Mastering Embedded System Online Diploma

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First Term (Final Project 1)

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➢ System Description

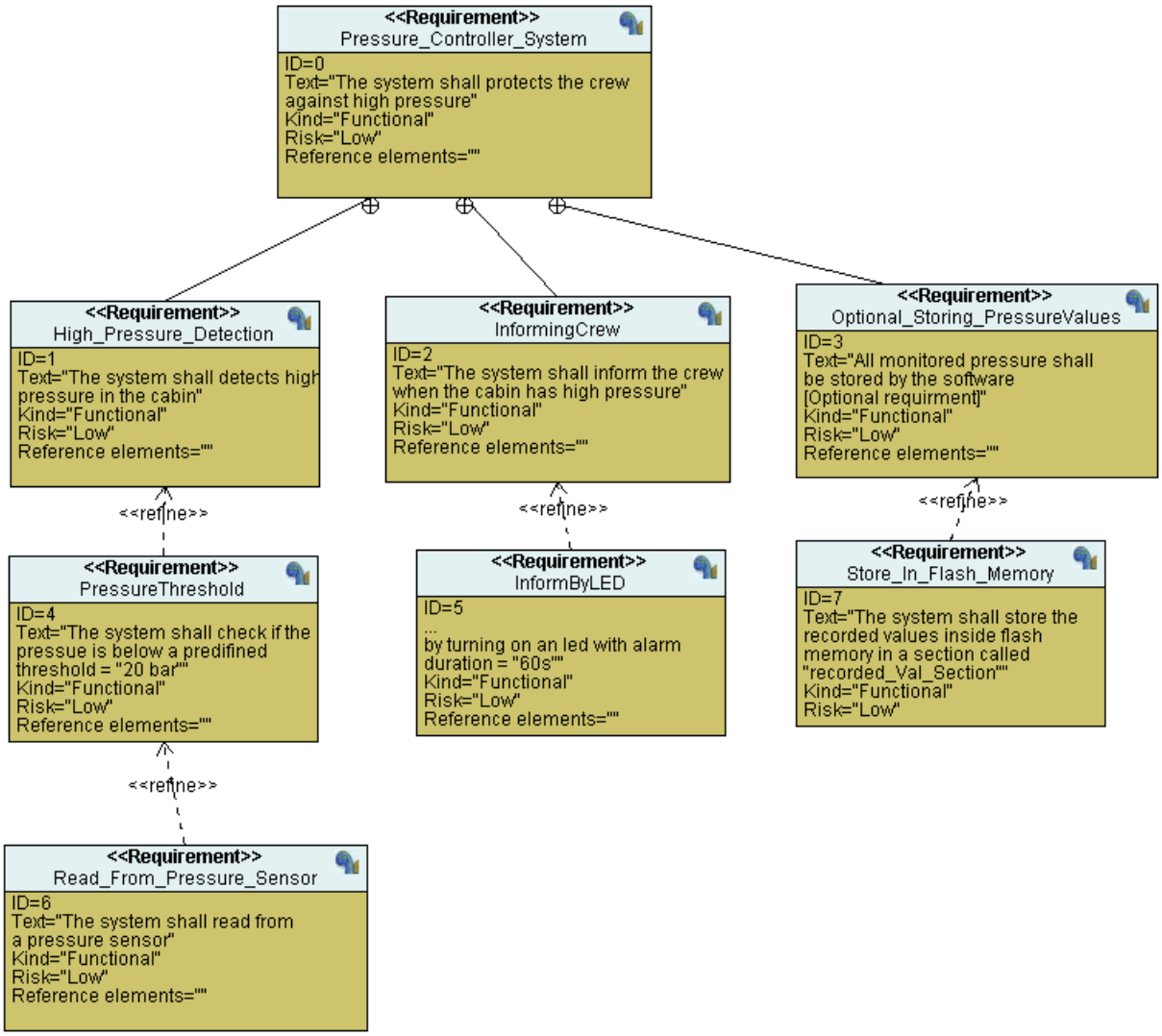
A pressure controller reads the values of pressure sensor.

The system informs the crew of a cabin with an alarm when the pressure exceeds 20 bars in the cabin.

The alarm duration equals 60 seconds.

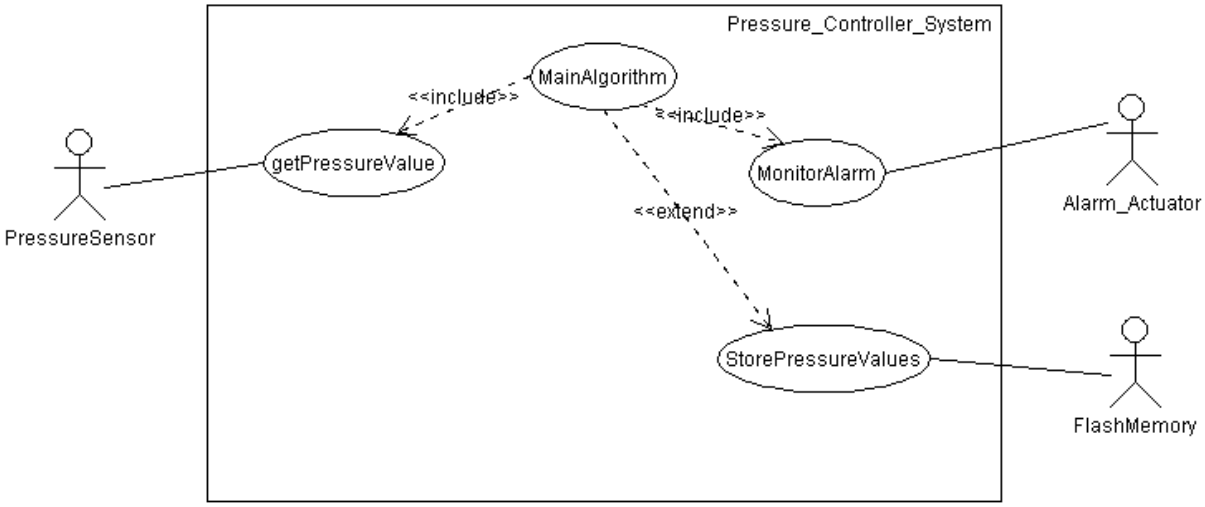
Hardware: STM32F103C6

➢ Requirements Diagram

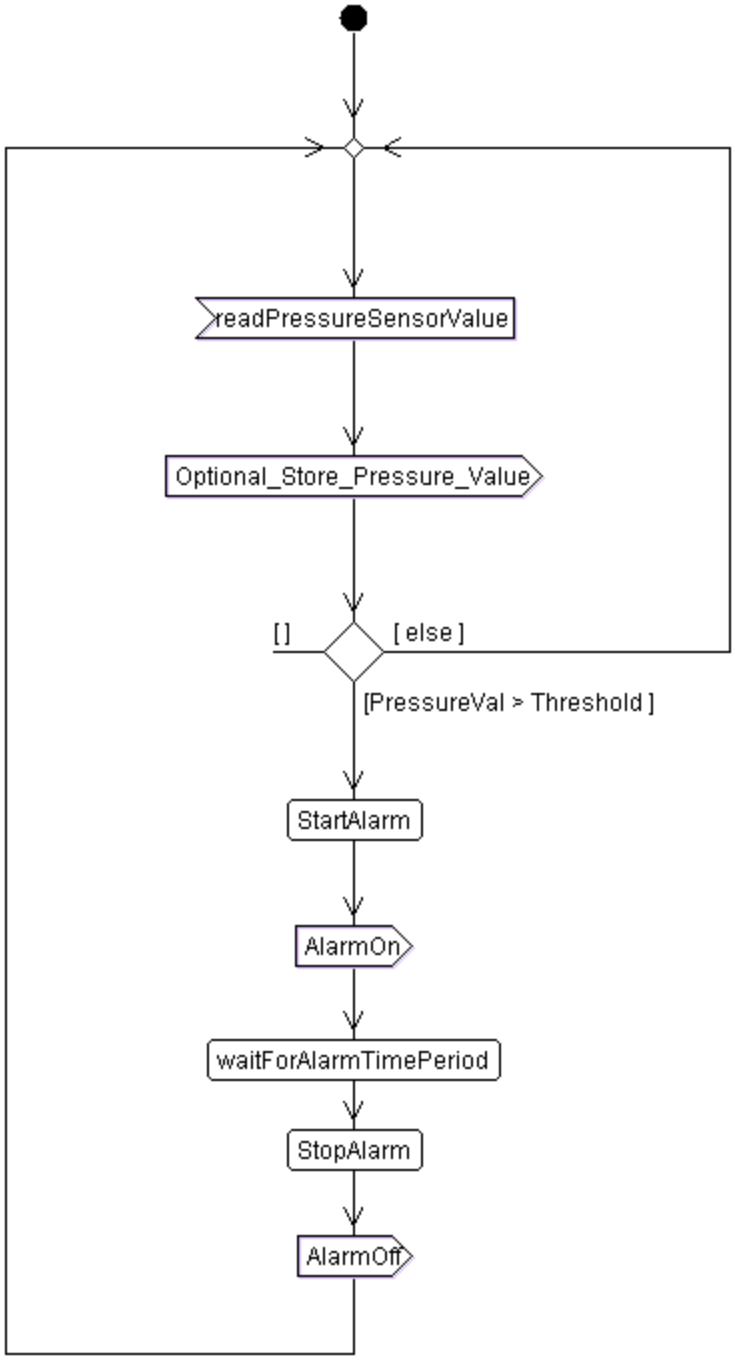


➢ System Analysis

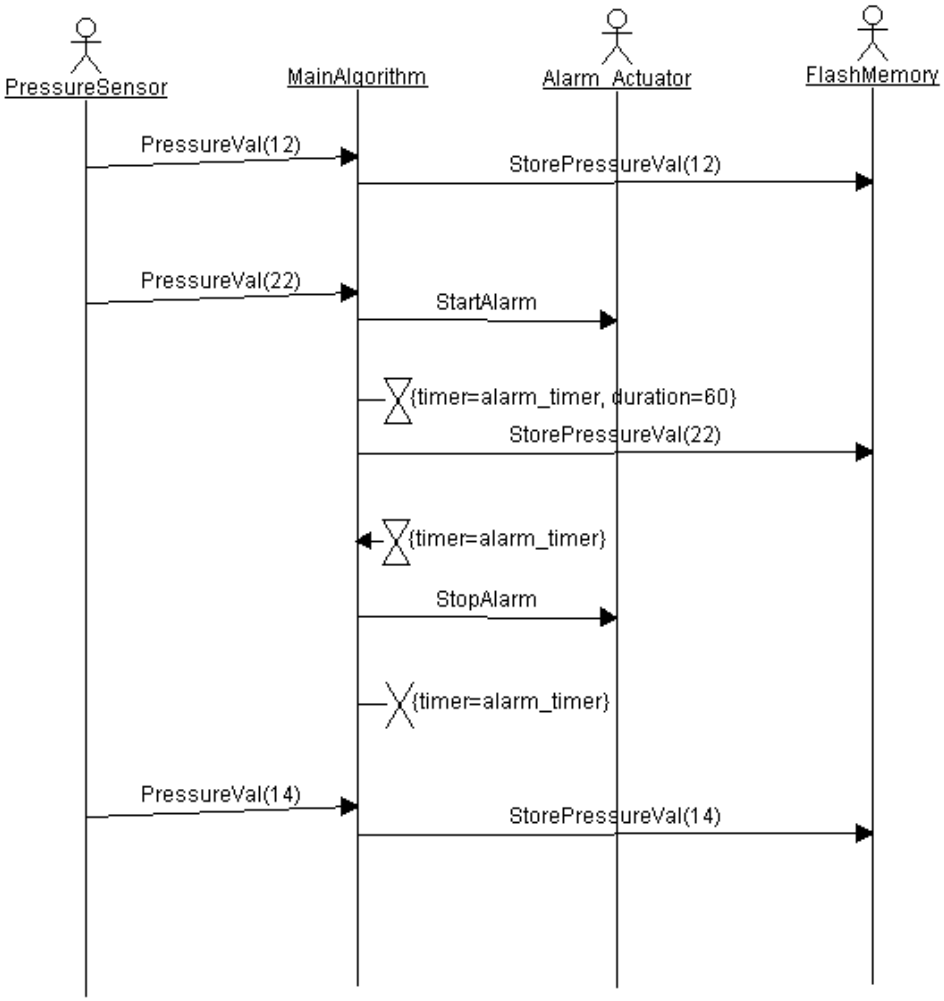
Use case Diagram.



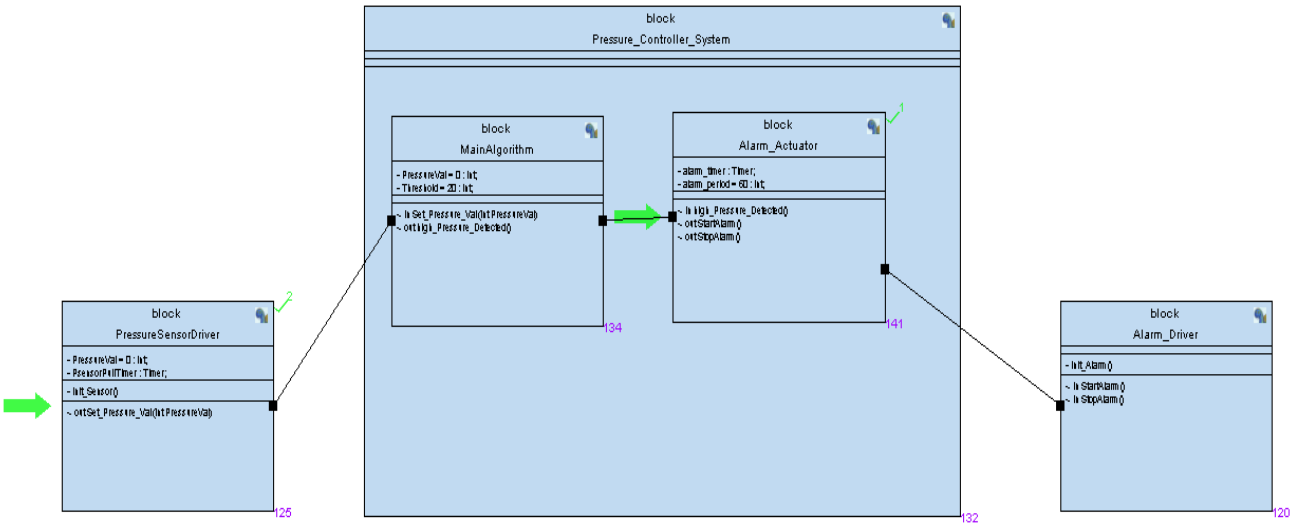
Activity Diagram



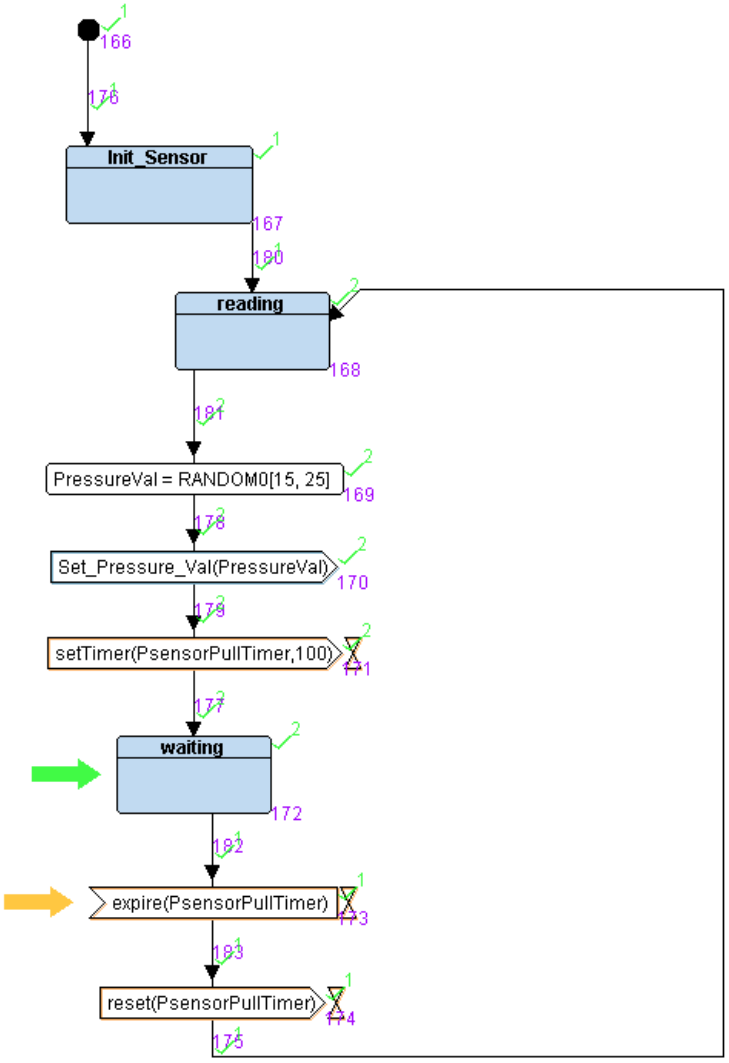
Sequence Diagram



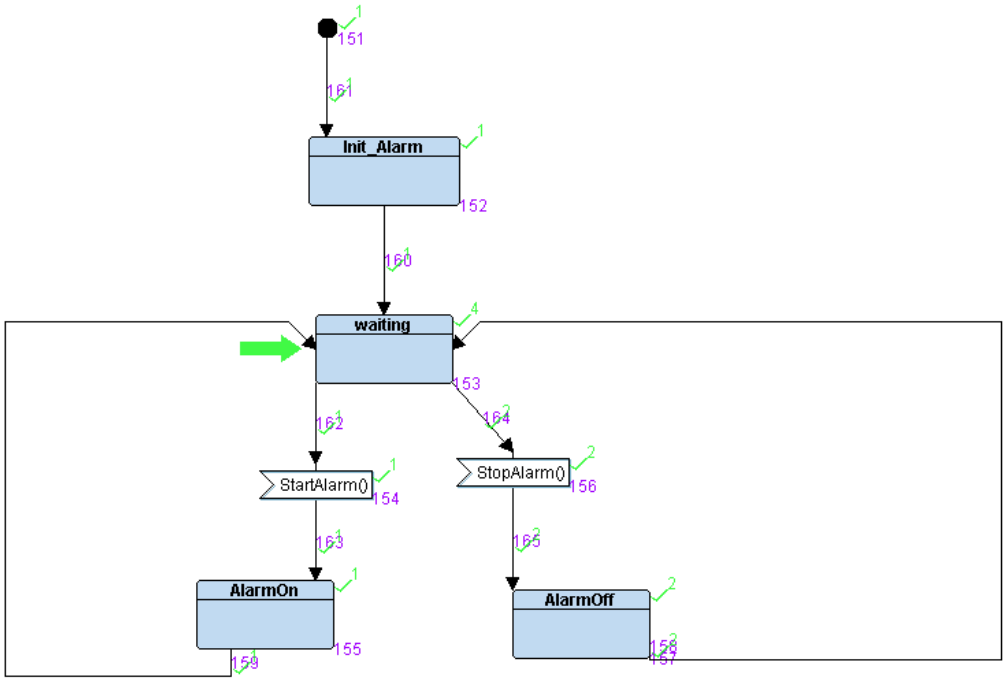
➢ System Design



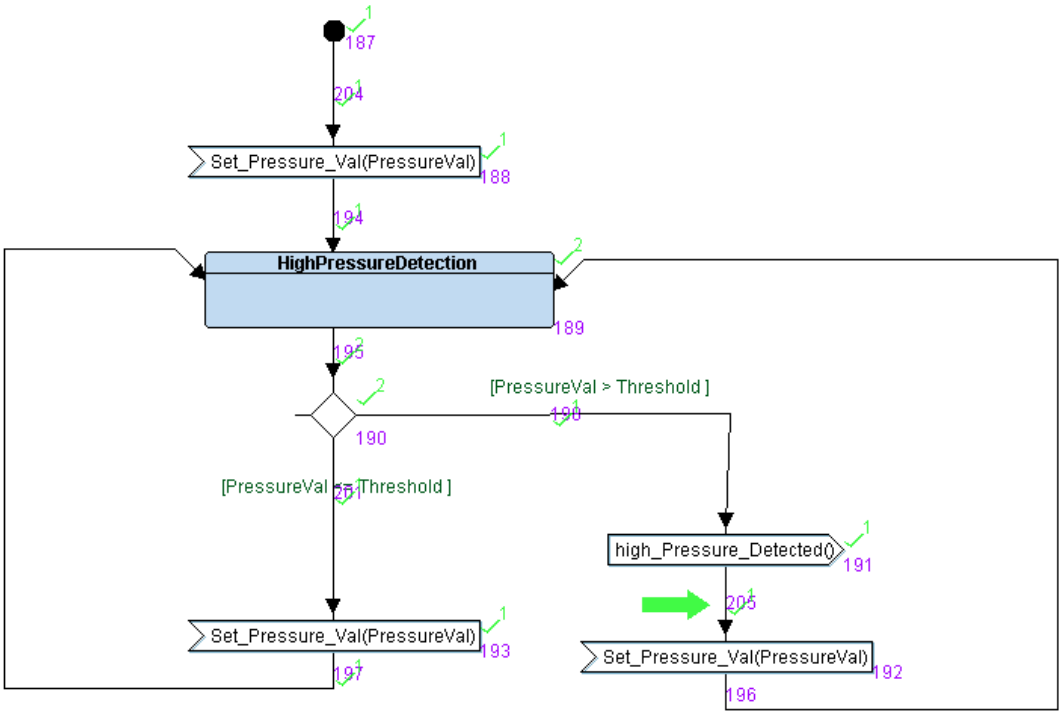
Pressure Sensor Driver



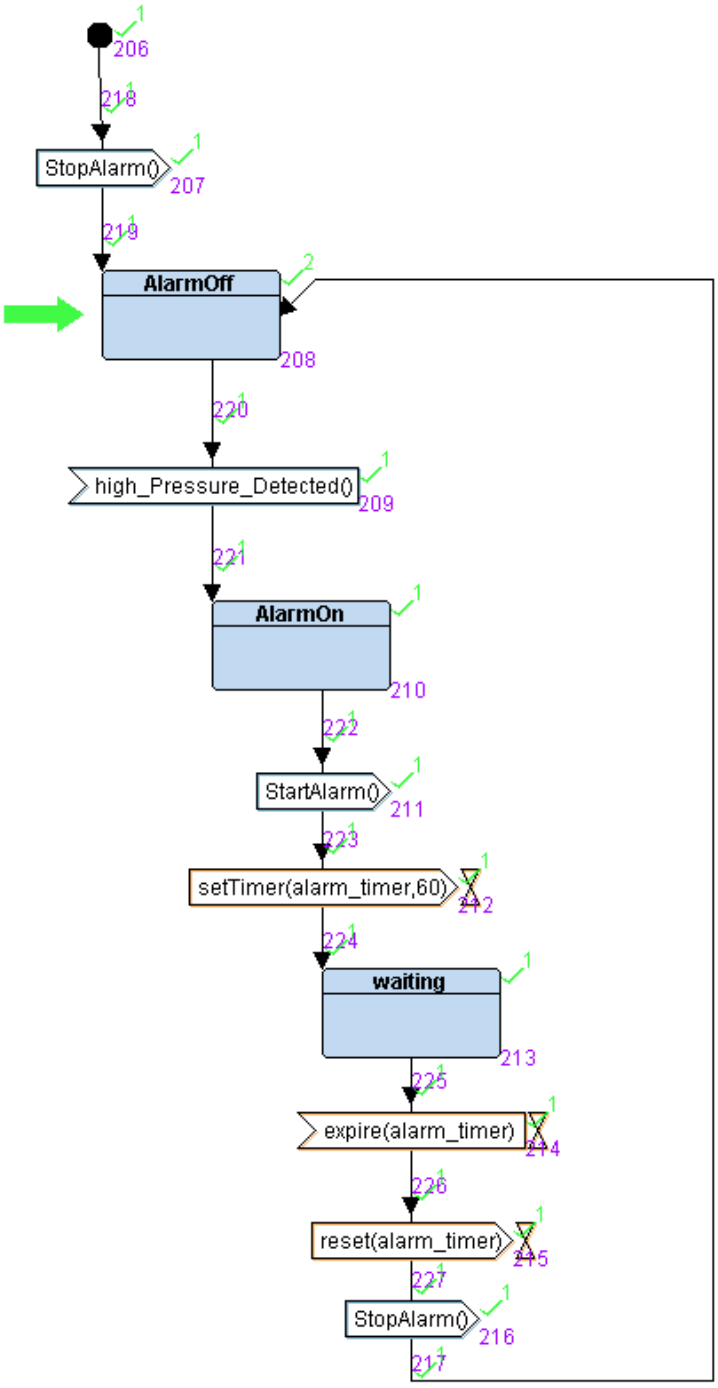
Alarm Driver



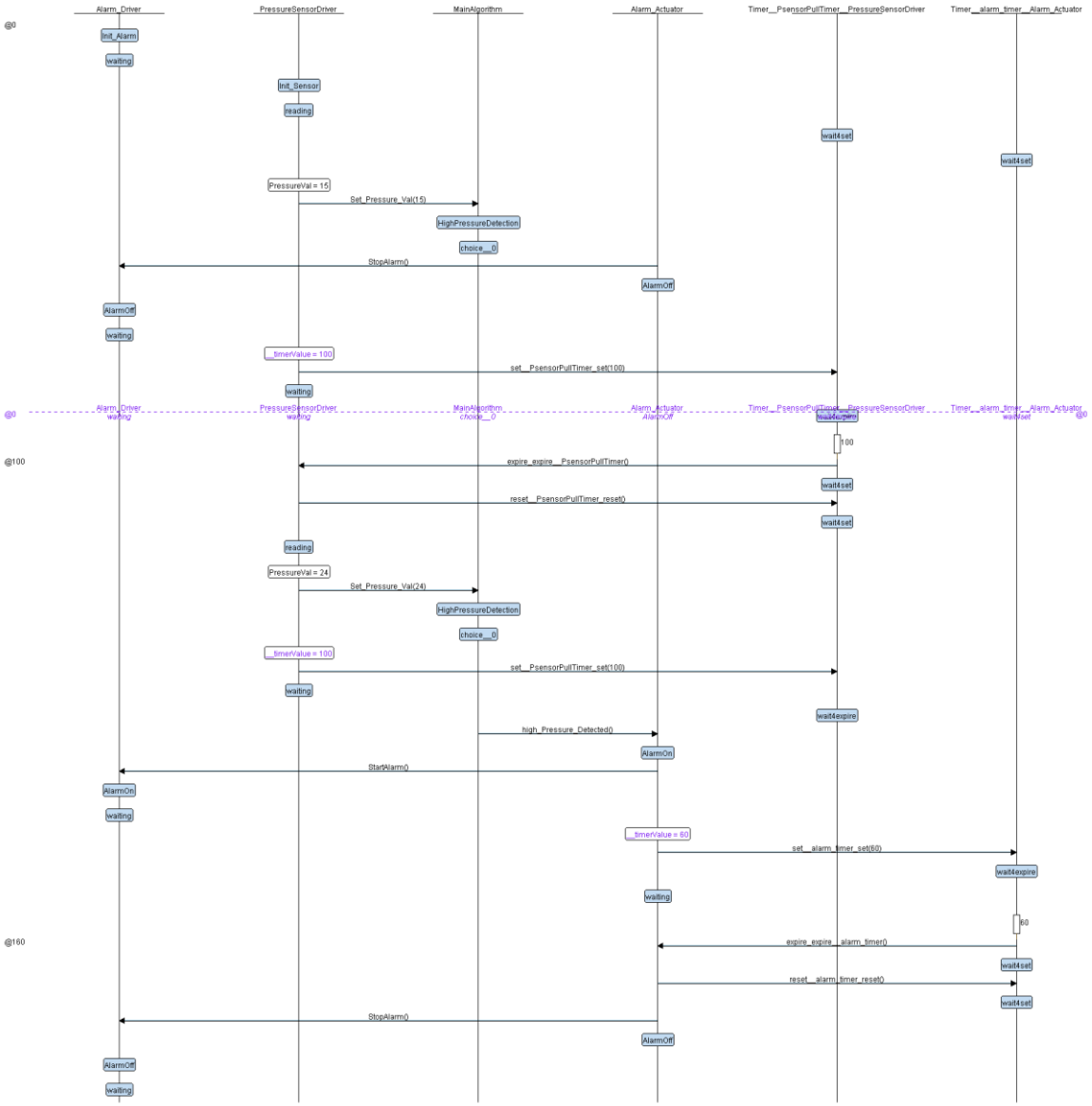
Main Algorithm



Alarm Actuator



➢ Simulation Trace



- **Now let's analyze Symbols and Sections**

First the symbols of main.o :

```
         U Alarm_Stat
00000001 C Alarm_State_ID
         U Delay
         U GPIO_INITIALIZATION
00000000 T main
         U P_state
00000001 C P_State_ID
         U PS_State
00000001 C PS_State_ID
         U ST_AlarmOff
         U ST_HIGH_Pressure_Detection
         U ST_Preading
```

Now the Symbols of Pressure_Controller.elf

```
2000000c B _E_bss
20000004 D _E_DATA
08000300 T _E_text
20000004 B _S_bss
20000000 D _S_DATA
2000100c B _stack_top
20001010 B Alarm_Stat
2000100c B Alarm_State_ID
20001014 B AlarmVal
08000270 W Bus_Fault
08000270 T Defalut_Handler
08000094 T Delay
080000b4 T getPressureVal
08000108 T GPIO_INITIALIZATION
08000270 W Hard_Fault_Handler
0800001c T High_Pressure_Detect
08000158 T main
08000270 W MM_Fault_Handler
08000270 W NMI_Handler
20001020 B P_state
20001018 B P_State_ID
20000008 B PressureVal
20000004 B PS_PressureVal
2000101c B PS_State
20001019 B PS_State_ID
0800027c T Reset_Handler
080000cc T Set_Alarm_actuator
080001a8 T SET_Pressure_Val
08000064 T ST_AlarmOff
0800007c T ST_AlarmOn
080001d4 T ST_HIGH_Pressure_Detection
08000218 T ST_Preading
08000250 T ST_Pwaiting
20000000 D Threshold
08000270 W Usage_Fault_Handler
08000000 T vectors
```

Here, we can notice the difference in number of symbols between both files.

Here is the memory sections for an object file for example main.o noticing that It hasn’t been located yet.

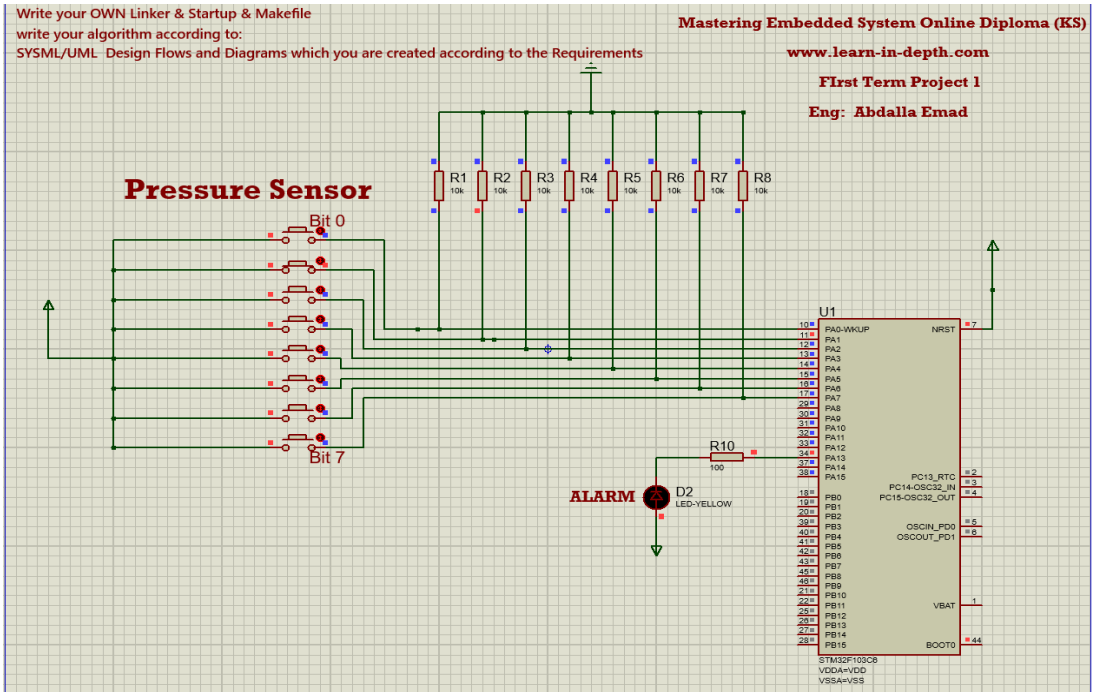
```
Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         00000050  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000000  00000000  00000000  00000084  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  00000084  2**0
                  ALLOC
```

And if we want to see the memory sections for Pressure_Controller.elf including debug informations

```
Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         00000050  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000000  00000000  00000000  00000084  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  00000084  2**0
                  ALLOC
  3 .debug_info   0000013e  00000000  00000000  00000084  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 00000095  00000000  00000000  000001c2  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    0000002c  00000000  00000000  00000257  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020  00000000  00000000  00000283  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   00000075  00000000  00000000  000002a3  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    000001b9  00000000  00000000  00000318  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007c  00000000  00000000  000004d1  2**0
                  CONTENTS, READONLY
 10 .debug_frame  0000002c  00000000  00000000  00000550  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 11 .ARM.attributes 00000033  00000000  00000000  0000057c  2**0
                  CONTENTS, READONLY
```

Now let’s see the simulation:

- ## When the pressure is below 20 bar:



- ## Now if the Pressure exceeds 20 bar: