First Term Project(1)

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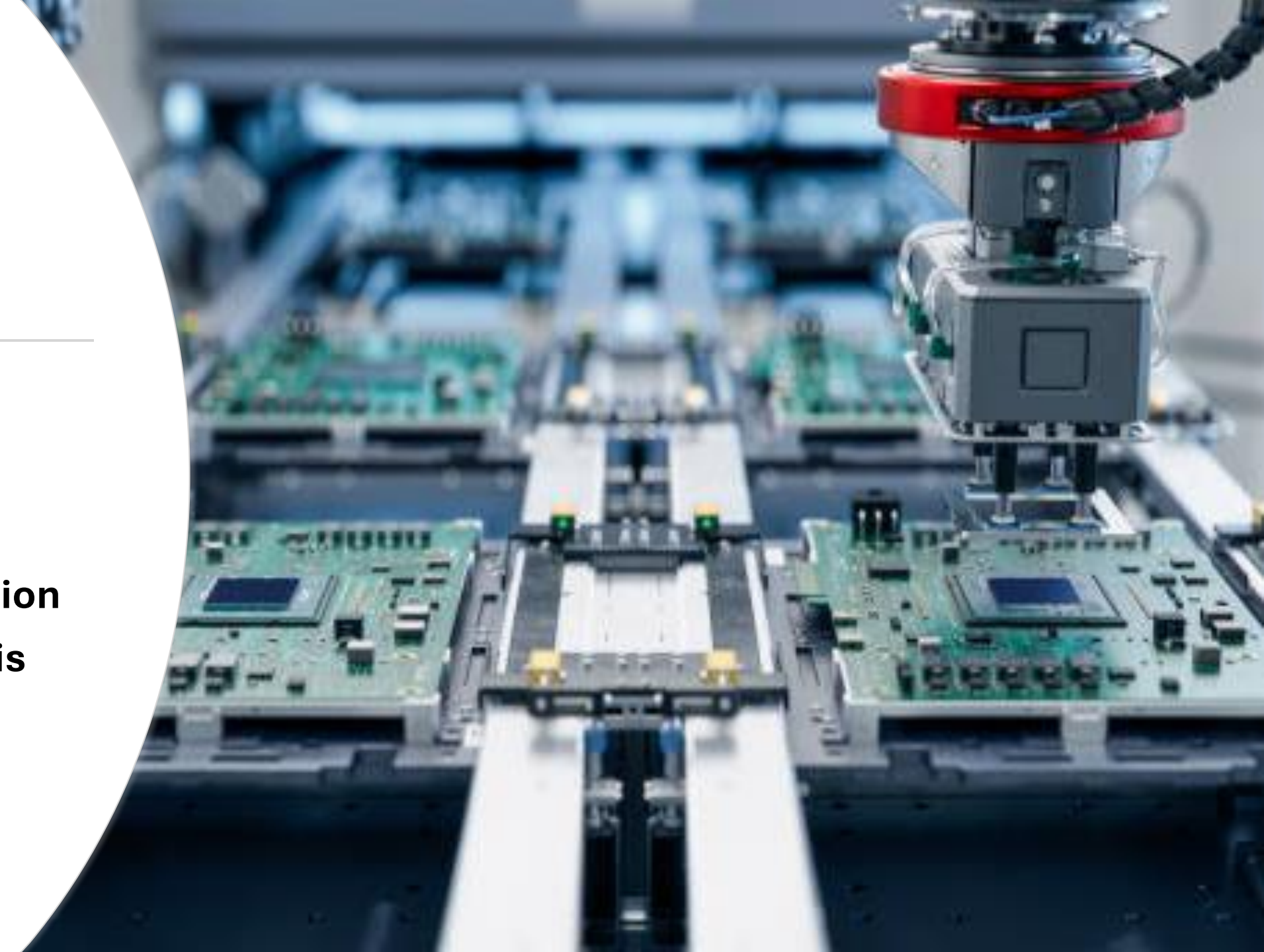
My LinkedIn: https://www.linkedin.com/in/abdullah-ghazal-364117247/

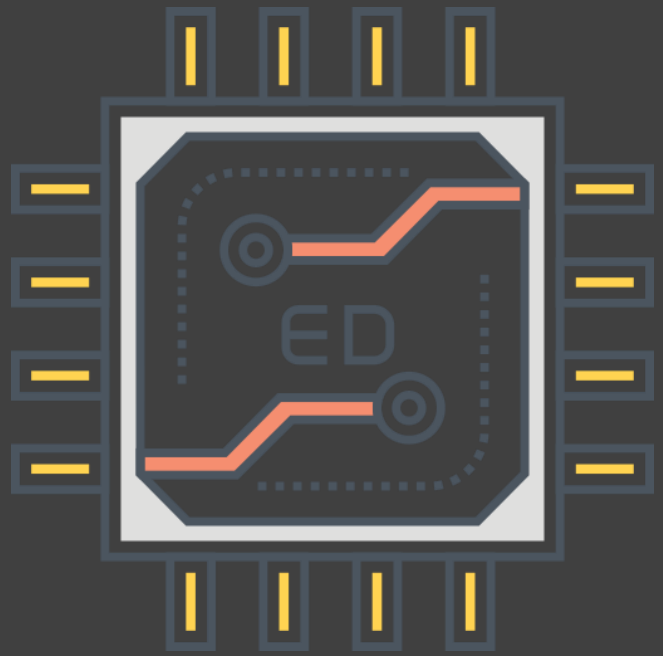
Pressure Controller

Overview:

- 1- Case Study
- 2- Method
- 3- Requirements
- 4- Space Exploration
- 5- System Analysis
- 6- System Design



Case Study



- Specification (from the client):

1) A pressure controller informs the crew of a cabin with an alarm

2) when the pressure exceeds 20 bars in the cabin.

3) The alarm duration equals 60 seconds.

4) keeps track of the measured values.

- My Assumptions:

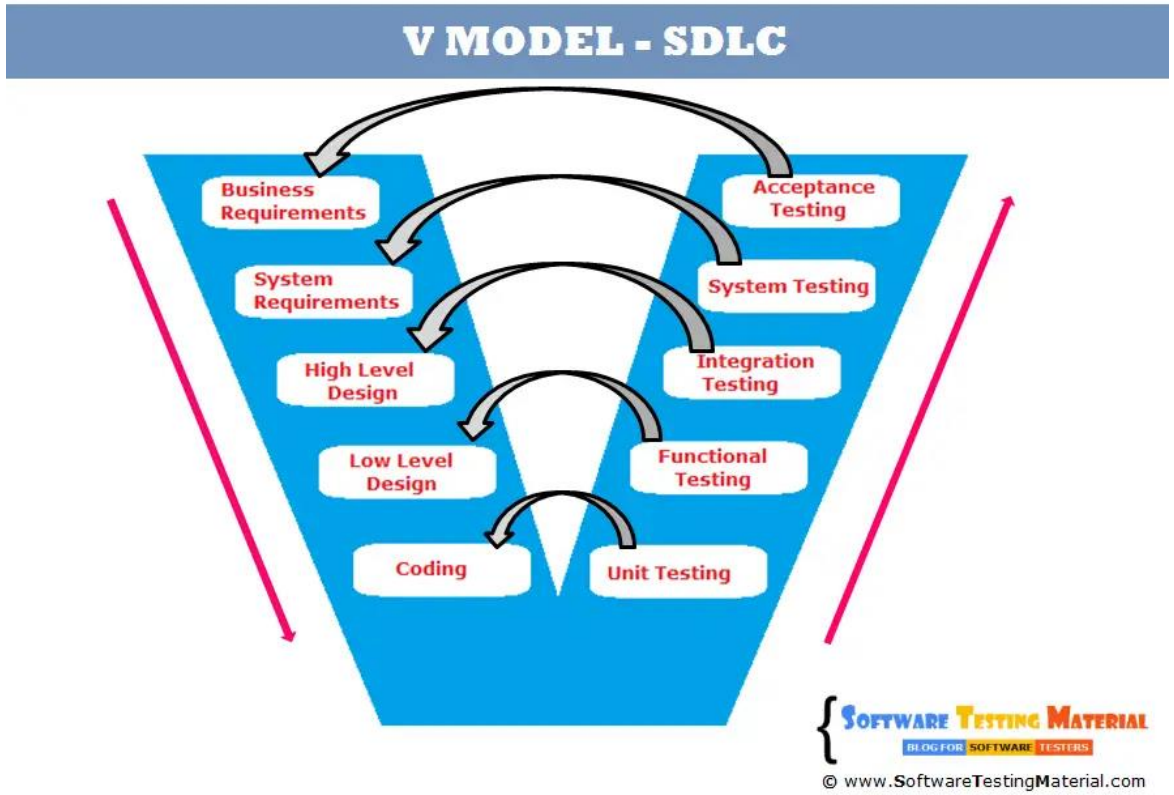
1) The controller set up and shutdown procedures are not modeled.

2) The controller maintenance is not modeled.

3) The pressure sensor never fails.

4) The alarm never fails.

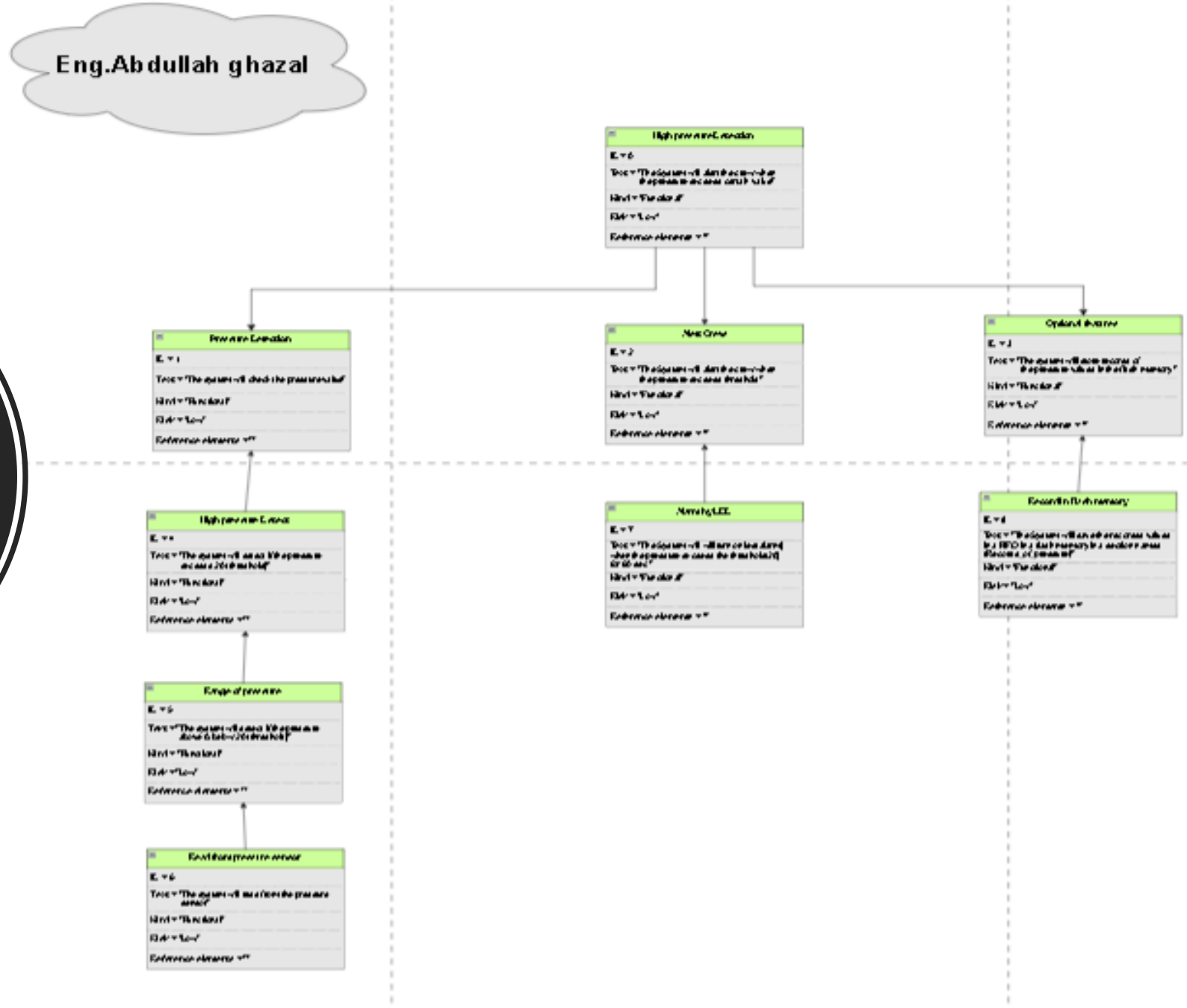
5) The controller never faces a power cut.



- I would work with the Vmodel method to apply my system design.

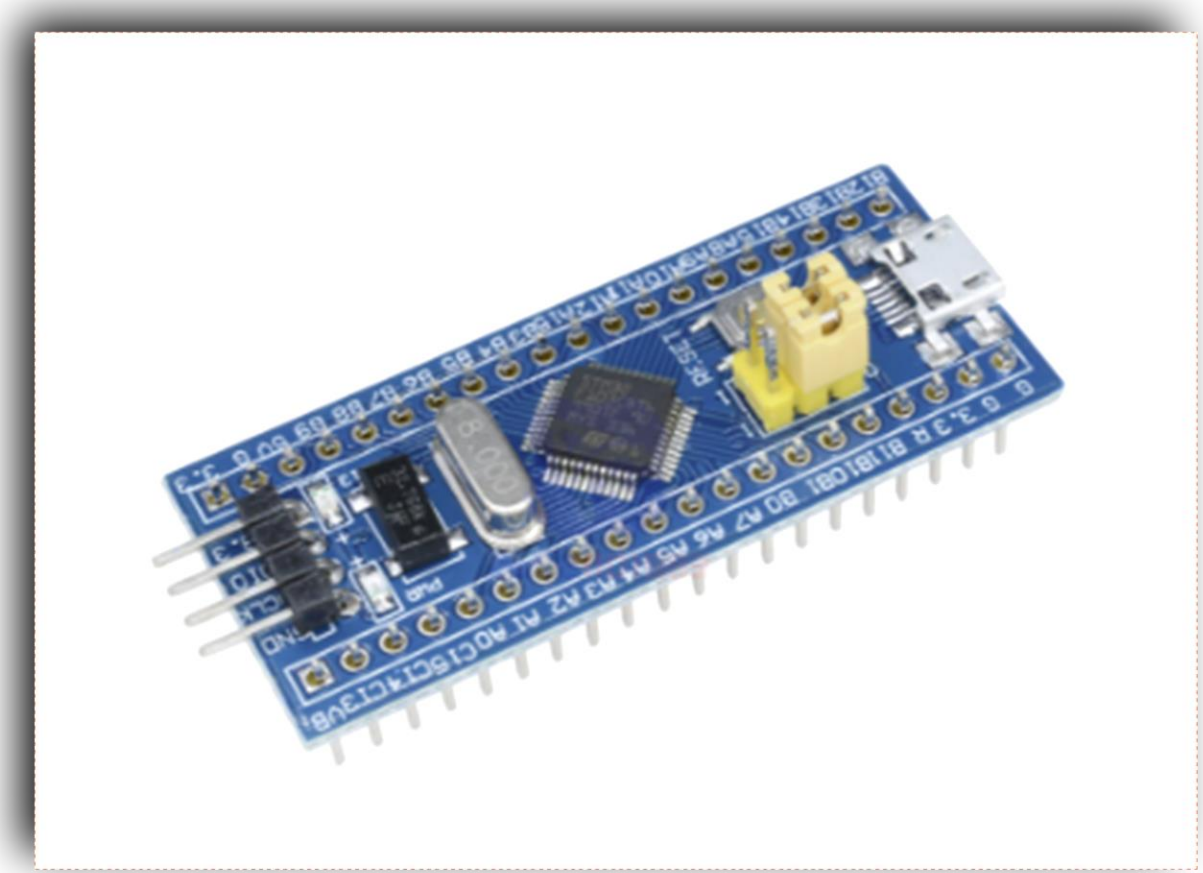
Method

Requirements



Space Exploration

the Board "STM32F103C8T6 (Cortex_M3) " is Very suitable for this Case study.



- **o Core:** 32-bit ARM Cortex-M3 CPU, running at up to 72MHz
- **o Memory:** 64 KB of Flash memory and 20 KB of SRAM.
- **o Peripherals:** Includes two 12-bit ADCs, three general purpose 16-bit timers, one PWM timer, and various communication interfaces like I2C, SPI, USART, USB, and CAN.
- **o Power:** Operates from a 2.0 to 3.6 V power supply and includes several power-saving modes.

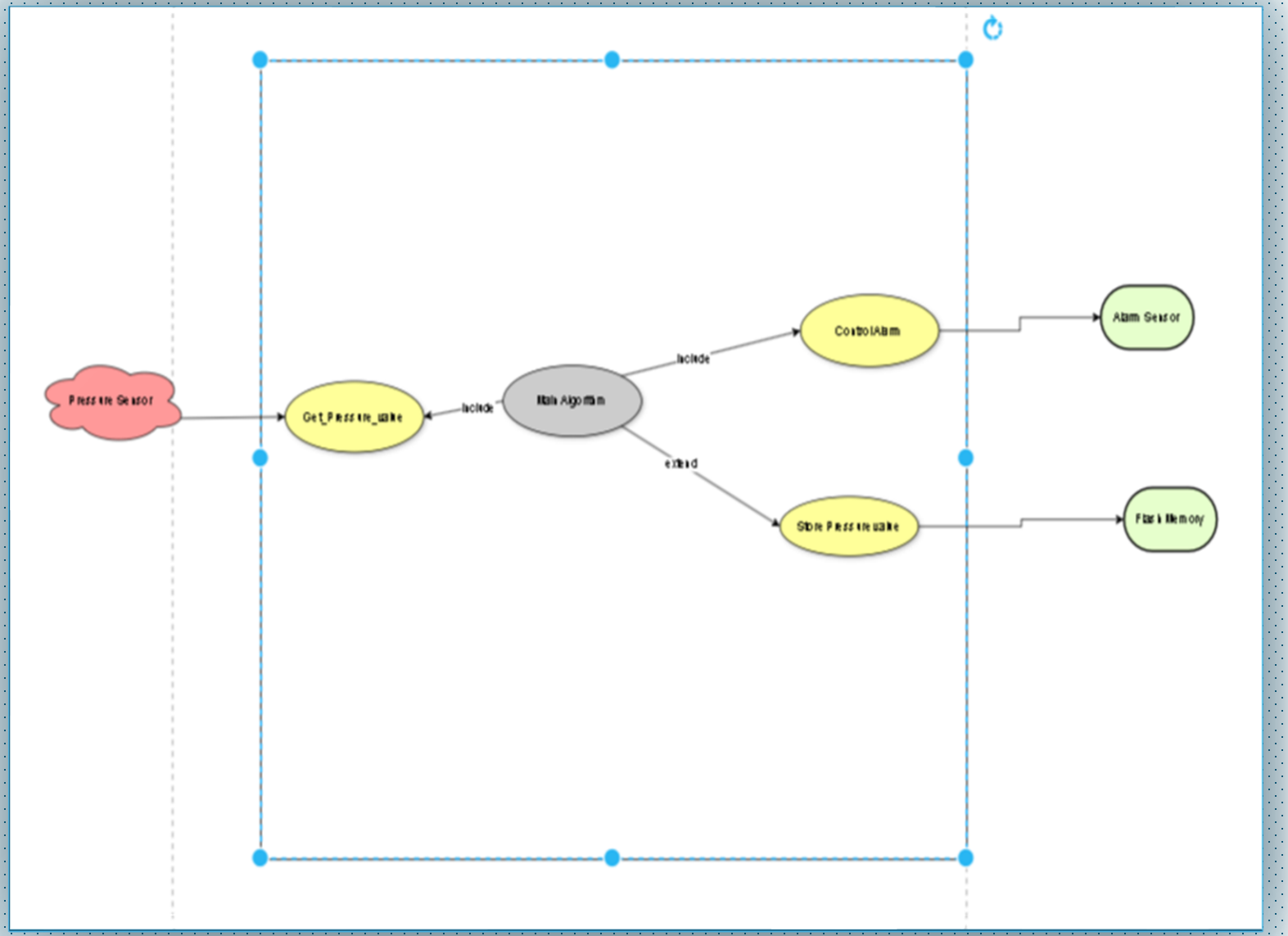
System Analysis

1- Use case

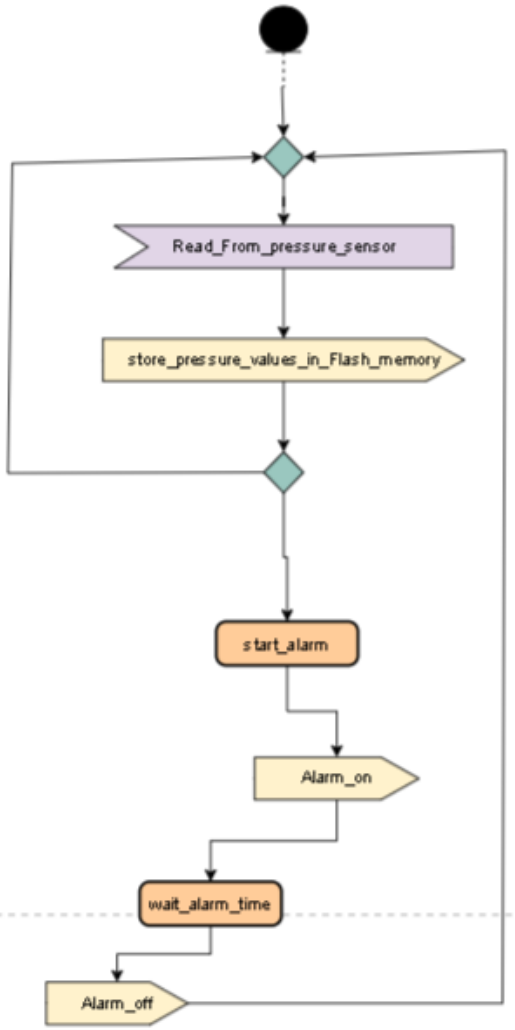
2- Activity Diagram

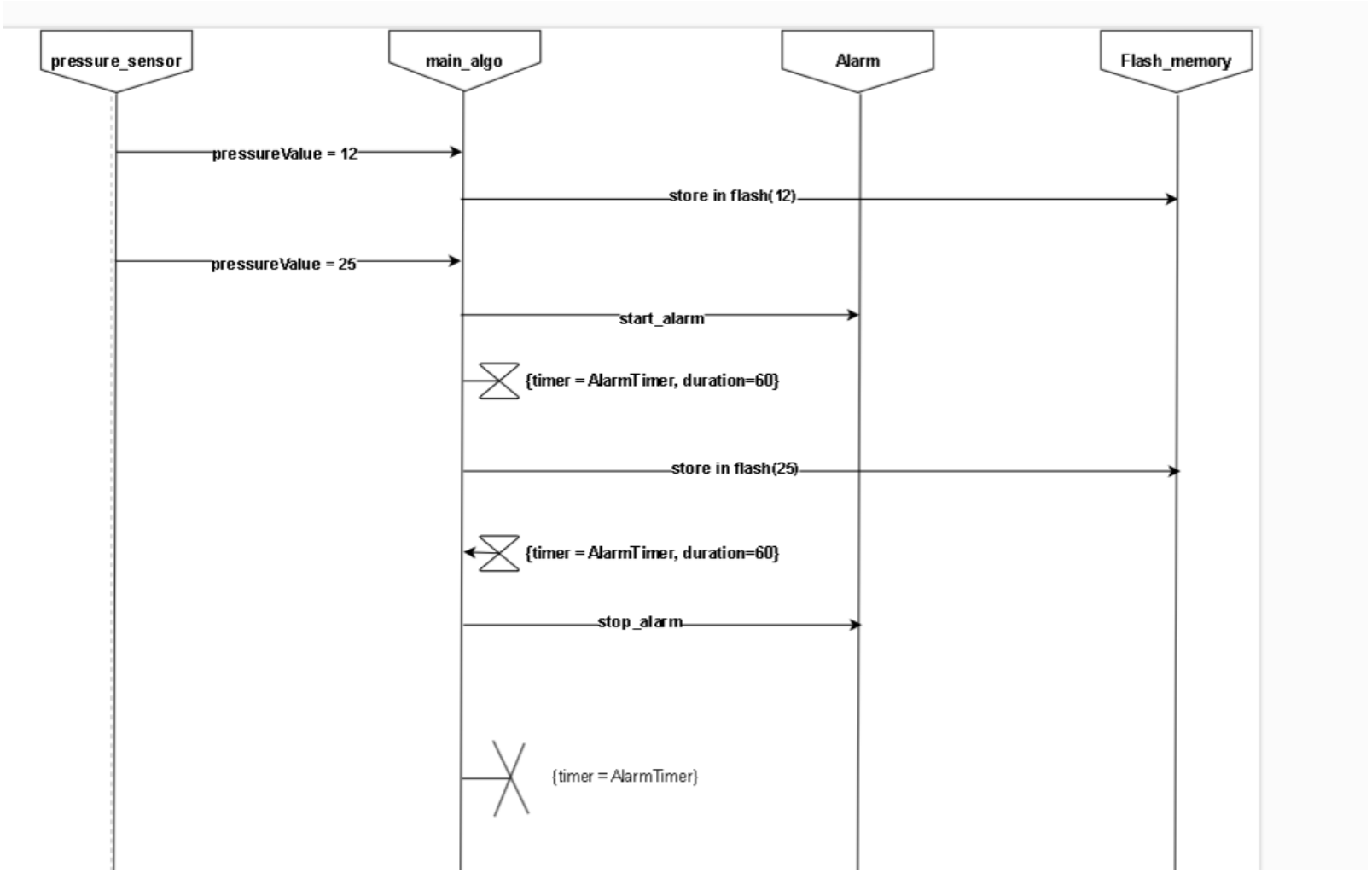
3- Sequences Diagram

- ***1) Use case***


Pressure Sensor
Get_Pressure_value
include
Main Algorithm
include
extend
ControlAlarm
Alarm Sensor
Store Pressure value
Flash Memory

- ***2- Activity Diagram***





Sequence Diagram

System Design

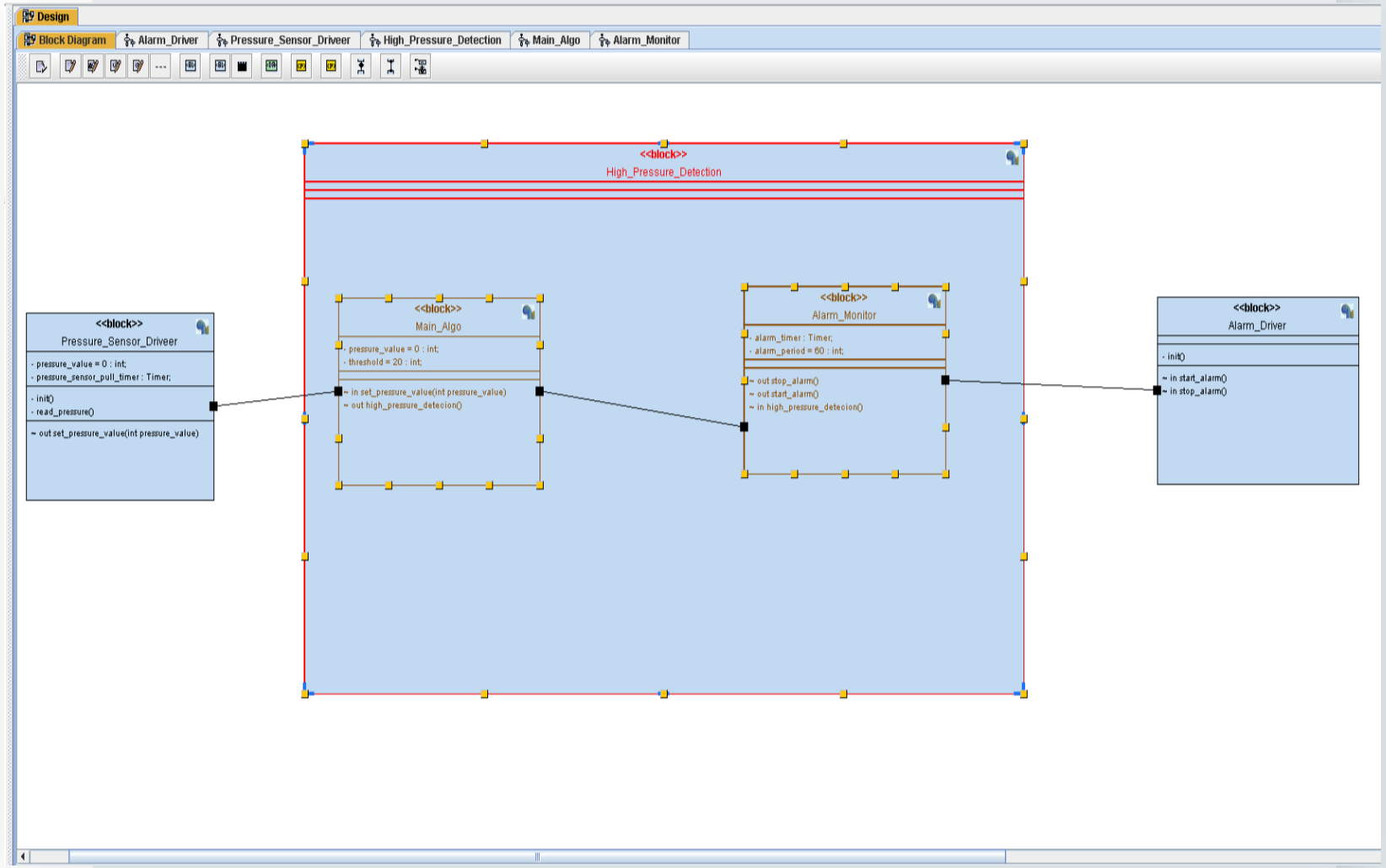
1- Block Diagram

2- Pressure Sensor

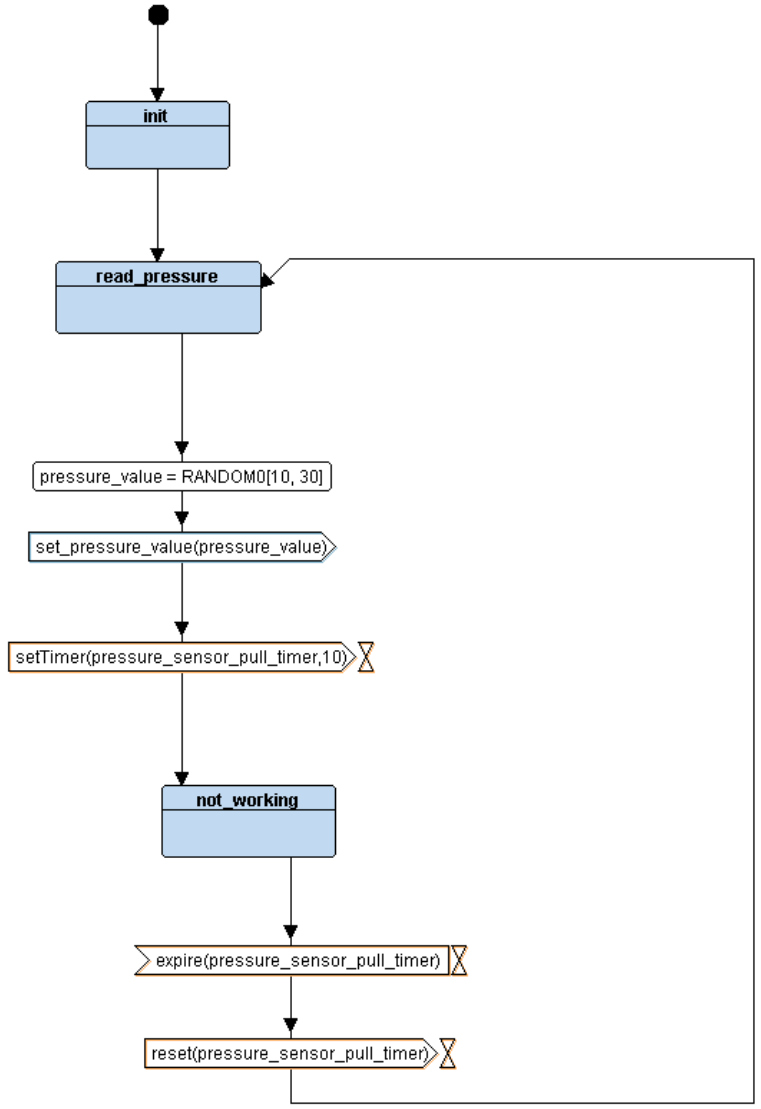
3- Main Algorithm

4- Alarm Actuator

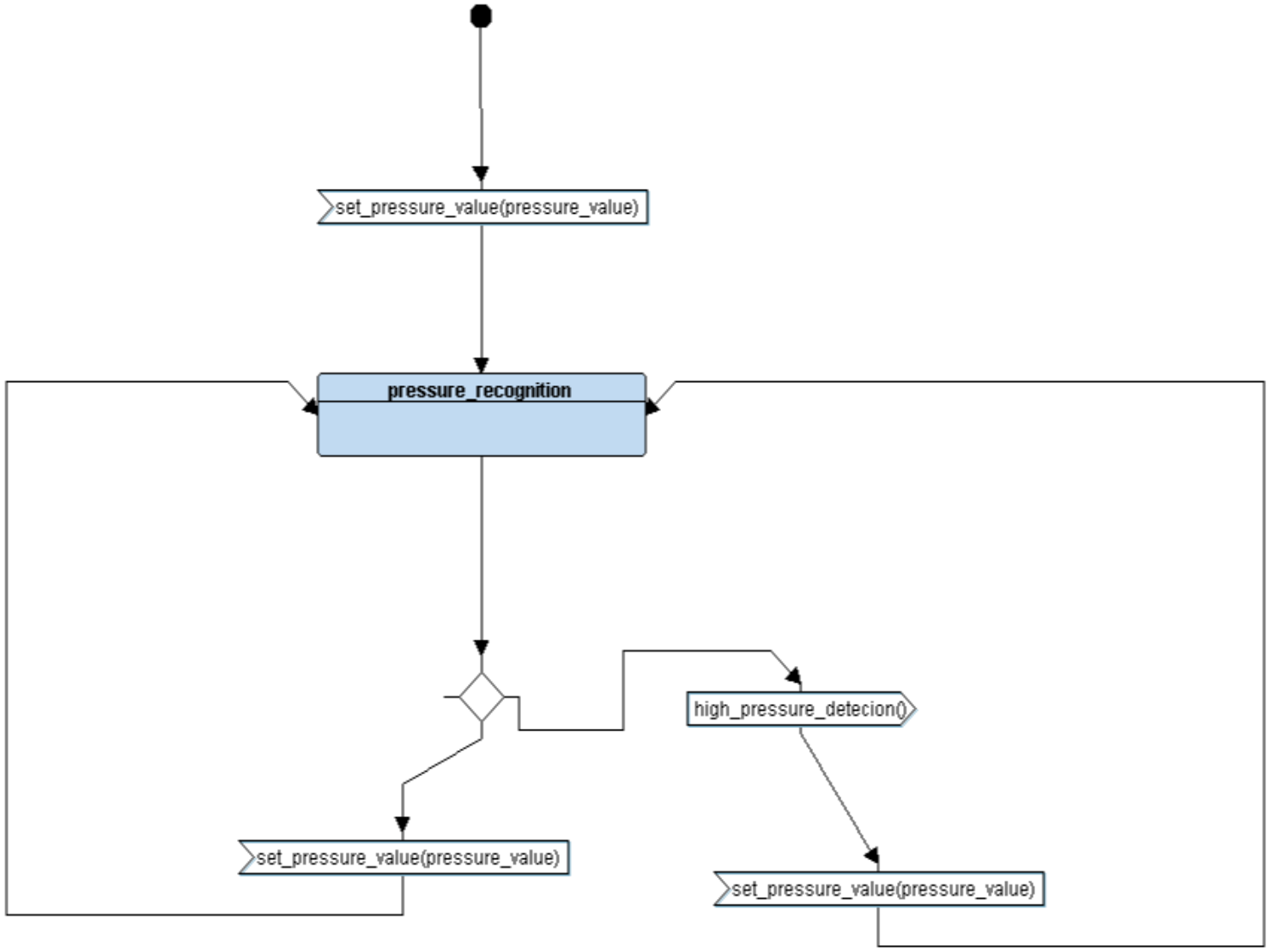
- ***1-Block Diagram:-***

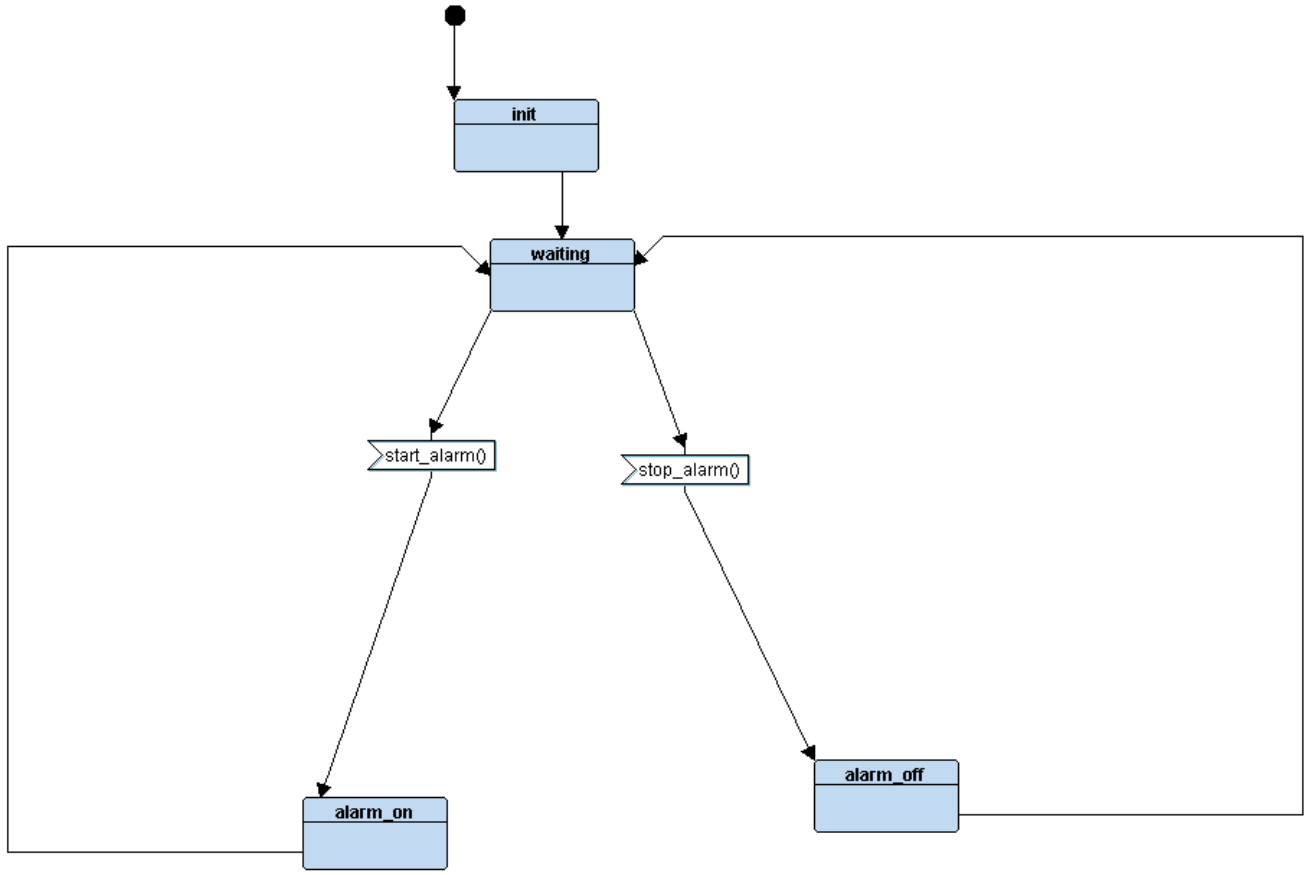


2- Pressure Sensor

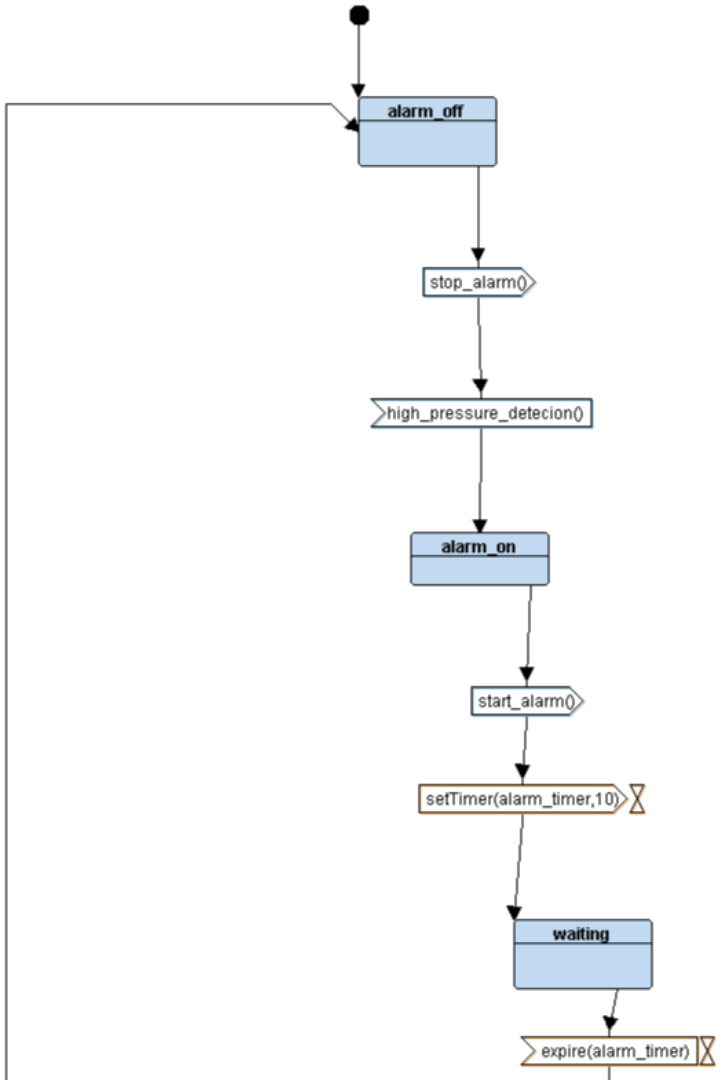


- **3- Main Algorithm**





4- Alarm Driver:



- ***5- Alarm Monitor***

```
user@DESKTOP-QVFG0EU MINGW64 /d/Embedded System Diploma Online KS/Data/First Term/Unit (5) Exams & Projects/Projects/Project (1)
$ make
arm-none-eabi-gcc.exe -c  -I . -mcpu=cortex-m3 -gdwarf-2 alarm_driver.c -o alarm_driver.o
arm-none-eabi-gcc.exe -c  -I . -mcpu=cortex-m3 -gdwarf-2 alarm_monitor.c -o alarm_monitor.o
arm-none-eabi-gcc.exe -c  -I . -mcpu=cortex-m3 -gdwarf-2 driver.c -o driver.o
arm-none-eabi-gcc.exe -c  -I . -mcpu=cortex-m3 -gdwarf-2 main.c -o main.o
arm-none-eabi-gcc.exe -c  -I . -mcpu=cortex-m3 -gdwarf-2 main_algo.c -o main_algo.o
arm-none-eabi-gcc.exe -c  -I . -mcpu=cortex-m3 -gdwarf-2 pressure_sensor_driver.c -o pressure_sensor_driver.o
arm-none-eabi-gcc.exe -c  -I . -mcpu=cortex-m3 -gdwarf-2 startup.c -o startup.o
arm-none-eabi-ld.exe -T Linker_Script.ld  alarm_driver.o alarm_monitor.o driver.o main.o main_algo.o pressure_sensor_driver.o st
r_M3.elf -Map=Map_File.map
arm-none-eabi-objcopy.exe -O binary pressure_controller_M3.elf pressure_controller_M3.bin
============ Build is Done ^_^ ============
```

Building Process

Symbol Tables:-

```
user@DESKTOP-QVFG0EU MINGW64 /d/Embedded System
$ arm-none-eabi-nm main.o
00000001 C alarm_actuator_stateID
00000001 C alarm_monitor_stateID
         U GPIO_INITIALIZATION
00000044 T main
00000001 C main_algo_stateID
         U pf_alarm_actuator
         U pf_alarm_monitor
         U pf_main_algorithm
         U pf_Pressure_Sensor
00000001 C pressure_sensore_driver_stateID
00000000 T setup
         U ST_alarm_actuator_init
         U ST_alarm_monitor_init
         U ST_main_algo_init
         U ST_pressure_sensore_driver_init
```

main

```
user@DESKTOP-QVFG0EU MINGW64 /d/Embedd
$ arm-none-eabi-nm main_algo.o
         U detect_high_pressure
00000001 C main_algo_stateID
00000004 C pf_main_algorithm
00000000 B pressure_detect
00000080 T set_pressure_value
00000048 T ST_main_algo_detect
00000000 T ST_main_algo_init
00000024 T ST_main_algo_waiting
00000000 D threshold
```

Main_algo

```
user@DESKTOP-QVFG0EU MINGW64 /d/Embedded
$ arm-none-eabi-nm alarm_driver.o
00000001 C alarm_actuator_stateID
00000004 C pf_alarm_actuator
         U Set_Alarm_actuator
00000000 T ST_alarm_actuator_init
00000070 T ST_alarm_actuator_turn_off
0000004c T ST_alarm_actuator_turn_on
00000028 T ST_alarm_actuator_waiting
00000094 T Start_Alarm
000000b0 T Stop_Alarm
```

Alarm_Driver

```
user@DESKTOP-QVFG0EU MINGW64 /d/Embedd
$ arm-none-eabi-nm alarm_monitor.o
00000001 C alarm_monitor_stateID
         U Delay
0000007c T detect_high_pressure
00000004 C pf_alarm_monitor
00000000 T ST_alarm_monitor_init
00000048 T ST_AM_alarm_on
00000024 T ST_AM_monitor
         U Start_Alarm
         U Stop_Alarm
```

Alarm_monitor

```
user@DESKTOP-QVFG0EU MINGW64 /d/Emb
$ arm-none-eabi-nm driver.o
00000000 T Delay
00000020 T getPressureVal
00000074 T GPIO_INITIALIZATION
00000038 T Set_Alarm_actuator
```

Driver

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System D
$ arm-none-eabi-nm pressure_controller_M3.elf
20000008 B alarm_actuator_stateID
20000014 B alarm_monitor_stateID
080003f0 W Bus_Fault
080003f0 T Default_Handler
08000180 T Delay
08000164 T detect_high_pressure
20000008 B E_Bss
20000004 D E_Data
08000480 T E_Text
080001a0 T getPressureVal
080001f4 T GPIO_INITIALIZATION
080003f0 W H_Fault_Handler
08000288 T main
20000016 B main_algo_stateID
080003f0 W MM_Fault_Handler
080003f0 W NMI_Handler
2000000c B pf_alarm_actuator
20000010 B pf_alarm_monitor
20000018 B pf_main_algorithm
2000001c B pf_Pressure_Sensor
20000004 B pressure_detect
20000015 B pressure_sensore_driver_stateID
20000020 B pressure_value
080003fc T Reset
20000004 B S_Bss
20000000 D S_Data
08000000 T S_Text
080001b8 T Set_Alarm_actuator
08000340 T set_pressure_value
08000244 T setup
0800001c T ST_alarm_actuator_init
0800008c T ST_alarm_actuator_turn_off
08000068 T ST_alarm_actuator_turn_on
08000044 T ST_alarm_actuator_waiting
080000e8 T ST_alarm_monitor_init
08000130 T ST_AM_alarm_on
0800010c T ST_AM_monitor
08000308 T ST_main_algo_detect
080002c0 T ST_main_algo_init
080002e4 T ST_main_algo_waiting
0800036c T ST_pressure_sensore_driver_init
08000390 T ST_pressure_sensore_driver_read
080003cc T ST_pressure_sensore_driver_waiting
20000024 B stack_top
080000b0 T Start_Alarm
080000cc T Stop_Alarm
20000000 D threshold
080003f0 W Usage_Fault_Handler
08000000 T vector_arr
```

pressure_controller

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System
$ arm-none-eabi-nm pressure_sensor_driver.o
         U getPressureVal
00000004 C pf_Pressure_Sensor
00000001 C pressure_sensore_driver_stateID
00000004 C pressure_value
         U set_pressure_value
00000000 T ST_pressure_sensore_driver_init
00000024 T ST_pressure_sensore_driver_read
00000060 T ST_pressure_sensore_driver_waiting
```

Pressure_sensor_controller

Section_Tables

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System Diploma Online KS/D
ller)/code
$ arm-none-eabi-objdump.exe -h main.o

main.o:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         0000007c  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000000  00000000  00000000  000000b0  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  000000b0  2**0
                  ALLOC
  3 .debug_info   00000ac1  00000000  00000000  000000b0  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 000001d8  00000000  00000000  00000b71  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    00000070  00000000  00000000  00000d49  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020  00000000  00000000  00000db9  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   0000018f  00000000  00000000  00000dd9  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    00000731  00000000  00000000  00000f68  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007f  00000000  00000000  00001699  2**0
                  CONTENTS, READONLY
 10 .debug_frame  0000004c  00000000  00000000  00001718  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 11 .ARM.attributes 00000033  00000000  00000000  00001764  2**0
                  CONTENTS, READONLY
```

main

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System Diploma Online KS/Dat
ller)/code
$ arm-none-eabi-objdump.exe -h main_algo.o

main_algo.o:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         000000ac  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000004  00000000  00000000  000000e0  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000004  00000000  00000000  000000e4  2**2
                  ALLOC
  3 .debug_info   0000015f  00000000  00000000  000000e4  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 000000dd  00000000  00000000  00000243  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    00000110  00000000  00000000  00000320  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020  00000000  00000000  00000430  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   0000005b  00000000  00000000  00000450  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    0000024e  00000000  00000000  000004ab  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007f  00000000  00000000  000006f9  2**0
                  CONTENTS, READONLY
 10 .debug_frame  00000094  00000000  00000000  00000778  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 11 .ARM.attributes 00000033  00000000  00000000  0000080c  2**0
                  CONTENTS, READONLY
```

Main_algo

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System Diploma Online KS/Data
ller)/code
$ arm-none-eabi-objdump.exe -h driver.o

driver.o:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         000000c4  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
  1 .data         00000000  00000000  00000000  000000f8  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  000000f8  2**0
                  ALLOC
  3 .debug_info   000000fc  00000000  00000000  000000f8  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 000000b5  00000000  00000000  000001f4  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    00000140  00000000  00000000  000002a9  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020  00000000  00000000  000003e9  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   0000012a  00000000  00000000  00000409  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    000001ce  00000000  00000000  00000533  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007f  00000000  00000000  00000701  2**0
                  CONTENTS, READONLY
 10 .debug_frame  000000a0  00000000  00000000  00000780  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 11 .ARM.attributes 00000033  00000000  00000000  00000820  2**0
                  CONTENTS, READONLY
```

driver

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System Diploma Online KS/Da
ller)/code
$ arm-none-eabi-objdump.exe -h pressure_sensor_driver.o

pressure_sensor_driver.o:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         00000084  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000000  00000000  00000000  000000b8  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  000000b8  2**0
                  ALLOC
  3 .debug_info   0000012f  00000000  00000000  000000b8  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 000000c1  00000000  00000000  000001e7  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    000000b4  00000000  00000000  000002a8  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020  00000000  00000000  0000035c  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   00000085  00000000  00000000  0000037c  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    0000029a  00000000  00000000  00000401  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007f  00000000  00000000  0000069b  2**0
                  CONTENTS, READONLY
 10 .debug_frame  0000006c  00000000  00000000  0000071c  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 11 .ARM.attributes 00000033  00000000  00000000  00000788  2**0
                  CONTENTS, READONLY
```

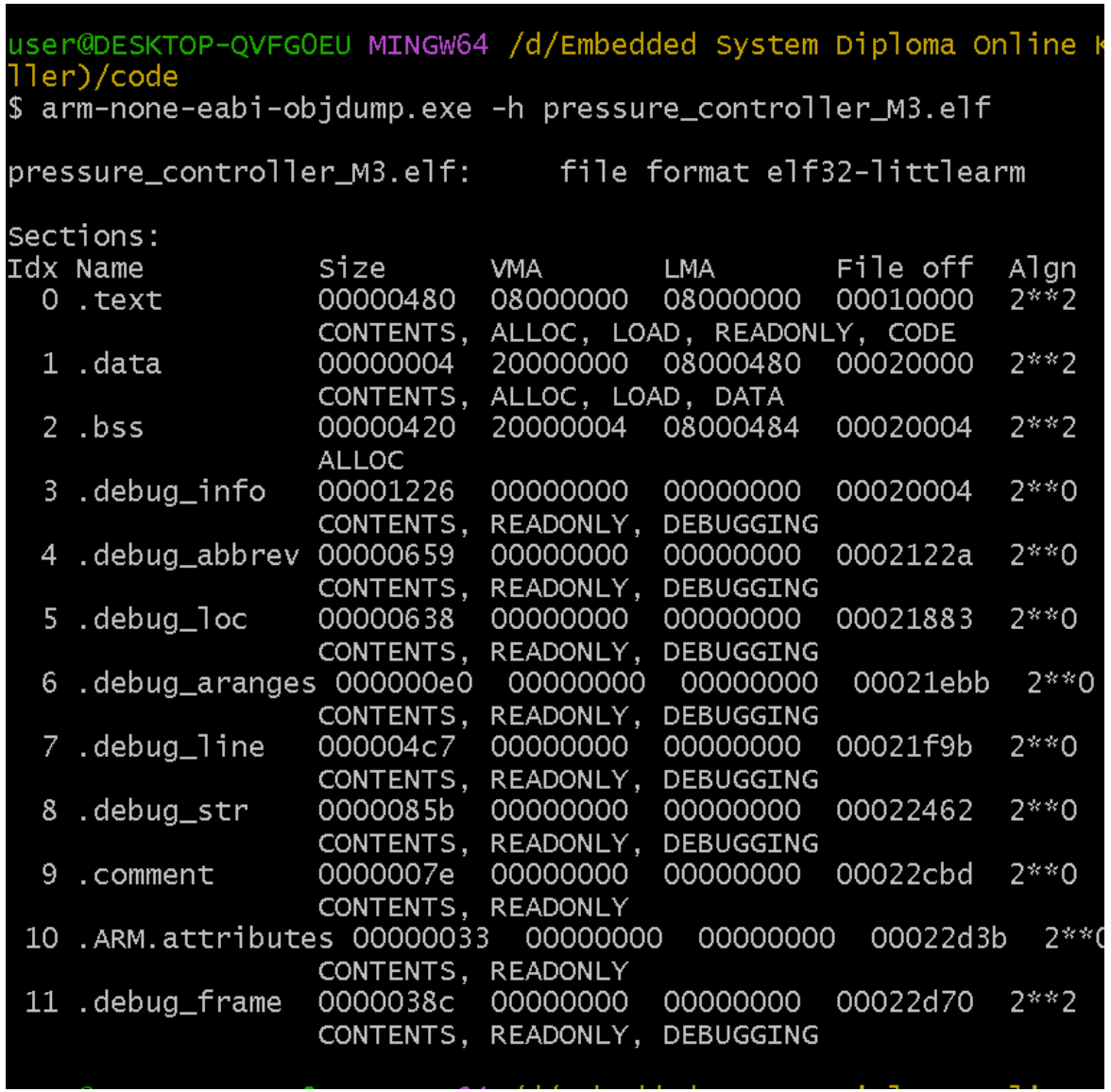
Pressure_sensor_Driver

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System Diploma Online KS/Da
ller)/code
$ arm-none-eabi-objdump.exe -h alarm_driver.o

alarm_driver.o:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         000000cc  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000000  00000000  00000000  00000100  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  00000100  2**0
                  ALLOC
  3 .debug_info   00000157  00000000  00000000  00000100  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 000000b4  00000000  00000000  00000257  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    00000150  00000000  00000000  0000030b  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020  00000000  00000000  0000045b  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   00000066  00000000  00000000  0000047b  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    0000028a  00000000  00000000  000004e1  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007f  00000000  00000000  0000076b  2**0
                  CONTENTS, READONLY
 10 .debug_frame  000000c4  00000000  00000000  000007ec  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 11 .ARM.attributes 00000033  00000000  00000000  000008b0  2**0
                  CONTENTS, READONLY
```

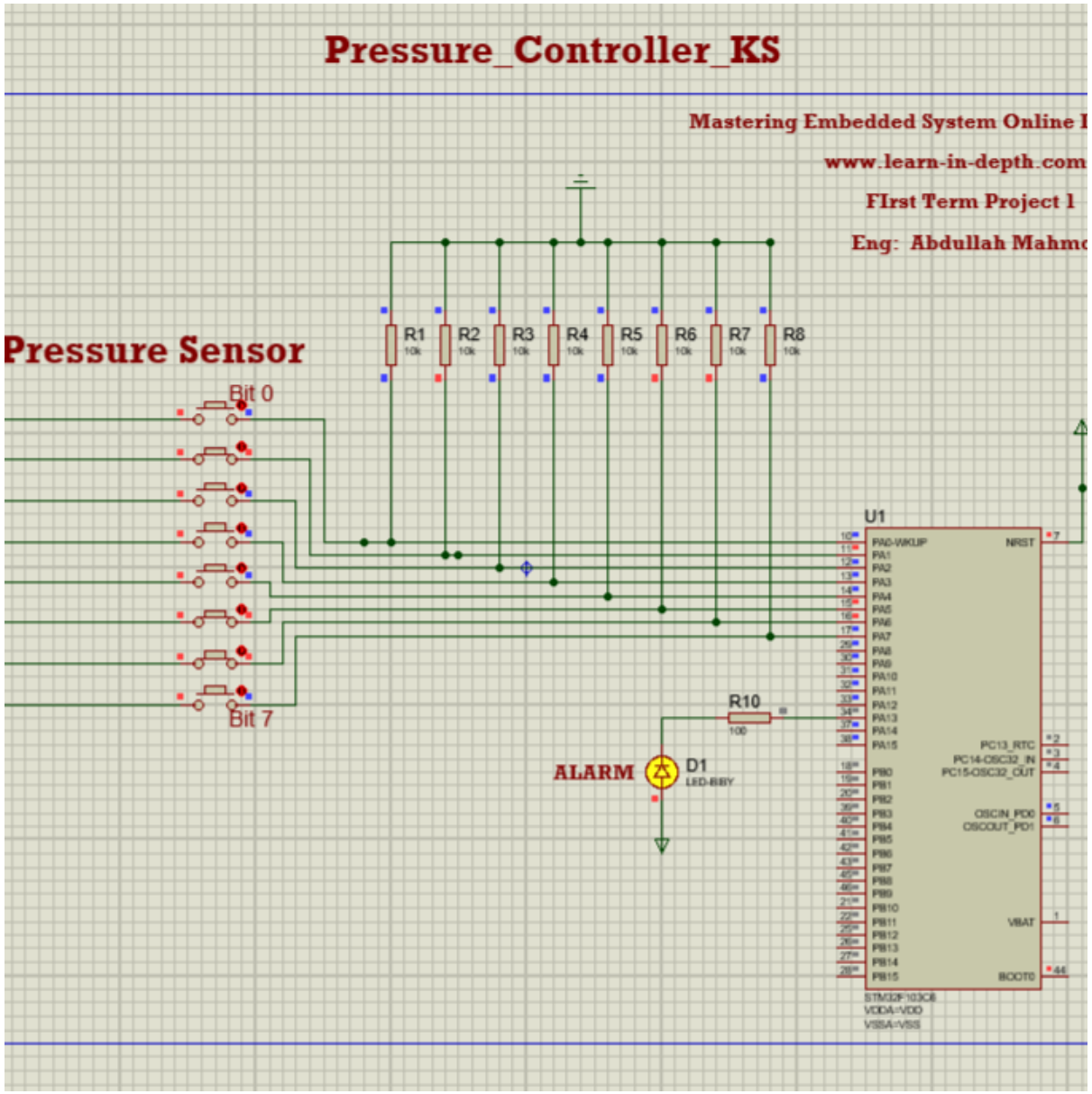
Alarm_driver

```
user@DESKTOP-QVFGOEU MINGW64 /d/Embedded System Diploma Online KS/Da
ller)/code
$ arm-none-eabi-objdump.exe -h alarm_monitor.o

alarm_monitor.o:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         00000098  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000000  00000000  00000000  000000cc  2**0
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  000000cc  2**0
                  ALLOC
  3 .debug_info   00000127  00000000  00000000  000000cc  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  4 .debug_abbrev 000000b4  00000000  00000000  000001f3  2**0
                  CONTENTS, READONLY, DEBUGGING
  5 .debug_loc    000000f8  00000000  00000000  000002a7  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_aranges 00000020  00000000  00000000  0000039f  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  7 .debug_line   00000061  00000000  00000000  000003bf  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_str    00000224  00000000  00000000  00000420  2**0
                  CONTENTS, READONLY, DEBUGGING
  9 .comment      0000007f  00000000  00000000  00000644  2**0
                  CONTENTS, READONLY
 10 .debug_frame  0000008c  00000000  00000000  000006c4  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 11 .ARM.attributes 00000033  00000000  00000000  00000750  2**0
                  CONTENTS, READONLY
```

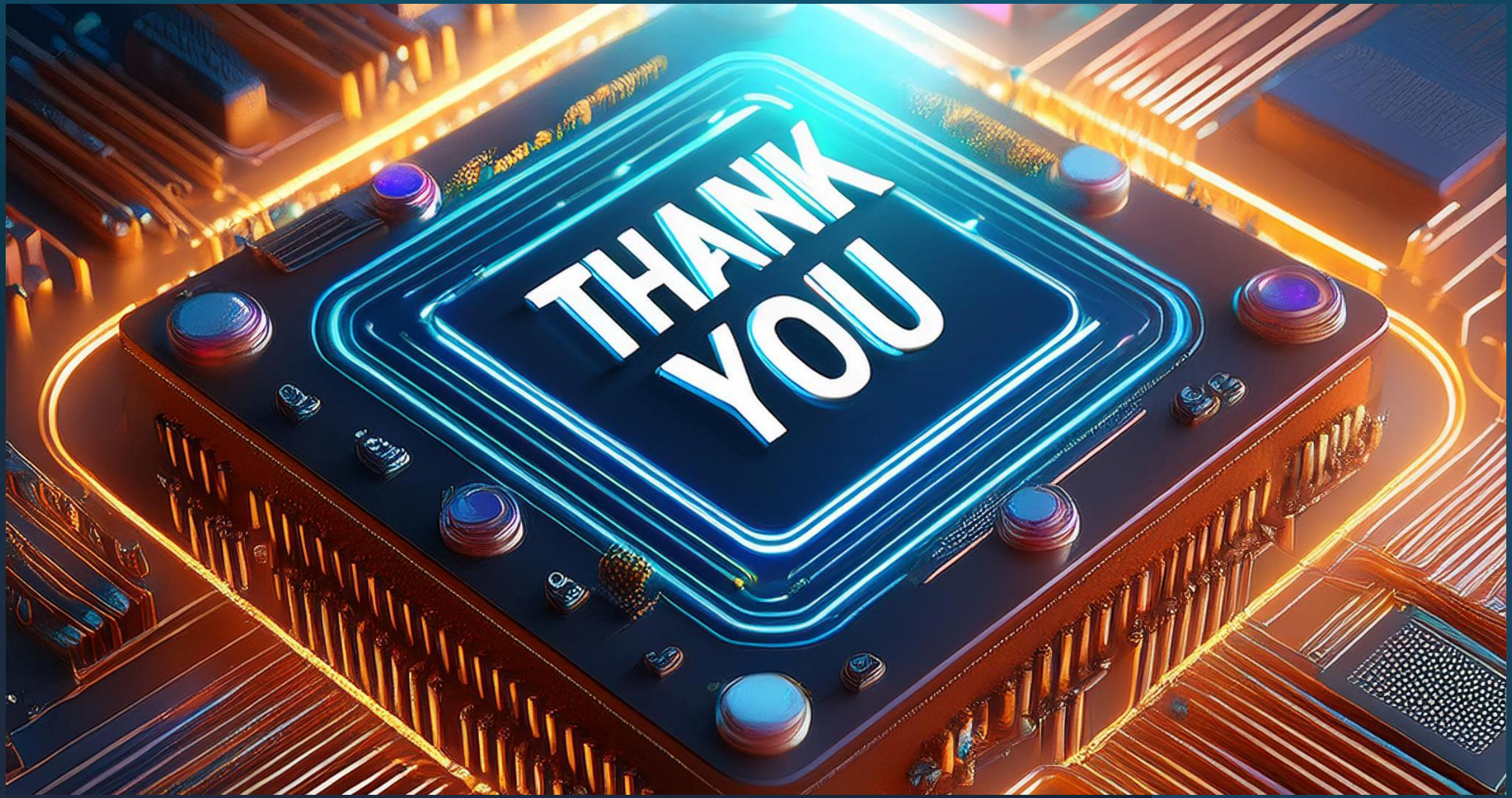
Alarm_monitor



Pressure_Controller


Pressure_Controller_KS
Mastering Embedded System Online
www.learn-in-depth.com
FIrst Term Project 1
Eng: Abdullah Mahm
Pressure Sensor
Bit 0
Bit 7
R1
R2
R3
R4
R5
R6
R7
R8
R10
ALARM
D1
U1

Simulation:-


THANK
YOU