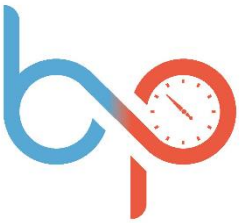
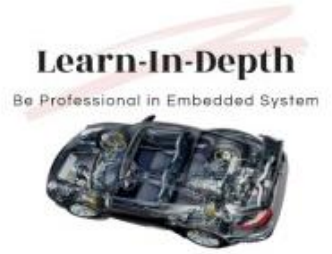


SafePressure Alert



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Design Document

First Term (Final Project 1)

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Design for Pressure Control System (PCS)

Version 1.0 approved

Prepared by: Abdallah Shabaan Ghazy

Organization: learn in depth

Date Created: 8/11/2024

1. Introduction

1.1 Purpose

This Design Document provides a comprehensive overview of the design for the Pressure Control System (PCS). It outlines the architecture, components, and design decisions that guide the development of the system.

1.2 Scope

The document covers the design of the PCS, which includes monitoring cabin pressure, alerting the crew when the pressure exceeds 20 bars, and optionally storing pressure values.

1.3 Definitions and Acronyms

- **PCS:** Pressure Control System
- **Alarm:** A signal to alert the crew of high pressure
- **Flash Memory:** Non-volatile storage for pressure data
- **LED:** Light Emitting Diode

2. System Overview

2.1 System Architecture

The PCS consists of several key components:

- **Pressure Sensor:** Measures the cabin pressure.
- **Control Unit:** Processes sensor data and checks against thresholds.
- **Alarm System:** Activates the alarm (LED) when needed.
- **Notification System:** Alerts the crew.
- **Flash Memory:** Stores pressure data (optional).

2.2 Design Constraints

- **Hardware Constraints:** Compatibility with existing cabin sensors and alarm hardware.
- **Environmental Constraints:** Operates effectively in the cabin's environmental conditions (temperature, noise).

3. Detailed Design

3.1 Components

3.1.1 Pressure Sensor

- **Function:** Continuously measures the cabin pressure.
- **Interface:** Connects to the Control Unit via an analog or digital interface.
- **Specifications:** Digital barometric pressure sensor with a range of 300 to 1100 hPa and accuracy of ±1 hPa.

3.1.2 Control Unit

- **Function:** Receives data from the Pressure Sensor and processes it.
- **Components:** Microcontroller or microprocessor.
- **Algorithms:** Includes logic to compare pressure values to the threshold (20 bars).

3.1.3 Alarm System

- **Function:** Activates an LED alarm when the pressure exceeds the threshold.
- **Components:** LED, driving circuitry.

3.1.4 Notification System

- **Function:** Notifies the crew about high pressure.
- **Components:** Audio or visual indicators.

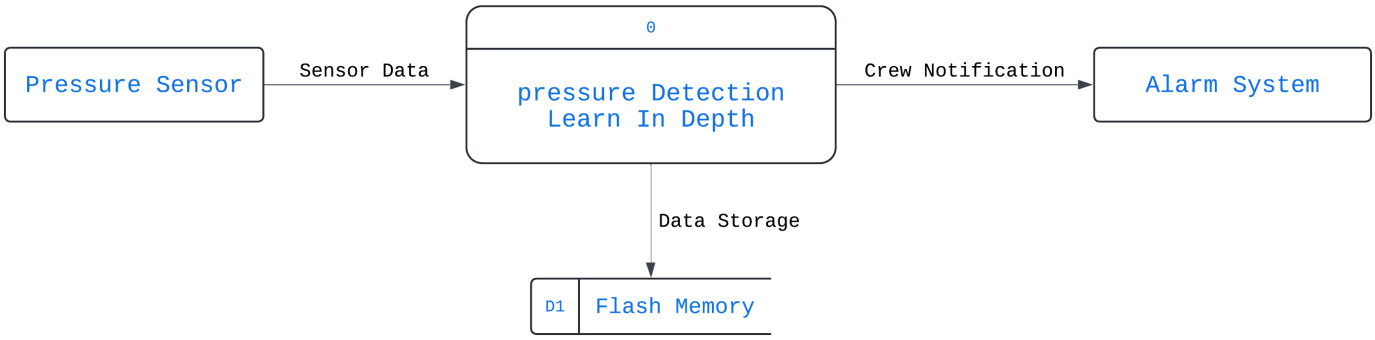
3.1.5 Flash Memory

- **Function:** Stores pressure values for future analysis.
- **Specifications:** [Include memory size, type, and interface details]

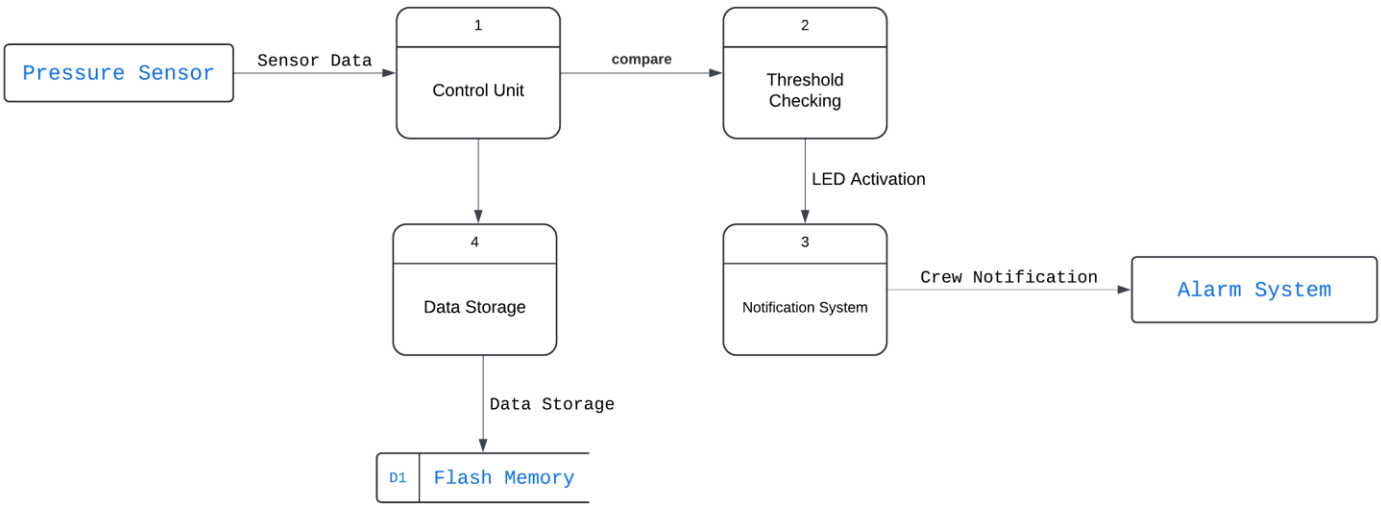
3.2 Data Flow

1. **Pressure Measurement**
   - **Description:** Pressure Sensor measures and sends data to the Control Unit.
   - **Data Flow:** Sensor Data → Control Unit
2. **Threshold Checking**
   - **Description:** Control Unit compares pressure data to the predefined threshold.
   - **Data Flow:** Sensor Data → Control Unit → Threshold Check
3. **Alarm Activation**
   - **Description:** If pressure exceeds 20 bars, the Alarm System activates.
   - **Data Flow:** Control Unit → Alarm System → LED Activation
4. **Crew Notification**
   - **Description:** Notifies the crew of high pressure.
   - **Data Flow:** Control Unit → Notification System
5. **Data Storage (Optional)**
   - **Description:** Stores pressure values in Flash Memory.
   - **Data Flow:** Control Unit → Flash Memory

Context Diagram



Level-0 DFD



4. Interface Design

4.1 Hardware Interfaces

- **Pressure Sensor:** Connects via GPIO pins
- **Alarm System:** Connects to Control Unit via GPIO pins

4.2 Software Interfaces

- **Control Unit Software:** Handles data from sensors, processes information, and interfaces with the alarm and notification systems.
- **Notification System Software:** Receives alerts from the Control Unit and activates notifications.

5. Error Handling

5.1 Error Detection

- **Sensor Failures:** Detect failures or inaccuracies in sensor readings.
- **Communication Errors:** Identify and handle issues with data transfer between components.

5.2 Error Response

- **Redundant Systems:** Implement backup systems or alerts for critical failures.
- **Logs:** Maintain logs for error diagnosis and troubleshooting.

6. Security

6.1 Data Security

- **Encryption:** Ensure sensitive data (if any) is encrypted.
- **Access Control:** Implement controls to restrict access to system data and configurations.

6.2 System Security

- **Physical Security:** Protect hardware components from tampering.
- **Software Security:** Regular updates and patches to fix vulnerabilities.

7. Performance

7.1 Response Time

- **Description:** The system must detect pressure changes and activate the alarm within 2 seconds.

7.2 Reliability

- **Description:** The system must operate continuously with minimal downtime.

8. Maintenance

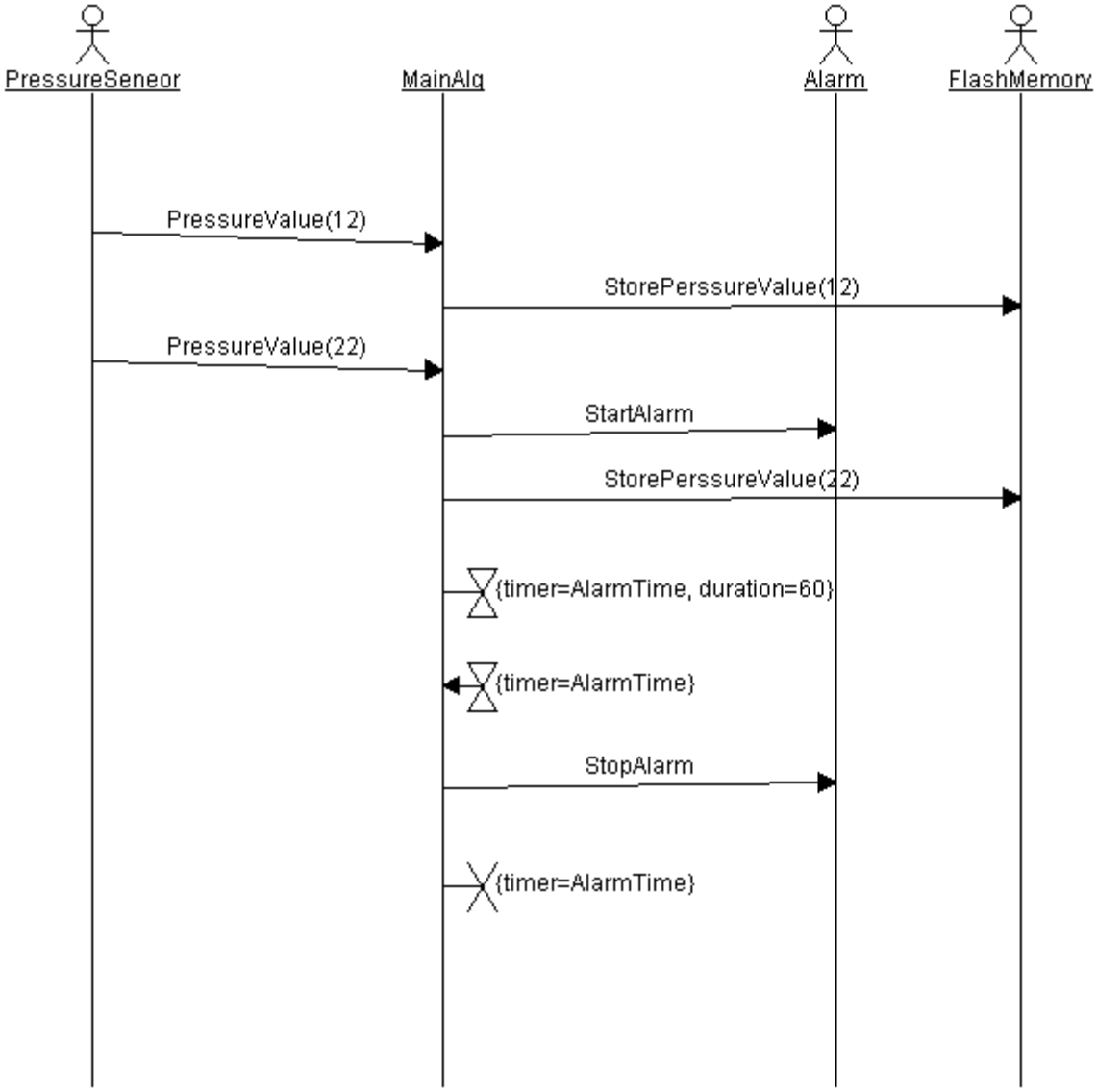
8.1 Regular Maintenance

- **Description:** Periodic checks and updates to ensure system functionality.
- **Components:** Sensors, control units, and alarm systems.

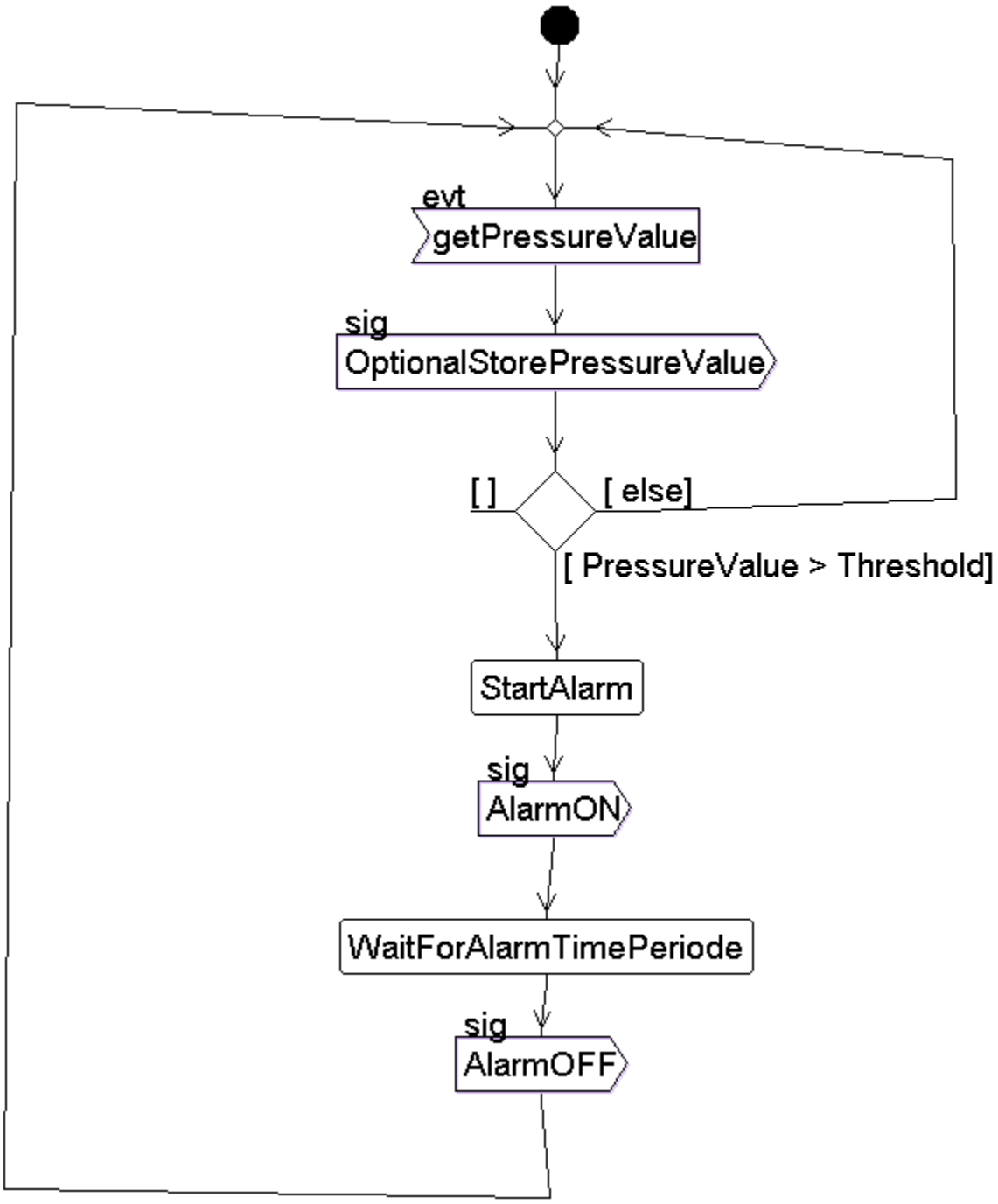
8.2 Troubleshooting

- **Description:** Procedures for diagnosing and fixing issues with the system.

Sequence Diagram

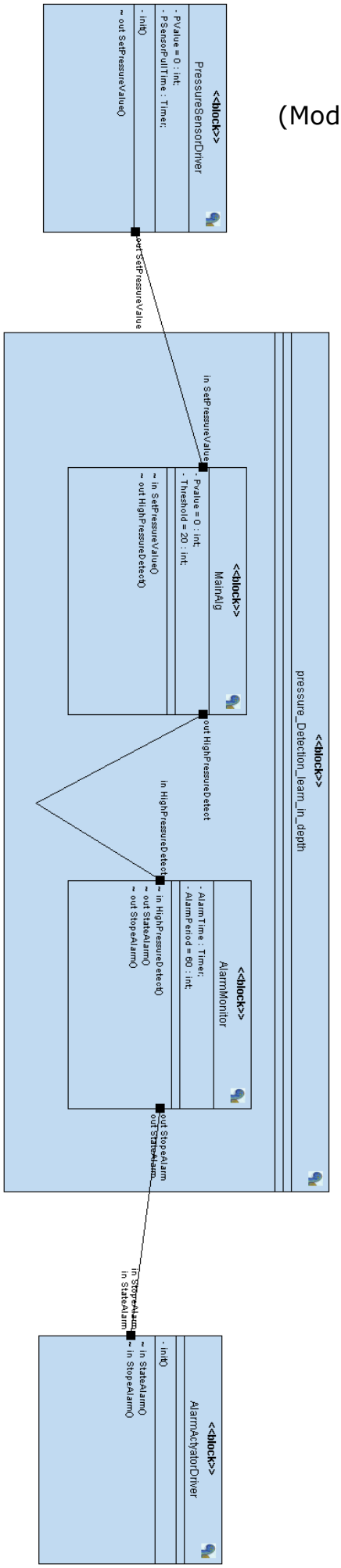


Activity Diagram

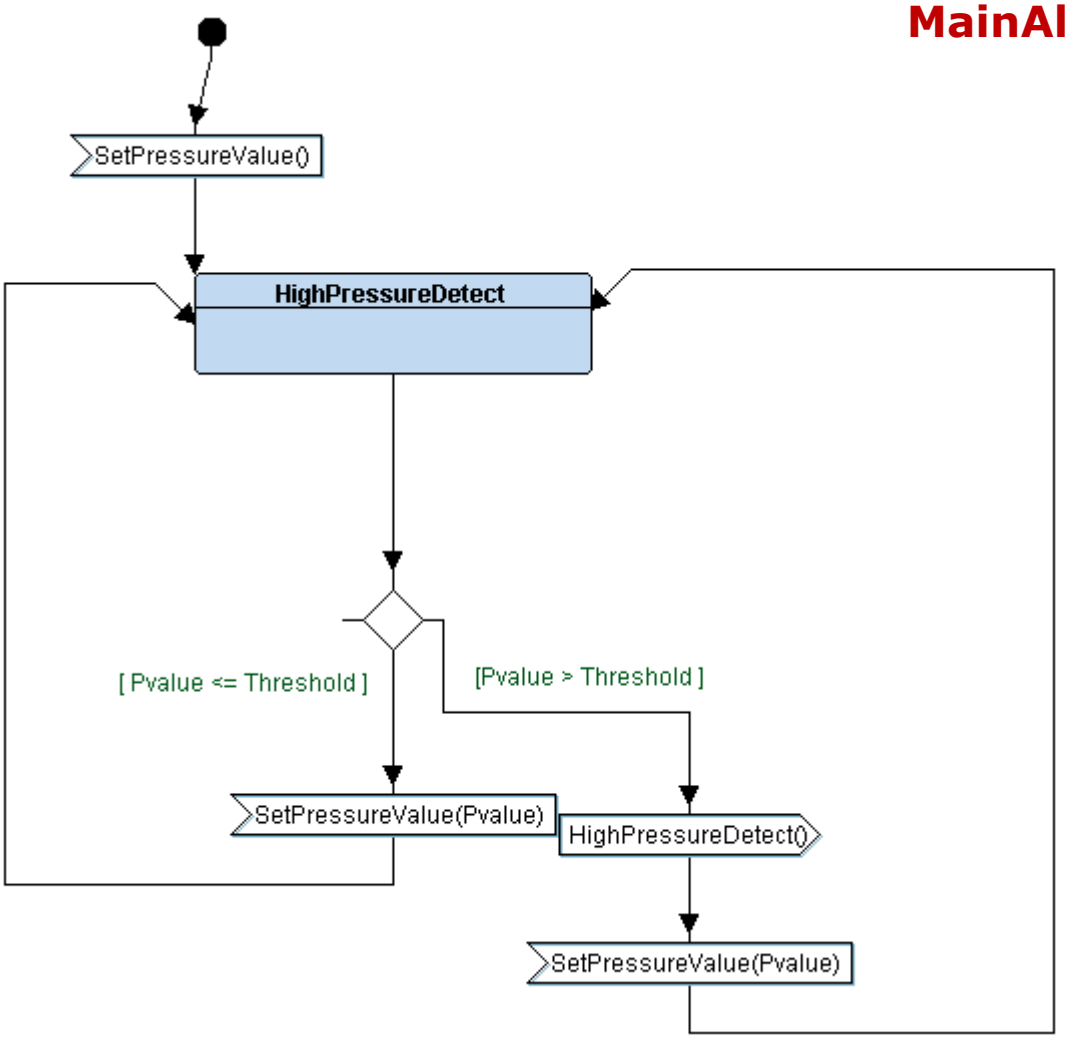


System Design

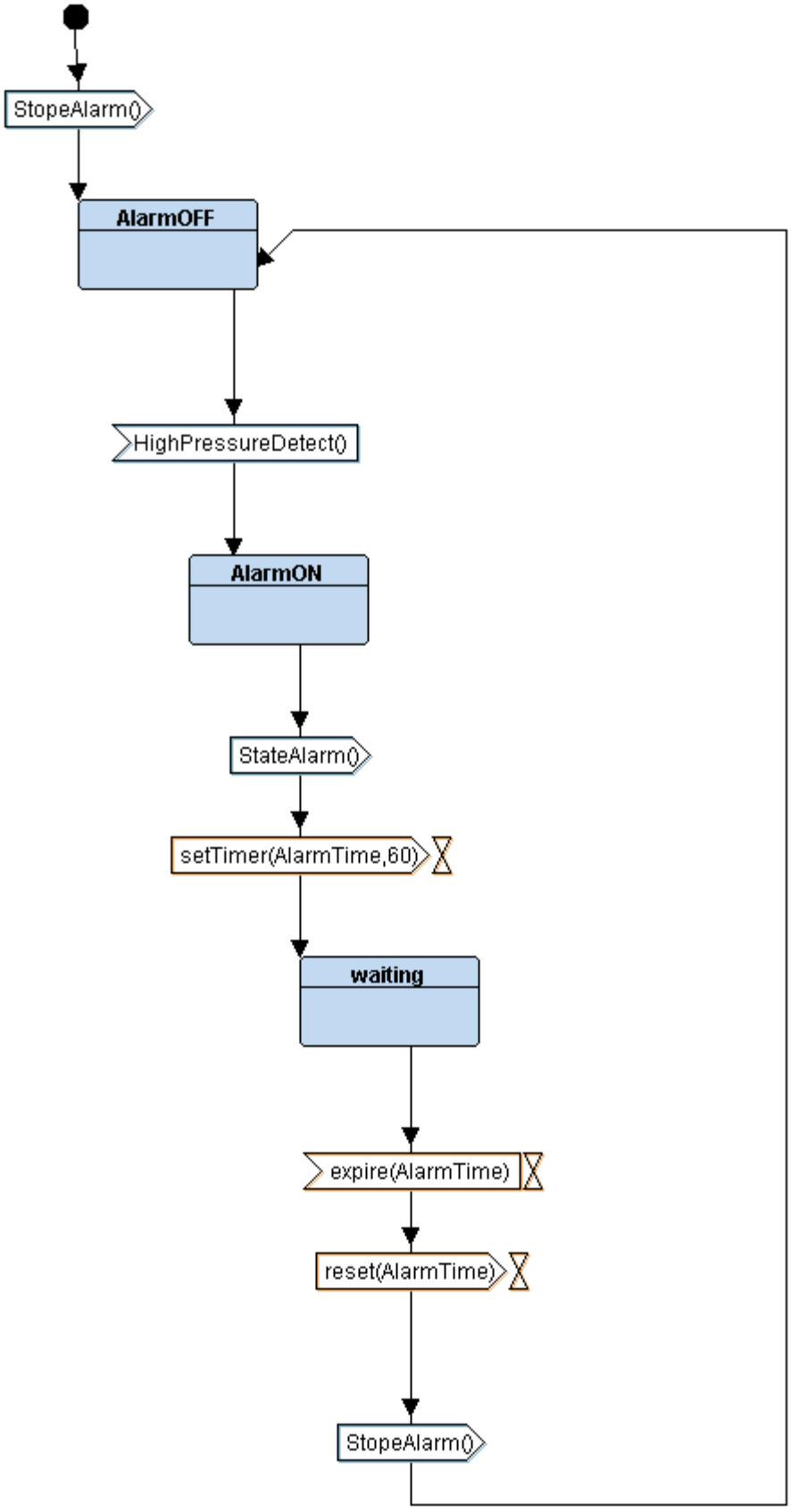
(Modules with its own state machines)



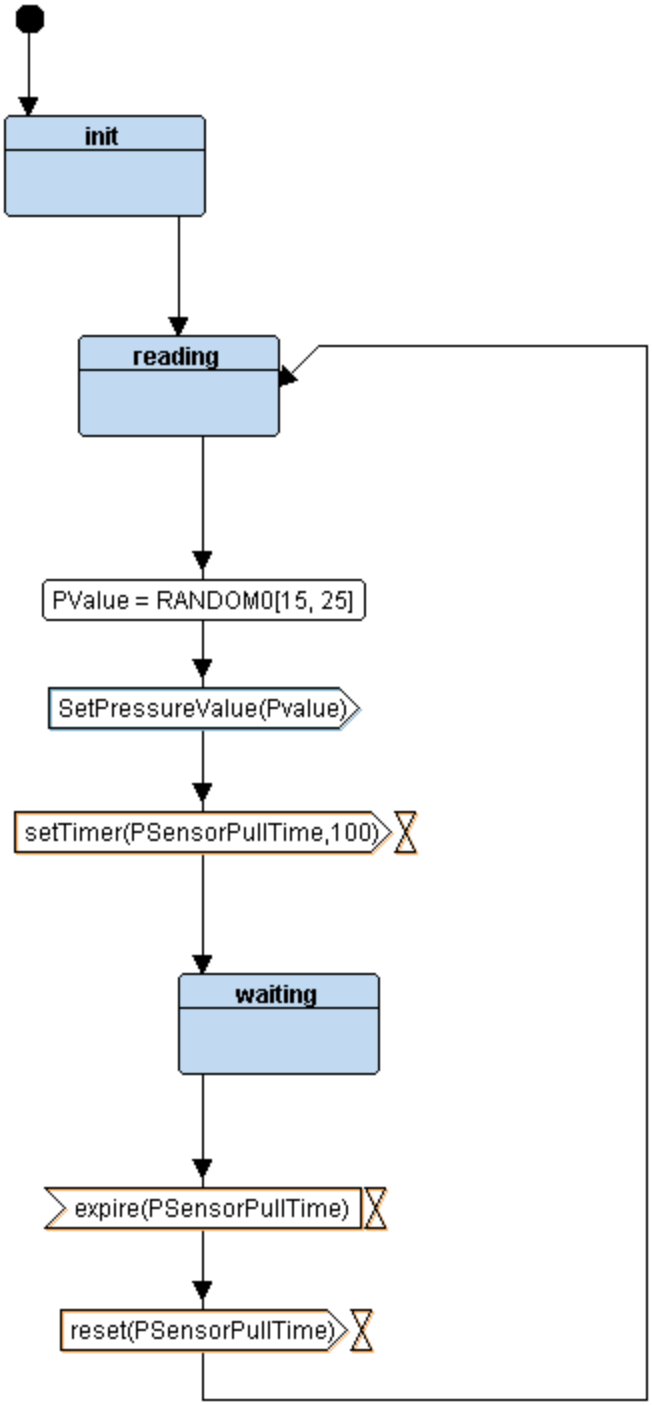
MainAlg


SetPressureValue()
HighPressureDetect
[Pvalue <= Threshold]
[Pvalue > Threshold]
SetPressureValue(Pvalue)
HighPressureDetect()
SetPressureValue(Pvalue)

AlarmMonitor



PressureSensorDriver



AlarmActyatorDriver