Timer

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Fundamentals
[Understanding Embedded System Clocks and Timers | by RocketMe Up I/O | Medium](#)
Timer and Clock Basics
- timer uses clock as a source to generate periodic signals or interrupts
    - clock
        - signal generated by oscillators
        - provides a timing reference
        - a device can have multiple clocks
    - timer
        - a register or peripheral
        - counter
            - can count the pulses of the clock to measure a specific period
            - ex: for a 1MHz clock, the timer counts 1 million cycles to generate a 1-second delay
- roles of clocks
    - synchronization across various components
    - timekeeping for applications
    - frequency of operation
        - power consumption
        - performance
- types of clocks
    - system clock
        - the main clock that drives the entire system
        - dictates processor and peripheral speed
    - peripheral clock
        - for timers, ADCs, communication interfaces…
    - real-time clock (RTC)
        - low power
        - tracks actual calendar time when main power is off
            - use backup batteries (supercapacitor, lithium battery, …)
            - can last from 1 day to 2 weeks
- roles of timers
    - PWM
    - event timing
        - how long an event lasts
    - task scheduling
        - tasks are executed in precise intervals

Timer Modes
- One-Shot Mode
    - counts to predefined value then stops
    - for single-trigger event
- Continuous Mode
    - counts to a set value, trigger, then reset to count again
- Capture Mode
    - records the exact time an external event occurs
    - button press or sensor signal
- Compare Mode

- - compares current count with a preset value then triggers when they match
    - PWM, waveform generation

Timer Prescalers

- sits in between clock and timer
- divides clock frequency by a factor
- allows timers to operate at different frequencies
- allows longer delays without timer overflow
  - ex: given 8MHz system clock, set prescaler to 8 for timer to run at 1MHz

Timer Resolution

- smallest time interval that a timer can measure
- depends on clock frequency and timer register bits (8, 16 or 32)