MICROCONTROLLER

UNIT–III

Lecture–II

COUNTER PROGRAMMING

- The timers can also be used as counters counting events happening outside the 8051.
- The use of the timer/counter as an event counter is concerned with programming the timer as a counter, except the source of the frequency.
- When the timer/counter is used as a timer, the 8051's crystal is used as the source of the frequency.

C/T bit in TMOD register

- The C/T bit in the TMOD register decides the source of the clock for the timer.
- If C/T=0, the timer gets pulses from the crystal. In contrast, when C/T=1, the timer is used as a counter and gets its pulses from outside the 8051.
- When C/T=1, the counter counts up as pulses are fed from pins 14 and 15. These pins are called T0 and T1.

TCON REGISTER

- TR0 and TR1 flags are used to turn on and off the timers. These bits are part of a register called TCON (timer control).
- This register is an 8-bit register. The upper 4-bits are used to store the TF and TR bits of both Timer 0 and Timer 1.
- The lower four bits are set aside for controlling the interrupt bits. The TCON register is a bit-addressable register.

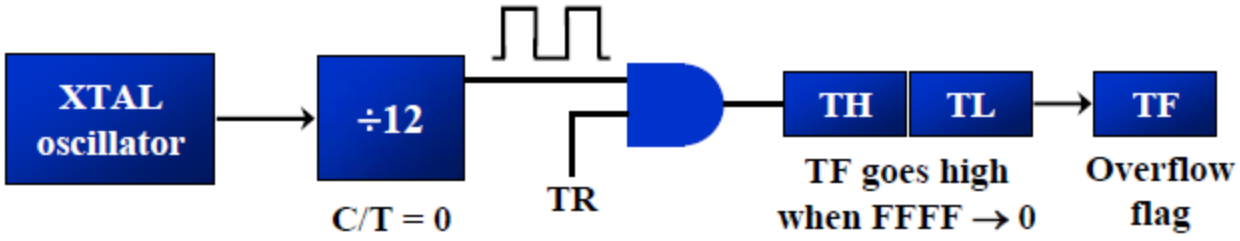
The case of GATE = 1 in TMOD

- When GATE = 0, the timer is started with instructions “SETB TR0” and “SETB TR1”, for Timer 0 and 1, respectively.
- If GATE = 1, the start and stop of the timer are done externally through pins P3.2 and P3.3 for Timers 0 and 1, respectively.
- TRx is turned on by the “SETB TRx” instruction.
- This allows us to start or stop the timer externally at any time via a simple switch.

Mode 1 Programming

- The following are the characteristics and operations of mode1:

(1.) It is a 16-bit timer; therefore, it allows value of 0000 to FFFFH to be loaded into the timer's register TL and TH



Contd.

(2.) After TH and TL are loaded with a 16-bit initial value, the timer must be started

This is done by SETB TR0 for timer 0 and SETB TR1 for timer 1

(3.) After the timer is started, it starts to count up

It counts up until it reaches its limit of FFFFH

Contd.

- When it rolls over from FFFFH to 0000, it sets
- high a flag bit called TF (timer flag)

– Each timer has its own timer flag: TF0 for

- timer 0, and TF1 for timer 1

– This timer flag can be monitored

Contd.

(4.) After the timer reaches its limit and rolls over, in order to repeat the process

- TH and TL must be reloaded with the original value, and
- TF must be reloaded to 0