ELECTRONICS

A SYSTEMS APPROACH TO DESIGN INCLUDING SYSTEMS PROCESSING

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ELECTRONICS

A SYSTEMS APPROACH TO DESIGN INCLUDING SYSTEMS PROCESSING

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1. SYSTEMS DIAGRAMS

2. CLOSED AND OPEN LOOP SYSTEMS

3. INPUTS, PROCESSING AND OUTPUTS

4. ANALOGUE AND DIGITAL SIGNALS

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WHAT IS A SYSTEMS DIAGRAM?

When planning a project, a 'systems' diagram is essential. It also allows you to think systematically and logically about the design problem and how it can be solved. Above all, it keeps you 'on track' and does not allow you to wander too far away from the original design problem. Systems diagrams are not restricted to electronics, as shown by the simple diagram below, which sets out the stages of making a cup of tea.

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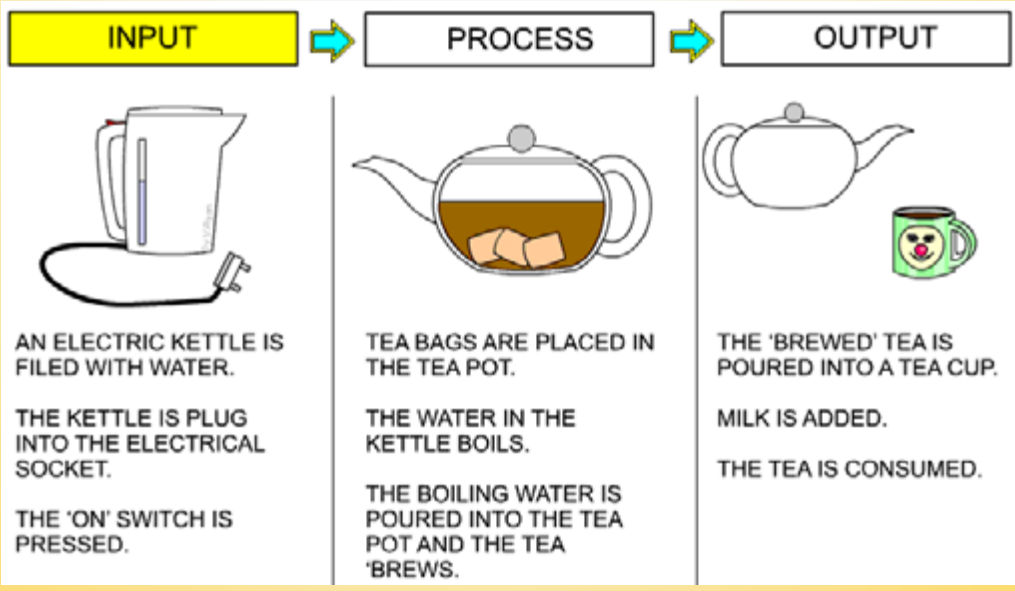

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WHAT IS A SYSTEMS DIAGRAM?

Systems diagrams are often based on three linked stages – INPUT – PROCESS - OUTPUT

Below is an example of a systems diagram, for an alarm project. The alarm system is for a briefcase, when the case is opened by anyone other than the owner, the alarm sounds.

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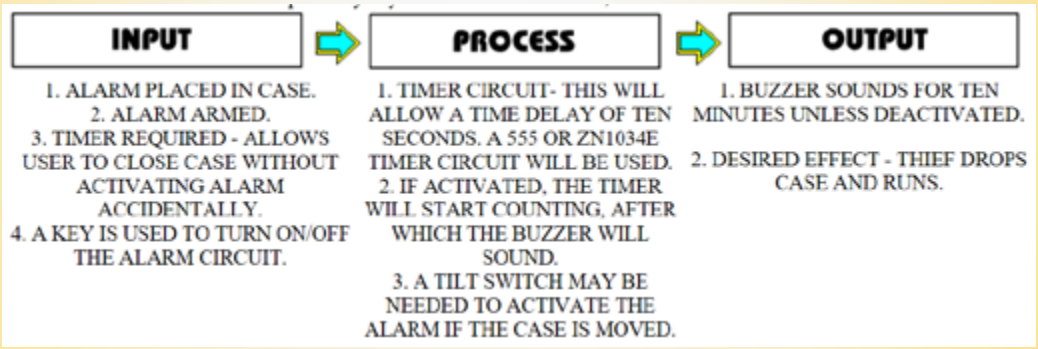

The following three slides, 'zoom in', on each of the stages shown above.

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INPUT

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1. ALARM PLACED IN CASE.
2. ALARM ARMED.
3. TIMER REQUIRED - ALLOWS USER TO CLOSE CASE WITHOUT ACTIVATING ALARM ACCIDENTALLY.
4. A KEY IS USED TO TURN ON/OFF THE ALARM CIRCUIT.

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PROCESS

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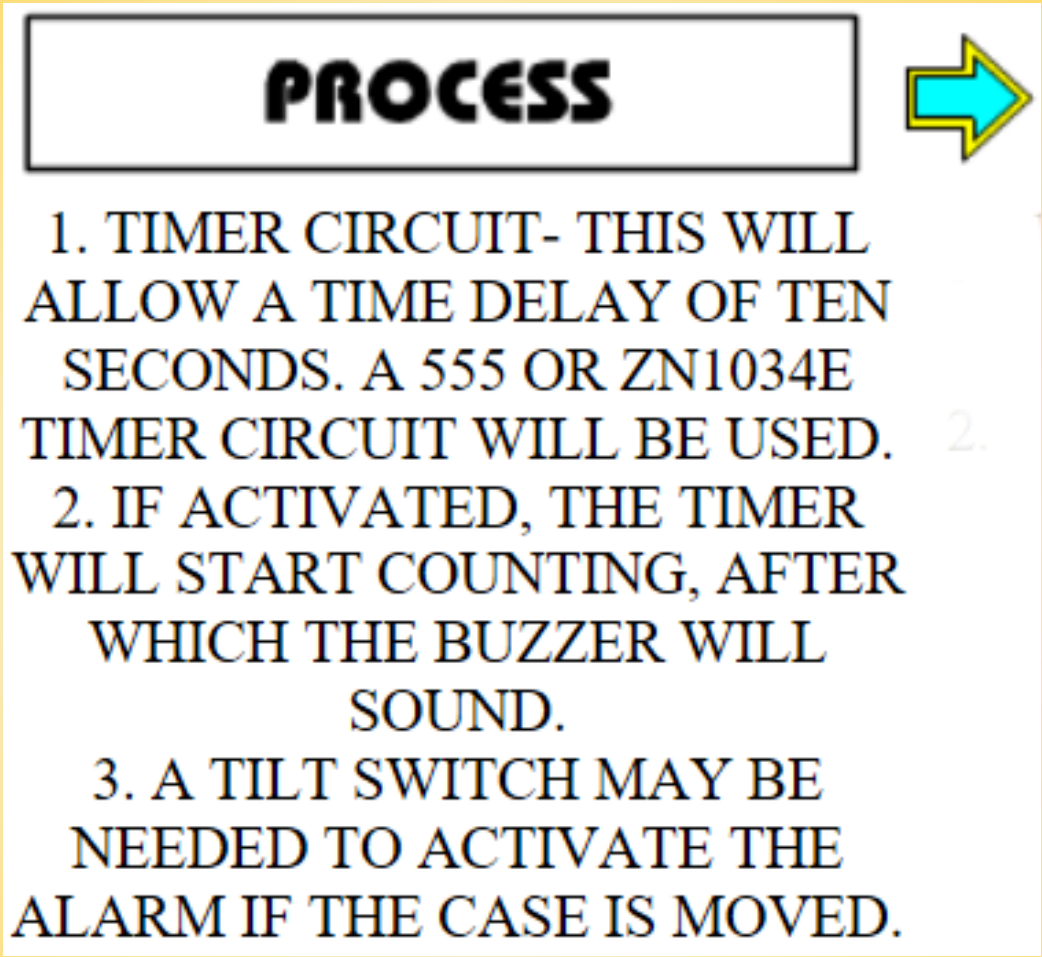

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OUTPUT

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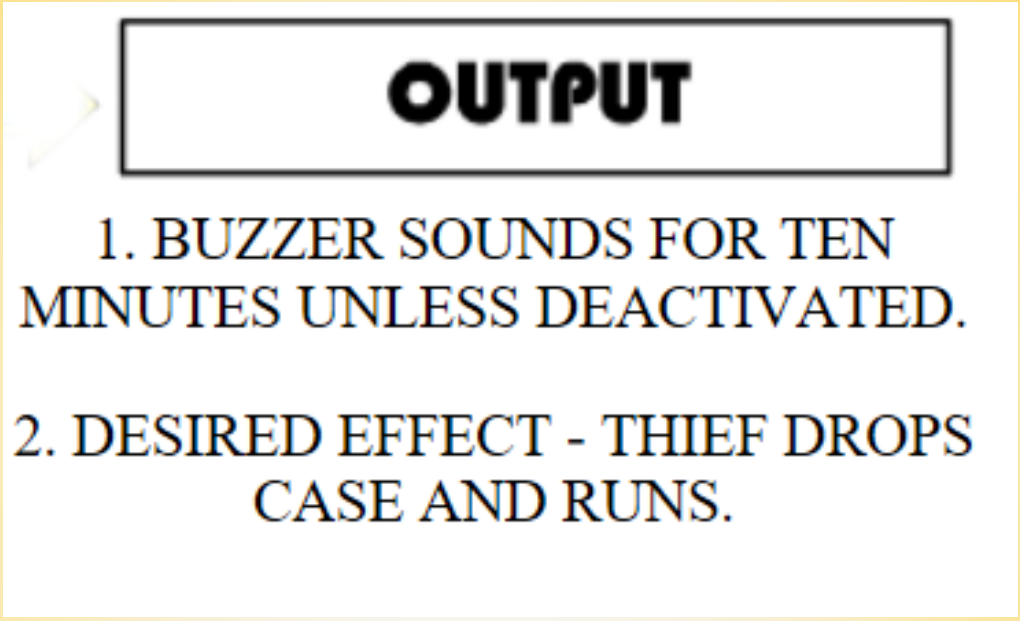

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Systems diagrams can also be applied to **CIRCUIT DESIGN** (see below)

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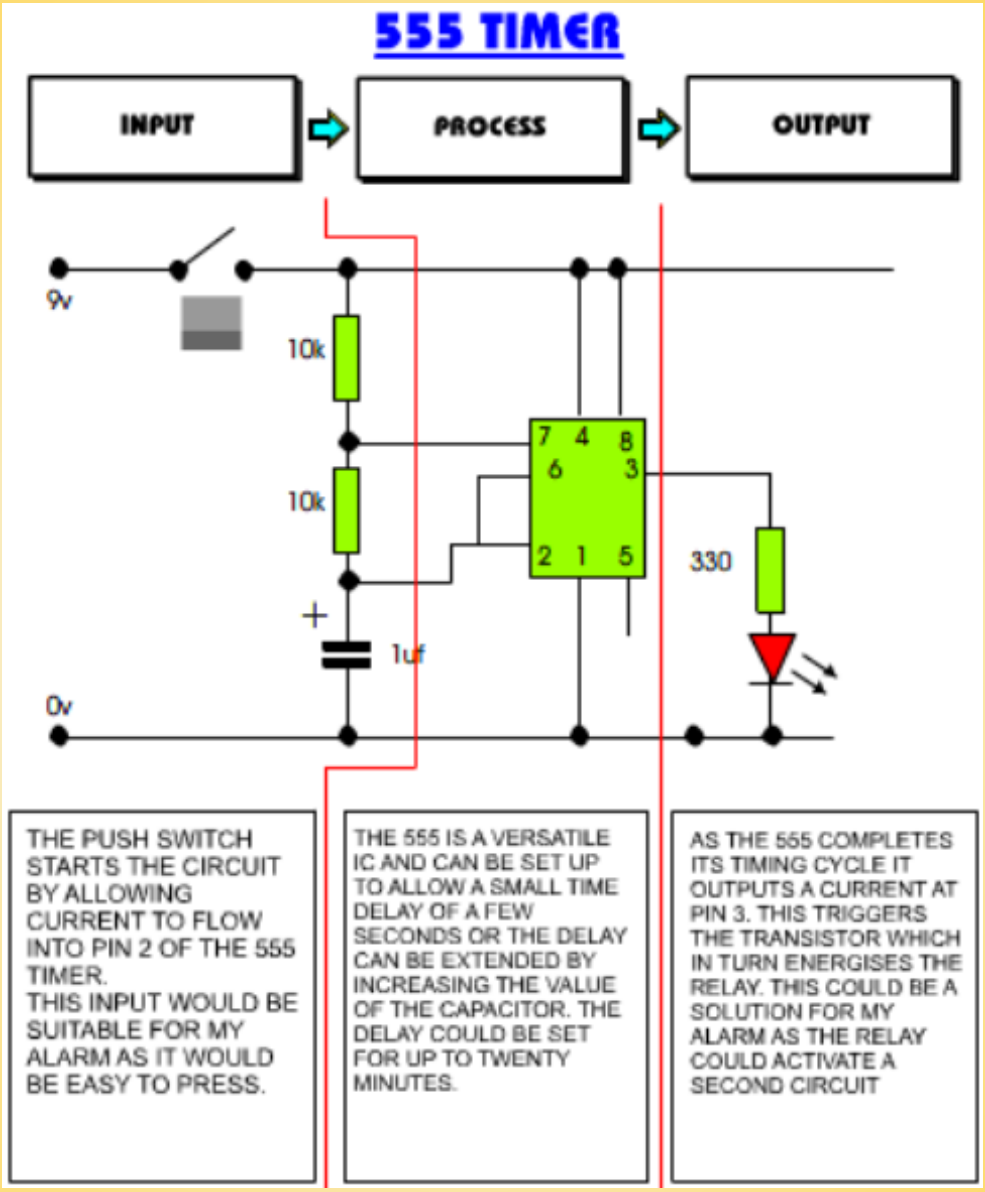

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Systems diagrams can also be applied to programmable **MICROCONTROLLER** circuits

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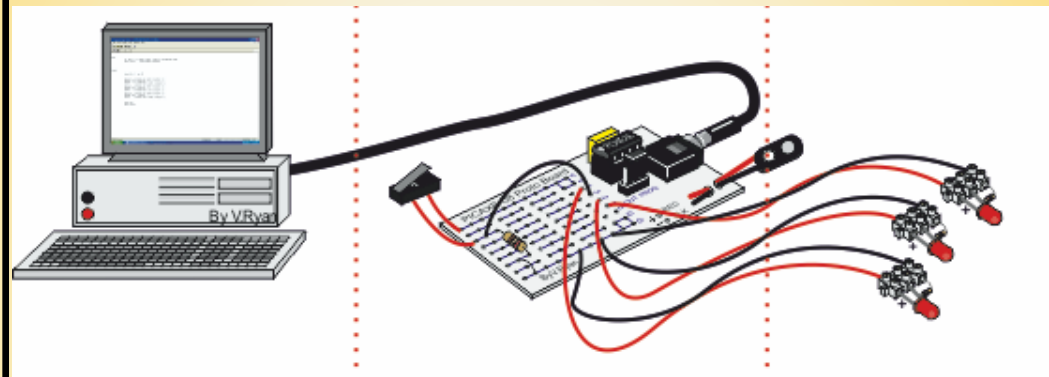

Computer - used to write a programme. The programme can be tested on screen so that obvious faults can be corrected.

PICAXE circuit - once the programme is loaded into its integrated circuit, the programme is processed.

LEDs -these are the output for this simple circuit. These flash on and off.
Motors and sound are other output devices.

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CLOSED SYSTEMS

A closed system includes FEEDBACK. For example; A simple weather station. The temperature is constantly monitored and this is called 'feedback'.

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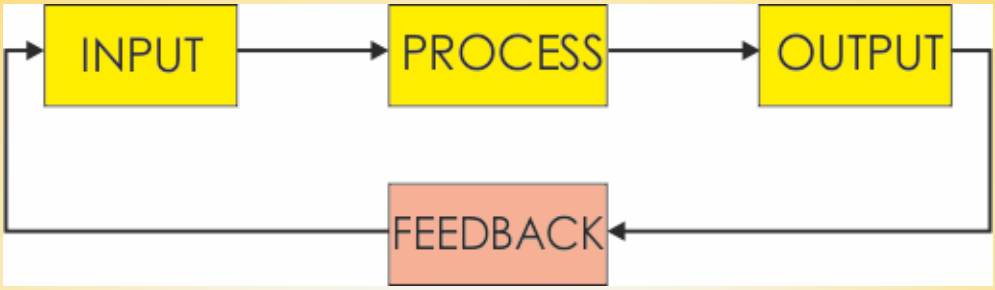

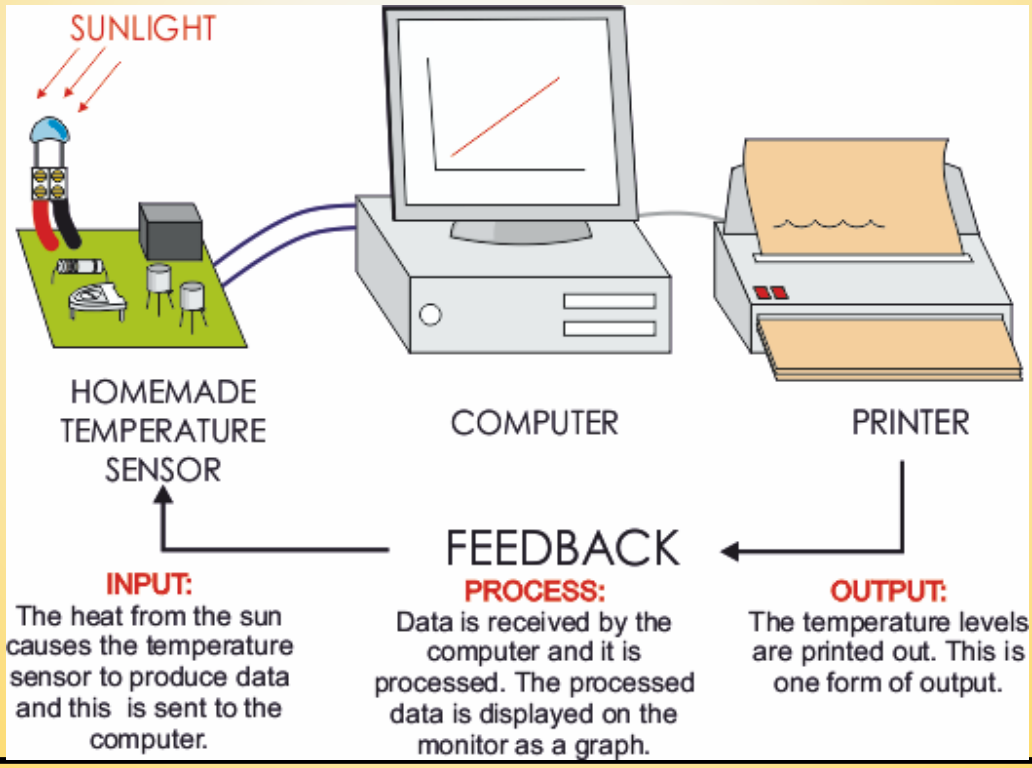

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OPEN SYSTEMS

A system that **does not** have feedback is an open system. An open system normally works once and then stops. A good example is seen below. A digital camera is used to take a photograph, it is transferred to the computer where processing of the picture takes place and finally a printout is produced. This is a closed system because there is no feedback and no attempt is made to improve the picture.

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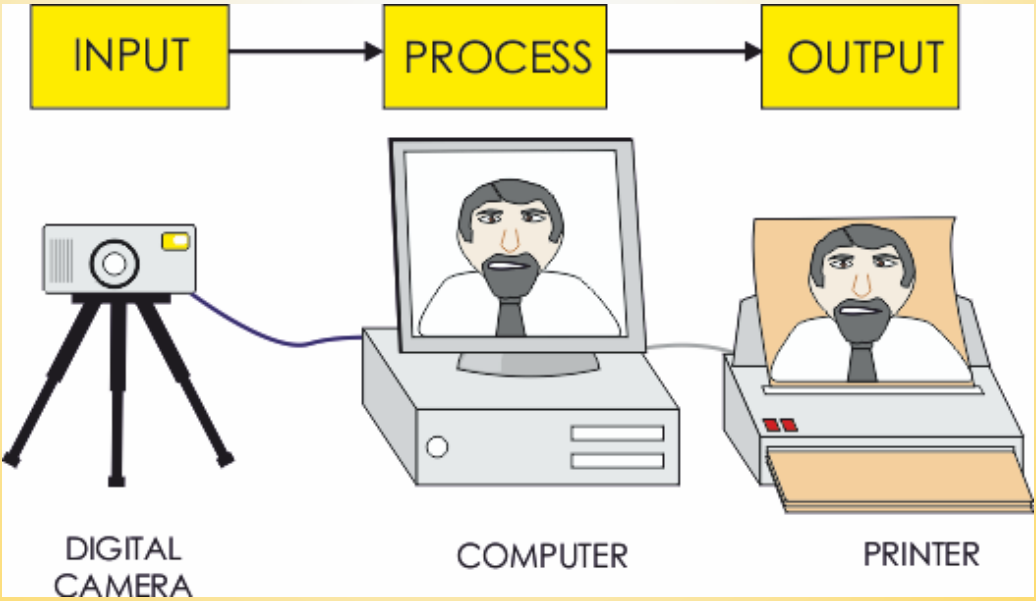

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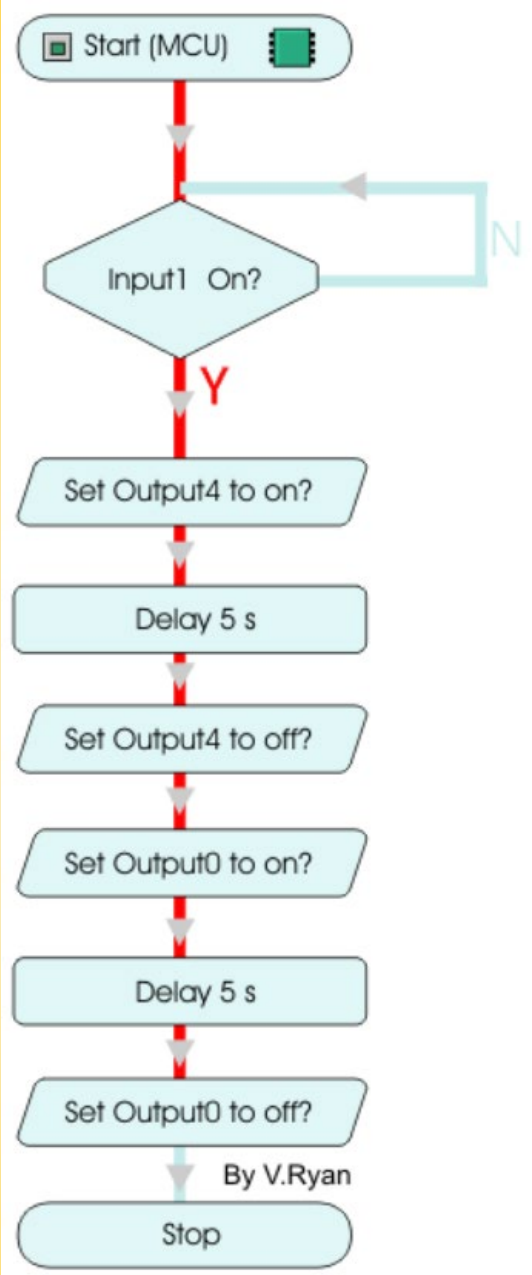
FLOW CHARTS



Systems diagrams (flow charts) are sometimes used to programme microcontroller circuits. This flow chart includes feedback (the diamond shape)

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EXAMPLES OF INPUTS

Systems are controlled initially by **INPUTS**.

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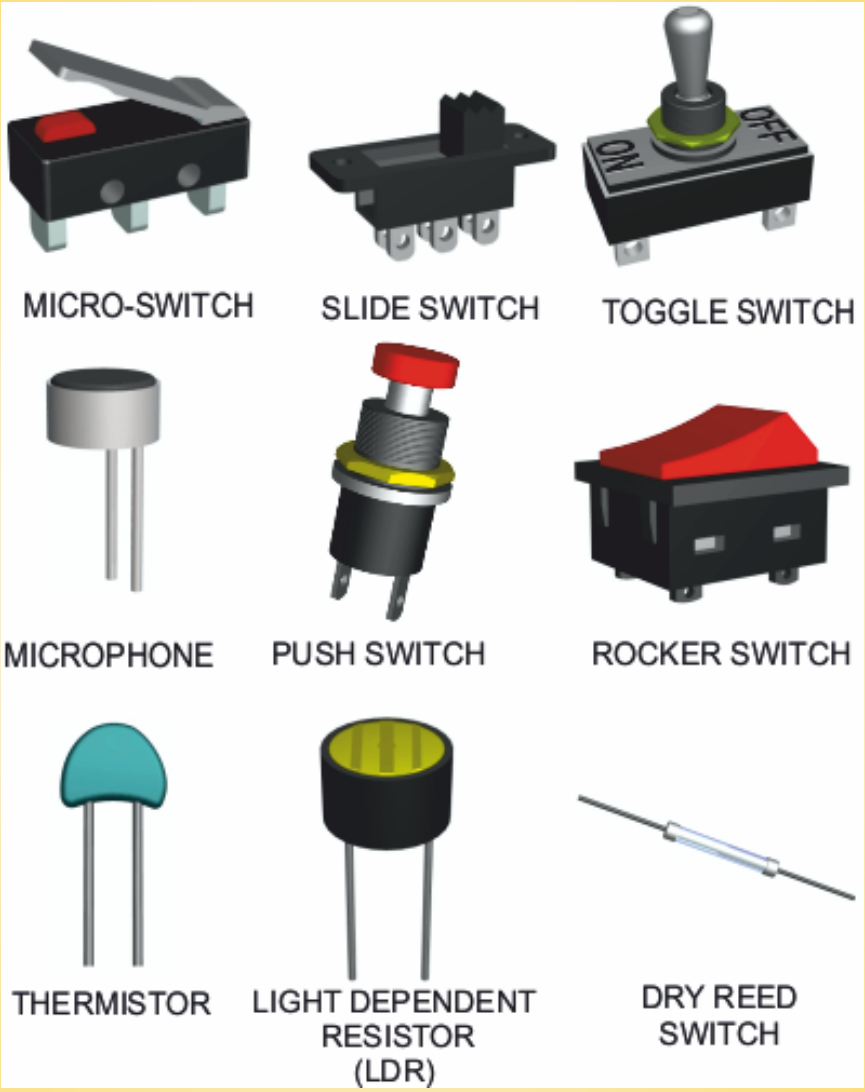

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EXAMPLES OF OUTPUTS

Here are some OUTPUTS for circuits including microcontroller circuits

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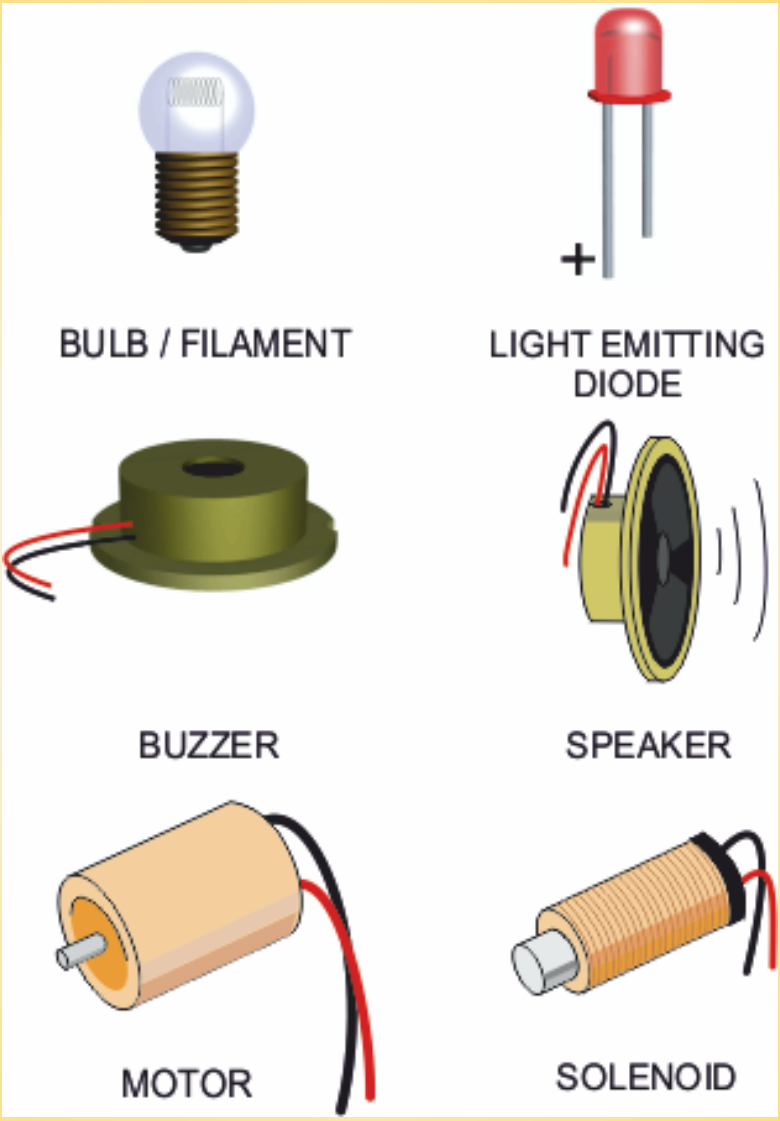

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EXAMPLES OF PROCESSING

PIC Microcontrollers are quickly replacing computers when it comes to programming robotic devices. These microcontrollers are small and can be programmed to carry out a number of tasks and are ideal for school and industrial projects. A simple program is written using a computer, it is then downloaded to a microcontroller which in turn can control a robotic device.

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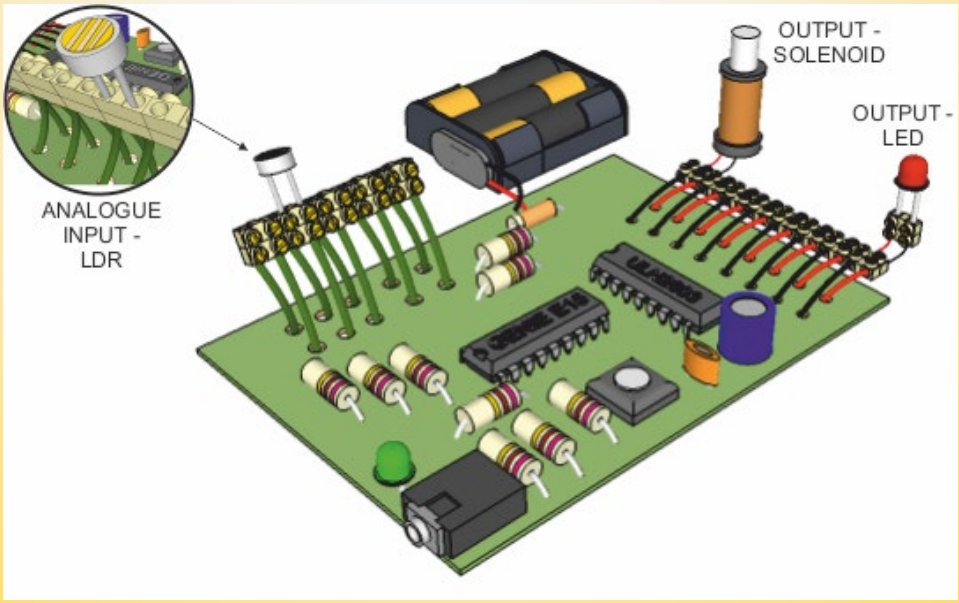
MICROCONTROLLER



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PROCESSING
THE 555 INTEGRATED CIRCUIT

Many circuits are composed of timers and the most common of them all is the 555 Integrated Circuit. It is used in many commercially manufactured items such as video recorders and timers.

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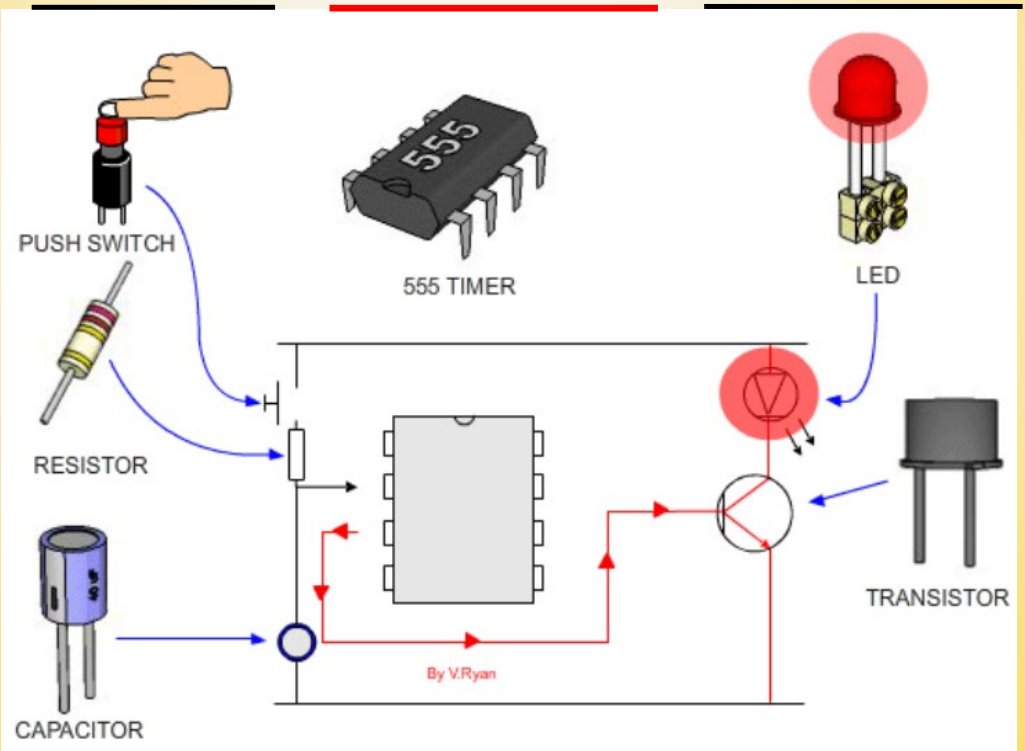
INPUTS **PROCESS** OUTPUTS



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PROCESSING- MONOSTABLE CIRCUITS

A monostable circuit is a circuit that works once and then turns off. A circuit controlling a sliding door on a train is a good example. A motion sensor detects a passenger and the door opens. It shuts once the customer has got on or off the train.

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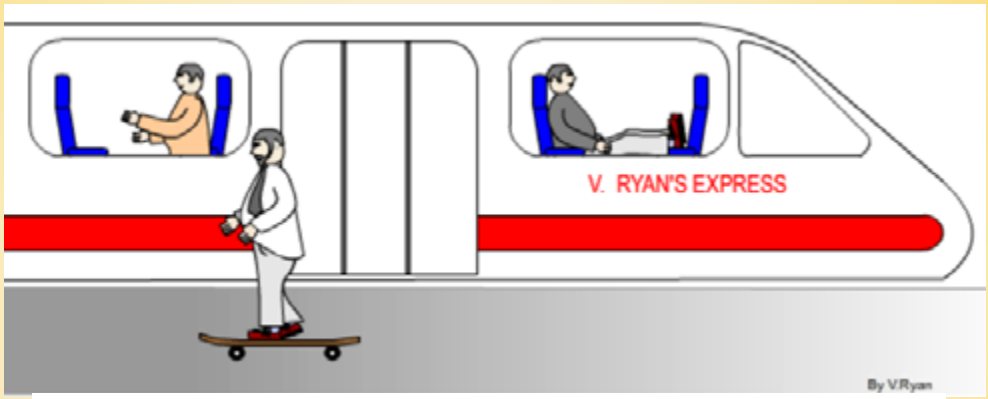

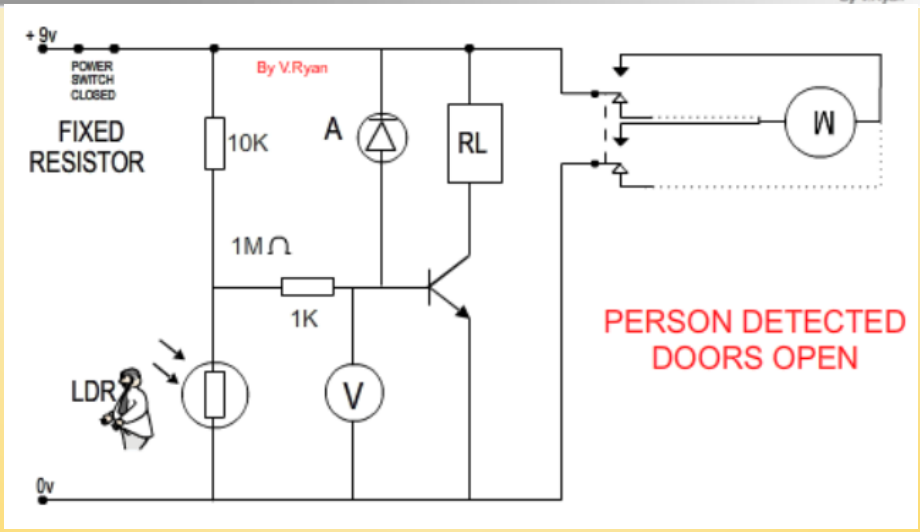

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PROCESSING - ASTABLE CIRCUITS

An astable circuit is one that works continually. That is, it is 'on', followed by 'off' repeatedly. A good example is seen below. When the 555 IC is used to produce an ASTABLE circuit - it will continually pulse until power is removed. Astable circuits can be used to flash lights/LEDs on and off or to turn a buzzer on and off repeatedly. They are used for warning lights / flashing lights.

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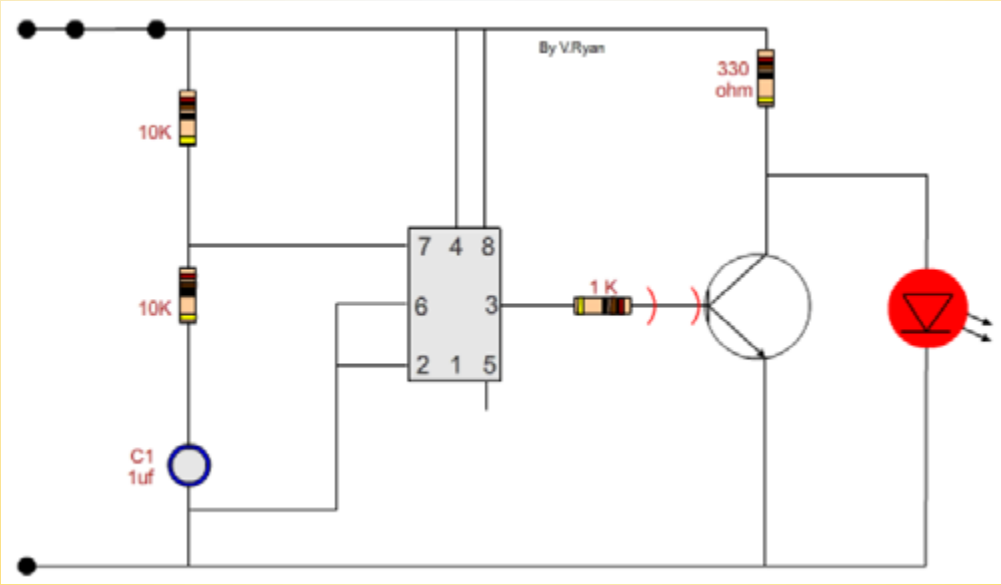

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PROCESSING
COUNTER CIRCUITS

Counter circuits have a wide variety of practical applications. An example is seen below

The 4017B is a circuit, designed to count pulses. They can be used in timing circuits and are often used to switch on and off LEDs or motors or other circuits. They are versatile and relatively simple to put together. Counters such as the 4017B are cheap and yet surprisingly useful.

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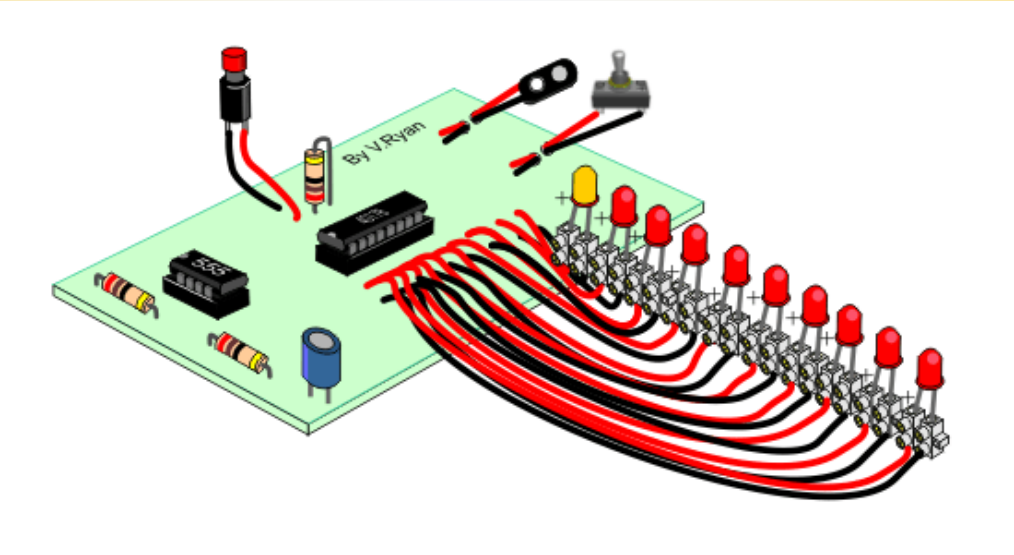

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ANALOGUE AND DIGITAL SIGNALS

Circuits communicate with other circuits / electronic devices, is through signals, which are either ‘analogue’ or ‘digital’.

Analogue signals: These are usually older electronic gadgets (introduced before the mid 1990’s). A good example of an analogue signal is the loud-speaker of a stereo system. When the volume is turned up the sound increases slowly and constantly.

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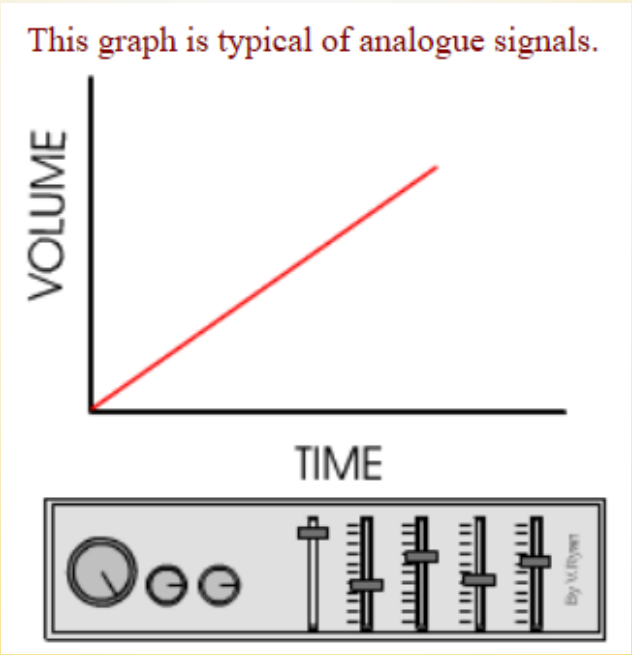

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ANALOGUE AND DIGITAL SIGNALS

Digital signals: Modern electronic products such as computers and mobile phones depend on digital signals. However, a good example of a digital signal is Morse Code. The signal is sent as a series of 'on' and 'off' pulses. The signal is either present or it is not. Morse code was introduced in 1837 by Samuel Morse, as a method of communication.

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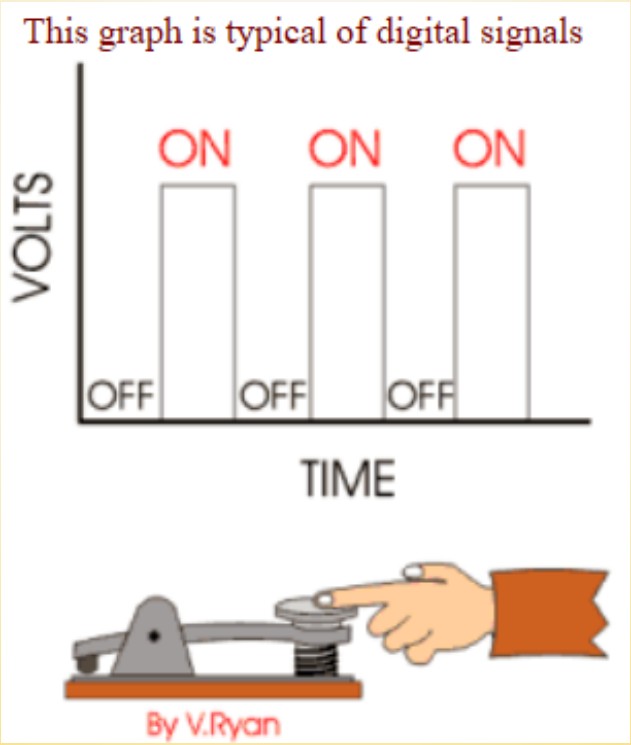

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