

Mastering Embedded System Online Diploma

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First term (Final Project 1)

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1. Chapter One : Requirement Diagram

1.1 Case Study :

1. Alarm when the pressure exceeds 20 bar
2. Alarm Works for 60 seconds
3. Optional the data is saved at runtime to flash memory

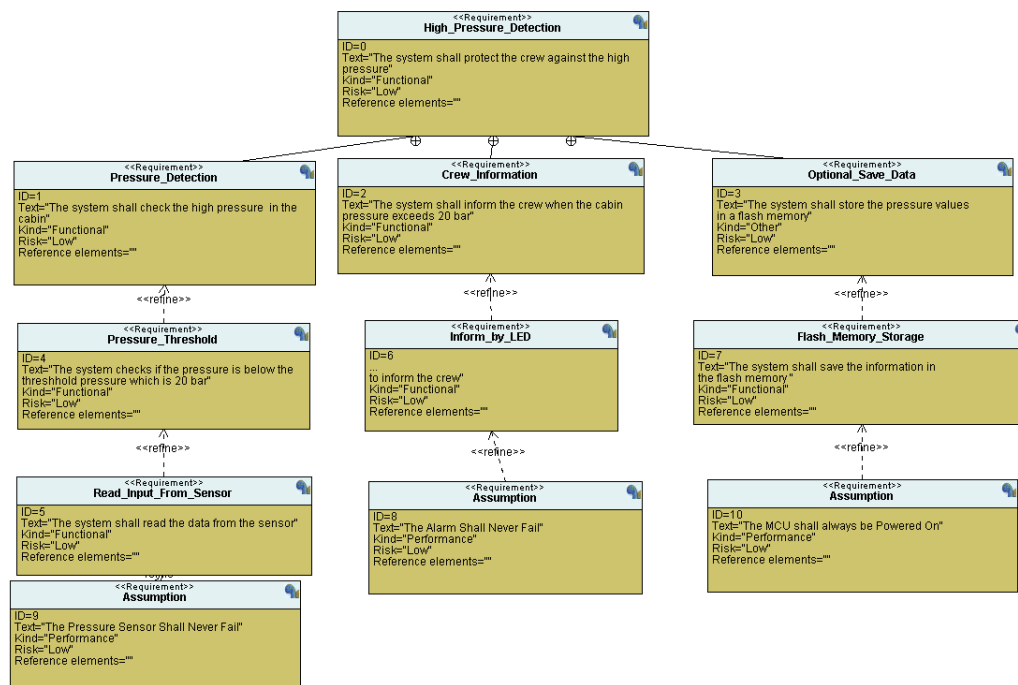
1.2 Requirement Diagram :

There are seven main blocks in the requirement diagram :

1. The system shall protect the crew against high pressure
2. The system shall check the high pressure in the cabin
3. The system shall check if the pressure is below the threshold
4. The system shall inform the crew in the cabin if the pressure exceeds 20bar
5. The system shall light up the LED to inform the crew
6. Optionally the system shall store the pressure values
7. Optionally the system shall store the pressure values in flash memory

There are three assumption blocks which are:

1. The Pressure Sensor will never fail
2. The Alarm will never fail
3. The MCU will always be powered On

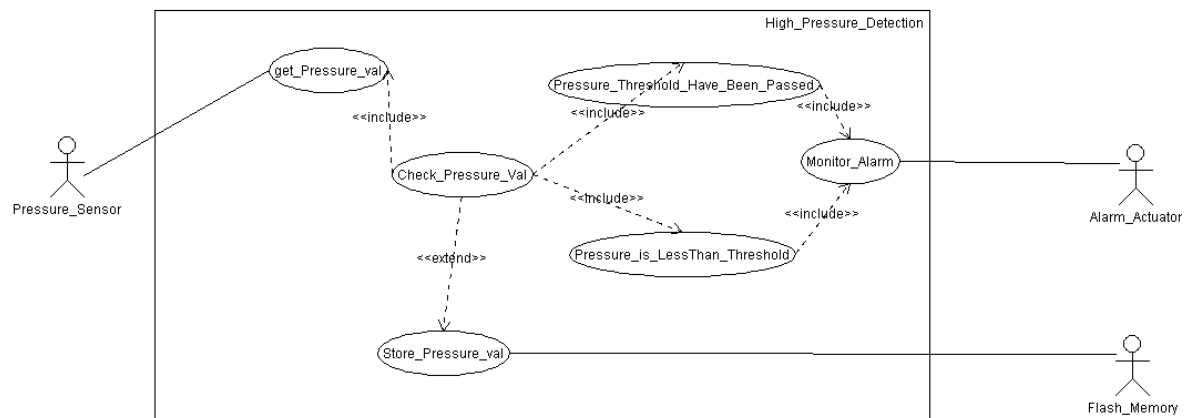


Chapter Two : System Analysis

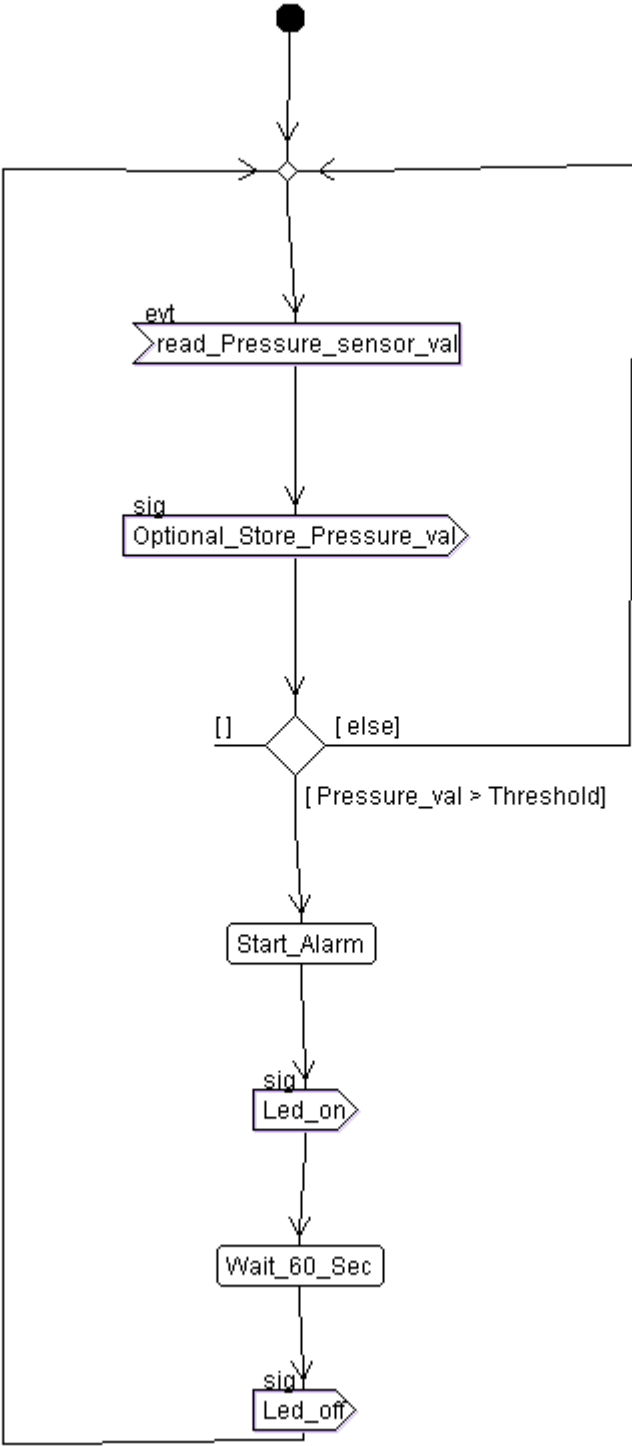
2.1 System Analysis :

2.2 Use Case Diagram

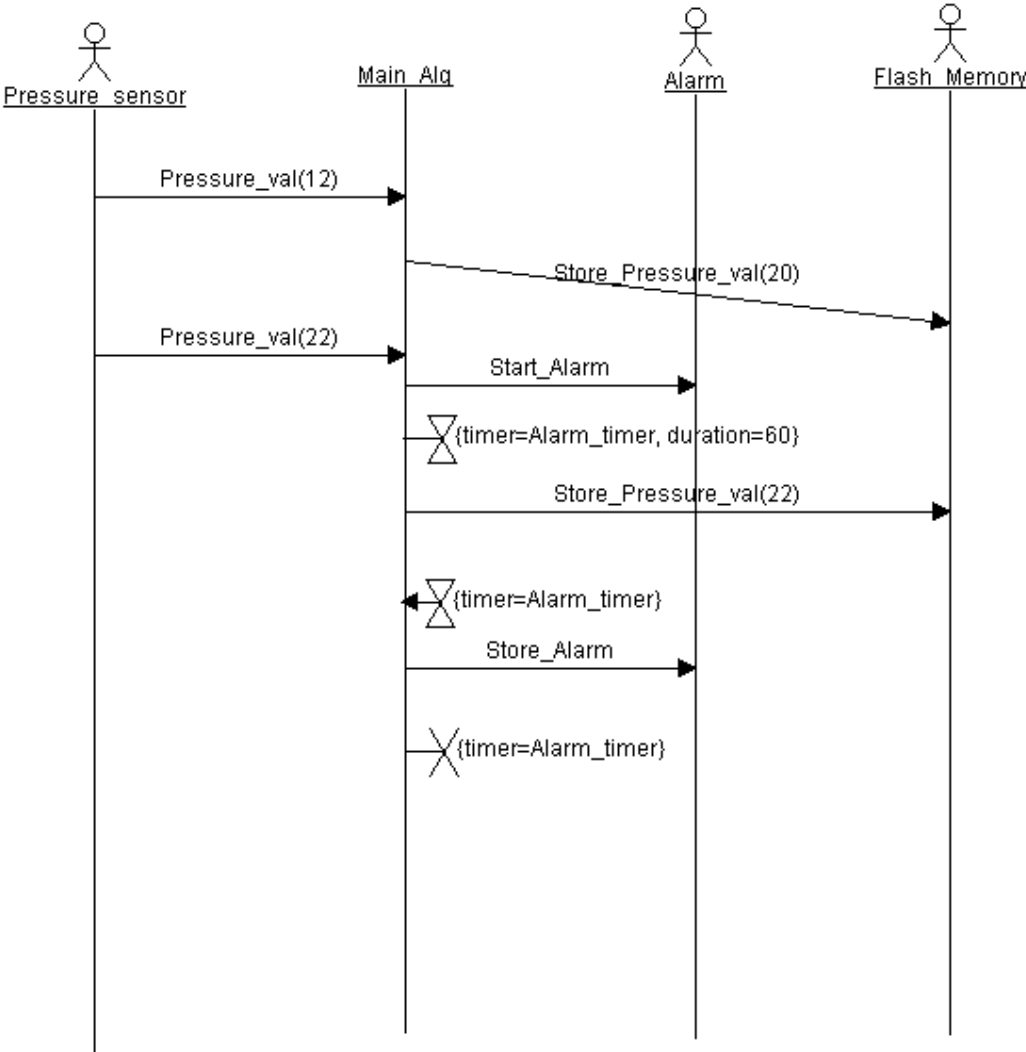
Here we consider the pressure sensor as an actor who have the role of getting the pressure value after that it sends the value to get checked if the pressure is more than the threshold then it goes to the alarm monitor to enable the alarm and if the pressure value is less than the threshold then the value is sent to the alarm monitor to disable the alarm



2.3 Activity Diagram

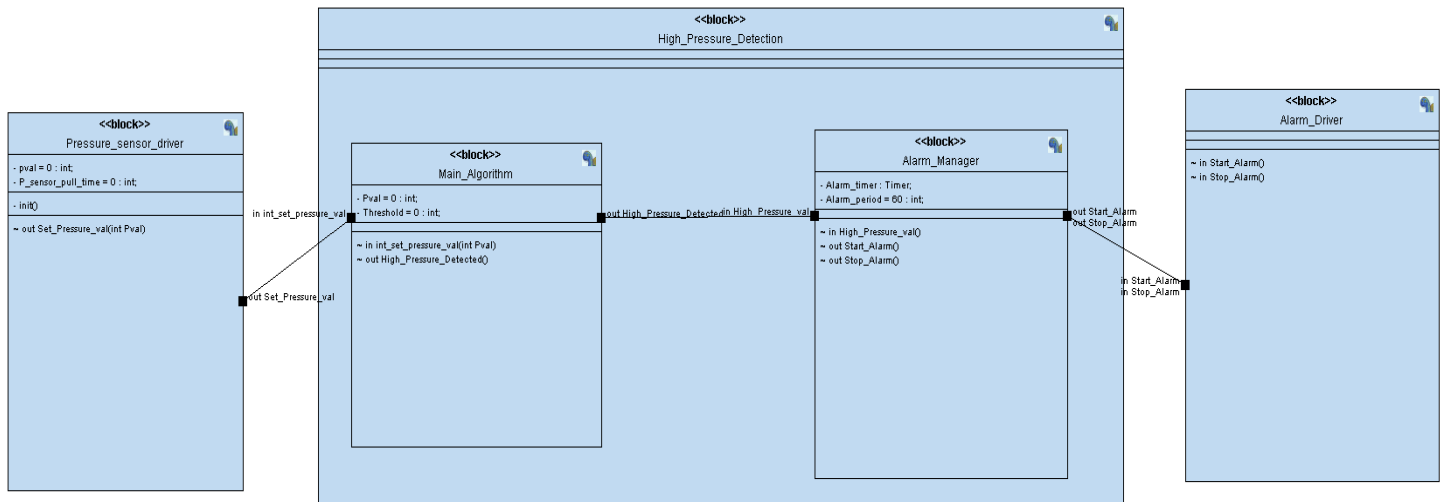


2.4 Sequence Diagram

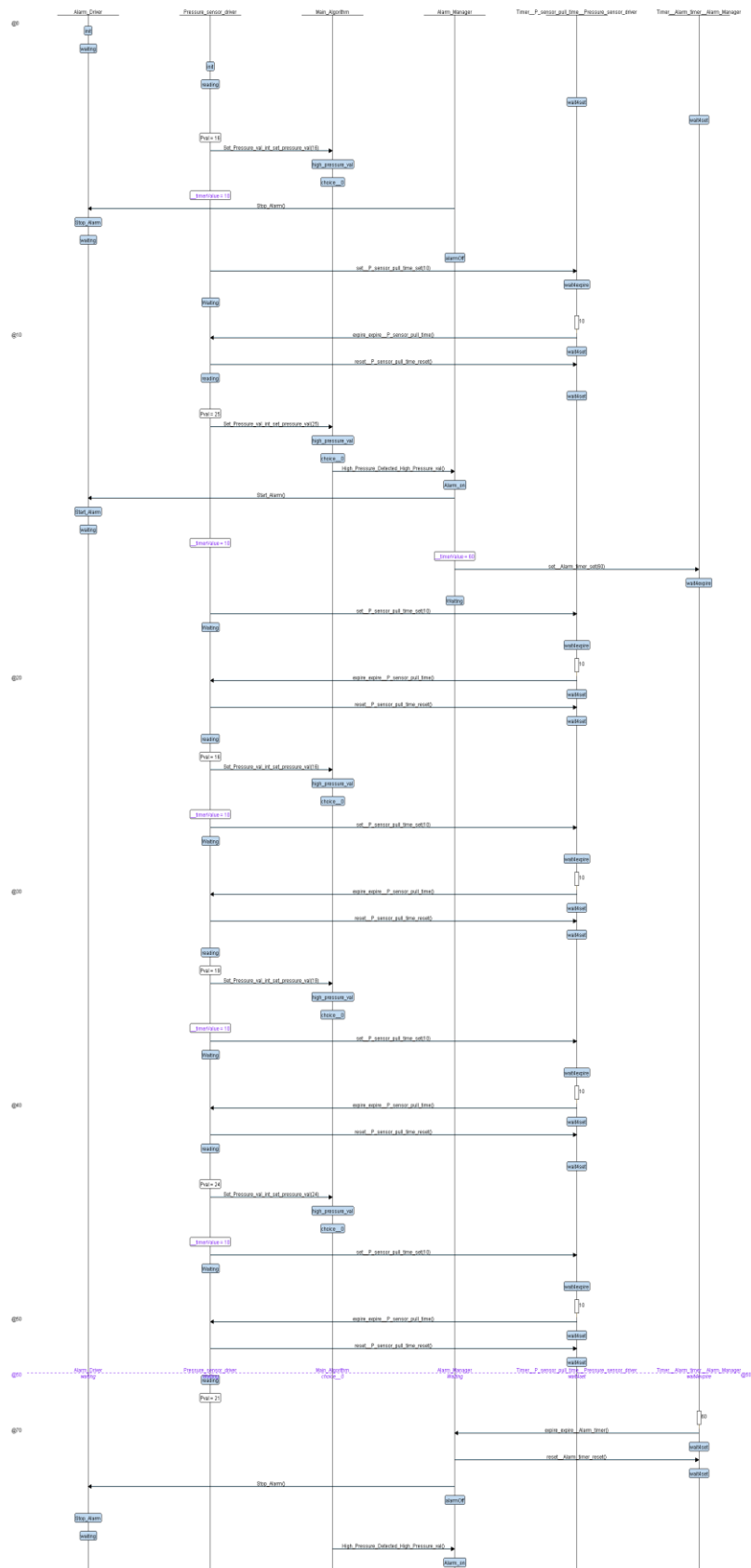


Chapter Three : System Design

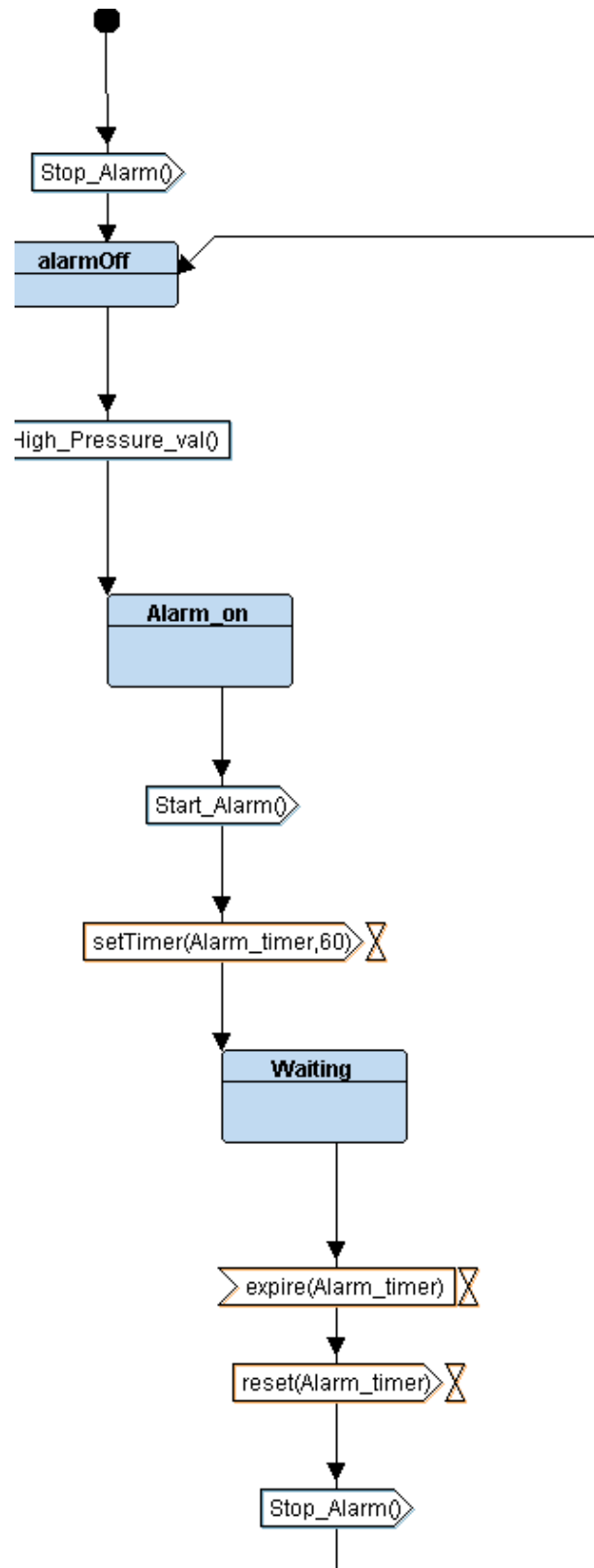
3.1 System Design



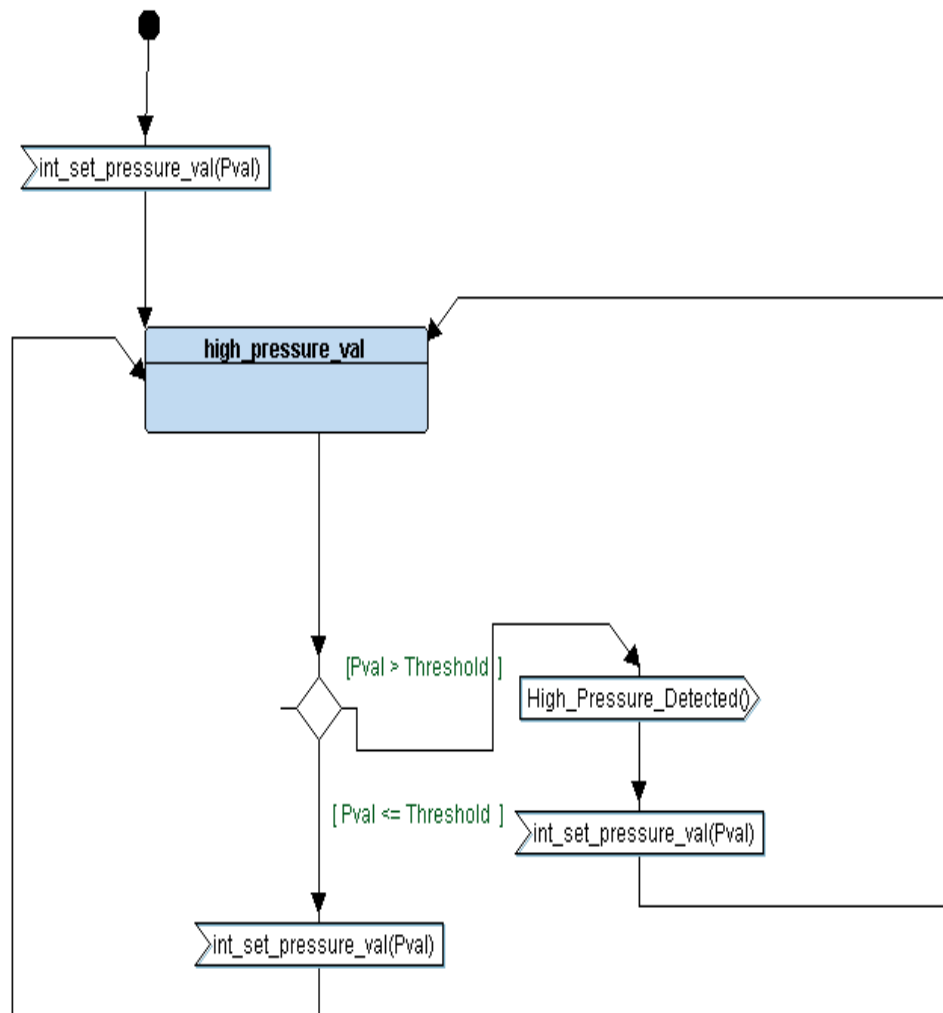
3.2 Simulation Diagram



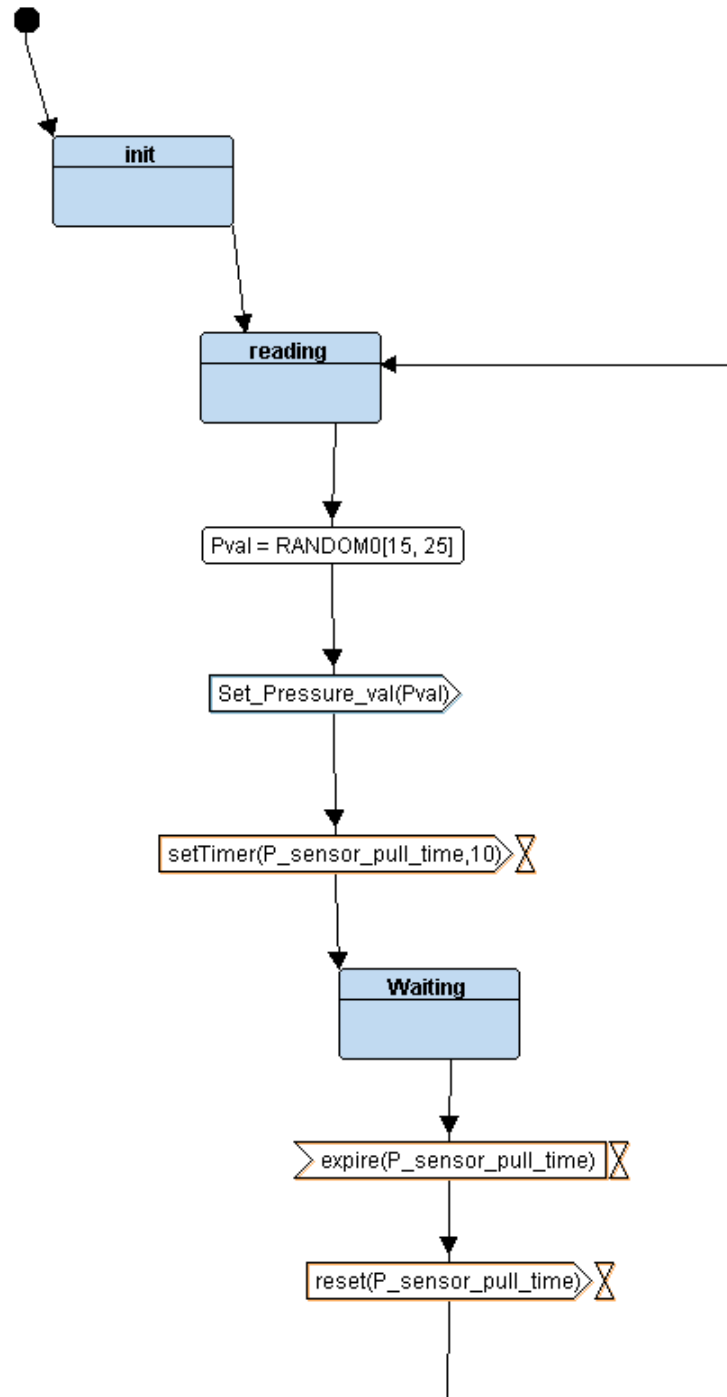
3.3 Alarm Manager



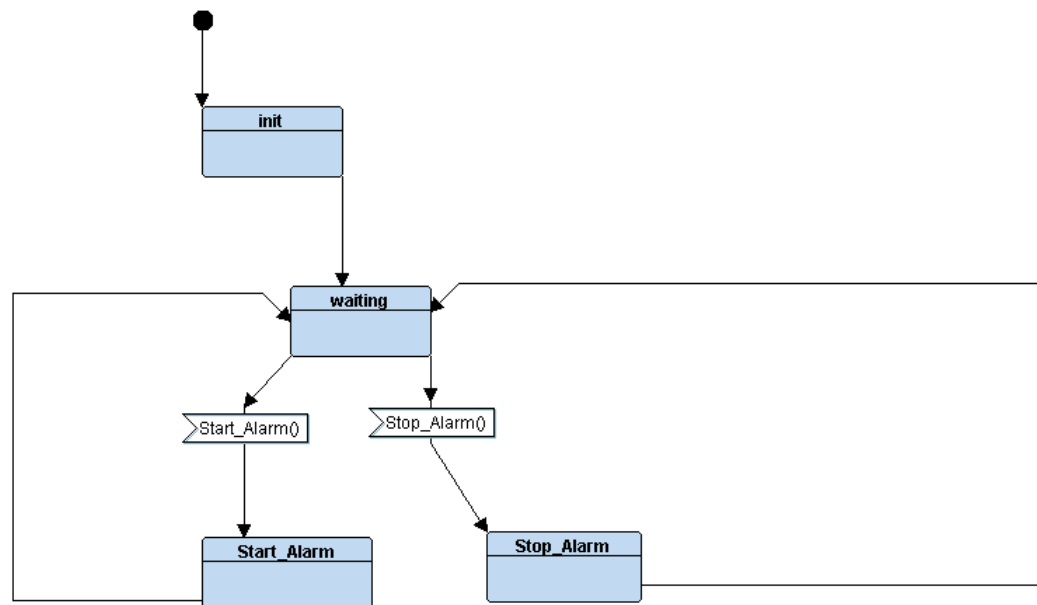
3.4 Main Algorithm



3.5 Pressure Sensor Driver

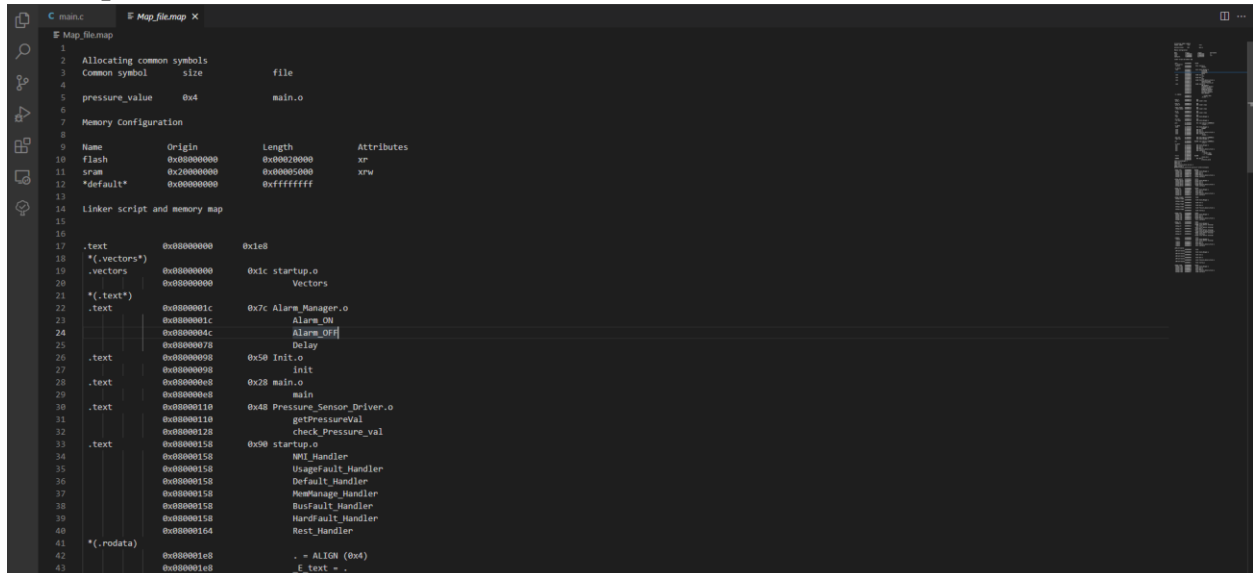


3.6 Alarm Driver

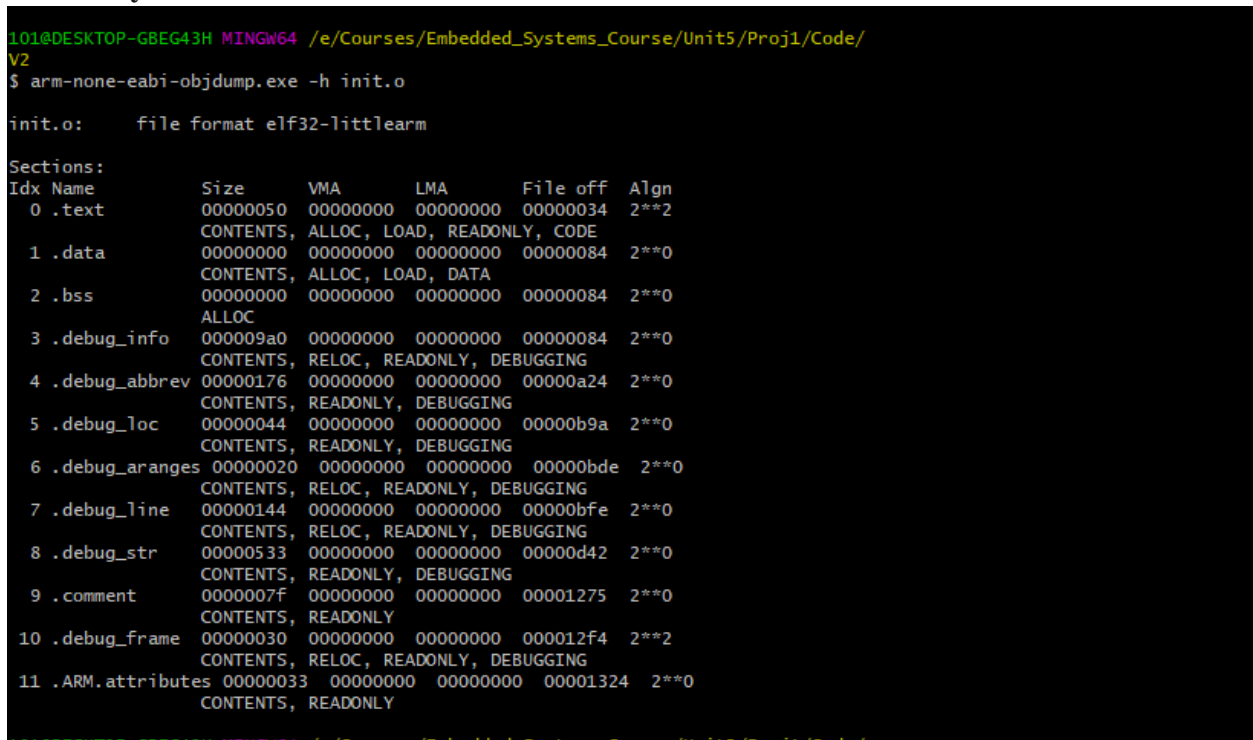


Chapter four : Code Analysis

4.1 Map File



4.2 Init Symbols



4.3 Pressure Sensor Driver Symbols

```
101@DESKTOP-GBEG43H MINGW64 /e/Courses/Embedded_Systems_Course/Unit5/Proj1/Code/V2
```

```
$ arm-none-eabi-objdump.exe -h Pressure_Sensor_Driver.o
```

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

```
Sections:
```

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	00000048	00000000	00000000	00000034	2**2
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE					
1	.data	00000000	00000000	00000000	0000007c	2**0
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000000	00000000	00000000	0000007c	2**0
	ALLOC					
3	.debug_info	000009f4	00000000	00000000	0000007c	2**0
	CONTENTS, RELOC, READONLY, DEBUGGING					
4	.debug_abbrev	000001bb	00000000	00000000	00000a70	2**0
	CONTENTS, READONLY, DEBUGGING					
5	.debug_loc	00000070	00000000	00000000	00000c2b	2**0
	CONTENTS, READONLY, DEBUGGING					
6	.debug_aranges	00000020	00000000	00000000	00000c9b	2**0
	CONTENTS, RELOC, READONLY, DEBUGGING					
7	.debug_line	00000175	00000000	00000000	00000cbb	2**0
	CONTENTS, RELOC, READONLY, DEBUGGING					
8	.debug_str	000005d4	00000000	00000000	00000e30	2**0
	CONTENTS, READONLY, DEBUGGING					
9	.comment	0000007f	00000000	00000000	00001404	2**0
	CONTENTS, READONLY					
10	.debug_frame	0000004c	00000000	00000000	00001484	2**2
	CONTENTS, RELOC, READONLY, DEBUGGING					
11	.ARM.attributes	00000033	00000000	00000000	000014d0	2**0
	CONTENTS, READONLY					

4.4 Startup Symbols

```
101@DESKTOP-GBEG43H MINGW64 /e/Courses/Embedded_Systems_Course/Unit5/Proj1/Code/V2
```

```
$ arm-none-eabi-objdump.exe -h startup.o
```

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

```
Sections:
```

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	00000090	00000000	00000000	00000034	2**2
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE					
1	.data	00000000	00000000	00000000	000000c4	2**0
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000000	00000000	00000000	000000c4	2**0
	ALLOC					
3	.vectors	0000001c	00000000	00000000	000000c4	2**2
	CONTENTS, ALLOC, LOAD, RELOC, DATA					
4	.debug_info	00000190	00000000	00000000	000000e0	2**0
	CONTENTS, RELOC, READONLY, DEBUGGING					
5	.debug_abbrev	000000d6	00000000	00000000	00000270	2**0
	CONTENTS, READONLY, DEBUGGING					
6	.debug_loc	0000007c	00000000	00000000	00000346	2**0
	CONTENTS, READONLY, DEBUGGING					
7	.debug_aranges	00000020	00000000	00000000	000003c2	2**0
	CONTENTS, RELOC, READONLY, DEBUGGING					
8	.debug_line	000000ff	00000000	00000000	000003e2	2**0
	CONTENTS, RELOC, READONLY, DEBUGGING					
9	.debug_str	000001b8	00000000	00000000	000004e1	2**0
	CONTENTS, READONLY, DEBUGGING					
10	.comment	0000007f	00000000	00000000	00000699	2**0
	CONTENTS, READONLY					
11	.debug_frame	00000050	00000000	00000000	00000718	2**2
	CONTENTS, RELOC, READONLY, DEBUGGING					
12	.ARM.attributes	00000033	00000000	00000000	00000768	2**0
	CONTENTS, READONLY					

4.5 Alarm Manger Symbols

```
101@DESKTOP-GBEG43H MINGW64 /e/Courses/Embedded_Systems_Course/Unit5/Proj1/Code
$ arm-none-eabi-objdump.exe -h Alarm_Manager.o

Alarm_Manager.o:      file format elf32-littlearm

Sections:
Idx Name              Size      VMA       LMA       File off  Algn
  0 .text              0000007c  00000000  00000000  00000034  2**2
                        CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data              00000004  00000000  00000000  000000b0  2**2
                        CONTENTS, ALLOC, LOAD, DATA
  2 .bss               00000000  00000000  00000000  000000b4  2**0
                        ALLOC
  3 .debug_info        00000a60  00000000  00000000  000000b4  2**0
                        CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev       000001e2  00000000  00000000  00000b14  2**0
                        CONTENTS, READONLY, DEBUGGING
  5 .debug_loc         000000cc  00000000  00000000  00000cf6  2**0
                        CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges     00000020  00000000  00000000  00000dc2  2**0
                        CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line        00000171  00000000  00000000  00000de2  2**0
                        CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str         00000590  00000000  00000000  00000f53  2**0
                        CONTENTS, READONLY, DEBUGGING
  9 .comment           0000007f  00000000  00000000  000014e3  2**0
                        CONTENTS, READONLY
10 .debug_frame        00000074  00000000  00000000  00001564  2**2
                        CONTENTS, RELOC, READONLY, DEBUGGING
11 .ARM.attributes     00000033  00000000  00000000  000015d8  2**0
                        CONTENTS, READONLY
```

4.6 Main Symbols

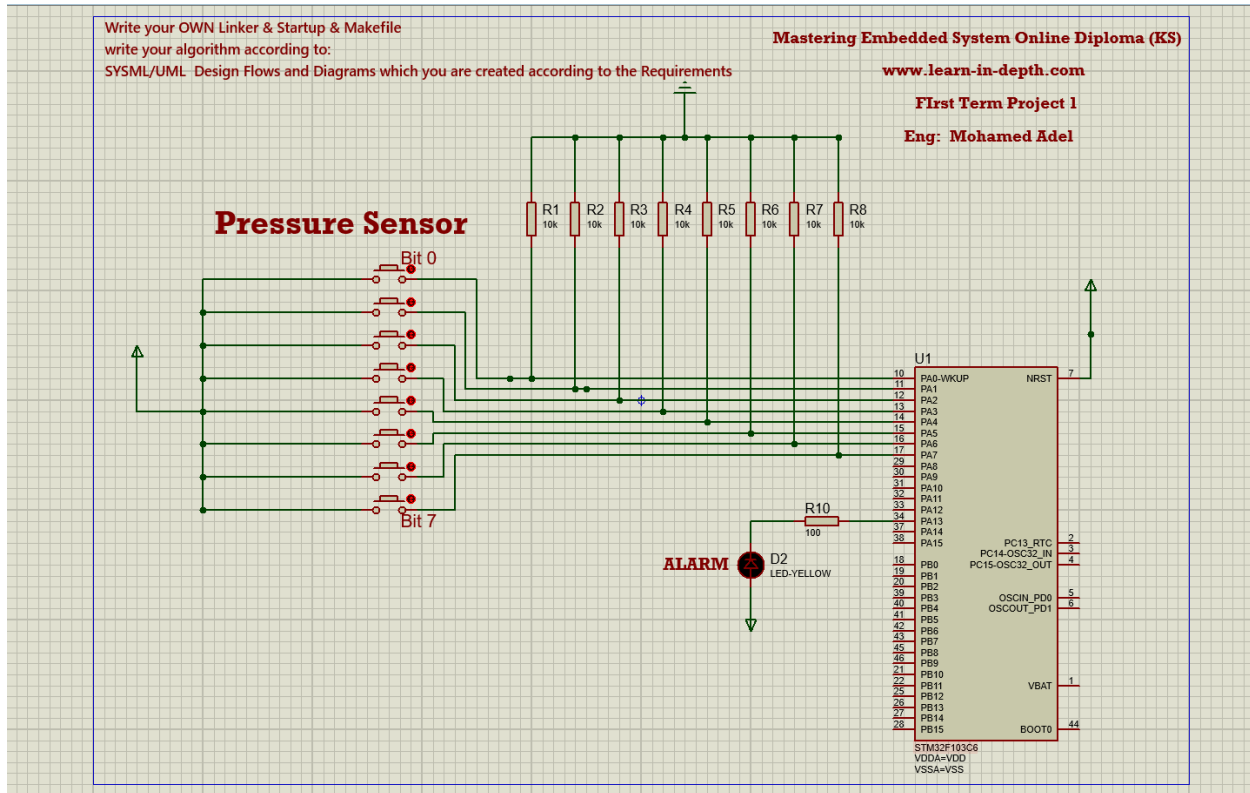
```
101@DESKTOP-GBEG43H MINGW64 /e/Courses/Embedded_Systems_Course/Unit5/Proj1/Code/
$ arm-none-eabi-objdump.exe -h main.o

main.o:      file format elf32-littlearm

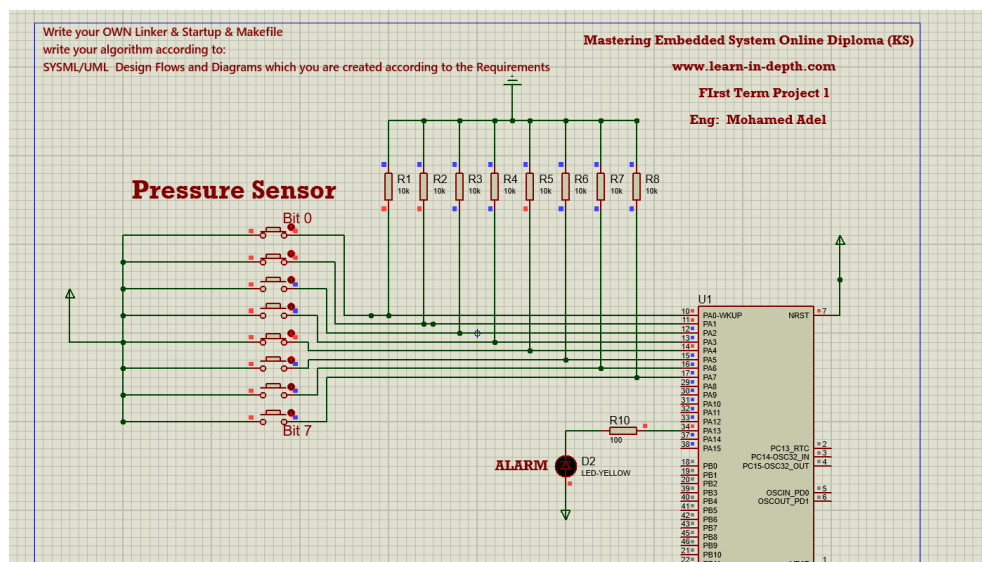
Sections:
Idx Name              Size      VMA       LMA       File off  Algn
  0 .text              00000028  00000000  00000000  00000034  2**1
                        CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data              00000000  00000000  00000000  0000005c  2**0
                        CONTENTS, ALLOC, LOAD, DATA
  2 .bss               00000000  00000000  00000000  0000005c  2**0
                        ALLOC
  3 .debug_info        000009ba  00000000  00000000  0000005c  2**0
                        CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev       000001a3  00000000  00000000  00000a16  2**0
                        CONTENTS, READONLY, DEBUGGING
  5 .debug_loc         0000002c  00000000  00000000  00000bb9  2**0
                        CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges     00000020  00000000  00000000  00000be5  2**0
                        CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line        00000101  00000000  00000000  00000c05  2**0
                        CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str         00000571  00000000  00000000  00000d06  2**0
                        CONTENTS, READONLY, DEBUGGING
  9 .comment           0000007f  00000000  00000000  00001277  2**0
                        CONTENTS, READONLY
10 .debug_frame        0000002c  00000000  00000000  000012f8  2**2
                        CONTENTS, RELOC, READONLY, DEBUGGING
11 .ARM.attributes     00000033  00000000  00000000  00001324  2**0
                        CONTENTS, READONLY
```

Chapter Five : Simulation

5.1 Main Circuit



5.2 In Case of Pressure value less than 19 (0001 0011) Which is less than the threshold (20)
The LED is OFF



**5.3 In Case of Pressure value 30 (0001 1110) which is greater than the threshold 20
The LED is ON**

