SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19ECT221 – MICROPROCESSORS AND MICROCONTROLLERS

II YEAR - IV SEM

UNIT 4– INTERFACING MICROCONTROLLER

Topic- 1: Programming of 8051 Timers

Programming of 8051 Timers

➤ The 8051 microcontroller has 2 timers/counters called T0 and T1.

➤ Their main purpose is to measure time and count external events. Besides, they can be used for generating clock pulses to be used in serial communication, so called Baud Rate.

➤ The timer registers can be used in two modes.

➤ These modes areTimer mode and the Counter mode.

➤ The only difference between these two modes is the source for incrementing the timer registers.

Timer and Counter Mode

➤ **In the timer mode,** the internal machine cycles are counted. So this register is incremented in each machine cycle.

➤ So when the clock frequency is 12MHz, then the timer register is incremented in each millisecond.

➤ In this mode it ignores the external timer input pin.

➤ **In the counter mode,** the external events are counted.

➤ In this mode, the timer register is incremented for each 1 to 0 transition of the external input pin.

➤ This type of transitions is treated as events.

TMOD Register

TMOD(Timer Mode) is an SFR. The address of this register is 89H. This is not bit-addressable.

Timer	Timer1 Mode				Timer0 Mode			
Bit Details	Gate (G)	C/$\overline{T}$	M1	M0	Gate (G)	C/$\overline{T}$	M1	M0

Bit Details	High Value(1)	Low Value(0)
C/$\overline{T}$	Configure for the Counter operations	Configure for the Timer operations
Gate (G)	Timer0 or Timer1 will be in RunMode when TRX bit of TCON register is high.	Timer0 or Timer1 will be in RunMode when TRX bit of TCON register is high and $\overline{INT0}$ or $\overline{INT1}$ is high.

Bit Details	00	01	10	11
M1 M0	This is for Mode 0. (8-bit timer/counter, with 5-bit pre-scaler)	This is Mode 1. (16-bit timer/counter)	This is Mode 3 (8-bit auto reload-timer/counter)	This is Mode 3 (The function depends on Timer0 or Timer1)

TCON Register

7	6	5	4	3	2	1	0	
TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0	TCON
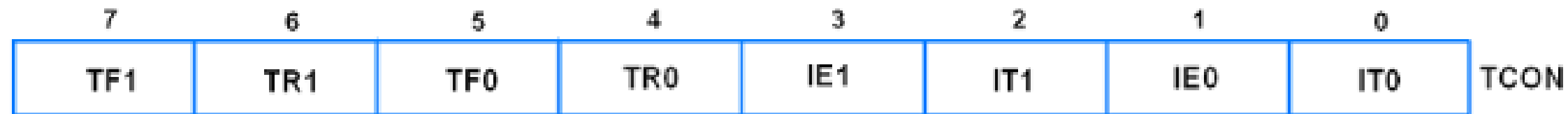
TCON is an 8-bit control register and contains a timer and interrupt flags.

Bit 7 - TF1: Timer1 Overflow Flag

    1 = Timer1 overflow occurred (i.e. Timer1 goes to its max and roll over back to zero).

    0 = Timer1 overflow not occurred.

It is cleared through software. In the Timer1 overflow interrupt service routine, this bit will get cleared automatically while exiting from ISR.

Bit 6 - TR1: Timer1 Run Control Bit

    1 = Timer1 start.

    0 = Timer1 stop.

It is set and cleared by software.

Bit 5 – TF0: Timer0 Overflow Flag

    1 = Timer0 overflow occurred (i.e. Timer0 goes to its max and roll over back to zero).

    0 = Timer0 overflow not occurred.

It is cleared through software. In the Timer0 overflow interrupt service routine, this bit will get cleared automatically while exiting from ISR.

Bit 4 – TR0: Timer0 Run Control Bit

    1 = Timer0 start.

    0 = Timer0 stop.

It is set and cleared by software.

Bit 3 - IE1: External Interrupt1 Edge Flag

    1 = External interrupt1 occurred.

    0 = External interrupt1 Processed.

It is set and cleared by hardware.

Bit 2 - IT1: External Interrupt1 Trigger Type Select Bit

    1 = Interrupt occurs on falling edge at INT1 pin.

    0 = Interrupt occur on a low level at the INT1 pin.

TCON Register

Bit 1 – IE0: External Interrupt0 Edge Flag

    1 = External interrupt0 occurred.

    0 = External interrupt0 Processed.

It is set and cleared by hardware.

Bit 0 – IT0: External Interrupt0 Trigger Type Select Bit

    1 = Interrupt occurs on falling edge at INT0 pin.

    0 = Interrupt occur on a low level at INT0 pin.

References

https://www.electronicwings.com/8051/8051-timers

https://www.tutorialspoint.com/timers-of-8051

https://www.tutorialspoint.com/embedded_systems/es_timer_counter.htm

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