Mastering Embedded System Online Diploma

High Pressure Detection System Project

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First Term (Final Project 1)

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CASE STUDY

- A client wants a software of the following specifications: -

  - 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. (optional)

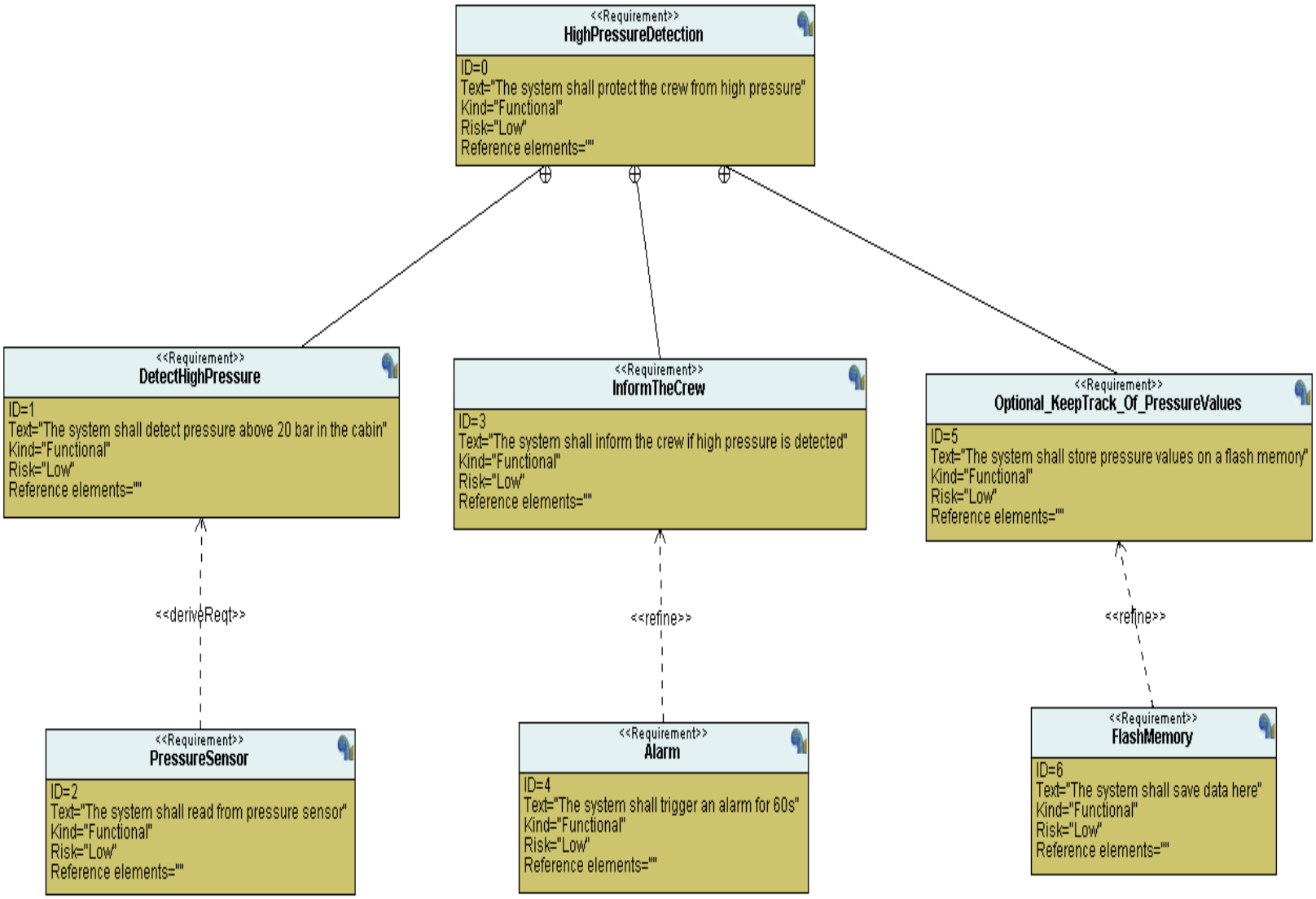
ASSUMPTIONS

- The controller set up and shutdown procedures are not modeled.
- The controller maintenance is not modeled.
- The pressure sensor never fails.
- The alarm never fails.
- The controller never faces power cut.

Versioning: -

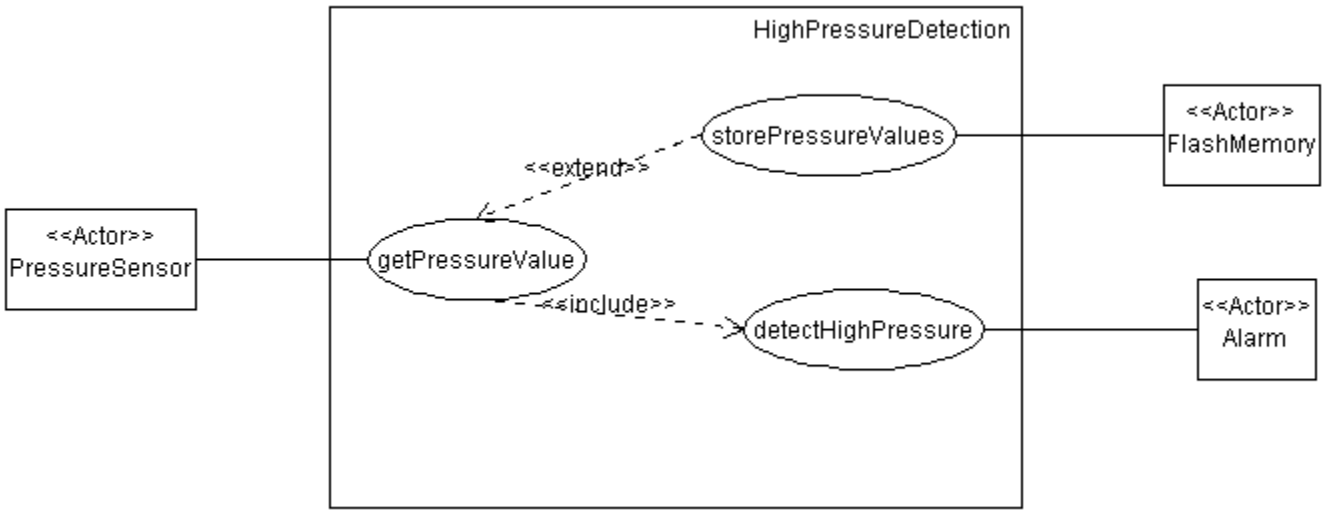
The" keep track of measured value" option is not modeled in the first version of the design.

REQUIREMENTS

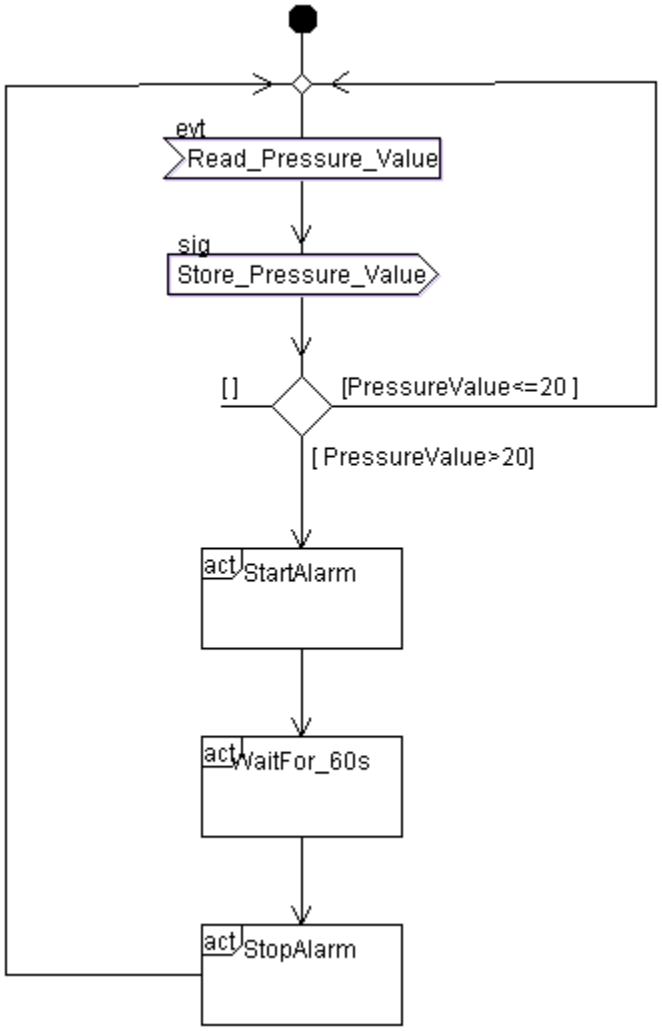


SYSTEM ANALYSIS

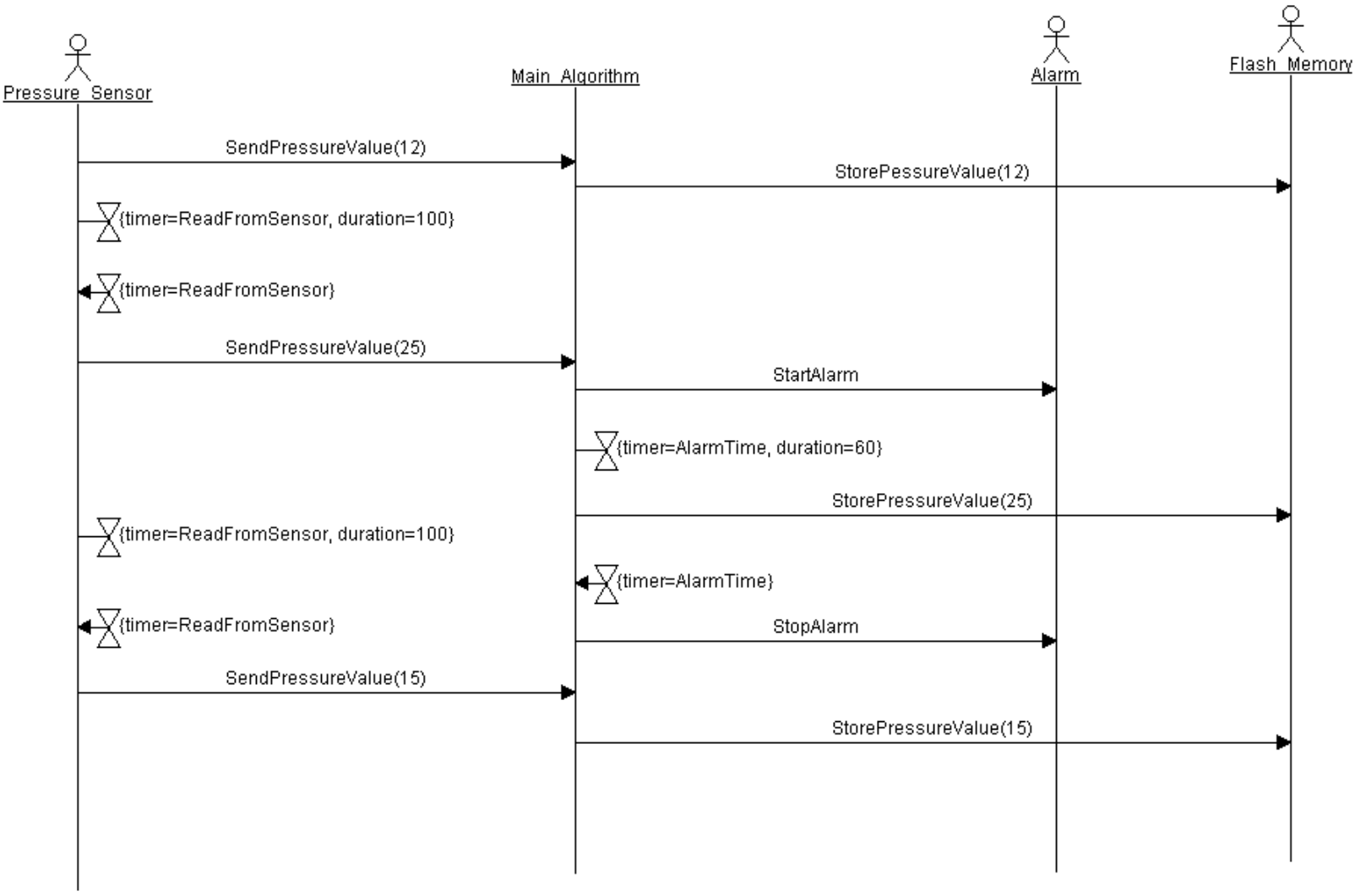
❖ USE CASE DIAGRAM



❖ ACTIVITY DIAGRAM

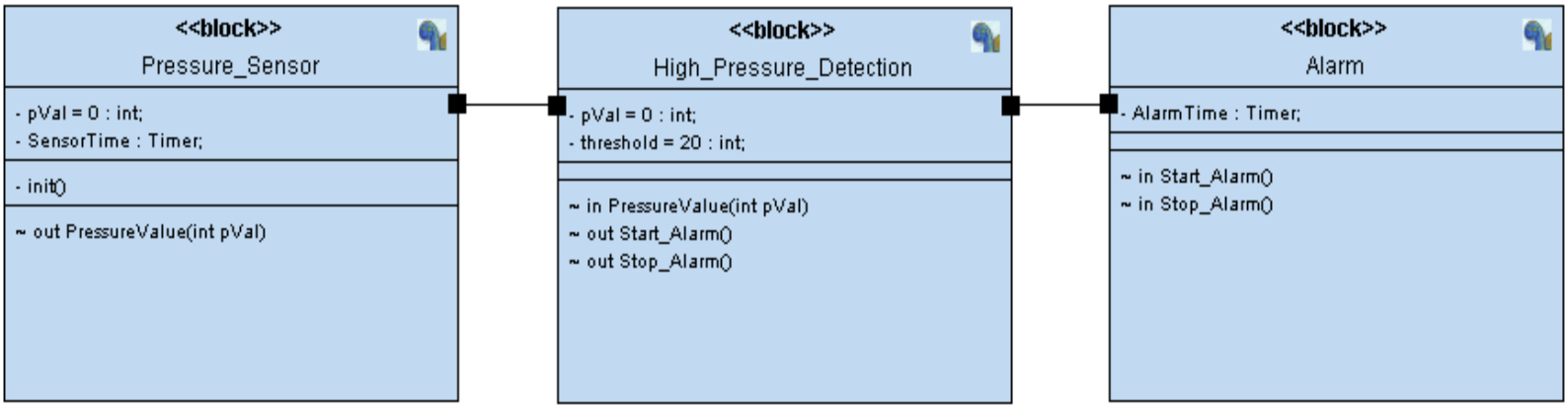


❖ SEQUENCE DIAGRAM



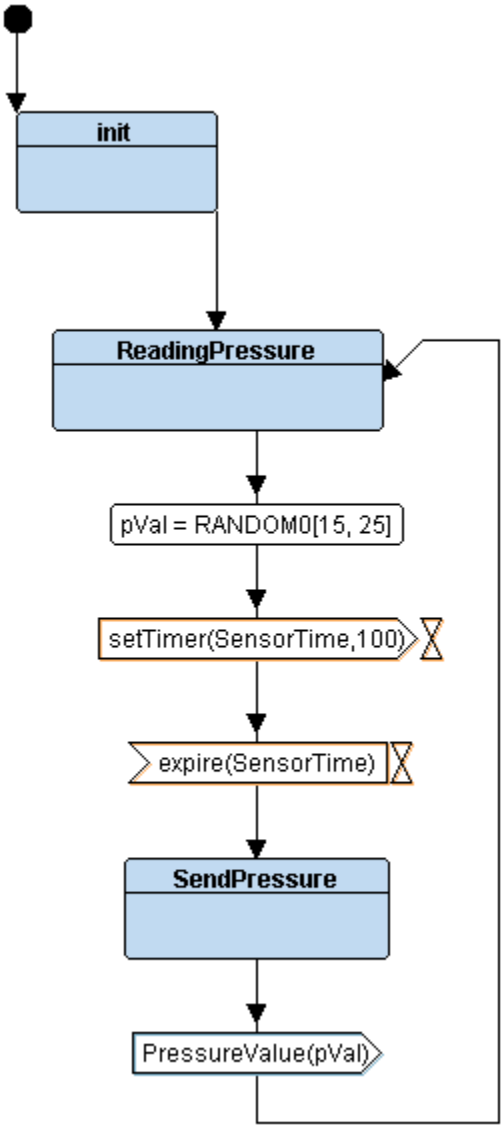
SYSTEM DESIGN

❖ BLOCK DIAGRAM

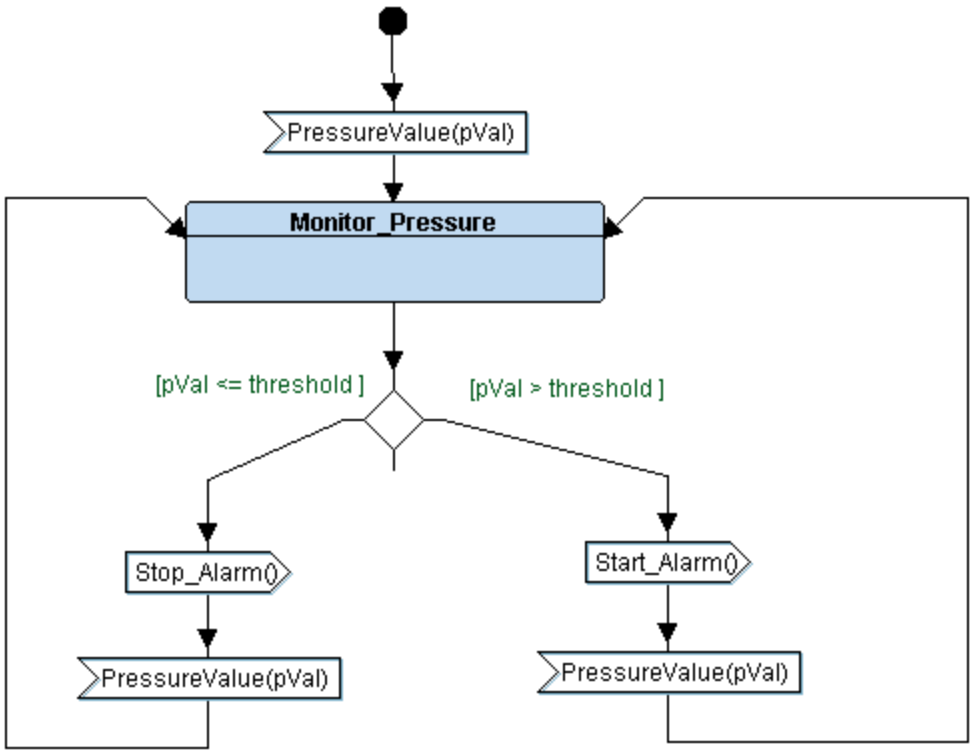


❖ STATE MACHINES: -

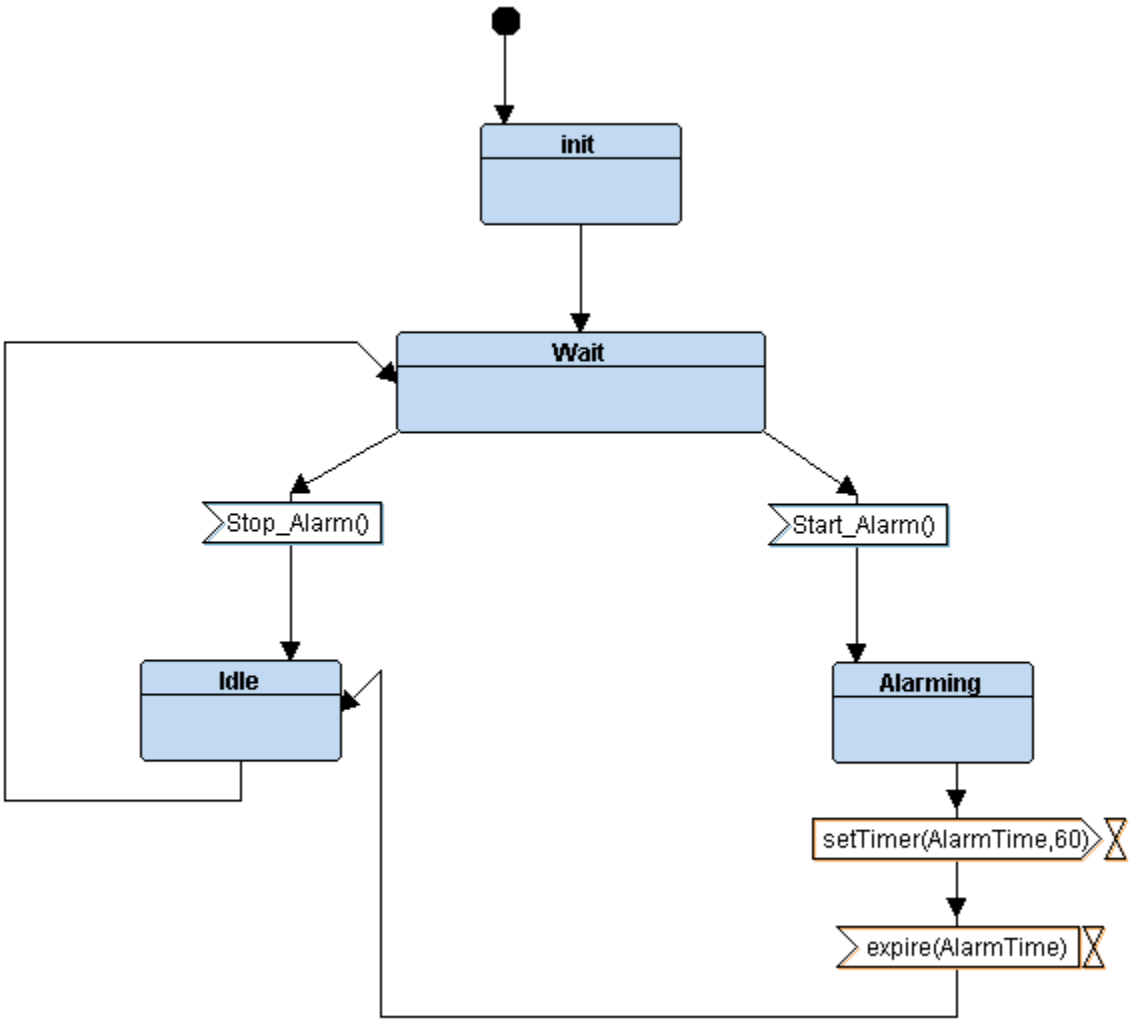
- Pressure_Sensor



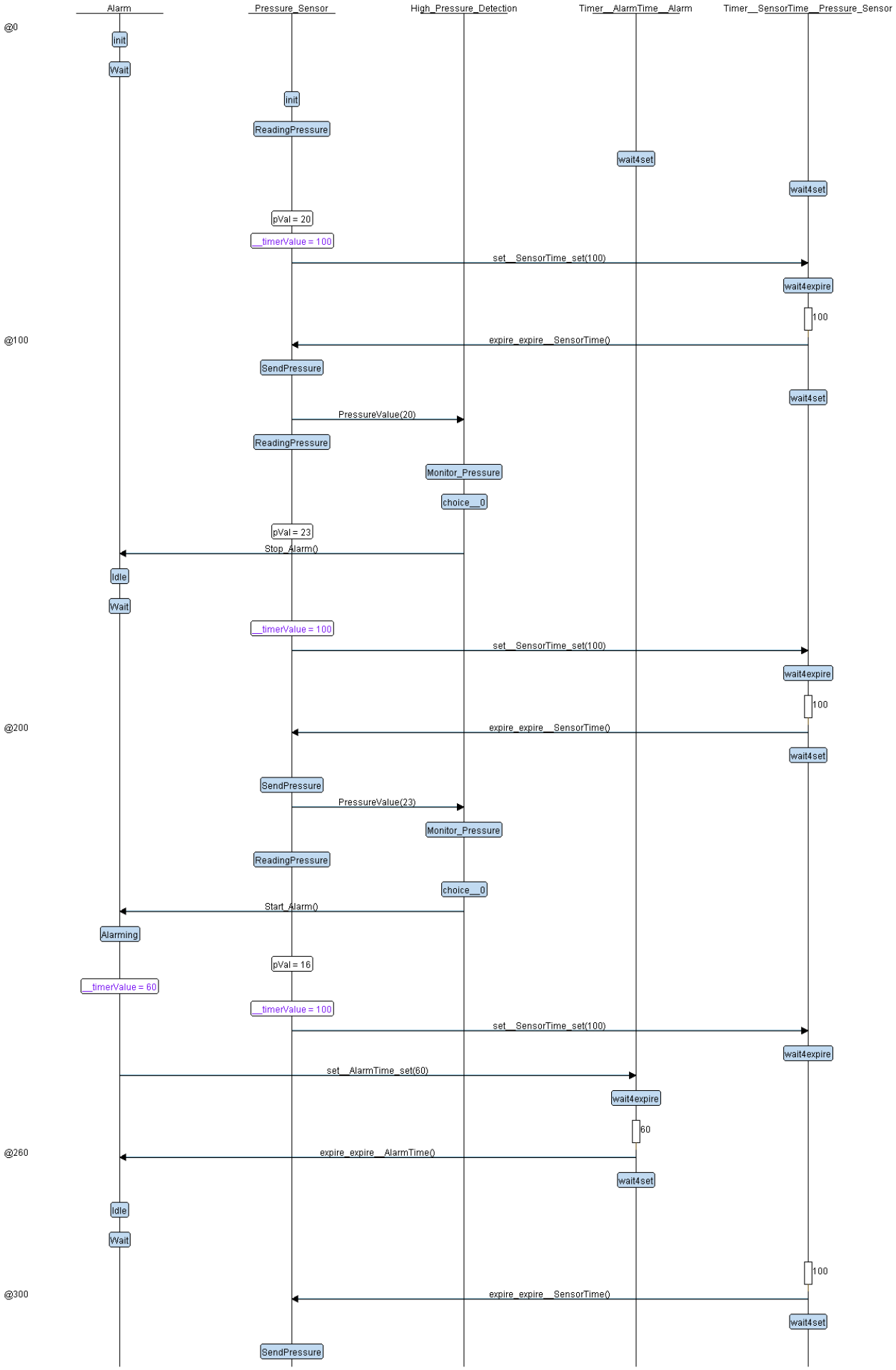
- High_Pressure_Detection



- Alarm



SIMULATION


Alarm
Pressure_Sensor
High_Pressure_Detection
Timer__AlarmTime__Alarm
Timer__SensorTime__Pressure_Sensor
@0
init
Wait
init
ReadingPressure
wait4set
wait4set
pVal = 20
__timerValue = 100
set__SensorTime_set(100)
wait4expire
100
@100
expire_expire__SensorTime()
SendPressure
wait4set
PressureValue(20)
ReadingPressure
Monitor_Pressure
choice__0
pVal = 23
Stop_Alarm()
Idle
Wait
__timerValue = 100
set__SensorTime_set(100)
wait4expire
100
@200
expire_expire__SensorTime()
wait4set
SendPressure
PressureValue(23)
Monitor_Pressure
ReadingPressure
choice__0
Start_Alarm()
Alarming
pVal = 16
__timerValue = 60
__timerValue = 100
set__SensorTime_set(100)
wait4expire
set__AlarmTime_set(60)
wait4expire
60
@260
expire_expire__AlarmTime()
wait4set
Idle
Wait
100
@300
expire_expire__SensorTime()
wait4set
SendPressure

IMPLEMENTATION

- **To Access Source Files Please Press the Link below: -**
  https://github.com/AssemAyman/Mastering-Embedded-System-Online-Diploma/tree/main/HighPressure_Detection_Project

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❖ FILE SECTIONS

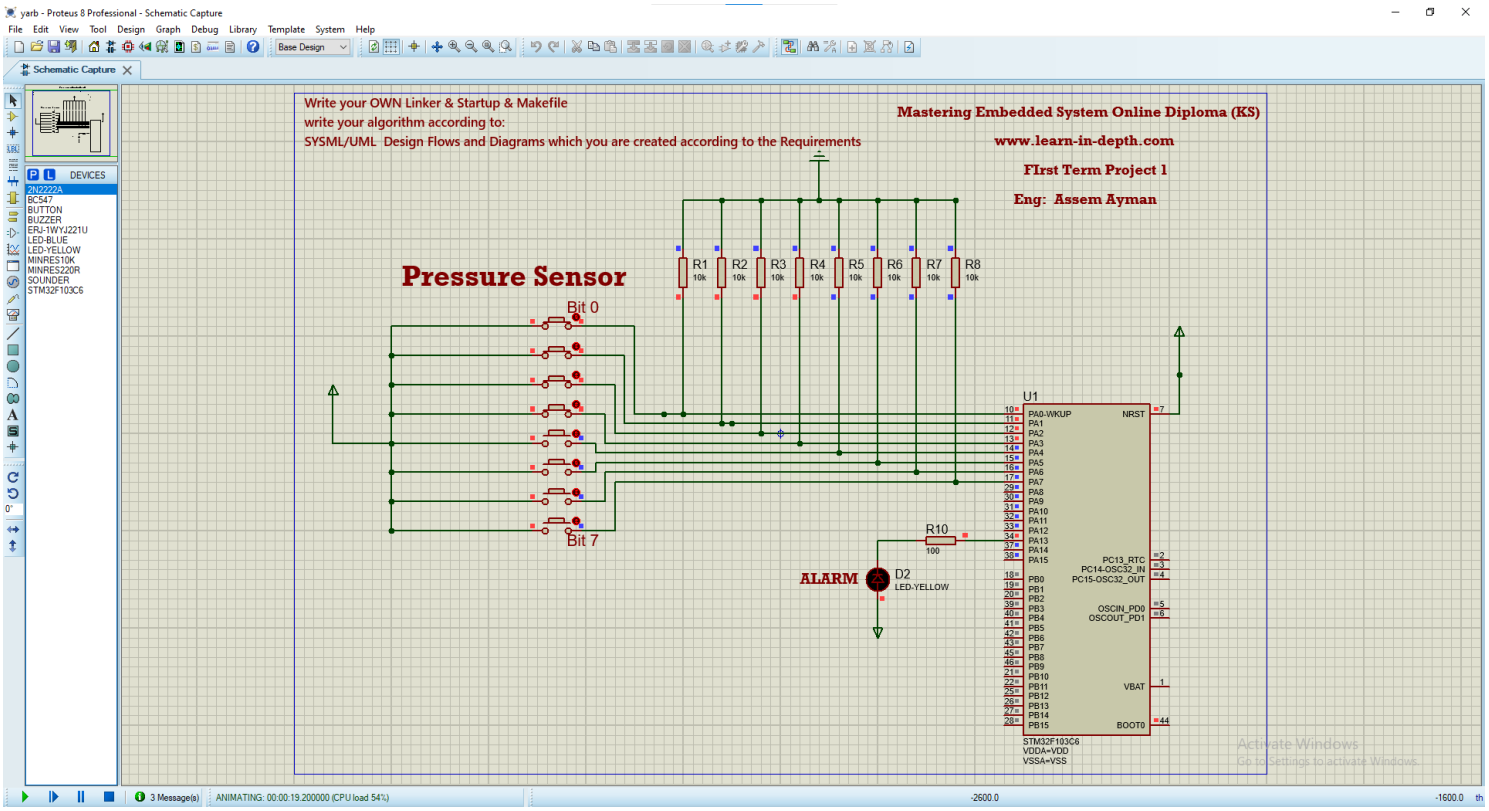
```
7ARB@DESKTOP-HRNQNVS MINGW32 /e/Diploma/GitHub/Mastering-Embedded-System-Online-
Diploma/HighPressure_Detection_Project (main)
$ arm-none-eabi-objdump.exe -h HighPressure_Detection.elf

HighPressure_Detection.elf:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         00000304  08000000  08000000  00010000  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .data         00000004  20000000  08000304  00020000  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          0000001c  20000004  08000308  00020004  2**2
                  ALLOC
  3 .debug_info   00003413  00000000  00000000  00020004  2**0
                  CONTENTS, READONLY, DEBUGGING
  4 .debug_abbrev 00000a41  00000000  00000000  00023417  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    000003a8  00000000  00000000  00023e58  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 000000c0  00000000  00000000  00024200  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_line   00000cdf  00000000  00000000  000242c0  2**0
                  CONTENTS, READONLY, DEBUGGING
  8 .debug_str    000006c7  00000000  00000000  00024f9f  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007b  00000000  00000000  00025666  2**0
                  CONTENTS, READONLY
 10 .ARM.attributes 00000033  00000000  00000000  000256e1  2**0
                  CONTENTS, READONLY
 11 .debug_frame  00000240  00000000  00000000  00025714  2**2
                  CONTENTS, READONLY, DEBUGGING
```

❖ SYMBOLS TABLE

```
7ARB@DESKTOP-HRNQNVS MINGW32 /e/Diploma/GitHub/Mastering-Embedded-System-Online-
Diploma/HighPressure_Detection_Project (main)
$ arm-none-eabi-nm.exe HighPressure_Detection.elf
20000020 B _E_bss
20000004 D _E_DATA
08000304 T _E_text
20000004 B _S_bss
20000000 D _S_DATA
20001020 B _stack_top
2000000c B Alarm_ptr
20000010 B Alarm_State
20000004 b bar
08000274 W Bus_fault
08000274 T Default_Handler
080000a4 T Delay
080000c4 T getPressureVal
08000118 T GPIO_INITIALIZATION
08000274 W H_fault_Handler
20000018 B High_Pressure_Detection_State
20000014 B HPD_ptr
080001bc T main
08000274 W MM_fault_Handler
08000274 W NMI_Handler
20000019 B Pressure_Sensor_State
08000168 T PressureValue
2000001c B PS_ptr
20000008 b pVal
08000280 T Reset_Handler
080000dc T Set_Alarm_actuator
08000054 T ST_Alarming
0800008c T ST_Idle
08000194 T ST_Monitor_Pressure
08000204 T ST_ReadingPressure
08000244 T ST_SendPressure
0800001c T Start_Alarm
08000038 T Stop_Alarm
20000000 d threshold
08000274 W Usage_fault_Handler
08000000 T vectors
```

PROTEUS

I. Low-Pressure value equals 15 bar, so the alarm is OFF.



II. High-Pressure value equals 36 bar, so the alarm is ON.