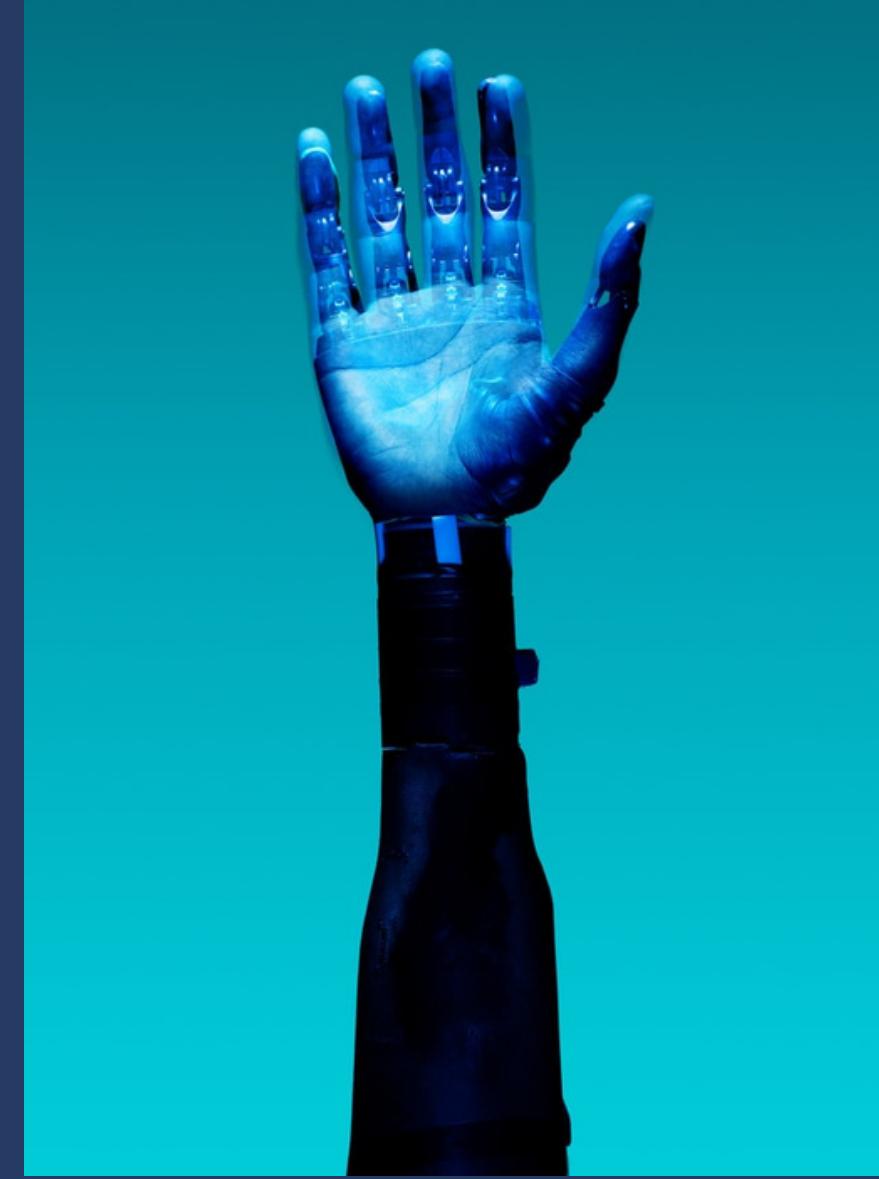
Connects the brain to the prosthetic arm through electrodes attached to the nerves under the skin.

Osseointegrated prostheses that connect directly to the bone, eliminating the need for potentially uncomfortable compression cups.

Two-way communication, providing you with a sense of feel so you can better guide your bionic arm.

Manufacturing can be done through 3D printing, a cost-effective approach that uses high-performance materials.

Send vibrations to create the illusion of movement, helping you rely less on looking at the limb to make sure it's making the movements you want.





INTERNET OF BODIES

An ecosystem of devices that are connected to the Internet that contain software and that either collect personal health data about you or can alter the body's function.

It's natural in a lot of ways to want to understand more about your body, how it functions, how well it's doing.





from his TED lecture

HUGH HERR

American rock climber, engineer, and biophysicist.

Hugh Herr is creating bionic limbs that emulate the function of natural limbs.

New bionics center established at MIT with \$24 million gift



Demonstration



**THANKS FOR
LISTENING**

QUESTIONS?

