

## Mastering Embedded System Online Diploma

<https://www.learn-in-depth.com>

### First Term (Final Project 1): High Pressure Detection

Eng. Mohamed Alaa Al-Din Ibrahim Mohamed

**My Profile:** [learn-in-depth/online-diploma/mohamed.alaa.work.1@gmail.com](https://www.learn-in-depth.com/online-diploma/mohamed.alaa.work.1@gmail.com)

**Project Link:** [github/Mastering Embedded System Diploma/first term project1](https://github.com/Mastering-Embedded-System-Diploma/first-term-project1)



## CONTENTS

1. Case study .....	1
2. Requirement diagram .....	2
3. Use case diagram .....	3
4. Activity diagram .....	4
5. Sequence diagram.....	5
6. Design diagram .....	6
6.1. Block diagram.....	6
6.2. Pressure detection state machine diagram .....	7
6.3. Alarm monitor state machine diagram.....	8
6.4. Driver state machine diagram.....	9
6.5. Design simulation by TTool .....	<b>Error! Bookmark not defined.</b>
7. System simulation by Proteus.....	10
7.1. Alarm on.....	10
7.2. Alarm off .....	11
8. SW analysis.....	12
8.1. Map file .....	12
8.2. Section header .....	14
8.3. Symbol table .....	15



## 1. CASE STUDY

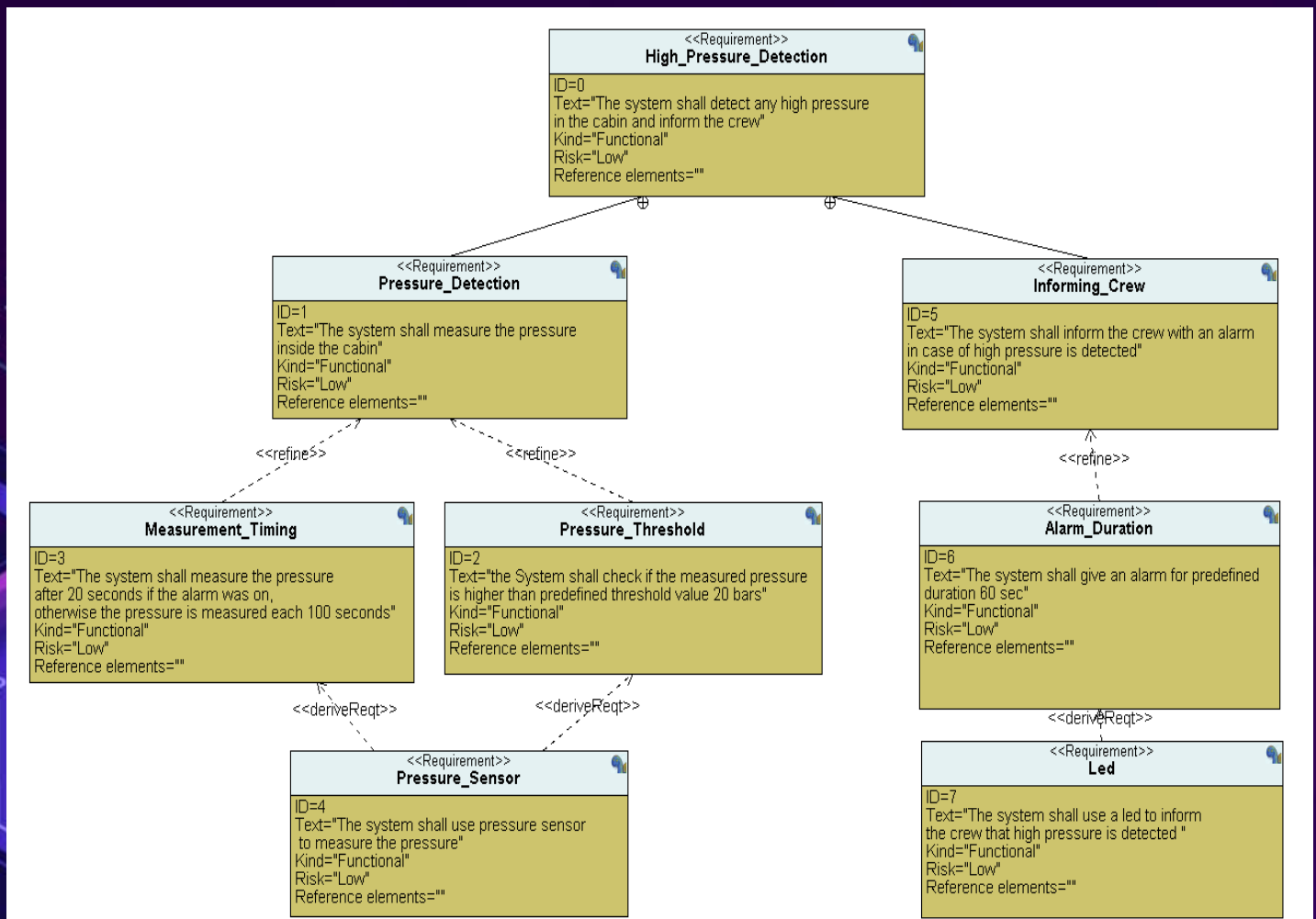
### ➤ Description:

- If the pressure exceeds 20 bars in the cabin the system detects high pressure
- When high pressure is detected, the system informs the crew with an alarm (LED)
- The alarm duration is 60 seconds
- In case of high pressure, the next value of pressure is measured after 20 seconds from the moment that alarm is off (quick check)
- In case of normal pressure, the next value of pressure is measured after 100 seconds (normal check)

### ➤ Assumptions:

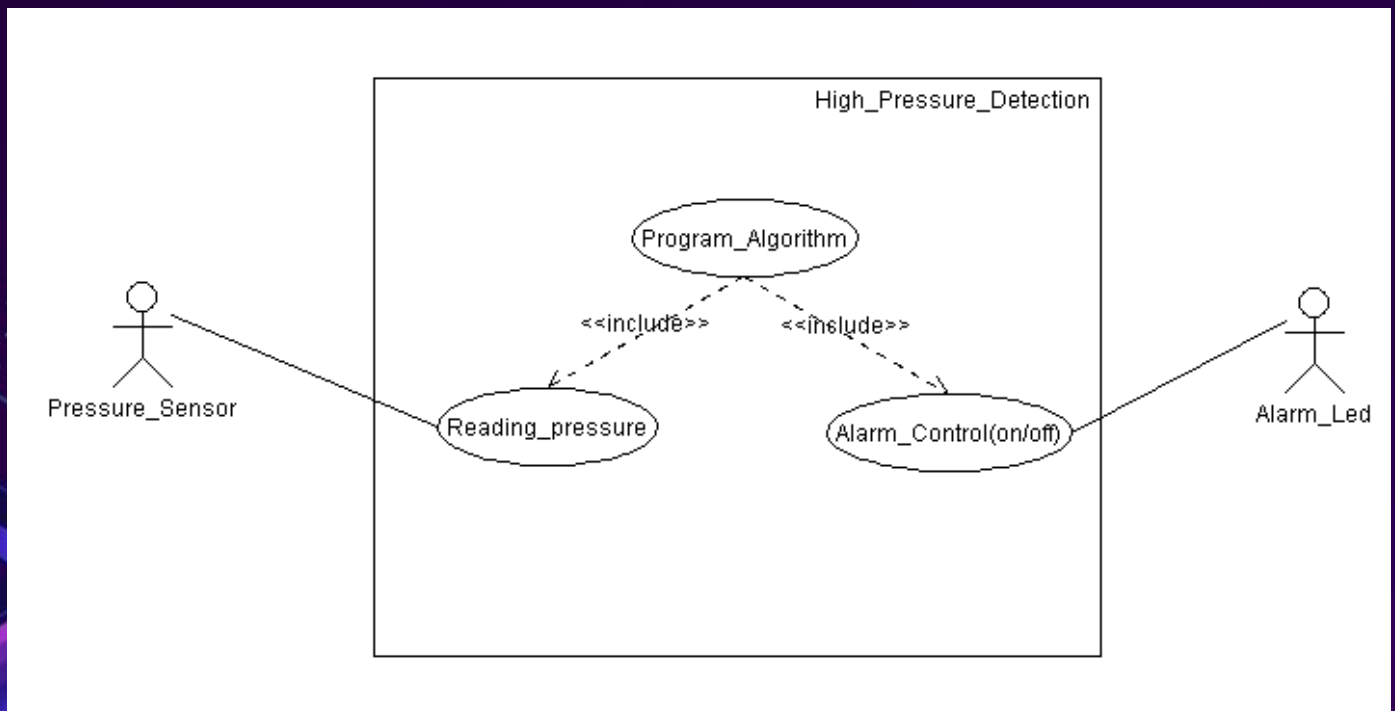
- System setup, reset, and shutdown are not modeled
- The system maintenance is not modeled
- The controller power is never cut
- The pressure sensor never fails
- The alarm never fails

## 2. REQUIREMENT DIAGRAM

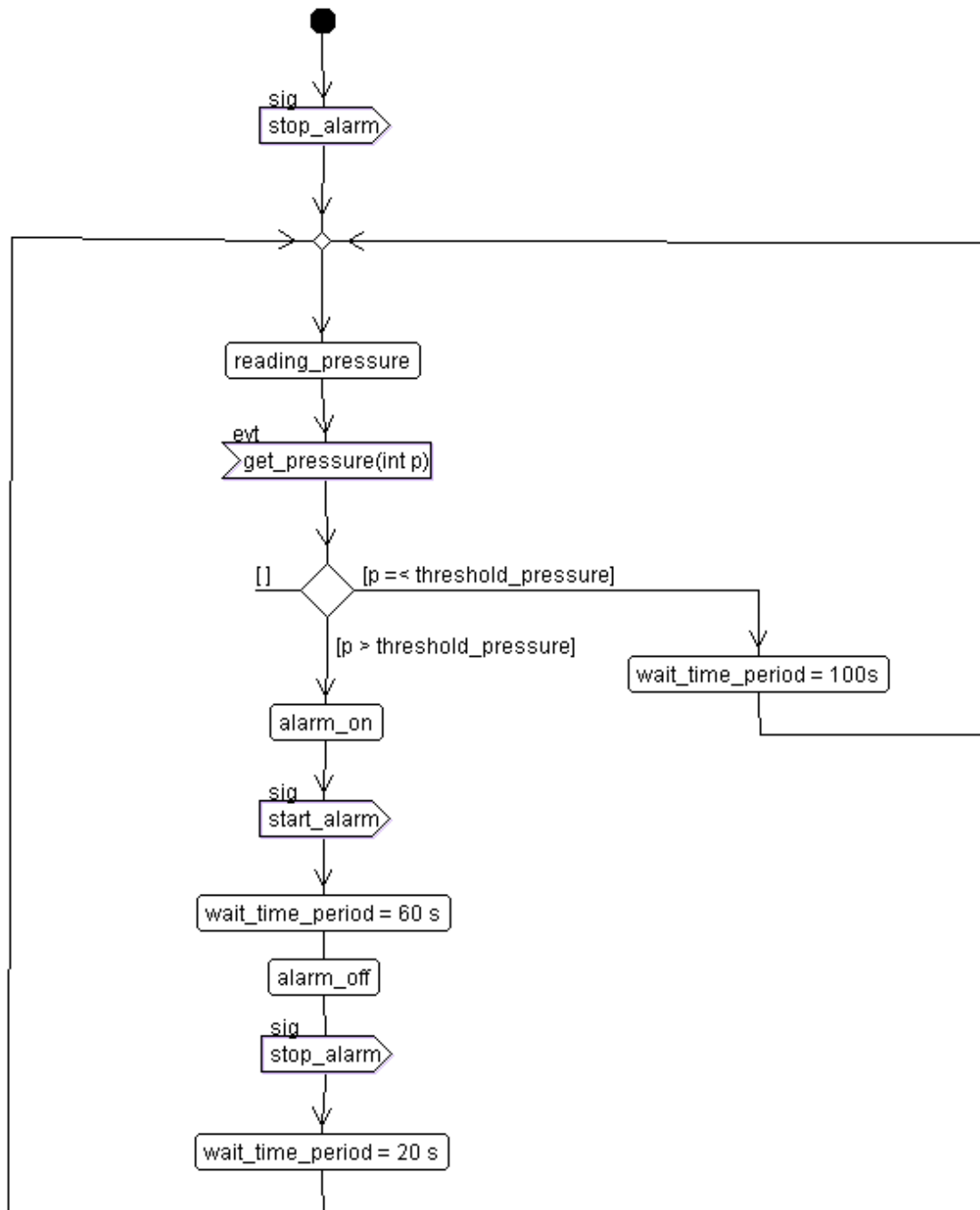




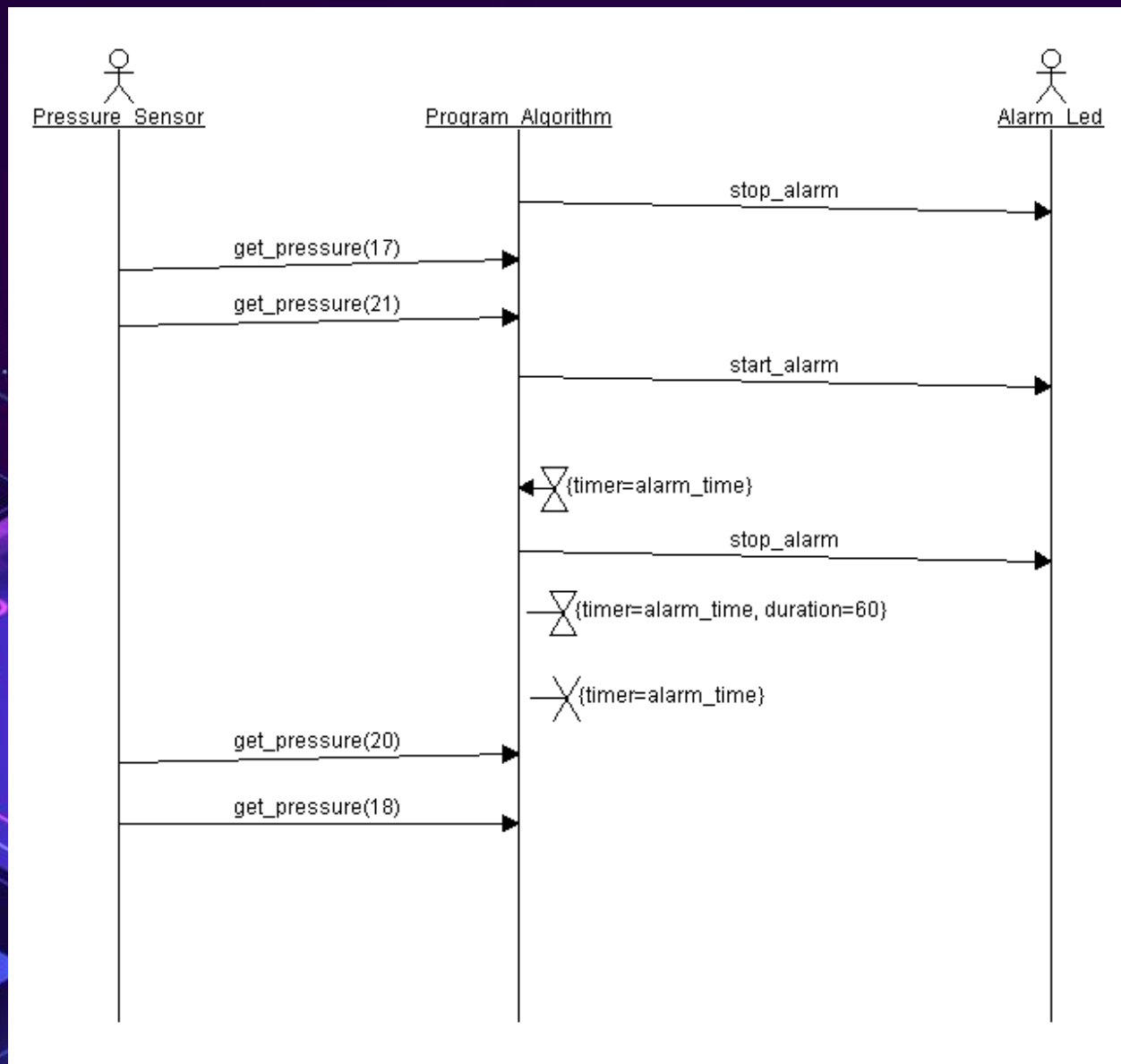
### 3. USE CASE DIAGRAM



## 4. ACTIVITY DIAGRAM



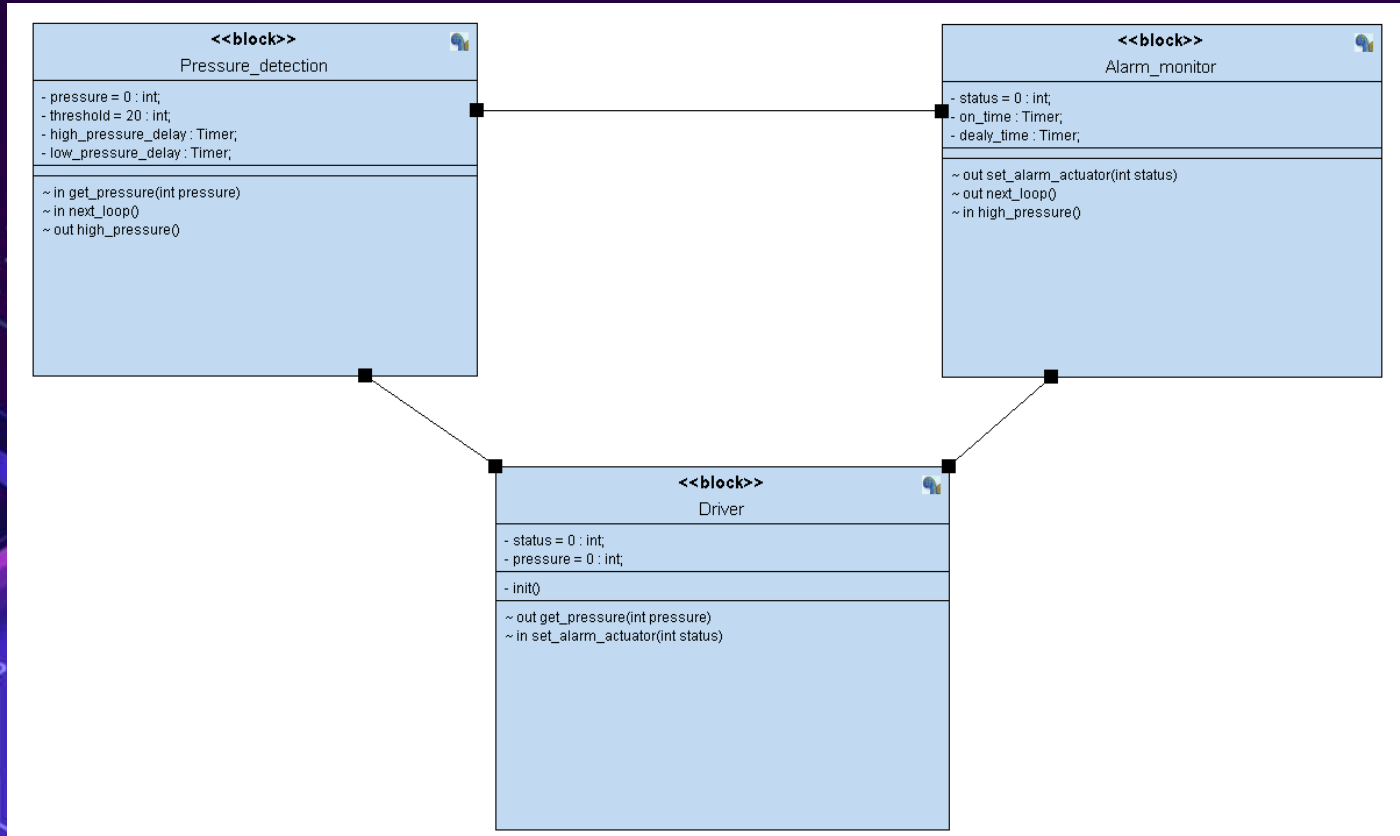
## 5. SEQUENCE DIAGRAM





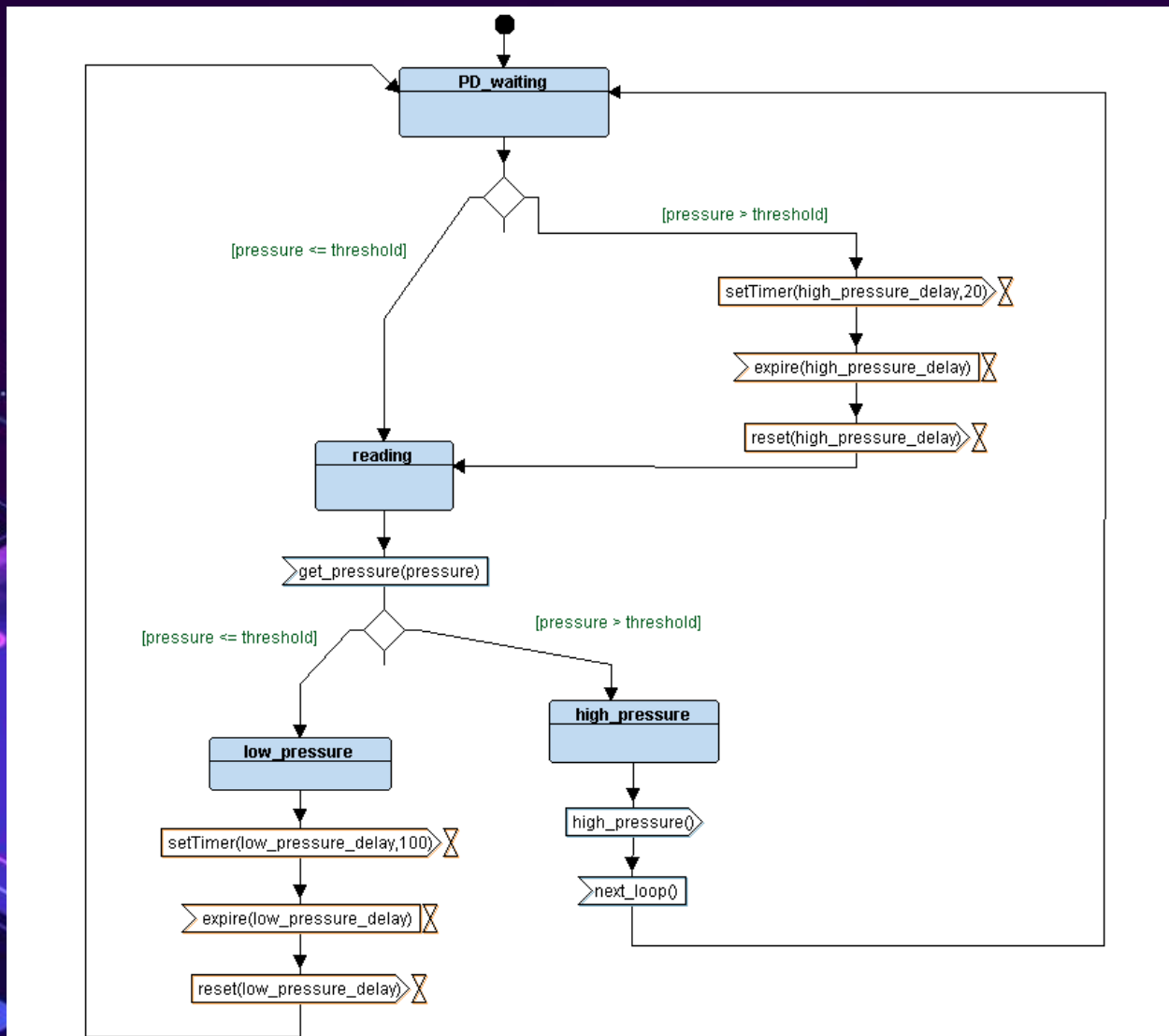
## 6. DESIGN DIAGRAM

### 6.1. Block diagram

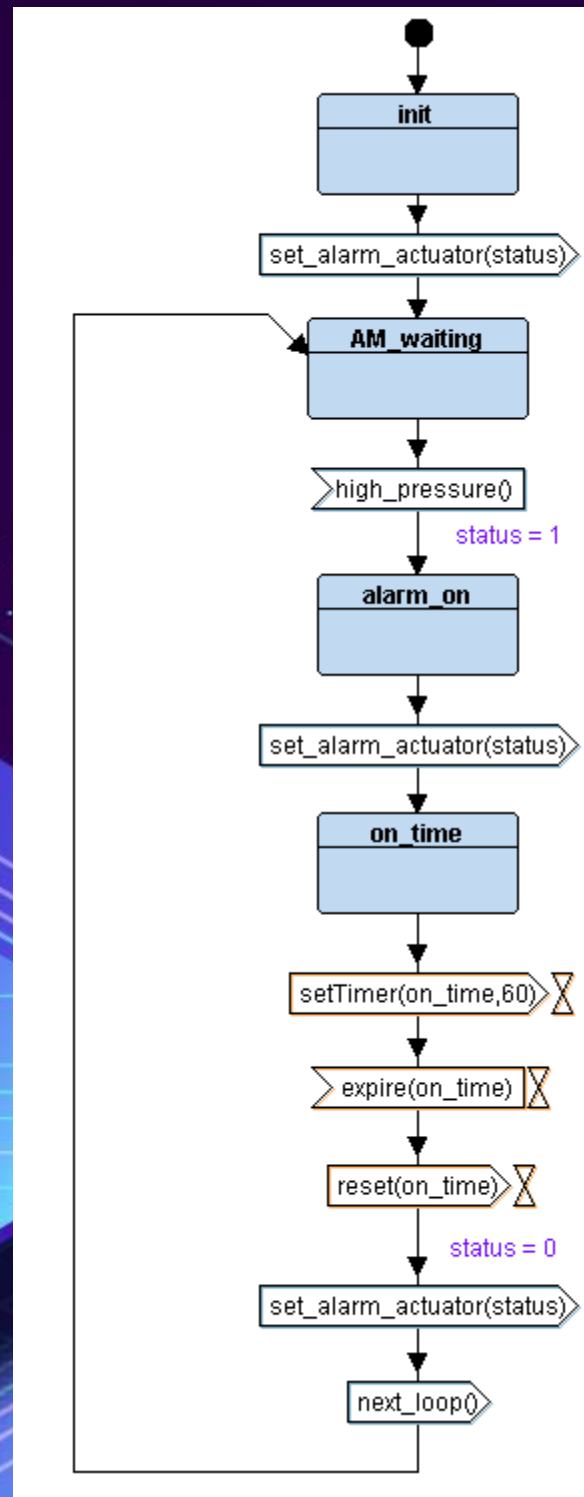




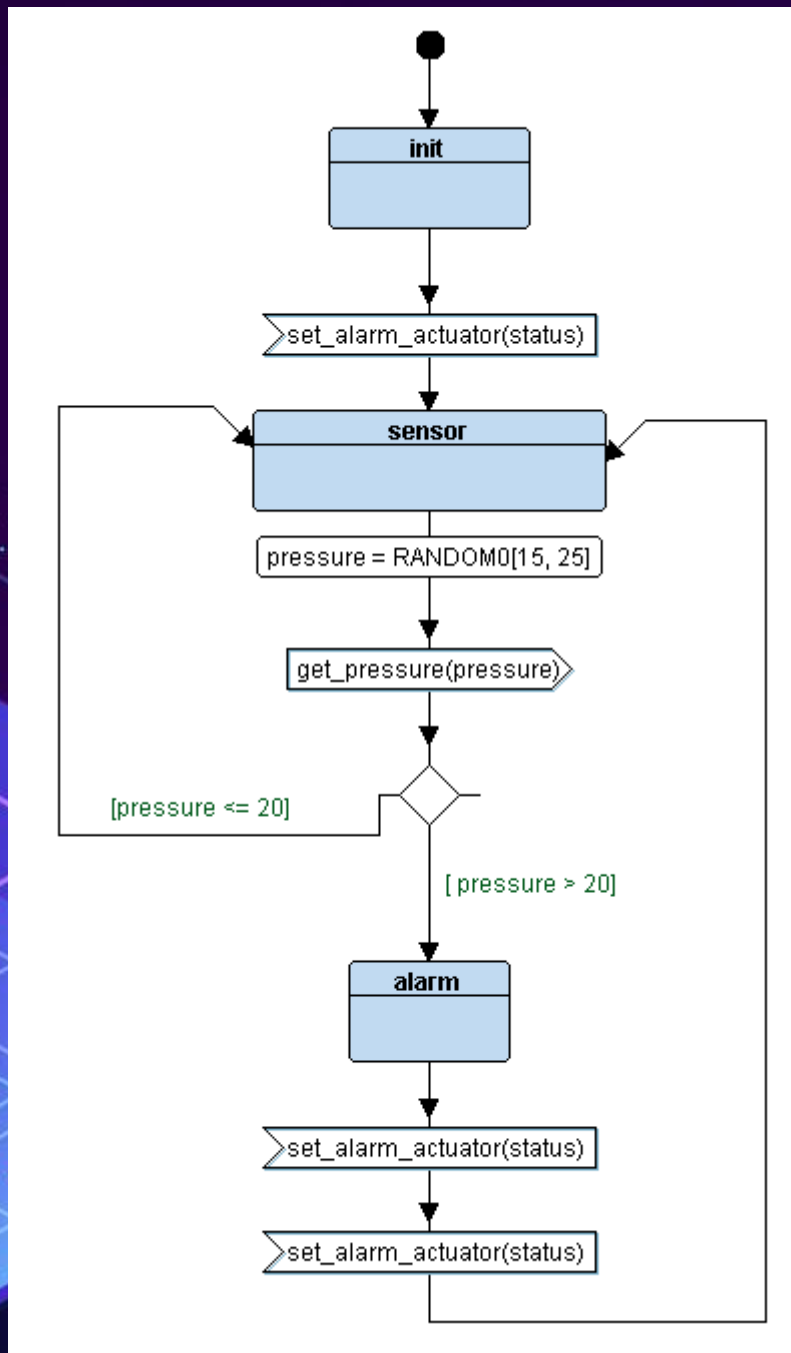
## 6.2. Pressure detection state machine diagram



### 6.3. Alarm monitor state machine diagram



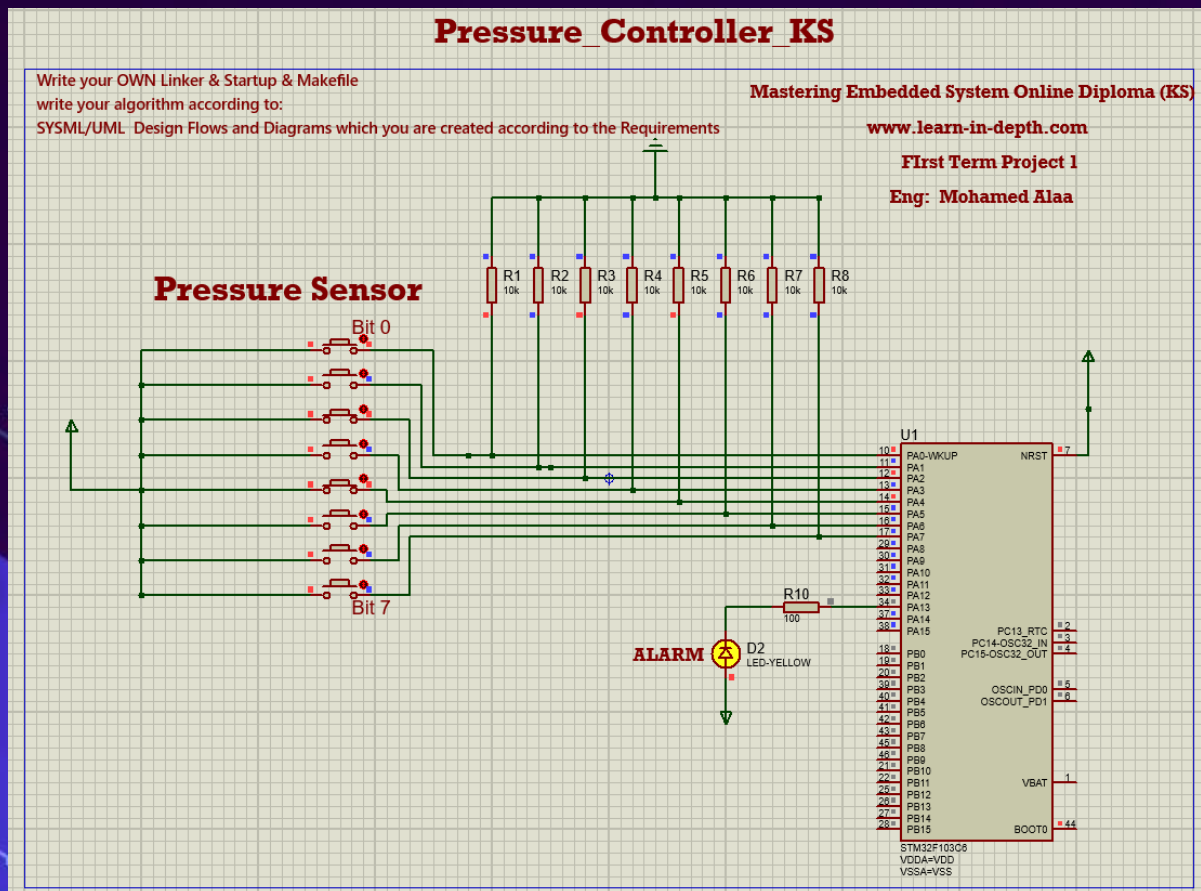
#### 6.4. Driver state machine diagram





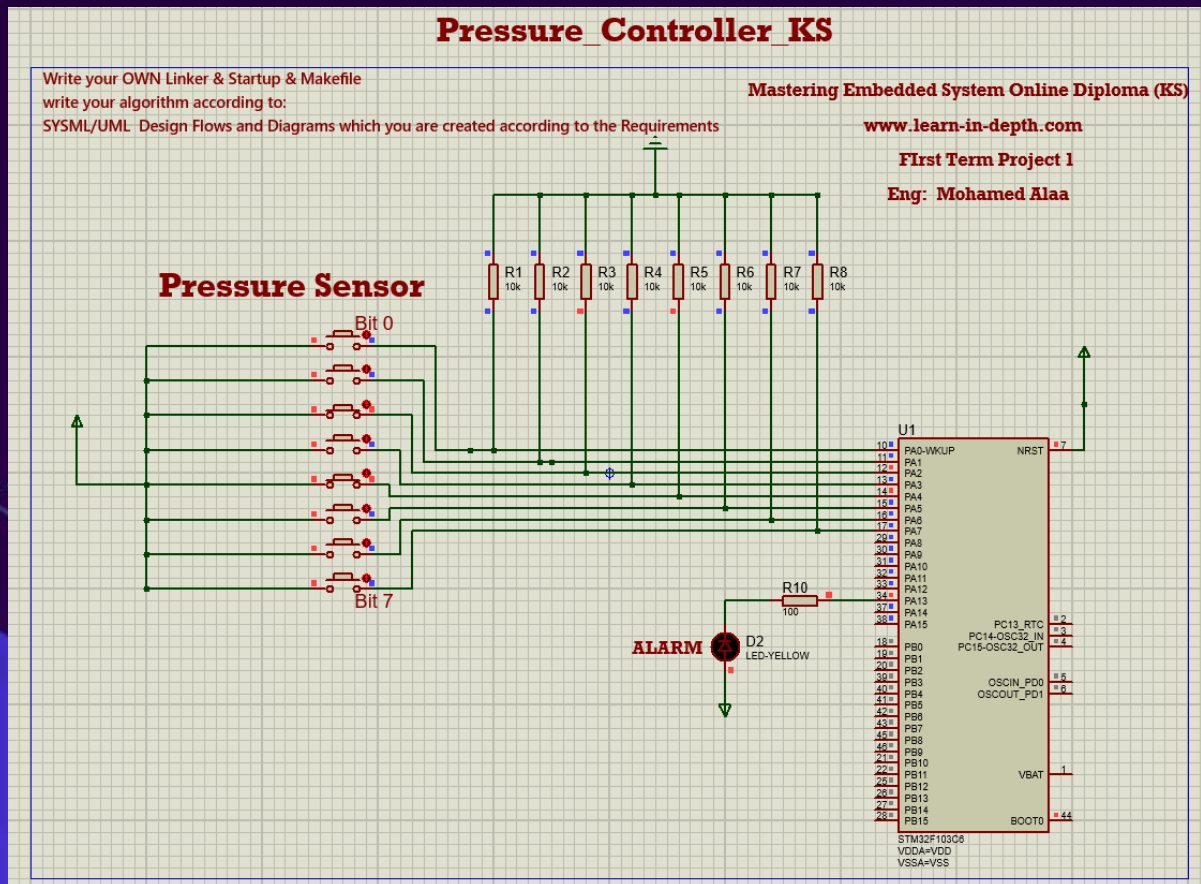
## 7. SYSTEM SIMULATION BY PROTEUS

### 7.1. Alarm on



Pressure = 21 bar

## 7.2. Alarm off



Pressure = 20 bar



## 8. SW ANALYSIS

### 8.1. Map file

#### Memory Configuration

Name	Origin	Length	Attributes
Flash	0x08000000	0x00020000	xr
SRAM	0x20000000	0x00005000	xrw
*default*	0x00000000	0xffffffff	

#### Linker script and memory map

```
.text          0x08000000      0x2e0
startup.o(.vectors)
.vectors       0x08000000      0x10 startup.o
               0x08000000      Vector_table
*(.text)
.text         0x08000010      0xbc startup.o
               0x08000010      NMI_handler
               0x08000010      Hard_fault_handler
               0x08000010      Default_handler
               0x0800001c      reset
.text         0x080000cc      0x54 pressure_detection.o
               0x080000cc      ST_PD_waiting
.text         0x08000120      0x24 main.o
               0x08000120      main
.text         0x08000144      0x10c driver.o
               0x08000144      Delay
               0x08000168      getPressureVal
               0x08000180      Set_Alarm_actuator
               0x080001d0      GPIO_INITIALIZATION
.text         0x08000250      0x90 alarm_monitor.o
               0x08000250      AM_init
               0x08000278      High_pressure
               0x08000290      ST_AM_waiting
*(.rodata)
               0x080002e0      _text_end = .
.glue_7       0x080002e0      0x0
.glue_7       0x00000000      0x0 linker stubs
```



```

.rel.dyn      0x080002e0      0x0
.rel.plt      0x00000000      0x0 startup.o

.data          0x20000000      0x8 load address 0x080002e0
              0x20000000      _data_start = .
*(.data)
.data          0x20000000      0x0 startup.o
.data          0x20000000      0x4 pressure_detection.o
              0x20000000      PD_state
.data          0x20000004      0x0 main.o
.data          0x20000004      0x0 driver.o
.data          0x20000004      0x4 alarm_monitor.o
              0x20000004      AM_state
              0x20000008      _data_end = .

.igot.plt      0x20000008      0x0 load address 0x080002e8
.igot.plt      0x00000000      0x0 startup.o

.bss           0x20000008      0x5 load address 0x080002e8
              0x20000008      _bss_start = .
*(.bss)
.bss           0x20000008      0x0 startup.o
.bss           0x20000008      0x4 pressure_detection.o
              0x20000008      PD_pressure
.bss           0x2000000c      0x0 main.o
.bss           0x2000000c      0x0 driver.o
.bss           0x2000000c      0x1 alarm_monitor.o
              0x2000000d      _bss_end = .
              0x20000010      . = ALIGN (0x4)
              0x20001010      _stack_top = (. + 0x1000)

LOAD startup.o
LOAD pressure_detection.o
LOAD main.o
LOAD driver.o
LOAD alarm_monitor.o
OUTPUT(High_Pressure_Detection_System.elf elf32-littlearm)

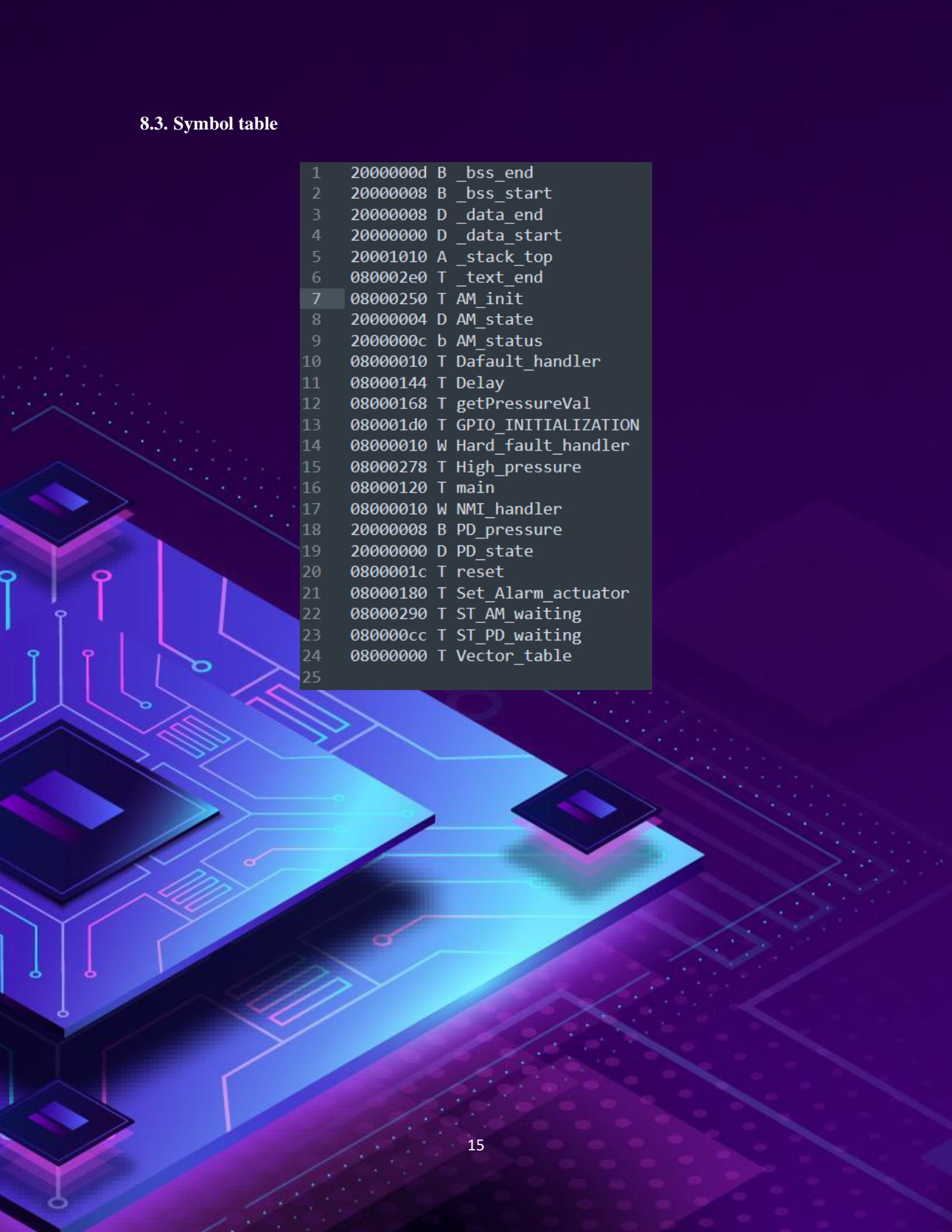
```

## 8.2. Section header

```
1
2 High_Pressure_Detection_System.elf:    file format elf32-littlearm
3
4 Sections:
5 Idx Name                               Size      VMA        LMA        File off  Algn
6   0 .text                             000002e0  08000000   08000000   00008000  2**2
7   CONTENTS, ALLOC, LOAD, READONLY, CODE
8   1 .data                             00000008  20000000   080002e0   00010000  2**2
9   CONTENTS, ALLOC, LOAD, DATA
10  2 .bss                               00000005  20000008   080002e8   00010008  2**2
11  ALLOC
12  3 .debug_info                        000004cb  00000000   00000000   00010008  2**0
13  CONTENTS, READONLY, DEBUGGING
14  4 .debug_abbrev                     000002ef  00000000   00000000   000104d3  2**0
15  CONTENTS, READONLY, DEBUGGING
16  5 .debug_loc                        00000208  00000000   00000000   000107c2  2**0
17  CONTENTS, READONLY, DEBUGGING
18  6 .debug_aranges                    000000a0  00000000   00000000   000109ca  2**0
19  CONTENTS, READONLY, DEBUGGING
20  7 .debug_line                       00000291  00000000   00000000   00010a6a  2**0
21  CONTENTS, READONLY, DEBUGGING
22  8 .debug_str                        0000022c  00000000   00000000   00010cfb  2**0
23  CONTENTS, READONLY, DEBUGGING
24  9 .comment                          00000011  00000000   00000000   00010f27  2**0
25  CONTENTS, READONLY
26 10 .ARM.attributes                   00000033  00000000   00000000   00010f38  2**0
27  CONTENTS, READONLY
28 11 .debug_frame                      0000017c  00000000   00000000   00010f6c  2**2
29  CONTENTS, READONLY, DEBUGGING
30
```



### 8.3. Symbol table



1	2000000d	B	_bss_end
2	20000008	B	_bss_start
3	20000008	D	_data_end
4	20000000	D	_data_start
5	20001010	A	_stack_top
6	080002e0	T	_text_end
7	08000250	T	AM_init
8	20000004	D	AM_state
9	2000000c	b	AM_status
10	08000010	T	Dafault_handler
11	08000144	T	Delay
12	08000168	T	getPressureVal
13	080001d0	T	GPIO_INITIALIZATION
14	08000010	W	Hard_fault_handler
15	08000278	T	High_pressure
16	08000120	T	main
17	08000010	W	NMI_handler
18	20000008	B	PD_pressure
19	20000000	D	PD_state
20	0800001c	T	reset
21	08000180	T	Set_Alarm_actuator
22	08000290	T	ST_AM_waiting
23	080000cc	T	ST_PD_waiting
24	08000000	T	Vector_table
25			