Learn-In-Depth

Be Professional in Embedded System

First term Project1 Report

Pressure Controller Project

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Submitted to: Eng. Keroles Shenoda

GitHub Project

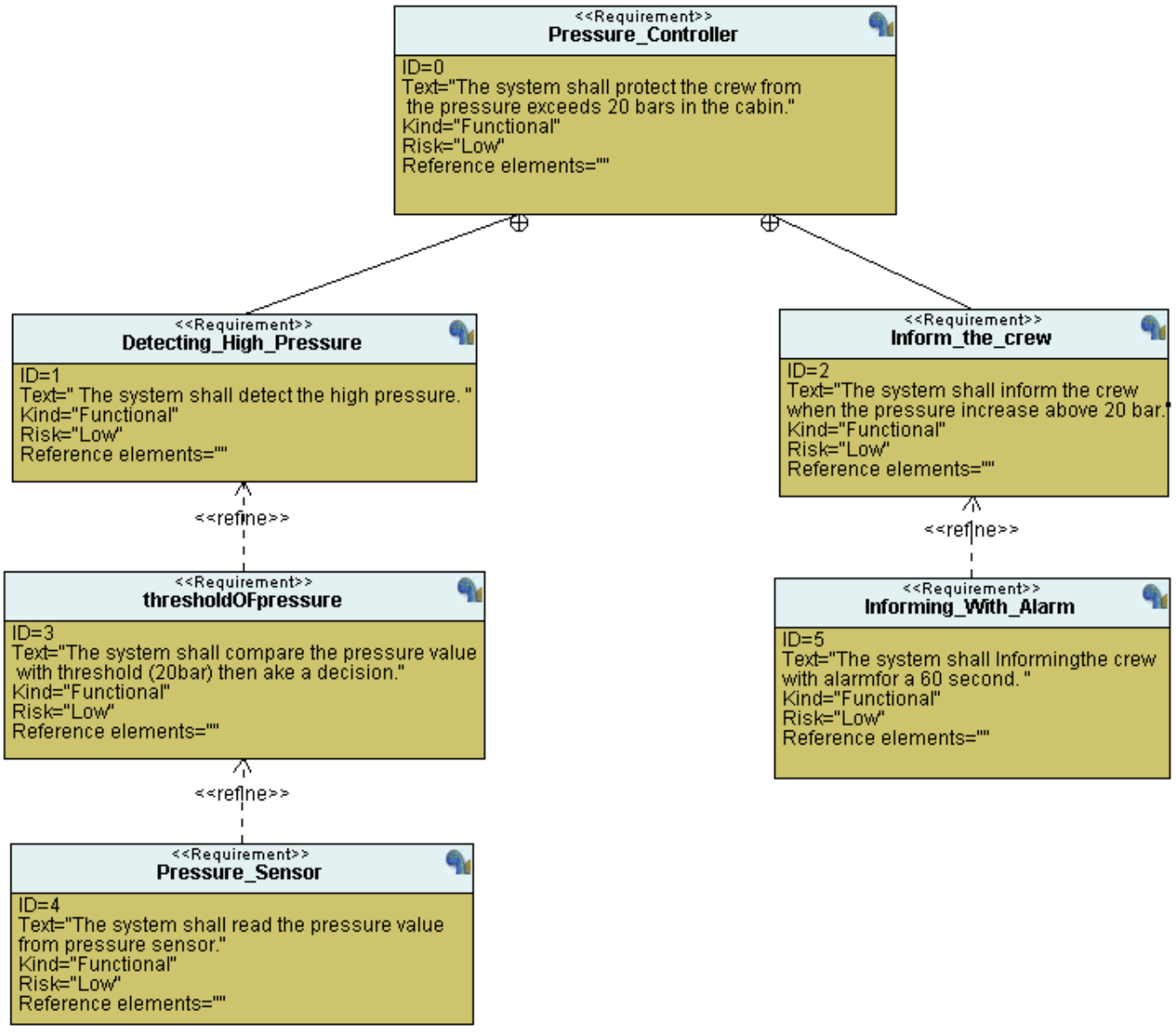
My Diploma profile

Problem description

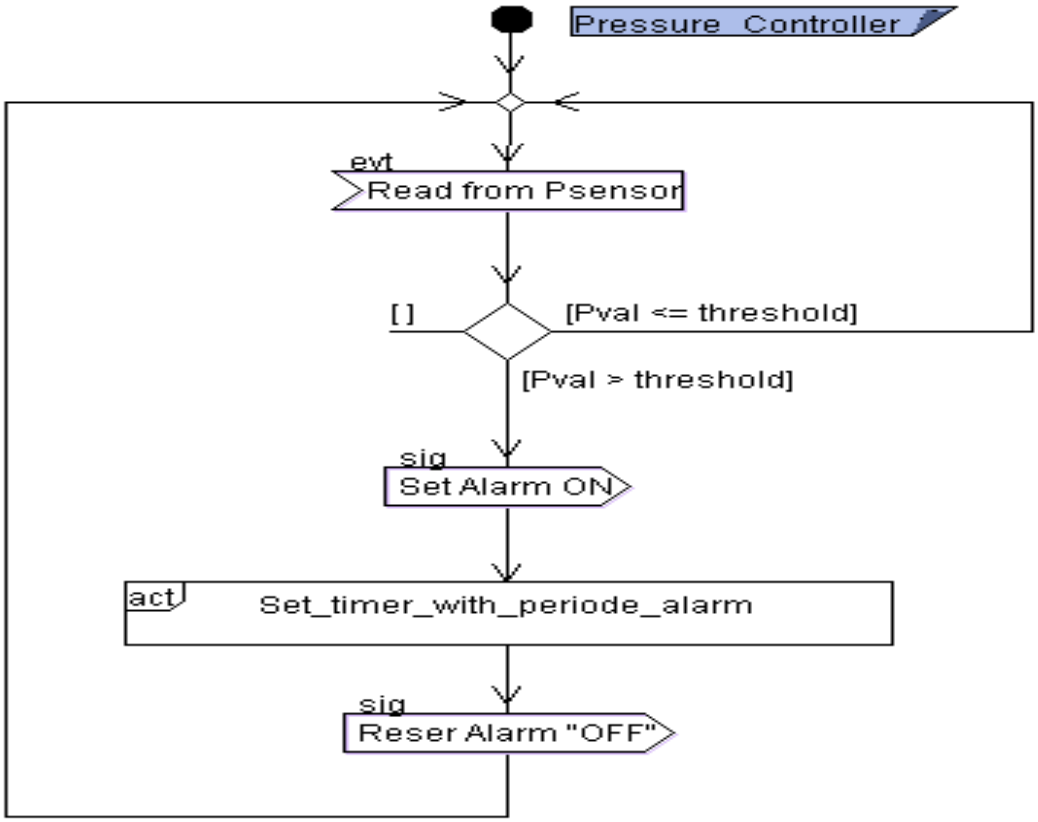
A client expects you to deliver the software of the following system specifications (from the client):

1. A pressure controller informs the crew of a cabin with an alarm when the pressure exceeds 20 bars in the cabin.
2. The alarm duration equals 60 seconds.

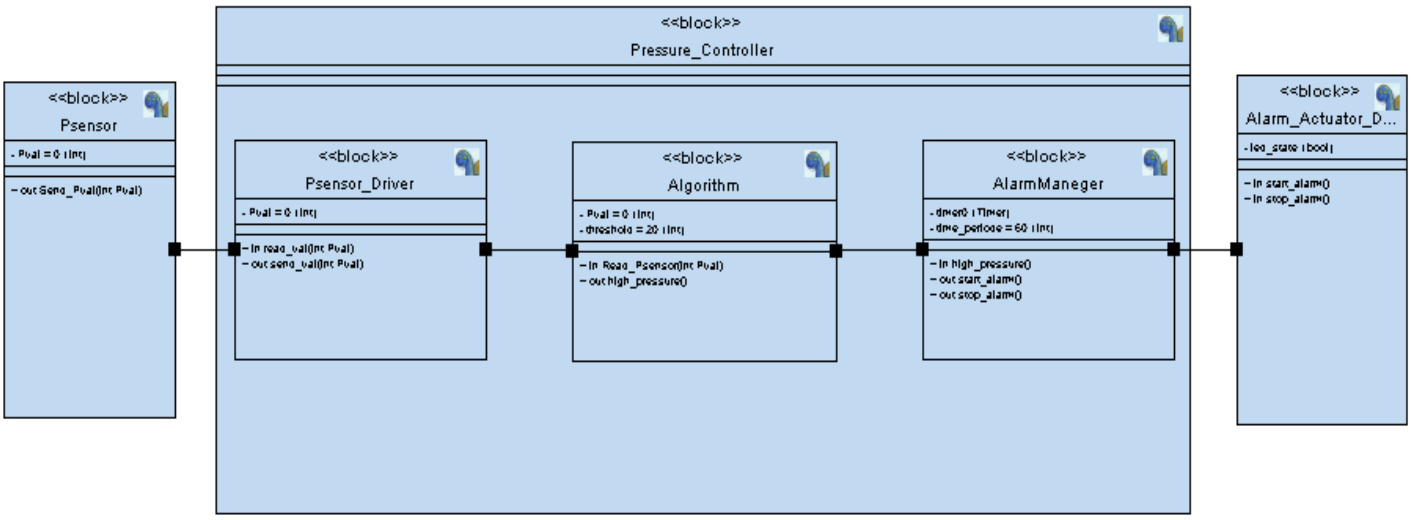
Requirements Diagram



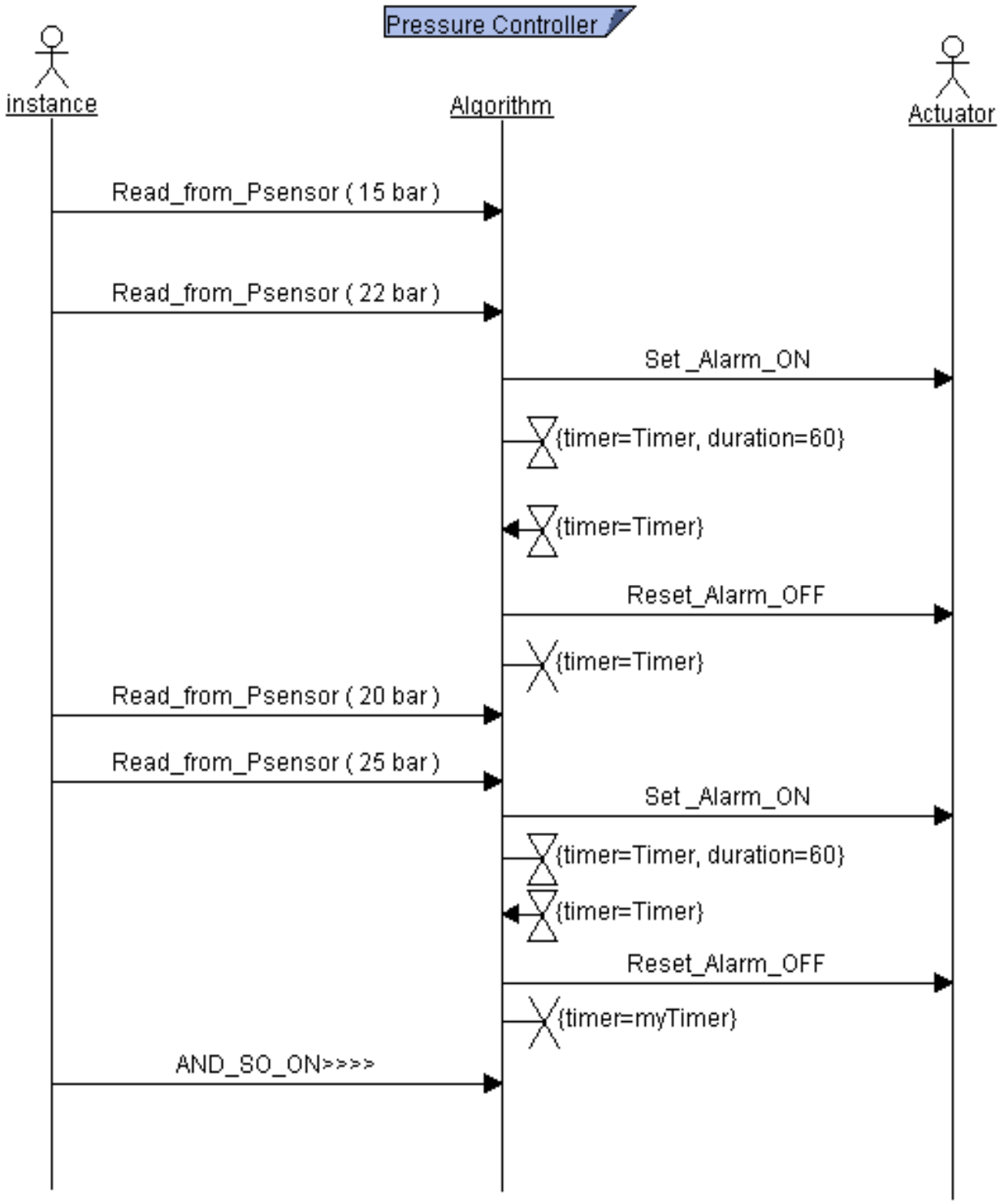
Activity Diagram



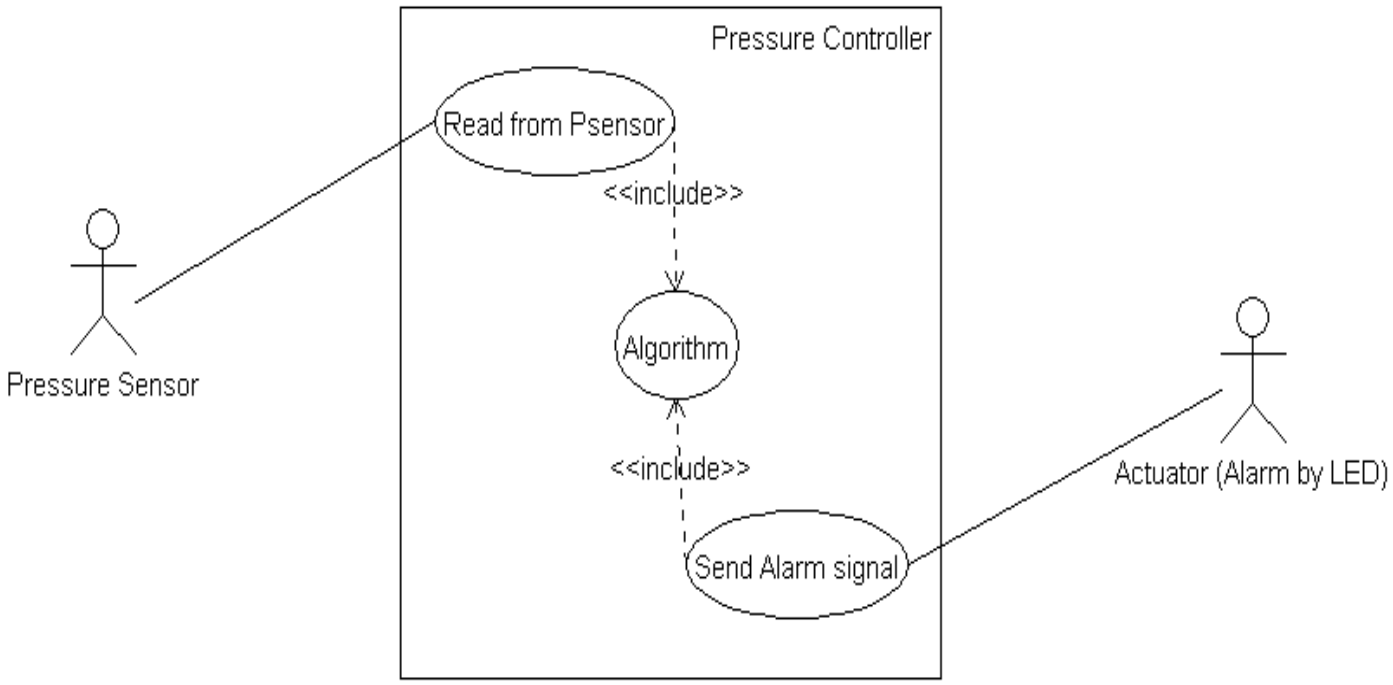
Block Diagram



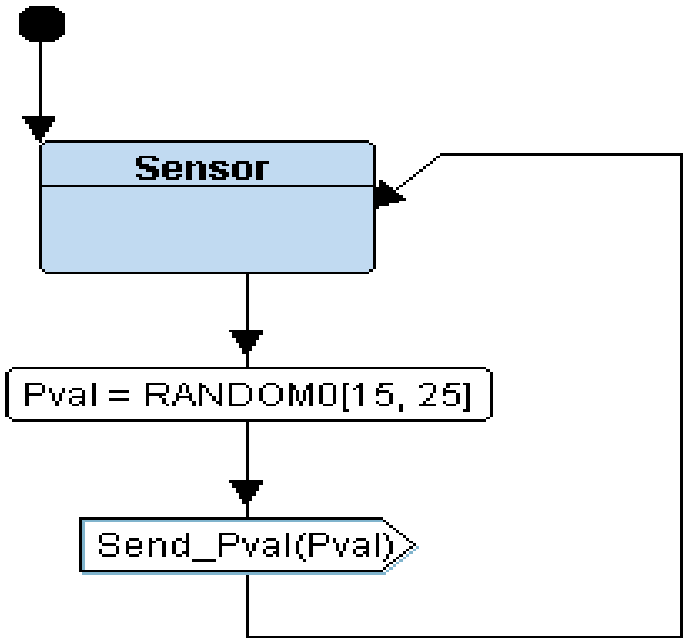
Sequence Diagram

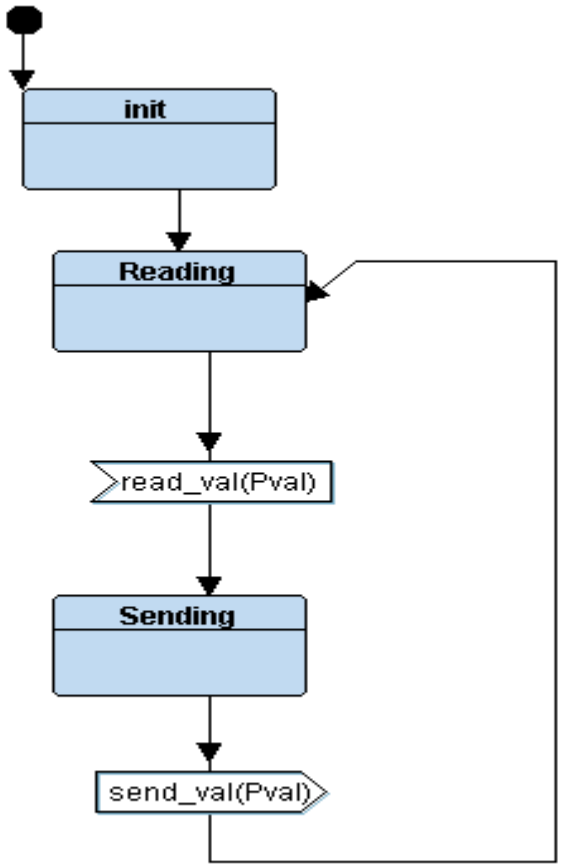


Use Case Diagram

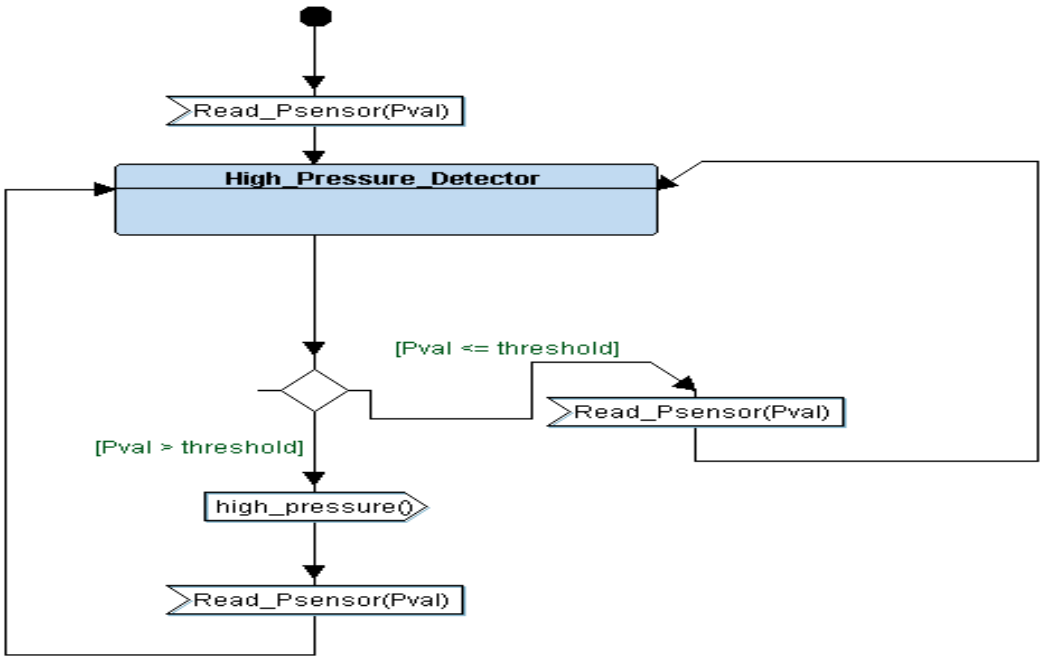


Pressure Sensor Block Diagram

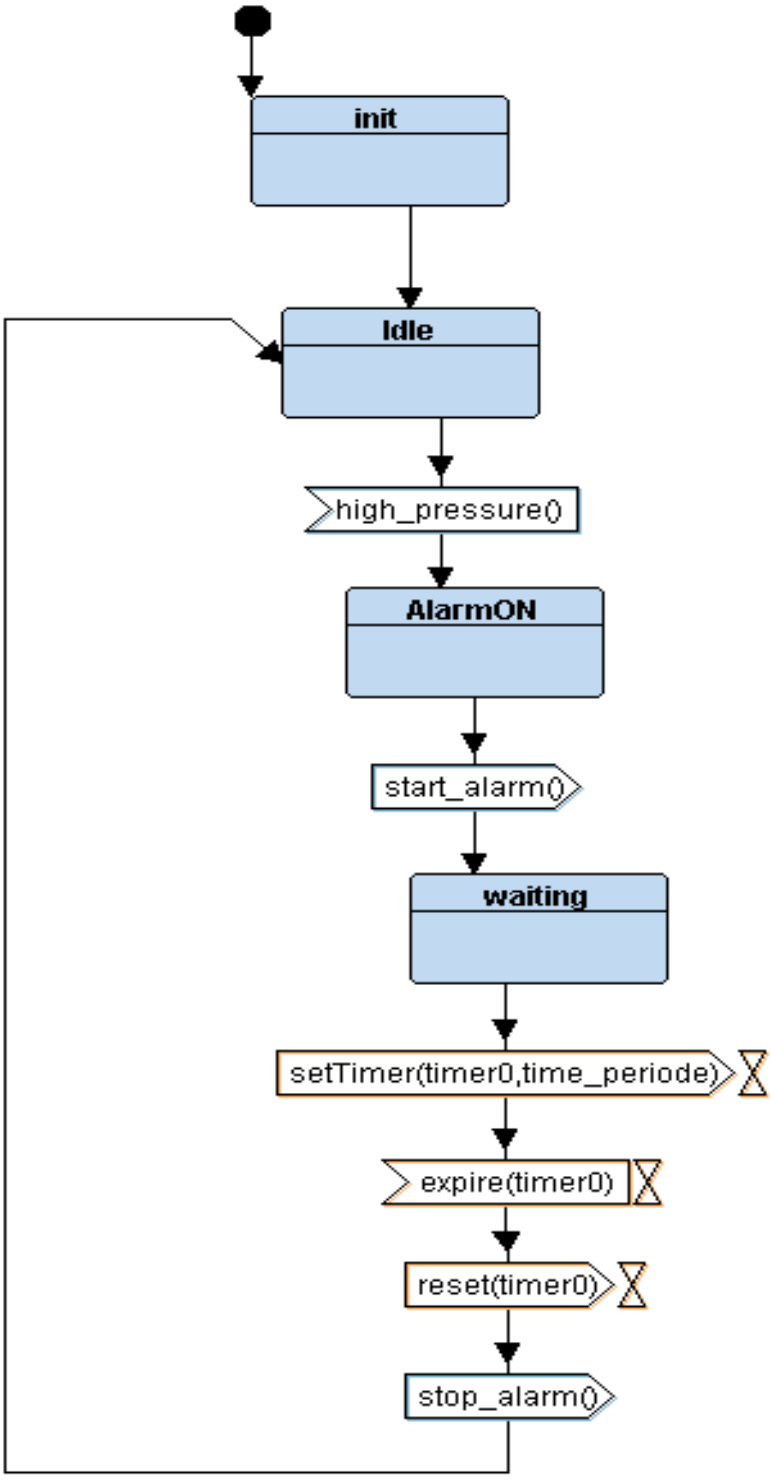




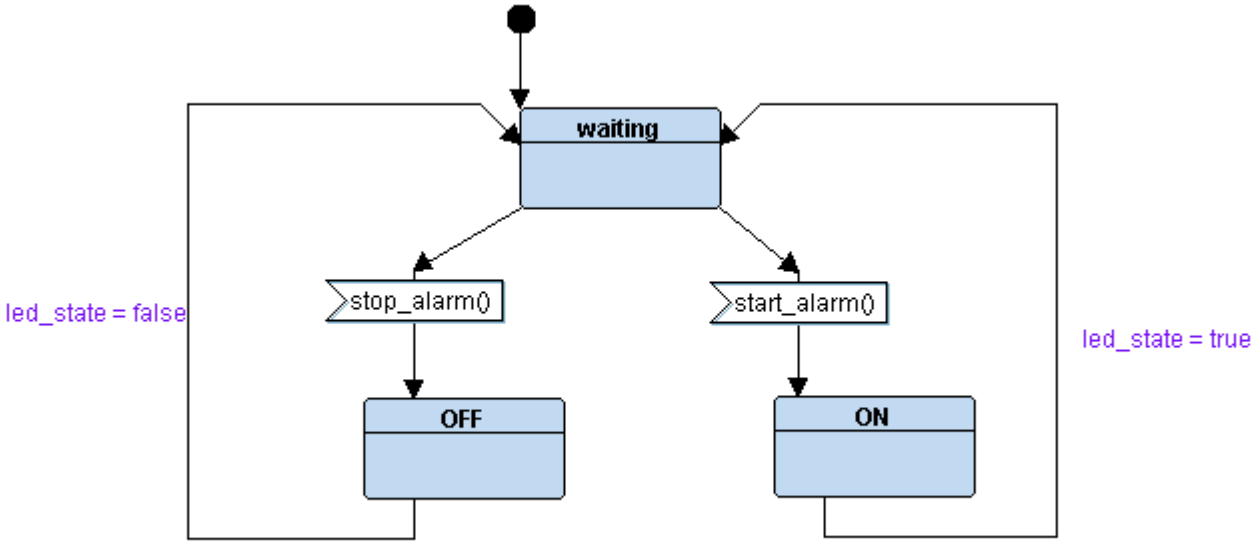
Algorithm Block Diagram



Alarm Monitor Block Diagram



Alarm Actuator Block Diagram



Code implementation

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main.c

```c
/*
 * main.c
 *
 *      Author: Eng. Mohamed Ahmed
 */

#include "driver.h"
#include "Alarm_Monitor.h"
#include "Alarm_Actuator.h"
#include "Algorithm.h"
#include "Sensor.h"
#include "State.h"

void setup()
{
    //init all drivers
    GPIO_INITIALIZATION();
    //init block
    PrSensor_init();
    alg_state = STATE(HighPreDetected);
    AM_state = STATE(AlarmOff);
    Alarm_init();
}
void main()
{
    setup();
    while(1)
    {
        PrS_state();
        alg_state();
        AM_state();
        Led_state();
```

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main.c | Algorithm.c | Alarm_Monitor.c | Alarm_Actuator.c | driver.c | Sensor.c

```c
/*
 * Algorithem.c
 *
 *      Author: Eng . Mohamed Ahmed
 */

#include "Algorithm.h"

//variabls
uint8 pVal = 0;
uint8 threshold = 20;

// state pointer to function
void (*alg_state)();

// connection abstraction
void setPressureVal(uint8 pressure)
{
    pVal = pressure;
    alg_state = STATE(HighPreDetected);
}

STATE_define(HighPreDetected)
{
    alg_state_id = HighPreDetected;
    if(pVal > threshold)
    {
        HighPressure();
        alg_state = STATE(HighPreDetected);
    }
    else
        alg_state = STATE(HighPreDetected);
```

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main.c | Algorithm.c | Alarm_Monitor.c | Alarm_Actuator.c | driver.c | Sensor.c

```c
/*
 * Alarm_Monitor.c
 *
 *      Author: Eng. Mohamed Ahmed
 */


#include "Alarm_Monitor.h"

void (*AM_state)();

void HighPressure()
{
    AM_state = STATE(AlarmOn);
}

STATE_define(AlarmOff)
{
    AM_state_id = AlarmOff;
    StopAlarm();
}

STATE_define(AlarmOn)
{
    AM_state_id = AlarmOn;
    StartAlarm();
    AM_state = STATE(AlarmOff);
}
```

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main.c | Algorithm.c | Alarm_Monitor.c | Alarm_Actuator.c | driver.c | Sensor.c

```c
/*
 * Alarm_Actuator.c
 *
 *      Author: Eng. Mohamed Ahmed
 */

#include "Alarm_Actuator.h"
#include "driver.h"

void (*Led_state)();

void Alarm_init()
{
    // init the alarm
    Led_state = STATE(Waiting);
}
void StartAlarm()
{
    Led_state = STATE(LedOn);
}

void StopAlarm()
{
    Led_state = STATE(LedOff);
}

STATE_define(LedOn)
{
    Led_state_id = LedOn;
    Set_Alarm_actuator(0);
    Delay(1500000);
    Set_Alarm_actuator(1);
```

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main.c | Algorithm.c | Alarm_Monitor.c | Alarm_Actuator.c | driver.c | Sensor.c

```c
// Eng . Mohamed Ahmed

#include "driver.h"
#include <stdint.h>
#include <stdio.h>
void Delay(int nCount)
{
    for(; nCount != 0; nCount--);
}

int getPressureVal(){
    return (GPIOA_IDR & 0xFF);
}

void Set_Alarm_actuator(int i){
    if (i == 1){
        SET_BIT(GPIOA_ODR,13);
    }
    else if (i == 0){
        RESET_BIT(GPIOA_ODR,13);
    }
}

void GPIO_INITIALIZATION (){
    SET_BIT(APB2ENR, 2);
    GPIOA_CRL &= 0xFF0FFFFF;
    GPIOA_CRL |= 0x00000000;
    GPIOA_CRH &= 0xFF0FFFFF;
    GPIOA_CRH |= 0x22222222;
}
```

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main.c | Algorithm.c | Alarm_Monitor.c | Alarm_Actuator.c | driver.c | Sensor.c

```c
/*
 * Sensor.c
 *
 *      Author: Eng. Mohamed Ahmed
 */

#include "Sensor.h"
#include "driver.h"

// variables
uint8 pressure = 0;

// State pointer to function
void (*PrS_state)();

// Flow of the program

void PrSensor_init()
{
    // initialize of the pressure sensor will be called from driver.h
    PrS_state = STATE(PrS_Reading);
}

STATE_define(PrS_Reading)
{
    PrS_state_id = PrS_Reading;
    pressure = getPressureVal();
    setPressureVal(pressure);
    PrS_state = STATE(PrS_Reading);
}
```

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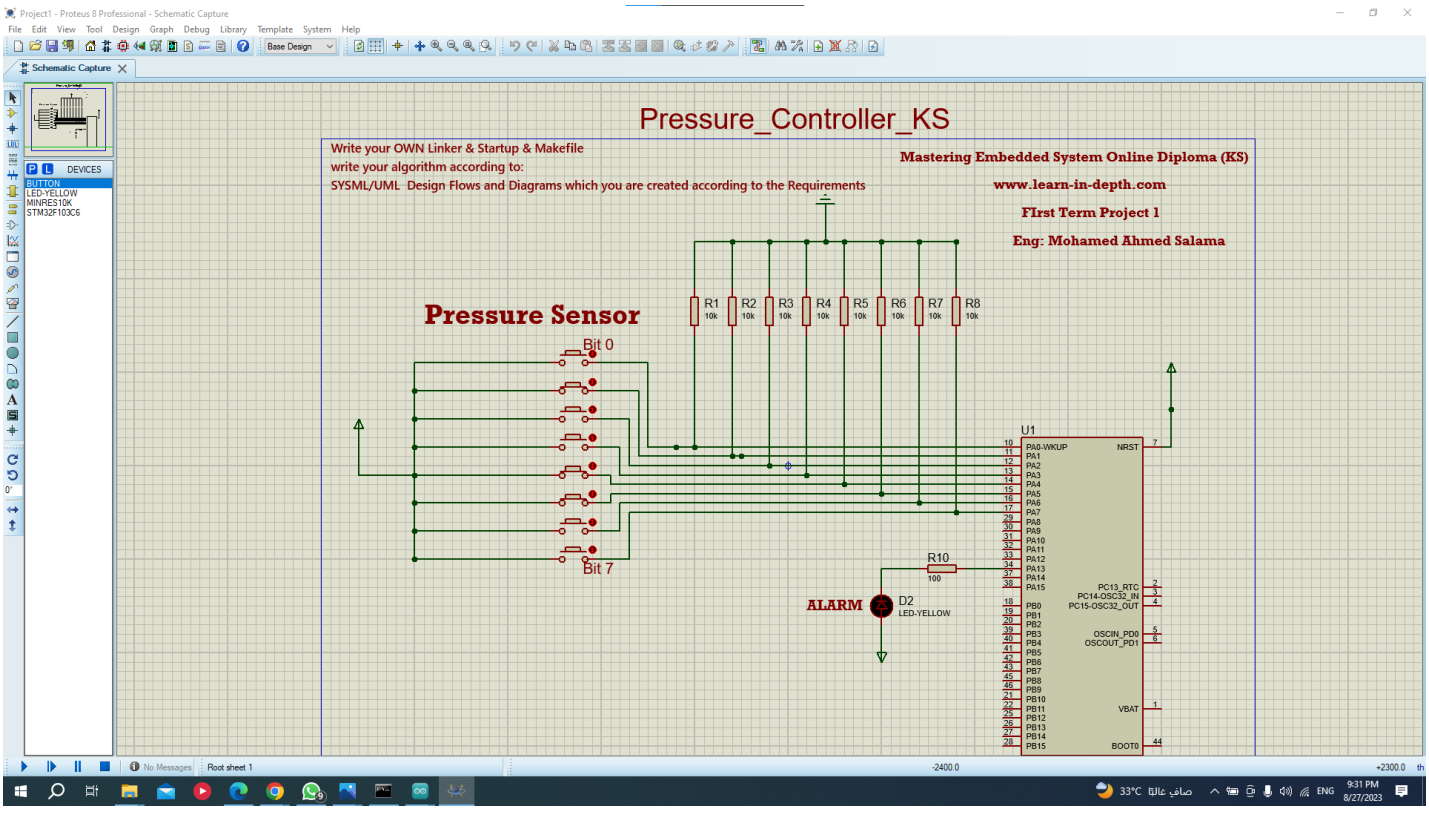
Proteus Simulation



When pressure = 50 > threshold so alarm is on for 60 seconds then off