Design Project: Event counter

Your project is to design and build a single-digit (decimal) counter that counts some kind of physical event (switch closure, passing objects, etc.). Your counter needs to have a reset switch to set it back to zero on demand. At minimum, you must built it using a separate counter IC, BCD-to-7-segment decoder/driver IC, and a 7 segment display. Here is a general schematic diagram for you to follow when designing your system:
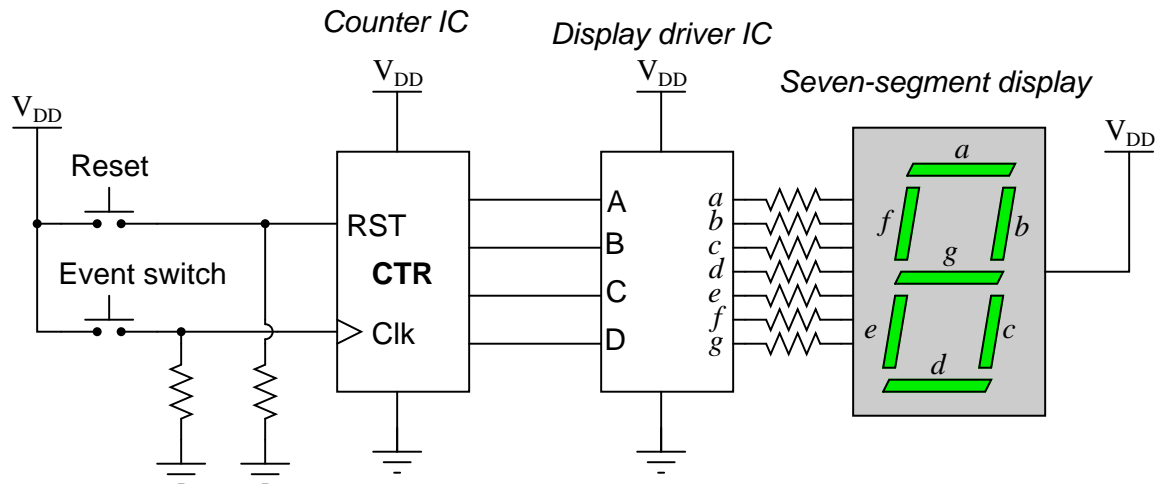
Please note that this is only a general schematic, and that the details will vary according to the particular chips you happen to choose. For example, the counter may be positive edge-triggered or negative edge-triggered; its reset may be active-high or active-low; if it is a binary counter (not BCD), you will have to add at least one logic gate to truncate its count from 0-F (hex) to 0-9 (BCD); the display driver may require common-anode or common-cathode displays; etc.

I encourage creativity when choosing the type of input switch and physical event to count. Ideas include:

- Sound-activated switch (one count per hand-clap or other loud burst of sound).
- Optical switch to count people passing through a doorway.
- Frequency divider to count seconds based on power line frequency (i.e. simple clock).

Deadlines (set by instructor):

- Project design completed:
- Components purchased:
- Working prototype:
- Finished system:
- Full documentation:

Question 1

If your event sensing switch is mechanical in nature, you will likely have to deal with *contact bounce*. Explain what contact "bounce" is and how you can mitigate the problem.

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Answer 1

Contact "bounce" is the physical bouncing and interference of metal switch contacts as they come to a closed state, causing spurious pulses which will be interpreted by the counter as multiple events. Perhaps the simplest way to mitigate the effects of contact bounce is to use a passive low-pass filter (RC integrator) circuit followed by a Schmitt trigger gate. Using a serial-in/serial-out shift register is a more sophisticated approach, but requires more components (including a clock signal generator).

Notes 1

Contact bounce can be a big problem in counter circuits getting their input from mechanical switches. Learning how to detect and eliminate this problem is a very practical exercise for electronics technicians.