Powered Exoskeletons

Team LeftOvers

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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

http://www.adafruit.com/blog/2010/09/08/ges-retro-exoskeleton-robot-from-the-1950s/http://www.adafruit.com/blog/2010/09/08/ges-retro-exoskeleton-robot-from-the-1950s/

History [3]

http://www.popsci.com/scitech/gallery/2008-04/brief-history-exoskeletons

- **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

http://www.popsci.com/scitech/gallery/2008-04/brief-history-exoskeletons

- 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

] http://smjcreations.blogspot.com/2010/05/new-innovations-latest-mobility-device.html#axzz1K5STDeFe

Body Support Assist [6],[8]

www.Honda.com

- 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 for higher degrees of knee rotation

CYBERDYNE: HYBRID ASSISTIVE LIMB [7]

http://www.cyberdyne.jp/english/robotsuithal/index.html

Robot Suit HAL moves in accordance with the wearer's intention

Cyberdyne: Hybrid Assistive Limb [9]

http://www.cyberdyne.jp/english/robotsuithal/index.html

- 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

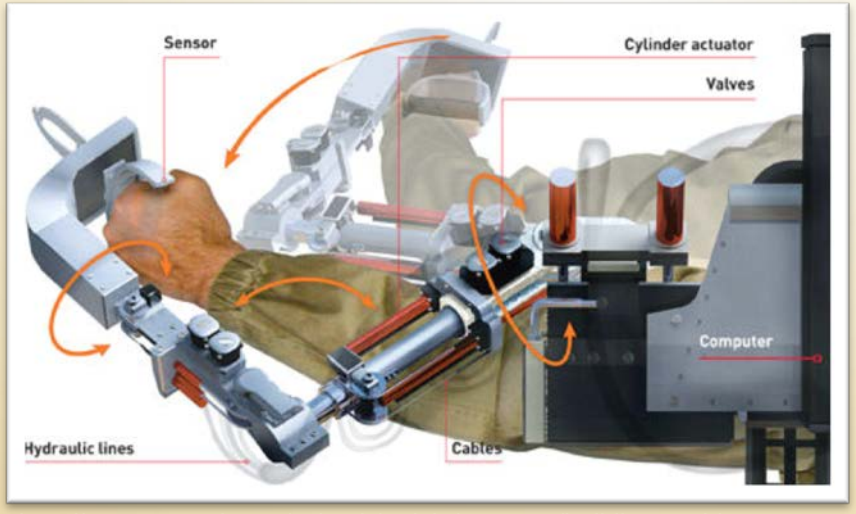
http://androidlifes.com/ces-2011-polaroid-square-tablet-trying-to-fit-in-a-round-peg-ces-polaroid-square-shows-off-tablet-android-ces-goers/

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



http://www.popsci.com/scitech/article/2008-04/building-real-iron-man

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 [12]

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

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- [3] “A Brief History of Exoskeletons,” 2008, Popular Science, from http://www.popsci.com/scitech/gallery/2008-04/brief-history-exoskeletons?image=0.
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QUESTIONS?