

# Lesson 9: Development Skills Requirements for Embedded Systems

# Small Scale Embedded Systems

# Skills for Small Scale System

- Full understanding of a microcontroller with a basic knowledge of computer architecture, digital electronic design, software engineering, data communication, control engineering, motors and actuators, sensors and measurements, analog electronic design and IC design and manufacture – Tim Wilmshurst

# Skills for Small Scale System

- Specific skills will be needed in specific situations. For example, control engineering knowledge will be needed for design of control systems and analog electronic design knowledge will be needed when designing the system interfaces.

# Small Scale Embedded Systems

- Skill to use IDE specific to the microcontroller or processor and Embedded C used for software development
- Skill to debug and simulate
- Skill to use RTOS for real-time systems

# Small Scale Embedded Systems

- Software coding skills so that the code fits within the memory available and keep in view the need to limit power dissipation when system is running continuously

# Skills for Small Scale System

- Computer architecture and organization.
- Interfacing the memories.
- Burning the executable machine codes in PROM or ROM.
- Use of decoders and demultiplexers.
- Use of Direct memory accesses.
- Use of Ports and device-drivers.

# Skills for Small Scale System

- Device drivers in assembly.
- Simple and sophisticated buses.
- Timers.
- Interrupt servicing mechanism.
- C programming elements.
- Memory optimization.
- Selection of hardware and microcontroller.



# Skills for Small Scale System

- Use of ICE (In-Circuit-Emulators), cross-assemblers and testing equipment.
- Debugging the software and hardware bugs by using test vectors.
- Basic knowledge in the other areas— software engineering, data communication, control engineering, motors and actuators, sensors and measurements, analog electronic design and IC design and manufacture

# May not need

- All concepts of interrupt latencies and deadlines and their handling the RTOS programming tools.

# Median Scale Embedded Systems

# Skills for Median Scale Embedded Systems

- Embedded C/C++ programming and RTOS programming and program modeling skills
- Programming the Tasks or threads and their scheduling by RTOS.
- Programming priorities and Cooperative and preemptive scheduling.

# Skills for Median Scale Embedded Systems

- Use of Inter processor communication functions.
- Use of shared data, and programming the critical sections and re-entrant functions.
- Use of semaphores, mailboxes, queues, sockets and pipes.
- Handling of interrupt-latencies and meeting task deadlines.
- Use of various RTOS functions.
- Use of physical and virtual device drivers.

# Skills for Median Scale Embedded Systems

- Designer must have access to an RTOS programming tool with Application Programming Interfaces (APIs) for the specific microcontroller to be used

# Sophisticated Embedded Systems

# Skills for Sophisticated Scale Embedded Systems

- Team is needed to co-design and solve the high level complexities of the hardware and software design.



# Hardware engineer skills for sophisticated scale embedded systems

- An embedded system hardware engineer should have full skills in hardware units and basic knowledge of 'C'/C++ and Java, RTOS and other programming tools.

# Software engineer Skills for Sophisticated Scale Embedded Systems

- Software engineer should have basic knowledge in hardware and a thorough knowledge of 'C', RTOS and other programming tools.
- Final optimum design solution by system integration.

# Summary

We learnt

- Skill requirements for three classes of systems

# End of Lesson 9