

First Term Project(1)

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Pressure Controller

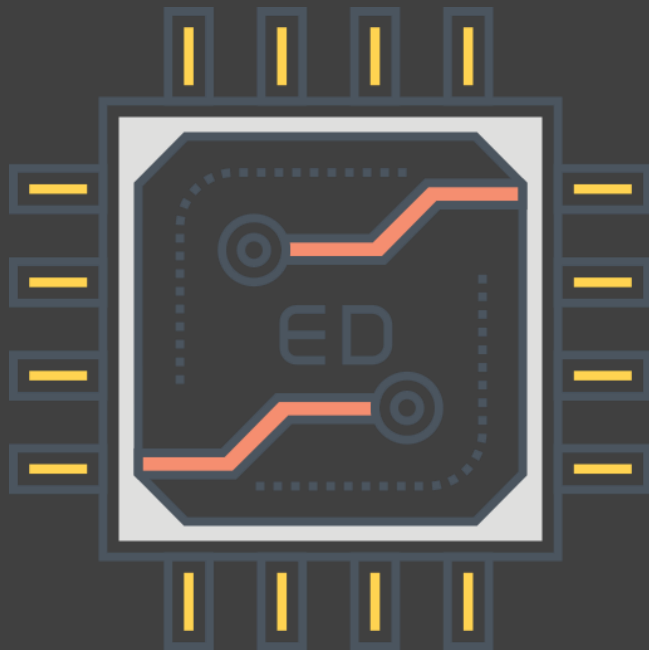




Overview:

- 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.

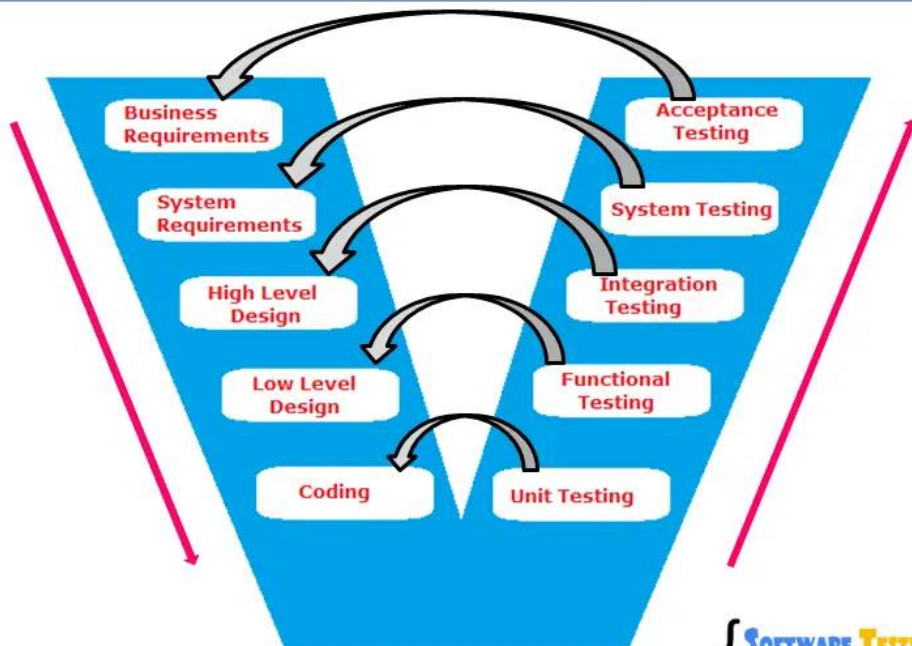


- 4) The alarm never fails.



- 5) The controller never faces a power cut.

V MODEL - SDLC

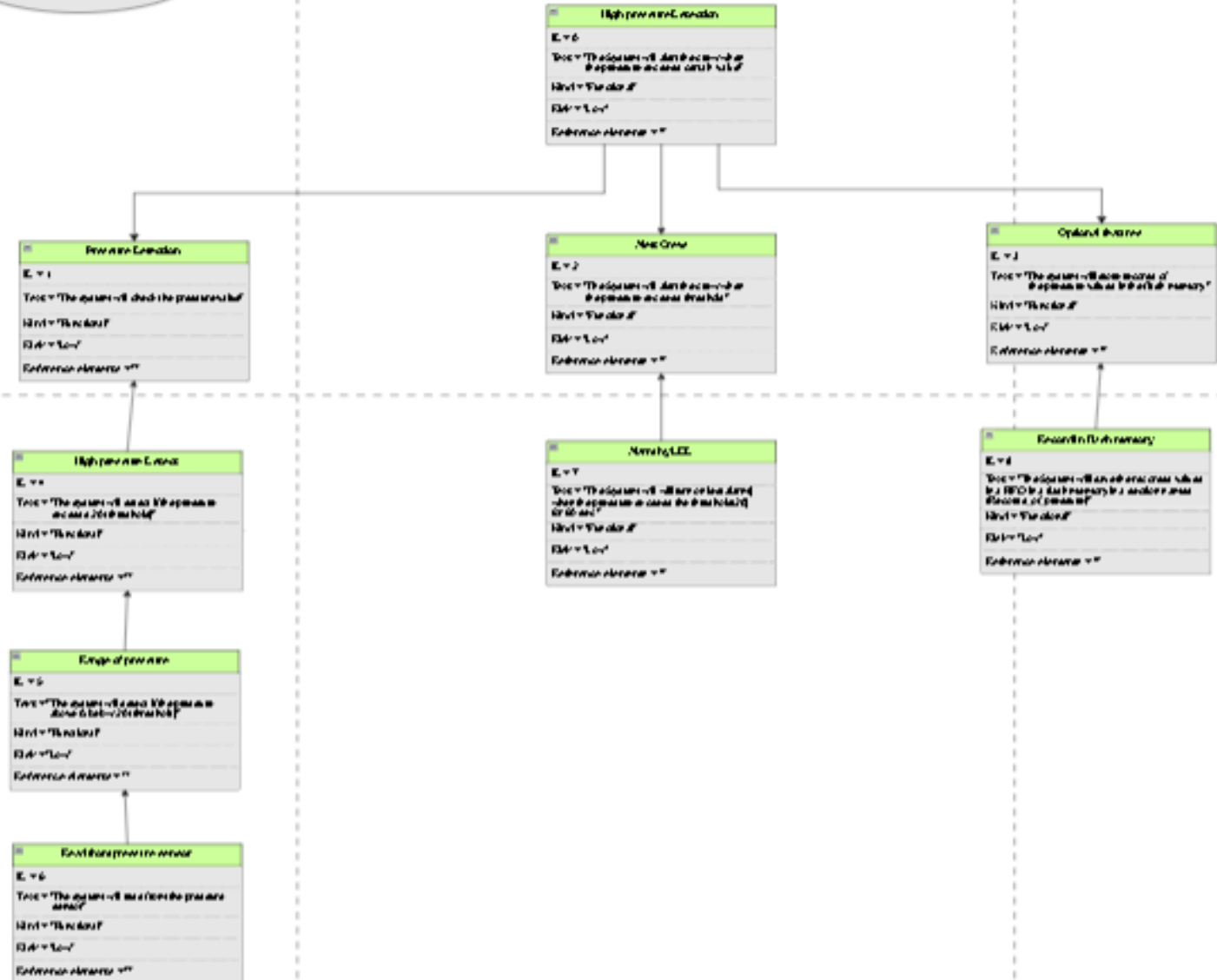


- I would work with the Vmodel method to apply my system design.

Method

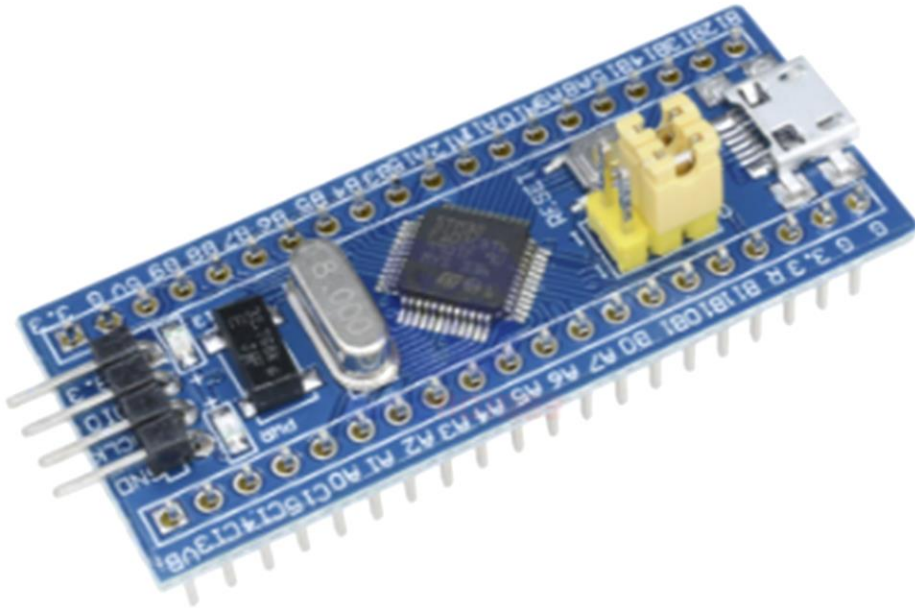
Eng.Abdullah ghazal

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.



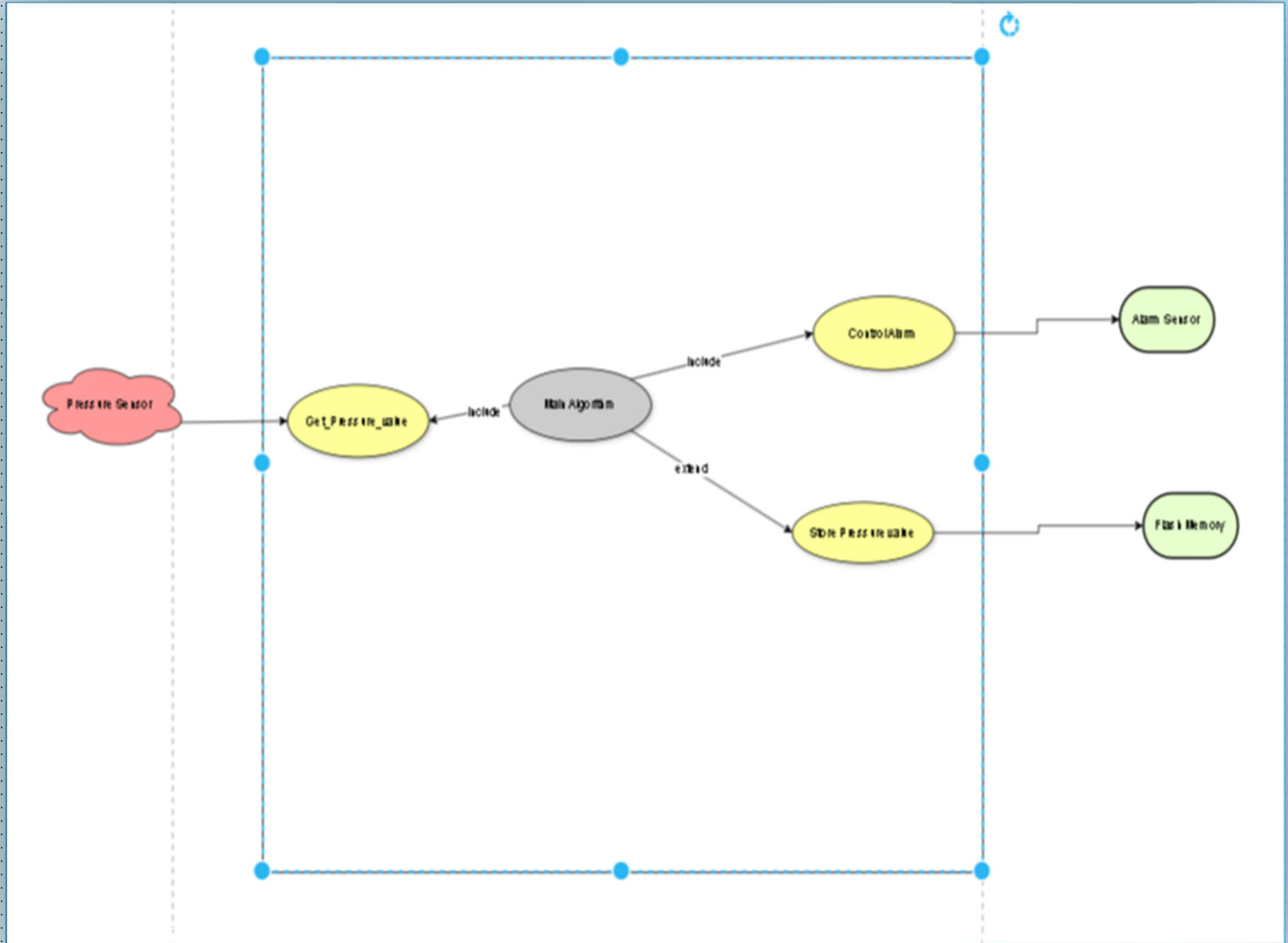
System Analysis

1- Use case

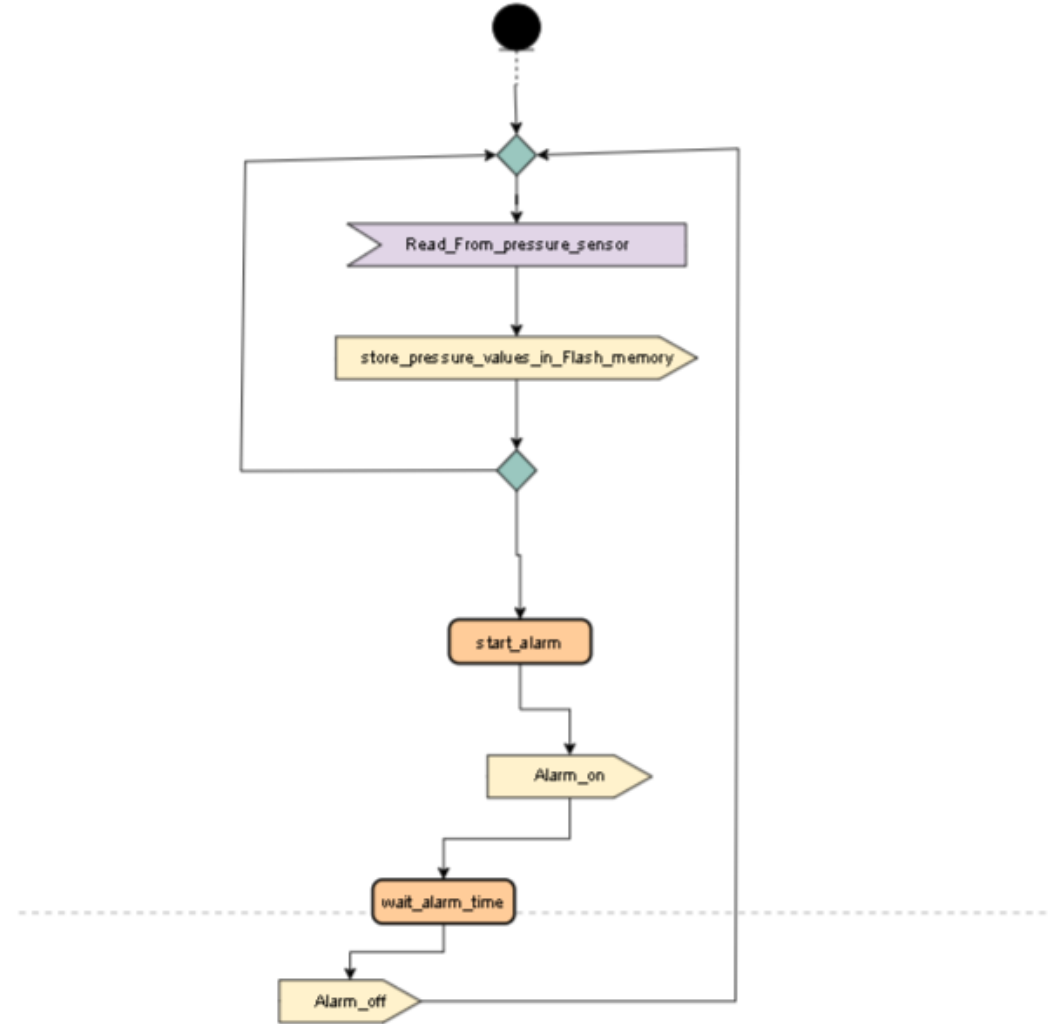
2- Activity Diagram

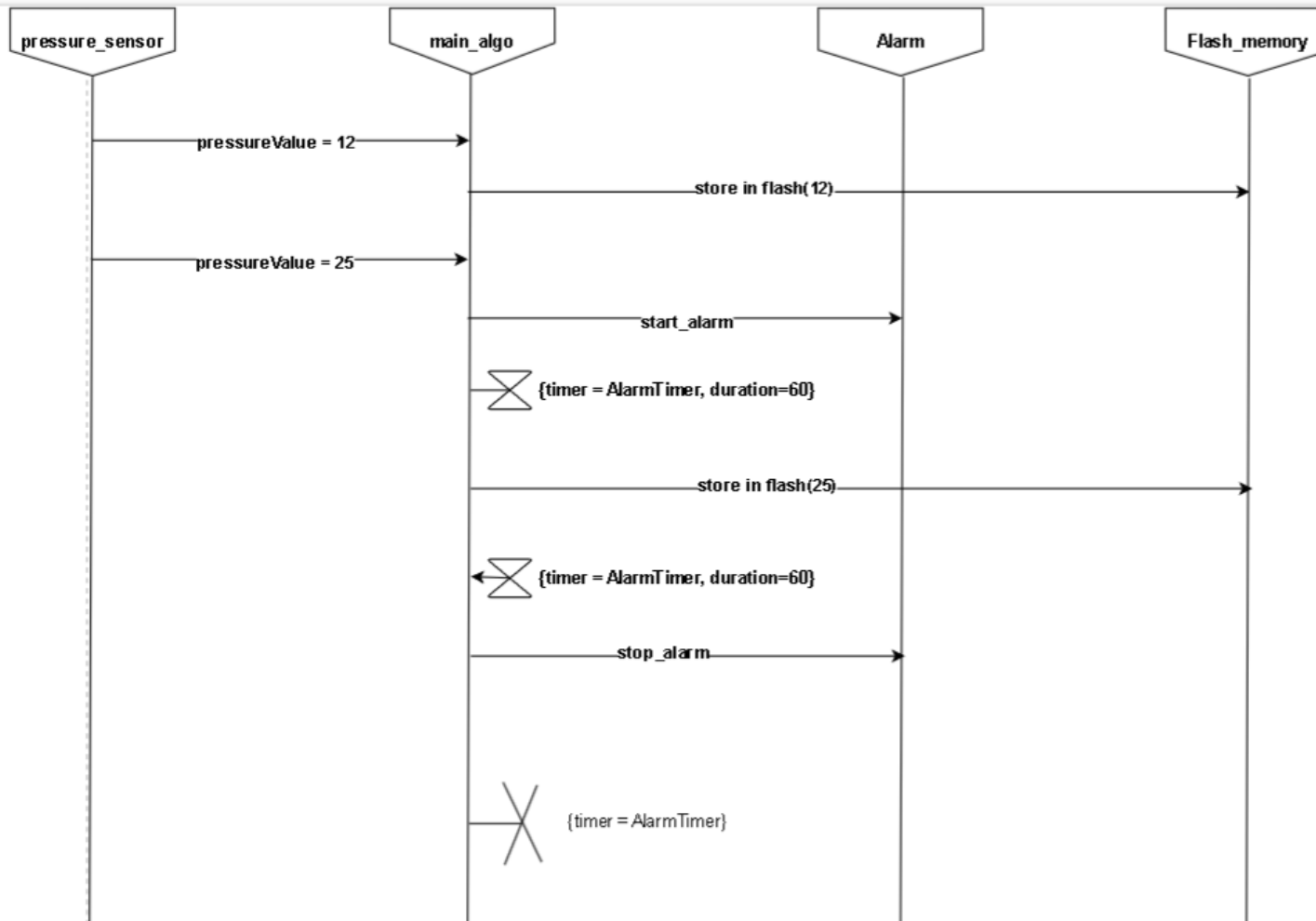
3- Sequences Diagram

- **1) Use case**



• 2- Activity Diagram





Sequence Diagram



System Design

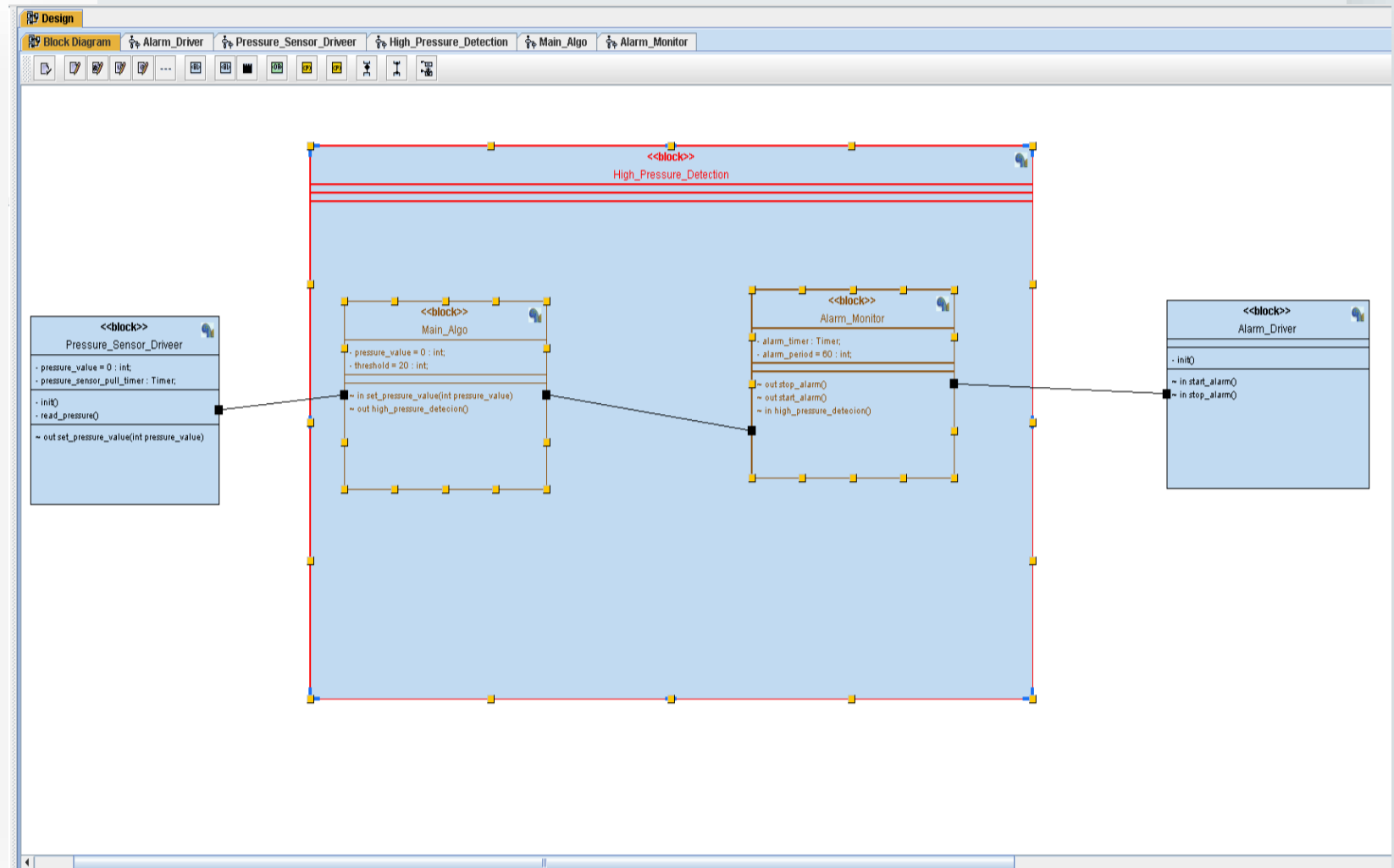
1- Block Diagram

2- Pressure Sensor

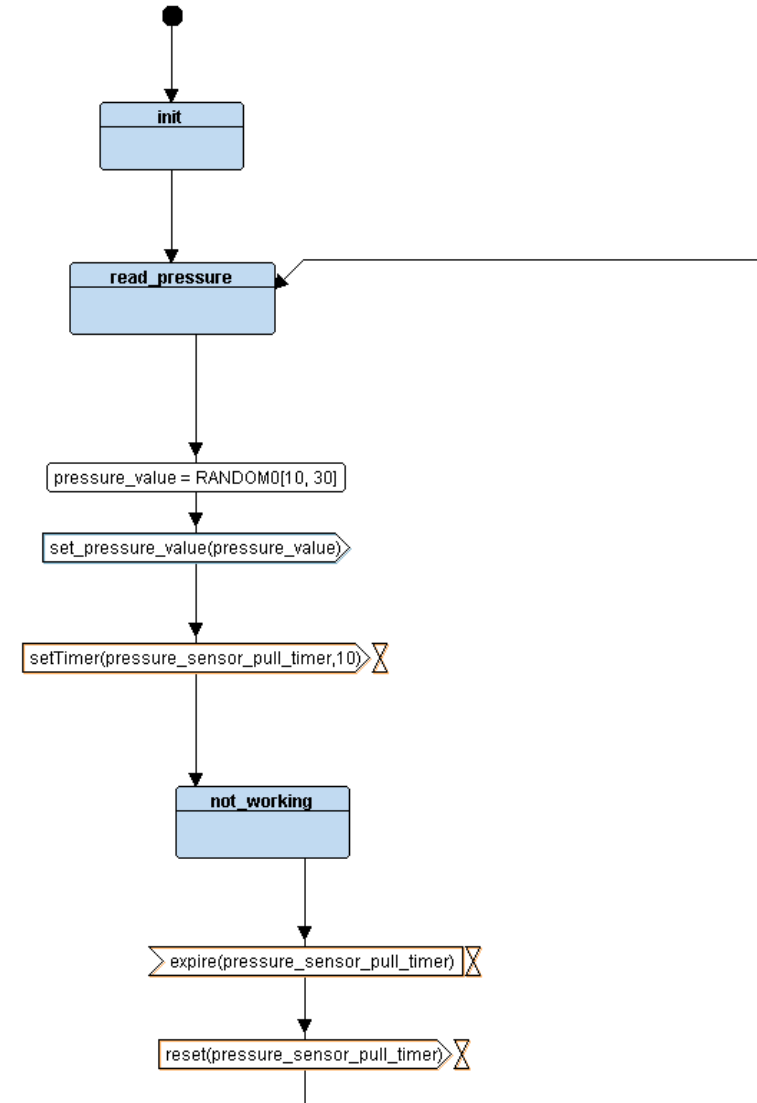
3- Main Algorithm

4- Alarm Actuator

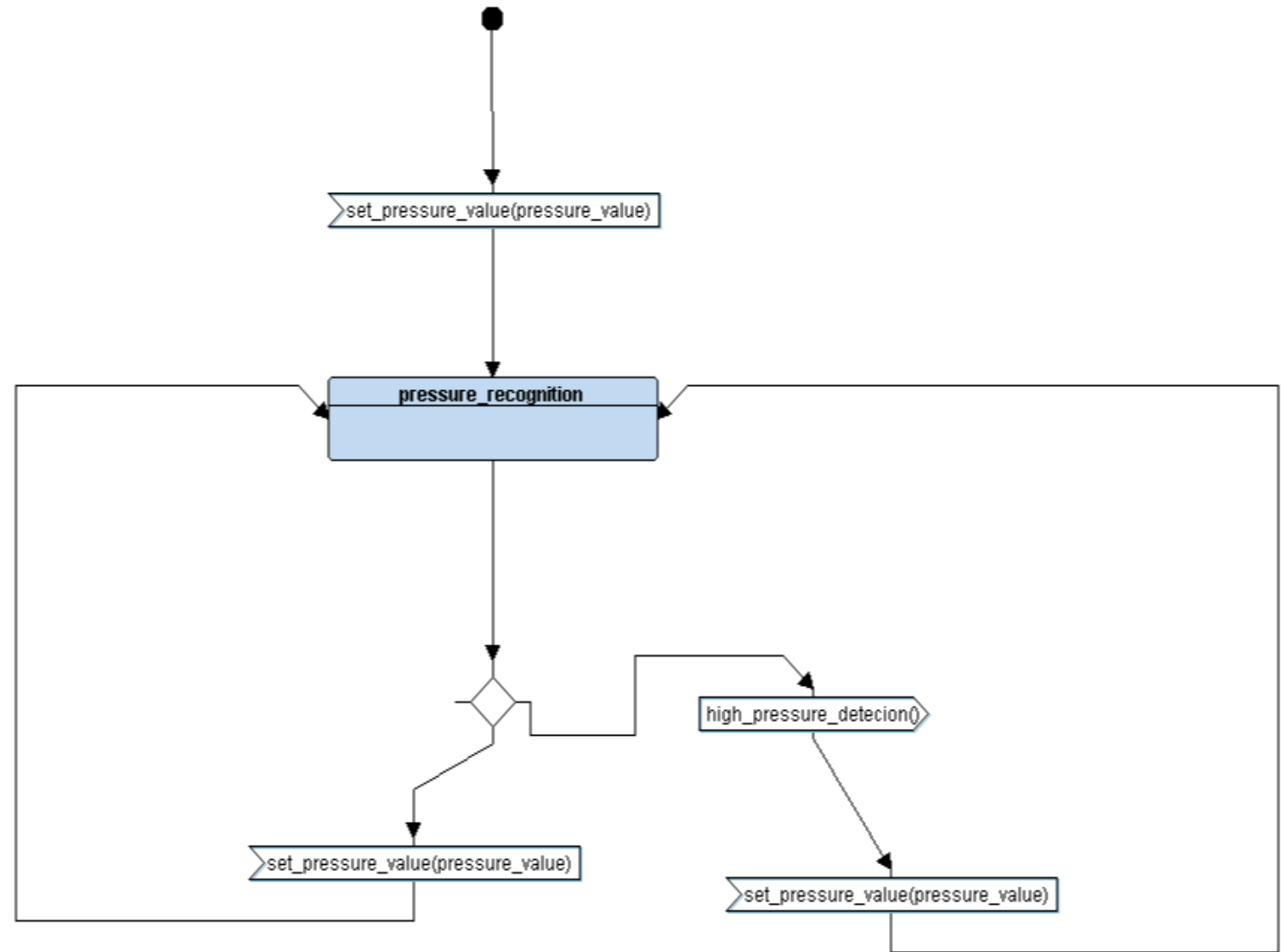
• 1-Block Diagram:-

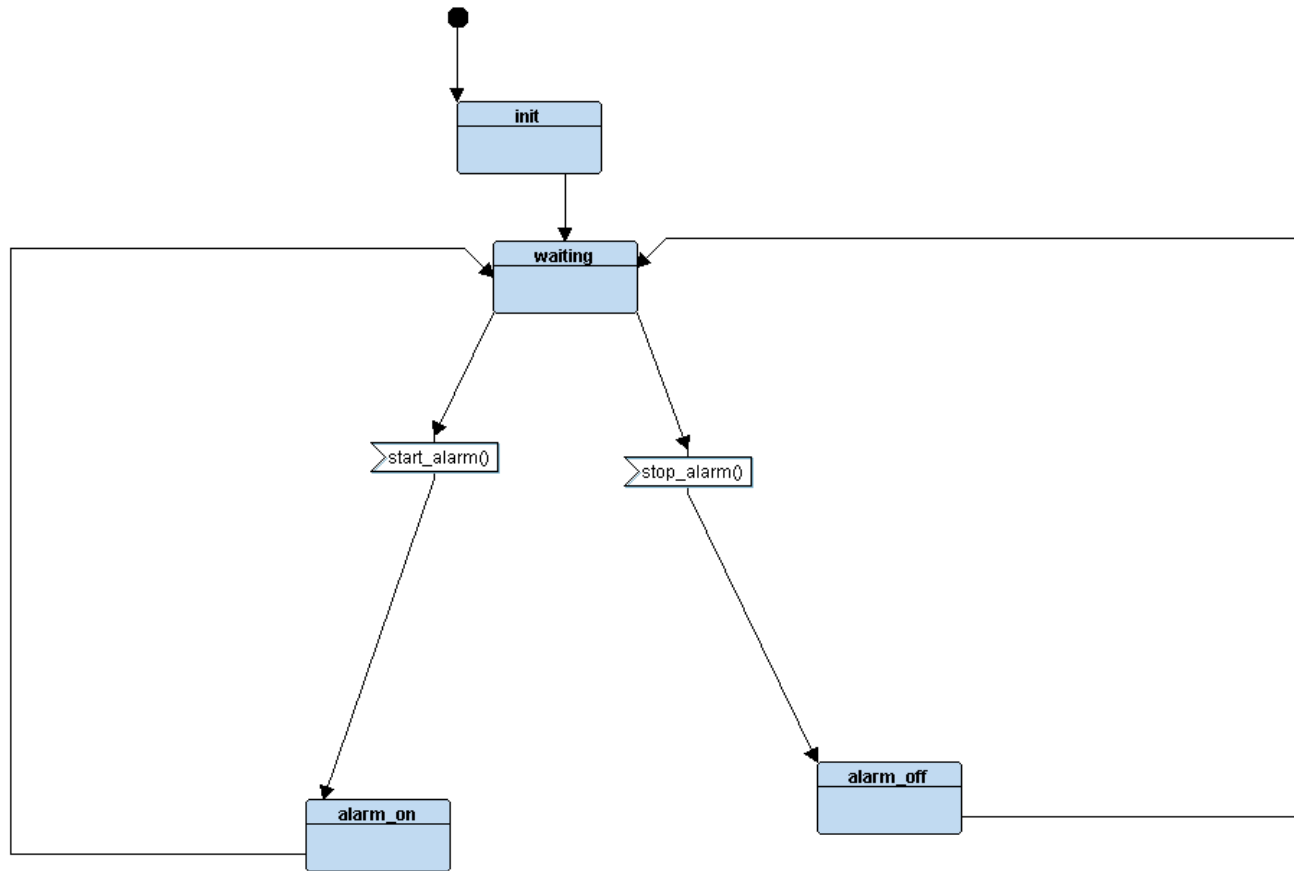


2- Pressure Sensor

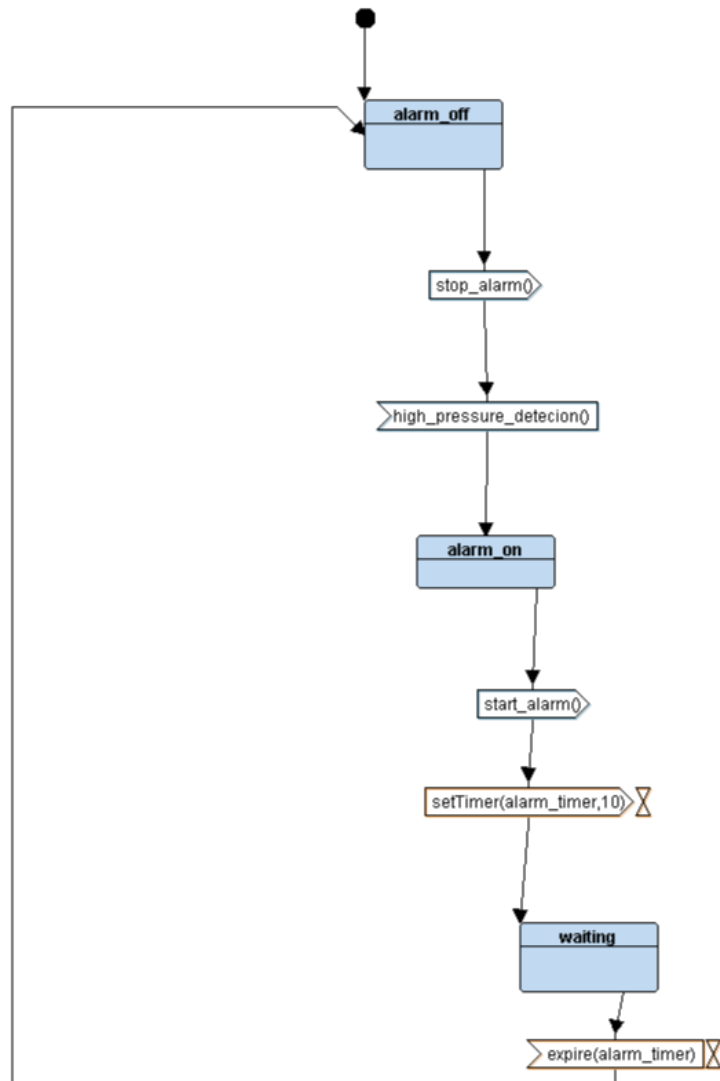


• 3- Main Algorithm





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 startup.o -Map=Map_File.map -o pressure_controller_M3.elf
arm-none-eabi-objcopy.exe -O binary pressure_controller_M3.elf pressure_controller_M3.bin
===== Build is Done ^^ =====
```

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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/Embedded
$ 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/Embedded
$ arm-none-eabi-nm driver.o
00000000 T Delay
00000020 T getPressureVal
00000074 T GPIO_INITIALIZATION
00000038 T Set_Alarm_actuator

```

Driver

```

user@DESKTOP-QVFG0EU 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

```

```

user@DESKTOP-QVFG0EU 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

pressure_controller

Section_Tables

```
user@DESKTOP-QVFG0EU MINGW64 /d/Embedded System Diploma Online KS/Dat
11er)/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-QVFG0EU MINGW64 /d/Embedded System Diploma Online KS/Dat
11er)/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-QVFG0EU MINGW64 /d/Embedded System Diploma Online KS/Data
11er)/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-QVFG0EU MINGW64 /d/Embedded System Diploma Online KS/Da
11er)/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-QVFG0EU 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-QVFG0EU 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

```
user@DESKTOP-QVFG0EU MINGW64 /d/Embedded System Diploma Online K
7ler)/code
```

```
$ arm-none-eabi-objdump.exe -h pressure_controller_M3.elf
```

```
pressure_controller_M3.elf:      file format elf32-littlearm
```

```
Sections:
```

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	00000480	08000000	08000000	00010000	2**2
	CONTENTS, ALLOC, LOAD, READONLY, CODE					
1	.data	00000004	20000000	08000480	00020000	2**2
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000420	20000004	08000484	00020004	2**2
	ALLOC					
3	.debug_info	00001226	00000000	00000000	00020004	2**0
	CONTENTS, READONLY, DEBUGGING					
4	.debug_abbrev	00000659	00000000	00000000	0002122a	2**0
	CONTENTS, READONLY, DEBUGGING					
5	.debug_loc	00000638	00000000	00000000	00021883	2**0
	CONTENTS, READONLY, DEBUGGING					
6	.debug_aranges	000000e0	00000000	00000000	00021ebb	2**0
	CONTENTS, READONLY, DEBUGGING					
7	.debug_line	000004c7	00000000	00000000	00021f9b	2**0
	CONTENTS, READONLY, DEBUGGING					
8	.debug_str	0000085b	00000000	00000000	00022462	2**0
	CONTENTS, READONLY, DEBUGGING					
9	.comment	0000007e	00000000	00000000	00022cbd	2**0
	CONTENTS, READONLY					
10	.ARM.attributes	00000033	00000000	00000000	00022d3b	2**0
	CONTENTS, READONLY					
11	.debug_frame	0000038c	00000000	00000000	00022d70	2**2
	CONTENTS, READONLY, DEBUGGING					

Pressure_Controller



Pressure_Controller_KS

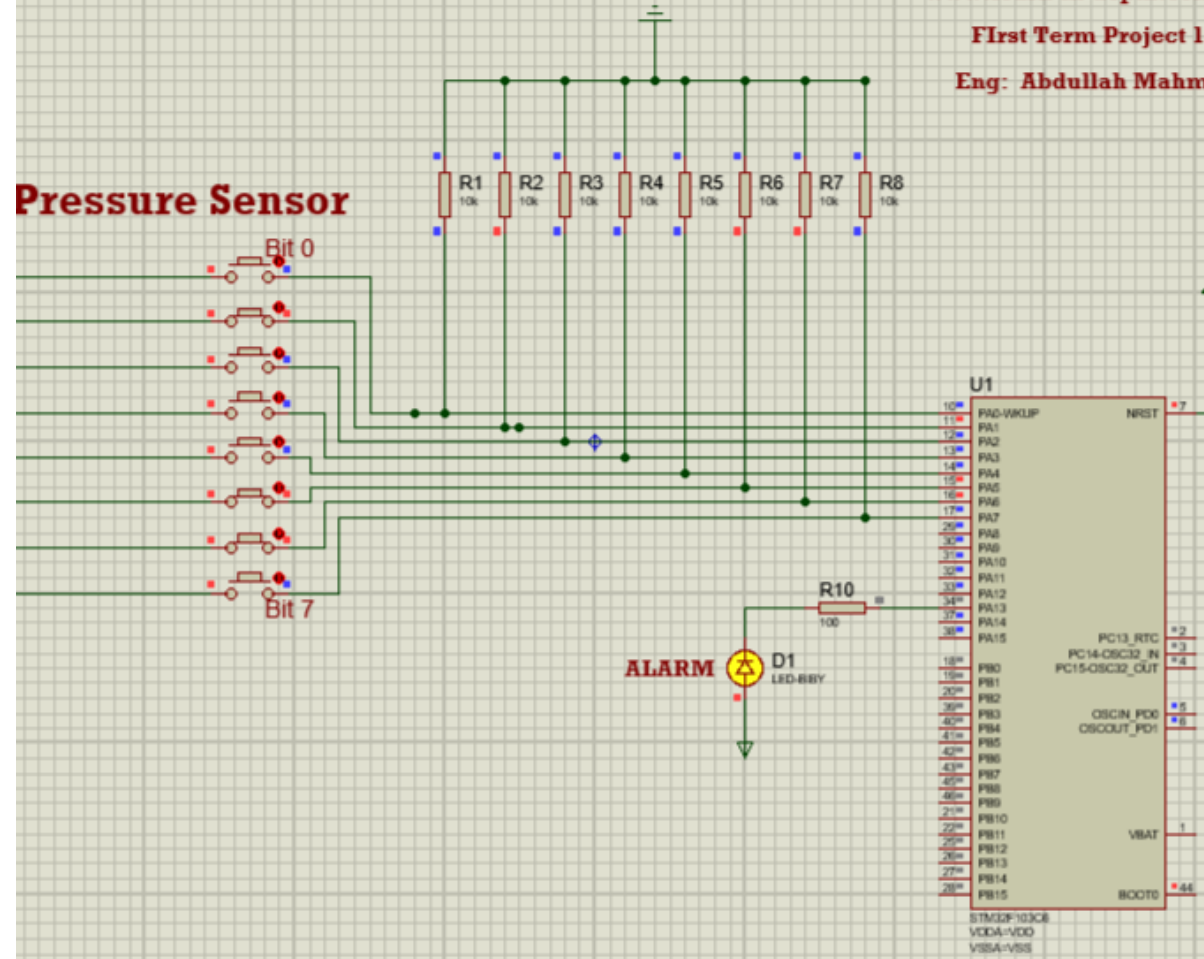
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First Term Project 1

Eng: Abdullah Mahmud

Pressure Sensor



Simulation:-

