

FUTUREquipped

ICT Sector

The Role of the Internet of Everything
in a SMART Home

UNIT

1

Funded by:



Scottish Funding Council
Promoting further and higher education

Designed and delivered
in collaboration by:

CONSTRUCTION
SCOTLAND
INNOVATION
CENTRE



DIGITAL
HEALTH & CARE
INSTITUTE

Learning outcome

Understand the role of the Internet of Everything (IoE) and how it can be used to create smart programmable homes in a care environment.



The Role of the Internet of Everything in a SMART Home

Introduction

This topic will introduce learners to the main aspects of the Internet of Everything (IoE) with emphasis on how digital technologies can facilitate independent and secure care environments for the ever increasing number of elderly people in the country.

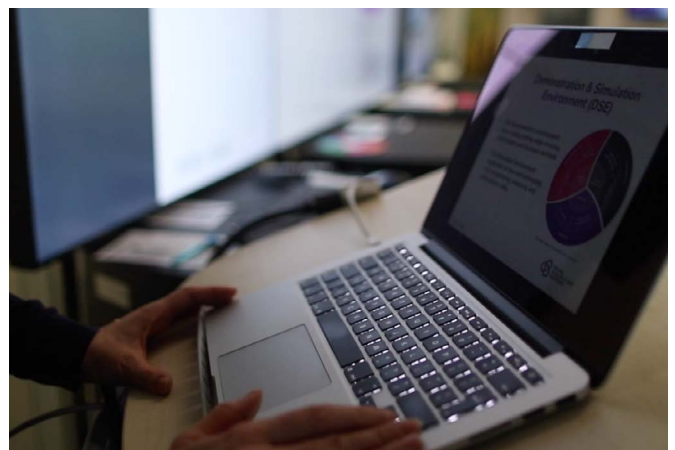
There is a vast increase in pressure on the public healthcare sector as currently it lacks the facilities to absorb a rise in demand. Therefore, there is a need for a fundamental shift in how health services are delivered to patients with a patient-centric healthcare system replacing the current surgery/doctor/hospital centered approach.

SMART Homes have the ability to integrate health and other ambient assisted living (AAL) technologies to revolutionise the way in which healthcare services are being provided to the growing elderly population.

An introduction to the main technical and computing aspects of SMART Homes would be essential for anyone who wishes to learn about how the construction industry and the computing industry can work together to address the needs of the care industry.

These aspects include:

- Hardware (Sensors, devices and wearables).
- Software Development: Programming the hardware components to do what we need them to do.
- Networking: How the components are connected together and centrally managed, whilst passing data back to the central user.
- Data: How the data is held in a secure and ethical fashion as well as how anomalies can be reported in emergencies.



Key drivers for Smart Programmable Homes in a Care Environment now and in the future

- The need to revolutionise the care sector to allow an ageing generation to adopt a more independent, at-home care system that can be complemented and managed by the introduction of smart technologies in new and existing homes.
- Pressure on the NHS can be eased if the care sector can help change societal perspective of the traditional methods of health care that are currently utilised.
- An increasing regulatory requirement for safe living environments placed on housing providers (e.g. air quality, temperature, humidity). Many of the sensors and methods could satisfy both regulatory and health and care needs.

Digital Assets

Please, follow this link to learn how SMART Home technologies can benefit the elderly and the disabled people: <https://www.youtube.com/watch?v=90zrHGOrBEc>

Please, follow this link to find out more about how SMART Home sensors enable seniors to live independently: <https://www.youtube.com/watch?v=NCixWY3eaOc>

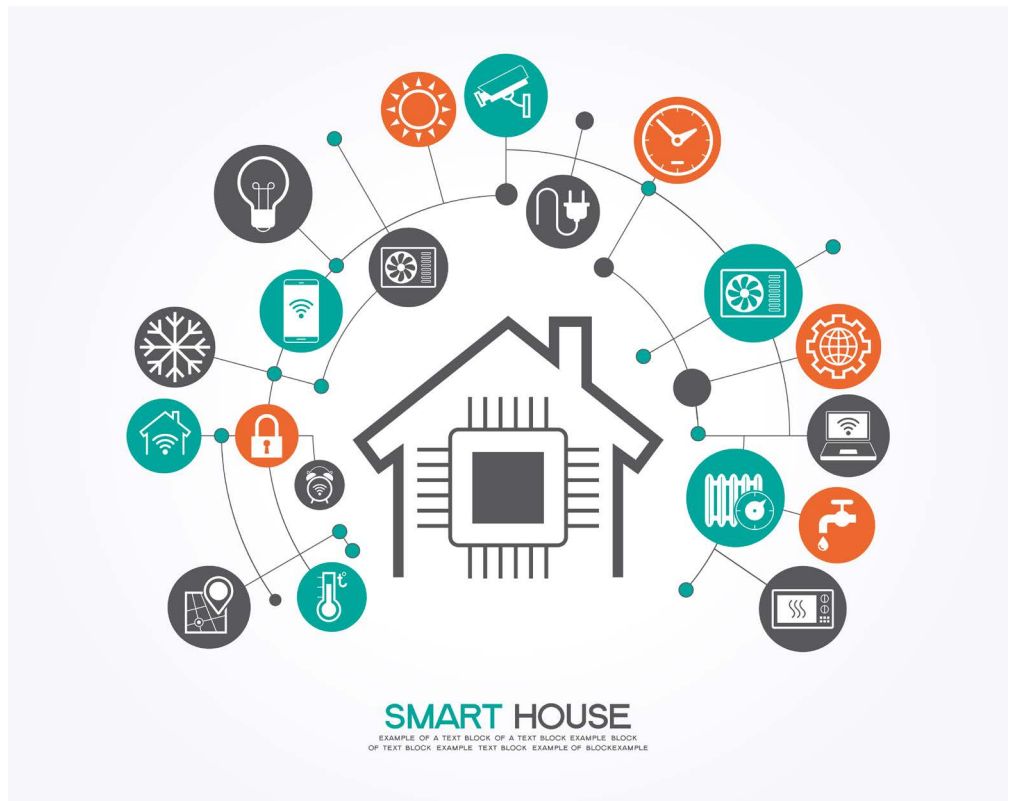
Key players in the development and implementation of Smart Programmable Homes in a Care Environment

Key players include the Health Boards, Care Providers and patients. Furthermore, technology companies play a big part in developing smart technologies.

Construction companies need to be aware of how internet-connected devices, sensors, and wearables can be considered in the homes that we maintain and build.

Society as a whole has been changing in its attitude to and experiences with smart technologies. However, acceptance of a new care model will also be required in the future.

Finally, as well as the potential benefits, society should also be aware of, and sensitive to, the ethical and security issues regarding how data generated by SMART Homes is used. See the Ethical considerations for programmers of SMART Home devices micro-learning topic for more information.



Which Scottish Innovation Centre is most closely linked to this theme?

- [CENSIS](#)
- [Data Lab](#)
- [Digital Health & Care Institute \(DHI\)](#)

For description of the Innovation Centres, please see the Health and Care Unit 1 SMART Homes Introductory Booklet, p. 6.



Key challenges and opportunities for the development / adoption / progress

Challenges:

- Society's reluctance to change to a more person-centred home-based care environment.
- Worries about the security and commercial use of data generated from smart technologies.
- Possible centralised failure due to an over reliance on digital, connected devices.
- Reluctance of construction companies to accept the Internet and smart devices as being as important as current utilities ie: Gas, Electricity and Water in the building process.
- Privacy concerns

Opportunities:

- The rise in smart technologies in the consumer market will help with the adoption of such technologies in a care/ housing environment.
- Prices will decrease while functionality of devices will increase.
- Opportunities exist for tech companies to identify the care/housing sectors as a growing potential customer base. Partnerships with health boards and/or construction companies can help grow their customer base.



Case study

highlighting best practice and emergent trends

Smart-Home Case Study: Comelit's SimpleHome is Installed at Assisted-Living Complex (Bannister, 2016)

The client is Triangle Housing Association and the project is 13 wheelchair-accessible apartments, with staff quarters, on a brownfield site at Hillsborough Old Road, near the River Lagan.

The design of the apartments and choice of components have been geared for residents facing mobility issues, learning disabilities or mental health problems. The association aims to provide accommodation that includes care and support for clients to live with independence. Door entry at the main gate features a metal entrance panel connected to the building over an Internet Protocol (IP) network. The panel has a colour camera and a two-way speaker unit and is modular in design with components such as readers and numerical keypads that can be added at a site as the project develops, or entry needs change.

Each apartment will be fitted with a monitor that combines door entry

functions with home automation. The unit features a 4.3-inch touch-screen display, with gesture recognition for menu navigation.

Additional safety features include heat sensors that trigger an input on the system and raise an alarm to staff, heating and ventilation controls in each apartment to manage electricity consumption and flood detectors. Managers are also able to remotely disconnect and control power sockets within apartments. Staff and family and staff can use the wall-mounted device to control the system. Although, residents will have use of a third-party smart tablet device to control video door entry, call for emergency assistance and to manage core home automation functions like heating and lighting.

The system relies on an IP network and a number of sensors that will be required to be programmed to work in a particular way. For example, sensors can be programmed to send notifications and messages when certain events take place.

FUTUREquipped

7

STUDY ROOM

LIVING ROOM

DINING ROOM

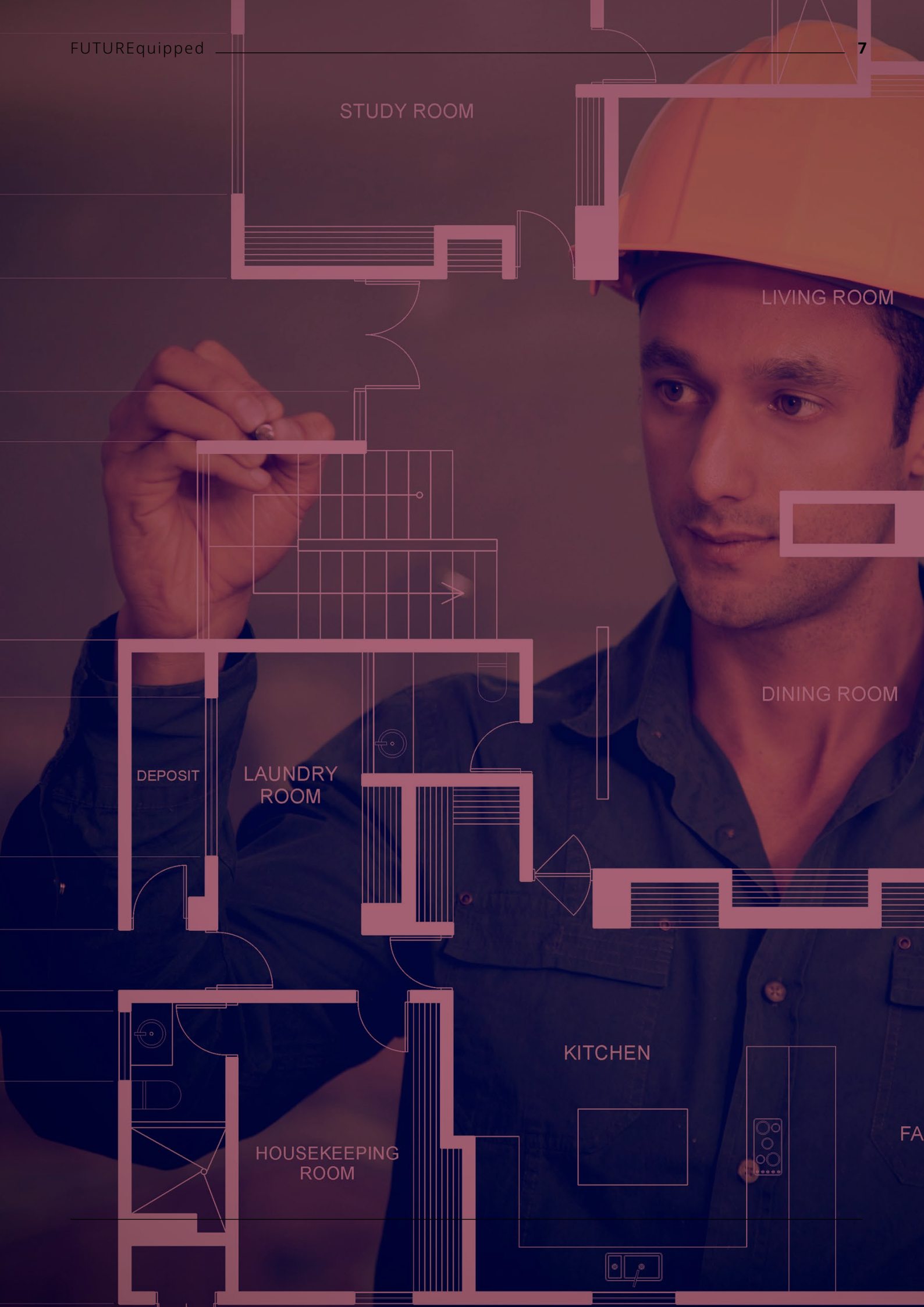
DEPOSIT

LAUNDRY ROOM

KITCHEN

HOUSEKEEPING ROOM

FA



Assessment 1

Multiple Choice Assessment

1. ***What is AAL?***
 - a. Assisted ambient living
 - b. Ambient assisted living
 - c. Assertive adapted living
 - d. Ambient adapted living
 2. ***The pressure on the NHS is NOT a key driver for the development of Smart Programmable Homes in a Care Environment?***
 - a. True
 - b. False
 3. ***Which of the following is NOT a key player in the development and implementation of Smart Programmable Homes in a Care Environment?***
 - a. Construction
 - b. Retail Industry
 - c. Society
 - d. Health Boards
 4. ***Which of the following could be a challenge for the development and implementation of Smart Programmable Homes in a Care Environment? (Select two options)***
 - a. Worries about the security and commercial use of data generated from smart technologies.
 - b. Reduction in cost of devices.
 - c. Society's reluctance to change to a more patient-centered home-based care environment.
 - d. Increase in functionality of devices.
 5. ***What could be an opportunity for the development and implementation of Smart Programmable Homes in a Care Environment? (Select two options)***
 - a. Increasing cost of devices.
 - b. Market growth could see more adoption of smart technologies in the care environment.
 - c. Lack of user knowledge of smart devices.
 - d. Tech companies could identify the care/housing sectors as a growing potential customer base.
 6. ***What is the name of the Housing Association discussed in the SMART Home case study?***
 - a. Circle
 - b. Oval
 - c. Square
 - d. Triangle
-

7. *As well as monitoring door entry, what other features can the system control?*

- a. Boiling the kettle
- b. Heating and lighting
- c. Playing music
- d. Turning on the TV

8. *Managers have no access to the system?*

- a. True
- b. False

9. *What technology does the system rely on to create connectivity?*

- a. Intranet Protocol and programmable sensors
- b. Internet Protocol only
- c. Internet Protocol and programmable sensors
- d. Camera and a two-way speaker unit

Answers on page 10

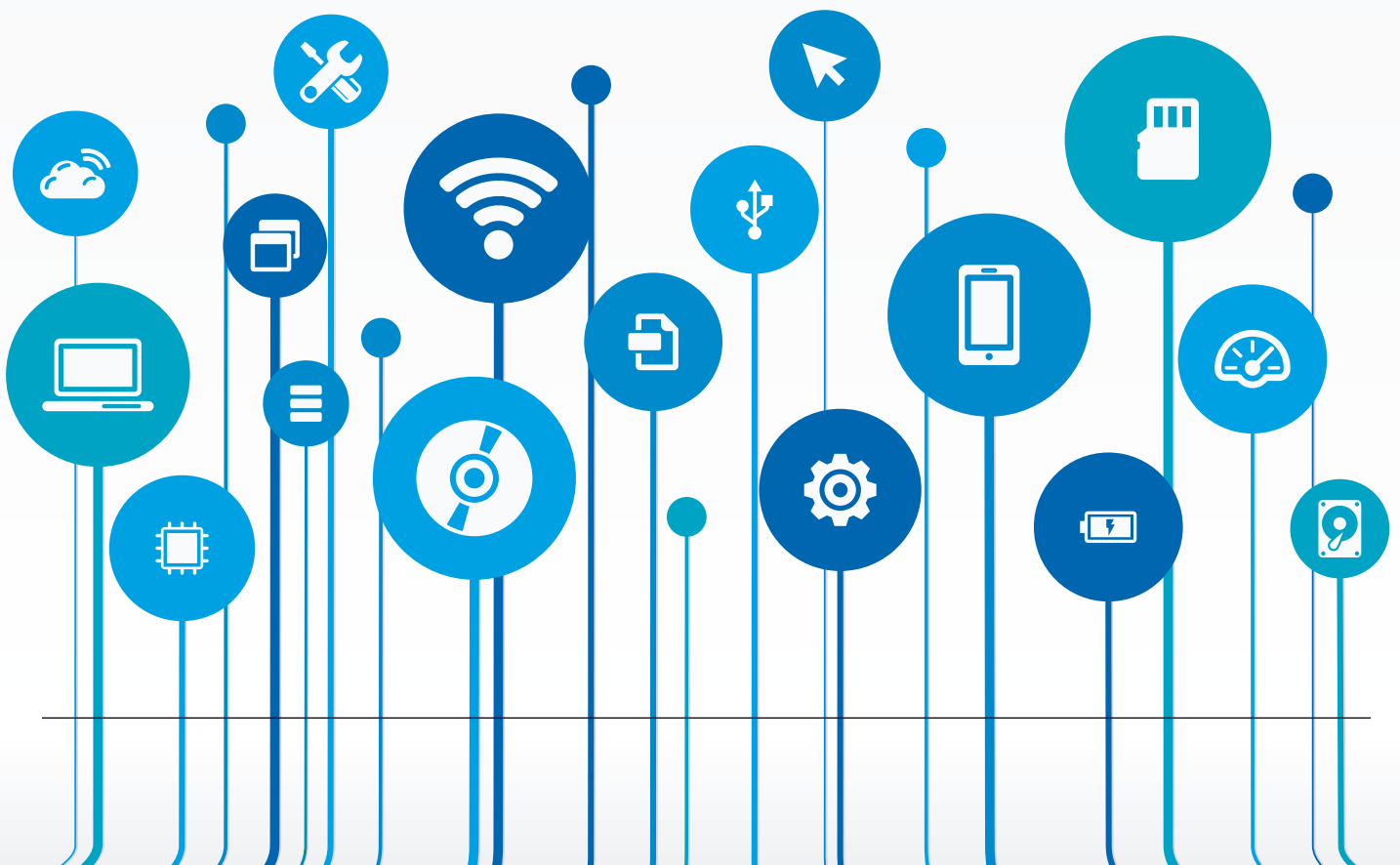
Assessment 2

Project Based Assessment

Your task is to link a raspberry Pi computer to a sensor and programme the sensor using Python to create a certain output if a particular condition is met.

Introduction and Parts - Raspberry Pi and Python tutorials:

https://www.youtube.com/watch?v=RpseX2ylEuw&list=PLQVvva0QuDesV8WWHLLXW_avmTzHmJLv (sentdex, 2017)



Assessment 1

Answers

- 1 b. ambient assisted living
- 2 b. False
- 3 b. Retail Industry
- 4 a. Worries about the security and commercial use of data generated from smart technologies.
c. Society's reluctance to change to a more patient-centered home-based care environment.
- 5 b. Market growth could see more adoption of smart technologies in the care environment
d. Tech companies could identify the care/housing sectors as a growing potential customer base.
- 6 d. Triangle
- 7 b. Heating and lighting
- 8 b. False
- 9 c. Internet Protocol and programmable sensors

These materials were produced by college lecturers as part of the FUTUREquipped project in 2018. The project was funded by the Scottish Funding Council and designed and delivered in collaboration by the Digital Health and Care Institute and the Construction Scotland Innovation Centre.

References

Monekosso, D., Florez-Revuelta, F. and Remagnino, P. (2015). Ambient Assisted Living [Guest editors' introduction]. IEEE Intelligent Systems, [online] (vol. 30, no. 04), pp.2-6. Available at: <https://www.computer.org/csdl/magazine/ex/2015/04/mex2015040002/13rRUwgQpvT> [Accessed 31 Mar. 2019].

Bannister, A. (2016). Comelit's SimpleHome is Installed at Assisted-Living Complex. [online] IFSEC Global | Security and Fire News and Resources. Available at: <https://www.ifsecglobal.com/smart-home-case-study-comelits-simplehome-installed-assisted-living-complex/> [Accessed 26 Mar. 2019].

sentdex (2017). Introduction and Parts - Raspberry Pi and Python tutorials. [video] Available at: https://www.youtube.com/watch?v=RpseX2yIEuw&list=PLQVvva0QuDesV8WWHLLXW_avmTzHmJLv [Accessed 31 Mar. 2019].

Annke (2018). SMART Home technologies that benefit disabled and elderly people. [video] Available at: <https://www.youtube.com/watch?v=90zrHGOrBEc> [Accessed 4 Apr. 2019].

National Science Foundation (2013). Home sensors enable seniors to live independently - Science Nation. [video] Available at: <https://www.youtube.com/watch?v=NCixWY3eaOc> [Accessed 4 Apr. 2019].