

Project A – Timer and Calculator

Introduction:

You are expected to develop a count-up and count-down digital timer. It includes a keypad input and LED display. It is also expected to perform simple arithmetic calculation on single-digit decimal data. The project will cover most of the I/O assignment, interrupt and timer usage. User-friendly design and functionality are expected.

Functional Requirements:

As timer

- ✧ Counting with the time interval of 1 second.
- ✧ Count up and count down from any preset initial value.
- ✧ “Start”, “stop” and “reset” functions
- ✧ Buzzer for one cycle overflow

As calculator

- ✧ Perform +, -, ×, ÷ for a pair of single-digit decimal input data
e.g. $3 \times 5 = 15$
- ✧ For division, only the quotient is displayed
- ✧ Use an additional LED to represent the sign (+ or -)
- ✧ “Clear” function

Display

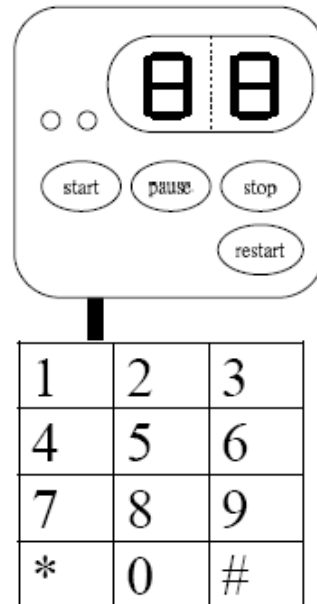
- ✧ At least two digits
- ✧ Either 7-segment LED or dot matrix LCD

Input

- ✧ 4-by-3 keypad
- ✧ For the preset of timer’s initial value and the input of calculator

Optional features

- ✧ Pause control function
- ✧ Additional LED for counting number of overflows
- ✧ Display of the remainder for division operation (by press a button)



Project B – Monotonic Frequency Detector

Introduction:

The detector is able to detect / capture the frequency of a periodic input signal. You can imagine it as a detector for tuning the musical instrument in the right scale by playing the note that is matched with the detector's expectation. However, it is not required to use a true audio signal. Artificially generated signals can be used for simulation.

Functional Requirements:

Frequency detection:

- ✧ Accept frequency from signal generator with 5 Vpp (square wave)
- ✧ Detectable frequencies (C D E F G A B):

C	D	E	F	G	A	B
256 Hz	298 Hz	341 Hz	384 Hz	405 Hz	448 Hz	490 Hz

- ✧ Error: $\pm 10\%$

Display options:

- ✧ 7-segment LED for display of frequency
- ✧ LEDs for detection result

Optional feature:

- ✧ Detection of audio signals generated by guitar or other instruments.

