

Implementation of a StopWatch

PARTS:

1. Modulo 10 counter : After displaying digits from 0 to 9, it again starts right from 0.

In this, the end of Counter(EoC) is 9 (1001) which is Q0.Q1'.Q2'.Q3 . In this the output of T0 and T3 must be toggled. So the value of T0 and T3 should be 1 after the EoC.

2. Modulo 6 counter : After displaying digits from 0 to 5, it again starts right from 0.

In this, the end of Counter(EoC) is 5(0101) which is Q0.Q1'.Q2.Q3' . In this, the output of T0 and T2 must be toggled. So the value of T0 and T2 should be 1 after the EoC.

3. Frequency Down Circuit : The freq of the given clock is 100MHz. So to change it in a frequency of 10Hz, 7 modulo 10 counters are used such that the output of the first counter is the clock of the second and so on.

4. J-K Flip flop : It is used to operate the start and pause switches of the stopwatch. If the value of start is 1 then the clock will remain unchanged else if the value of pause is 1 then the signal of the clock became 0.

5. 7 segment 4 digit display : In this, the LED corresponding to Anode1 is used to represent the 1/10th part of a second. Anode2 is used to represent the ones digit of the second and Anode3 is used to represent the tens digit of the second. Anode4 is used to represent the minutes.

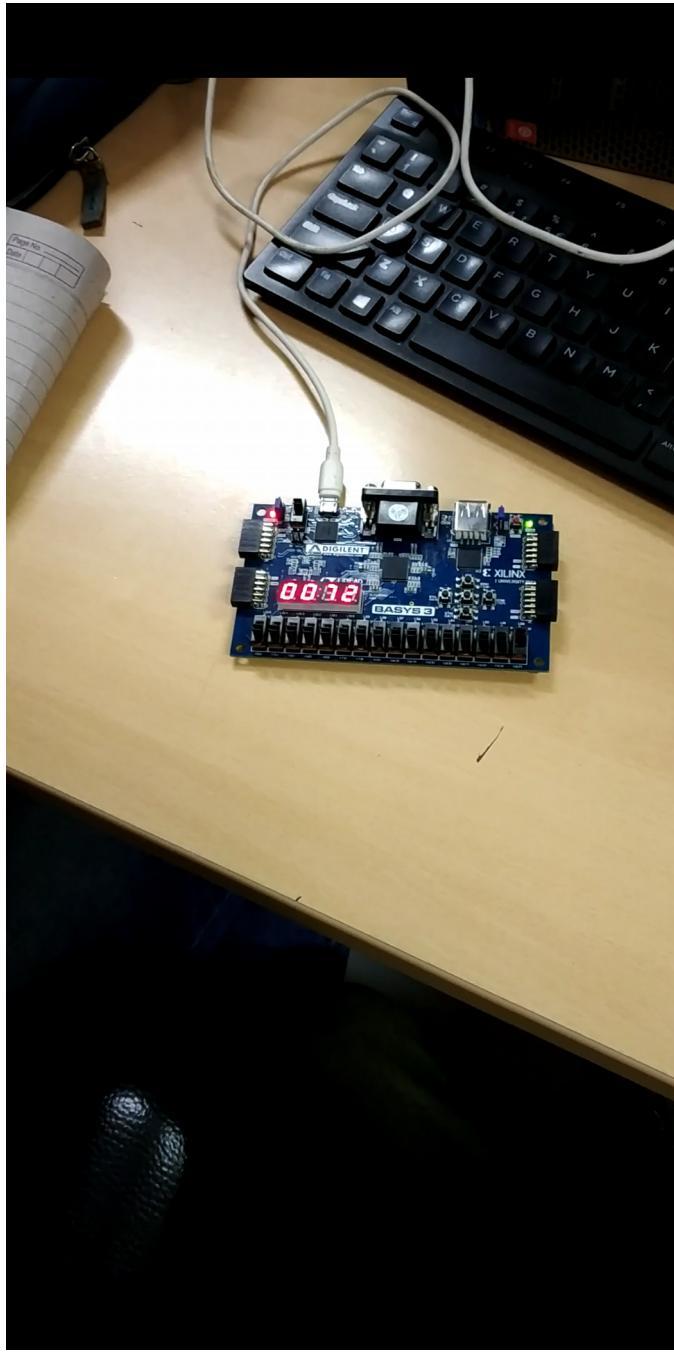
Design Logic:

For every modulo 10 counter, a clock and a single bit reset signal are the inputs and a 4-bit digit and the inverse of Q3 are the outputs of the counter. We take inverse of Q3 as the clock of the next modulo counter. For modulo 6 counter, we take the inverse of Q2 as the clock of the next modulo counter. Whenever the value of Q3 bar (or Q2 bar) changes from 0 to 1, then it is followed by an increment in the digit of the immediate next modulo counter.

Frequency of LED 1 is 10Hz, frequency of LED2 is 1Hz, frequency of LED3 is 0.1 Hz and frequency of LED4 is 1/60 Hz.

Limitations:

1. when the input START is set to 1 then the clock starts but when it is set to 0 without setting the PAUSE switch to 1 , the clock doesn't stop.
2. If the PAUSE switch is not given the value 1 before resetting then the watch automatically starts after setting the RESET from 1 to 0.



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