Level 3: Analog – Digital Conversion

1. Input

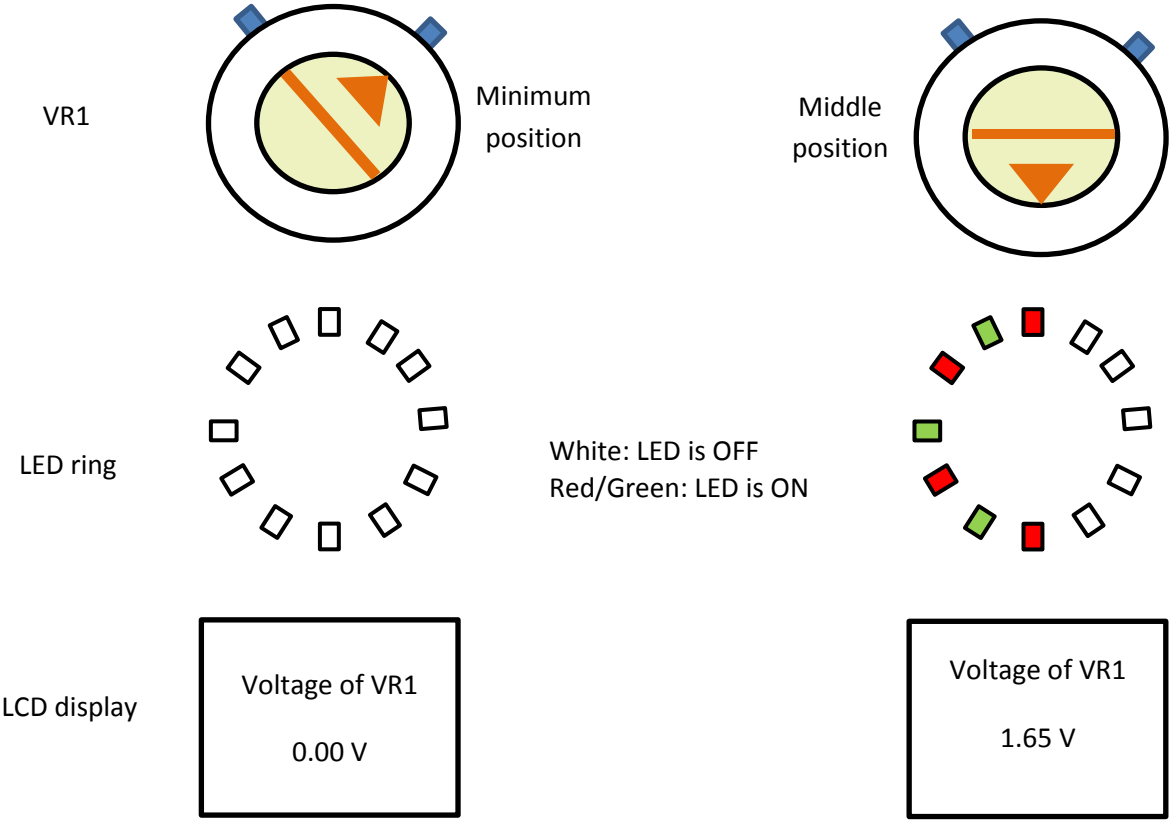
- RL78/G14 RDK board
- CubeSuite+ E2.02.00I
- StartUML
- Workspace: Common Workspace → Final Exercise → L3 (empty)
- Requirements for this level (see Requirements below)

2. Output

- Sequence diagram (using Start UML)
- Source code

3. Task Description

Write a program to display VR1 voltage (0 ~ 3.3V) on LCD module (see the illustration below). VR1 is connected to ANI8 pin. The voltage 0V to 3.3V is output to ANI8 when turning VR1. The reference voltage is V_{REF}=3.3V. The A-D converter will provide the results according to the resolution within 0V~3.3V. The result will be presented by LCD and LED ring.



4. Requirements

Detailed requirements of this task are described as below.

4.1 A-D converter

- Resolution: 10 bits
- A/D conversion channel selection mode: Select mode.
- A/D conversion trigger mode: Software trigger mode
- A/D conversion mode: Sequential conversion mode
- Conversion Clock (f_{AD}): $f_{CLK}/64$

4.2 LCD display

- The first line of the LCD display will show a message about measurement object.
- Result will be showed with the unit and decimal places are 2 digits (the third digit is for rounding-off).

4.3 LED ring display

Voltage range	Number of lighted LED
0.00 -> 0.14	0
0.15 -> 0.27	1
0.28 -> 0.54	2
0.55 -> 0.82	3
0.83 -> 1.10	4
1.11 -> 1.36	5
1.37 ->1.64	6
1.65 -> 1.92	7
1.93 ->2.20	8
2.21 -> 2.47	9
2.48 -> 2.74	10
2.75 -> 3.02	11
3.03 -> 3.30	12

4.4 Time management

- The A-D converter completes sampling and gives the result every 100ms.
- Time management is based on 12-bit interval timer – 10ms cycle.

4.5 Conversion error

With current target board (VREF (+) = VDD, AVREF (-) = VSS), the typical value of overall error of A-D conversion is 1.2 LSB (r01ds0053ej0100_rl78g14.pdf, page 90).

- Investigate the affection of overall error.
- Apply error to calculate input voltage.

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