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Learn-in-depth
First Term Project 1
High Pressure Detection System

Problem Statement

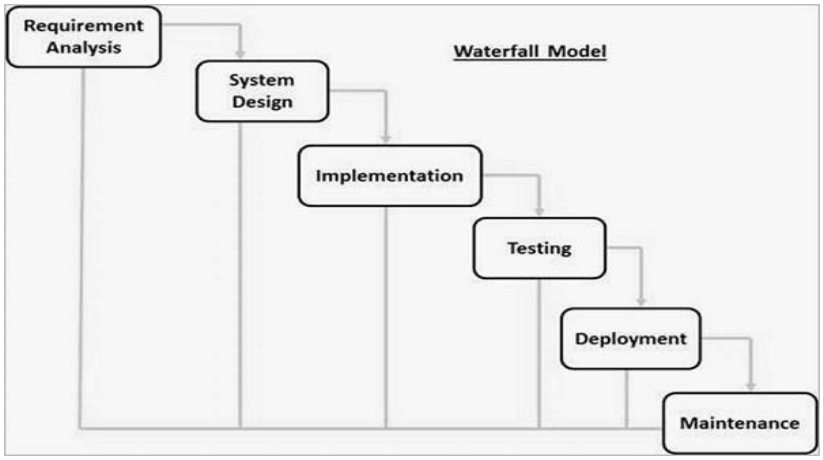
A high-pressure detection system informs the crew of a cabin with an alarm when the pressure in the cabin exceeds 20 bar, the alarm duration equals to 60 seconds:

Assumptions

1. The controller set up and shutdown procedures are not modeled.
2. The controller maintenance is not modeled.
3. The pressure sensor never fails.
4. The alarm never fails.
5. The controller never faces power cut.

Methodology

Since the system has multiple modules so we invest more time in the designing process before the implementation to ensure that the design works well. So, **waterfall model** is the best methodology in this case. Waterfall model is very simple to understand and use. In a waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases.



1. **Requirement Gathering and analysis** − All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification document.

2. **System Design** − The requirement specifications from first phase are studied in this phase and the system design is prepared. This system design helps in specifying hardware and system requirements and helps in defining the overall system architecture.

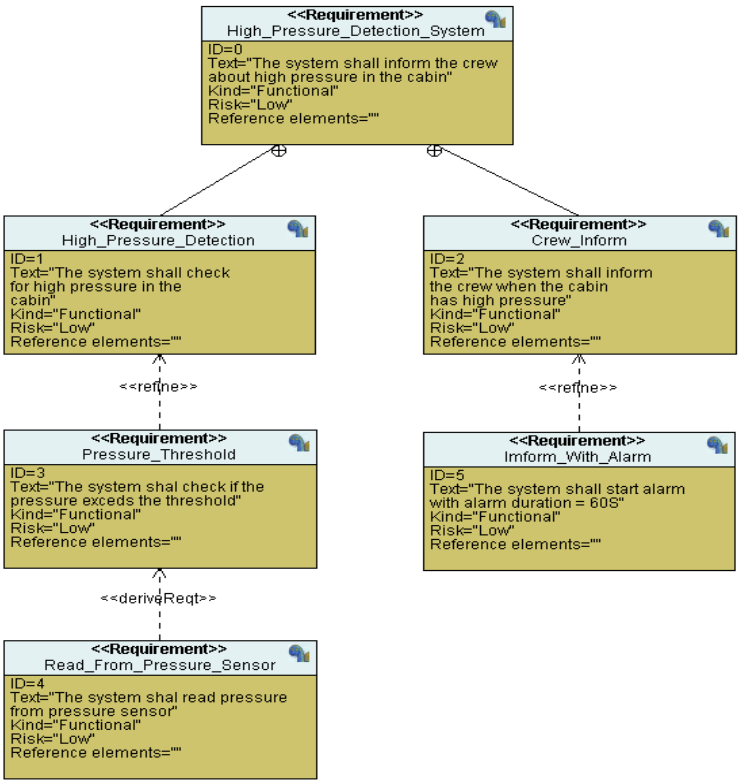
3. **Implementation** − With inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.

4. **Integration and Testing** − All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.

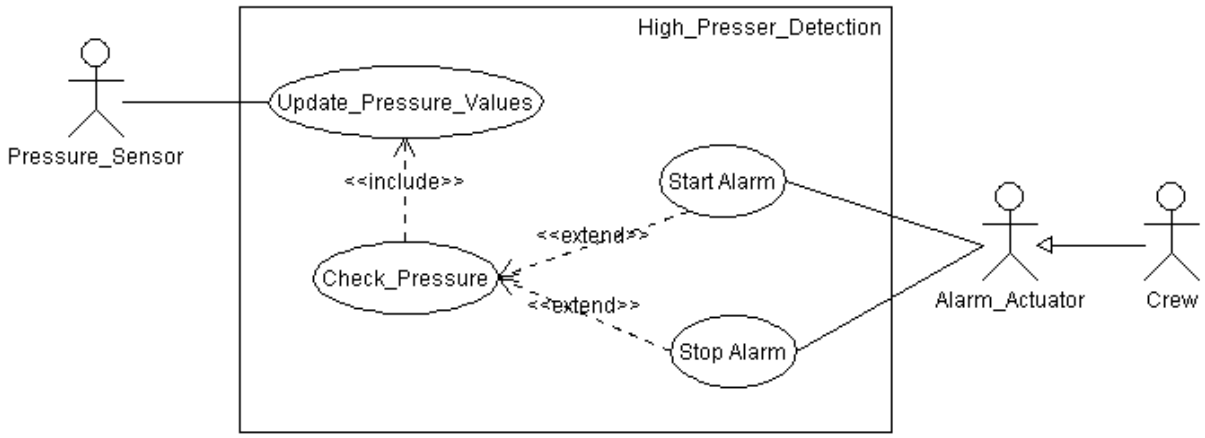
5. **Deployment of system** − Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.

6. **Maintenance** − There are some issues which come up in the client environment. To fix those issues, patches are released. Also, to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

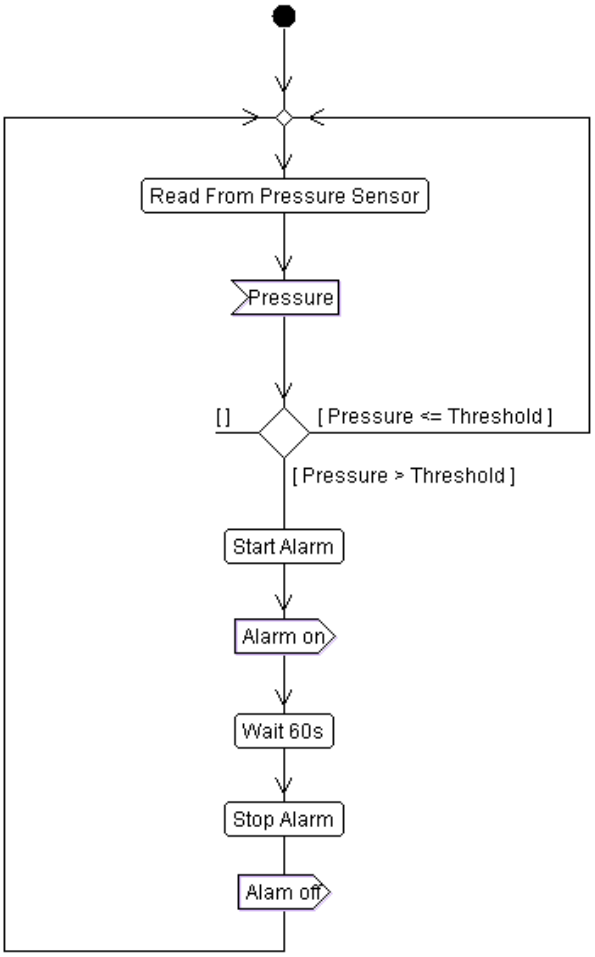
Requirement Diagram



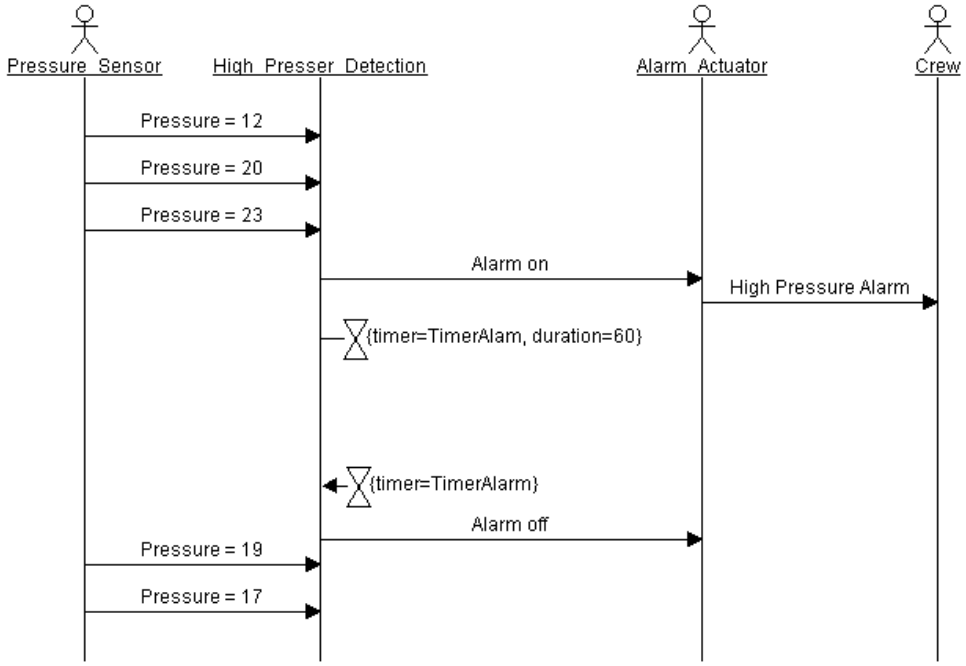
Use case diagram



Activity Diagram

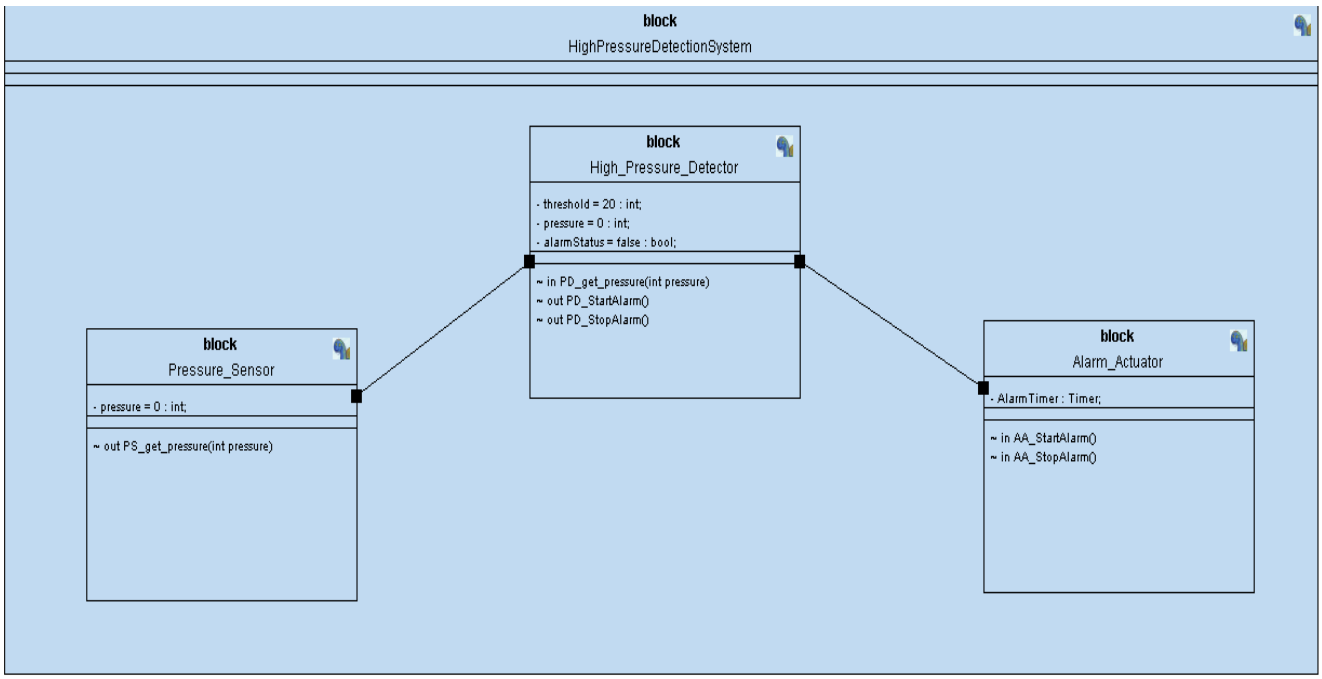


Sequence Diagram

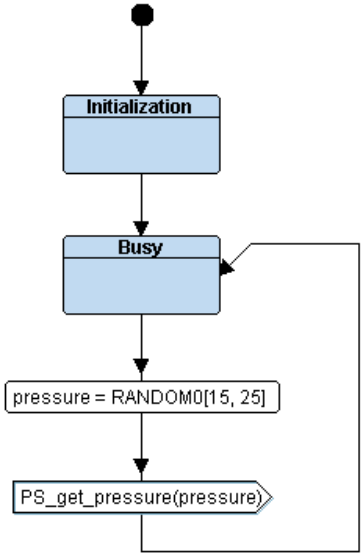


Design

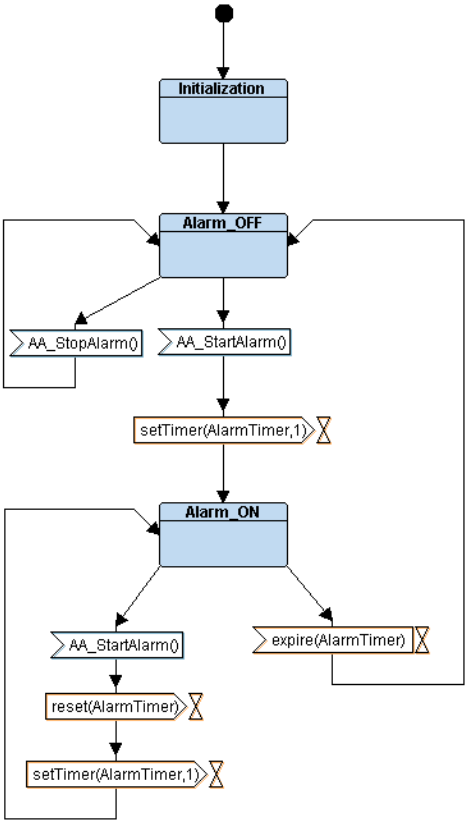
1. Block Diagram



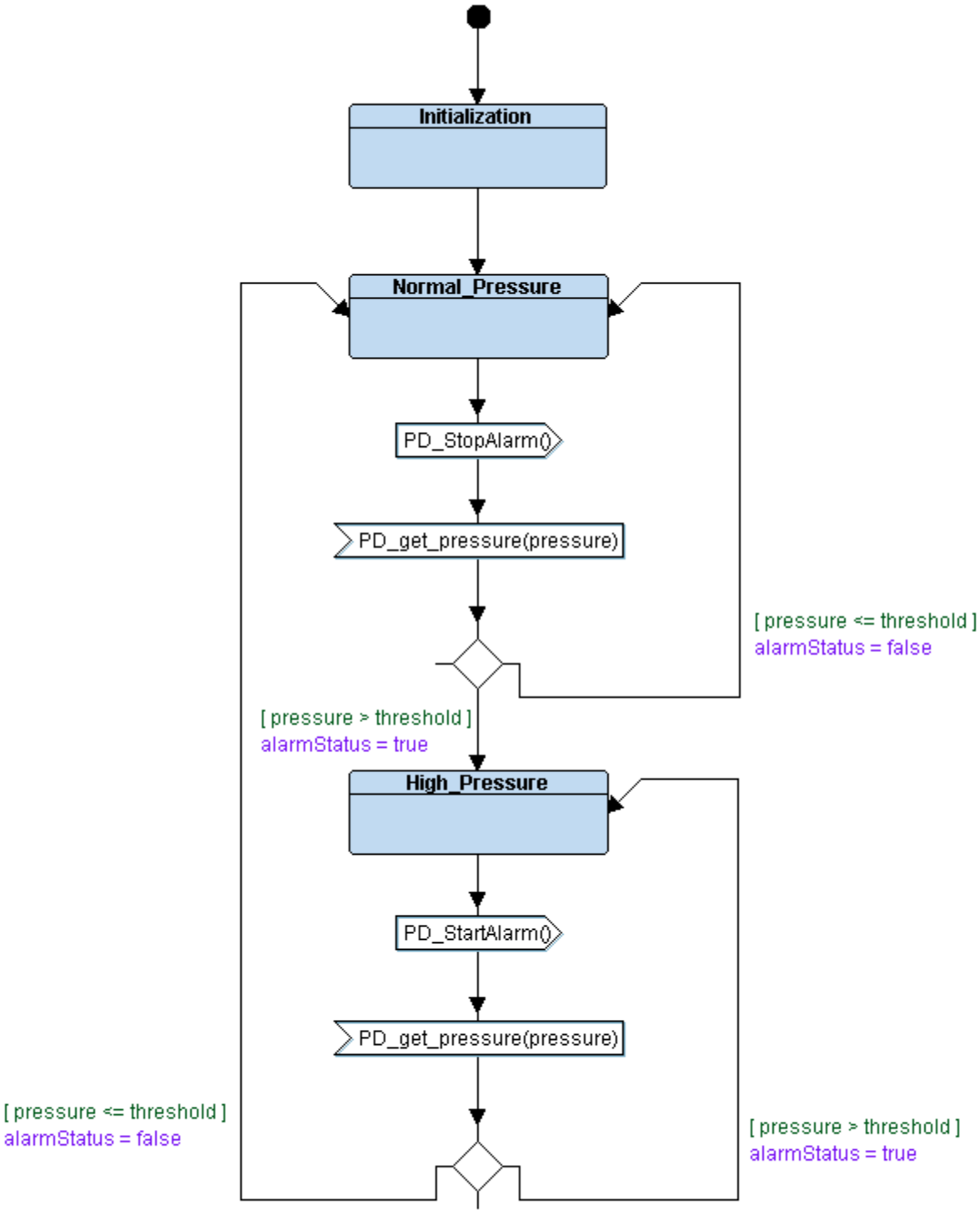
2. Pressure Sensors State Machine Diagram



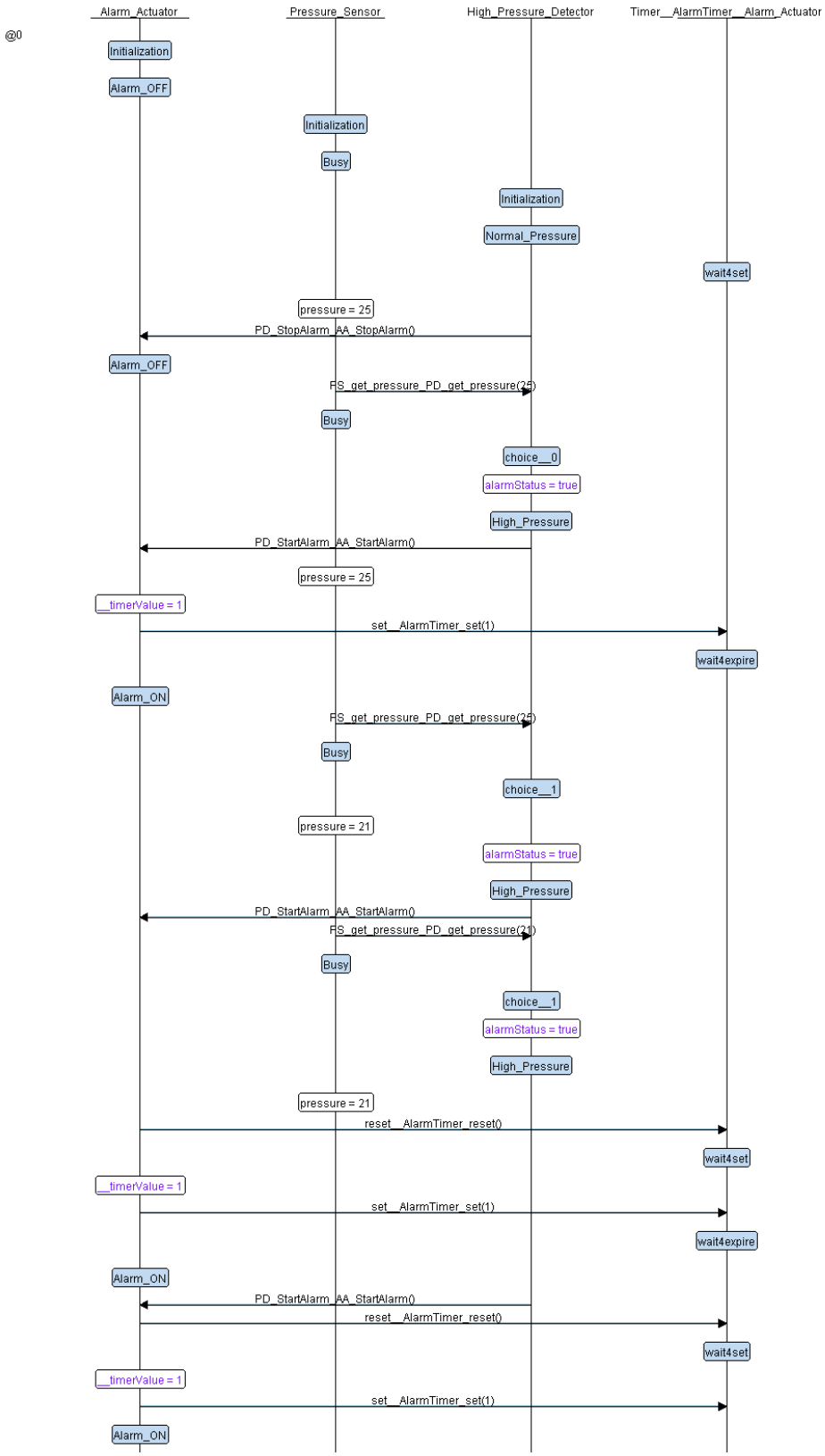
3. Alarm Actuator State Machine Diagram

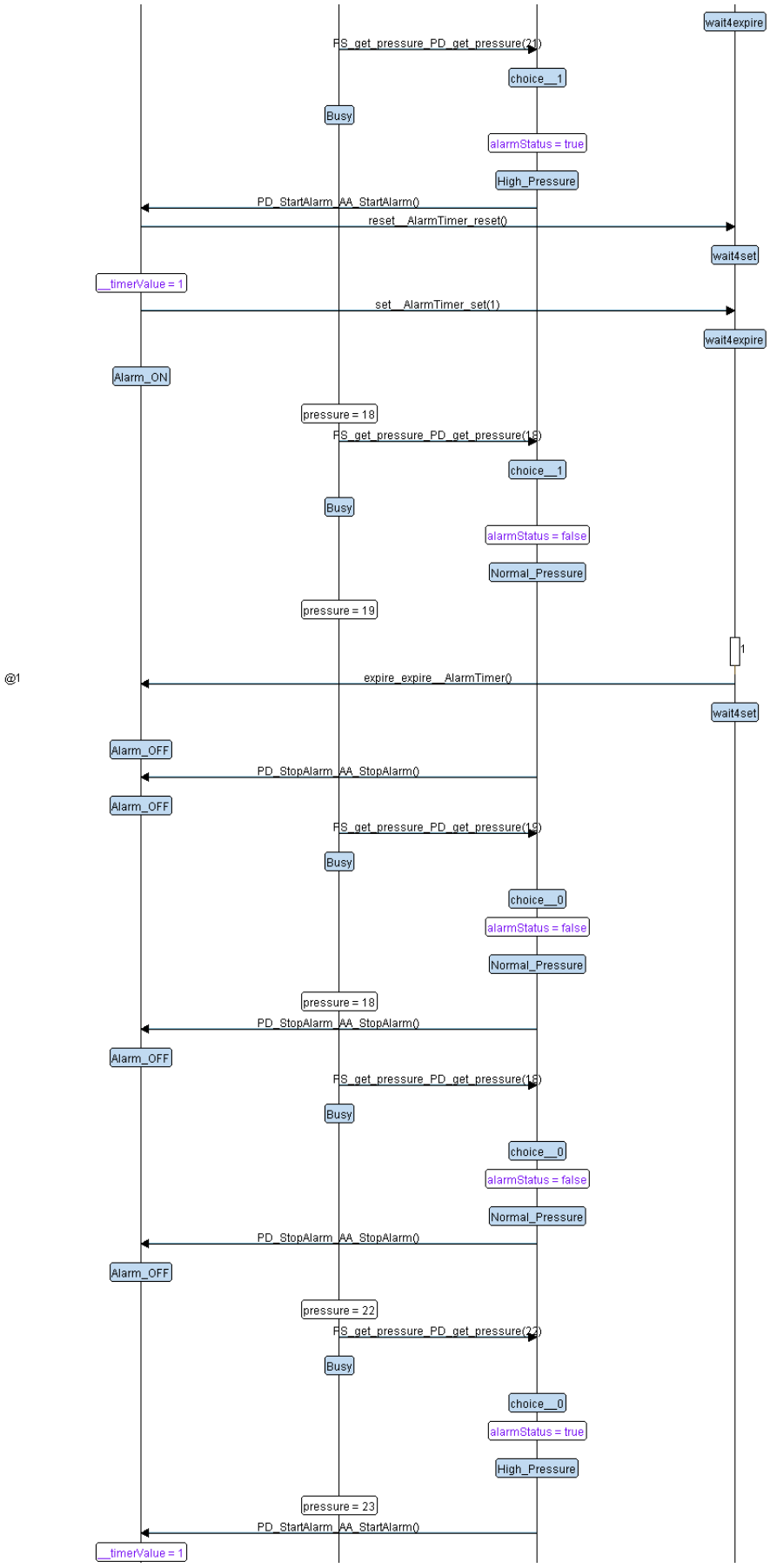


4. High Pressure Detection State Machine Diagram



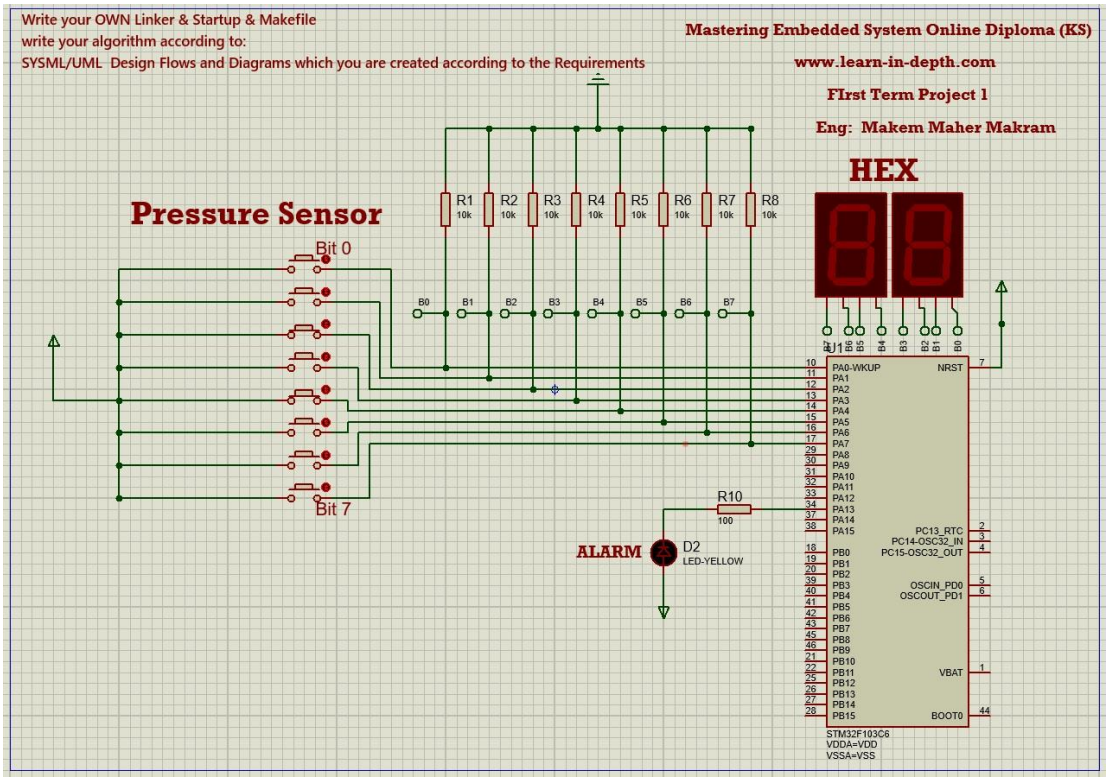
Interactive Simulation



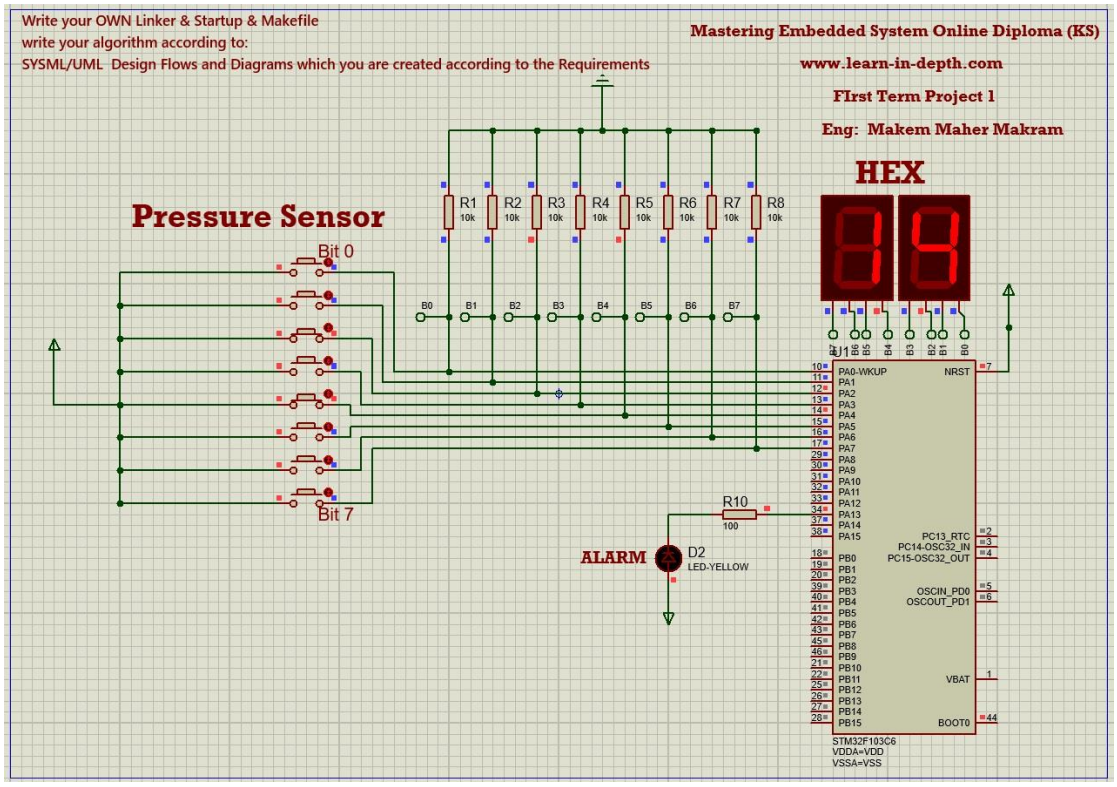

wait4expire
PS_get_pressure_PD_get_pressure(21)
choice__1
Busy
alarmStatus = true
High_Pressure
PD_StartAlarm_AA_StartAlarm()
reset__AlarmTimer_reset()
wait4set
__timerValue = 1
set__AlarmTimer_set(1)
wait4expire
Alarm_ON
pressure = 18
PS_get_pressure_PD_get_pressure(18)
choice__1
Busy
alarmStatus = false
Normal_Pressure
pressure = 19
1
@1
expire_expire__AlarmTimer()
wait4set
Alarm_OFF
PD_StopAlarm_AA_StopAlarm()
Alarm_OFF
PS_get_pressure_PD_get_pressure(18)
Busy
choice__0
alarmStatus = false
Normal_Pressure
pressure = 18
PD_StopAlarm_AA_StopAlarm()
Alarm_OFF
PS_get_pressure_PD_get_pressure(18)
Busy
choice__0
alarmStatus = false
Normal_Pressure
PD_StopAlarm_AA_StopAlarm()
Alarm_OFF
pressure = 22
PS_get_pressure_PD_get_pressure(22)
Busy
choice__0
alarmStatus = true
High_Pressure
pressure = 23
PD_StartAlarm_AA_StartAlarm()
__timerValue = 1

Execution

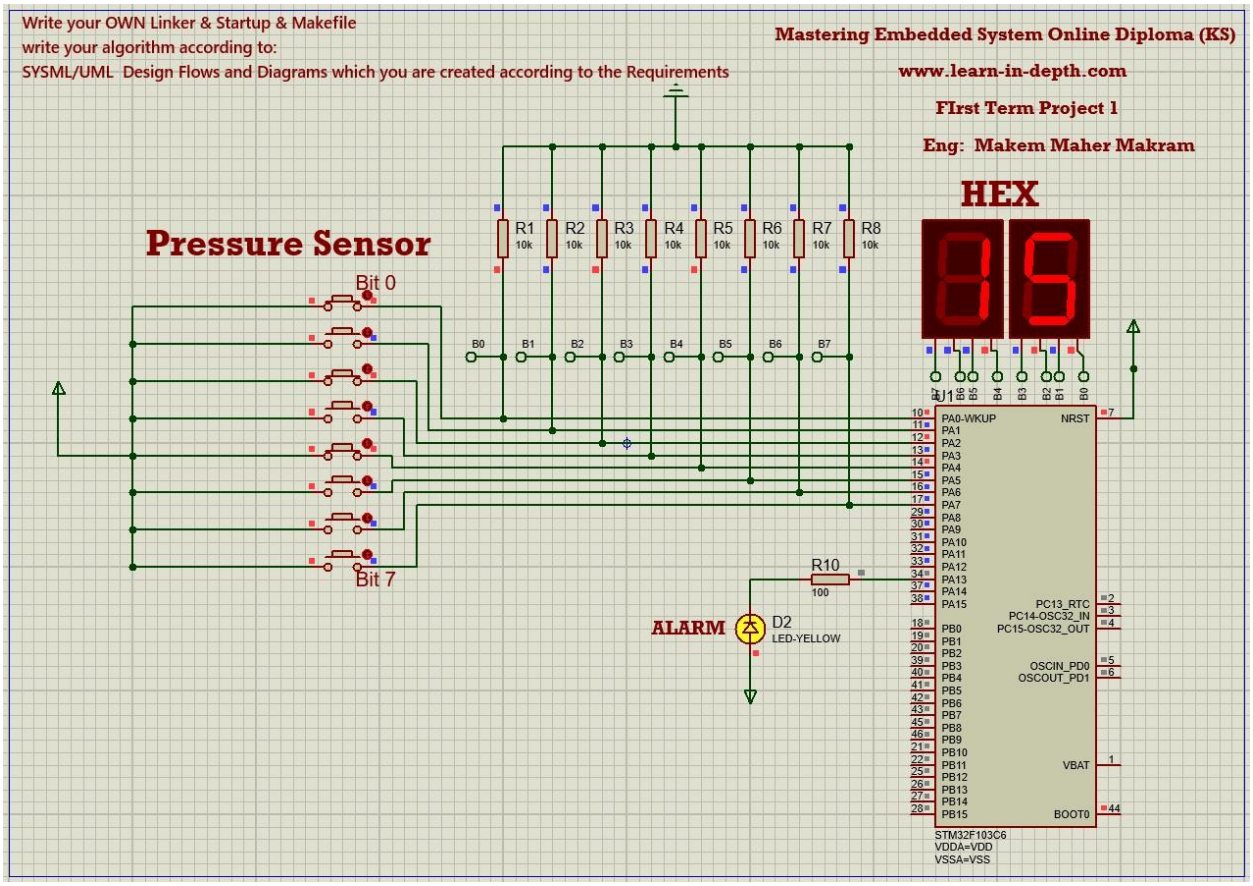
Proteus Design



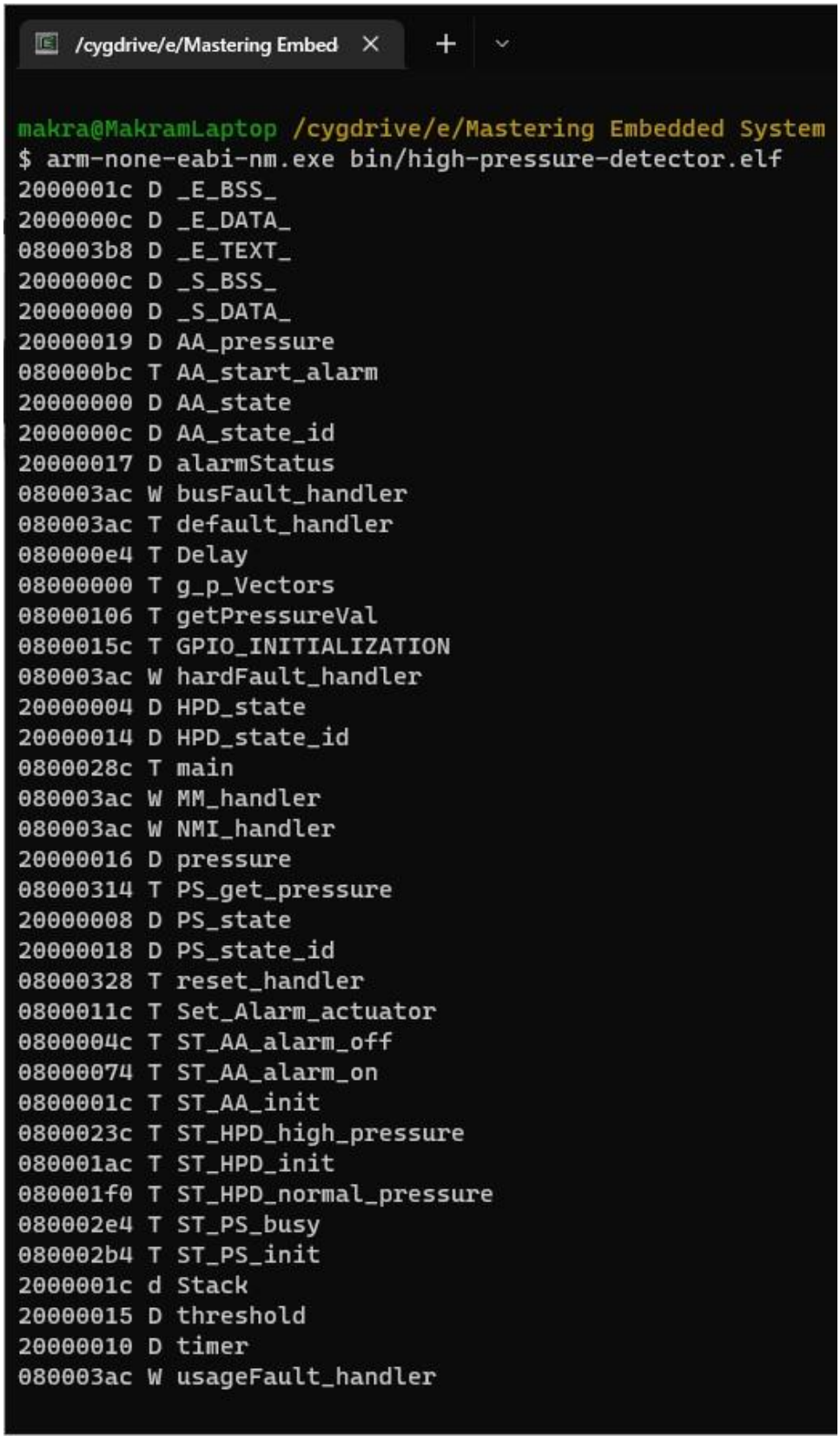
Low Pressure Case



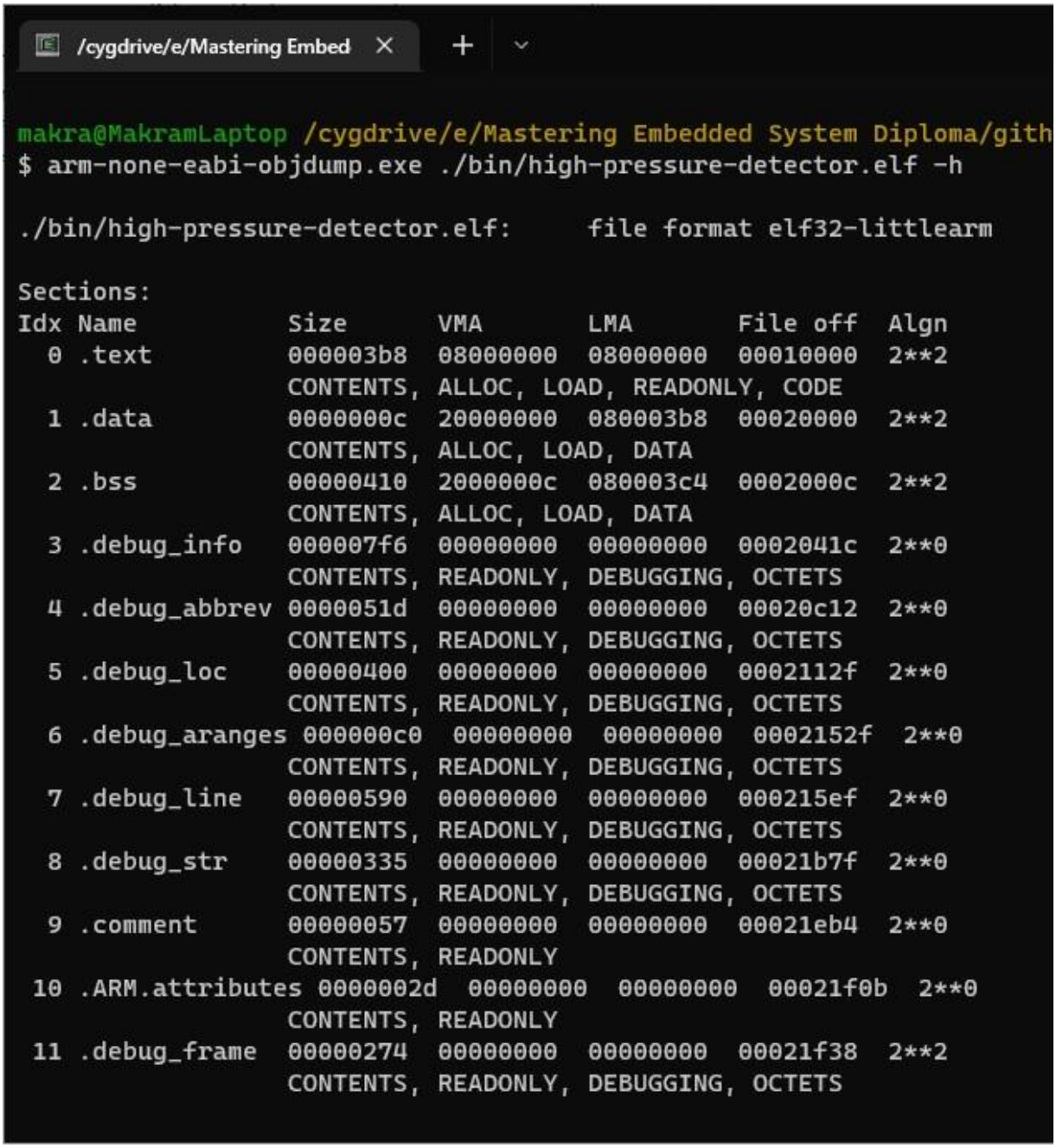
High Pressure Case



Symbol table



Objdumb


/cygdrive/e/Mastering Embed
makra@MakramLaptop /cygdrive/e/Mastering Embedded System Diploma/gith
$ arm-none-eabi-objdump.exe ./bin/high-pressure-detector.elf -h
./bin/high-pressure-detector.elf: file format elf32-littlearm
Sections:
Idx Name Size VMA LMA File off Algn
0 .text 000003b8 08000000 08000000 00010000 2**2
CONTENTS, ALLOC, LOAD, READONLY, CODE
1 .data 0000000c 20000000 080003b8 00020000 2**2
CONTENTS, ALLOC, LOAD, DATA
2 .bss 00000410 2000000c 080003c4 0002000c 2**2
CONTENTS, ALLOC, LOAD, DATA
3 .debug_info 000007f6 00000000 00000000 0002041c 2**0
CONTENTS, READONLY, DEBUGGING, OCTETS
4 .debug_abbrev 0000051d 00000000 00000000 00020c12 2**0
CONTENTS, READONLY, DEBUGGING, OCTETS
5 .debug_loc 00000400 00000000 00000000 0002112f 2**0
CONTENTS, READONLY, DEBUGGING, OCTETS
6 .debug_aranges 000000c0 00000000 00000000 0002152f 2**0
CONTENTS, READONLY, DEBUGGING, OCTETS
7 .debug_line 00000590 00000000 00000000 000215ef 2**0
CONTENTS, READONLY, DEBUGGING, OCTETS
8 .debug_str 00000335 00000000 00000000 00021b7f 2**0
CONTENTS, READONLY, DEBUGGING, OCTETS
9 .comment 00000057 00000000 00000000 00021eb4 2**0
CONTENTS, READONLY
10 .ARM.attributes 0000002d 00000000 00000000 00021f0b 2**0
CONTENTS, READONLY
11 .debug_frame 00000274 00000000 00000000 00021f38 2**2
CONTENTS, READONLY, DEBUGGING, OCTETS