Modern embedded systems are based on **microcontrollers** and **microprocessors** so before understanding embedded system one need to know what microcontrollers and microprocessors are.

MICROPROCESSORS AND MICROCOTROLLERS

A **microprocesso**r is a single, **very-large-scale-integration (VLSI)** chip that contains many digital circuits that perform arithmetic, logic, communication, and control functions, the microprocessor, also called the central processing unit (CPU) or microprocessor unit (MPU), is where the primary computation and system control operations occur.

While a **Microcontroller** contains a microprocessor, memory, I/O capabilities, and other on-chip resources. It is basically a microcomputer on a single IC. Examples of microcontrollers are **Microchip's PIC**, **ATmega328p**, **Motorola's 68HC11**, and **Intel's 8096**.

The **memory** store set of instructions which are used by the processor to perform specific tasks, the instructions are in form of a computer program (usually in assembly) written for that particular task. Programs can also be written in a higher level language such as BASIC or C, provided that a compiler is available that can generate machine code for the specific microprocessor being used. The advantages of using a high-level language are that it is easier to learn and use, programs are easier to debug (the process of finding and removing errors), and programs are easier to comprehend. A disadvantage is that the resulting machine code may be less efficient (i.e., slower and require more memory) than a corresponding well-written assembly language program.

EMBEDDED SYSTEMS

An embedded system is a controller with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Ninety-eight percent of all microprocessors manufactured are used in embedded systems.

Implementation of embedded systems has advanced so that they can easily be implemented with already-made boards that are based on worldwide accepted platforms. These platforms include, but are not limited to, **Arduino** and **Raspberry Pi.**

APPLICATIONS

Embedded systems are commonly found in consumer, industrial, automotive, home appliances, medical, commercial and military applications.

Telecommunications systems employ numerous embedded systems from telephone switches for the network to cell phones at the end user. Computer networking uses dedicated routers and network bridges to route data.

Consumer electronics include MP3 players, mobile phones, video game consoles, digital cameras, GPS receivers, and printers. Household appliances, such as microwave ovens, washing machines and dishwashers, include embedded systems to provide flexibility, efficiency and features. Advanced HVAC systems use networked thermostats to more accurately and efficiently control temperature that can change by time of day and season. Home automation uses wired- and wireless-networking that can be used to control lights, climate, security, audio/visual, surveillance, etc., all of which use embedded devices for sensing and controlling.

Automobiles, electric vehicles, and hybrid vehicles increasingly use embedded systems to maximize efficiency and reduce pollution. Other automotive safety systems include anti-lock braking system (ABS), Electronic Stability Control (ESC/ESP), traction control (TCS) and automatic four-wheel drive.

Medical equipment uses embedded systems for vital signs monitoring, electronic stethoscopes for amplifying sounds, and various medical imaging (PET, SPECT, CT, and MRI) for non-invasive internal inspections. Embedded systems within medical equipment are often powered by industrial computers.

Embedded system can be found from simple consumer electronics to complex engineering systems such as robots, rockets and satellites, IoT devices and home automation system.

REFERENCES:

- https://en.wikipedia.org/wiki/Embedded_system
- introduction to mechatronics and measurement system (fourth edition) by David G. Alciatore & Michael B. Histand