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TECHNOLOGY

# Internet of Things Research

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# Overview of IoT research involvement

- Holly Project
- Modular Hearing Aid
- Networking technologies for the IoT
- Fall Detection
- Authentication based on wearables
- Software Defined Networking for the IoT

# Holly Project

- An implementation project with the Swinburne Software Innovation Lab
  - Now based at Deakin
- Project was an industry supported trial of the capabilities of sensor networks and aged care
  - Goal was to enable elderly to remain in their home longer than would otherwise be the case
  - Lots of technical and social issues
- Research areas
  - Security
  - Detection of anomalous behaviour
  - Fusion of multiple sensor inputs
  - Networking

# Holly Project Research Issues

- Analysis of data generated by Holly
  - Holly was being trialled in a number of homes of elderly people in the Geelong area. The data generated could provide insights into:
    - Are there common characteristics of “normal” behaviour?
    - What timeframe is needed to detect “abnormal” behaviour?
    - What is the best technique to model of behaviour?
- Security of Holly infrastructure
  - Holly sensors and actuators need to be able to be replaced without any complex configuration yet need to be secure
    - How?
- Fusion of multiple sensor inputs
  - How can data from multiple sources be fused to be more reliable?
    - Eg How can Holly tell whether the house is unoccupied or the resident has had a fall?
- Networking
  - Lots of issues (discussed in a later section)

# IoT Networking Technologies

- Supported by M2MConnectivity Pty Ltd
- Investigating emerging networking technologies, particularly 6LoWPAN
- IoT wireless infrastructure commonly using WLAN and ZigBee
  - Issues with scalability and compatibility
- 6LoWPAN uses same wireless technology as ZigBee but integrates IPv6
- But issues with its deployment
  - Robustness, particularly handover from one gateway to another
  - Energy aware routing, particularly where nodes are mobile

# Modular Hearing Aid

- Supervision of a PhD student working with the ARC Training Centre in Biodevices (BioReactor)
  - Project is in association with an industry partner
  - (Subject to Non-disclosure Agreement)
- Goal of the project is to develop new, very low energy techniques for managing hearing aids
  - Hearing aids now very small
  - Battery size and frequency of replacement an important issue
  - Want to minimize the battery drain in controlling hearing aid

# Fall Detection

- Antony Tang's project with local Health Service
- Goals
  - to develop sensor system and cloud processing to help minimize falls in at-risk patients
- Make use of low cost sensors, low cost networking
- Antony's work on fall detection with two Nursing homes
  - generate alerts to carers when we detect that
    - an elderly person has fallen in the house;
    - an elderly person has entered a bathroom but not coming out;
    - an elderly person has not gotten up from bed at the usual time

# Authentication based on wearables

- In association with Ingo Mueller (Data61) and John Grundy (Deakin)
  - Use biometric data to unlock a locally managed keystore
- Develop a wearable device that
  - Allows users to carry their 'digital identity' (similar to a traditional passport)
  - Performs key/password management on behalf of the user
  - Enables automated contactless user authentication on paired devices
- At prototype stage
  - Bluetooth communication with end user devices (Windows, Skype etc)
  - Finding biometric signatures an area of ongoing research



# Software Defined Networking for the IoT

- With Jiong Jin and John Grundy
  - PhD proposal
- Different models for networking of the IoT
  - Purpose built, dedicated networks
  - Shared networks such as cellular or utility WLAN
- Many questions of scalability of existing networking approaches
  - Cellular expensive
  - WLAN
- This project looks at how the second approach could make use of SDN to deal with issues of security, functionality and resource allocation

# Conclusion

- My interests in the IoT
  - Implementations
  - Networking, particularly mesh networks
  - Security
  - Anomaly Detection