2023

High Pressure Detection system

AHMED OSAMA AHMED SOLIMAN

FIRST TERM PROJECT 1

Ahmed Osama Ahmed Soliman

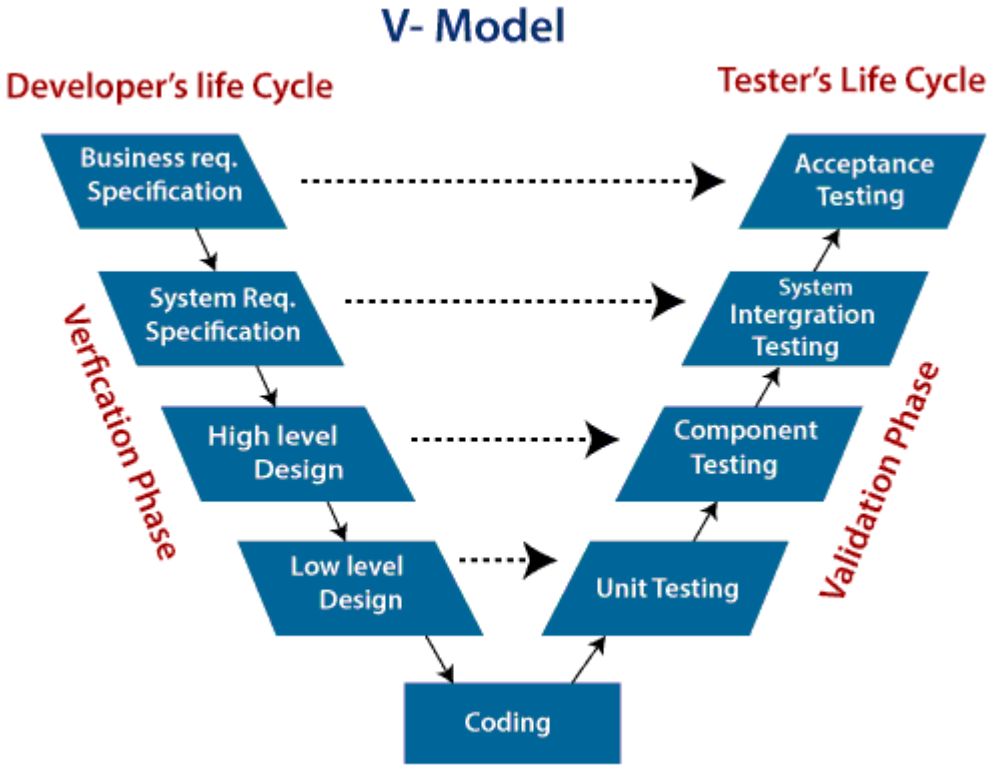
1st Term Project 1

Case study:

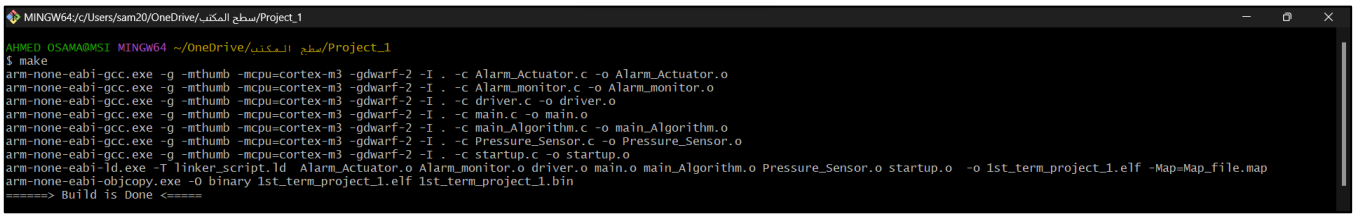
- A pressure controller informs the crew of a cabin with an alarm when the pressure exceeds 20 bars in the cabin
- The alarm duration equals 60 seconds.
- keeps track of the measured values.

Method:

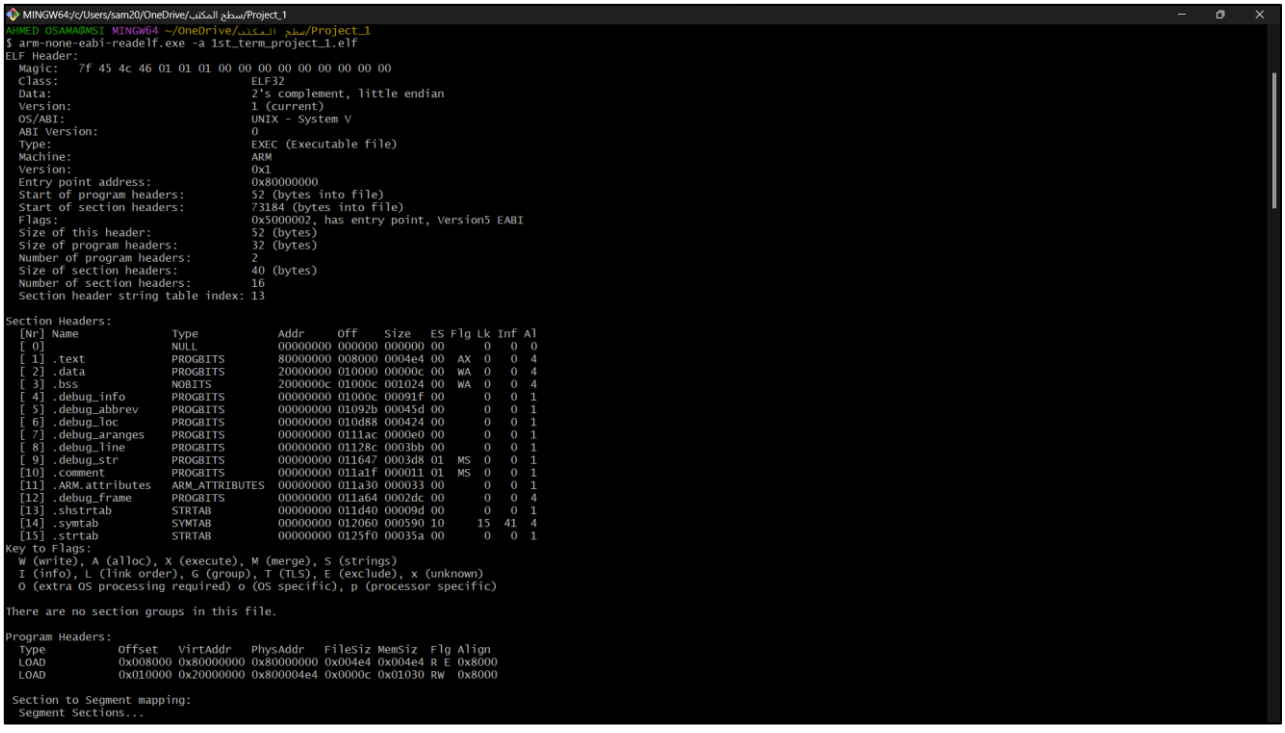
I'll work with v-model method.

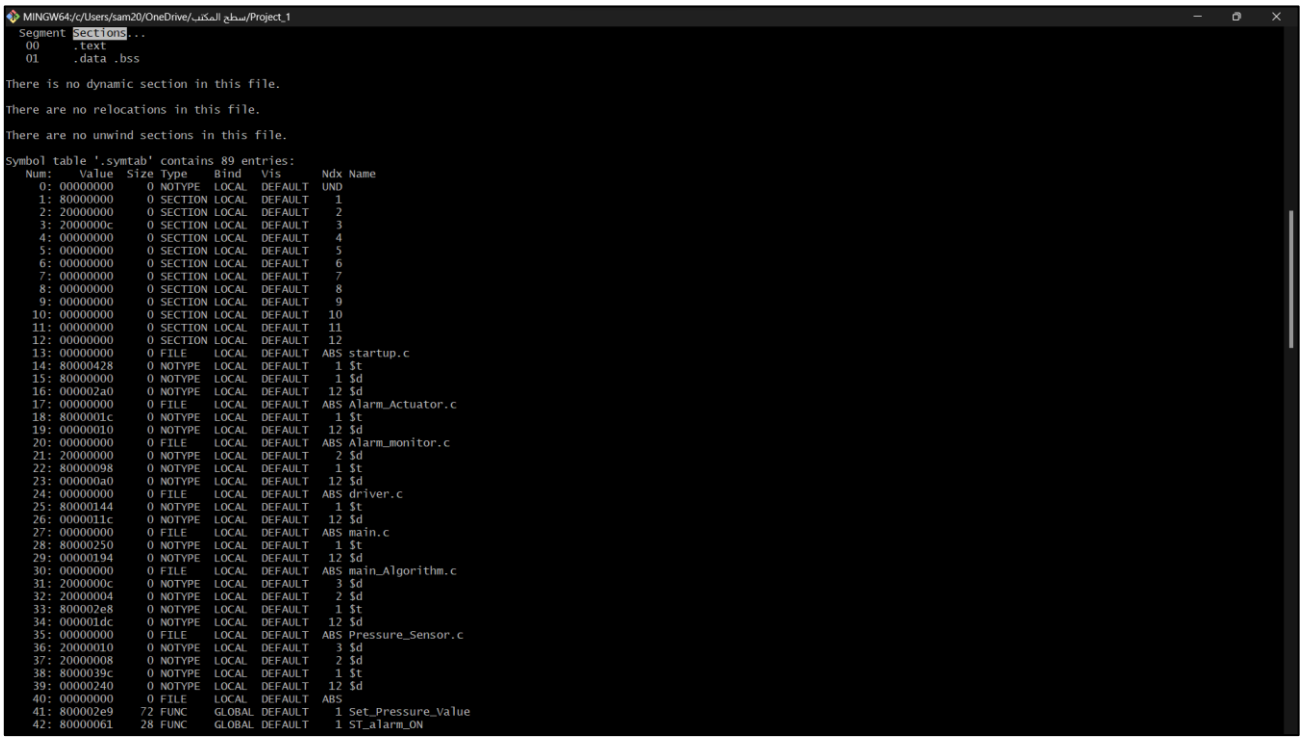


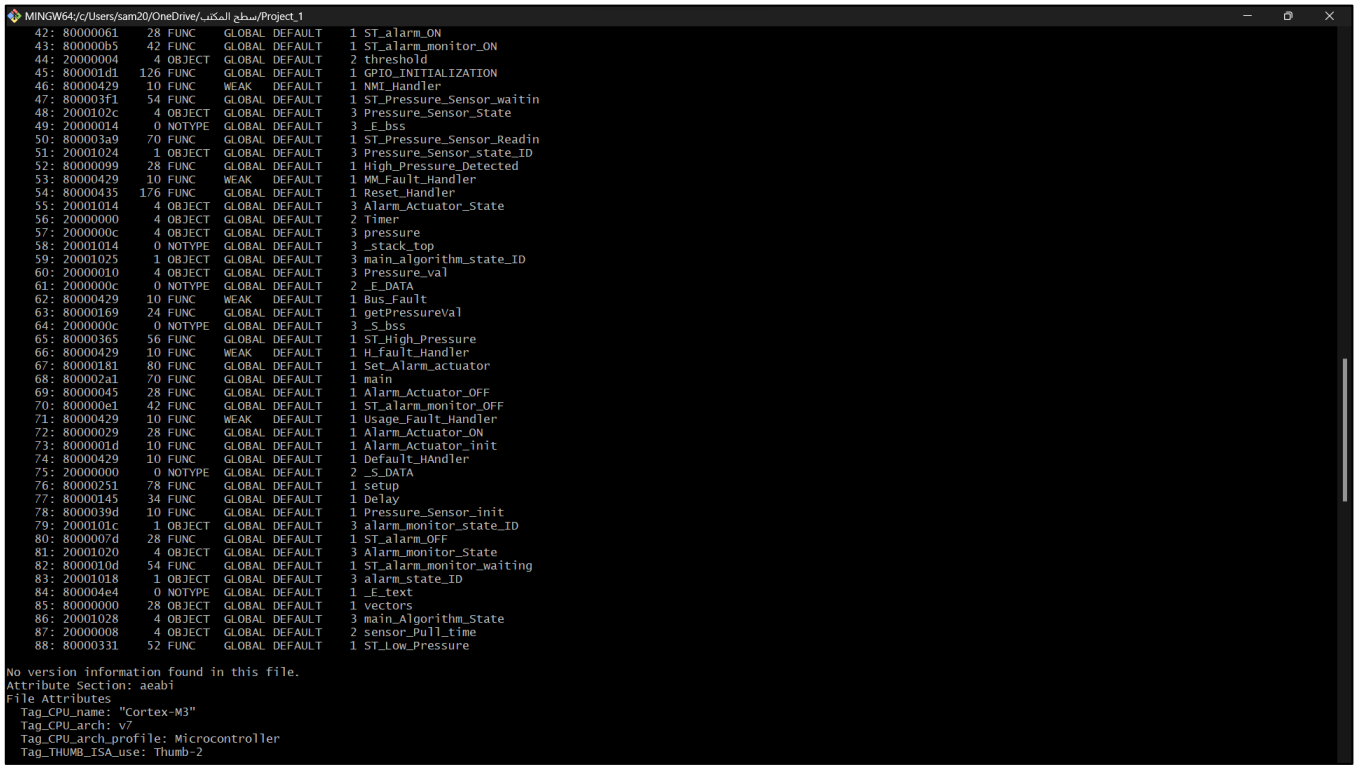
Building file by using my makefile



Readelf




MINGW64:/c/Users/sam20/OneDrive/سطح المكتب/Project_1
Segment Sections...
00 .text
01 .data .bss
There is no dynamic section in this file.
There are no relocations in this file.
There are no unwind sections in this file.
Symbol table '.symtab' contains 89 entries:
Num: Value Size Type Bind Vis Ndx Name
0: 00000000 0 NOTYPE LOCAL DEFAULT UND
1: 80000000 0 SECTION LOCAL DEFAULT 1
2: 20000000 0 SECTION LOCAL DEFAULT 2
3: 2000000c 0 SECTION LOCAL DEFAULT 3
4: 00000000 0 SECTION LOCAL DEFAULT 4
5: 00000000 0 SECTION LOCAL DEFAULT 5
6: 00000000 0 SECTION LOCAL DEFAULT 6
7: 00000000 0 SECTION LOCAL DEFAULT 7
8: 00000000 0 SECTION LOCAL DEFAULT 8
9: 00000000 0 SECTION LOCAL DEFAULT 9
10: 00000000 0 SECTION LOCAL DEFAULT 10
11: 00000000 0 SECTION LOCAL DEFAULT 11
12: 00000000 0 SECTION LOCAL DEFAULT 12
13: 00000000 0 FILE LOCAL DEFAULT ABS startup.c
14: 80000428 0 NOTYPE LOCAL DEFAULT 1 $t
15: 80000000 0 NOTYPE LOCAL DEFAULT 1 $d
16: 000002a0 0 NOTYPE LOCAL DEFAULT 12 $d
17: 00000000 0 FILE LOCAL DEFAULT ABS Alarm_Actuator.c
18: 8000001c 0 NOTYPE LOCAL DEFAULT 1 $t
19: 00000010 0 NOTYPE LOCAL DEFAULT 12 $d
20: 00000000 0 FILE LOCAL DEFAULT ABS Alarm_monitor.c
21: 20000000 0 NOTYPE LOCAL DEFAULT 2 $d
22: 80000098 0 NOTYPE LOCAL DEFAULT 1 $t
23: 000000a0 0 NOTYPE LOCAL DEFAULT 12 $d
24: 00000000 0 FILE LOCAL DEFAULT ABS driver.c
25: 80000144 0 NOTYPE LOCAL DEFAULT 1 $t
26: 0000011c 0 NOTYPE LOCAL DEFAULT 12 $d
27: 00000000 0 FILE LOCAL DEFAULT ABS main.c
28: 80000250 0 NOTYPE LOCAL DEFAULT 1 $t
29: 00000194 0 NOTYPE LOCAL DEFAULT 12 $d
30: 00000000 0 FILE LOCAL DEFAULT ABS main_Algorithm.c
31: 2000000c 0 NOTYPE LOCAL DEFAULT 3 $d
32: 20000004 0 NOTYPE LOCAL DEFAULT 2 $d
33: 800002e8 0 NOTYPE LOCAL DEFAULT 1 $t
34: 000001dc 0 NOTYPE LOCAL DEFAULT 12 $d
35: 00000000 0 FILE LOCAL DEFAULT ABS Pressure_Sensor.c
36: 20000010 0 NOTYPE LOCAL DEFAULT 3 $d
37: 20000008 0 NOTYPE LOCAL DEFAULT 2 $d
38: 8000039c 0 NOTYPE LOCAL DEFAULT 1 $t
39: 00000240 0 NOTYPE LOCAL DEFAULT 12 $d
40: 00000000 0 FILE LOCAL DEFAULT ABS
41: 800002e9 72 FUNC GLOBAL DEFAULT 1 Set_Pressure_Value
42: 80000061 28 FUNC GLOBAL DEFAULT 1 ST_alarm_ON


MINGW64:/c/Users/sam20/OneDrive/سطح المكتب/Project_1
42: 80000061 28 FUNC GLOBAL DEFAULT 1 ST_alarm_ON
43: 800000b5 42 FUNC GLOBAL DEFAULT 1 ST_alarm_monitor_ON
44: 20000004 4 OBJECT GLOBAL DEFAULT 2 threshold
45: 800001d1 126 FUNC GLOBAL DEFAULT 1 GPIO_INITIALIZATION
46: 80000429 10 FUNC WEAK DEFAULT 1 NMI_Handler
47: 800003f1 54 FUNC GLOBAL DEFAULT 1 ST_Pressure_Sensor_waitin
48: 2000102c 4 OBJECT GLOBAL DEFAULT 3 Pressure_Sensor_State
49: 20000014 0 NOTYPE GLOBAL DEFAULT 3 _E_bss
50: 800003a9 70 FUNC GLOBAL DEFAULT 1 ST_Pressure_Sensor_Readin
51: 20001024 1 OBJECT GLOBAL DEFAULT 3 Pressure_Sensor_state_ID
52: 80000099 28 FUNC GLOBAL DEFAULT 1 High_Pressure_Detected
53: 80000429 10 FUNC WEAK DEFAULT 1 MM_Fault_Handler
54: 80000435 176 FUNC GLOBAL DEFAULT 1 Reset_Handler
55: 20001014 4 OBJECT GLOBAL DEFAULT 3 Alarm_Actuator_State
56: 20000000 4 OBJECT GLOBAL DEFAULT 2 Timer
57: 2000000c 4 OBJECT GLOBAL DEFAULT 3 pressure
58: 20001014 0 NOTYPE GLOBAL DEFAULT 3 _stack_top
59: 20001025 1 OBJECT GLOBAL DEFAULT 3 main_algorithm_state_ID
60: 20000010 4 OBJECT GLOBAL DEFAULT 3 Pressure_val
61: 2000000c 0 NOTYPE GLOBAL DEFAULT 2 _E_DATA
62: 80000429 10 FUNC WEAK DEFAULT 1 Bus_Fault
63: 80000169 24 FUNC GLOBAL DEFAULT 1 getPressureVal
64: 2000000c 0 NOTYPE GLOBAL DEFAULT 3 _S_bss
65: 80000365 56 FUNC GLOBAL DEFAULT 1 ST_High_Pressure
66: 80000429 10 FUNC WEAK DEFAULT 1 H_fault_Handler
67: 80000181 80 FUNC GLOBAL DEFAULT 1 Set_Alarm_actuator
68: 800002a1 70 FUNC GLOBAL DEFAULT 1 main
69: 80000045 28 FUNC GLOBAL DEFAULT 1 Alarm_Actuator_OFF
70: 800000e1 42 FUNC GLOBAL DEFAULT 1 ST_alarm_monitor_OFF
71: 80000429 10 FUNC WEAK DEFAULT 1 Usage_Fault_Handler
72: 80000029 28 FUNC GLOBAL DEFAULT 1 Alarm_Actuator_ON
73: 8000001d 10 FUNC GLOBAL DEFAULT 1 Alarm_Actuator_init
74: 80000429 10 FUNC GLOBAL DEFAULT 1 Default_HAndler
75: 20000000 0 NOTYPE GLOBAL DEFAULT 2 _S_DATA
76: 80000251 78 FUNC GLOBAL DEFAULT 1 setup
77: 80000145 34 FUNC GLOBAL DEFAULT 1 Delay
78: 8000039d 10 FUNC GLOBAL DEFAULT 1 Pressure_Sensor_init
79: 20001018 1 OBJECT GLOBAL DEFAULT 3 alarm_monitor_state_ID
80: 8000007d 28 FUNC GLOBAL DEFAULT 1 ST_alarm_OFF
81: 20001020 4 OBJECT GLOBAL DEFAULT 3 Alarm_monitor_State
82: 8000010d 54 FUNC GLOBAL DEFAULT 1 ST_alarm_monitor_waiting
83: 20001018 1 OBJECT GLOBAL DEFAULT 3 alarm_state_ID
84: 800004e4 0 NOTYPE GLOBAL DEFAULT 1 _E_text
85: 80000000 28 OBJECT GLOBAL DEFAULT 1 vectors
86: 20001028 4 OBJECT GLOBAL DEFAULT 3 main_Algorithm_State
87: 20000008 4 OBJECT GLOBAL DEFAULT 2 sensor_Pull_time
88: 80000331 52 FUNC GLOBAL DEFAULT 1 ST_Low_Pressure
No version information found in this file.
Attribute Section: aeabi
File Attributes
Tag_CPU_name: "Cortex-M3"
Tag_CPU_arch: v7
Tag_CPU_arch_profile: Microcontroller
Tag_THUMB_ISA_use: Thumb-2

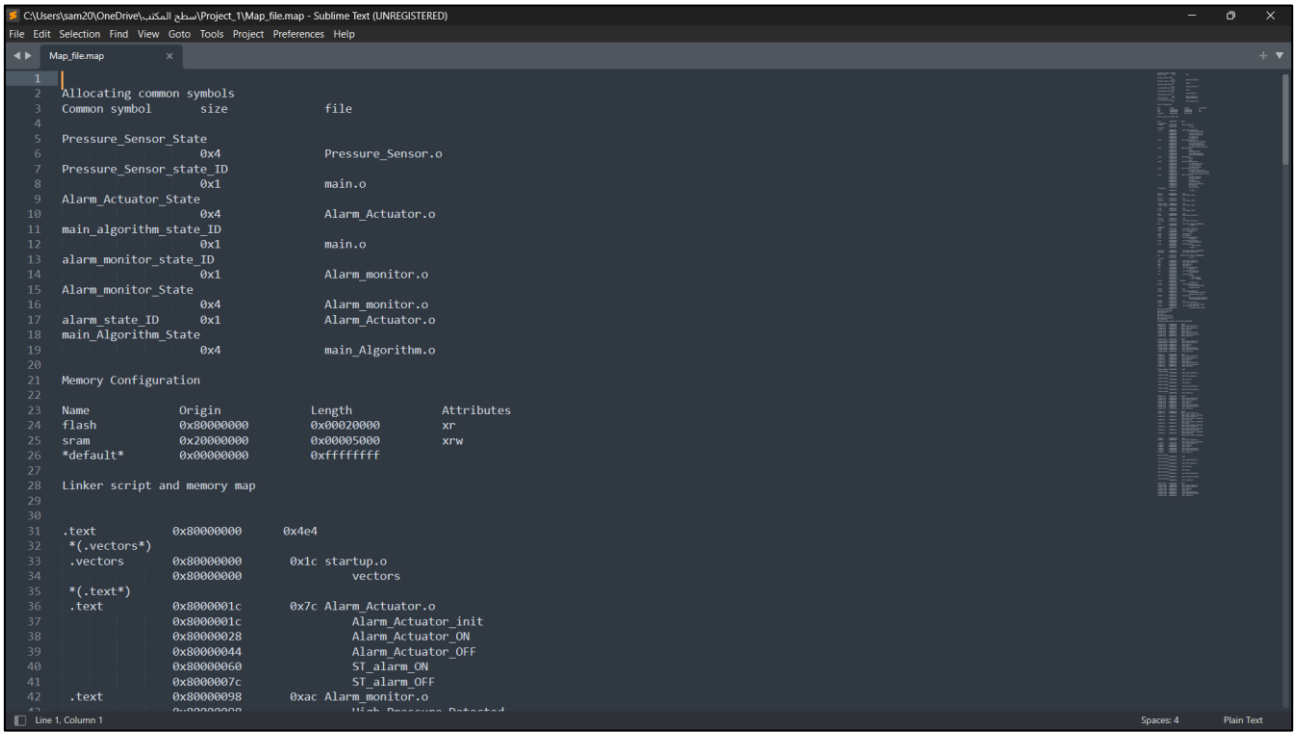
```
No version information found in this file.
Attribute Section: aeabi
File Attributes
  Tag_CPU_name: "Cortex-M3"
  Tag_CPU_arch: v7
  Tag_CPU_arch_profile: Microcontroller
  Tag_THUMB_ISA_use: Thumb-2
  Tag_ABI_PCS_wchar_t: 4
  Tag_ABI_FP_denormal: Needed
  Tag_ABI_FP_exceptions: Needed
  Tag_ABI_FP_number_model: IEEE 754
  Tag_ABI_align_needed: 8-byte
  Tag_ABI_align_preserved: 8-byte, except leaf SP
  Tag_ABI_enum_size: small
  Tag_ABI_optimization_goals: Aggressive Debug
  Tag_CPU_unaligned_access: v6
```

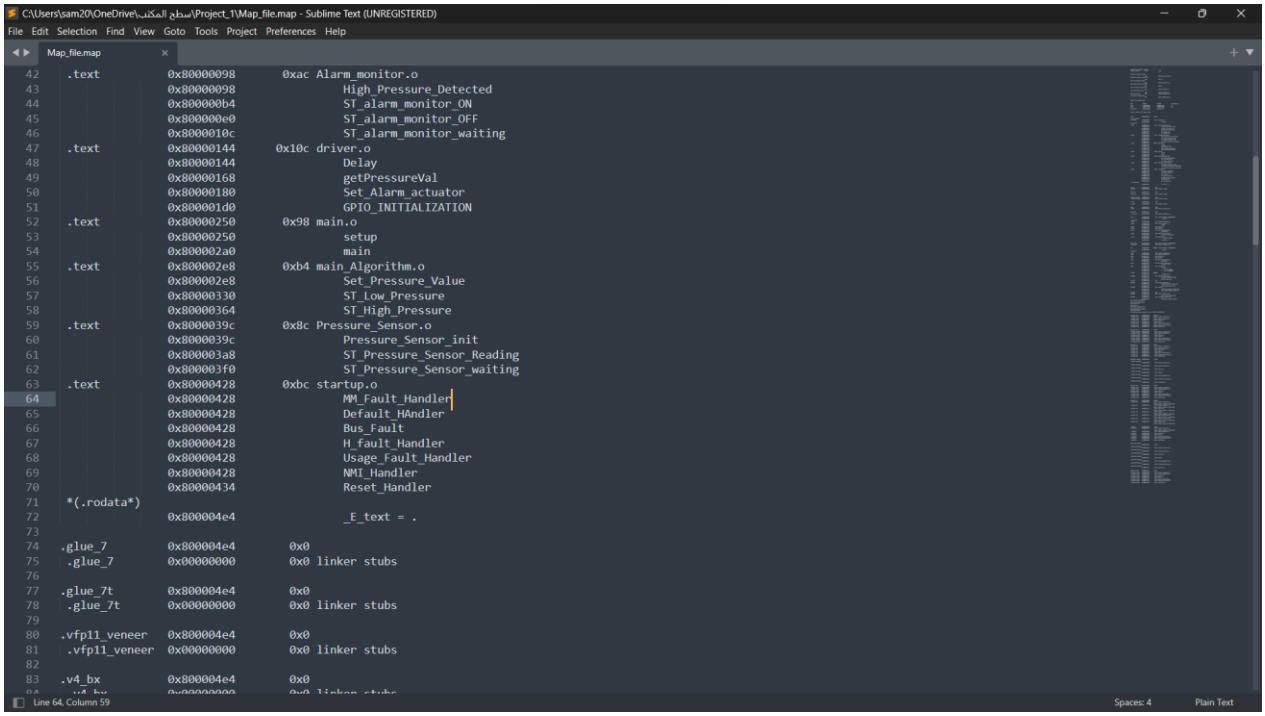
Sections

```
MINGW64:/c/Users/sam20/OneDrive/سطح المكتب/Project_1
AHMED OSAMA@MSI MINGW64 ~/OneDrive/سطح المكتب/Project_1
$ arm-none-eabi-objdump.exe -h 1st_term_project_1.elf

1st_term_project_1.elf:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         000004e4  80000000  80000000  00008000  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .data         0000000c  20000000  800004e4  00010000  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00001024  2000000c  800004f0  0001000c  2**2
                  ALLOC
  3 .debug_info   0000091f  00000000  00000000  0001000c  2**0
                  CONTENTS, READONLY, DEBUGGING
  4 .debug_abbrev 0000045d  00000000  00000000  0001092b  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    00000424  00000000  00000000  00010d88  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 000000e0  00000000  00000000  000111ac  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_line   000003bb  00000000  00000000  0001128c  2**0
                  CONTENTS, READONLY, DEBUGGING
  8 .debug_str    000003d8  00000000  00000000  00011647  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      00000011  00000000  00000000  00011a1f  2**0
                  CONTENTS, READONLY
 10 .ARM.attributes 00000033  00000000  00000000  00011a30  2**0
                  CONTENTS, READONLY
 11 .debug_frame  000002dc  00000000  00000000  00011a64  2**2
                  CONTENTS, READONLY, DEBUGGING
```

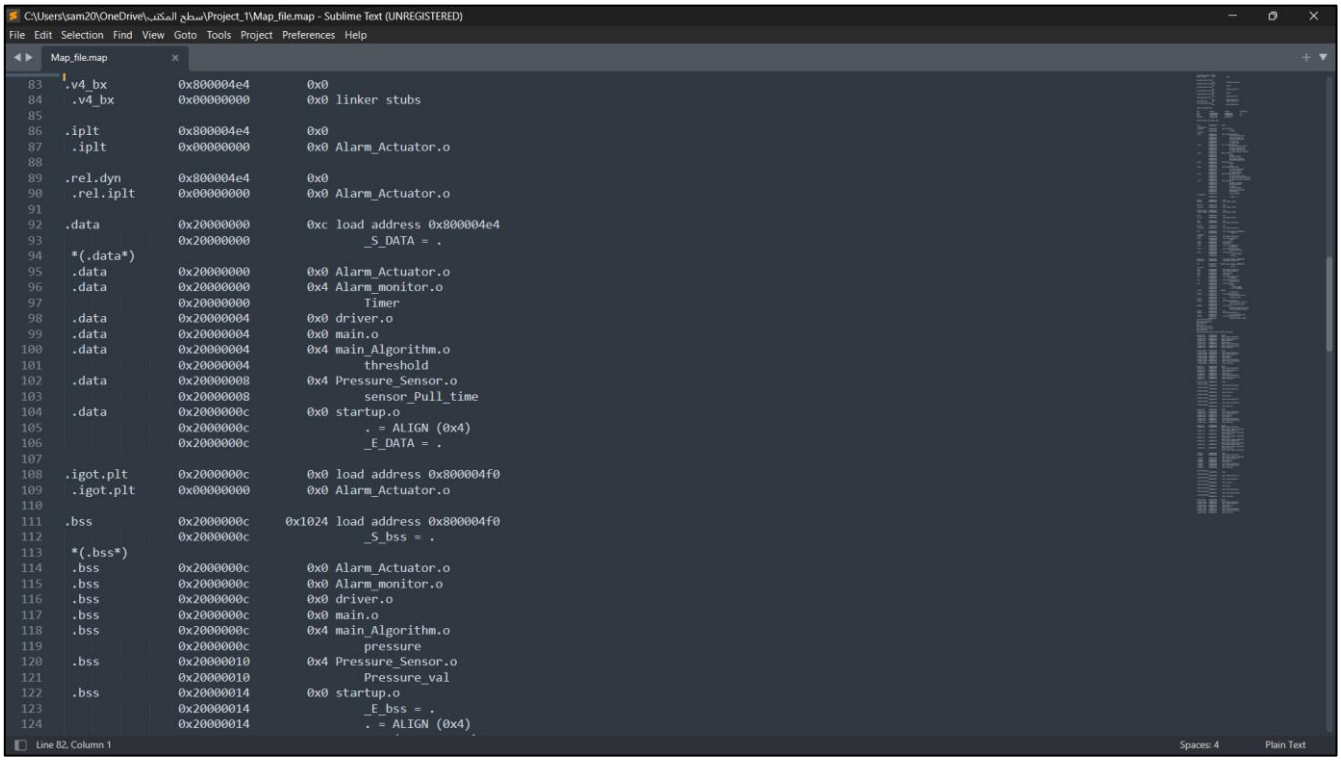
Symbol Table

MAP File

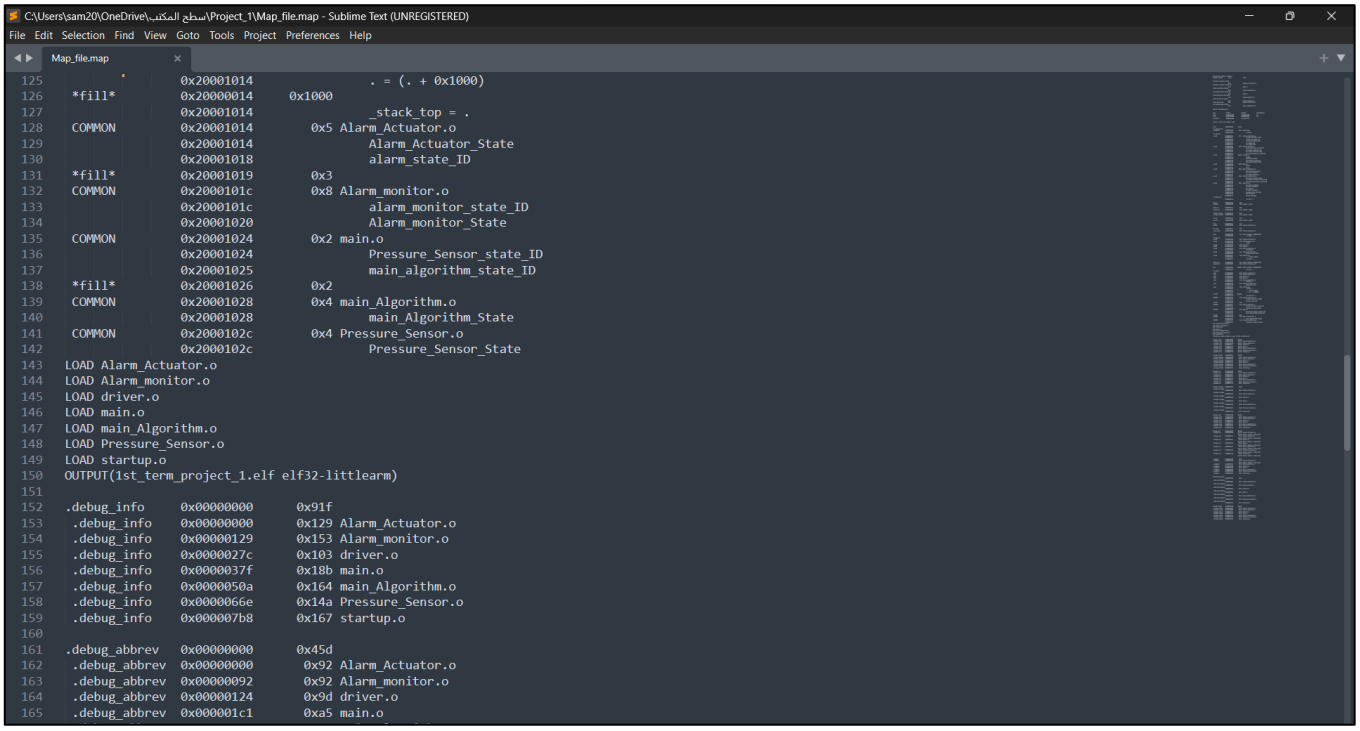




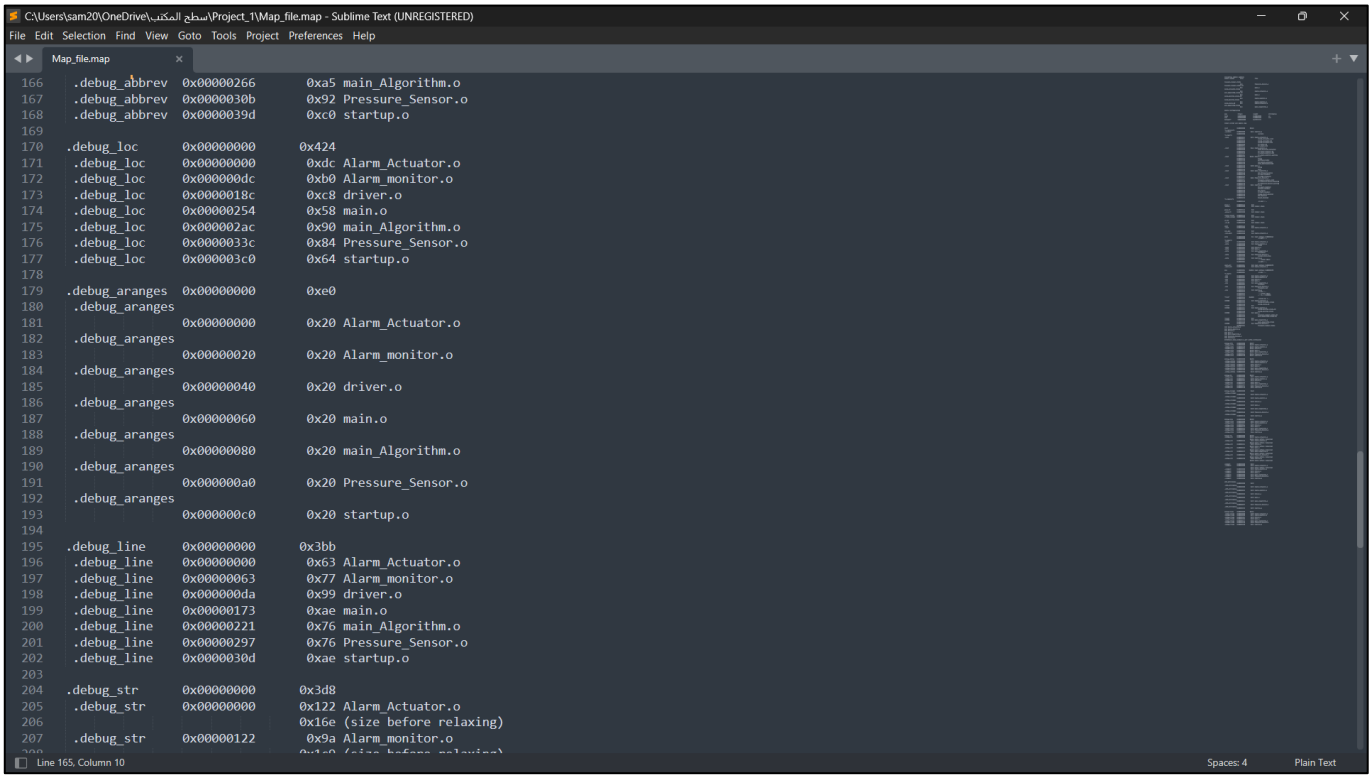
```
C:\Users\sam20\OneDrive\سطح المكتب\Project_1\Map_file.map - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
Map_file.map
 .text          0x80000098      0xac Alarm_monitor.o
                0x80000098              High_Pressure_Detected
                0x800000b4              ST_alarm_monitor_ON
                0x800000e0              ST_alarm_monitor_OFF
                0x8000010c              ST_alarm_monitor_waiting
 .text          0x80000144     0x10c driver.o
                0x80000144              Delay
                0x80000168              getPressureVal
                0x80000180              Set_Alarm_actuator
                0x800001d0              GPIO_INITIALIZATION
 .text          0x80000250      0x98 main.o
                0x80000250              setup
                0x800002a0              main
 .text          0x800002e8      0xb4 main_Algorithm.o
                0x800002e8              Set_Pressure_Value
                0x80000330              ST_Low_Pressure
                0x80000364              ST_High_Pressure
 .text          0x8000039c      0x8c Pressure_Sensor.o
                0x8000039c              Pressure_Sensor_init
                0x800003a8              ST_Pressure_Sensor_Reading
                0x800003f0              ST_Pressure_Sensor_waiting
 .text          0x80000428      0xbc startup.o
                0x80000428              MM_Fault_Handler
                0x80000428              Default_HAndler
                0x80000428              Bus_Fault
                0x80000428              H_fault_Handler
                0x80000428              Usage_Fault_Handler
                0x80000428              NMI_Handler
                0x80000434              Reset_Handler
 *(.rodata*)
                0x800004e4              _E_text = .

 .glue_7        0x800004e4       0x0
  .glue_7       0x00000000       0x0 linker stubs

 .glue_7t       0x800004e4       0x0
  .glue_7t      0x00000000       0x0 linker stubs

 .vfp11_veneer  0x800004e4       0x0
  .vfp11_veneer 0x00000000       0x0 linker stubs

 .v4_bx         0x800004e4       0x0
Line 64, Column 59                                                    Spaces: 4  Plain Text
```



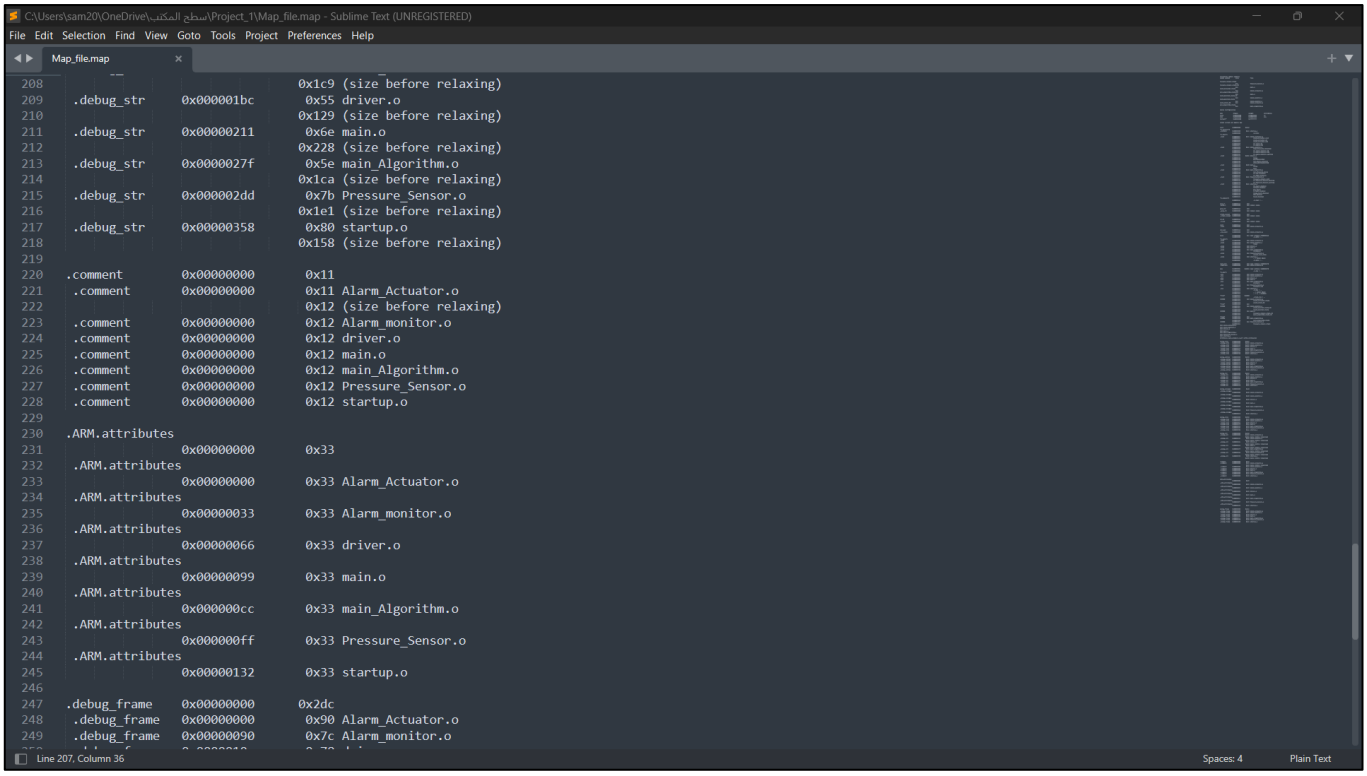
```
C:\Users\sam20\OneDrive\سطح المكتب\Project_1\Map_file.map - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
Map_file.map
 .v4_bx         0x800004e4       0x0
  .v4_bx        0x00000000       0x0 linker stubs

 .iplt          0x800004e4       0x0
  .iplt         0x00000000       0x0 Alarm_Actuator.o

 .rel.dyn       0x800004e4       0x0
  .rel.iplt     0x00000000       0x0 Alarm_Actuator.o

 .data          0x20000000       0xc load address 0x800004e4
                0x20000000              _S_DATA = .
 *(.data*)
 .data          0x20000000       0x0 Alarm_Actuator.o
 .data          0x20000000       0x4 Alarm_monitor.o
                0x20000000              Timer
 .data          0x20000004       0x0 driver.o
 .data          0x20000004       0x0 main.o
 .data          0x20000004       0x4 main_Algorithm.o
                0x20000004              threshold
 .data          0x20000008       0x4 Pressure_Sensor.o
                0x20000008              sensor_Pull_time
 .data          0x2000000c       0x0 startup.o
                0x2000000c              . = ALIGN (0x4)
                0x2000000c              _E_DATA = .

 .igot.plt      0x2000000c       0x0 load address 0x800004f0
  .igot.plt     0x00000000       0x0 Alarm_Actuator.o

 .bss           0x2000000c     0x1024 load address 0x800004f0
                0x2000000c              _S_bss = .
 *(.bss*)
 .bss           0x2000000c       0x0 Alarm_Actuator.o
 .bss           0x2000000c       0x0 Alarm_monitor.o
 .bss           0x2000000c       0x0 driver.o
 .bss           0x2000000c       0x0 main.o
 .bss           0x2000000c       0x4 main_Algorithm.o
                0x2000000c              pressure
 .bss           0x20000010       0x4 Pressure_Sensor.o
                0x20000010              Pressure_val
 .bss           0x20000014       0x0 startup.o
                0x20000014              _E_bss = .
                0x20000014              . = ALIGN (0x4)
Line 82, Column 1                                                     Spaces: 4  Plain Text
```

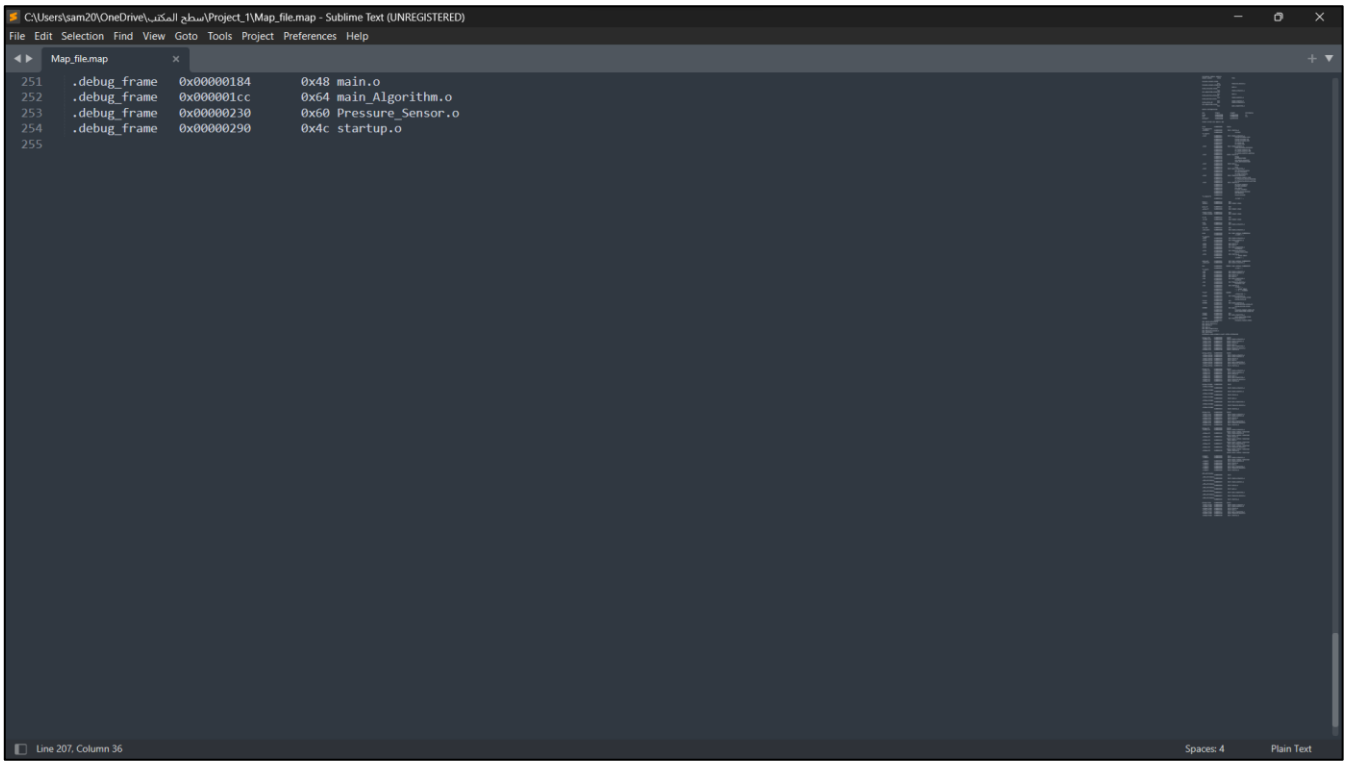


```
C:\Users\sam20\OneDrive\سطح المكتب\Project_1\Map_file.map - Sublime Text (UNREGISTERED)
File  Edit  Selection  Find  View  Goto  Tools  Project  Preferences  Help
Map_file.map
                0x20001014                . = (. + 0x1000)
 *fill*         0x20000014     0x1000
                0x20001014                _stack_top = .
 COMMON         0x20001014        0x5 Alarm_Actuator.o
                0x20001014                Alarm_Actuator_State
                0x20001018                alarm_state_ID
 *fill*         0x20001019        0x3
 COMMON         0x2000101c        0x8 Alarm_monitor.o
                0x2000101c                alarm_monitor_state_ID
                0x20001020                Alarm_monitor_State
 COMMON         0x20001024        0x2 main.o
                0x20001024                Pressure_Sensor_state_ID
                0x20001025                main_algorithm_state_ID
 *fill*         0x20001026        0x2
 COMMON         0x20001028        0x4 main_Algorithm.o
                0x20001028                main_Algorithm_State
 COMMON         0x2000102c        0x4 Pressure_Sensor.o
                0x2000102c                Pressure_Sensor_State
LOAD Alarm_Actuator.o
LOAD Alarm_monitor.o
LOAD driver.o
LOAD main.o
LOAD main_Algorithm.o
LOAD Pressure_Sensor.o
LOAD startup.o
OUTPUT(1st_term_project_1.elf elf32-littlearm)

.debug_info     0x00000000      0x91f
 .debug_info    0x00000000      0x129 Alarm_Actuator.o
 .debug_info    0x00000129      0x153 Alarm_monitor.o
 .debug_info    0x0000027c      0x103 driver.o
 .debug_info    0x0000037f      0x18b main.o
 .debug_info    0x0000050a      0x164 main_Algorithm.o
 .debug_info    0x0000066e      0x14a Pressure_Sensor.o
 .debug_info    0x000007b8      0x167 startup.o

.debug_abbrev   0x00000000      0x45d
 .debug_abbrev  0x00000000       0x92 Alarm_Actuator.o
 .debug_abbrev  0x00000092       0x92 Alarm_monitor.o
 .debug_abbrev  0x00000124       0x9d driver.o
 .debug_abbrev  0x000001c1       0xa5 main.o
```

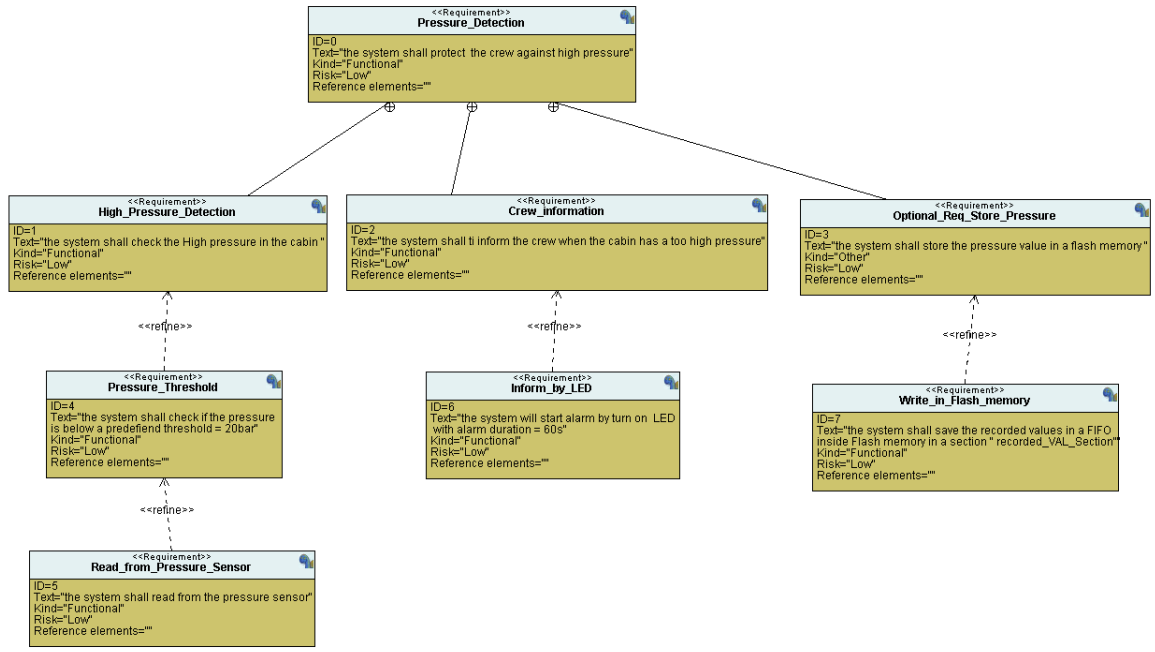


```
C:\Users\sam20\OneDrive\سطح المكتب\Project_1\Map_file.map - Sublime Text (UNREGISTERED)
File  Edit  Selection  Find  View  Goto  Tools  Project  Preferences  Help
Map_file.map
 .debug_abbrev  0x00000266       0xa5 main_Algorithm.o
 .debug_abbrev  0x0000030b       0x92 Pressure_Sensor.o
 .debug_abbrev  0x0000039d       0xc0 startup.o

.debug_loc      0x00000000      0x424
 .debug_loc     0x00000000       0xdc Alarm_Actuator.o
 .debug_loc     0x000000dc       0xb0 Alarm_monitor.o
 .debug_loc     0x0000018c       0xc8 driver.o
 .debug_loc     0x00000254       0x58 main.o
 .debug_loc     0x000002ac       0x90 main_Algorithm.o
 .debug_loc     0x0000033c       0x84 Pressure_Sensor.o
 .debug_loc     0x000003c0       0x64 startup.o

.debug_aranges  0x00000000       0xe0
 .debug_aranges
                0x00000000       0x20 Alarm_Actuator.o
 .debug_aranges
                0x00000020       0x20 Alarm_monitor.o
 .debug_aranges
                0x00000040       0x20 driver.o
 .debug_aranges
                0x00000060       0x20 main.o
 .debug_aranges
                0x00000080       0x20 main_Algorithm.o
 .debug_aranges
                0x000000a0       0x20 Pressure_Sensor.o
 .debug_aranges
                0x000000c0       0x20 startup.o

.debug_line     0x00000000      0x3bb
 .debug_line    0x00000000       0x63 Alarm_Actuator.o
 .debug_line    0x00000063       0x77 Alarm_monitor.o
 .debug_line    0x000000da       0x99 driver.o
 .debug_line    0x00000173       0xae main.o
 .debug_line    0x00000221       0x76 main_Algorithm.o
 .debug_line    0x00000297       0x76 Pressure_Sensor.o
 .debug_line    0x0000030d       0xae startup.o

.debug_str      0x00000000      0x3d8
 .debug_str     0x00000000      0x122 Alarm_Actuator.o
                                0x16e (size before relaxing)
 .debug_str     0x00000122       0x9a Alarm_monitor.o
Line 165, Column 10                                    Spaces: 4    Plain Text
```

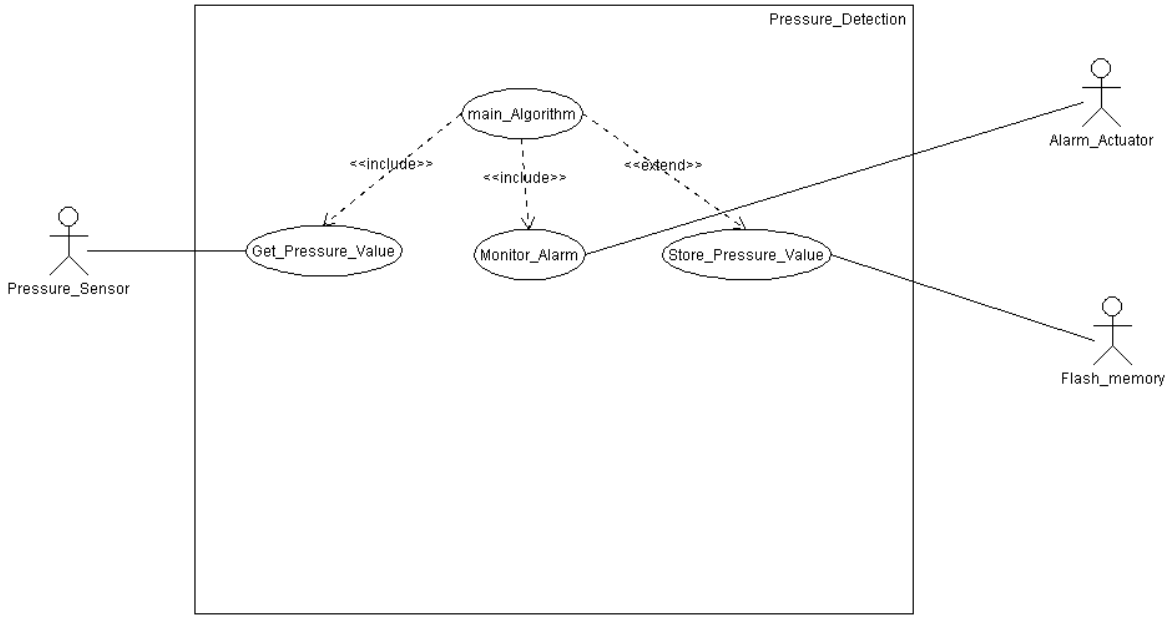

C:\Users\sam20\OneDrive\سطح المكتب\Project_1\Map_file.map - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
Map_file.map
208 0x1c9 (size before relaxing)
209 .debug_str 0x000001bc 0x55 driver.o
210 0x129 (size before relaxing)
211 .debug_str 0x00000211 0x6e main.o
212 0x228 (size before relaxing)
213 .debug_str 0x0000027f 0x5e main_Algorithm.o
214 0x1ca (size before relaxing)
215 .debug_str 0x000002dd 0x7b Pressure_Sensor.o
216 0x1e1 (size before relaxing)
217 .debug_str 0x00000358 0x80 startup.o
218 0x158 (size before relaxing)
219
220 .comment 0x00000000 0x11
221 .comment 0x00000000 0x11 Alarm_Actuator.o
222 0x12 (size before relaxing)
223 .comment 0x00000000 0x12 Alarm_monitor.o
224 .comment 0x00000000 0x12 driver.o
225 .comment 0x00000000 0x12 main.o
226 .comment 0x00000000 0x12 main_Algorithm.o
227 .comment 0x00000000 0x12 Pressure_Sensor.o
228 .comment 0x00000000 0x12 startup.o
229
230 .ARM.attributes
231 0x00000000 0x33
232 .ARM.attributes
233 0x00000000 0x33 Alarm_Actuator.o
234 .ARM.attributes
235 0x00000033 0x33 Alarm_monitor.o
236 .ARM.attributes
237 0x00000066 0x33 driver.o
238 .ARM.attributes
239 0x00000099 0x33 main.o
240 .ARM.attributes
241 0x000000cc 0x33 main_Algorithm.o
242 .ARM.attributes
243 0x000000ff 0x33 Pressure_Sensor.o
244 .ARM.attributes
245 0x00000132 0x33 startup.o
246
247 .debug_frame 0x00000000 0x2dc
248 .debug_frame 0x00000000 0x90 Alarm_Actuator.o
249 .debug_frame 0x00000090 0x7c Alarm_monitor.o
Line 207, Column 36
Spaces: 4
Plain Text


C:\Users\sam20\OneDrive\سطح المكتب\Project_1\Map_file.map - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
Map_file.map
251 .debug_frame 0x00000184 0x48 main.o
252 .debug_frame 0x000001cc 0x64 main_Algorithm.o
253 .debug_frame 0x00000230 0x60 Pressure_Sensor.o
254 .debug_frame 0x00000290 0x4c startup.o
255
Line 207, Column 36
Spaces: 4
Plain Text

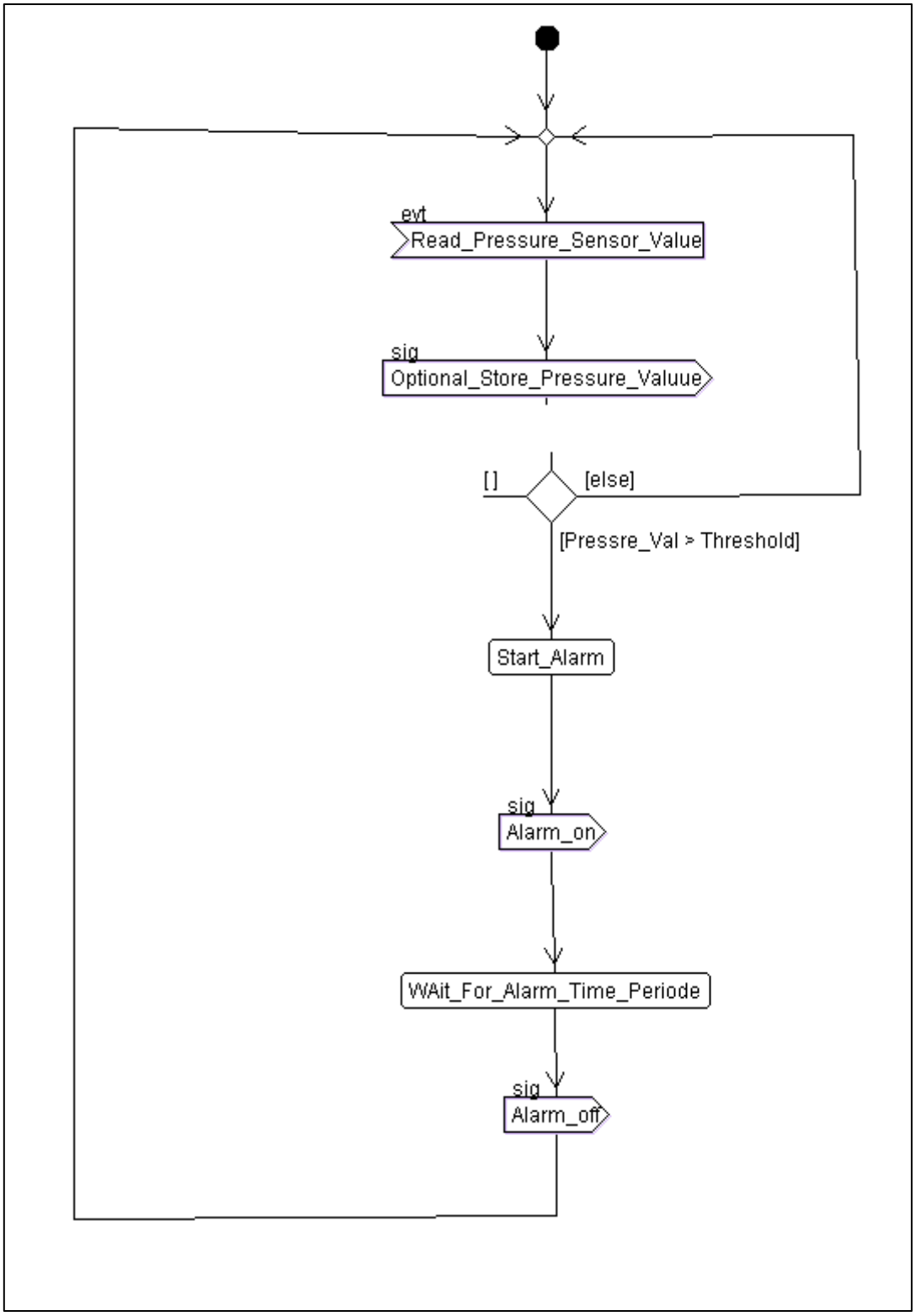
Requirements Diagram



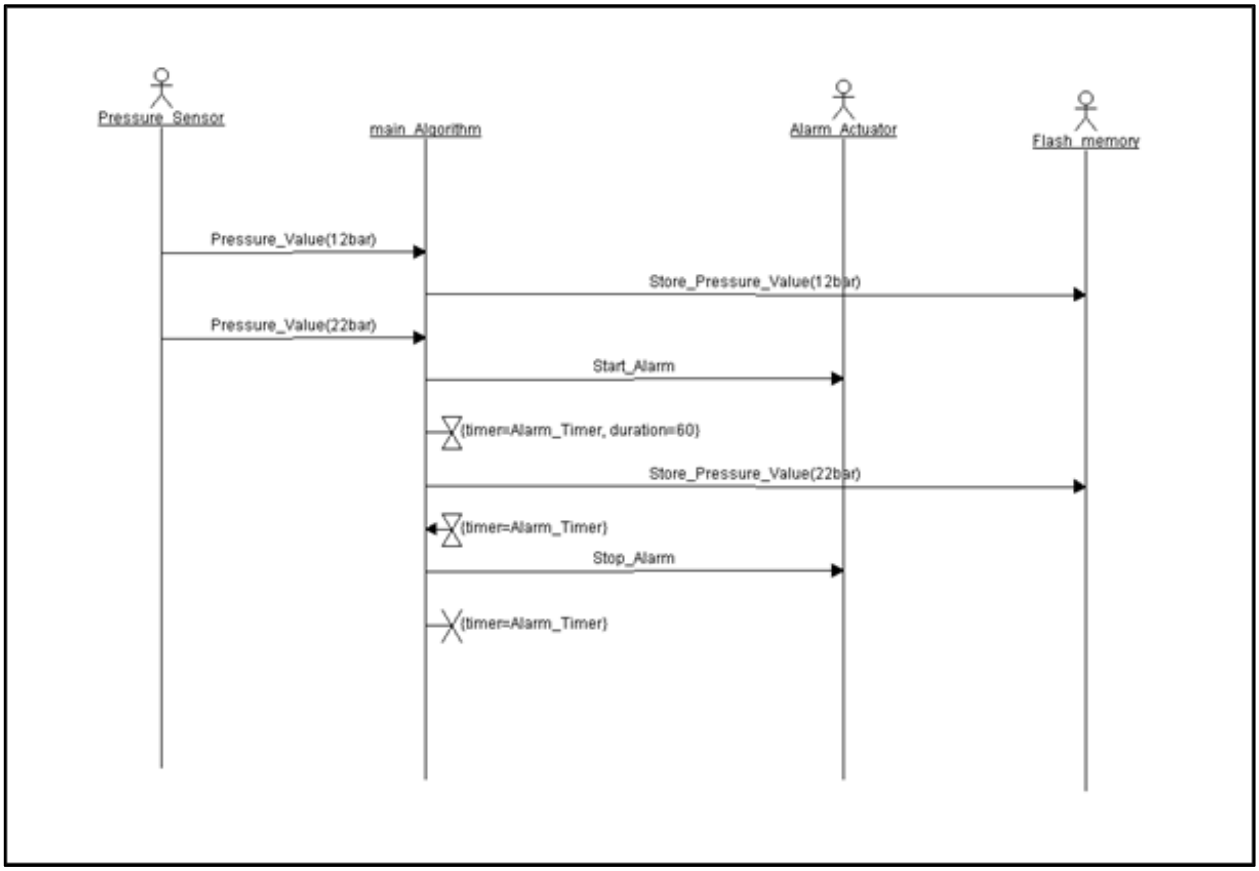
System Analysis: Use case diagram



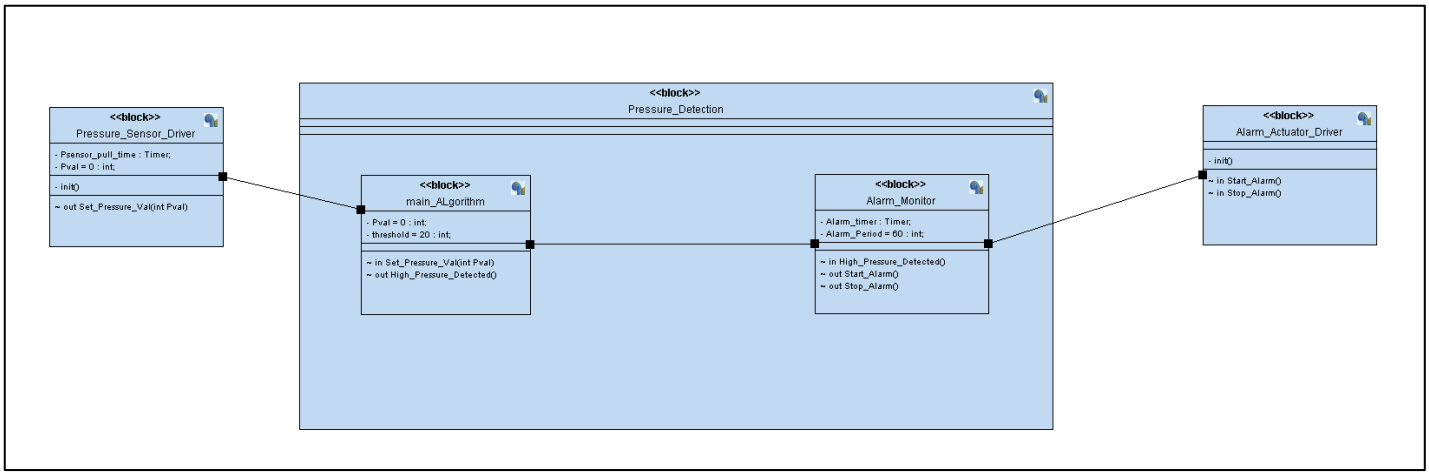
System Analysis: Activity diagram



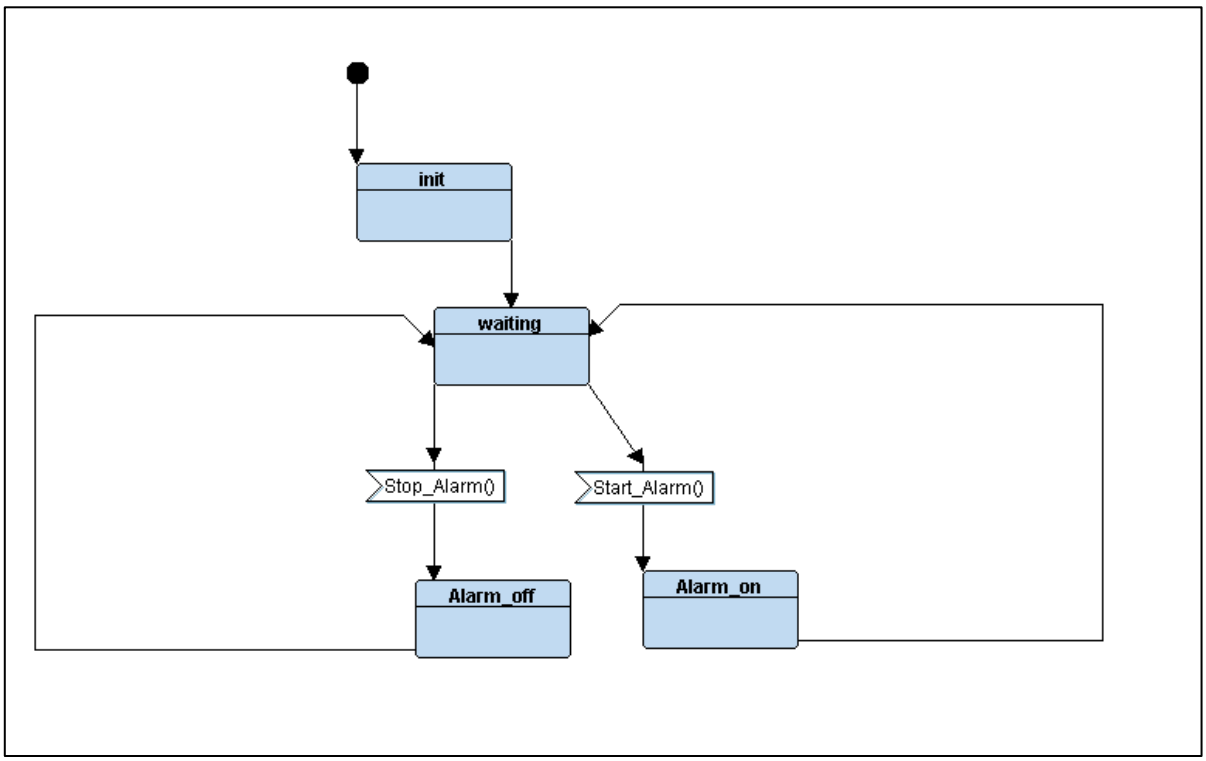
System Analysis: Sequence diagram

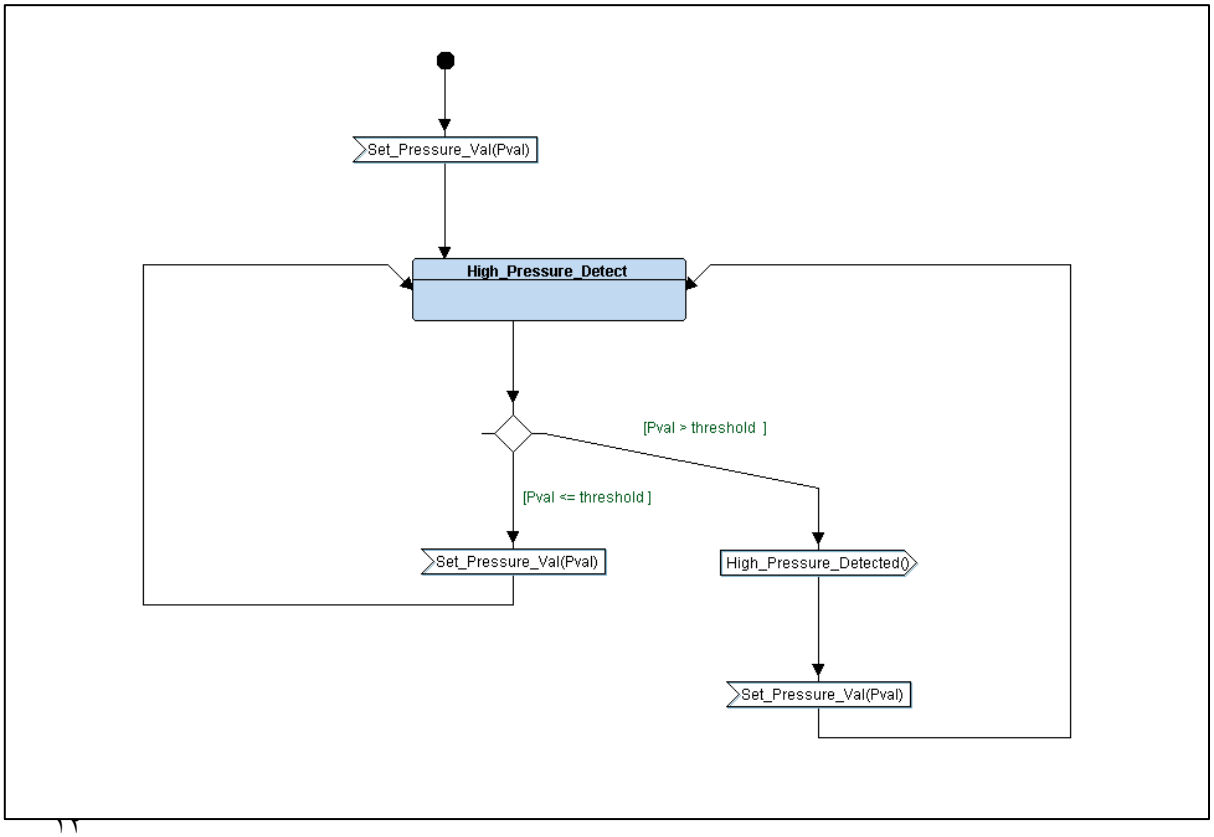


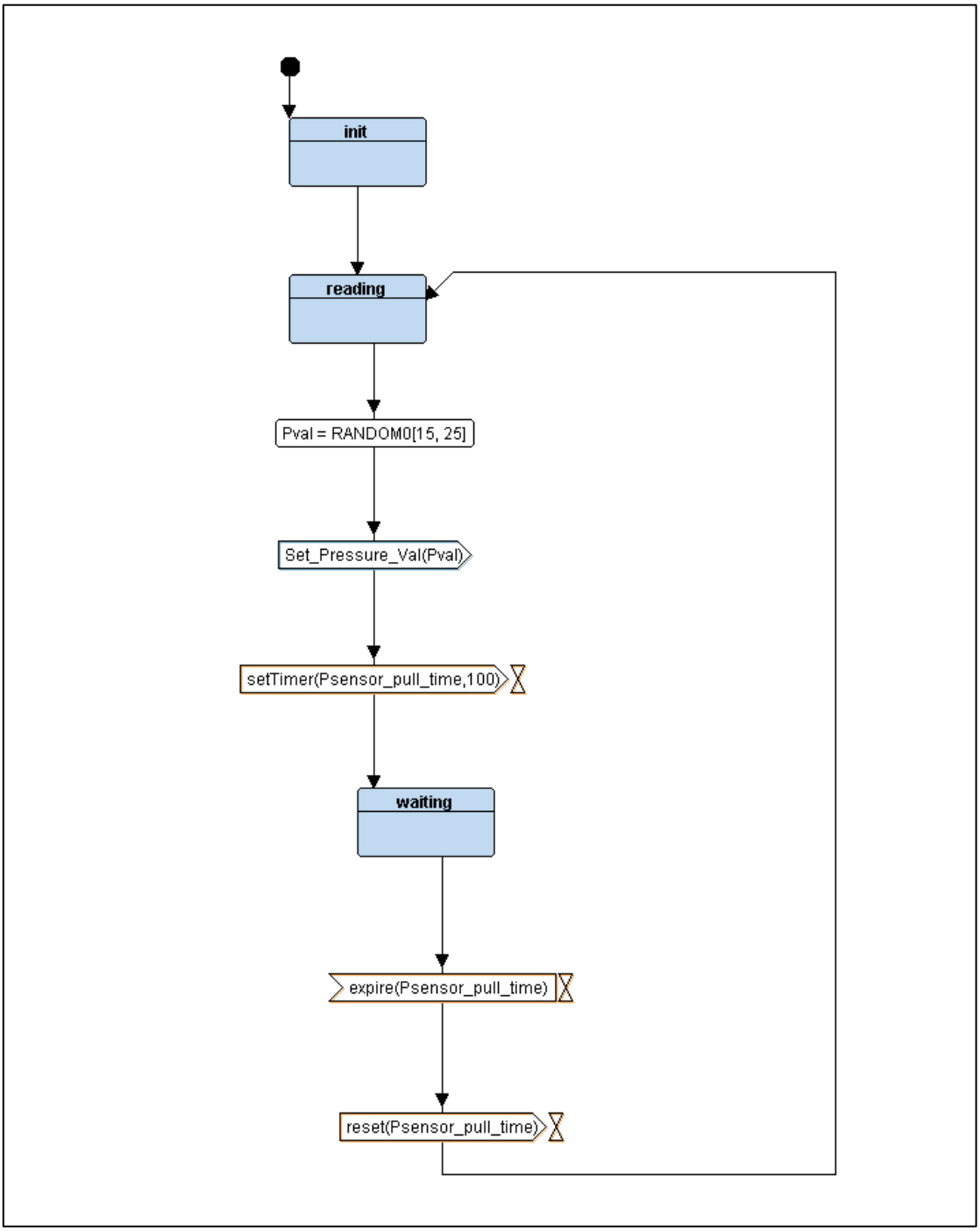
System Design

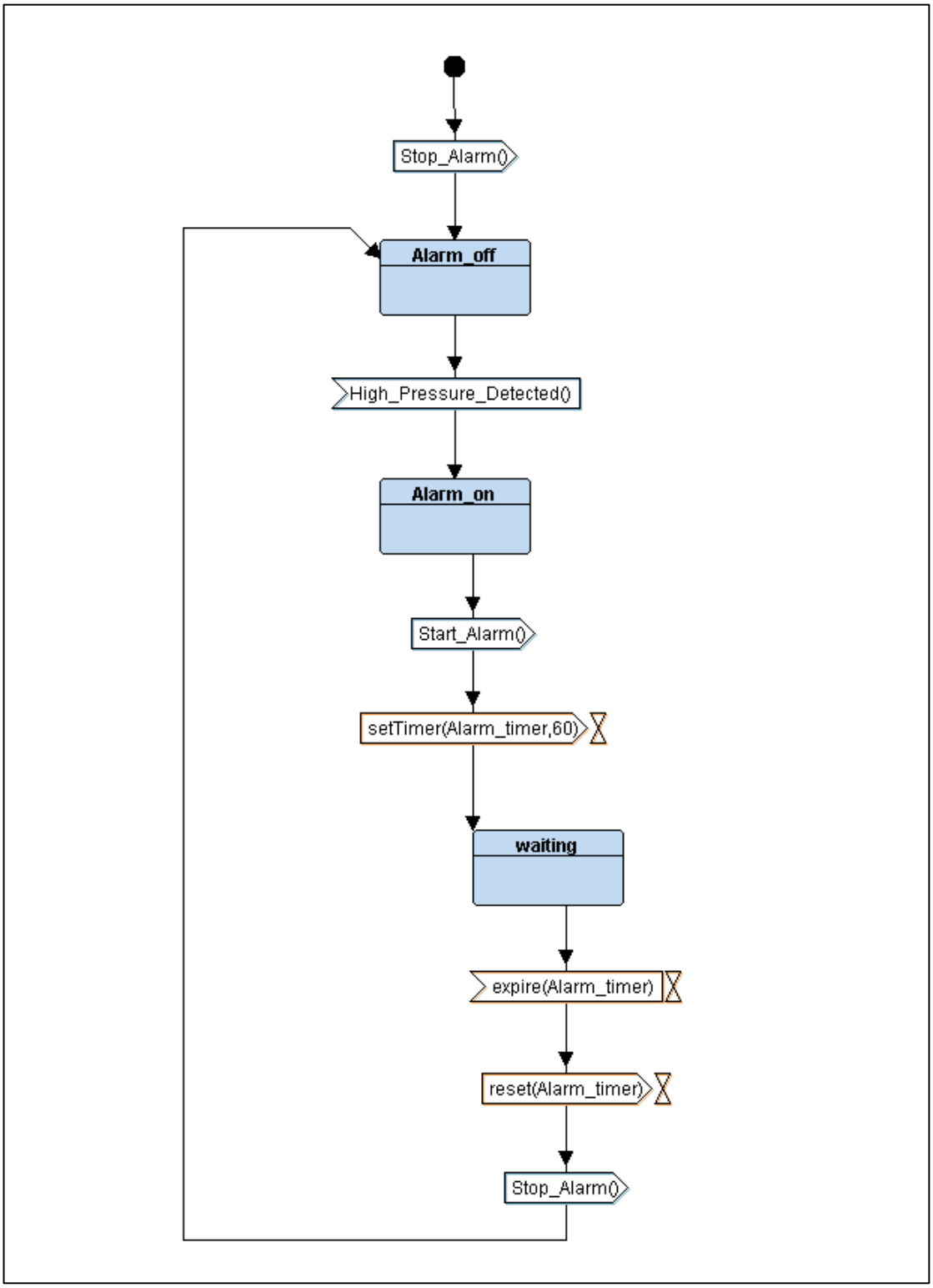


Blocks diagrams

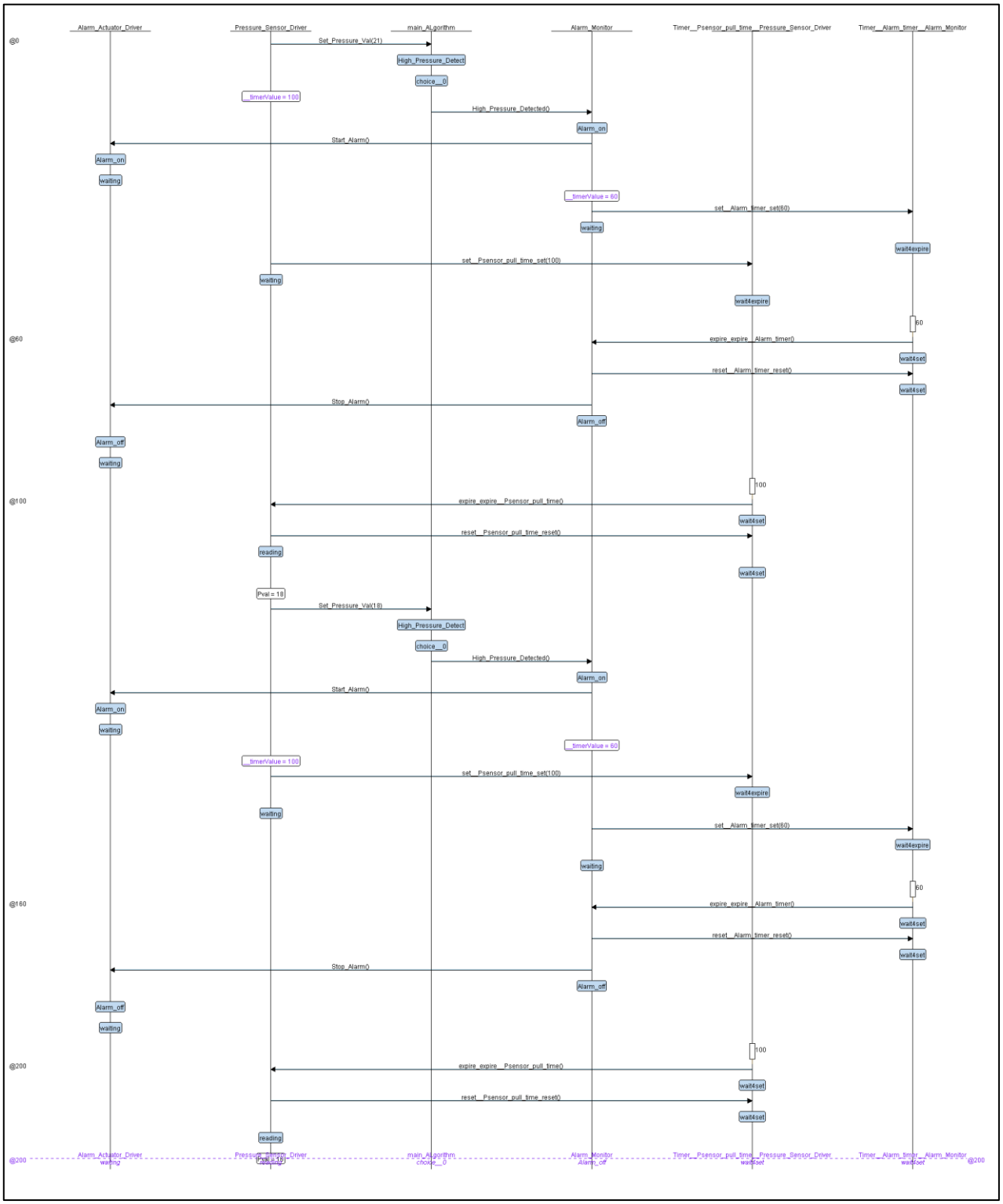





init
reading
Pval = RANDOM0[15, 25]
Set_Pressure_Val(Pval)
setTimer(Psensor_pull_time,100)
waiting
expire(Psensor_pull_time)
reset(Psensor_pull_time)

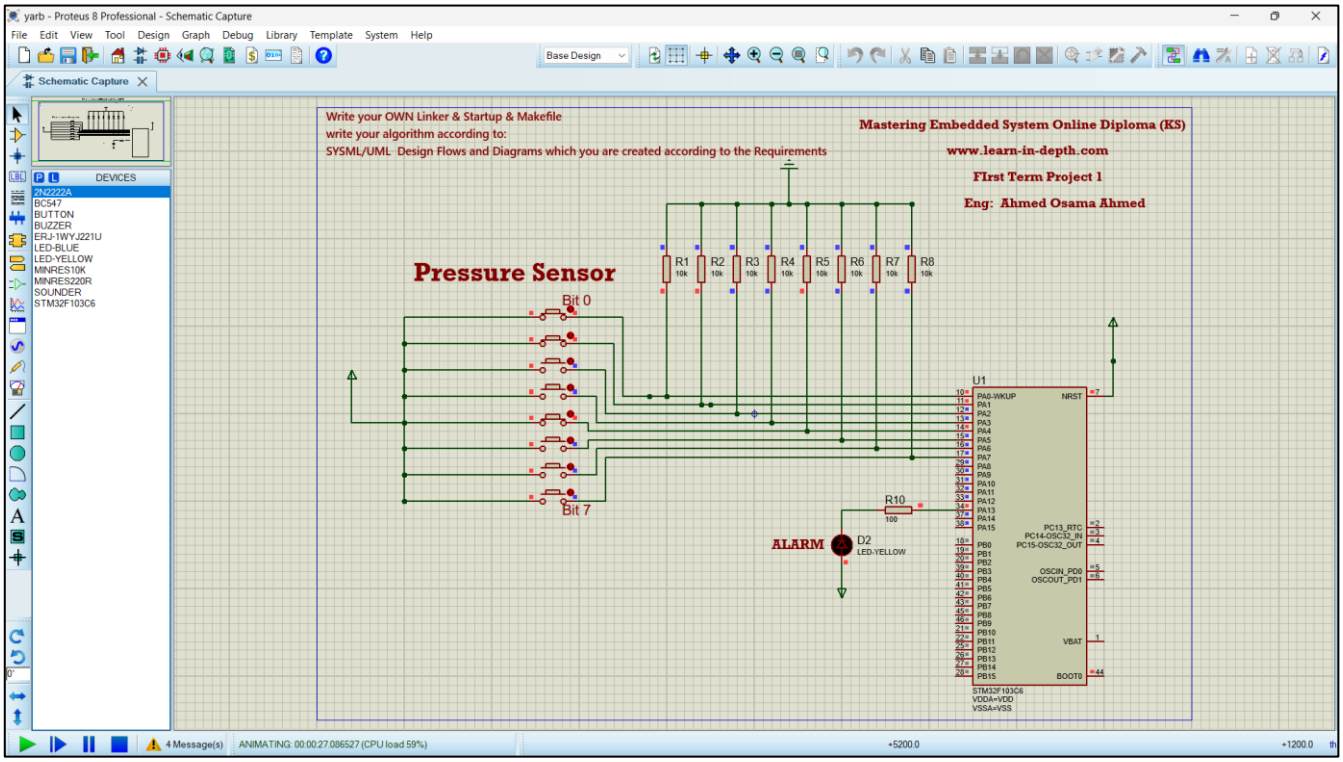

Stop_Alarm()
Alarm_off
High_Pressure_Detected()
Alarm_on
Start_Alarm()
setTimer(Alarm_timer,60)
waiting
expire(Alarm_timer)
reset(Alarm_timer)
Stop_Alarm()

Blocks simulation



Proteus simulation

at 19bar



at 36bar