DEVICES AND COMMUNICATION BUSES FOR DEVICES NETWORK–

Lesson-16: Real time clock

Real Time Clock (RTC)

- A clock, which is based on the interrupts at preset intervals. An interrupt service routine executes on each timeout (overflow) of this clock. This timing device once started never resets or never reloaded with another value. Once it is set, it is not modified later.

RTC

- Used in a system to save the time and date.
- Used in a system to initiate return of control to the system (OS) after the set system clock periods

RTC Application

- Assume that a hardware timer of an RTC for calendar is programmed to interrupt after every 5.15 ms (=1 day period/ 2^{24})
- Assume each tick (interrupt) a service routine runs and updates at a memory location. Within one day (86400 s) there will be 2^{24} ticks, the memory location will reach 0x000000 after reaching the maximum value 0xFFFFFF.

RTC with 5.5 ms tick

- Within 256 days there will be 2^{32} ticks, the memory location will reach 0x00000000 after reaching the maximum value 0xFFFFFFFF.
- A battery is used to protect the memory for long period

RTC for implementing a software timer

- A hardware 16-bit timer ticks from processor clock after 0.5 μs. It will overflow and execute an overflow interrupt service routine after 2^{15} μs = 32.768 ms.
- The interrupt service routine can generate a port bit output after every time it runs or can call a software routine or send a message for a task. If n = 30, the RTC initiated software will run every 30 × 32.768 ms, which is close to 1 s.

68HC11 microcontroller RTC

- Pulse Accumulator Control Register, PACTL and two lowest significance bits, RT1-RT0 (1st and 0th).
- PACTL is *write* only.
- If the RT1-RT0 pair is set =0-0, an RTC interrupt can occur after 2^{13} pulses of the E clock. If the E clock pulses are of 2 MHz and *T* is 0.5 μs, the interrupt from a real time clock occurs after every 4.096 ms.

68HC11 microcontroller RTC

- If the RT1-RT0 pair is 01, an interrupt can occur after 2^{14} pulses of the E clock, that is, after 8.192 ms.
- If the RT1-RT0 pair is 10, the interrupt can occur after 2^{15} pulses of the E clock, that is after 16.384 ms.
- If the RT1-RT0 pair is 11, an interrupt can occur after 2^{16} pulses of the E clock, that is, after 32.768 ms. The real time clock is based on a free running counter. RT1-RT0 bits control its rate factor

68HC11 microcontroller RTC

- RTC disabled or enabled by the I bit in the CC (clock control) register
- Interrupts from real time clocks are also locally masked by the 6th bit, RTI in timer interrupt mask register2, TMASK2.

Unmask and reset to mask of real time interrupt

- RTI is set to unmask and reset to mask the real time interrupt locally.
- If RTI and I bits permit the interrupt request for real time, the microcontroller fetches the lower and higher bytes of the interrupt servicing routine address from the addresses 0xFFF0 (higher byte) and 0xFFF1 (lower byte)

Summary

We learnt

- A real time clock (RTC) provides the system clock to generate the system interrupts
- An interrupt service routine executes on each tick (timeout or overflow) of this clock.
- This timing device once started is generally never reset or never reloaded to another value

End of Lesson 16 of Chapter 3