

Assistive technologies for gait and sitting posture monitoring



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Introduction

- Assistive technologies are becoming a worthy and viable instrument for supporting different categories of people:
 - People with special need
 - Elderly
 - ...and even healthy

- Aiming at aging –in place
 - On-time intervention
 - Care in the community
 - Lifestyle and well-being

The rest of this talk...

- Assistive technologies for elderly
- Gait analysis
- Posture monitoring
- Conclusion

Assistive technologies for elderly

- Assistive technologies are pervasive technologies that can be fitted following the needs of the person
- Can be integrated as part of smart homes
- Often they are used to collect data for the sake of monitoring
- Are used for elderly with
 - Visual, auditory and speech disabilities
 - Cognitive impairments

Assistive technologies for elderly

➤ Affordability

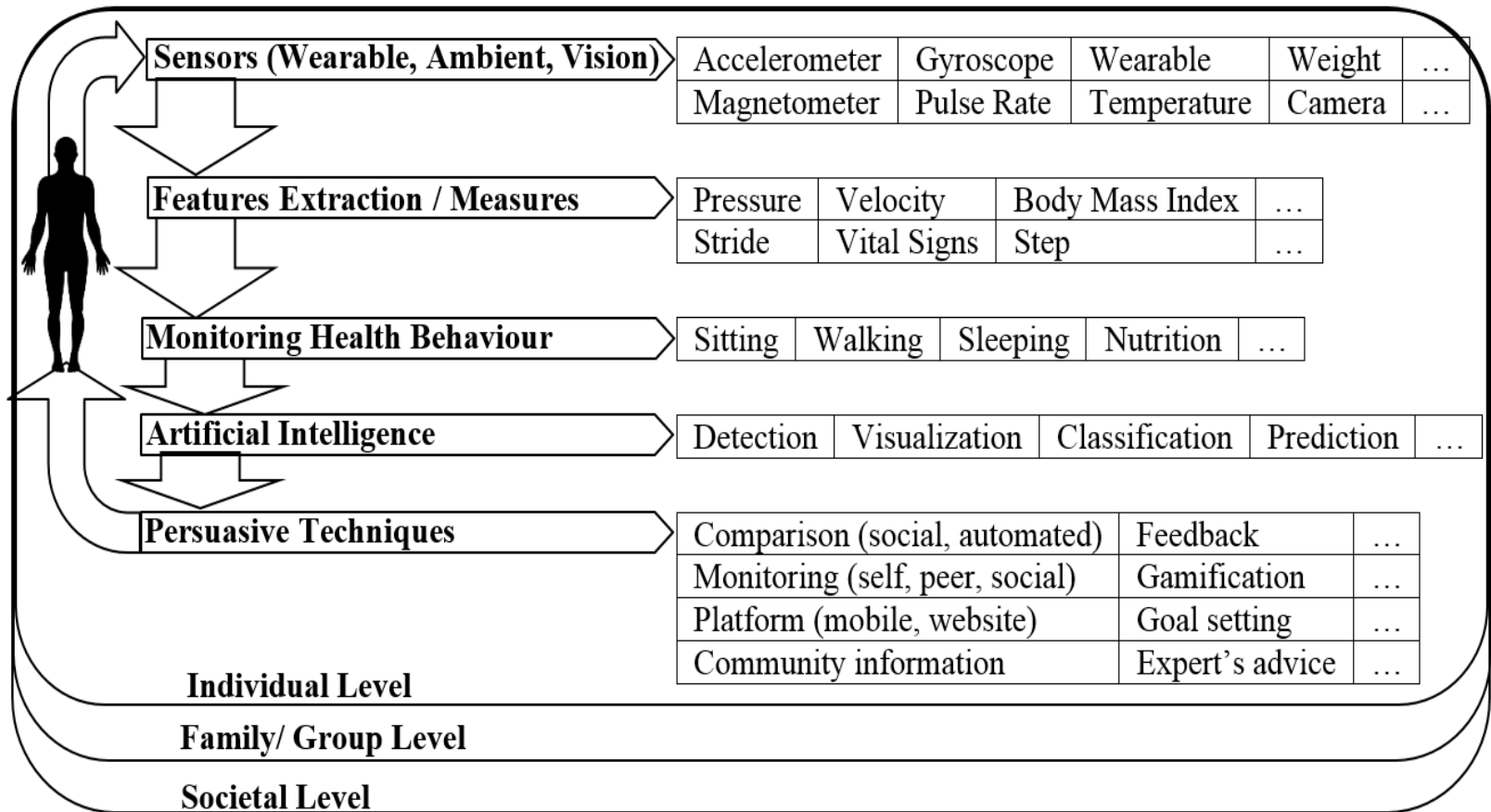
- Progress in sensor technologies
- Wireless technology
- Machine learning (data science) as enabler

➤ Examples

- Community alarms
- Video-monitoring
- Fall detectors
- Movement detectors
- Health monitors
- Heap protectors
- Smoke, flood, fire, etc. alarms, ...

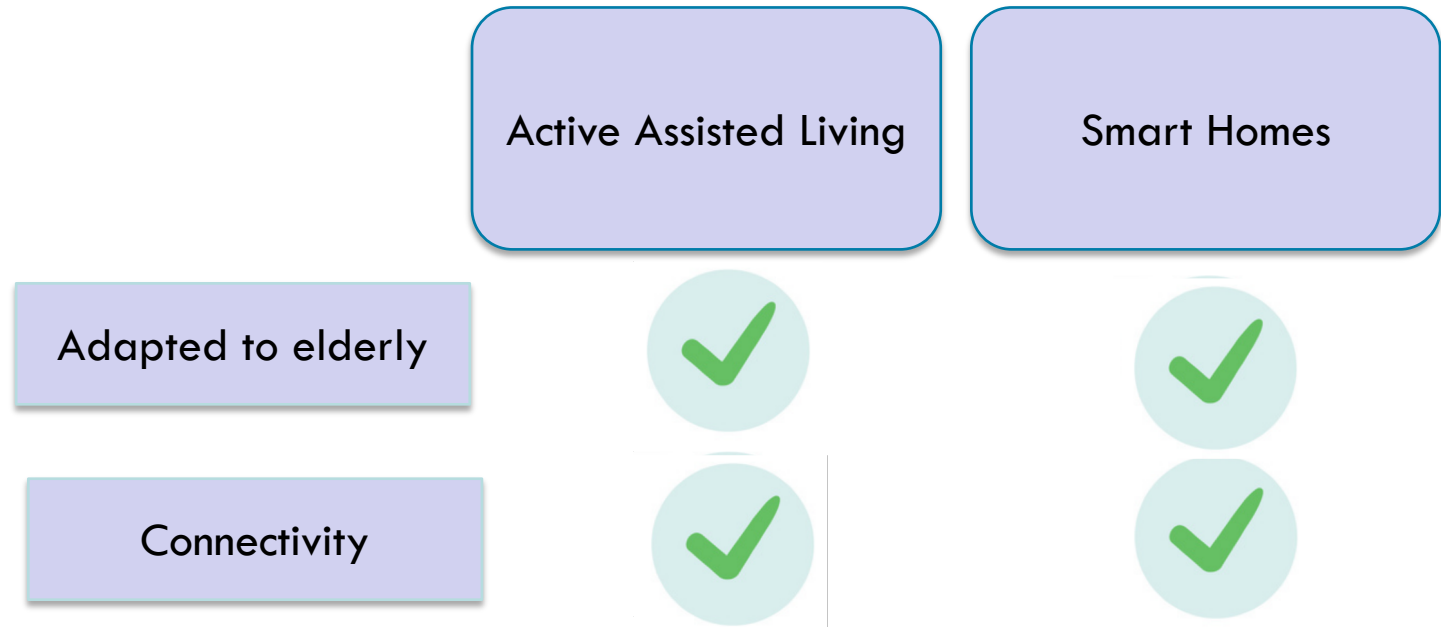
Framework

➤ Setting the big picture



Framework

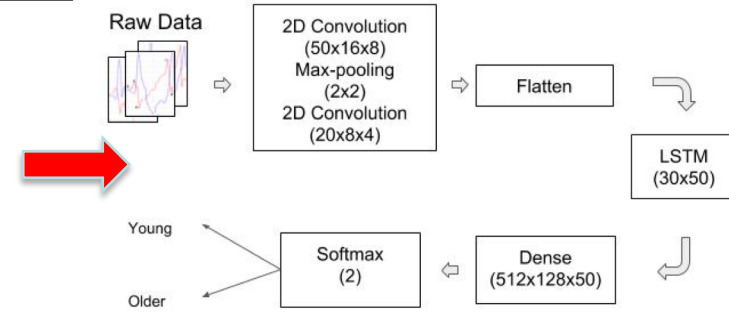
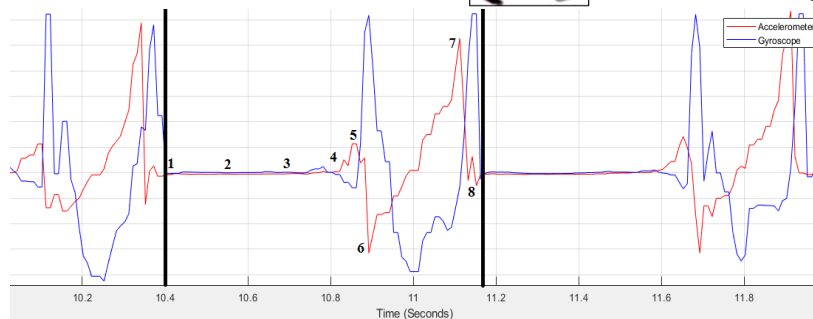
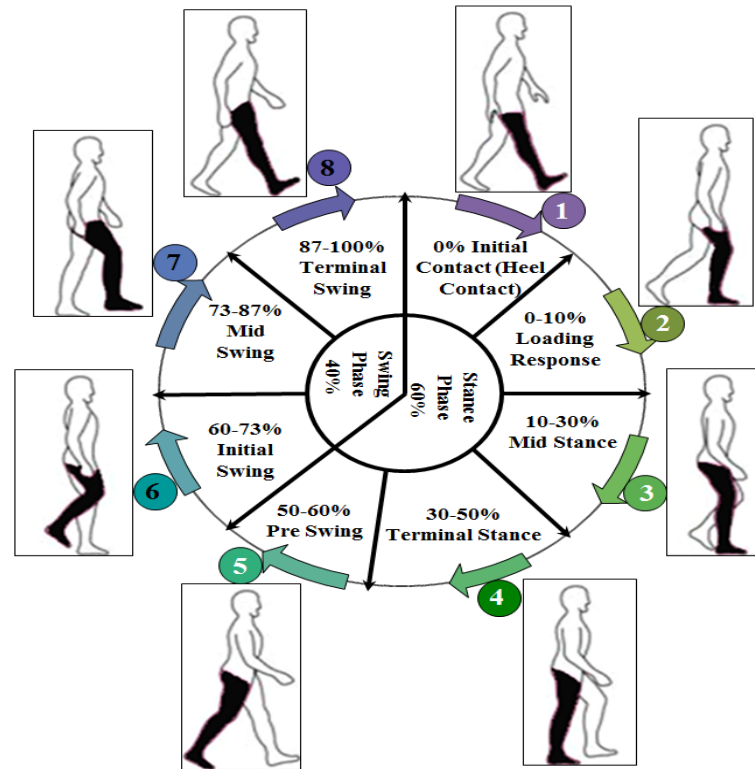
➤ Driven by:



Example 1 : Gait analysis

- Gait disorders increase with age: a result of age related physiological changes
- assessment of patients at risk of falls: predict, detect and prevent falls.
- Diseases include arthritis of the limbs, foot conditions (such as an ingrowing toenail, warts, corns or skin ulceration), fractures, mental health disorders.
- Gait changes can be a hallmark of diagnosis and recovery in patients with Parkinson's disease, cerebrovascular accidents, amputees, stroke, osteoarthritis, spinal deformity, fractures, limb-length inequality and cerebral palsy

Example 1 : Gait analysis



Healthcare: Gait Analysis

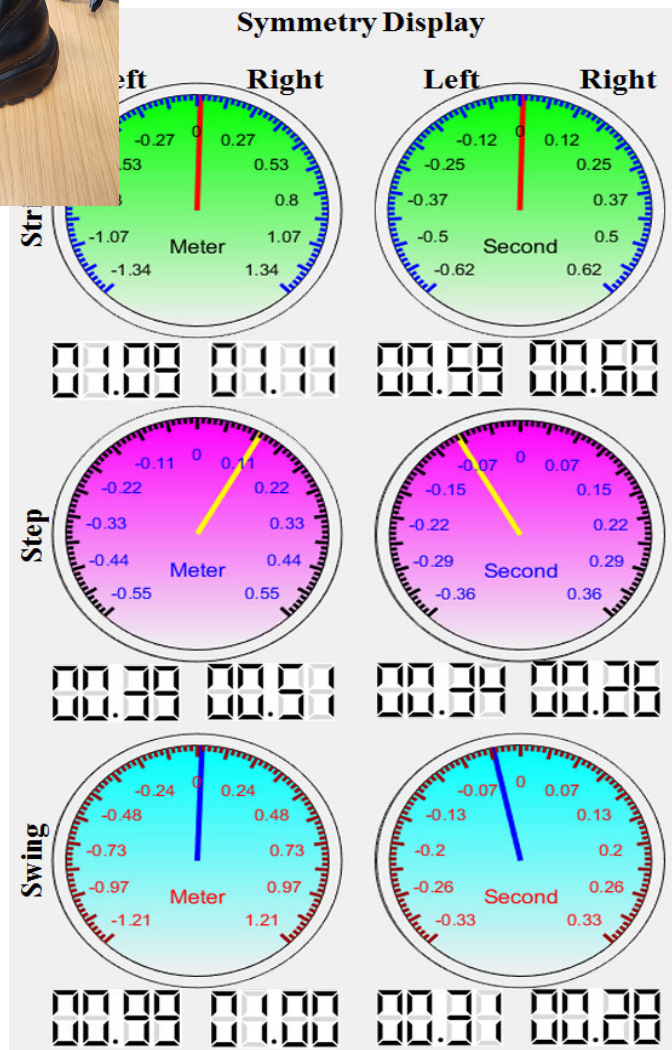
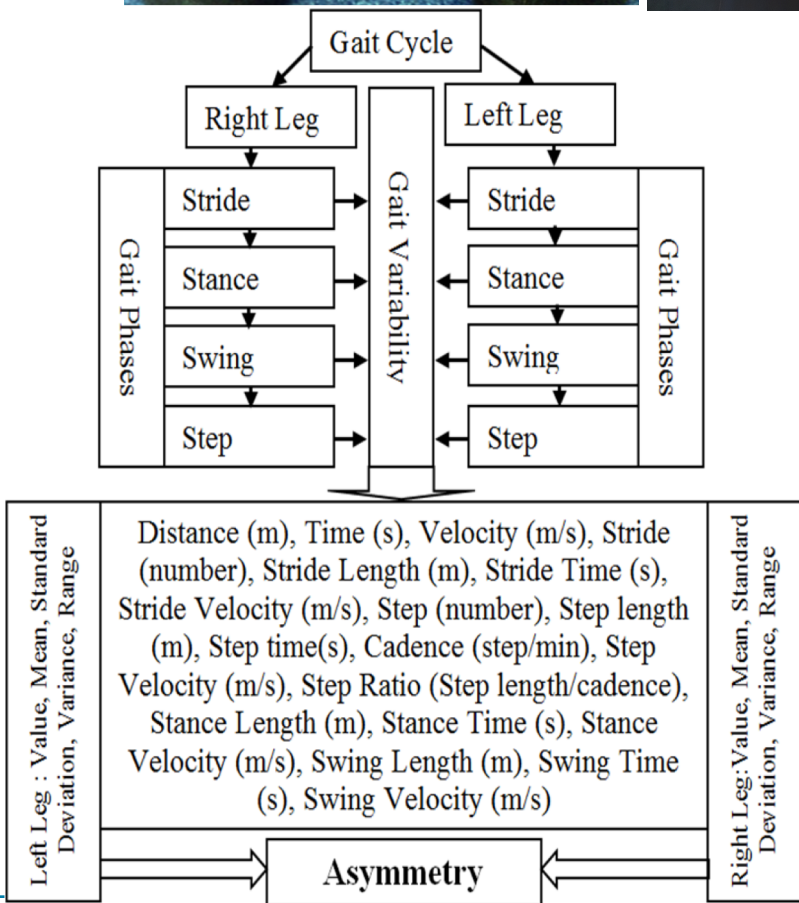
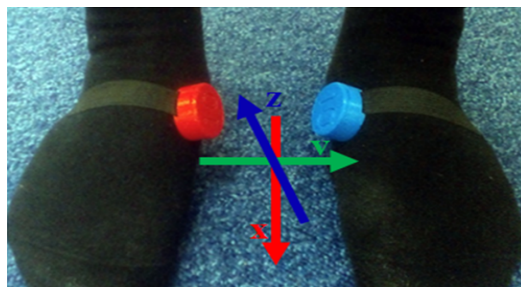


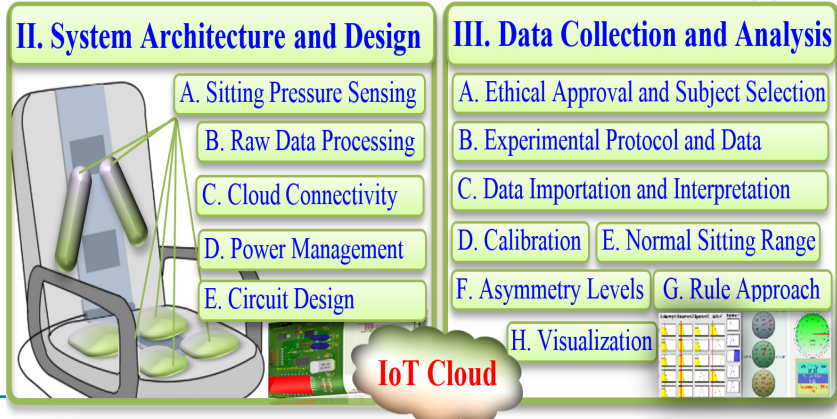
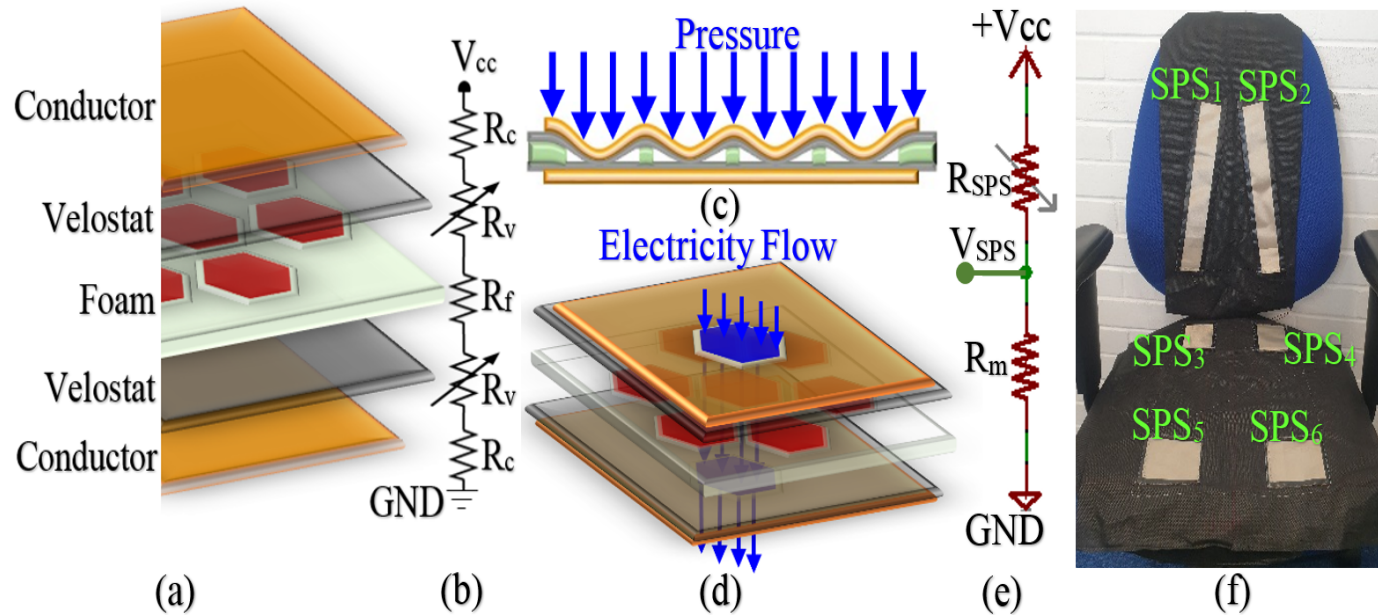
Figure: Extracted gait features

Example 2 : Posture monitoring

- Sitting with a straight, upright, symmetrical and stable posture
- Prolonged sitting is now becoming a common phenomenon due to the changes in transportation, communications, workplace and entertainment
- Health risks such as musculoskeletal disorders, cardiovascular disease, stroke, repetitive stress injuries, pressure sores, some cancers, type 2 diabetics, etc.
- Asymmetric sitting postures are associated with pelvic asymmetry in respect to the alignment of the vertical axis, in the frontal or sagittal planes resulting in spinal imbalance leading to spinal deformity such as kyphosis, scoliosis, lordosis, and increase risk of chronic low back pain

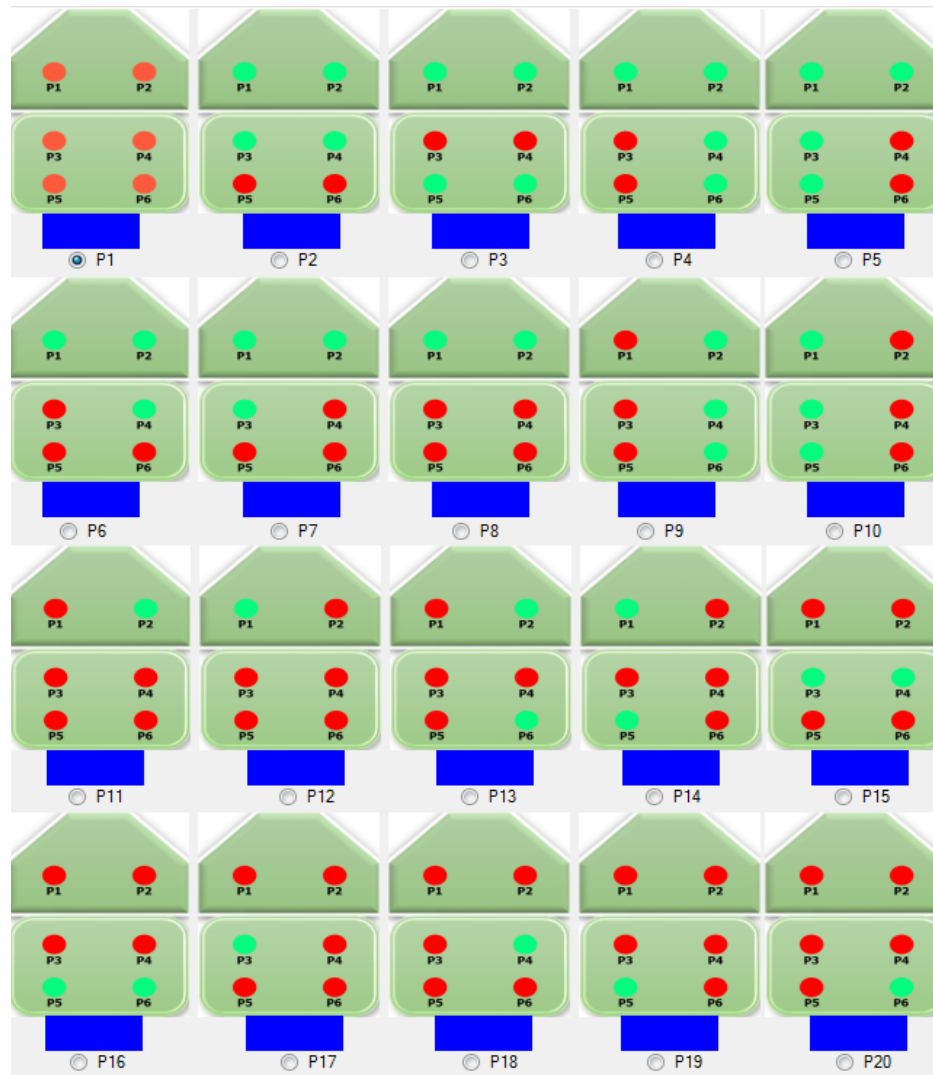
Example 2 : Posture monitoring

- Sensing system



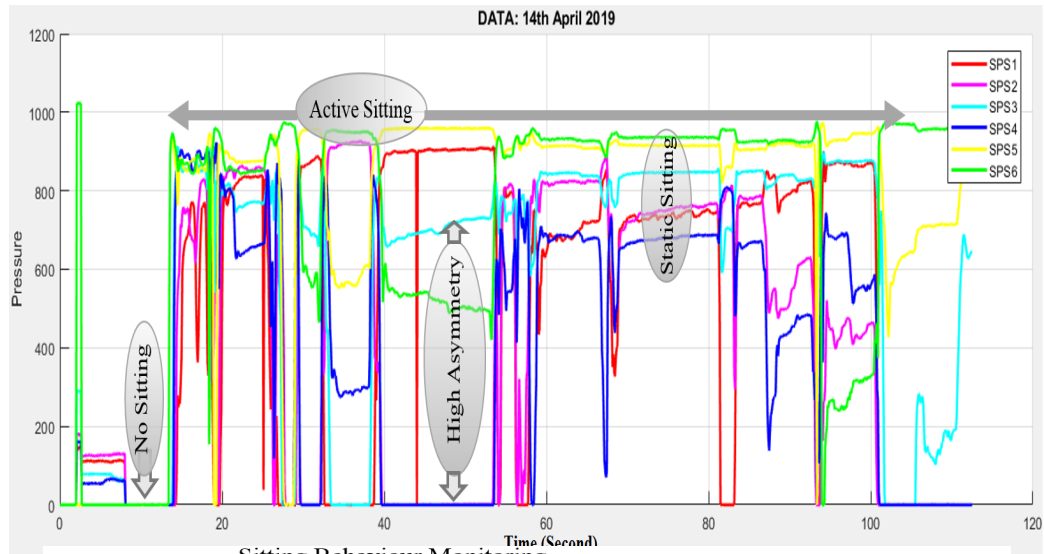
Example 2 : Posture monitoring

— Postures



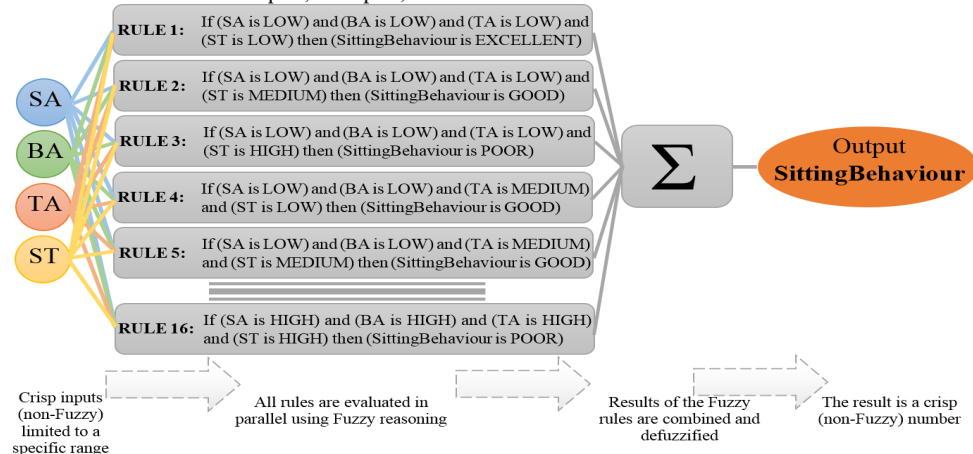
Example 2 : Posture monitoring

Monitoring



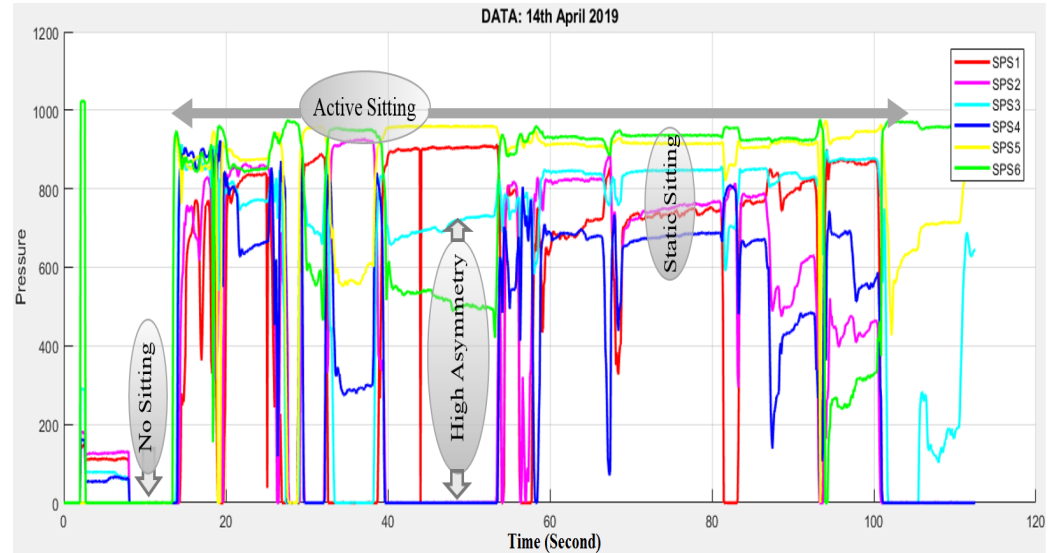
Sitting Behaviour Monitoring

4 Inputs, 3 Outputs, 16 Rules

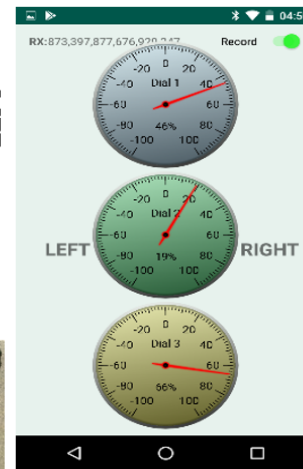


Example 2 : Posture monitoring

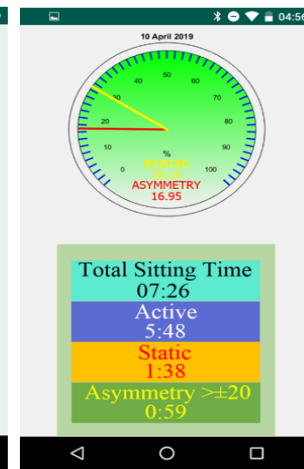
Monitoring



(a)



(b)



(c)

Conclusion

- Assistive technologies are vital for monitoring different conditions
- Aspects to be considered:
 - Acceptability
 - Safety
 - Security/privacy
- Checking the value
 - Promotion of the technologies
 - Behaviour change
- Developing the framework further to cover
 - Nutrition
 - Social integration, among others

- For questions or interest in collaboration, please contact Prof Hamid Bouchachia at abouchachia@bournemouth.ac.uk