# The Internet of Things (IoT): Implications for Students with Disabilities

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# A research project funded by the 2017 Curtin Learning and Teaching Innovation Grant

- This project aims to identify innovative and effective solutions to support the educational outcomes for PWD which will ultimately assist in improving employment outcomes and increasing participation rates.

- Research question:

  - **As students increasingly utilise mobile devices as a key resource in University learning, how does the Internet of Things (IoT) benefit the educational outcomes of students with disabilities?**

# Methodology

1. Comprehensive literature review
   1. Internet of things and disability
   2. Internet of things and students with disability
2. Student Interviews

# Snapshot of findings

- The IoT is in a very early stage of development. As such, its possible uses and practicalities are unclear at this stage.

- Our students prefer Android devices.

- Technology must be adaptable. The students we interviewed regularly modify technology to suit their specific needs.

- They share a widespread willingness to try new technology, and equally a willingness to abandon that technology if it doesn't provide the support they require.

- They have different learning styles, for example some are visual, others are aural etc, and therefore require different technologies.

- Lecturers continue to be unaware of the access needs of students with disability – for example, lecturers are often of the view that if it is digital it is accessible. This was a widespread concern amongst the interviewees.

- Although the IoT offers great opportunities, it is vital that lecturers retain control of the classroom.

- They already feel overloaded with information – there is a fear that the IoT could exacerbate this.

- They hope that the IoT will be able to offer flexible and timely ways to better manage accessing educational materials.

# Internet of Things

The interconnection and interoperation of physical and virtual 'things'.

"Everyday objects turn into smart objects able to sense, interpret and react to the environment thanks to the combination of the internet and emerging technologies such as Radio-frequency Identification (RFID), real-time localization and embedded sensors" (Domingo, 2012, p. 584)

Domingo, Mari Carmen. (2012), "An overview of the internet of things for people with disabilities", *Journal of Network and Computer Applications*, Vol. 35, pp. 584 - 596
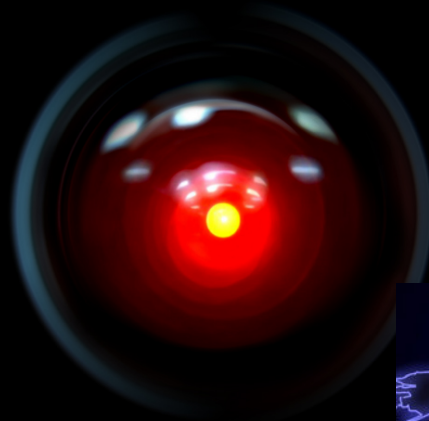
"Today computers, and therefore the Internet, are nearly wholly dependent on humans for information. The problem is, people have limited time and accuracy, all of which means they are not very good at capturing data about things in the real world. And that's a big deal"

(Ashton, 2009).

# Pornhub on a refrigerator in Home Depot

WarGames

CHESS
POKER
FIGHTER COMBAT
GUERRILLA ENGAGEMENT
DESERT WARFARE
AIR-TO-GROUND ACTIONS
THEATERWIDE TACTICAL WARFARE
THEATERWIDE BIOTOXIC AND CHEMICAL WARFARE

GLOBAL THERMONUCLEAR WAR

DO YOU WANT TO PLAY A GAME ?          DEFCON 5 4 3 2 1

SKYNET
NEURAL NET-BASED ARTIFICIAL INTELLIGENCE
CYBERYNE SYSTEMS CORPORATION

# FACEBOOK'S ARTIFICIAL INTELLIGENCE ROBOTS SHUT DOWN AFTER THEY START TALKING TO EACH OTHER IN THEIR OWN LANGUAGE

A humanoid robot named Han developed by Hanson Robotics reacts as the controller commands it via a mobile phone to make a facial expression during the Global Sources spring electronics show in Hong Kong April 18, 2015 / *REUTERS/Tyrone Siu*

'you i i i everything else'

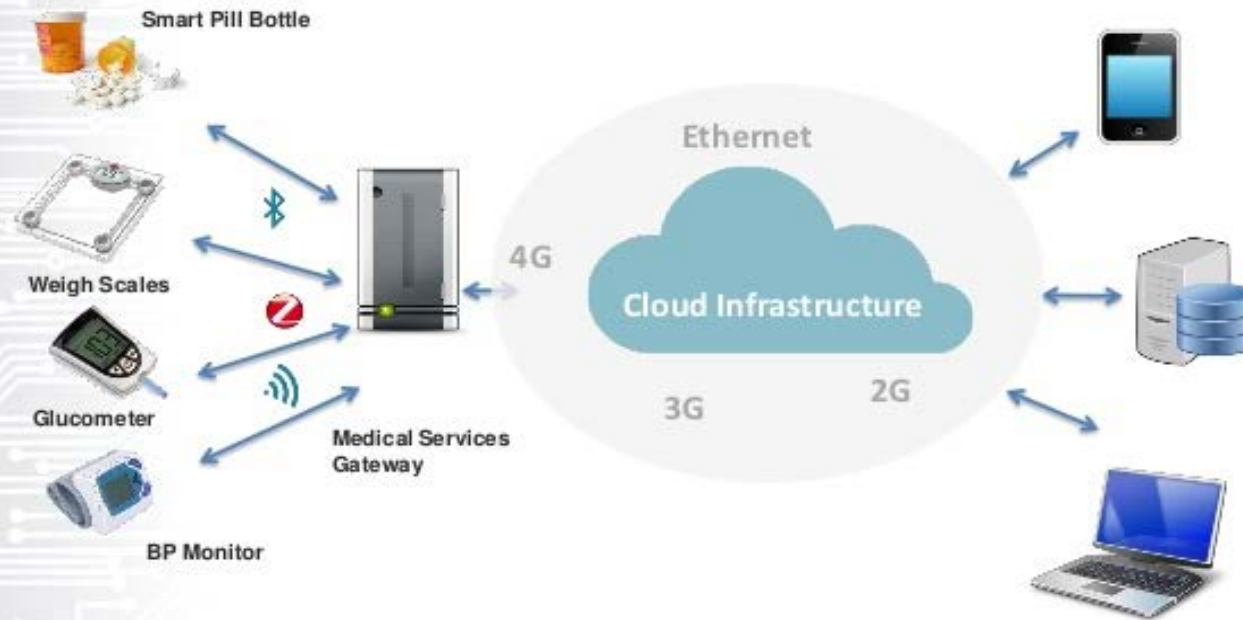**ANDREW GRIFFIN**
@_andrew_griffin
Monday 31 July 2017 16:10 BST

# IoT is not AI



IoT BASED PRODUCT DEVELOPMENT

MISTRAL
... Partners in Real Time

- IOT infrastructure consists of - Terminal devices, Communication and Cloud infrastructure

Smart Pill Bottle

Ethernet

Weigh Scales

4G

Cloud Infrastructure

Glucometer

3G          2G

Medical Services Gateway

BP Monitor

3rd Edition
electronics
Rocks 2014

Oct-14                                    Mistral Confidential                                    15

1. Context aware information

- Sensors on bodies and in environments

- RFID Technology

2. Network Layer

- Able to transmit the context aware information

- Internet protocols were originally designed for fixed networks but now need to accommodate mobile networks for the IoT:

  - WLAN
  - WiMAX
  - Bluetooth
  - Zigbee

- Wireless is optimal

- Convergence of heterogeneous networks and applications as a result of a single IP based network

3. Application Layer

- Accessed by monitoring stations and applications

- Authentication, billing, service management

Domingo, Mari Carmen. (2012), "An overview of the internet of things for people with disabilities", *Journal of Network and Computer Applications*, Vol. 35, pp. 584 - 596

# Issues:

- **Standardization**
- **Privacy**
- **Security**

In July, hackers shut down a car while it was traveling at 70 miles per hour. In August, researchers blew open the ZigBee networking protocol, paving the way for the hacking of everything from Philips Hue light bulbs to Kwikset smart locks. This year's DEF CON security conference featured three full days of Internet of Things (IoT) hacking seminars and workshops, beginning with the ominous-sounding "The Hand That Rocks the Cradle: Hacking IoT Baby Monitors."
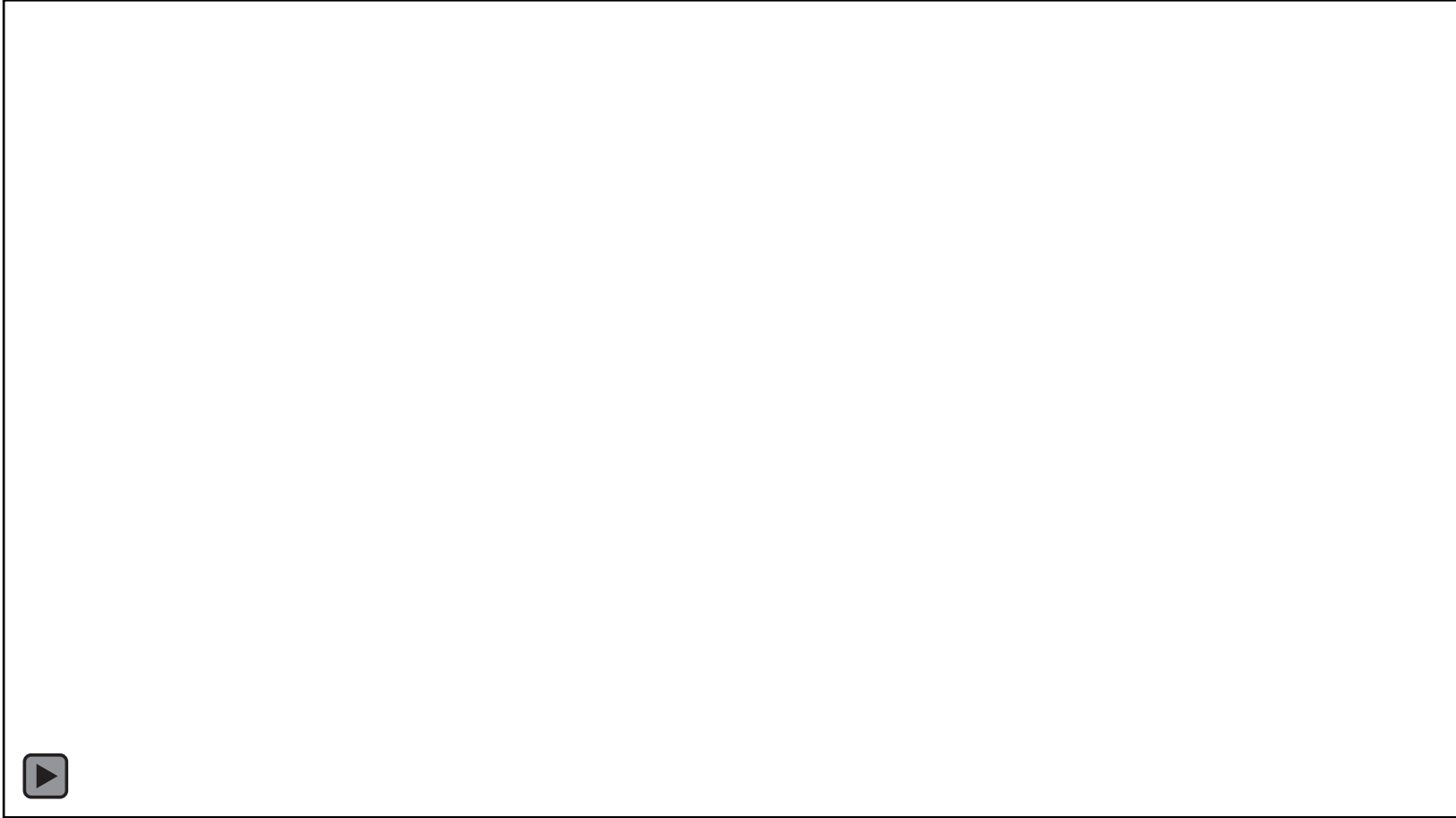
# Sign of the Times: Deaf Find Their Voices via Mobile Video and Apps

The emergence of video MMS and chat, in particular, keep the deaf and hard of hearing connected—all the while preserving sign language

FOR Andrew Wiltshire, video smart phones have broken the final barrier. The 45-year-old is fourth-generation deaf – ''I've never known what it is to be hearing'' – but he says by using his iPhone for video messaging he has unleashed his ability to sign to people directly.

''Finally, with deaf people, we can become mobile. We can go around and still communicate,'' the employment services manager said.

''It means I'm not disadvantaged or behind. I'm with everyone else ... my hearing mates, we're all on an equal footing. I feel more confident and more able to do things.''
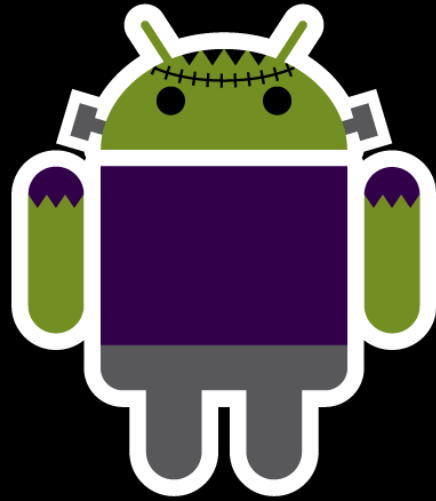
# Disability and IoT

Effectively integrated and reflexive technological infrastructures reduce the impact of the social model of disability.

Universal design is normalised.

'Accommodations' are reflexive and reactive to the specific needs of individuals.

# Specialised Human-Machine Interfaces

Specialised zooming enabling vision control

Specialised touch-screens to access information

Head-tracking devices, facial detection, eye-movement control, gesture recognition

...to create enabling environments.

# ELIMINATING BLIND SPOTS

The electronic walking stick can help a visually impaired person to move around independently

## FEATURES OF THE CANE

➤ Uses **radio frequency identification system** which is highly accurate

➤ **Ultrasonic sensors** can find distance from any obstacle

➤ **Built-in speakers help navigate** through voice command

➤ The **cane vibrates to notify the obstacle**

➤ **Intensity of vibration** is directly proportional to distance from obstacle

➤ **Beeps** if user is right next to obstacle

➤ **Affordable** compared to other products in the market
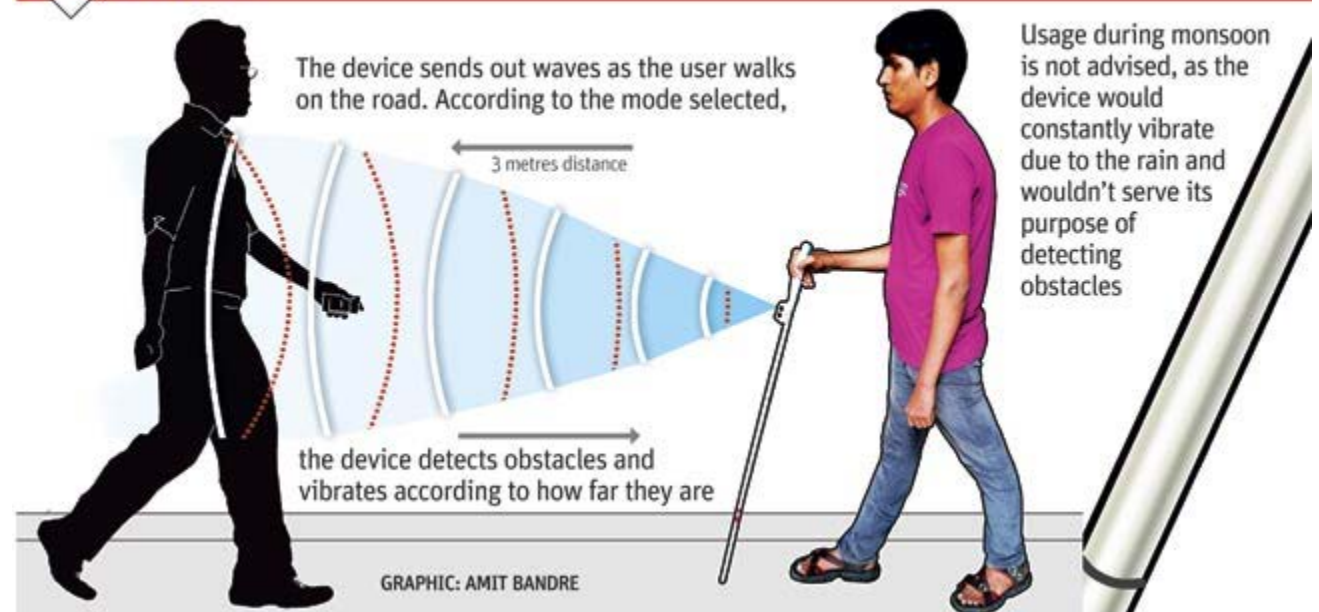
### HOW TO NAVIGATE

**Menu** | To **select destination** from the pre-recorded options

**Previous/Next** | To **toggle** in between the options

**OK** | To **confirm** a destination

## How it works

The device sends out waves as the user walks on the road. According to the mode selected,

3 metres distance

the device detects obstacles and vibrates according to how far they are

Usage during monsoon is not advised, as the device would constantly vibrate due to the rain and wouldn't serve its purpose of detecting obstacles

GRAPHIC: AMIT BANDRE

# Real-Time Response

- The potential to integrate student-centred, reflexive and reactive learning environments for students to personalise their learning experience. For students with disabilities this means being able to tailor educational experiences and environments to the conditions suited to them and offer greater choice for learning both on-campus and off-campus.

# Ubiquitous Computing

"The most profound technologies are those that disappear"

Mark Weiser, 1991

"Ubiquitous computing is a method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user."

Mark Weiser, 1993

# The Journal of Toaster Studies

an academic publication about new technologies

# Conclusions

- The IoT offers great potential for both the greater inclusion of students with disabilities in higher education and a better and more customised learning experience for all students.

- However the technology, while evolving, is not yet at a point where it could be effectively deployed in learning and teaching at the university level.

- Nevertheless, it does show great potential.

- For this potential to be realised, consideration of the wider significance of the relationships between technology and society,
  - education and disability,
  - access and literacy
  - privacy and security

# Recommendations

- Curtin University should not immediately deploy IoT technologies, but that careful consideration and planning be undertaken for how this might best be done in the future and what implication this might have.

- Priority should to be given to incorporating IoT within specific pedagogical issues regarding learning and teaching, with particular consideration being given to the integration of students with disabilities. This is in addition to Curtin's current focus on integrating IoT technologies primarily in association with facilities management.

- Any IoT equipment associated with learning should have the ability to provide its output to students via a learning management system or app. This would ensure that students with disabilities can process the data with their preferred assistive technology.

- Any future implementation of IoT solutions should focus around the use of personal smartphones as the primary IoT interface device for students with disabilities.

- All IoT-related implementations must also consider privacy, security and interoperability.

- Any IoT solution must be accompanied by training to ensure that all staff and students are able to use it effectively.

- The applicability of using a digital assistant as a real-time captioning device warrants further research.

- A trial of the use of existing technologies and further consultation with industry and students should be undertaken over 2018.

# Thankyou!

- Our full report is available at this link:
- https://www.ncsehe.edu.au/internet-of-things-iot-education-and-technology-the-relationship-between-education-and-technology-for-students-with-disabilities/

- More information contact A/Prof Mike Kent m.kent@curtin.edu.au