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Learning aim A

Examine systems and services that form part of the Internet of Things

UNit 19 Internet Of Things

Assignment 1

Contents

[Introduction 2](#_Toc126592335)

[**What is the IoT?** 2](#_Toc126592336)

[What do we use IoT for? 2](#_Toc126592337)

[**IoT Systems** 2](#_Toc126592338)

[Sector Home 2](#_Toc126592339)

[Sector Health 3](#_Toc126592340)

[Industrial and transportation 3](#_Toc126592341)

[Retail and commerce 3](#_Toc126592342)

[Principles behind IoT 3](#_Toc126592343)

[**Characteristics of IoT systems and services** 3](#_Toc126592344)

[General characteristics 3](#_Toc126592345)

[Technical characteristics 3](#_Toc126592346)

[**Home Sector** 3](#_Toc126592347)

[Smart Doorbell 3](#_Toc126592348)

[*Purpose* 3](#_Toc126592349)

[*How does it work?* 3](#_Toc126592350)

[Smart Lighting 3](#_Toc126592351)

[*Purpose* 4](#_Toc126592352)

[*How does it work?* 4](#_Toc126592353)

[**Health Sector** 4](#_Toc126592354)

[Remote Patient Monitoring 4](#_Toc126592355)

[*Purpose* 4](#_Toc126592356)

[*How does it work?* 4](#_Toc126592357)

[Pacemaker 4](#_Toc126592358)

[*Purpose* 5](#_Toc126592359)

[*How does it work?* 5](#_Toc126592360)

[**Comparison** 5](#_Toc126592361)

[**Evaluation** 5](#_Toc126592362)

# Introduction

This report aims to examine the real-world impact of IoT systems, and the various components, applications, and challenges associated with these systems in the modern world. Furthermore, it will highlight specific scenarios where IoT systems play a crucial role in enhancing quality of life and, in some cases, even saving lives, particularly within the healthcare sector.

# **What is the IoT?**

While the IoT (Internet of Things) is a relatively new concept and idea, coming around only in the 21st century, there remains a lot to be said about this innovative technology. The IoT refers to a network of objects embedded with electronics, software, sensors, and connectivity which enables them to connect and exchange data. This encompasses a wide range of devices, including physical objects, vehicles, household appliances, and other items that meet the aforementioned criteria.

## What do we use IoT for?

The IoT (Internet of Things) is widely utilized across the globe, encompassing a diverse range of industries. There are several key sectors, including:

* Home Sector
* Health Sector
* Industrial and Transportation Sector
* Retail and Commerce Sector

The applications of IoT vary greatly based on the specific industry or environment for which it is designed and implemented. For instance, in the Home Sector, IoT may be used to control a remotely operated radiator, while in the Transportation Sector, the focus may be on advanced traffic management systems rather than smaller devices like a radiator or thermostat.

# **IoT Systems**

The Internet of Things systems have a significant impact across various industries, including the Home, Health, Industrial and Transportation, and Retail and Commerce sectors. The role of these systems varies depending on the specific situation, with each sector leveraging IoT systems to improve quality of life and other relevant aspects. The following provides examples of IoT systems utilized in different sectors.

## Home Sector

The rise of the Internet of Things has had a profound impact on our daily lives. With an increasing number of devices able to connect to the internet and be controlled remotely, we now have greater control over many aspects of our homes. From smart cameras and thermostats, to speakers, lights, and plugs, these IoT devices are making it easier to manage our homes and enhance our daily experiences. With the use of a mobile app, we can control these devices from anywhere, at any time, making our homes more comfortable, convenient, and efficient places to live.

## Health sector

In the health sector, the IoT has had a major impact. It has completely overhauled the way the patients are receiving care alongside aiding the medical professionals that are providing said care. Due to the increasing production and emphasis on IoT systems, there exists a not insignificant number of devices that help to monitor and manage health conditions, such as wearable fitness trackers, smart scales, and other medical devices. These systems collect data to be analysed and compared to previously available data that helps to identify any potential health hazards or issues the patient might run into. This promotes more personalised care that is catered towards an individual, increasing the quality of care they receive. Additionally, IoT systems have enabled patients to connect to medical professionals remotely for different procedures such as a consultation or follow up, such as seen with AskMyGP in the UK. Finally, this has allowed the healthcare system to be much more accessible for everyone.

## Industrial and transportation sector

The impact of IoT systems in the industrial and transportation sector is undeniable. IoT has transformed the way businesses and organizations operate, providing real-time data and insights on various systems. This has led to improved efficiency, reduced downtime, and increased productivity. IoT sensors, for instance, can monitor industrial machinery and vehicles, giving businesses valuable information on their performance and location. This optimizes processes and procedures, making operations more effective.

In transportation, IoT systems are used for tracking and monitoring vehicles, resulting in faster delivery times and increased road safety. Furthermore, integrating IoT can also help reduce fuel consumption and promote eco-friendliness in businesses.

## Retail and commerce sector

The retail and commerce sector has benefitted from the use of IoT systems in a variety of ways. However, there any many opportunities for improvement that can be found detailed below.

One example is the implementation of smart shelves, which keep track of inventory levels and let store managers know when stock is running low. Another is smart shopping carts that help customers keep track of their purchases and simplify the checkout process. IoT sensors can also be used in inventory management systems to monitor the movement of goods within a store. Electronic price tags, updated remotely with IoT, can eliminate the need for manual updates. Customer experience can be improved through the use of IoT sensors and cameras that gather data on customer behaviour. Predictive maintenance using IoT sensors can prevent equipment downtime. Contactless payment systems using IoT technology reduce the risk of infection and augmented reality displays provide customers with interactive product information and recommendations.

# Principles behind IoT

# **Characteristics of IoT systems and services**

## General characteristics

## Technical characteristics

# **Home Sector**

## Smart Doorbell

A smart doorbell is a great example of an IoT system that is commonly used in the home sector. A famous example of the smart doorbell is the ring camera, which works through an application on the phone and an internet connection.

### *Purpose*

The purpose of the smart doorbell in the home sector varies depending on the person, however it follows the general idea of serving as a way for people to view their front door while not answering the door or not being home. Another purpose for this IoT system is to be used as a way to receive a parcel or speak to the delivery driver in order to request that a parcel is left inside or nearby, or any other instructions.

### *How does it work?*

The smart doorbell works similarly to most IoT systems. In this specific example of the Ring doorbell, it works by first being calibrated and connected to a network that is constantly operating nearby. This is most commonly done on a mobile device such as a phone or tablet, however some products may offer a desktop setup. Once the doorbell has been connected to a network, it is setup outside of a door and holds a sensor that works based on motion detection or button activation when someone would press a button on the doorbell to “ring” the doorbell. This then sends a notification through the internet onto a mobile device that also has an internet connection, and also has the specific software for the hardware, which in this situation is the doorbell. Once the notification has been received, the user can access the application and view the live camera feed, choosing whatever action they want, whether that be answering the door or talking to the person through the doorbell.

## Smart Lighting

Smart lighting is another great example of an IoT device that has come into the limelight recently. It provides people with a way to control lighting both inside and outside of the house, ensuring that money is not lost on electricity bills from the lighting. Additionally, these lights usually tend to be LEDs with multiple colour options, giving more life to peoples living rooms and many more.

### *Purpose*

As mentioned above, the primary purpose of smart lighting is to provide people with a way to turn lights off and on remotely. This has a host of benefits that greatly improve quality of life, such as being able to control all the lights in the house from a mobile phone, and not having to worry about whether all lights are disabled once someone leaves the house as they can just check through their phone. They also tend to have an added benefit of offering multiple colour options and being LED lights.

### *How does it work?*

Smart lighting works similarly to the Smart Doorbell. Initially, the light is screwed into an empty light. From there, a user will have a specific application that they are required to download, the software, in order to connect to the light and calibrate it. Similarly, the light must be calibrated by being connected to the network so it has constant access to the internet. Once calibrated, the user is then able to send a signal through the internet containing the instructions for the light that they accessed through the application, such as turn on, turn off, change colour, and change brightness.

# **Health Sector**

## Remote Patient Monitoring

Remote patient monitoring is one of the most recent inventions from the health sector that allow clinicians and technicians to monitor patient’s health from remote locations such as their office. It works as a way for patients to remain out and about while also remaining monitored, giving them more freedom in their life but not sacrificing their safety, security and health.

### *Purpose*

The purpose of remote patient monitoring is to communicate important information about patients to clinicians and technicians, and once this information has been communicated then the healthcare professionals are able to make adequate and important decisions while being well informed. Finally, this is a great way for patients to continue to live their life while not jeopardising their health and the quality of any reports they might have to make about it.

### *How does it work?*

Remote patient monitoring works by connecting to a mobile device through a network like Bluetooth or 4G, and then transmits the necessary data to the hospitals and healthcare professionals. One device that tracks information like this is a weight scale, and another example is a blood pressure monitor. This is accomplished by connecting these to the network or mobile device, which sends the information to the hospital without any input from the patient.

## Pacemaker

A pacemaker is a vital piece of IoT that works inside of patients to send electronic pulses to your heart to keep it beating at a regular and adequate speed in order to make sure that your heart is functioning properly, and there are no issues with your heartbeat. This is a device that can be crucial in improving people’s quality of life if people have issues with slow heartrate and for others, it can be lifesaving.

### *Purpose*

The purpose of a pacemaker is described as above. It works to keep the heart beating at a constant and regular pace to make sure that it is not too slow. This can prevent a number of issues, most notably, a slower heartbeat which can greatly impact someone’s ability to live a normal life. It causes issues such as chest pain, confusion, memory problems, and dizziness or light-headedness.

### *How does it work?*

A pacemaker works by being installed just above someone’s heart under their collarbone, and senses, using wires, whether or not the heart is beating fast enough. If it is not, or it misses even a single beat, it sends an electrical pulse to the heart, causing it to beat. Recently, pacemakers have had options to connect to a network, giving information to doctors and healthcare professionals about the patient data and information regarding their heartbeat. This is calibrated before it is installed by the healthcare professional/hospital employee.

# **Comparison**

# **Evaluation**