" Mastering Embedded System Online Diploma "

" First Term (High Presuure Detection) "

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My Profile : https://www.learn-in-depth-store.com/profile/a-sabra44473878/profile

1. Case Study :

The client expects the delivery of the software of the following system:

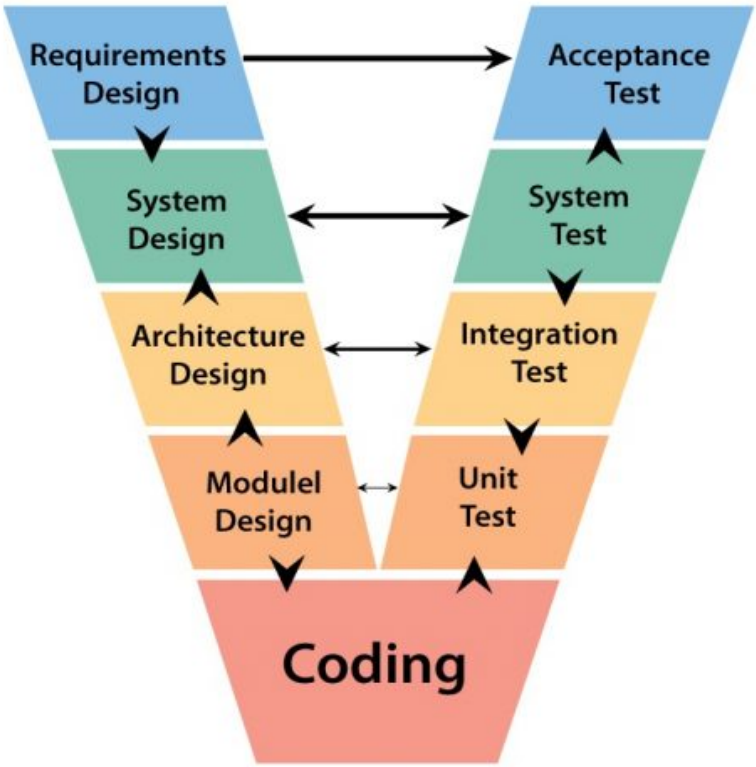
- **A pressure detection system that informs the crew of a cabin with an alarm when the pressure exceeds 20 bars in the cabin.**
- **The alarm duration equals 60 seconds.**

Assumptions :

- **The controller setup and shut down procedures are not modeled.**
- **The controller maintenance is not modeled.**
- **The pressure sensor never fails.**
- **The alarm never fails.**
- **The controller never faces power cut.**

2. Methiod :

The chosen method in designing and implementing this system is the V-model method.



3. Space exploration and hardware / software partitioning :

- **Hardware :**

  Controller: STM32F103C6.

  Alarm: LED.

  Sensor: Pressure sensor.

- **Software :**

  Pressure sensor driver.

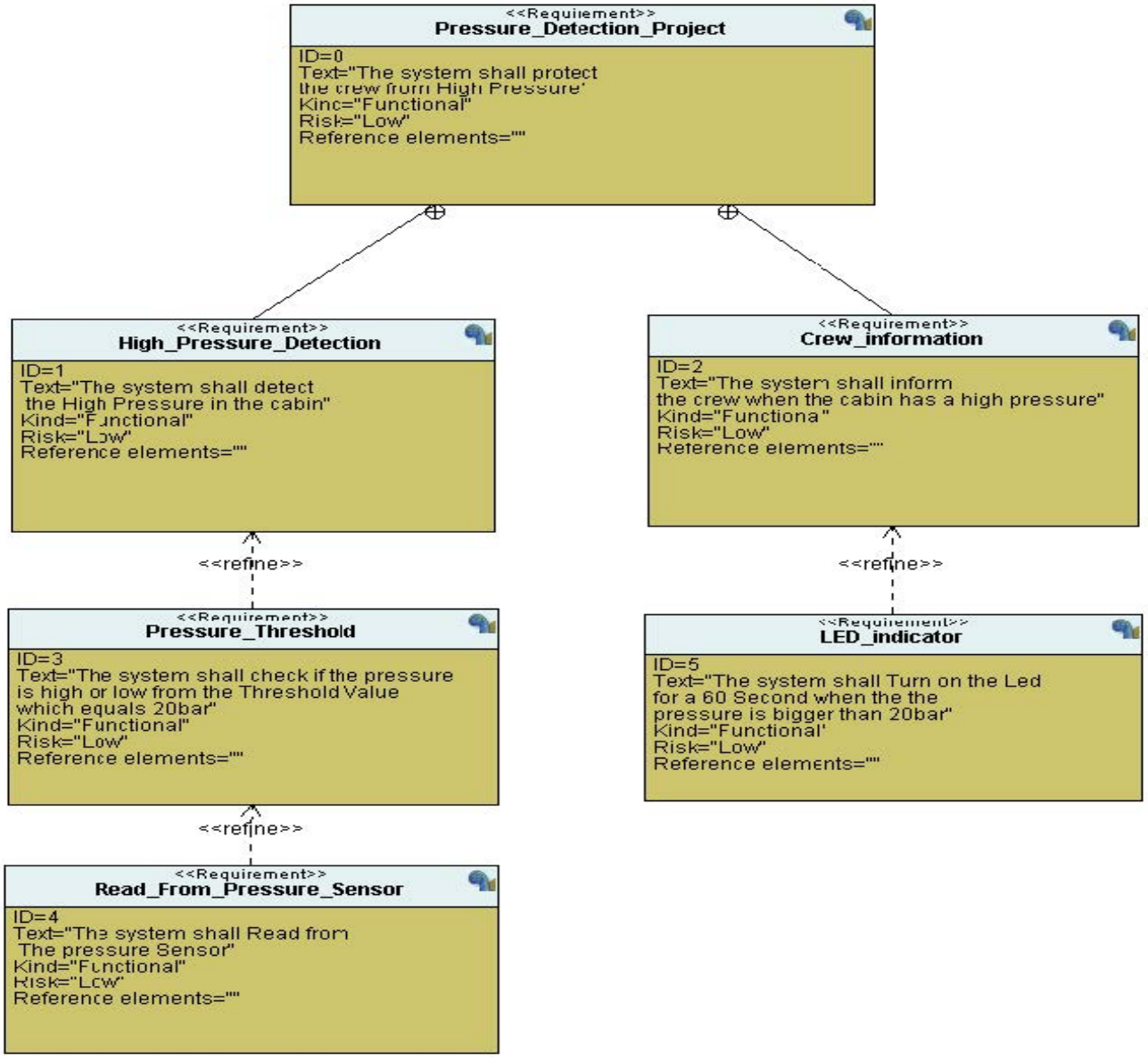
  Main algorithm.

  Alarm monitor.

  Alarm actuator driver.

4. Requirement :

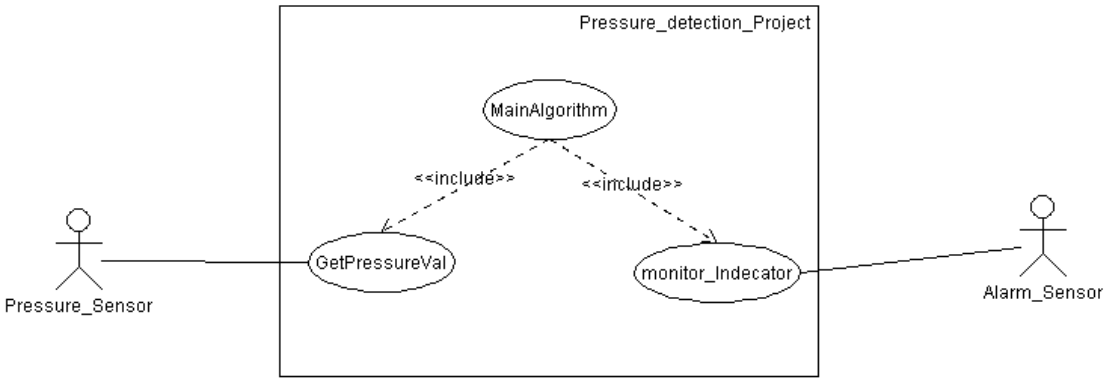
After talking with the customer, I got the requirements of this project and then I show the requirements diagram to the customer to ensure its right or not.



5. System Analysis :

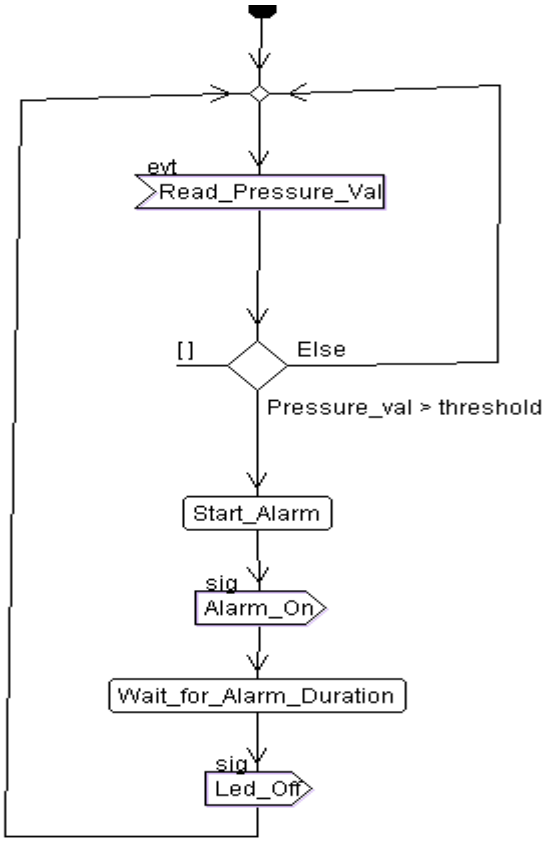
Use Case Digram ::

System boundary and main functions. Not describe step by step algorithm.



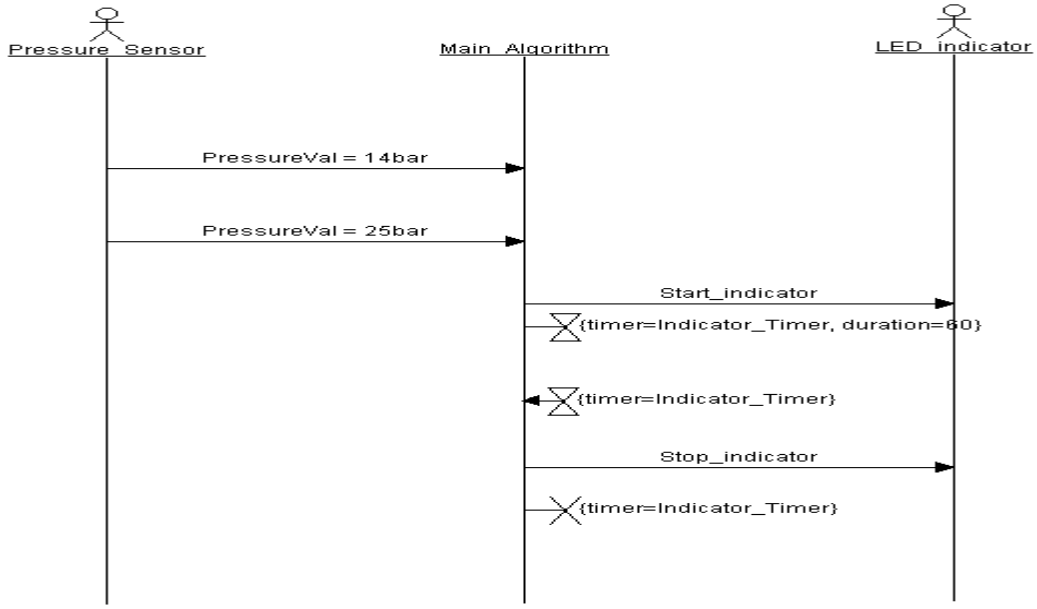
Activity Digram :

Describe the workflow behavior of a system.

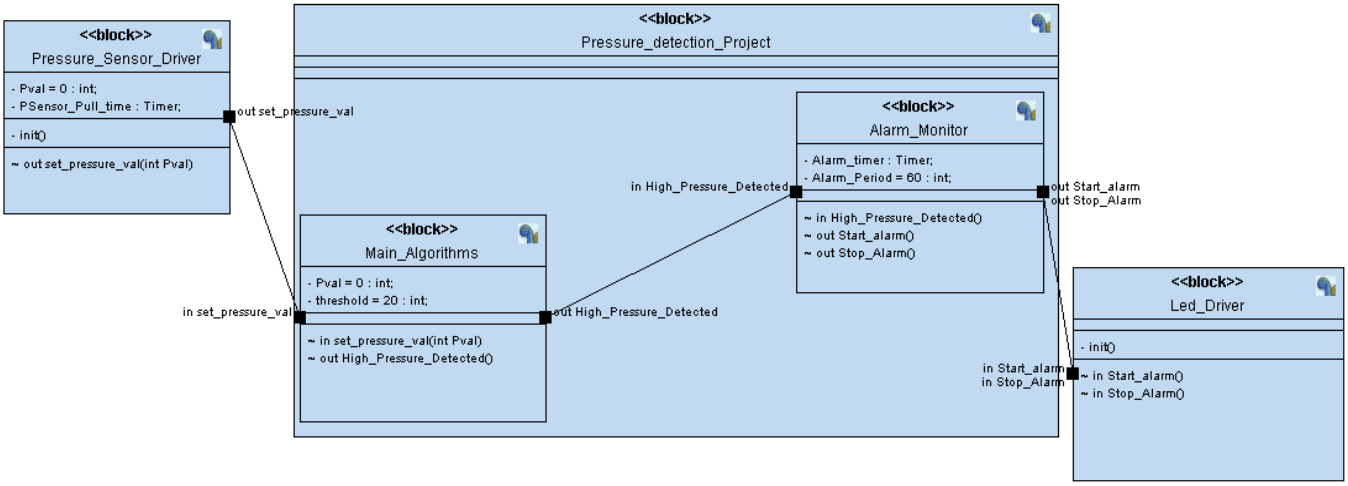


Sequence Diagram

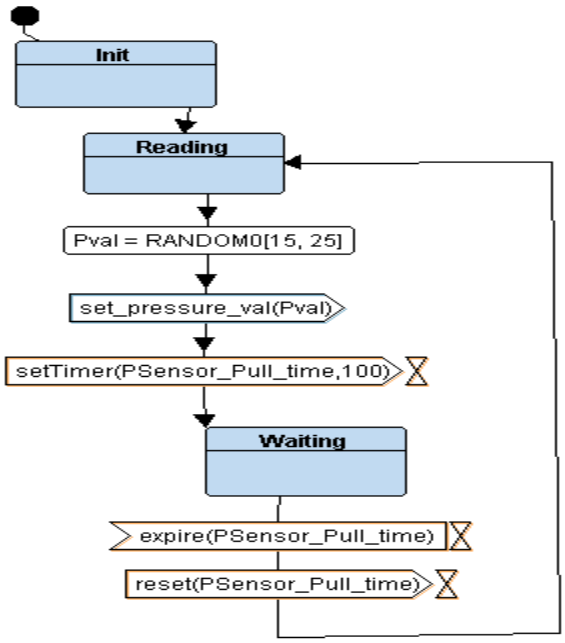
If Pressure Value is bigger than 20bar the indicator will start and wait for 60 seconds.



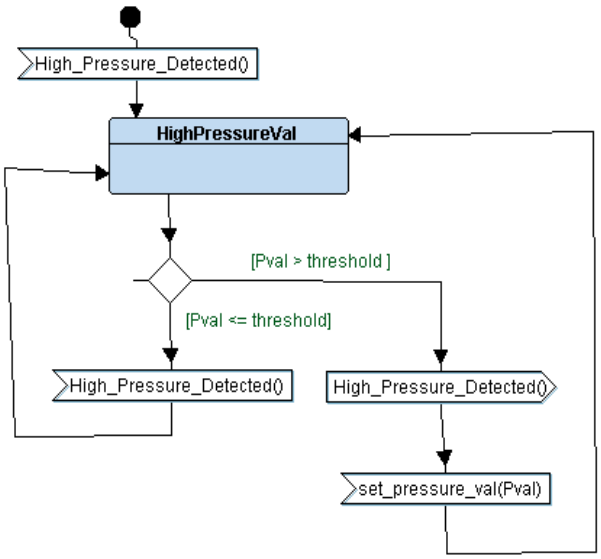
System Design



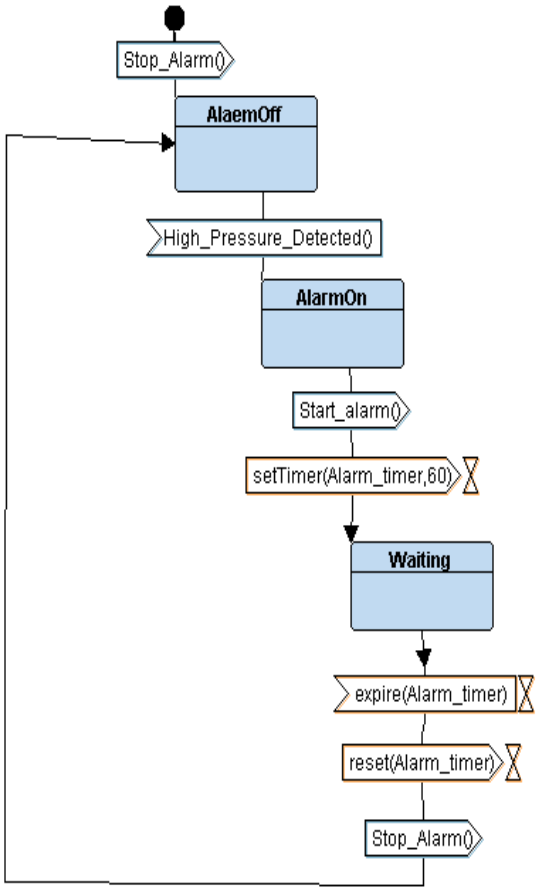
Pressure Sensor Block



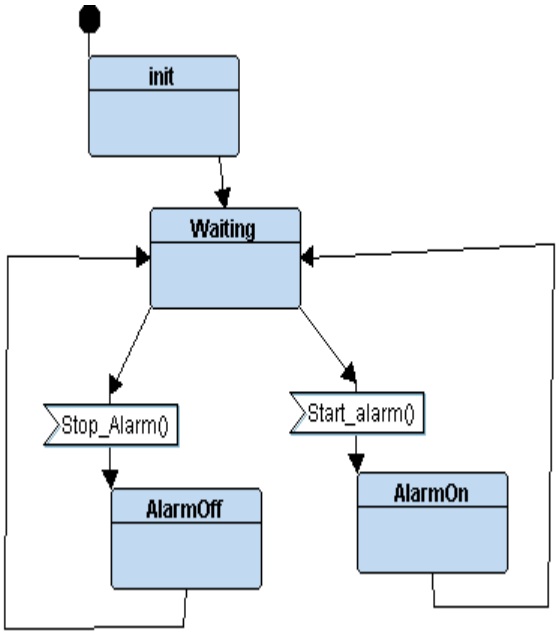
* Main Algorithms



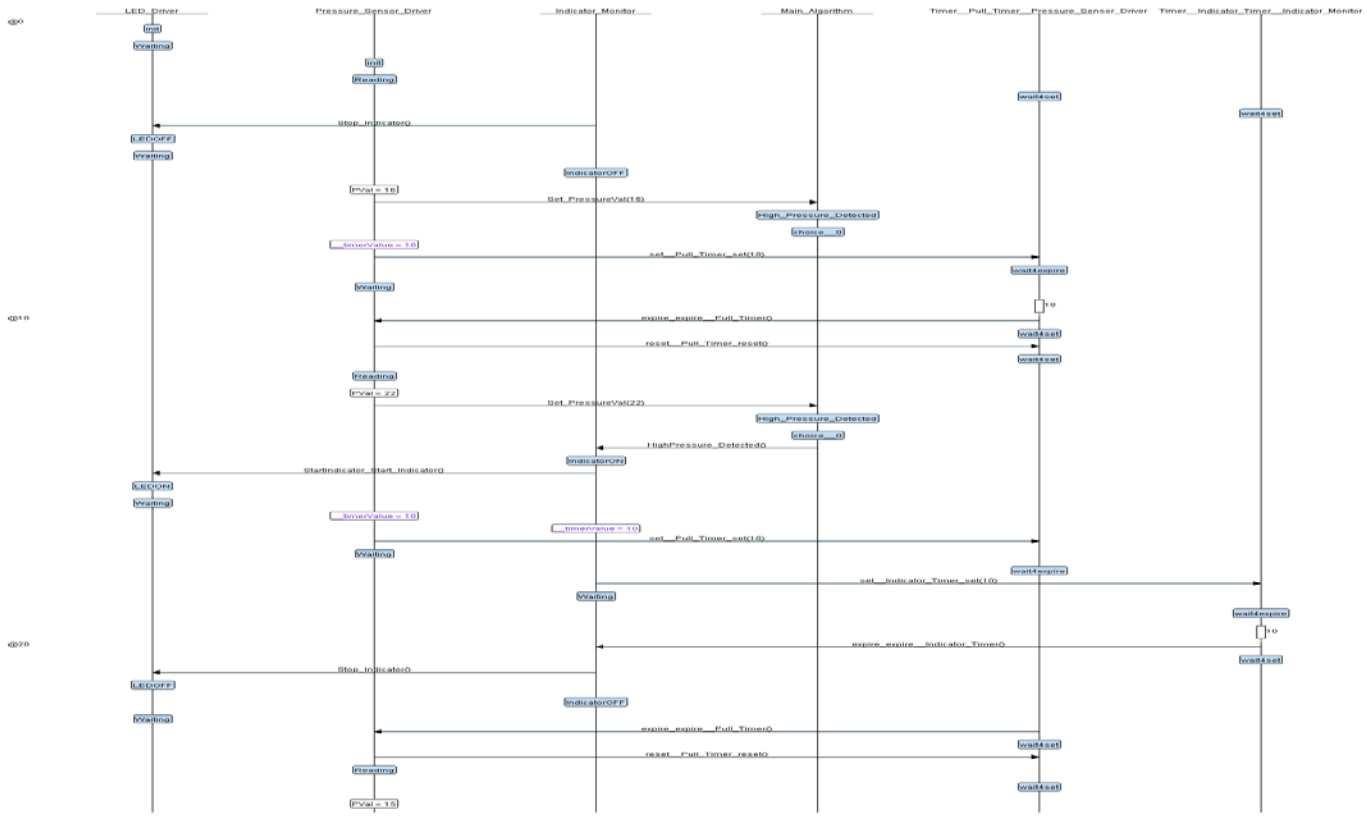
Alarm Monitor



* Led Driver



Analysis and Timing Diagram

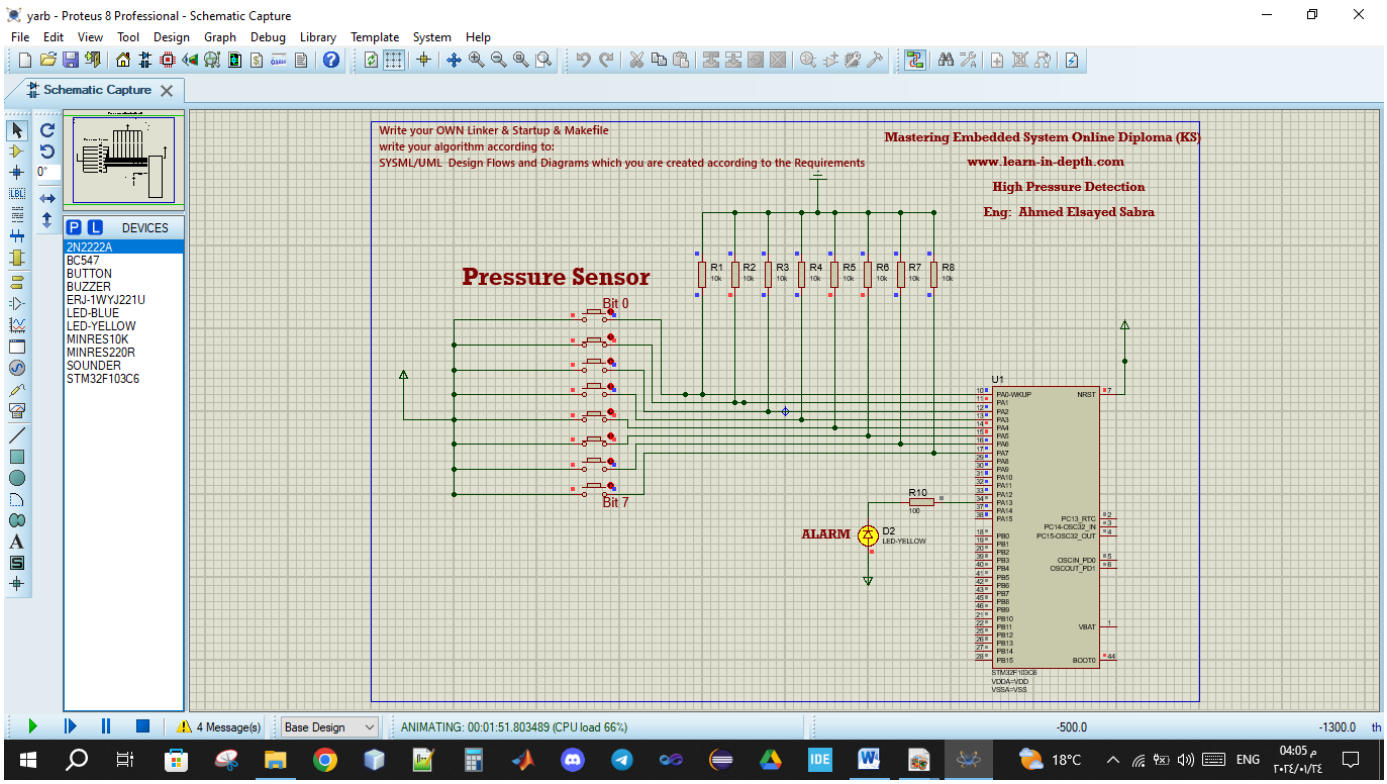


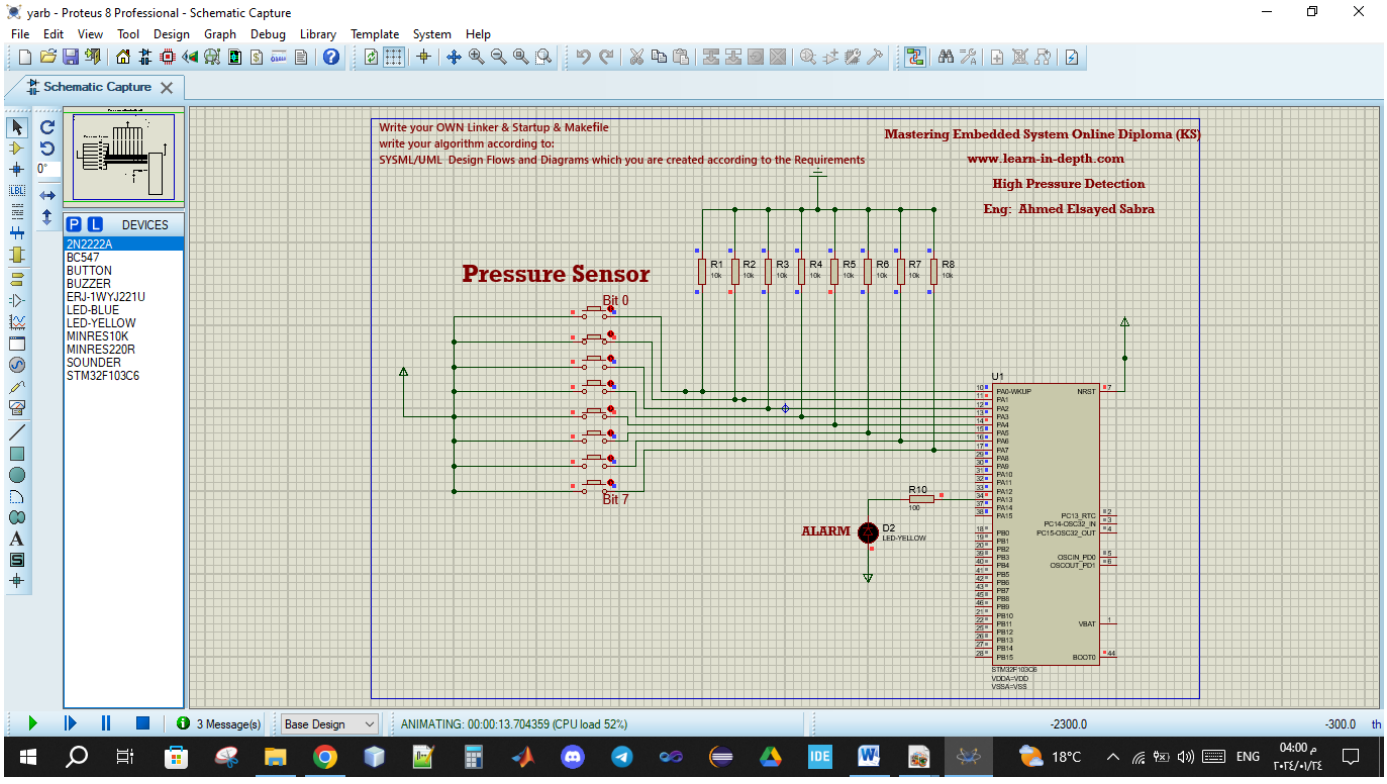
"Build Project By Make File "

```
A7MED@DESKTOP-UM04P0I MINGW32 /d/diploma/Master Embedded System Diploma Codes/Ma
ster_Embedded_Systems/03. Final Projects/First Project- High Pressure Detection
(main)
$ make
arm-none-eabi-gcc.exe -c -mcpu=cortex-m3 -mthumb -gdwarf-2 -I . -std=c99  Alarm_Monitor.c -o Alarm_Monitor.o
arm-none-eabi-gcc.exe -c -mcpu=cortex-m3 -mthumb -gdwarf-2 -I . -std=c99  Led_Driver.c -o Led_Driver.o
arm-none-eabi-gcc.exe -c -mcpu=cortex-m3 -mthumb -gdwarf-2 -I . -std=c99  Main_Algorithm.c -o Main_Algorithm.o
arm-none-eabi-gcc.exe -c -mcpu=cortex-m3 -mthumb -gdwarf-2 -I . -std=c99  Pressure_Sensor_Driver.c -o Pressure_Sensor_Driv
arm-none-eabi-gcc.exe -c -mcpu=cortex-m3 -mthumb -gdwarf-2 -I . -std=c99  driver.c -o driver.o
arm-none-eabi-gcc.exe -c -mcpu=cortex-m3 -mthumb -gdwarf-2 -I . -std=c99  main.c -o main.o
arm-none-eabi-gcc.exe -c -mcpu=cortex-m3 -mthumb -gdwarf-2 -I . -std=c99  startup.c -o startup.o
arm-none-eabi-ld.exe -T  linker_script.ld  Alarm_Monitor.o Led_Driver.o Main_Algorithm.o Pressure_Sensor_Driver.o driver.o
Pressure_Detection.elf -Map=map_file.map
arm-none-eabi-objdump.exe -D main.o > log.txt
arm-none-eabi-objcopy.exe -O binary High_Pressure_Detection.elf  High_Pressure_Detection.bin
======== Build Is Done ========

A7MED@DESKTOP-UM04P0I MINGW32 /d/diploma/Master Embedded System Diploma Codes/Master_Embedded_Systems/03. Final Projects/F
 Detection (main)
$ make clean_all
rm *.o *.elf *.bin *.map
======== Every thing Is Deleted ========
```

```
A7MED@DESKTOP-UM04P0I MINGW32 /d/diploma/Master Embedded System Diploma Codes/Master_Embedded_Systems/03. Final Projects/F
irst Project- High Pressure Detection (main)
$ ls *.c
Alarm_Monitor.c  driver.c  Led_Driver.c  main.c  Main_Algorithm.c  Pressure_Sensor_Driver.c  startup.c

A7MED@DESKTOP-UM04P0I MINGW32 /d/diploma/Master Embedded System Diploma Codes/Master_Embedded_Systems/03. Final Projects/F
irst Project- High Pressure Detection (main)
$ ls *.h
Alarm_Monitor.h  driver.h  Led_Driver.h  Main_Algorithm.h  Platform_Type.h  Pressure_Sensor_Driver.h  State.h

A7MED@DESKTOP-UM04P0I MINGW32 /d/diploma/Master Embedded System Diploma Codes/Master_Embedded_Systems/03. Final Projects/F
irst Project- High Pressure Detection (main)
$ ls *.o
Alarm_Monitor.o  driver.o  Led_Driver.o  main.o  Main_Algorithm.o  Pressure_Sensor_Driver.o  startup.o
```

“ Simulation Project By Proteus ”





“Analysis Software - Data Section foe System && Showing All Symbol ”

MINGW32:/d/diploma/Master Embedded System Diploma Codes/Master_Embedded_Systems/03. Final Projects/First Project- High Pressure Detection

```
A7MED@DESKTOP-UM04P0I MINGW32 /d/diploma/Master Embedded System Diploma Codes/Master_Embedded_Systems/03. Final Projects/First Project- High Pressure Detection (main)
$ arm-none-eabi-nm.exe High_Pressure_Detection.elf
20000008 B _E_BSS
20000004 D _E_DATA
080004f0 T _E_text
20000004 B _S_BSS
20000000 D _S_DATA
20001008 B _Stack_top
0800004c T Alarm_Monitor_init
20001008 B Alarm_Monitor_State
20000000 D alarm_Period
080004e0 W Bus_Fault_Handler
080004e0 W Debug_reserved_Handler
080004e0 T Default_Handler
08000288 T Delay
080002ac T getPressureVal
08000314 T GPIO_INITIALIZATION
080004e0 W Hard_Fault_Handler
08000058 T High_Pressure_Detected
080004e0 W IRQ0_Handler
080004e0 W IRQ1_Handler
080004e0 W IRQ2_Handler
080000f4 T Led_Driver_init
20001010 B Led_Driver_State
080003f0 T main
20001018 B Main_Algorithm_State
20000004 B main_Pressure_Sensor_Value
080004e0 W MM_Fault_Handler
080004e0 W NMI_Handler
2000100c B P_Func_Alarm_Monitor
20001014 B P_Func_Led_Driver
2000101c B P_Func_Main_Algorithm_State
20001028 B P_Func_Pressure_Sensor
080004e0 W Pendsv_Handler
08000200 T Pressure_Sensor_Init
20001024 B Pressure_Sensor_State
20001020 B Pressure_Sensor_Value
```

```
080004e0 W RESERVED0_Handler
080004e0 W RESERVED1_Handler
080004e0 W RESERVED2_Handler
080004e0 W RESERVED3_Handler
080004e0 W RESERVED4_Handler
08000430 T Reset_Handler
080002c4 T Set_Alarm_actuator
08000178 T Set_Pressure_Val
08000394 T Set_Up
080000b0 T ST_Alarm_Monitor_Off
08000074 T ST_Alarm_Monitor_On
080000c8 T ST_Alarm_Monitor_Waiting
08000160 T ST_Led_Driver_Waiting
080001a8 T ST_Main_High_Pressure_Detected
0800020c T ST_Pressure_Sensor_Reading
0800025c T ST_Pressure_Sensor_Waiting
08000100 T Start_Alarm
08000130 T Stop_Alarm
080004e0 W Sv_Call_Handler
080004e0 W SysTick_Handler
080004ec T Threshold
080004e0 W Usage_fault_Handler
08000000 T vectors
```

```
A7MED@DESKTOP-UM04P0I MINGW32 /d/diploma/Master Embedded System Diploma Codes/Master_Embedded_Systems/03. Final Projects/First Project- High Pressure Detection (main)
$ arm-none-eabi-objdump.exe -h High_Pressure_Detection.elf

High_Pressure_Detection.elf:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         000004f0  08000000  08000000  00008000  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .data         00000004  20000000  080004f0  00010000  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00001028  20000004  080004f4  00010004  2**2
                  ALLOC
  3 .debug_info   0000095b  00000000  00000000  00010004  2**0
                  CONTENTS, READONLY, DEBUGGING
  4 .debug_abbrev 00000505  00000000  00000000  0001095f  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    000003f8  00000000  00000000  00010e64  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 000000e0  00000000  00000000  0001125c  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_line   00000390  00000000  00000000  0001133c  2**0
                  CONTENTS, READONLY, DEBUGGING
  8 .debug_str    00000426  00000000  00000000  000116cc  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      00000011  00000000  00000000  00011af2  2**0
                  CONTENTS, READONLY
 10 .ARM.attributes 00000033  00000000  00000000  00011b03  2**0
                  CONTENTS, READONLY
 11 .debug_frame  000002c4  00000000  00000000  00011b38  2**2
```

-gdwarf-2

"Analysis Map File "

D:\diploma\Master Embedded System Diploma Codes\Master_Embedded_Systems\03. Final Projects\First Project- High Pressure Detection\map_file.map - Notepad++

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

makefile | linker_script.ld | main.c | Platform_Type.h | startup.c | main.c | startup.c | CortexM4_linker_script.ld | map_file.map

```
10  Main_Algorithm_State
11                      0x1             Main_Algorithm.o
12  Pressure_Sensor_State
13                      0x1             Pressure_Sensor_Driver.o
14  P_Func_Alarm_Monitor
15                      0x4             Alarm_Monitor.o
16  Led_Driver_State    0x1             Alarm_Monitor.o
17  P_Func_Pressure_Sensor
18                      0x4             Pressure_Sensor_Driver.o
19  P_Func_Main_Algorithm_State
20                      0x4             Main_Algorithm.o
21
22  Memory Configuration
23
24  Name             Origin             Length             Attributes
25  flash            0x08000000         0x00020000         xr
26  sram             0x20000000         0x00005000         xrw
27  *default*        0x00000000         0xffffffff
28
29  Linker script and memory map
30
31
32  .text            0x08000000       0x4f0
33   *(.vectors*)
34   .vectors        0x08000000        0x4c startup.o
35                   0x08000000                vectors
```

Common symbol

Normal text file | length : 11,818 lines : 265 | Ln : 1 Col : 1 Pos : 1 | Windows (CR LF) | UTF-8 | INS

18°C ENG 04:48

"Log File "

log - Notepad

File Edit Format View Help

```
main.o:     file format elf32-littlearm


Disassembly of section .text:

00000000 <Set_Up>:
   0:   b580            push    {r7, lr}
   2:   af00            add     r7, sp, #0
   4:   f7ff fffe       bl      0 <Led_Driver_init>
   8:   f7ff fffe       bl      0 <Pressure_Sensor_Init>
   c:   f7ff fffe       bl      0 <Alarm_Monitor_init>
  10:   f240 0300       movw    r3, #0
  14:   f2c0 0300       movt    r3, #0
  18:   f240 0200       movw    r2, #0
  1c:   f2c0 0200       movt    r2, #0
  20:   601a            str     r2, [r3, #0]
  22:   f240 0300       movw    r3, #0
  26:   f2c0 0300       movt    r3, #0
  2a:   f240 0200       movw    r2, #0
  2e:   f2c0 0200       movt    r2, #0
  32:   601a            str     r2, [r3, #0]
  34:   f240 0300       movw    r3, #0
  38:   f2c0 0300       movt    r3, #0
  3c:   f240 0200       movw    r2, #0
  40:   f2c0 0200       movt    r2, #0
  44:   601a            str     r2, [r3, #0]
  46:   f240 0300       movw    r3, #0
  4a:   f2c0 0300       movt    r3, #0
```

Ln 1, Col 1 | 100% | Windows (CRLF) | UTF-8

17°C ENG 05:34