Diploma Programme
Programme du diplôme
Programa del Diploma

Information technology in a global society
Case study: Smart Homes

For use in May and November 2016

Instructions to candidates

- Case study booklet required for higher level paper 3 information technology in a global society examinations.

International Baccalaureate
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Foreword

The ITGS case study, *Smart Homes*, is the stimulus material for the research investigation required for May and November 2016 higher level paper 3. All of the work related to the case study should reflect the integrated approach explained on pages 15–17 of the ITGS guide.

Candidates should consider *Smart Homes* with respect to:
•   relevant IT systems in a social context
•   both local and global areas of impact
•   social and ethical impacts on individuals and societies
•   current challenges and solutions
•   future developments.

Candidates are expected to research real-life situations similar to *Smart Homes* and relate their findings to first-hand experiences wherever possible. Information may be collected through a range of activities: secondary and primary research, field trips, guest speakers, personal interviews and email correspondence.

Responses to examination questions **must** reflect the synthesis of knowledge and experiences that the candidates have gained from their investigations. In some instances, additional information may be provided in examination questions to allow candidates to generate new ideas.

What is a smart home?

"Smart home" is a phrase used to describe the use of a wide range of different technologies within the home to connect devices that perform specific tasks. The goal is to make homes more efficient, user friendly and/or environmentally compatible. Futuristic and smart homes have been incorporated into many science fiction movies, but the home of the future is
5 already here.

A smart home is a home incorporating a communications network that connects devices and allows them to be remotely controlled, monitored or accessed.

"Remotely", in this context, means that devices in the home can be controlled, monitored or accessed from both within the home and from outside the home, which is illustrated in
10 **Figure 1** below.

Figure 1 – A smart home
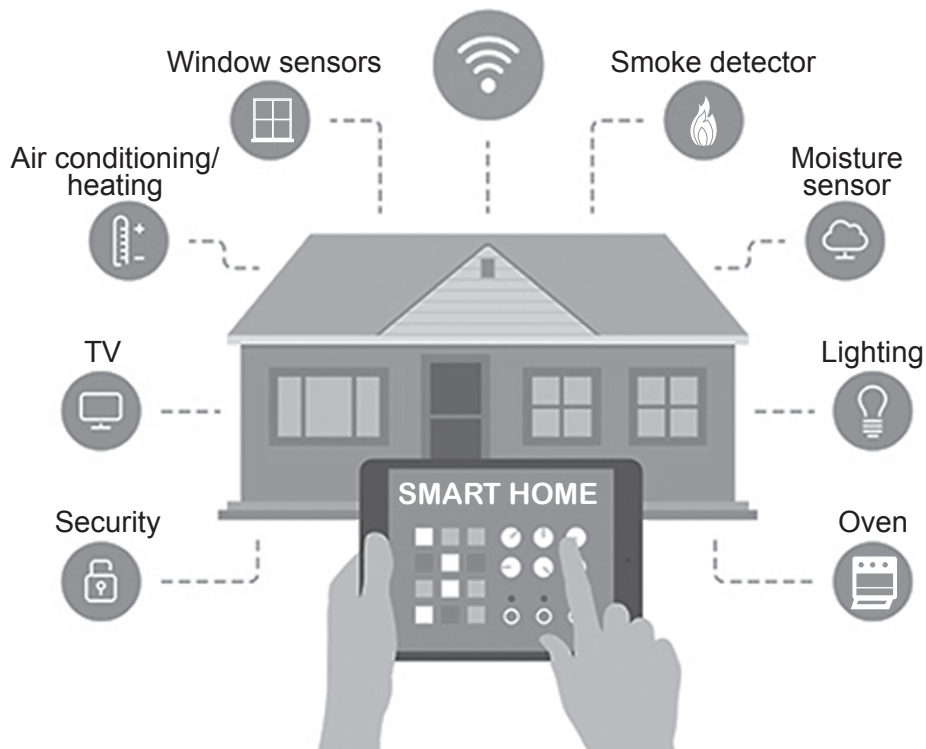
[Source: www.republicmortgage.com/make-home-smart-home/]

This case study will focus on a more holistic approach to the social and ethical challenges faced when integrating technologies into the management of a smart home, rather than on specific devices. It is appropriate to consider the broad range of technologies that are involved in making smart homes a reality, which includes innovations such as the Internet of Things (IoT)
15 and If This Then That (IFTTT) recipes.

Overview

Brix Homes is a company based in Brisbane, Australia that develops estates* of smart homes that can be configured to the users' requirements.

At the moment, various projects are in the planning stages and Brix Homes are investigating possible providers of this smart technology and ways of integrating and controlling the devices.

Current IT system

20   Brix Homes use a range of sensors and devices in their smart homes to generate data. This data may be stored for later use or shared.

The houses will need a network to facilitate the flow of information and control of the devices. Brix Homes will need to liaise with ISPs to ensure that the required infrastructure for internet services is in place.

25   Each smart device that is part of the home network can be controlled individually. The options for accessing these devices are:
- locally or remotely through a centralized hub within the home
- cloud based through a third party portal.

Devices can be controlled in several ways:
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- scheduled
- programmed using a variety of methods
- activated using proprietary controls
- reacting to other devices in the house.

Software developers are required to adhere to a set of protocols to enable the devices to
35   communicate with each other.

The development of smart homes has led to the creation of control software based on programming recipes using triggers and actions, linked together by an if/then statement. The rules can be created, edited or deleted through a web interface, an app or device interface.

Some of the above could be achieved using a simple rules-based programming system, such
40   as IFTTT (**Figure 2**).

Figure 2 – Example of a rules-based programming system

Recipe

if this then that

Trigger   Action

[Source: https://ifttt.com]

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* estate: an area of land and buildings developed, or redeveloped, for residential purposes

Two examples of recipes using IFTTT to control devices are shown below.

Figure 3 – A basic IFTTT recipe

Sunset   Turn on light switch

[Source: http://radar.oreilly.com/2013/08/if-thisthen-that-ifttt-and-the-belkin-wemo.html]

While the example in **Figure 3** is basic, some recipes can include input from one or more devices before activating another device. This can be seen in **Figure 4** below.

Figure 4 – IFTTT recipe including input from another device

If it rises above 72 degrees Fahrenheit outside then turn the air conditioning on

[Source: https://ifttt.com/recipes/182712-if-it-rises-above-___-degrees-outside-then-turn-your-a-c-on]

Challenges faced

Technological developments

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- As these technologies evolve, there is uncertainty about whether it will be possible to seamlessly integrate increasing numbers of devices into smart homes.
- The development of new interfaces based on Human–Computer Interaction (HCI) to manage the devices has highlighted the need to constantly re-evaluate the relationship between the reliability of the device manager and other factors, such as its cost, intuitiveness, usability and aesthetics. Brix Homes is aware the initial owners of smart

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homes will be early adopters of technology and prepared to accept suboptimal products. However as smart homes become more common place, the relative importance of these factors may change.
- Brix Homes is concerned that either the individual devices or the network may malfunction and cause damage within the smart homes and they may be held liable.

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- Members of Brix Homes's management team are concerned that some of the smart home developments are technological determinism: technology for the sake of technology.
- Preliminary findings suggest that a smart home may evolve into an intelligent home that customizes itself to suit the behaviour of the people that live in the house. Some home owners might not want the software within and beyond the smart home to

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autonomously analyse data and make decisions on their behalf.

The smart home market
- There are many small companies doing innovative work linked to smart homes that are competing to enter the highly competitive marketplace. At the same time, some larger companies have bought out smaller companies but have often found the different technologies are incompatible with each other.

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- A company has approached Brix Homes with the offer of a range of proprietary products or devices that are guaranteed to be 100 % compatible with each other. They claim it would have benefits for Brix Homes, the company and the owners of smart homes.
- Brix Homes has had enquiries from potential customers about the range of devices they supply to smart homes. People were interested in devices from areas such as

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home entertainment, assistive devices for the elderly and people with disabilities, health monitoring, security, sport and activity monitoring, managing domestic appliances, managing energy and resource usage. Brix Homes is concerned about the impact of trying to develop too many areas at once.

Use and misuse of data
- Access from outside of the home is a major advantage of the smart home system. However

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it raises a number of security concerns.
- Brix Homes and the home owners are concerned about access, control and storage of the vast quantity of data that can be generated from the smart home, especially when stored in the cloud by third party vendors.
- Civil liberty groups are concerned that the data collected by Brix Homes may be used

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inappropriately. Brix Homes clearly states in its mission statement that it takes an ethical approach to the protection and use of customers' data.

Specific information technology items, additional to those in the ITGS guide, which are associated with *Smart Homes*

App
Automation
Compatibility
Human–Computer Interaction (HCI)
If This Then That (IFTTT); recipes, triggers, actions
Intelligent homes
Internet of Things (IoT)
Proprietary controls
Protocols
Technological determinism

Any individuals named in this case study are fictitious and any similarities with actual entities are purely coincidental.