POWERED EXOSKELETONS

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JUSTIFICATION [1]

• Military personnel required to carry large amounts of gear
  • Currently carries 100 pounds
  • Chronic back injuries

• Wheelchair patients
  • 1% of the world’s population in wheelchairs

http://www.screenhead.com/reviews/iron-man-review-stark-entertainment/
OUTLINE

• History of exoskeletons
• Civilian uses for exoskeletons
• Military uses for exoskeletons
• Road ahead
• Conclusions

http://www.dailymail.co.uk/sciencetech/article-1049215/Paralysed-man-walks-thanks-Robocop-style-exoskeleton.html
**History [2,3]**

- **Hardiman**
  - Developed by Ralph Mosher, an engineer for GE, in the 1950’s
  - Consisted of powered arms and legs
  - GE had high hopes for the exoskeleton robot

- **Developments**
  - 1987: Lifesuit
    - Developed by Monty Reed, who started work on it for physical therapy
  - 1990: Power Assist Suit
    - Japan’s Kanagawa Institute of Technology

HISTORY [3]

• **2002: Hal-3**
  - Developed by Japanese company, Cyberdyne, to help nurses carry patients. Late, Hal-5 was released

• **2004: Bleex**
  - Berkeley’s Lower Extremity Exoskeleton

• In 2001, DARPA started to lead in the development with 3 contractors

• In 2004, Sarcos Research Company was selected as the finalist

• Sacros has developed 3 main systems, and continues to research

HONDA: BODY SUPPORT ASSIST
[4],[5]

- Function
  - Reduce stress on legs and knees
  - Provide Partial body weight support
- Height 160 to 180cm
- Lithium ion Battery
- 2 hour Operating Time
- 2 motor drive system

1 http://smjcreations.blogspot.com/2010/05/new-innovations-latest-mobility-device.html#axzz1K5STDcFe
Body Support Assist [6],[8]

- Unique Innovation
- directs the assisting force toward the user's center of gravity
- Varying assisting force to the legs based on sensor information
- Increases assisting force for higher degrees of knee rotation

www.Honda.com
Robot Suit HAL moves in accordance with the wearer's intention

CYBERDYNE: HYBRID ASSISTIVE LIMB [9]

- Voluntary control system
  - Bio electric signals are picked up with sensors on the skin
  - Signals are analyzed by a computer
  - Power unit sends a signal to compliment the wearers muscle movement
- Robotic Autonomous Control

**Specs [9]**

- **Height** – 1.4 to 1.6m
- **Weight** 23Kg
- **Power** - Rechargeable Batter (100V)
- **Operation Time** – 2hrs 40 mins
- **Indoor/Outdoor use**

MILITARY USES

http://www.ironman2.net/
MILITARY USES [10]

- Raytheon XOS
  - Funded by DARPA
  - 150 lb
  - 200 lb feels like 10 lb
  - 30 hydraulic actuators

MILITARY USES [11]

• Human Universal Load Carrier (HULC)
  • Berkeley Bionics and Lockheed Martin
  • Can take 200 lb without hindering wearer
  • 81 lb at 2 MPH decreases overall oxygen use by 15%
  • Powered by battery pack
  • LCD screen controls
  • Adjustable

http://bleex.me.berkeley.edu/
Future depends on developing new technologies to remedy certain problems.

- Power Source
- Structural Materials
- Control
- Actuation
- Biomechanics
- Stealth
CONCLUSIONS

• Powered exoskeletons have the potential to change battlefield technology forever

• Paraplegic patients may leverage new technologies to walk again

• Future exoskeletons will better integrate with humans, blurring the line between man and machine
REFERENCES


QUESTIONS?