Mastering Embedded System Online Diploma

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First Term (Final Project 1)

High Pressure Detection

Eng. Ahmed Nasser Ahmed

My Profile:

ahna06588-learn-in-depth.com

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1. Intro

High pressure detection project used in planes to inform and warn crew of cabin when pressure is increasing above threshold value of it. It's simple project aims to learn how to design and analysis embedded system projects .

2. Specs

- Informs Crew of a cabin with an alarm when pressure is greater than or equal to threshold value(20bar).
- the alarm duration equal 60 sec.
- store all pressure values in external EEPROM.
- EEPROM data is taken after every flight and store in excel file.

3. Assumptions

We assume that :

- System never faces power problems.
- Set up and Shutdown producers are not modeled.
- Maintenance is not modeled.
- Pressure Sensor never fails.

- alarm(LED) never fails.

4. Versioning

The project will consist of two versions:

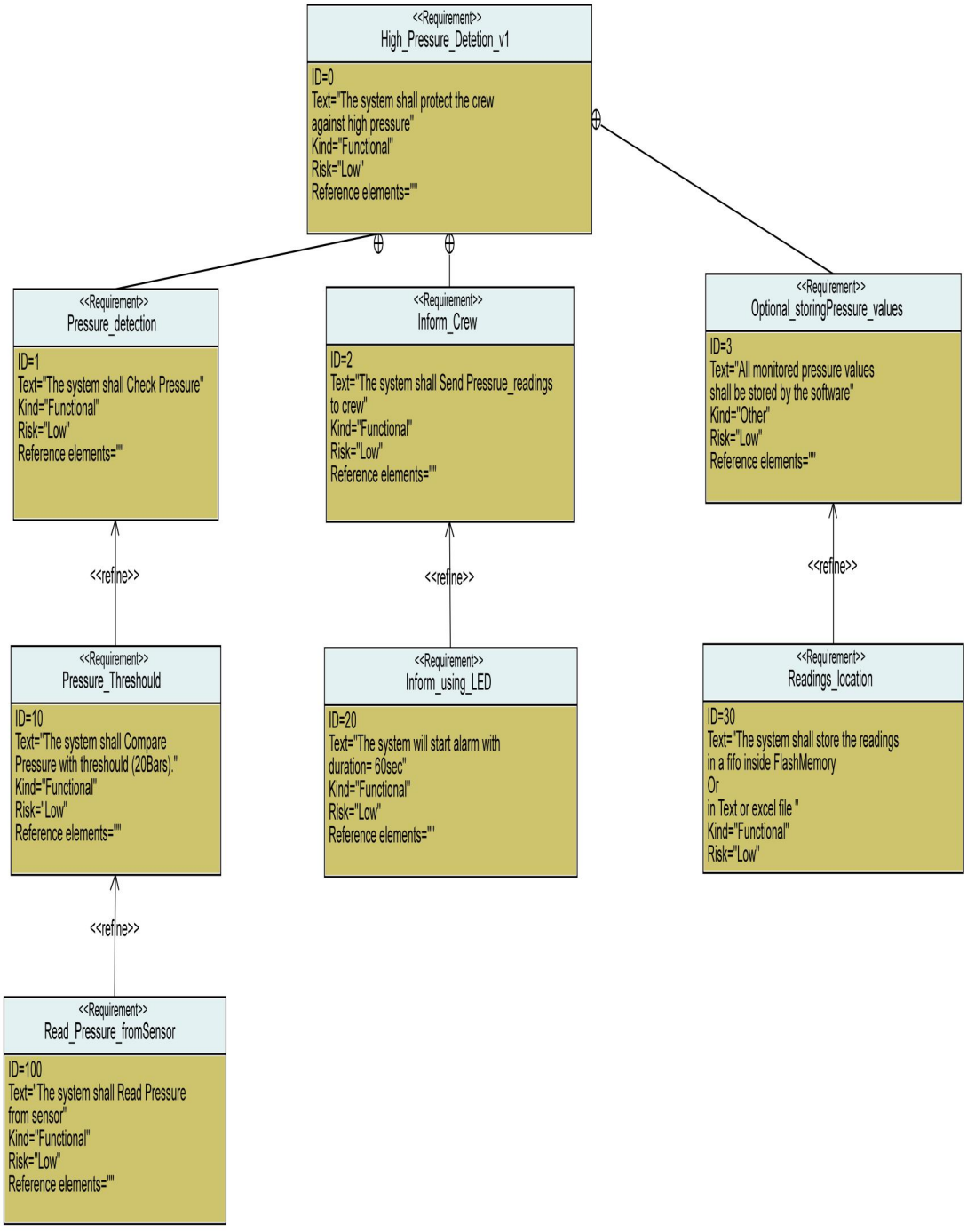
Version 1: Store Pressure Values in EEPROM is not Modeled.

Version 2: Store Pressure Values in EEPROM will be Modeled and save data in excel file .

5. Method

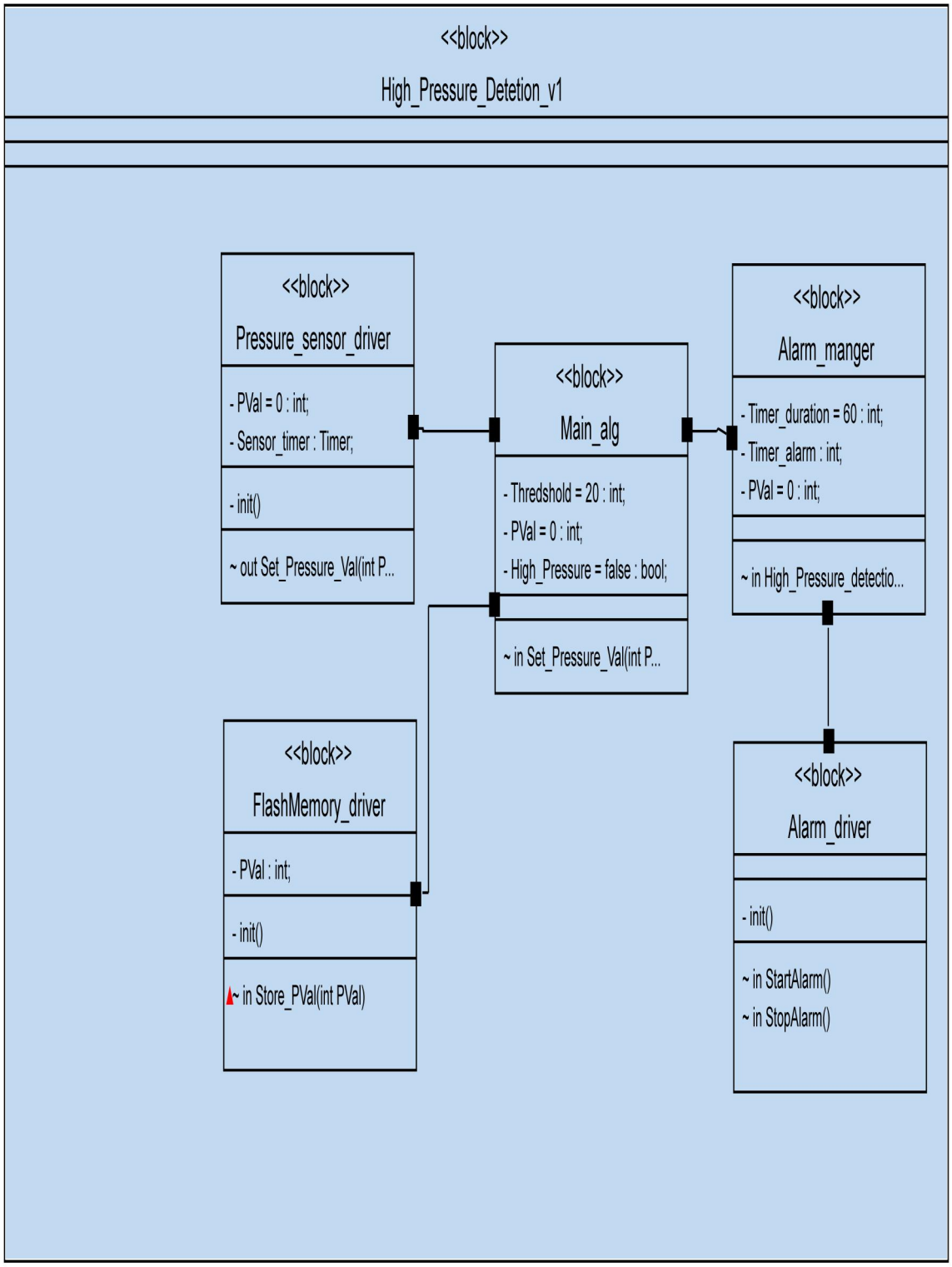
Use agile scrum methodology.

6. Requirements

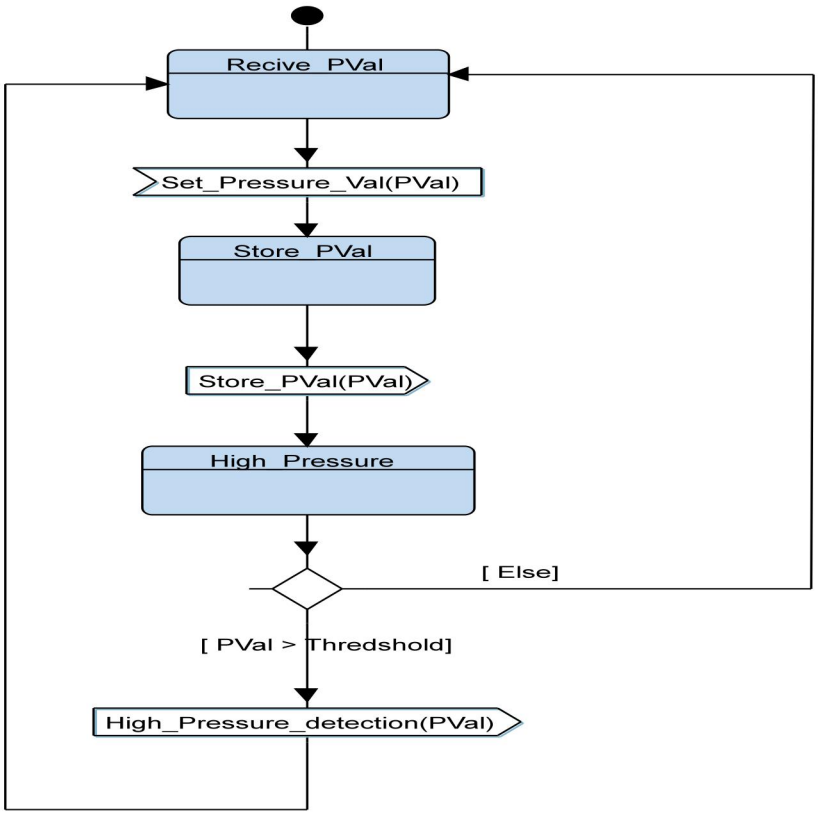


7. System Design

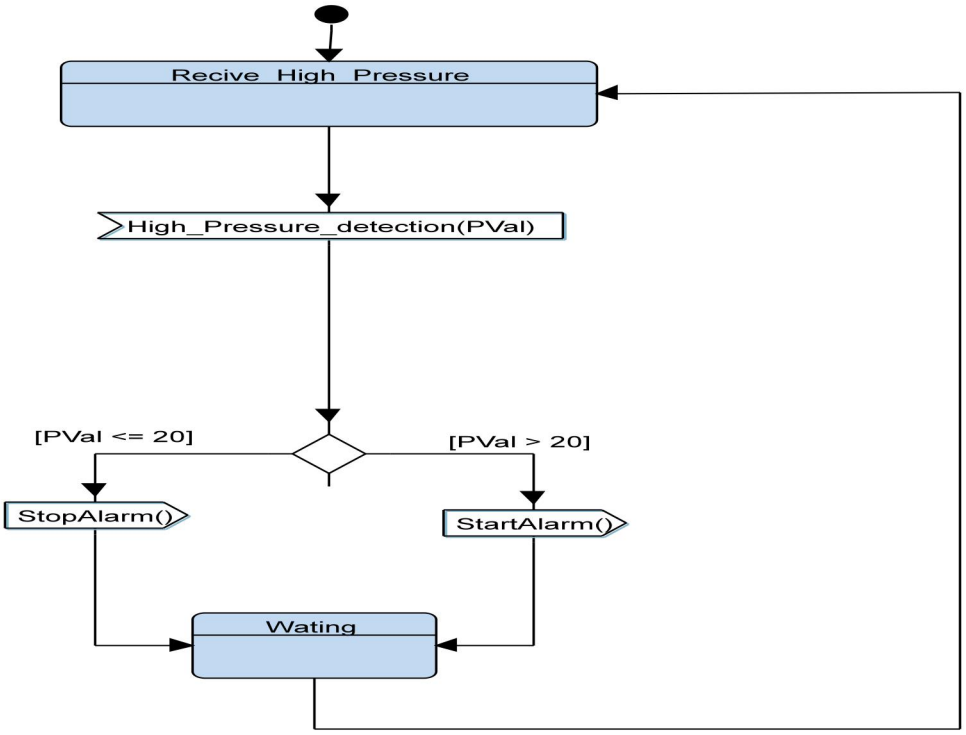
a) Block Diagram



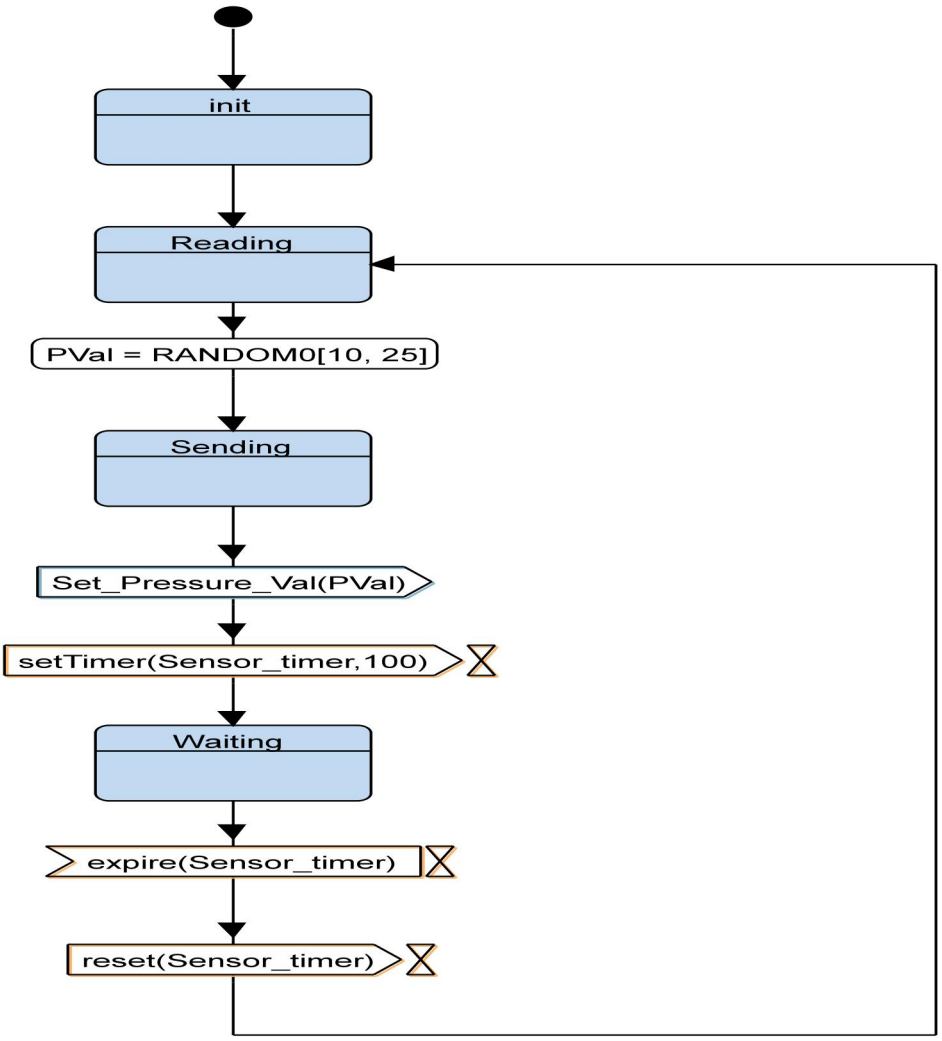
b) Main algorithm



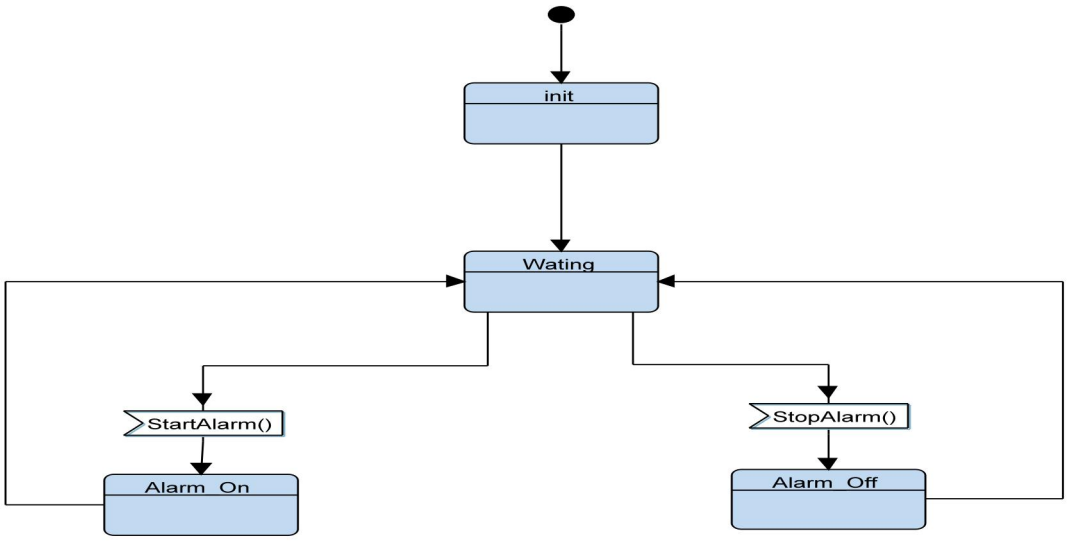
c) Alarm Manager



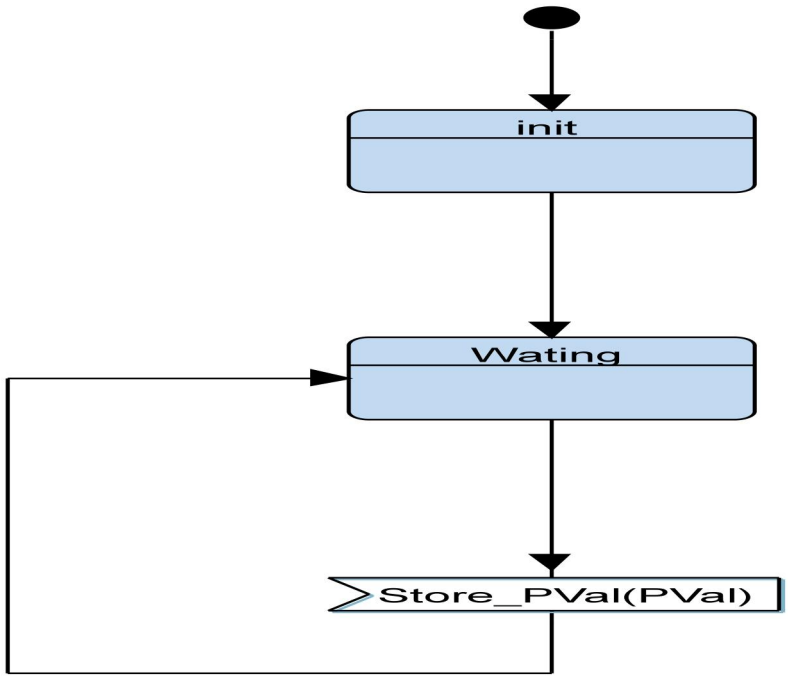
d) Pressure sensor driver



e) Alarm Driver

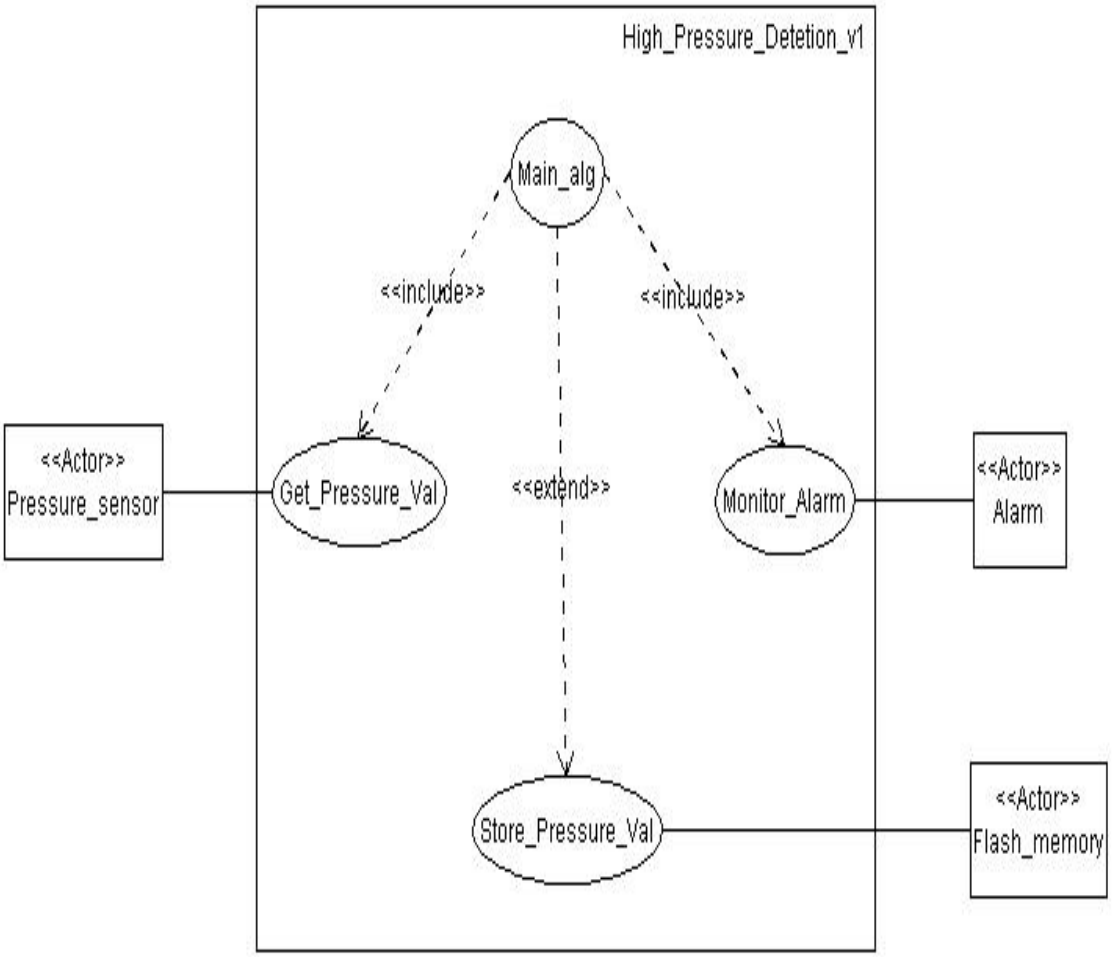


f)Flash Memory driver

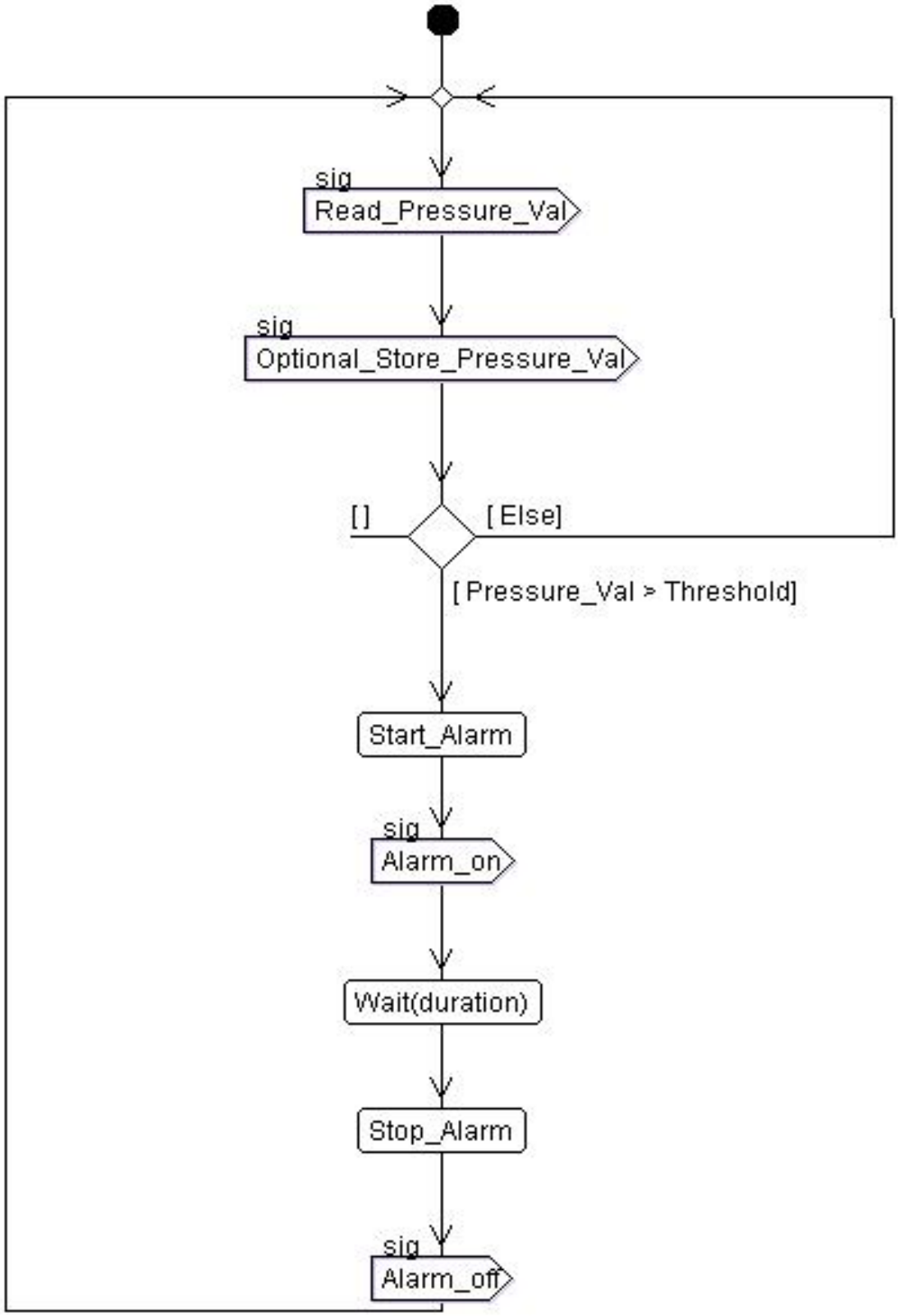


8. System Analysis

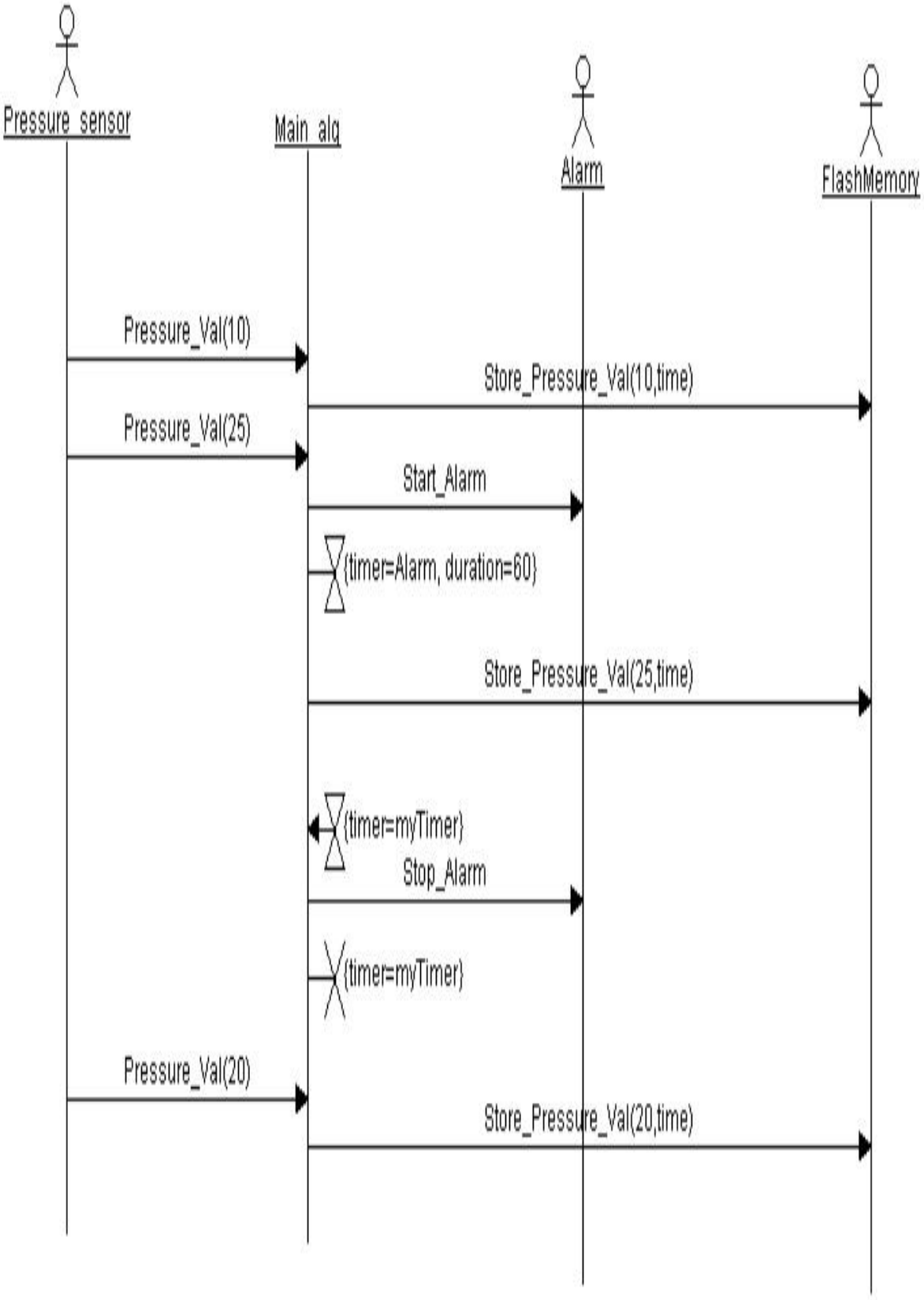
a) Use case Diagram



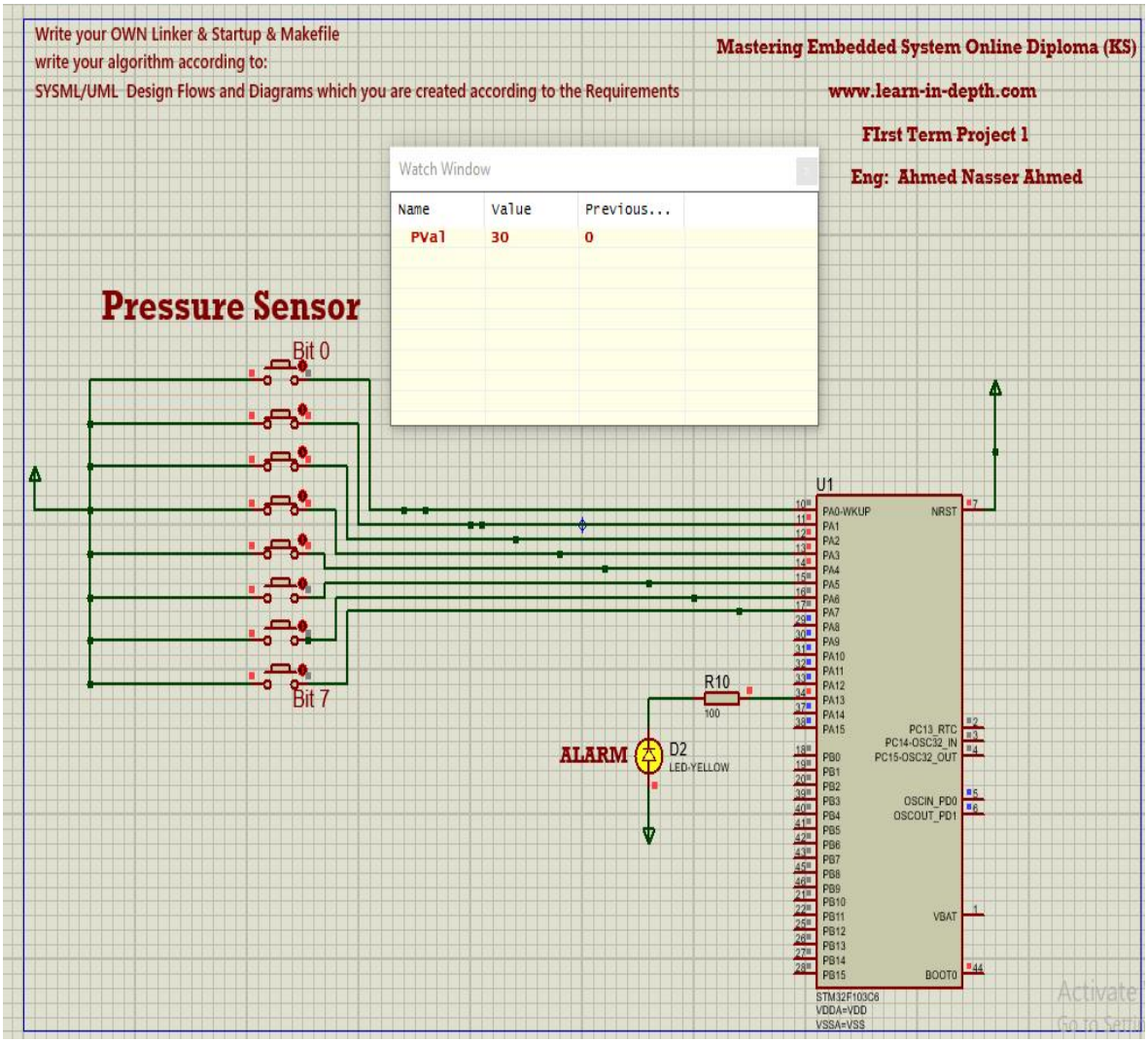
b) Activity Diagram



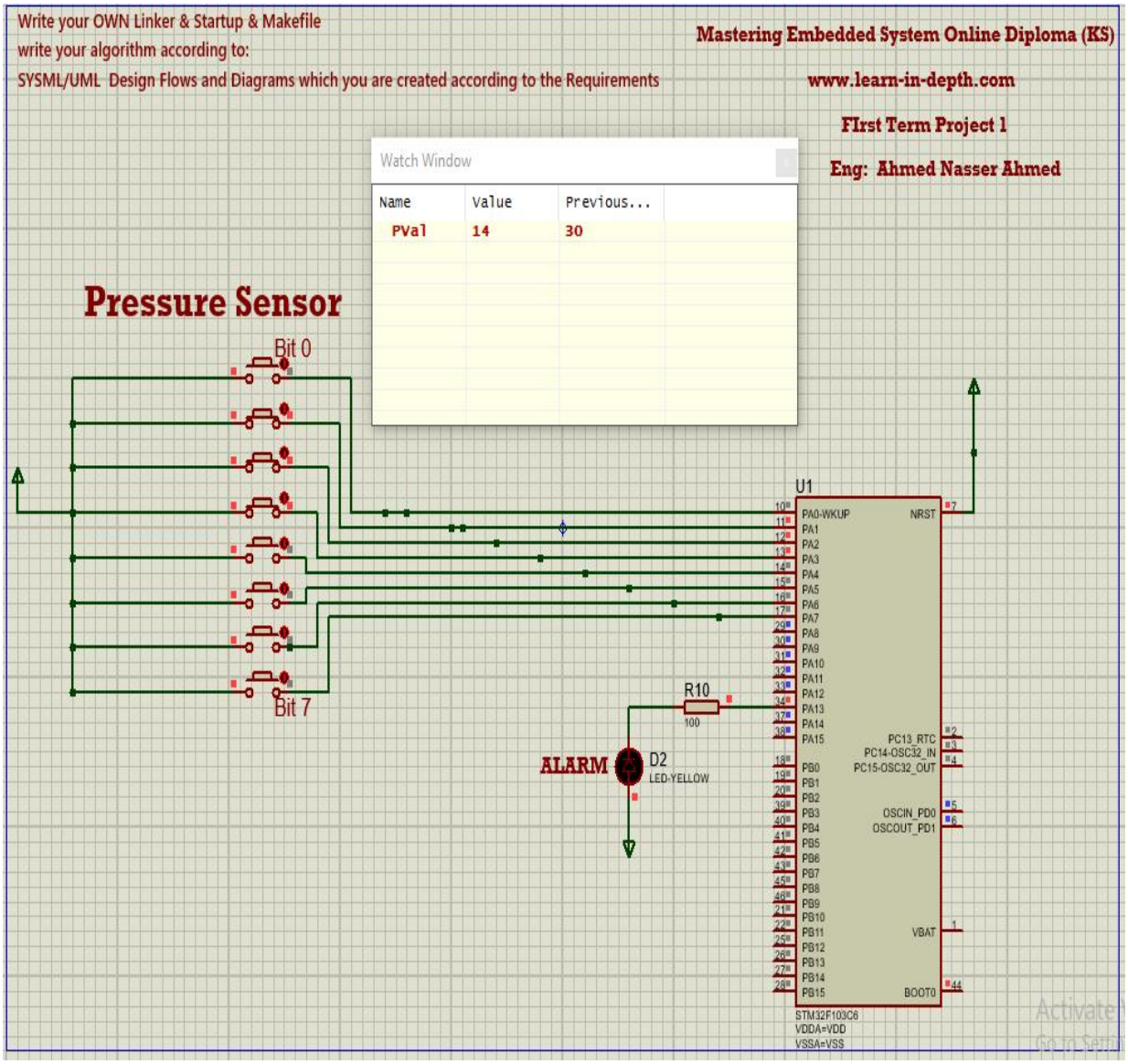
c) Sequence Diagram



9. Results



As show value of pressure is 30 (>20-threshold) so the alarm starts (Led is ON).



The value become 14 which is less than threshold so the alarm stops (Led is OFF).

10. Code analysis

A) Symbol table

```
Ahmed Nasser@DESKTOP-VDBO14G MINGW64 /f/work_space/learn_in_depth/Term1_Projects
/Term1_Project1/Pressure_detector/Code (main)
$ arm-none-eabi-nm.exe HighPressureDetection.elf
20000000 B _E_bss
20000000 T _E_data
080002d8 T _E_text
20000000 B _S_bss
20000000 T _S_data
20001000 B _stack_top
08000050 T Alarm_init
0800005c T Alarm_start
0800006c T Alarm_stop
0800021c W Bus_Fault_Handler
0800021c W Debug_MOnitor_Handler
0800021c T Default_Handler
080000b4 T Delay
0800021c W EXTI0_Handler
0800021c W EXTI1_Handler
0800021c W EXTI2_Handler
0800021c W FLASH_Handler
080000d8 T Get_Pressure_Val
0800014c T GPIO_INITIALIZATION
0800021c W H_Fault_Handler
0800007c T High_pressure_detection
080001c8 T main
0800021c W MM_Fault_Handler
0800021c W NMI_Handler
0800021c W PendSV_Handler
080001f8 T Pressure_sensor_init
08000204 T Pressure_sensor_reading
20001000 B PVal
0800021c W PVD_Handler
0800021c W RCC_Handler
08000228 T Reset_Handler
0800021c W RTC_Handler
080000fc T Set_Alarm_actuator
0800021c W SVCall_Handler
0800021c W SYS_Tick_Handler
0800021c W TAMPER_Handler
0800021c W Usage_Fault_Handler
08000000 T vectors
0800021c W WWDG_Handler
```

B) Sections in obj file

```
Ahmed Nasser@DESKTOP-VDBO14G MINGW64 /f/work_space/learn_in_depth/Term1_Projects/Term1_Project1/Pressure_det
$ arm-none-eabi-objdump.exe -h HighPressureDetection.elf

HighPressureDetection.elf:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         000002d8  08000000  08000000  00008000  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .bss          00001004  20000000  080002d8  00010000  2**2
                  ALLOC
  2 .debug_info   0000054b  00000000  00000000  000082d8  2**0
                  CONTENTS, READONLY, DEBUGGING
  3 .debug_abbrev 0000031b  00000000  00000000  00008823  2**0
                  CONTENTS, READONLY, DEBUGGING
  4 .debug_loc    00000284  00000000  00000000  00008b3e  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_aranges 000000e0  00000000  00000000  00008dc2  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_line   0000025a  00000000  00000000  00008ea2  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_str    00000253  00000000  00000000  000090fc  2**0
                  CONTENTS, READONLY, DEBUGGING
  8 .comment      00000011  00000000  00000000  0000934f  2**0
                  CONTENTS, READONLY
  9 .ARM.attributes 00000033  00000000  00000000  00009360  2**0
                  CONTENTS, READONLY
 10 .debug_frame  000001dc  00000000  00000000  00009394  2**2
                  CONTENTS, READONLY, DEBUGGING
```

11. Problems

I face a problem in using pull-up or pull-down with buttons , the IDR register always Zero. I try to overcome on it by :

- increasing the value of the voltage but doesn’t work.
- connect buttons directly and it finally works.

12. Repo link

https://github.com/AhmedNasser38/learn_in_depth/tree/main/Unit5_Term1_Projects/P1_HighPressure_detection

13. Google Drive link

https://drive.google.com/drive/folders/1e3cM27GguG4JdJFdrHY_--NWF9PL1j9E?usp=sharing