

FACTFILE: GCE TECHNOLOGY & DESIGN

1.17 ELECTRONIC SYSTEMS: PART 8

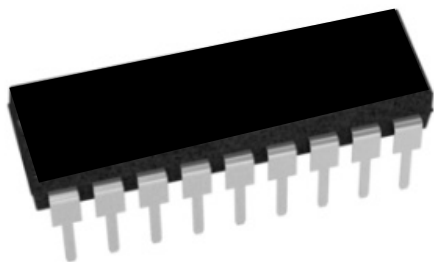


Programmable Systems

Learning Outcomes:

Students should be able to:

- demonstrate knowledge and understanding of the following:
 - programmable systems: with awareness of the advantages and disadvantages of programmable systems such as peripheral interface controllers (PICs) compared with hardwired solutions.

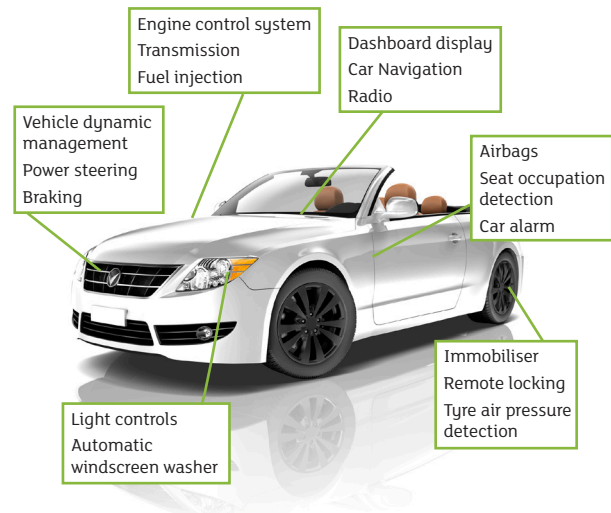


Course Content

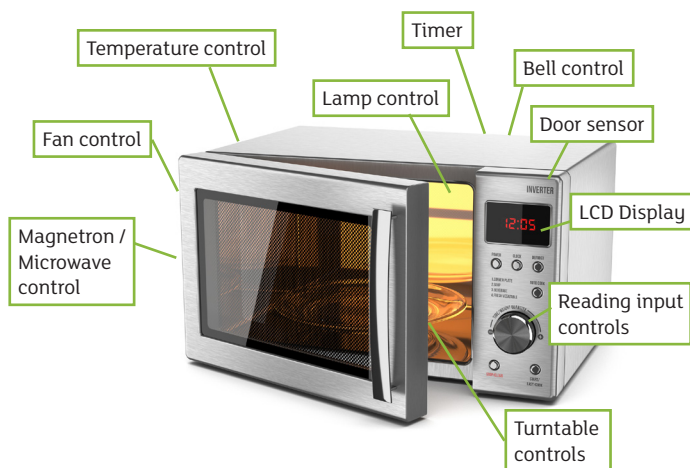
A microcontroller is often described as a 'computer-on-a-chip'. It is an integrated circuit that contains memory, processing units, and input/output circuitry in a single unit. Microcontrollers are purchased 'blank' and then programmed with a specific control program. Once programmed the microcontroller is built into a product to make the product more intelligent and easier to use.

Applications that use microcontrollers include household appliances, alarm systems, medical equipment, vehicle subsystems, and electronic instrumentation.

Some modern cars contain over 30 microcontrollers - used in a range of subsystems from engine management to remote locking.



As an example, a microwave oven may use a single microcontroller to process information from the keypad, display user information on the seven segment display and control the output devices (turntable motor, light, bell etc). One microcontroller can often replace a number of separate parts, or even a complete electronic circuit. In some cases, microcontrollers are used along with other integrated circuits.



What is a Peripheral Interface Controller PIC?

Different microcontrollers are available from a number of manufacturers. One of the most popular microcontroller 'brands' used in industry, and the microcontroller used by many of the educational programming systems, is the PIC microcontroller (PICmicro) manufactured by Microchip. This microcontroller, commonly known simply as a 'PIC', is available in a number of different sizes (8, 18, 28 pin etc.) and variants (e.g. with or without in-built analogue to digital converters).

Advantages

Some of the advantages of using microcontrollers compared with hardwired solutions in a product design are:

- increased reliability through a smaller part count
- reduced stock levels, as one microcontroller replaces several parts
- simplified product assembly and smaller end products
- greater product flexibility and adaptability since features are programmed into the microcontroller and not built into the electronic hardware
- rapid product changes or development by changing the program and not the electronic hardware

Disadvantages

Some of the disadvantages of using microcontrollers compared with hardwired solutions in a product design are:

- the need to learn how to write a program. With hardwired solutions, it is necessary just to connect the components.
- the need for an expensive programmer equipment. To some extent this problem has been solved by the inclusion of a 'boot' program in some microcontrollers. This automatically downloads programs from a PC to the microcontroller using an inexpensive serial lead.
- the need for a PC in order to write the program and program the microcontroller. This is not a great problem due to the ready availability of PCs.
- limited numbers of inputs or outputs. Some applications require more outputs that are available from common microcontrollers. The problem may be avoided by the use of a number of microcontrollers or specialist integrated circuits.
- speed limitations of common microcontrollers. For some high-speed applications, microcontrollers are unable to process the data quickly enough, in which case hardwired solutions may be preferred.

? Revision Questions

- 1 A programmable system such as a PIC could be employed to achieve the same function as a hardwired circuit. List **two** advantages and **one** disadvantage of using a programmable system over a hardwired system.

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- 2 Describe **one** advantage and **one** disadvantage (apart from cost and size) of using a programmable system such as a PIC over a hardwired solution to make a nightlight circuit.

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