Mastering Embedded System Online Diploma

Mark Emad Kadies

First Term (Final Project 1) :

Pressure Detection (Project Report)

Report for:

LEARN-IN-DEPTH DEPLOMA (K.S)

www.learn-in-depth.com

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1) Table of Contents

2) Introduction

a) Case Study

A pressure detector informs the Piot cabin with an alarm whenever the pressure exceeds 20 bars

b) Assumptions

- There are drivers, HAL and ISR to be defined later.
- Pressure Sensor will never fail
- Alarm LED will never fail
- The power will never be off for the controller
- Storing in flash is not implemented, it can be implemented in the second version of project.
- Controller setup and shutdown procedures are not modeled.

c) Lifecycle method

Waterfall model : As the project is not very large, we can use the waterfall model. We can end each stage without returning to it again. We can develop each module separately until finishing it, without looping on code

3) Requirements Diagram

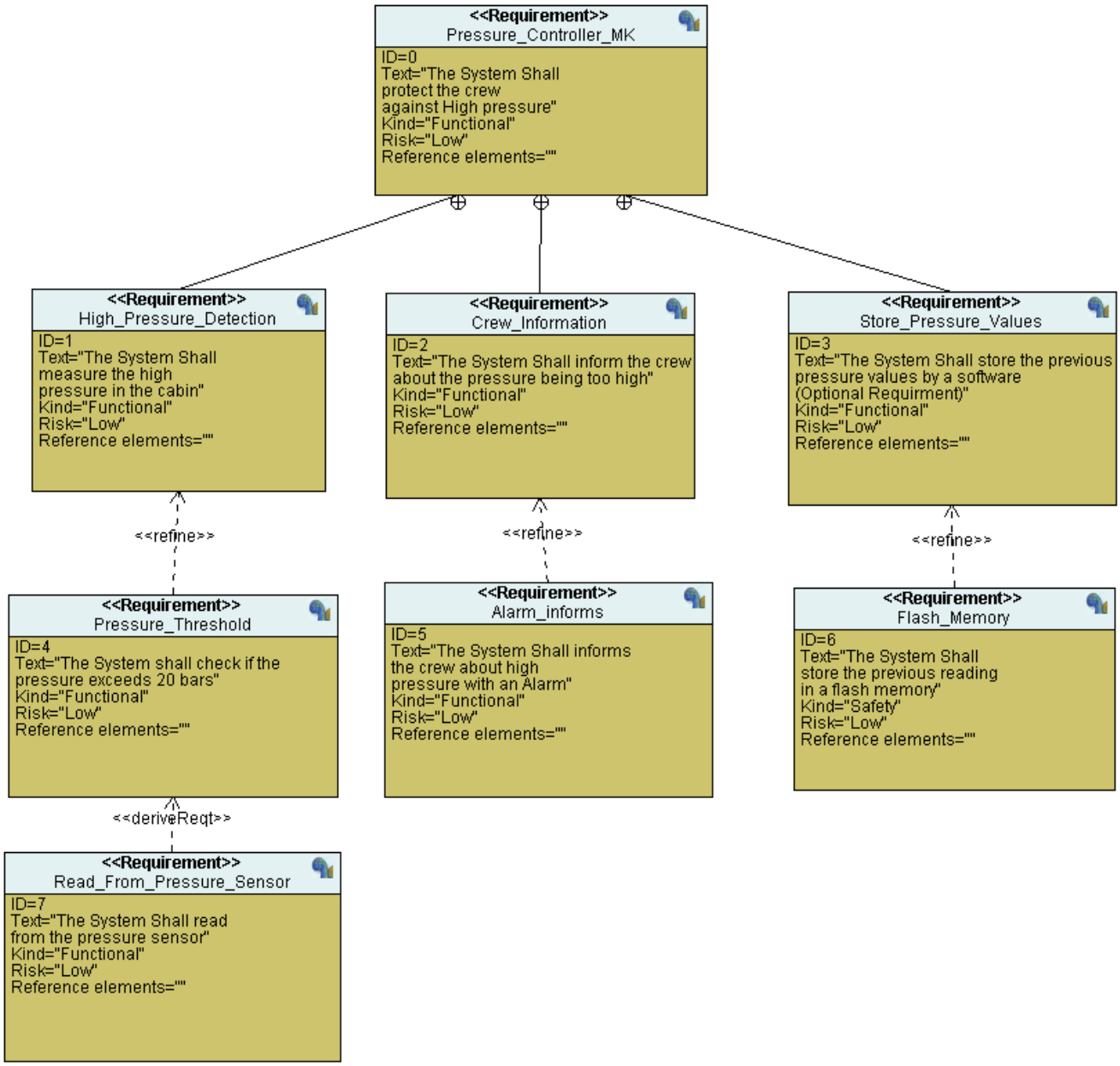
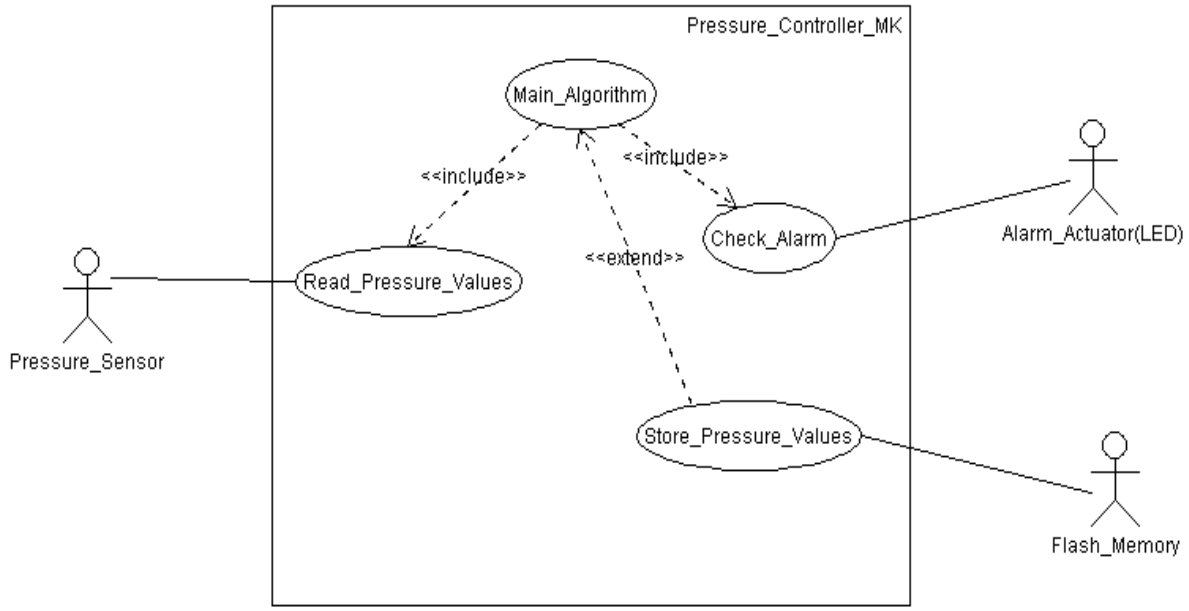


Figure 1 Requirement Diagram

4) System Analysis Diagrams

4.1) Use Case Diagram

Figure 2 Use Case Diagram



4.2) Activity Diagram

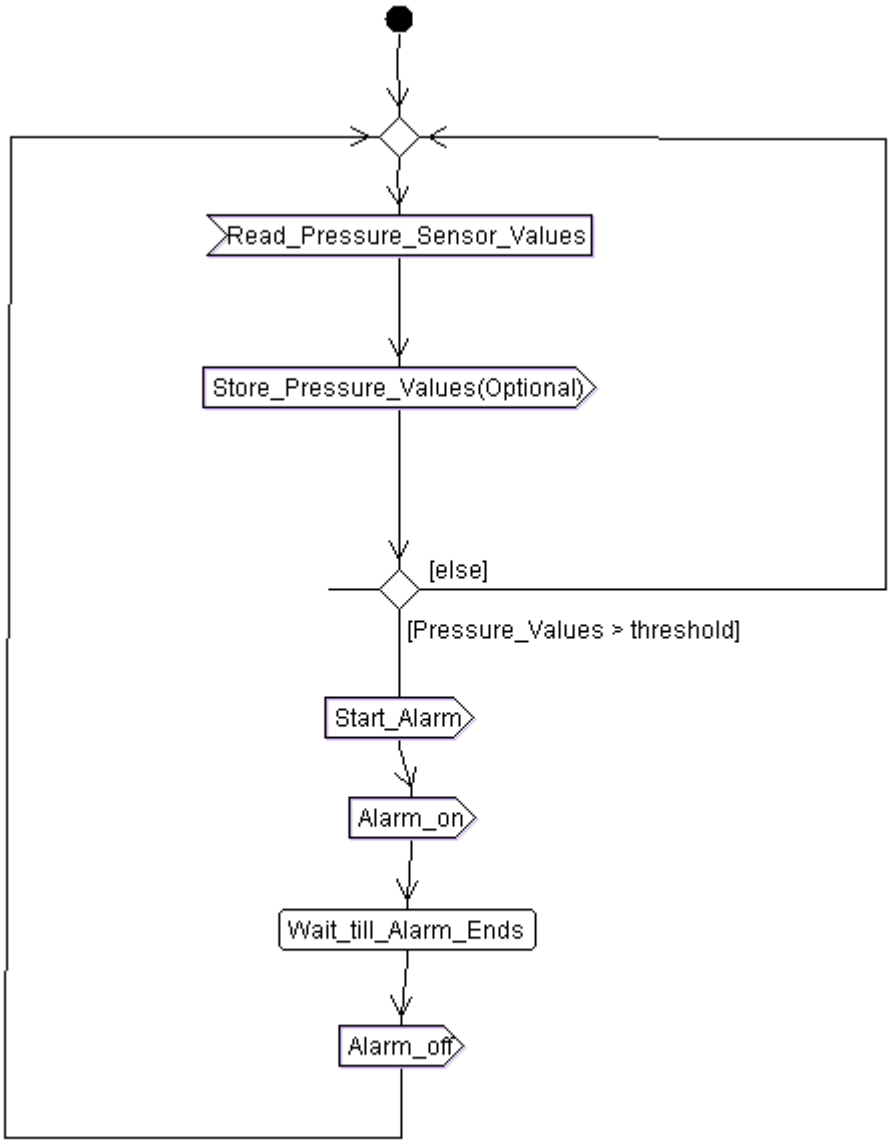
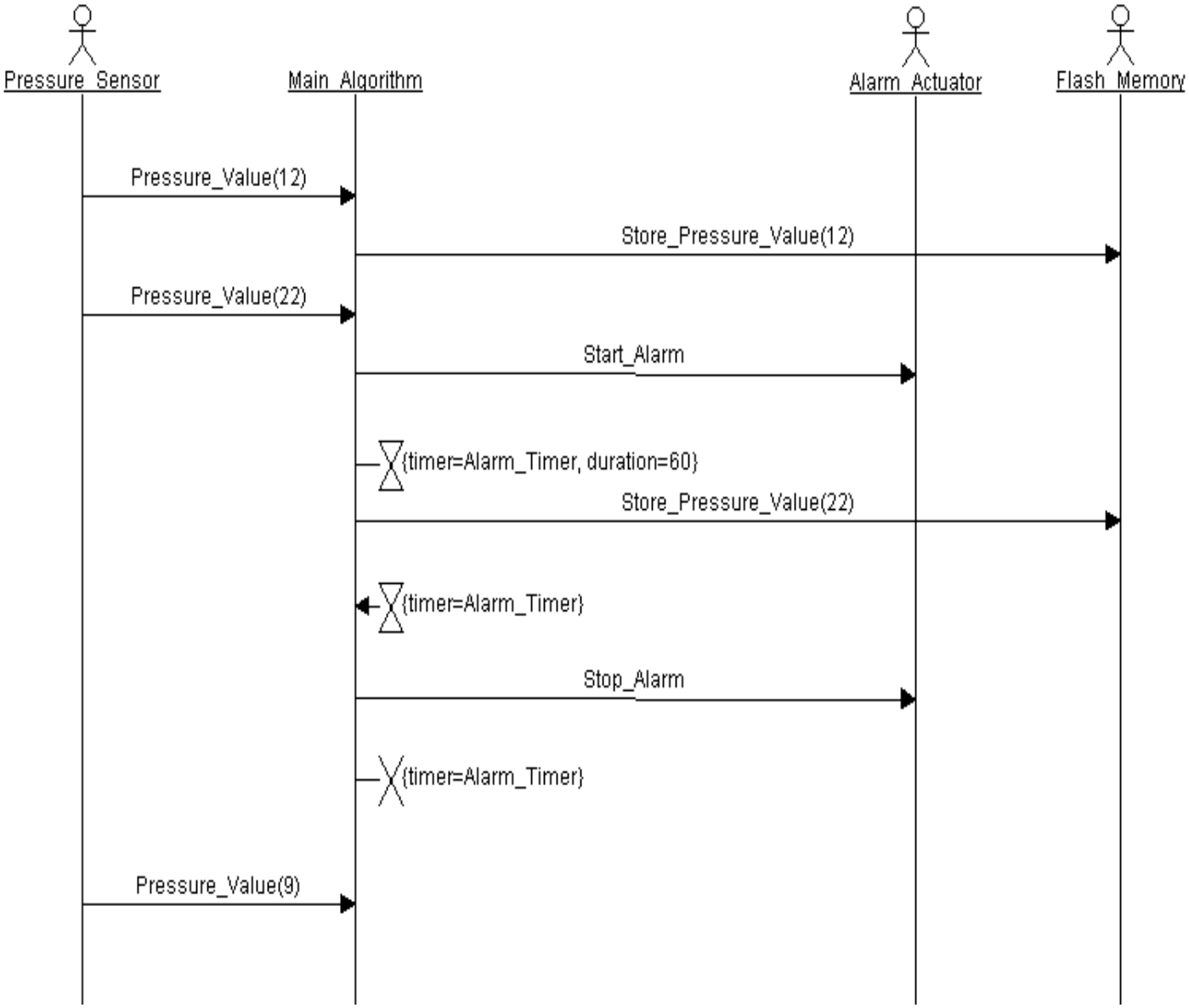


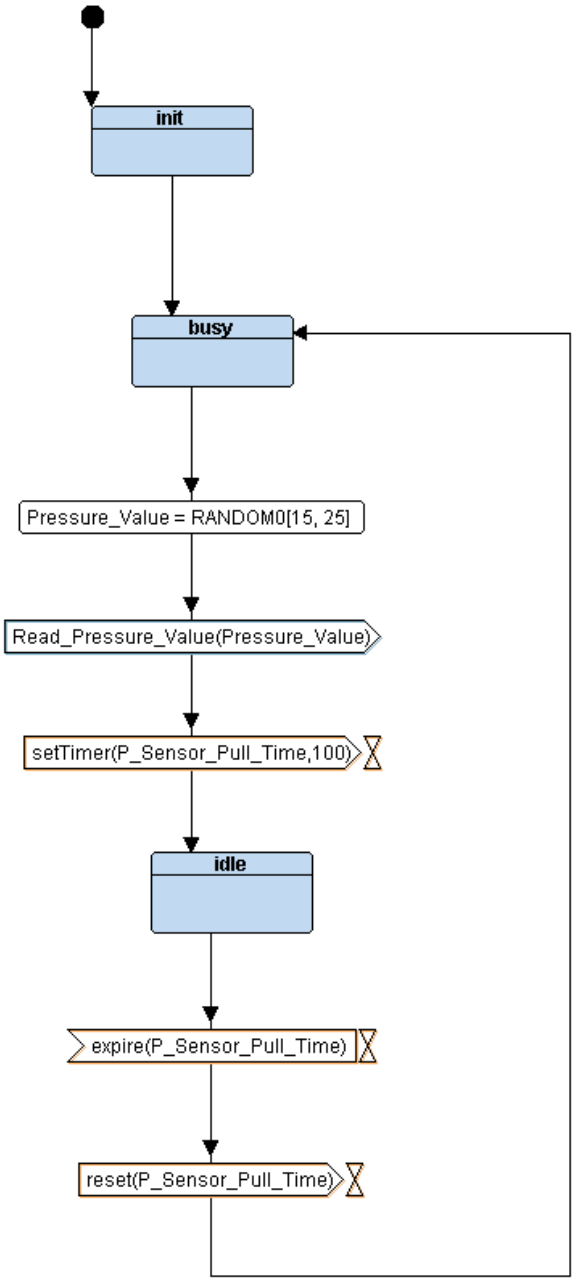
Figure 3 Activity Diagram

4.3) Sequence Diagram

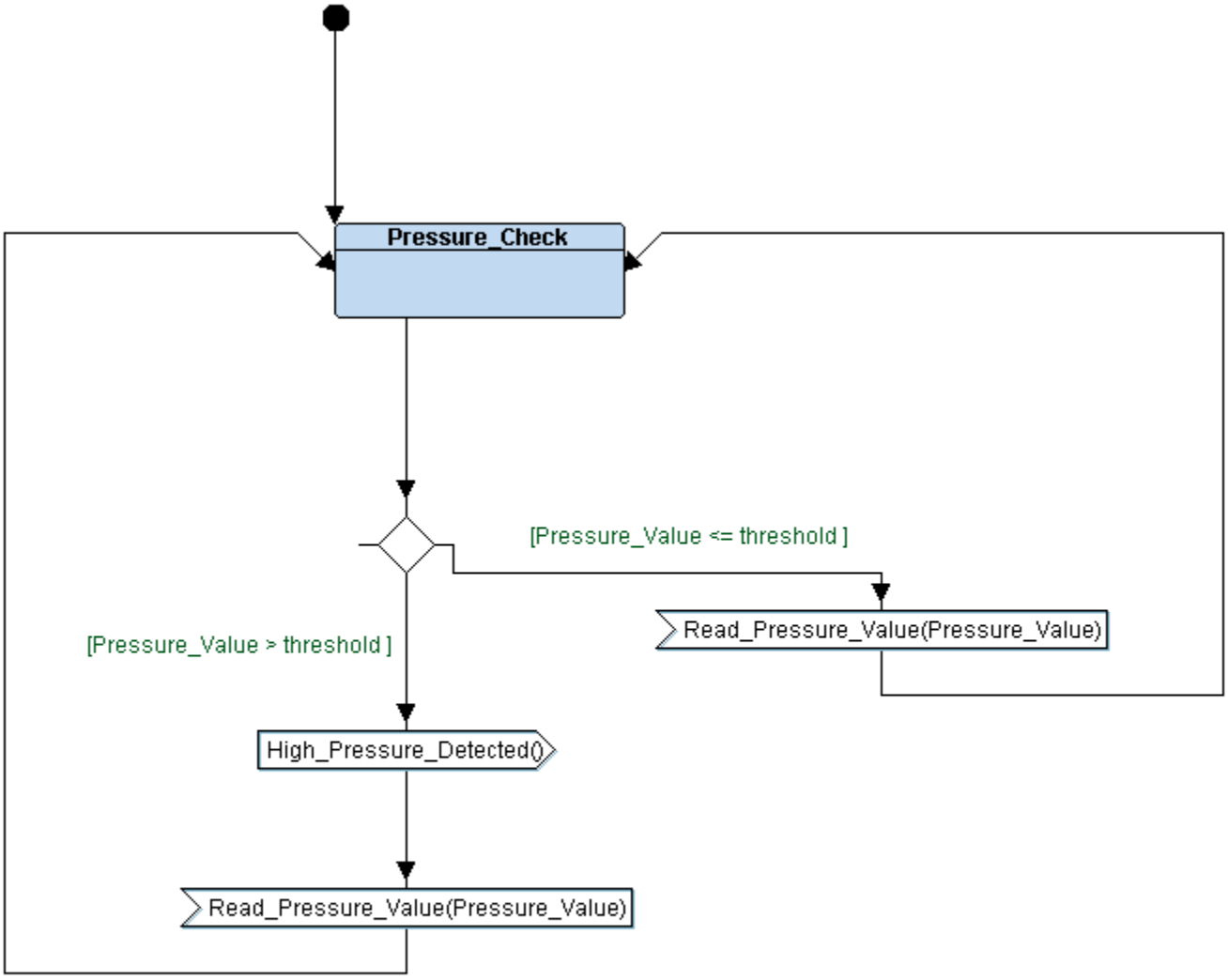


5) System Design

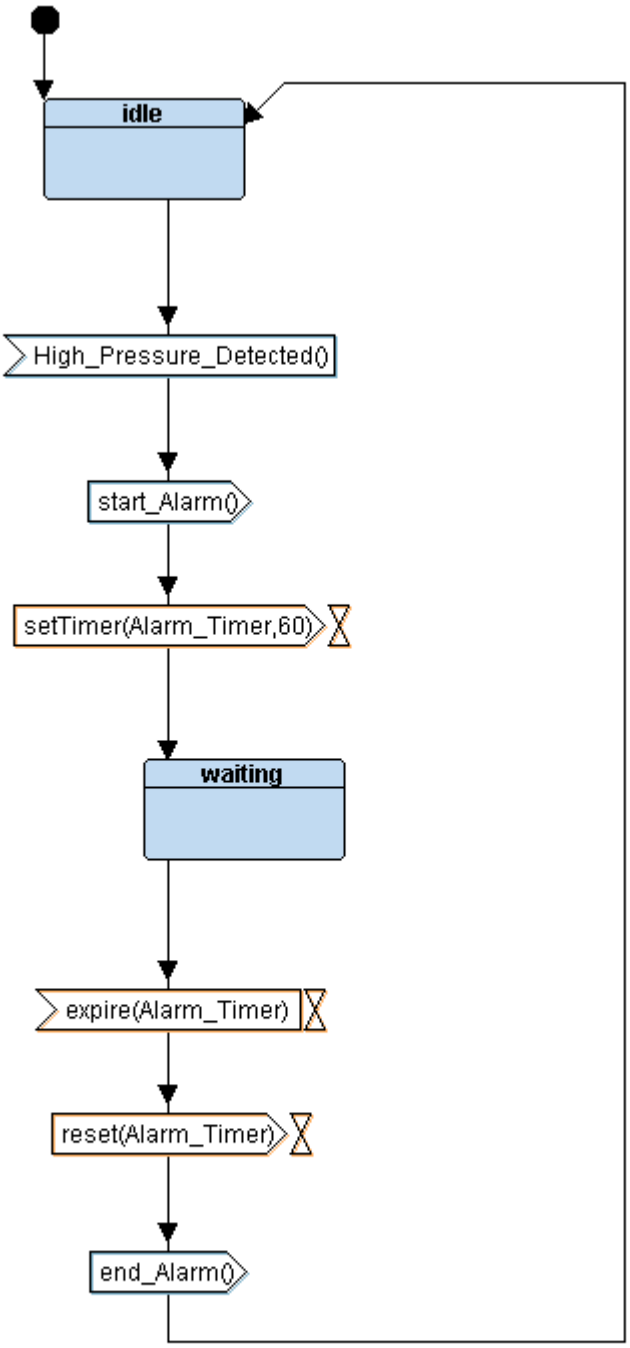
5.1) Sensor Driver State Machine



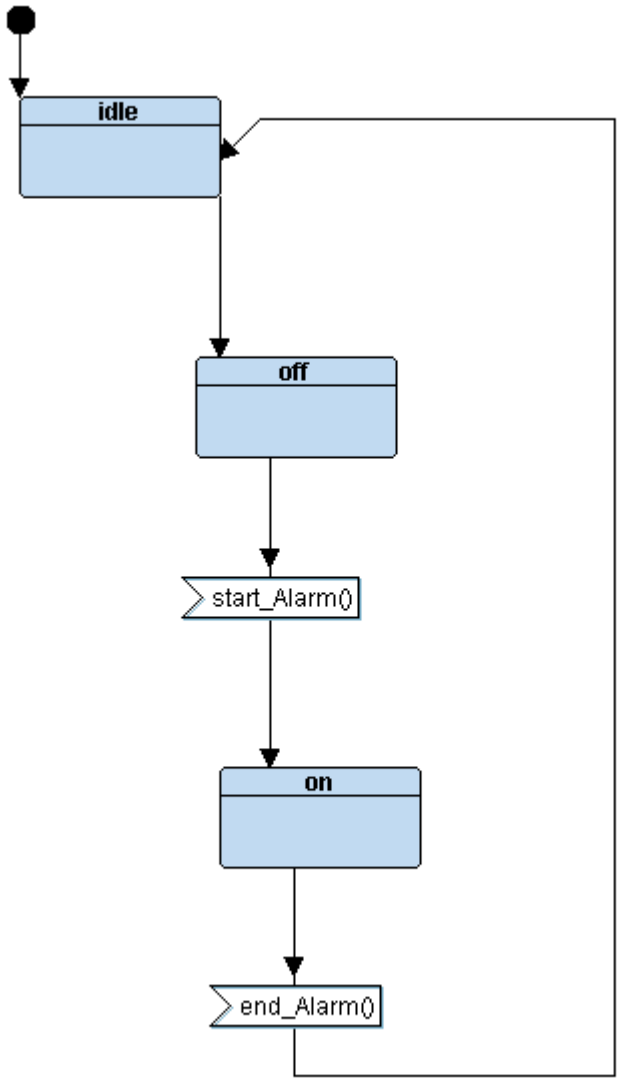
5.2) Main Algorithm State Machine



5.3) Alarm Monitor State Machine

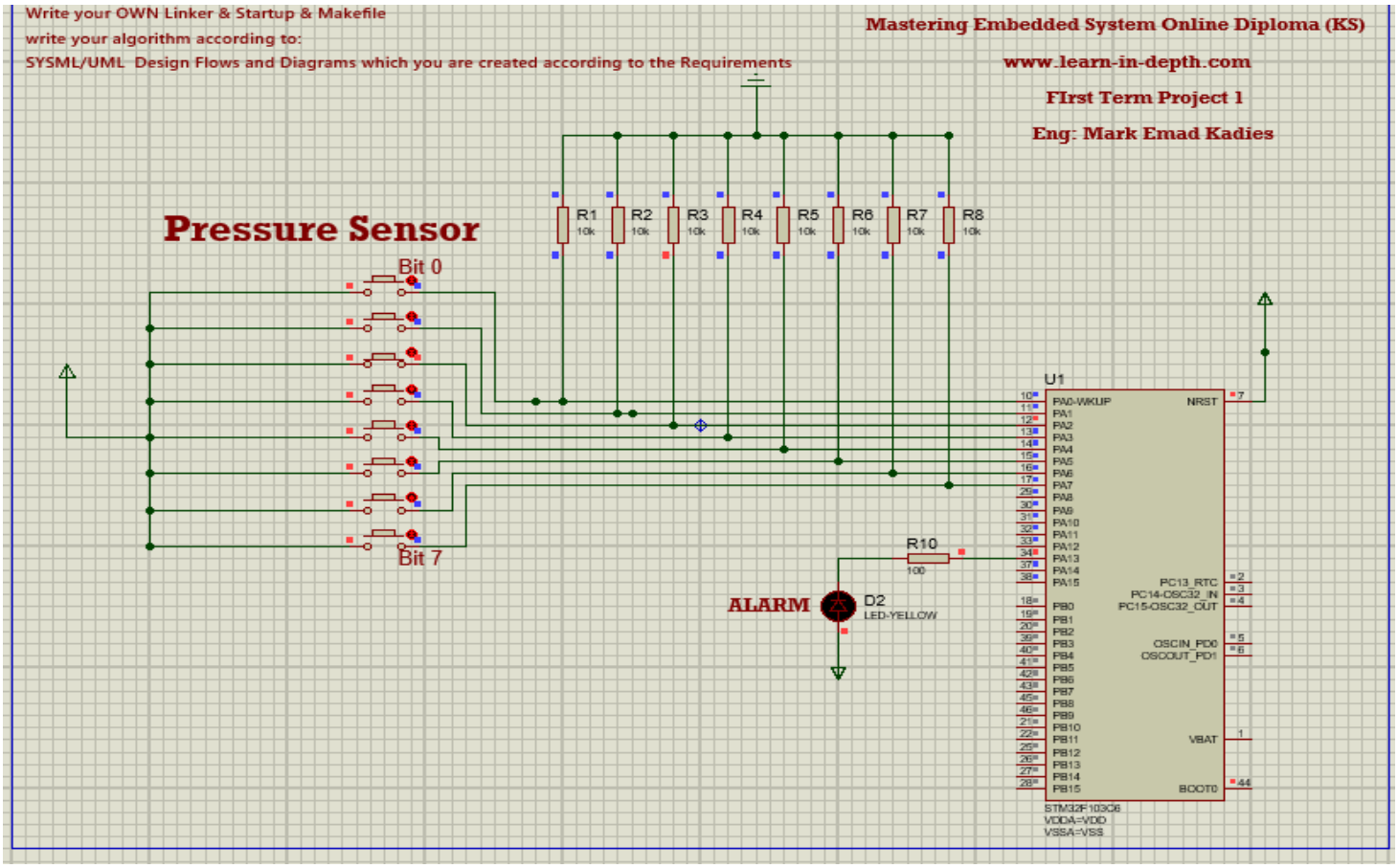


5.4) Alarm Actuator Driver State Machine

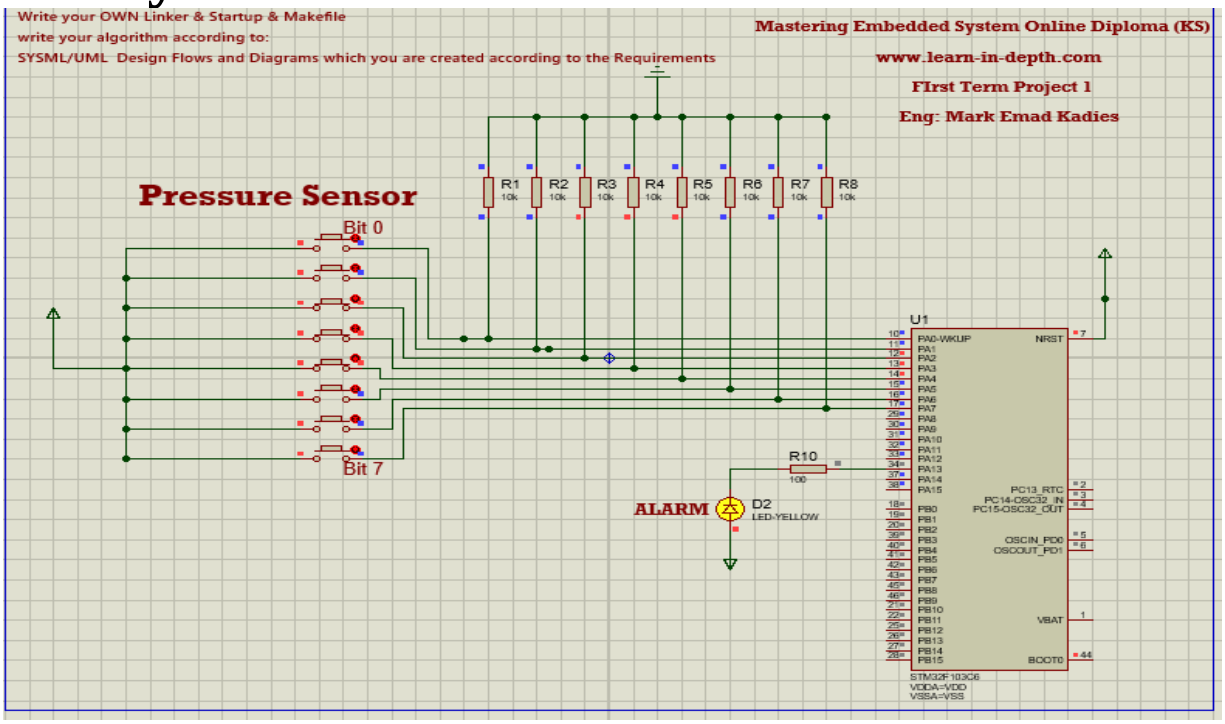


6) Simulation Results

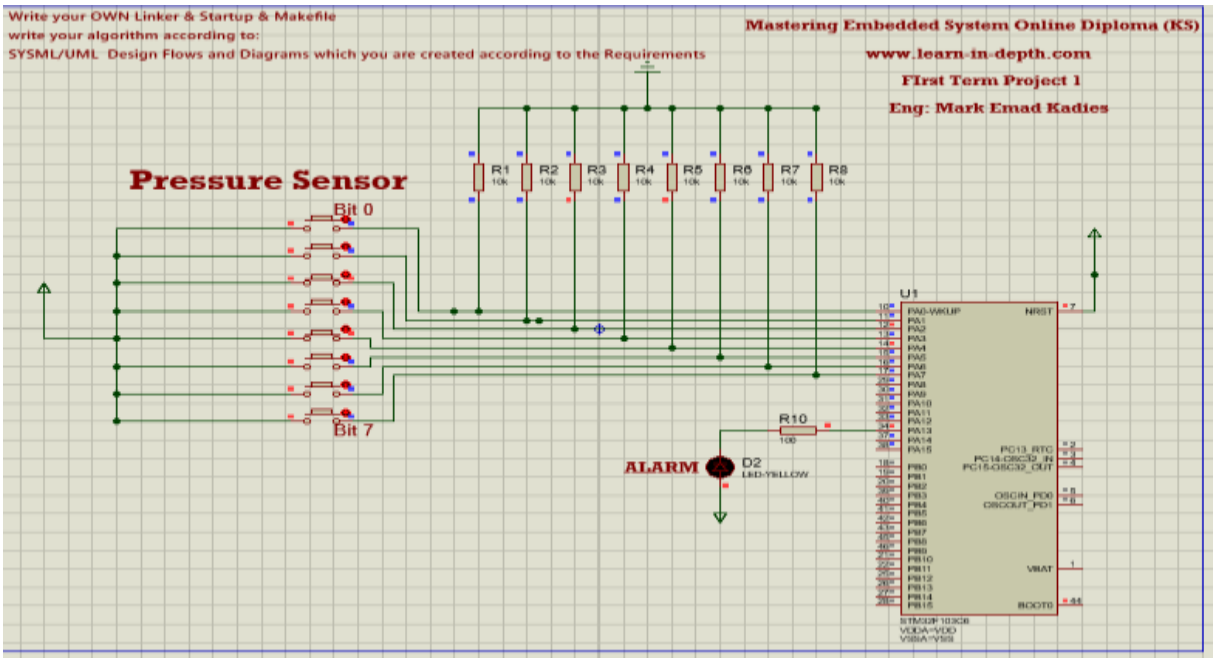
First Value :4 Bar (Safe) → Alarm LED OFF
Binary : 0000 0100



Second Value :28 Bar (Danger) → Alarm LED ON
Binary : 0001 1100



Third Value :20 Bar (Safe) → Alarm LED OFF
Binary : 0001 0100



Symbol Table :

```
Kadees@DESKTOP-E7JG9AI MINGW64 /d/Embedded diploma
$ arm-none-eabi-nm.exe Pressure_Controller_MK.elf
20000004 B _E_BSS
20000000 D _E_DATA
000003cc T _E_TEXT
20000000 B _S_BSS
20000000 D _S_DATA
00000000 T _S_TEXT
20001004 B _stack_top
0000001c T Alarm_Actuator_init
20001008 B Alarm_Actuator_state
20001004 B Alarm_Actuator_state_id
2000100c B Alarm_monitor_state
20001010 B Alarm_monitor_state_id
000003c0 W Bus_Fault_Handler
000003c0 T Default_Handler
00000204 T Delay
00000054 T end_Alarm
00000000 T g_p_fn_Vectors
00000224 T getPressureVal
00000278 T GPIO_INITIALIZATION
000003c0 W H_Fault_Handler
000000a0 T HighPressureDetected
20001014 B MA_pVal
20001018 B MA_state
2000101c B MA_state_id
000002f8 T main
000003c0 W MM_Fault_Handler
000003c0 W NMI_Handler
20000000 B PS_pVal
20001020 B PS_state
20001024 B PS_state_id
00000164 T Read_Pressure_Value
00000338 T Reset_Handler
00000190 T Sensor_init
0000023c T Set_Alarm_actuator
000002c8 T setup
00000088 T ST_Alarm_Actuator_OFF
00000070 T ST_Alarm_Actuator_ON
000000bc T ST_Alarm_Monitor_OFF
000000d4 T ST_Alarm_Monitor_ON
000000f8 T ST_Alarm_Monitor_Waiting
00000124 T ST_PressureCheck
000001ac T ST_PS_busy
000001e0 T ST_PS_idle
00000038 T start_Alarm
000003c0 W Usage_Fault_Handler
```

Section Table :

```
Kadees@DESKTOP-E7JG9AI MINGW64 /d/Embedded diploma (Learn_in_depth)/First
$ arm-none-eabi-objdump.exe -h Pressure_Controller_MK.elf

Pressure_Controller_MK.elf:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         000003cc  00000000  00000000  00010000  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .data         00000000  20000000  000003cc  00020000  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00001025  20000000  000003cc  00020000  2**2
                  ALLOC
  3 .debug_info   00003ed8  00000000  00000000  00020000  2**0
                  CONTENTS, READONLY, DEBUGGING
  4 .debug_abbrev 00000baf  00000000  00000000  00023ed8  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    00000560  00000000  00000000  00024a87  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 000000e0  00000000  00000000  00024fe7  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_line   000009a3  00000000  00000000  000250c7  2**0
                  CONTENTS, READONLY, DEBUGGING
  8 .debug_str    000007b0  00000000  00000000  00025a6a  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007e  00000000  00000000  0002621a  2**0
                  CONTENTS, READONLY
 10 .ARM.attributes 00000033  00000000  00000000  00026298  2**0
                  CONTENTS, READONLY
 11 .debug_frame  0000032c  00000000  00000000  000262cc  2**2
                  CONTENTS, READONLY, DEBUGGING
```

Built Process :

```
Kadees@DESKTOP-E7JG9AI MINGW64 /d/Embedded diploma (Learn_in_depth)/First_Term_P
rojects/HW_project_KIT_FIRST_TERM_project1
$ make
arm-none-eabi-gcc.exe -c -I .  -mcpu=cortex-m4 -gdwarf-2 AlarmActuartorDriver.c
-o AlarmActuartorDriver.o
arm-none-eabi-gcc.exe -c -I .  -mcpu=cortex-m4 -gdwarf-2 AlarmMonitor.c -o Alarm
Monitor.o
arm-none-eabi-gcc.exe -c -I .  -mcpu=cortex-m4 -gdwarf-2 MainAlgorithm.c -o Main
Algorithm.o
MainAlgorithm.c:12:1: warning: parameter names (without types) in function decla
ration
 void Read_Pressure_Value(PS_pVal);
 ^~~~
MainAlgorithm.c: In function 'Read_Pressure_Value':
MainAlgorithm.c:24:6: warning: type of 'PS_pVal' defaults to 'int' [-Wimplicit-i
nt]
 void Read_Pressure_Value(PS_pVal){
      ^~~~~~~~~~~~~~~~~~~
arm-none-eabi-gcc.exe -c -I .  -mcpu=cortex-m4 -gdwarf-2 Sensor.c -o Sensor.o
Sensor.c: In function 'ST_PS_busy':
Sensor.c:25:11: warning: assignment makes pointer from integer without a cast [-
Wint-conversion]
  PS_state = PS_idle;
           ^
arm-none-eabi-gcc.exe -c -I .  -mcpu=cortex-m4 -gdwarf-2 driver.c -o driver.o
arm-none-eabi-gcc.exe -c -I .  -mcpu=cortex-m4 -gdwarf-2 main.c -o main.o
arm-none-eabi-gcc.exe -c -I .  -mcpu=cortex-m4 -gdwarf-2 startup.c -o startup.o
arm-none-eabi-ld.exe -T linker-script.ld  AlarmActuartorDriver.o AlarmMonitor.o
MainAlgorithm.o Sensor.o driver.o main.o startup.o  -o Pressure_Controller_MK.el
f -Map=Map-file.map
arm-none-eabi-objcopy.exe -O binary Pressure_Controller_MK.elf Pressure_Controll
er_MK.bin
==========Build is Done===============
```

7) Codes And Files

https://github.com/Markadies/Embedded-Systems-Online-Diploma/tree/main/First%20Term%20Projects/1_Pressure_Controller