Mastering Embedded Systems Online Diploma
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Pressure Controller

Prepared by
Eng. Mohamed Magdi

My Profile:
https://www.learn-in-depth.com/online-diploma/mohamed.m.alsehli%40gmail.com

1. Specification

- 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.

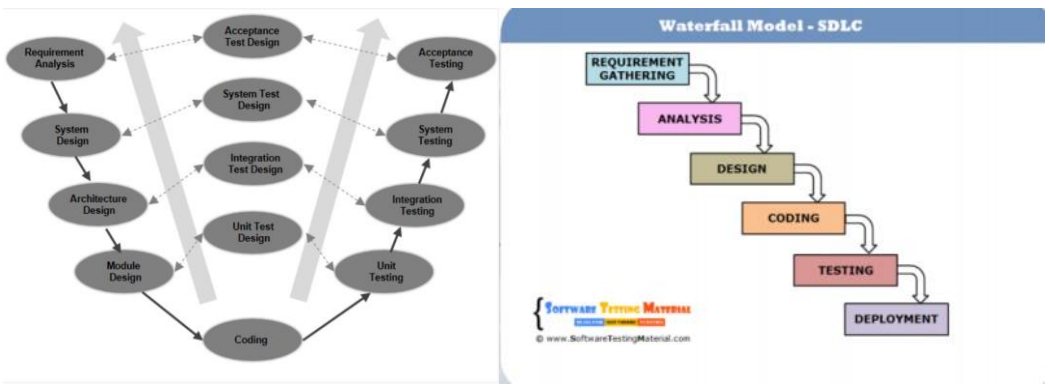
2. Design Sequence

- Case Study:

  A pressure controlling systems has assumptions:

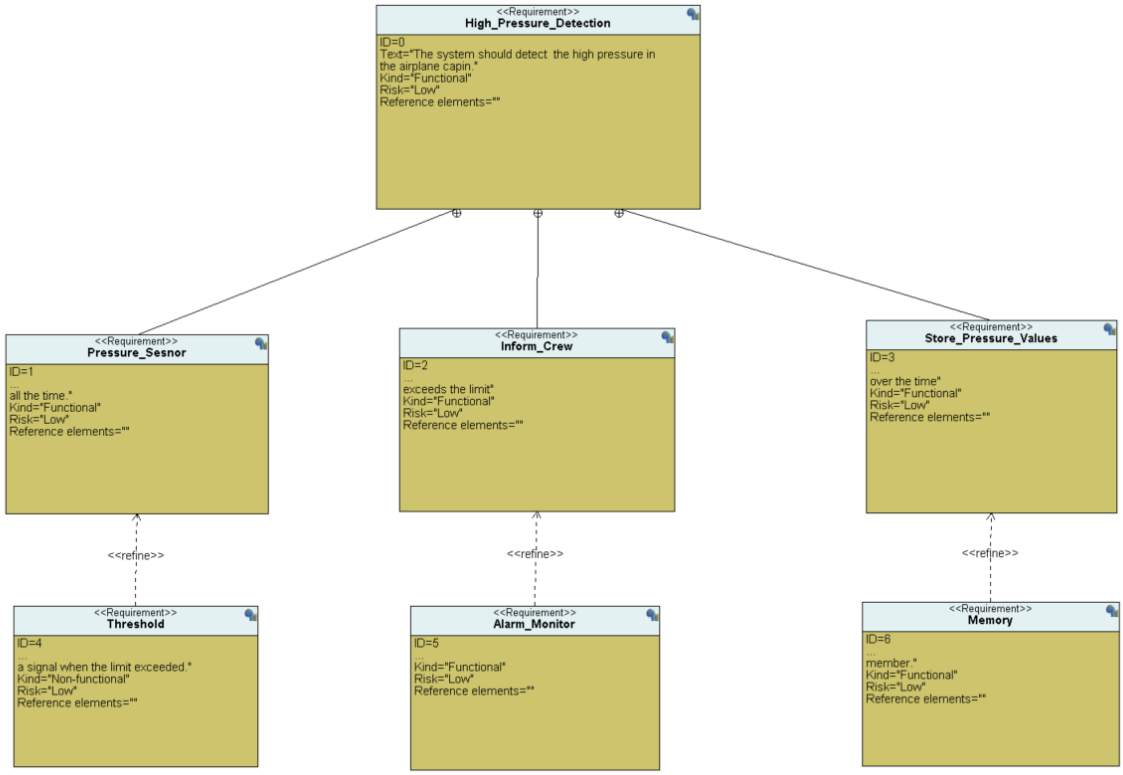
  1. The controller set up and shutdown procedures are not modeled.
  2. The controller maintenance is not modeled.
  3. The pressure sensor never fails.
  4. The alarm never fails.
  5. The controller never faces power cut.
  6. The keep track of the measured value option is not modeled in the first version of the design.

- Method:
  - The V-Model is an extension of the waterfall model and is based on the association of a testing phase for each corresponding development stage. This means that for every single phase in the development cycle, there is a directly associated testing phase. This is a highly disciplined model, and the next phase starts only after completion of the previous phase.



- Requirement:
  - Each requirement identifies a unique identifier, a description in plain text and a type.

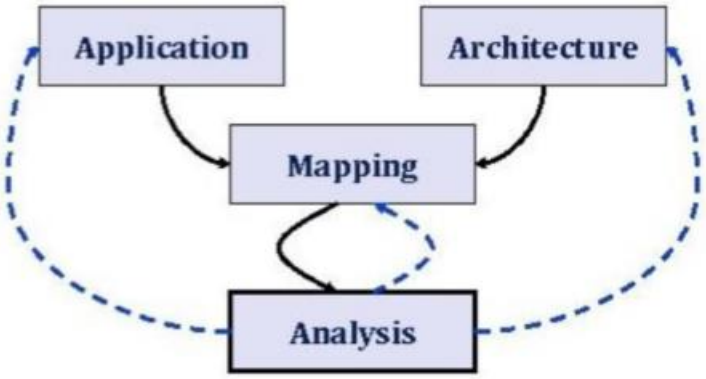
  - Requirement Diagram:



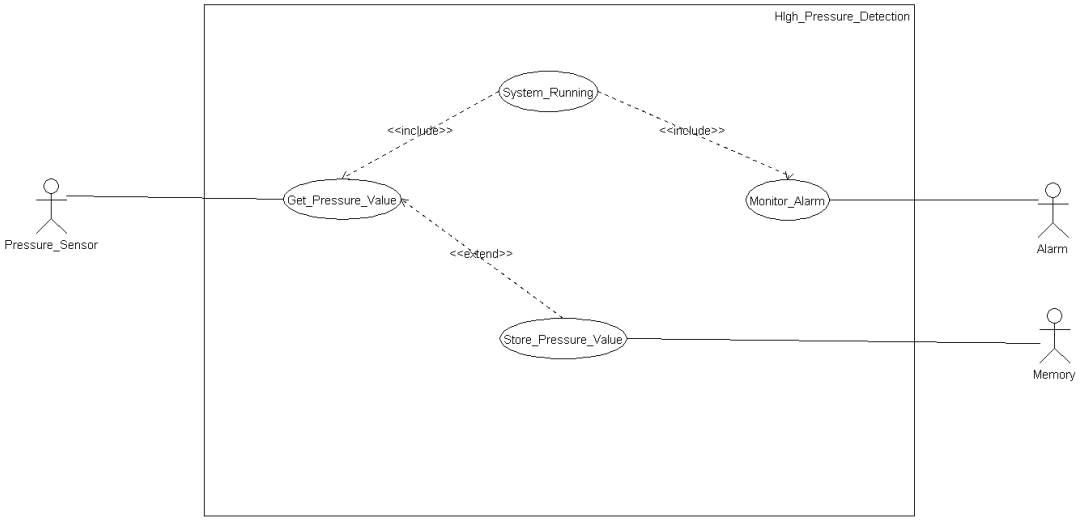
We defined the blocks in the diagram as a one main block and sub-blocks which is composed and refined to the main blocks.

- Composition:
  Composition is the process of combining smaller requirements to create a larger, more comprehensive requirement.
- Refinement:
  Refinement is the process of breaking down higher-level, abstract requirements into more detailed and specific sub-requirements.

- Design Space Exploration:
  The goal of design exploration is to find the best trade-offs among various design decisions. We will use STM32F103C6 microcontroller with a cortex-m3.
  We aim to design alternatives to identify the most optimal solution.

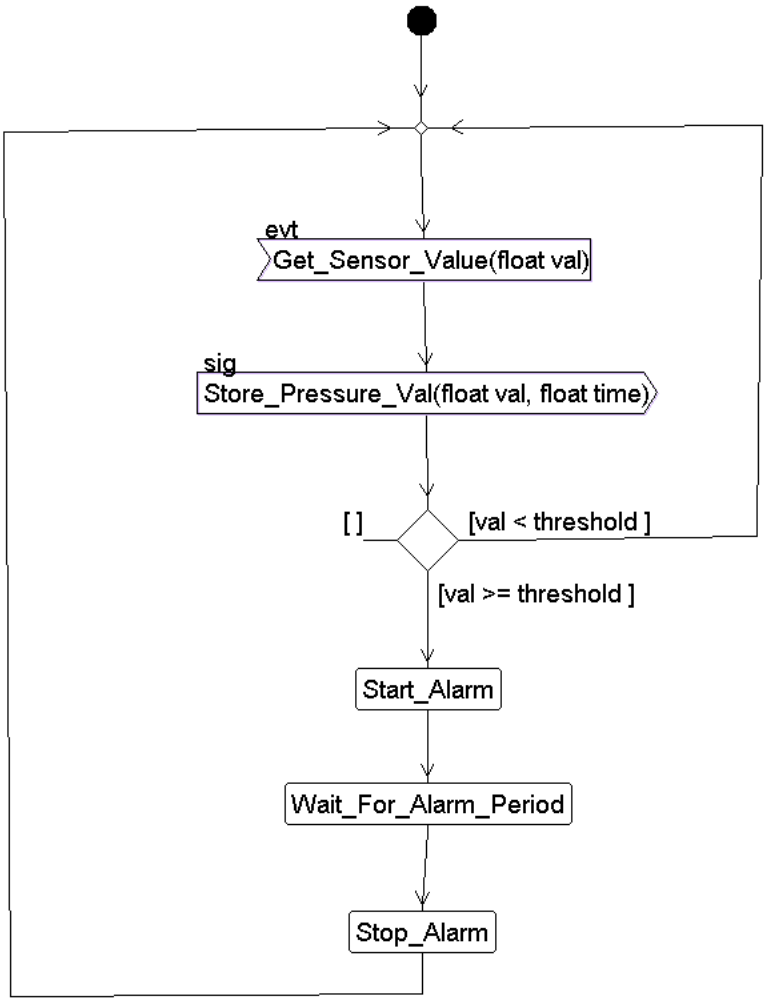


- System Analysis:
  - **Analysis Method.**
    1. Use Case Diagram.
       Defining system boundary and main function.



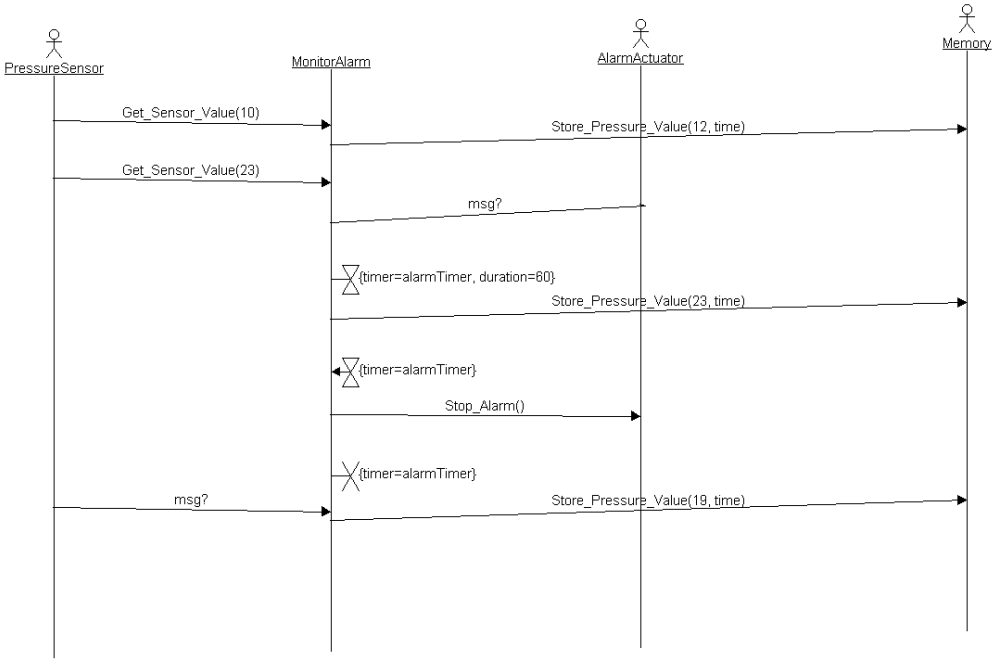
2. Activity Diagram.

   Describe the workflow behavior of the system.

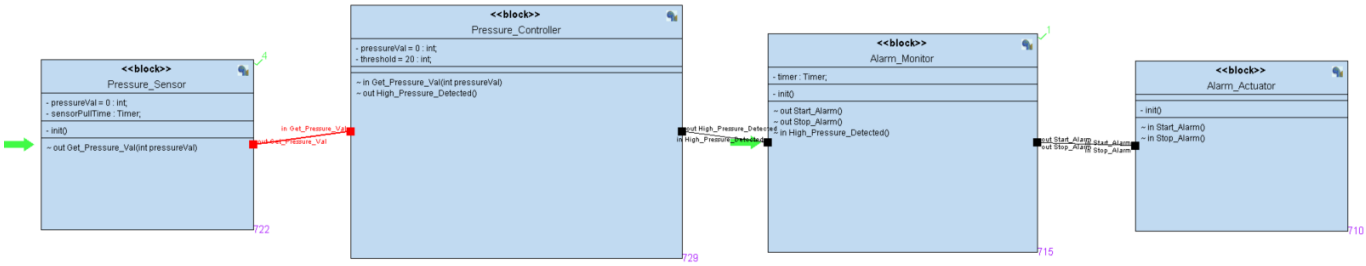


3. Sequence Diagram.

   How operations are carried out.

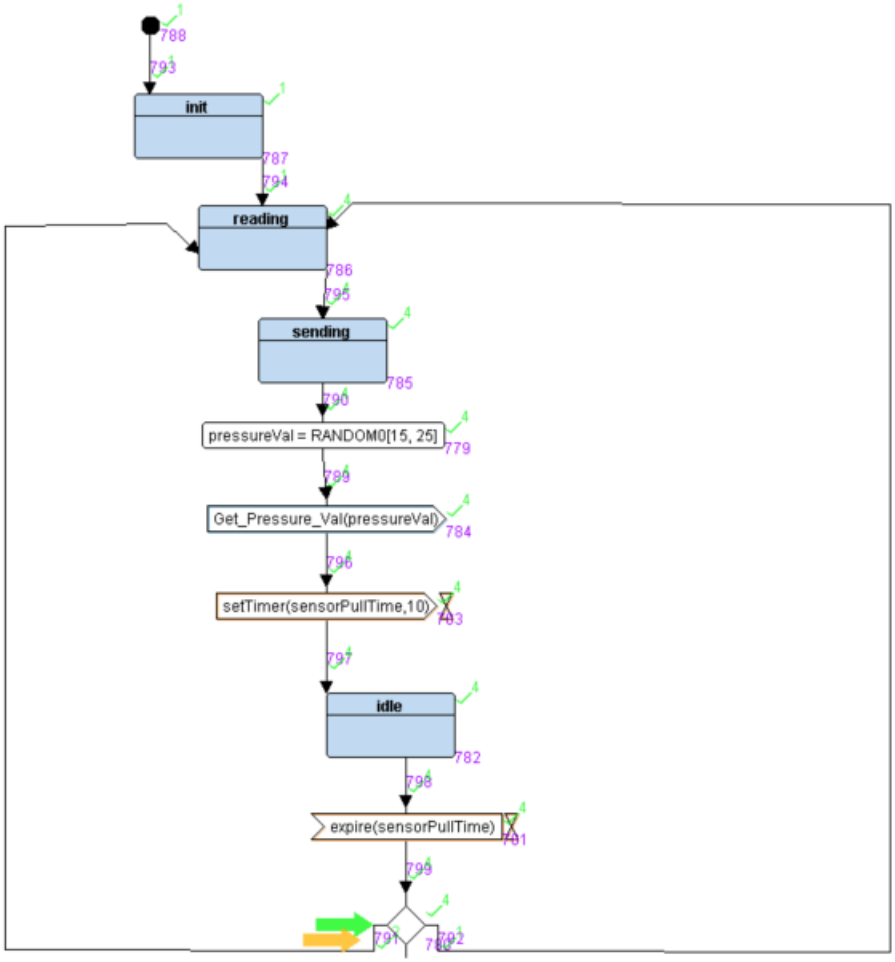


- System Design:
  - Block Diagram:

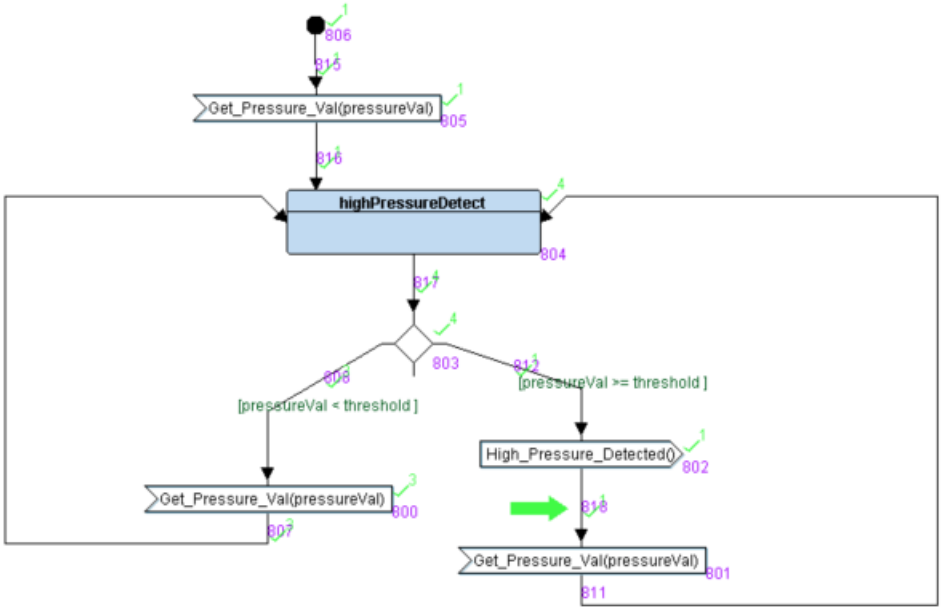


State Machines of Each Block:

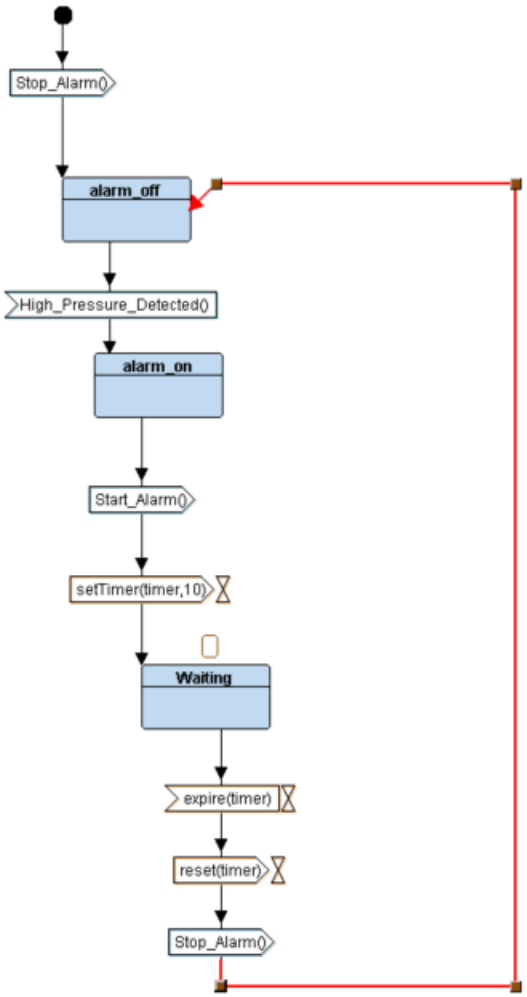
- Pressure Sensor State



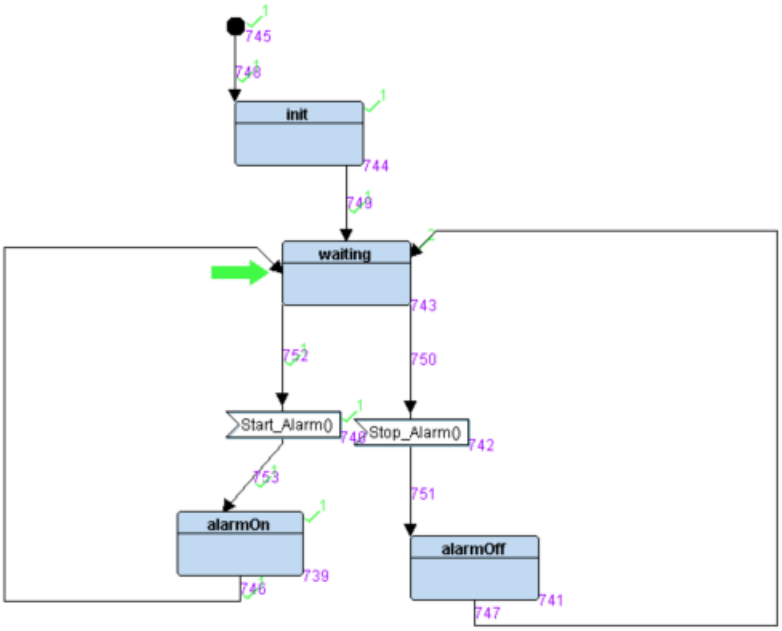
- Pressure Controller



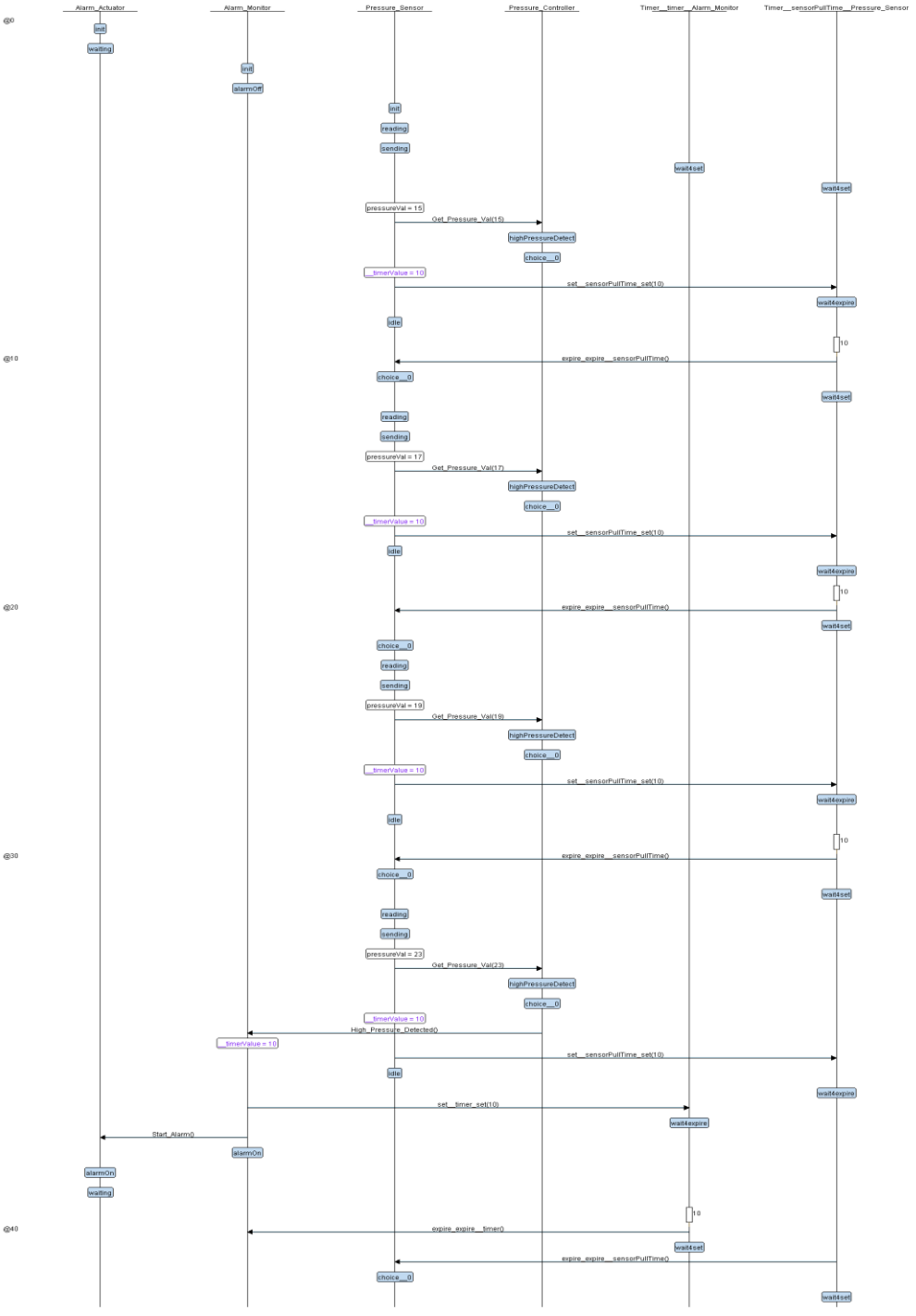
- Alarm Monitor



- Alarm Actuator



Simulation Tree:



Executable Symbols:

```
> arm-none-eabi-nm pressureController.elf
20000004 D _E_DATA
080004bc T _E_TEXT
080004b4 t _reset
20000004 B _S_BSS
20000000 D _S_DATA
20001018 B _stack_top
2000101c B ALARM_ACT_ID
20001024 B ALARM_MON_ID
080001f0 T Delay
08000214 T getPressureVal
08000390 T GetPressureVal
0800027c T GPIO_INITIALIZATION
08000124 T highPressureDetected
08000350 T main
20001018 B pAlarmAct
20001020 B pAlarmMon
20001025 B PControllerID
2000000c B pCState
20001028 B pPSensor
20000010 b pressureVal
20000008 b pressureVal
20001026 B PSENSORID
20000014 B sensorPullTime
0800022c T Set_Alarm_actuator
080002fc T setup
080000c4 T ST_alarmActOff
080000f4 T ST_alarmActOn
08000098 T ST_alarmActWaiting
08000140 T ST_alarmMonOff
0800016c T ST_alarmMonOn
080001b8 T ST_alarmMonWaiting
080003c0 T ST_HighPressureDetected
08000470 T ST_idle
08000404 T ST_init
0800008c T ST_initAlarmAct
08000410 T ST_reading
08000458 T ST_sending
08000054 T StartAlarm
08000070 T StopAlarm
20000000 d threshold
20000004 B timer
080004ba t Vector_handler
```

Proteus Simulation: