Programming of Embedded Systems

Laboratory work No.2

Digital to Analog (DAC) / Analog to Digital Converter (ADC)

1st Example

```
# main.py -- put your code here!
from pyb import DAC
import time


# create DAC 1 on pin D24
dac = DAC(1)
# write a value to the DAC (makes D24 0V)
dac.write(0);

while True:
    #makes D24 from 0V to 3.3V increase step 0.065V (5/255*3.3) each 100ms
    for x in range(0, 255, 5):
        dac.write(x);
        time.sleep_ms(100);
```

2nd Example

```
# main.py -- put your code here!
from pyb import DAC
from machine import Pin
from machine import ADC
import time

# create DAC 1 on pin D24
dac = DAC(1)
# write a value to the DAC (makes D24 1.65V)
dac.write(128);

# create an analog input pin on pin #A0
A0 = Pin("A0", Pin.ANALOG)
adc = ADC(A0)

#D24 is connected to A0 via wire
while True:
    val = adc.read_u16()
    #print value in 16 bit ADC range
    print (val)
    #print value in Volts
    print (val*(3.3/65536),"V")
    time.sleep_ms(1000);
```

Individual task:

Microcontroller: STM32F756ZG
Board: Nucleo F756ZG
Compiler: MicroPhyton

Generate an Analog output on D13 (DAC2). Use a button SW to change the output voltage (start with any initial voltage and select any decrease or increase step on button press). Generated output is connected to a given ADC pin. Read the analog value from ADC pin and convert to a given sensor measuring range and output to terminal.

Table 1

No.	ADC pin	AO sensor type	Measuring range
1	A1	Humidity, %	10 ÷ 90
2	A2	CO2, ppm	0 ÷ 2000
3	A3	Temperature, ^{O}C	-35 ÷ 60
4	A4	Air flow, m3/h	0 ÷ 1000
5	A5	Humidity, %	20 ÷ 80
6	D11	CO2, ppm	0 ÷ 1000
7	D12	Temperature, ^{O}C	-25 ÷ 50
8	D24	Air flow, m3/h	0 ÷ 5000
9	D24	Humidity, %	0 ÷ 100
10	D12	CO2, ppm	0 ÷ 500
11	D11	Temperature, ^{O}C	0 ÷ 50
12	A5	Air flow, m3/h	0 ÷ 3000
13	A4	Humidity, %	20 ÷ 100
14	A3	CO2, ppm	0 ÷ 1500
15	A2	Temperature, ^{O}C	-5 ÷ 35
16	A1	Air flow, m3/h	0 ÷ 2000
17	A1	Humidity, %	0 ÷ 80
18	A2	CO2, ppm	100 ÷ 2000
19	A3	Temperature, ^{O}C	-15 ÷ 55
20	A4	Air flow, m3/h	0-1000

21	A5	Humidity, %	10 ÷ 90
22	D11	CO2, ppm	100 ÷ 1000
23	D12	Temperature, ^{O}C	-5 ÷ 40
24	D24	Air flow, m3/h	0-7000
25	D24	Humidity, %	30 ÷ 70
26	D12	CO2, ppm	200 ÷ 1500
27	D11	Temperature, ^{O}C	-20 ÷ 40
28	A5	Air flow, m3/h	0-6000
29	A4	Humidity, %	30 ÷ 80
30	A3	CO2, ppm	100 ÷ 1000

Report:

1. The aim of the laboratory work.
2. Variant No and data.
3. Program algorithm.
4. Program body with comments.
5. Conclusions.