Lesson 5: Software for embedding in System- Part 2

Device drivers, Device manager, OS, RTOS and Software tools

Outline

- Device drivers
- Device manager
- Multitasking using an operating system (OS) and Real time operating system (RTOS)
- Software tools

Devices

- In an embedded system, there are number of *physical devices*.
- Physical devices – keypad, LCD display or touch screen, memory stick (flash memory), wireless networking device, parallel port and network-card…

Devices

- In an embedded system, there are number of *virtual devices*.
- Virtual devices – pipe, file, RAM disk, socket, …

Device Driver

- A *device driver* is software for controlling (configuring), receiving and sending a byte or a stream of bytes from or to a device.

Device Drivers

- A set of generic functions, such as create ( ), open ( ), connect ( ), listen ( ), accept ( ), read ( ), write ( ), close ( ), delete ( ) for use by high level programmers
- Each generic function calls a specific software (interrupt service routine), which controls a device function or device input or output

Device controls and functions by :

1. Calling an ISR (also called Interrupt Handler Routine) on hardware or software interrupt
2. Placing appropriate bits at the control register or word.
3. Setting status flag(s) in the status register for interrupting, therefore running (driving) the ISR, Resetting the status flag after interrupt service.

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Device Manager for the devices and drivers

- Device Management software (usually a part of the OS) provide codes for detecting the presence of devices, for initializing (configuring) these and for testing the devices that are present.

- Also includes software for allocating and registering port(s) or device codes and data at memory addresses for the various devices at distinctly different addresses, including codes for detecting any collision between the allocated addresses , if any

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Concurrent Processes, tasks or threads

- A System is composed of two or more concurrent processes that execute

Operating System

- Multitasking (multiprocessing or multithreaded) software
- Scheduling multiple tasks,
- Processes, memory, device, ports, network, file system, timers, event functions, inter-processor communication, shared memory, security, GUIs, ... management

Real Time Operating System (RTOS)

- Embedded software is most often designed for deterministic performance and task and ISR latencies in addition to the OS functions
- Performing multiple actions and controlling multiple devices and their ISRs with defined real time constraints and with deadlines for these

Real Time Operating System (RTOS)

- Task and ISRs priority allocations, their preemptive scheduling, ..

RTOS and concurrent processes

- OS for providing deterministic performance during concurrent processing and execution with hard (stringent) or soft timing requirements with priority allocation and preemption

RTOS is needed when the tasks for the system have real time constraints and deadlines for finishing the tasks

Important RTOSes

- OS µCOS-II
- VxWorks
- Windows CE
- OSEK
- Linux 2.6.24 or RTLinux
- QNX

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Development Tools

1. **Editor,**
2. **Interpreter,**
3. **Compiler,**
4. **Assembler and Cross Assembler, IDE,**
5. **Prototyper**

[Ref: Table 1.2 and Chapter 13 for details]

Application Software Development Tools

- Source Code Engineering Tools
- Stethoscope (tracks the switching from one task to another as a function of time, stores beats)
- Trace Scope (traces changes in a parameter(s) as a function of time)

Simulator

A Simulator... To simulate the target processor and hardware elements on a host PC and to run and test the executable module

Project Manager

To manage the files that associates with a design stage project and keep several versions of the source file(s) in an orderly fashion.

Summary

We learnt:

- Device and manager functions
- OS and RTOSes
- Tools

End of the Lesson –5