

Embedded systems

GCSE Computer Science

Lesson Objectives

Identify

Identify several embedded systems

Explain

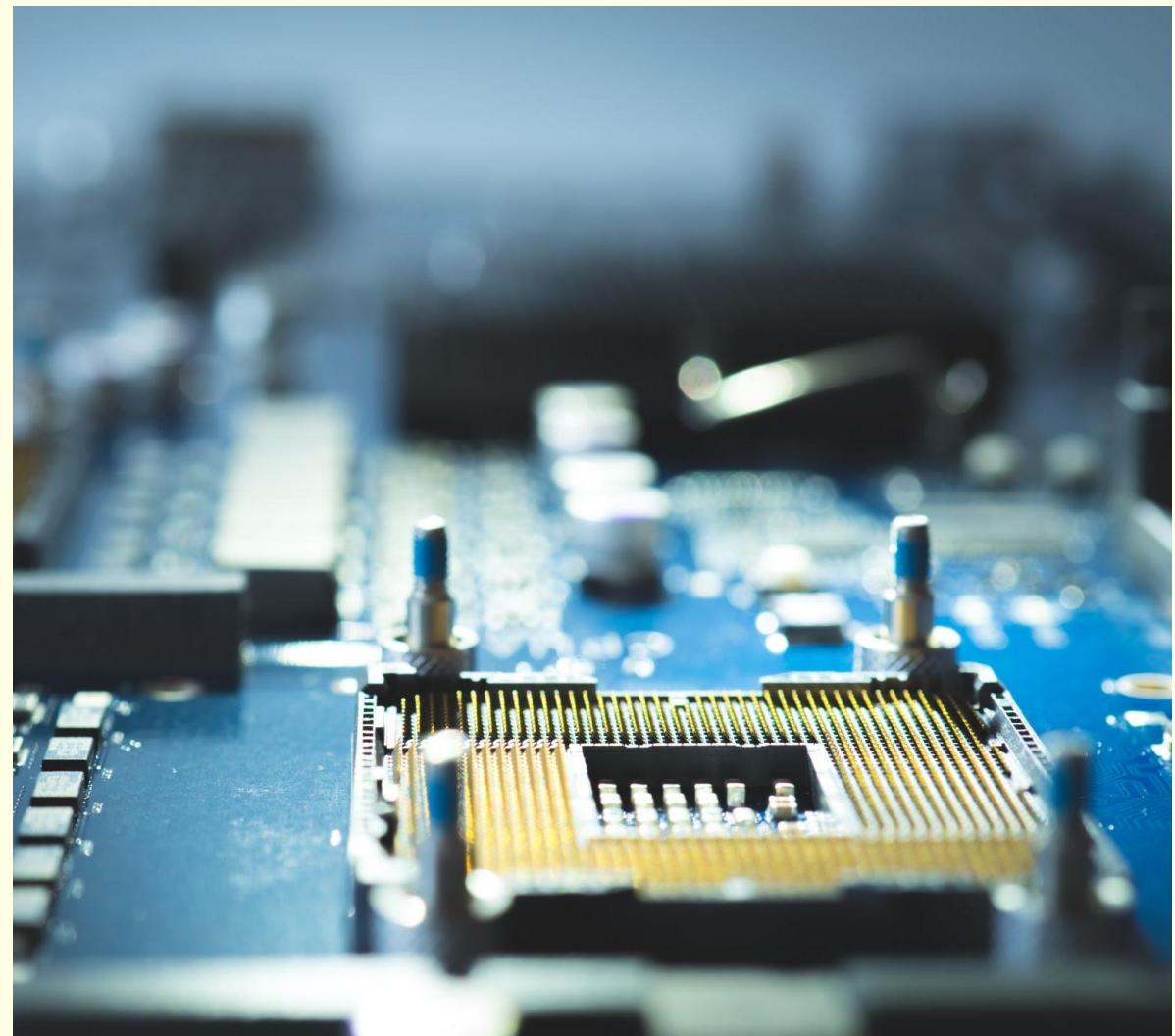
Explain the difference between an embedded system and a general-purpose computer

Identify

Identify the benefits of using an embedded system

Computer Systems

- Previously, you have learned what makes up a computer.
 - What are the components required for a device to be considered a computer?
-
- Processor
 - Memory
 - Input and output.



General-purpose computers

- There are two general categories of computers.
- General-purpose computers are the ones that you are most familiar with.
- You would recognise them as computers.
- Devices that could be considered general purpose include desktop PCs, laptops, smartphones and tablets.



Computers that don't look like computers

The vast majority of devices that could be considered a computer don't look anything like one.

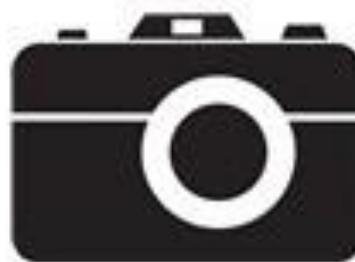




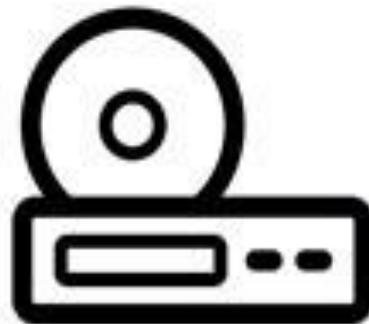
Industrial Robots



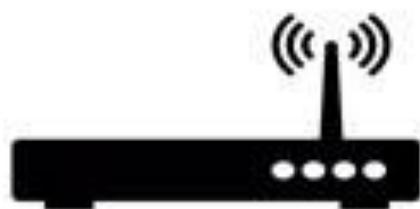
GPS Receivers



Digital Cameras



DVD Players

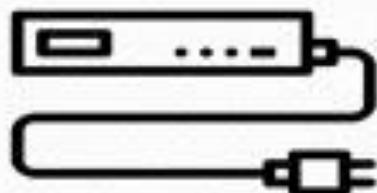


Wireless Routers

Embedded Systems



MP3 Players



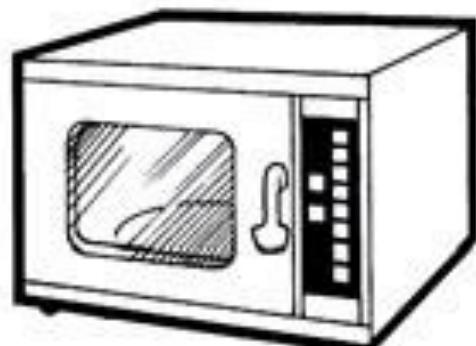
Set top Boxes



Gaming Consoles



Photocopiers



Microwave Ovens

Embedded systems

- An embedded computer is usually a fairly simple computer, often on a single printed circuit board.
- It is usually responsible for a dedicated task.
- Traffic lights are an example. The controller is usually out of sight but it has parts that:
 - switch the lights
 - keep track of time in each state
 - receive input from the pedestrian button
 - receive input from the road sensors, etc.



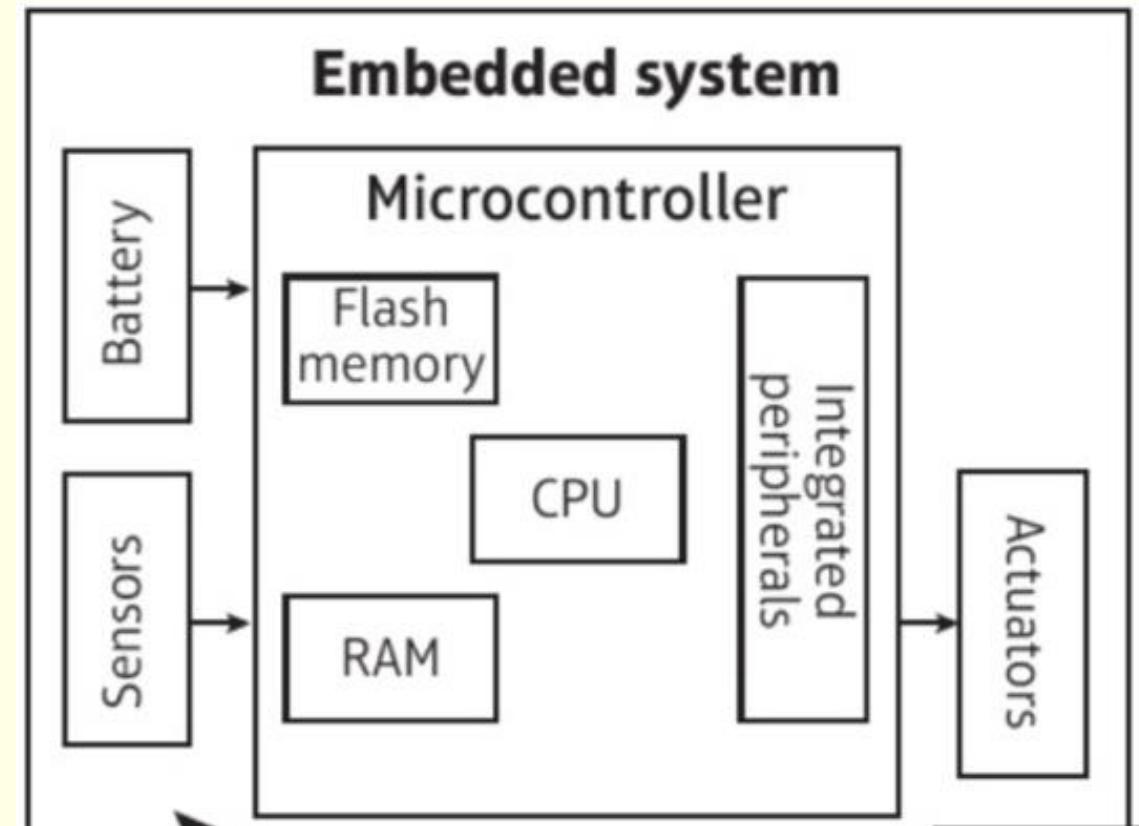
Microcontroller

All the components are all on a single chip – known as a microcontroller.

Senor readings (temperature sensor reading) are input into the system and stored in RAM.

CPU interprets and acts on the data according to the program instructions stored in flash memory.

A signal is sent to an output device, such as a actuator (switch cooling unit on and off).

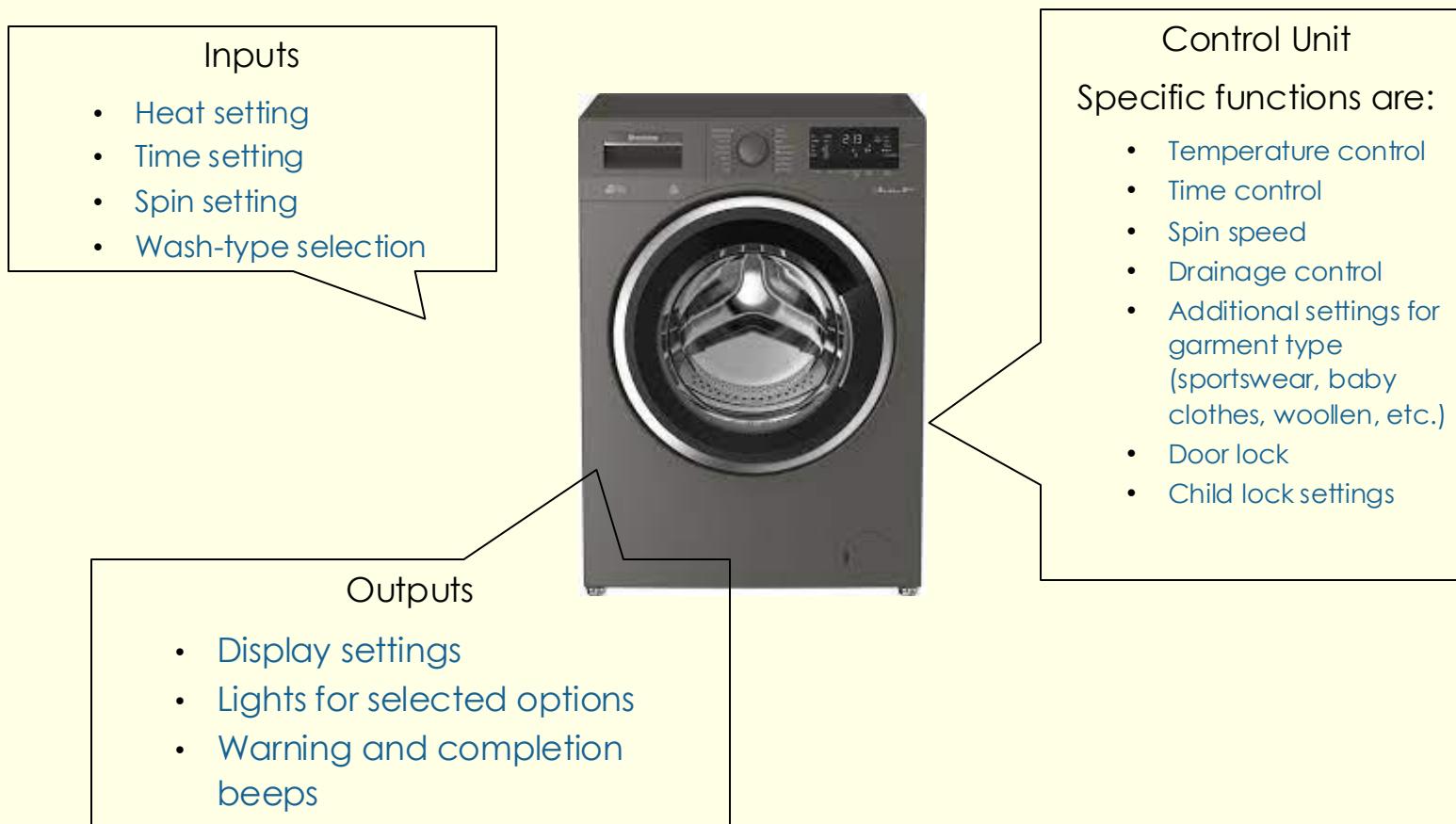


Characteristics of an embedded system

- Task specific (single purpose)
- Low power consumption
- Small physical size
- Low maintenance
- Low cost
- Often real-time or responsive to their environment.



embedded within a washing machine. What are its inputs and outputs?



Software in an embedded system

- All computing devices need some kind of program to control them.
- Generally, embedded computers have a small storage device to store their simple programs. As most embedded computers are single-purpose, their programs are short and simple, relying only on the fixed inputs and outputs of the system.
- This means that programs written for embedded systems are often very small and they do not need to be modified once installed on the device. This is often known as **firmware**.



Hardware in an embedded system



Advantages:

- Their limited number of functions means they are **cheaper** to design and build.
- They tend to require **less power**. Some devices run from batteries.
- Can fit in a tiny space
- They do not need much processing power. They can be built using cheaper, less powerful processors.

Disadvantages:

- **Difficult to program** and requires specialist knowledge
- If a problem occurs with the system it is **difficult to repair**
- Difficult to upgrade
- If any problem occurs then you need to reset settings
- Troubleshooting is difficult

