

- \* RTOS & General purpose OS
- \* General purpose Systems & Embedded Systems → Differences
- \* What are device drivers
- \* How can hardware understand the codes that we write in Embedded Systems?

\* How actually .c files are converted into exe files?

C files it first go through the pre-processor, then compiler compiles it into assembly & creates object file (main.o). Then linker link the main.o with required header objects & libraries & creates a executable file (program.exe).

\* What are device drivers in Computer?

A driver, (or) device driver, is a set of files that tells a piece of hardware how to function by communicating with a Computer's Operating System.

→ All pieces of hardware require a driver, from our internal computer components, such as your graphics card, to your external peripherals, like a printer.

→ There are various types of device drivers for I/O devices such as keyboards, mouse, CD/DVD



drives, controllers, printers, graphics & ports.

→ A device driver is a specialized software that operates a particular computer-connected device - offering a software interface to the hardware allows operating systems & other computer applications to access hardware functionalities

\*> Embedded systems:-

→ Any Embedded S/m can be thought of as a computing system that is designed to serve a dedicated purpose.

→ An Embedded system is mostly subsystem within a larger system.

Ex:- A GPS navigator, ABS in vehicles.

→ An Embedded S/m consists of both

\* Hardware

\* Software

\*> Purpose of Embedded Systems.

1) Data Collection / Storage Representation

2) Data Communication.

3) Data (s/m) processing

4) Monitoring



5) Control

6) Application Specific User Interface.

### 1) Data Collection / Storage / Representation

→ Storage, analysis, Manipulation, transmission

→ text, voice, message, image, video, electrical sig.

→ Data Analog / Digital

Eg: Digital Camera.

### 2) Data Communication

→ From satellite communication to home N/w system.

→ Analog / Digital

→ Routers, switches, hubs.

### 3) Data sig processing.

→ Speech, coding, Synthesis, audio, video codes-transmission

→ Eg: Digital hearing aid.

### 4) Monitoring:

→ I/p sensors are used for determining state of some variables.

→ Medical Applications.

→ EEG, Digital, CRO.



## 5) Controlling:

→ Controlling Variables.

→ Sensors i/p & actuators contains o/p

Eg:- AC. Maintaining for certain room temperature

## 6) Application Specific User Interface

→ Used as interface like switches, buttons, Keypad, light, display units

Eg:- Mobile phones

## \* Major Application areas of Embedded systems:

1) Consumer Electronics → Eg: Camcorders, Cameras etc.

2) Household appliances → Eg: TV, DVD player, Washing machine, Fridge, Microwave Oven etc.

3) Home automation & Security Systems → Eg: AC, Fire alarms

4) Automotive Industry → Eg: Anti-lock breaking Systems (ABS), Engine Controls, automatic navigation Systems

5) Telecom: Eg: Cellular telephones, telephone switches, handset multimedia application etc.

6) Computer peripherals: → Eg: printers, Scanners, fax etc



7) Computer Networking Systems → Eg: Network routers, switches, hub, firewall.

8) Health Care → Eg: EEG, ECG, Scanner etc

9) Measurement Instrumentation: Eg: Digital Multimeters, Digital CRO's etc.

10) Banking & Retail: → Eg: ATM, Currency Counters etc.

11) Card Readers: → Eg: Barcode, Smart card readers, handheld devices etc.



12) Wearable Devices: → Eg: Health & fitness trackers

13) Cloud Computing & Internet of Things (IoT)

\* Differences b/w General purpose System & Embedded System

Criteria.	General purpose System	Embedded System
Purpose	System is Multipurpose & can be used for variety of applications	System is combination of Special purpose of hardware & Embedded as for Specific application



Operating System

General purpose  
OS like windows,  
linux, MAC

Operating system  
may not be present,  
(or) Real time OS.

Alteration

Functionality can be  
altered by execution  
different program  
& application

Not alterable since  
the firmware is  
programmed for  
specific task

Key factor:

performance &  
Speed

Application Specific,  
Time.

power Consumption  
- on

More since it  
large system &  
Multipurpose s/m

Less because it  
application specific  
system.

Response  
Time

Not critical

critical

User Interface

GUI (Graphical  
User Interface)

May or May not  
be there.

Execution

Need not be  
deterministic,  
Soft Real time

Deterministic for  
certain type of  
Embedded s/m



Size	Large	Small
programming	Can be programmed by end user	Cannot be programmed by end user
peripheral	Large No. of peripheral like keyboard, mouse, Monitor, Scanner, printer etc.	Less no. of peripheral like key switch, sensor, LCD, 7-segment etc.
Memory	Large primary memory RAM. Huge Secondary memory Hard disks, Floppy disks, Magnetic tapes etc.	Small primary memory RAM Generally Secondary memory is missing.

\* Difference b/w GPOS & RTOS.

⇒ In general, an OS is responsible for managing the hardware resources of a computer & hosting applications that run on the computer.

⇒ An RTOS performs these tasks, but is also specially designed to run applications with very precise timing & a high degree of reliability.