<Landing gear system>

<ROB301>

Summary:
<This document describes the landing system for aircraft. It implements the software part of a landing gear system.>

Company: <ENSTA>
Authors: <Yufei HU and Yu Wang>
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1. General Project Description

This document describes the landing system for aircraft. It implements the software part of a landing gear system.

The entire system is described in the operator "System". The flow of the system can be briefly described as follows: all sensors get the status of each position via the operator "Sensor_voter_system" (voting system), the operator "Computer_logical" gives the corresponding electric valve commands via the information given to the sensors, and the operator "Monitor_monitor" gives the corresponding electric valve (EV) commands. The operator "Computer_logical" gives the corresponding electric valve commands from the information given to the sensors, and the operator "Monitor_system" displays the corresponding sensor information to the pilot.

In addition, we need to clarify some rules.
(1) The unit for all durations is 1s.
(2) A handle of "true" means that the handle is in the "up" position. A handle of "false" means that the handle is in the "down" position.
(3) A switch of "true" means the switch is in the "open" position, a switch of "false" means the switch is in the "close" position

2. Software Architecture

2.1. Project Architecture

This section displays the package hierarchy of projects.

Project Landing_gear_system

2.2. Call Graph

This Call Graph displays the dependency tree of model operators.

1. System
   1.1. Compute_logical [2]
      1.1.1. Handle_control
   1.2. Monitor_system
      1.2.1. C10_general_EV_circuit_pressurized_low2high
      1.2.2. C1_open_EV_sensors_door_closed
      1.2.3. C2_open_EV_sensors_door_opened
      1.2.4. C3_close_EV_sensors_door_closed
      1.2.5. C4_close_EV_sensors_door_opened
      1.2.6. C5_extend_EV_sensors_gear_retracted
      1.2.7. C6_extend_EV_sensors_gear_extended
      1.2.8. C7_retract_EV_sensors_gear_retracted
      1.2.9. C8_retract_EV_sensors_gear_extended
      1.2.10. C9_general_EV_circuit_pressurized_high2low
   1.3. Sensor_voter_system
      1.3.1. Voter [17]

3. Landing_gear_system Project

3.1. Root Elements

3.1.1. C10_general_EV_circuit_pressurized_low2high Operator

Declared as **public node**

3.1.1.1. Comments and Information

C10_general_EV_circuit_pressurized_low2high Comments:
This operator deals with the case where the signal general_EV and circuit pressurized sensors information are given. We need this operator to judge where the corrsponding sensors are work.(Low to high)

3.1.1.2. Interface

Table 1: Inputs of C10_general_EV_circuit_pressurized_low2high

Name	Type	Comments and Information
general_EV	bool	
circuit_pressurized	bool	

Table 2: Outputs of C10_general_EV_circuit_pressurized_low2high

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.1.3. Locals

Table 3: Locals of C10_general_EV_circuit_pressurized_low2high

Name	Type	Properties		Comments and Information
general_EV_changed	bool	default	false	

3.1.1.4. Operator Hierarchy

diagram : C10_general_EV_circuit_pressurized_low2high
state-machine : SM1
state : Detection
state : Failure
state : Normal

3.1.1.5. Graphical and Textual Diagrams

3.1.1.5.1. View of C10_general_EV_circuit_pressurized_low2high (C10_general_EV_circuit_pressurized_low2high)

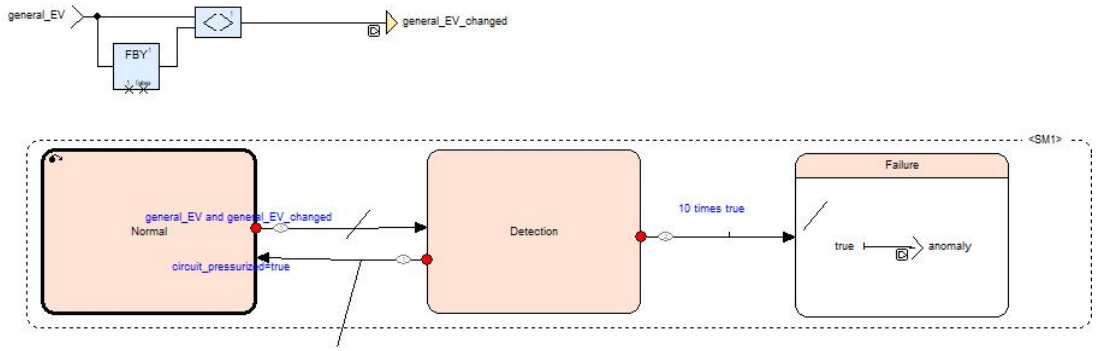

Figure 1: View of C10_general_EV_circuit_pressurized_low2high (C10_general_EV_circuit_pressurized_low2high)

Table 4: State Machines of C10_general_EV_circuit_pressurized_low2high

State Machine	Comments and Information
SM1	

Table 5: States of C10_general_EV_circuit_pressurized_low2high

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 6: Transitions of C10_general_EV_circuit_pressurized_low2high

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** circuit_pressurized = true	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 10 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** general_EV and general_EV_changed	

3.1.2. C1_open_EV_sensors_door_closed Operator

Declared as **public node**

3.1.2.1. Comments and Information

C1_open_EV_sensors_door_closed Comments:
This operator deals with the case where the signal open_EV and door closed sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.2.2. Interface

Table 7: Inputs of C1_open_EV_sensors_door_closed

Name	Type	Comments and Information
door_closed_front	bool	
door_closed_left	bool	
door_closed_right	bool	
open_EV	bool	

Table 8: Outputs of C1_open_EV_sensors_door_closed

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.2.3. Locals

Table 9: Locals of C1_open_EV_sensors_door_closed

Name	Type	Properties		Comments and Information
any_doors_closed_true	bool	default	true	
open_EV_changed	bool	default	false	

3.1.2.4. Operator Hierarchy

diagram : C1_open_EV_sensors_door_closed
state-machine : SM1
state : Detection
state : Failure
state : Normal

3.1.2.5. Graphical and Textual Diagrams

3.1.2.5.1. View of C1_open_EV_sensors_door_closed (C1_open_EV_sensors_door_closed)

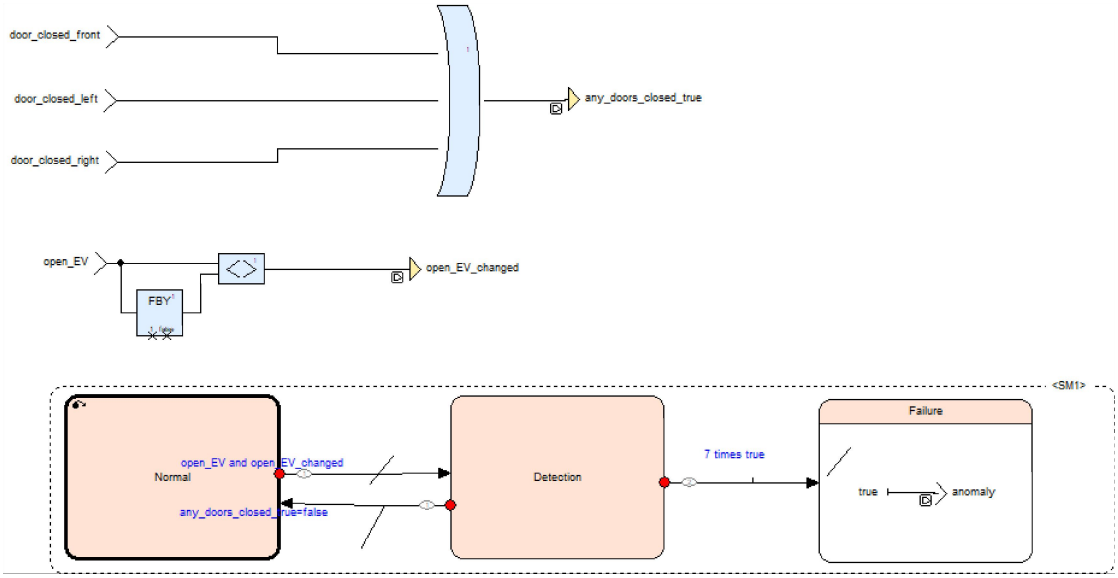

Figure 2: View of C1_open_EV_sensors_door_closed (C1_open_EV_sensors_door_closed)

Table 10: State Machines of C1_open_EV_sensors_door_closed

State Machine	Comments and Information
SM1	

Table 11: States of C1_open_EV_sensors_door_closed

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 12: Transitions of C1_open_EV_sensors_door_closed

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** any_doors_closed_true = false	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** open_EV and open_EV_changed	

3.1.3. C2_open_EV_sensors_door_opened Operator

Declared as **`public node`**

3.1.3.1. Comments and Information

C2_open_EV_sensors_door_opened Comments:
This operator deals with the case where the signal open_EV and door opened sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.3.2. Interface

Table 13: Inputs of C2_open_EV_sensors_door_opened

Name	Type	Comments and Information
door_opened_front	bool	
door_opened_left	bool	
door_opened_right	bool	
open_EV	bool	

Table 14: Outputs of C2_open_EV_sensors_door_opened

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.3.3. Locals

Table 15: Locals of C2_open_EV_sensors_door_opened

Name	Type	Properties		Comments and Information
all_doors_opened_true	bool	default	true	
open_EV_changed	bool	default	false	

3.1.3.4. Operator Hierarchy

diagram : C2_open_EV_sensors_door_opened
  state-machine : SM1
    state : Detection
    state : Failure
    state : Normal

3.1.3.5. Graphical and Textual Diagrams

3.1.3.5.1. View of C2_open_EV_sensors_door_opened (C2_open_EV_sensors_door_opened)

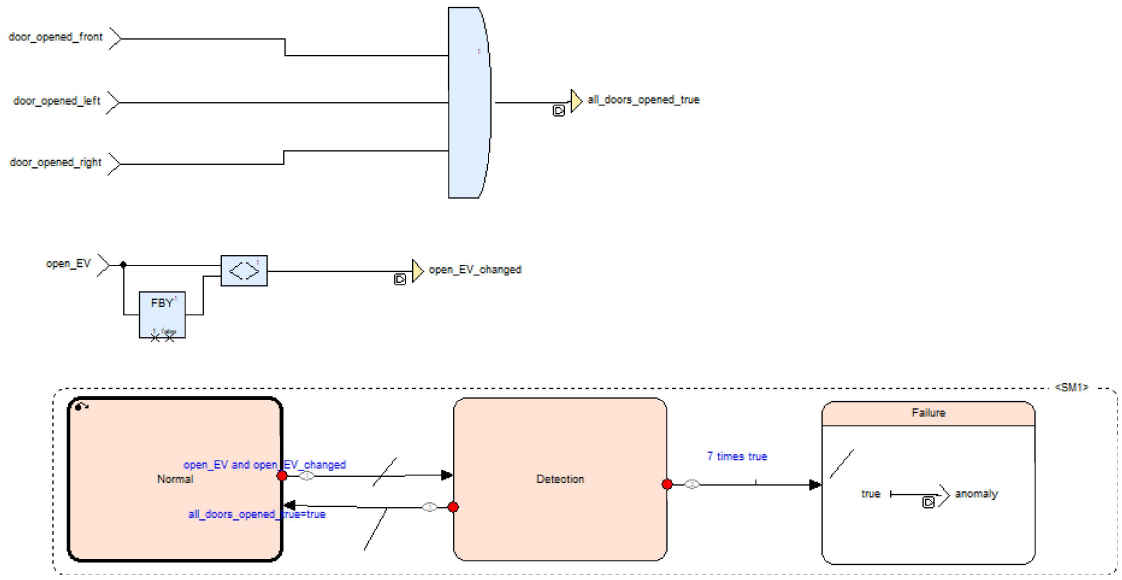

Figure 3: View of C2_open_EV_sensors_door_opened (C2_open_EV_sensors_door_opened)

Table 16: State Machines of C2_open_EV_sensors_door_opened

State Machine	Comments and Information
SM1	

Table 17: States of C2_open_EV_sensors_door_opened

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 18: Transitions of C2_open_EV_sensors_door_opened

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** all_doors_opened_true = true	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
	1		

Source: SM1:Normal **Target:** SM1:Detection		**Condition:** open_EV and open_EV_changed	

3.1.4. C3_close_EV_sensors_door_closed Operator

Declared as **`public node`**

3.1.4.1. Comments and Information

C3_close_EV_sensors_door_closed Comments:
This operator deals with the case where the signal close_EV and door closed sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.4.2. Interface

Table 19: Inputs of C3_close_EV_sensors_door_closed

Name	Type	Comments and Information
door_closed_front	bool	
door_closed_left	bool	
door_closed_right	bool	
close_EV	bool	

Table 20: Outputs of C3_close_EV_sensors_door_closed

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.4.3. Locals

Table 21: Locals of C3_close_EV_sensors_door_closed

Name	Type	Properties		Comments and Information
all_doors_closed_true	bool	default	true	
close_EV_changed	bool	default	false	

3.1.4.4. Operator Hierarchy

diagram : C3_close_EV_sensors_door_closed
state-machine : SM1
state : Detection
state : Failure
state : Normal

3.1.4.5. Graphical and Textual Diagrams

3.1.4.5.1. View of C3_close_EV_sensors_door_closed (C3_close_EV_sensors_door_closed)

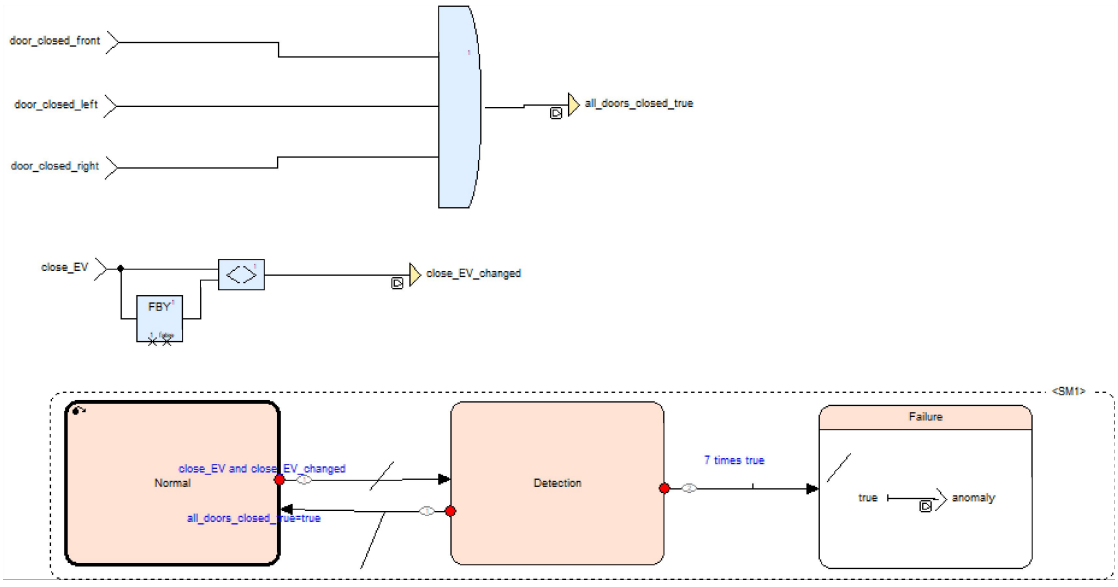

Figure 4: View of C3_close_EV_sensors_door_closed (C3_close_EV_sensors_door_closed)

Table 22: State Machines of C3_close_EV_sensors_door_closed

State Machine	Comments and Information
SM1	

Table 23: States of C3_close_EV_sensors_door_closed

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 24: Transitions of C3_close_EV_sensors_door_closed

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** all_doors_closed_true = true	

Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** close_EV and close_EV_changed	

3.1.5. C4_close_EV_sensors_door_opened Operator

Declared as **`public node`**

3.1.5.1. Comments and Information

C4_close_EV_sensors_door_opened Comments:
This operator deals with the case where the signal close_EV and door opened sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.5.2. Interface

Table 25: Inputs of C4_close_EV_sensors_door_opened

Name	Type	Comments and Information
door_opened_front	bool	
door_opened_left	bool	
door_opened_right	bool	
close_EV	bool	

Table 26: Outputs of C4_close_EV_sensors_door_opened

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.5.3. Locals

Table 27: Locals of C4_close_EV_sensors_door_opened

Name	Type	Properties		Comments and Information
any_door_opened_true	bool	default	true	
close_EV_changed	bool	default	false	

3.1.5.4. Operator Hierarchy

diagram : C4_close_EV_sensors_door_opened
state-machine : SM1
state : Detection
state : Failure
state : Normal

3.1.5.5. Graphical and Textual Diagrams

3.1.5.5.1. View of C4_close_EV_sensors_door_opened (C4_close_EV_sensors_door_opened)

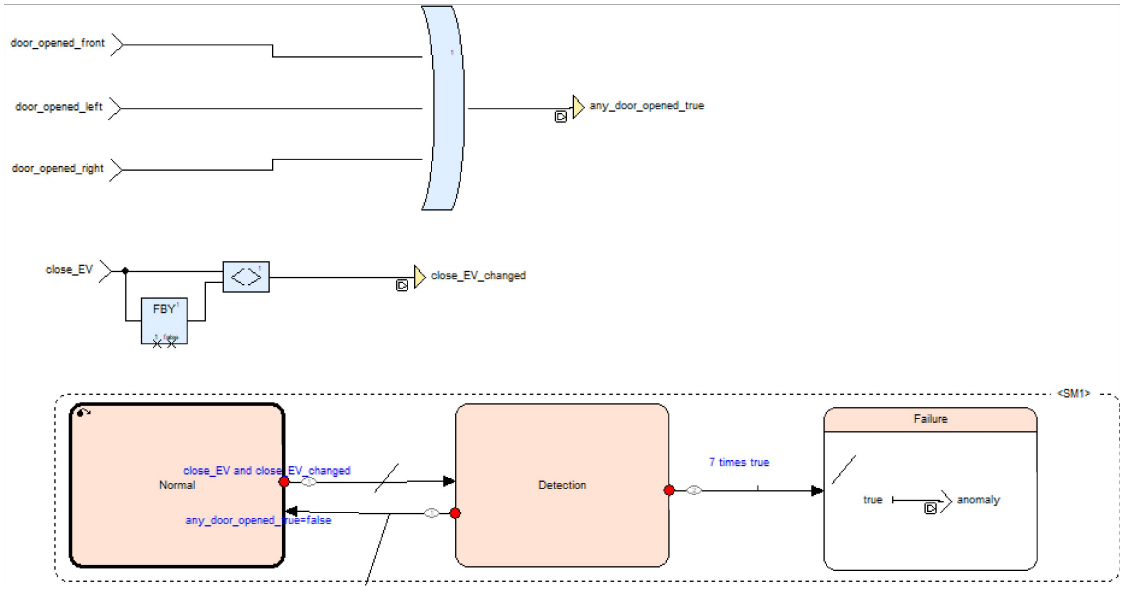

Figure 5: View of C4_close_EV_sensors_door_opened (C4_close_EV_sensors_door_opened)

Table 28: State Machines of C4_close_EV_sensors_door_opened

State Machine	Comments and Information
SM1	

Table 29: States of C4_close_EV_sensors_door_opened

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 30: Transitions of C4_close_EV_sensors_door_opened

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** any_door_opened_true = false	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** close_EV and close_EV_changed	

3.1.6. C5_extend_EV_sensors_gear_retracted Operator

Declared as **`public node`**

3.1.6.1. Comments and Information

C5_extend_EV_sensors_gear_retracted Comments:
This operator deals with the case where the signal extend_EV and gear retracted sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.6.2. Interface

Table 31: Inputs of C5_extend_EV_sensors_gear_retracted

Name	Type	Comments and Information
gear_retracted_front	bool	
gear_retracted_left	bool	
gear_retracted_right	bool	
extend_EV	bool	

Table 32: Outputs of C5_extend_EV_sensors_gear_retracted

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.6.3. Locals

Table 33: Locals of C5_extend_EV_sensors_gear_retracted

Name	Type	Properties		Comments and Information
any_gear_retracted_true	bool	default	true	
extend_EV_changed	bool	default	false	

3.1.6.4. Operator Hierarchy

diagram : C5_extend_EV_sensors_gear_retracted
  state-machine : SM1
    state : Detection
    state : Failure
    state : Normal

3.1.6.5. Graphical and Textual Diagrams

3.1.6.5.1. View of C5_extend_EV_sensors_gear_retracted (C5_extend_EV_sensors_gear_retracted)

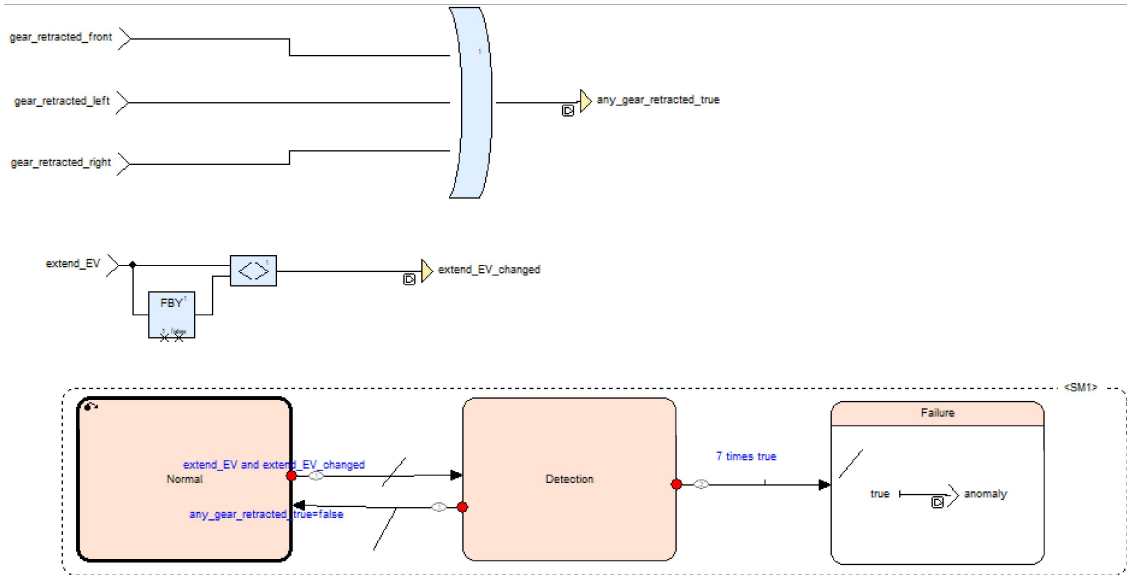

Figure 6: View of C5_extend_EV_sensors_gear_retracted (C5_extend_EV_sensors_gear_retracted)

Table 34: State Machines of C5_extend_EV_sensors_gear_retracted

State Machine	Comments and Information
SM1	

Table 35: States of C5_extend_EV_sensors_gear_retracted

State	Comments and Information
SM1:Detection	
SM1:Failure	

SM1:Normal	

Table 36: Transitions of C5_extend_EV_sensors_gear_retracted

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** any_gear_retracted_true = false	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** extend_EV and extend_EV_changed	

3.1.7. C6_extend_EV_sensors_gear_extended Operator

Declared as **`public node`**

3.1.7.1. Comments and Information

C6_extend_EV_sensors_gear_extended Comments:
This operator deals with the case where the signal extend_EV and gear extended sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.7.2. Interface

Table 37: Inputs of C6_extend_EV_sensors_gear_extended

Name	Type	Comments and Information
gear_extended_front	bool	
gear_extended_left	bool	
gear_extended_right	bool	
extend_EV	bool	

Table 38: Outputs of C6_extend_EV_sensors_gear_extended

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.7.3. Locals

Table 39: Locals of C6_extend_EV_sensors_gear_extended

Name	Type	Properties		Comments and Information
all_gears_extended_true	bool	default	true	
retract_EV_changed	bool	default	false	

3.1.7.4. Operator Hierarchy

diagram : C6_extend_EV_sensors_gear_extended
state-machine : SM1
state : Detection
state : Failure
state : Normal

3.1.7.5. Graphical and Textual Diagrams

3.1.7.5.1. View of C6_extend_EV_sensors_gear_extended (C6_extend_EV_sensors_gear_extended)

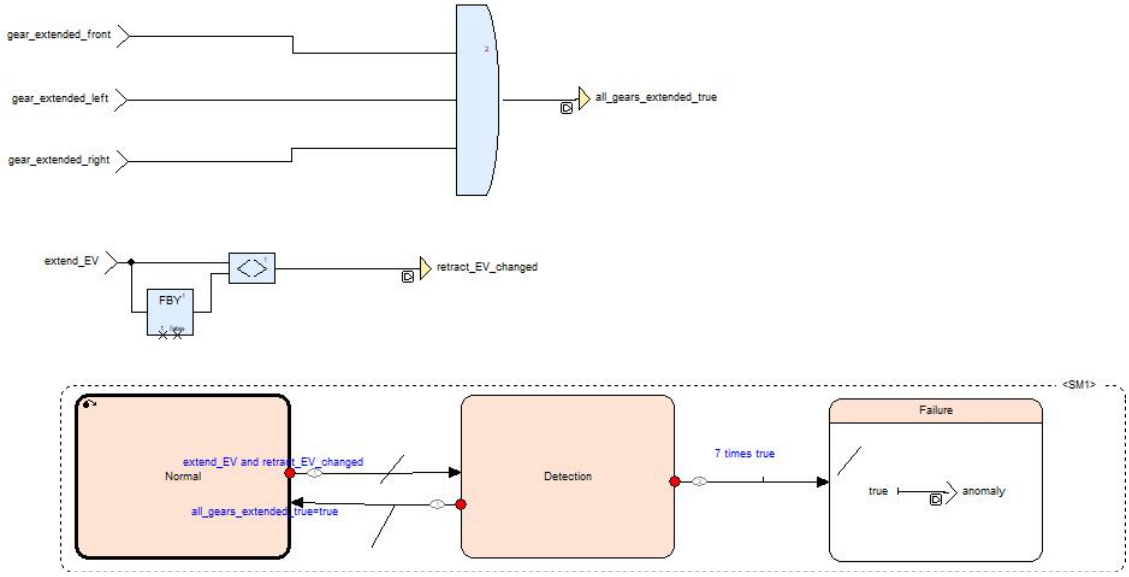

Figure 7: View of C6_extend_EV_sensors_gear_extended (C6_extend_EV_sensors_gear_extended)

Table 40: State Machines of C6_extend_EV_sensors_gear_extended

State Machine	Comments and Information
SM1	

Table 41: States of C6_extend_EV_sensors_gear_extended

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 42: Transitions of C6_extend_EV_sensors_gear_extended

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** all_gears_extended_true = true	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** extend_EV and retract_EV_changed	

3.1.8. C7_retract_EV_sensors_gear_retracted Operator

Declared as **`public node`**

3.1.8.1. Comments and Information

C7_retract_EV_sensors_gear_retracted Comments:
This operator deals with the case where the signal retract_EV and gear retracted sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.8.2. Interface

Table 43: Inputs of C7_retract_EV_sensors_gear_retracted

Name	Type	Comments and Information
gear_retracted_front	bool	
gear_retracted_left	bool	
gear_retracted_right	bool	
retract_EV	bool	

Table 44: Outputs of C7_retract_EV_sensors_gear_retracted

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.8.3. Locals

Table 45: Locals of C7_retract_EV_sensors_gear_retracted

Name	Type	Properties		Comments and Information
all_gears_retracted_true	bool	default	true	
retract_EV_changed	bool	default	false	

3.1.8.4. Operator Hierarchy

diagram : C7_retract_EV_sensors_gear_retracted
  state-machine : SM1
    state : Detection
    state : Failure
    state : Normal

3.1.8.5. Graphical and Textual Diagrams

3.1.8.5.1. View of C7_retract_EV_sensors_gear_retracted (C7_retract_EV_sensors_gear_retracted)

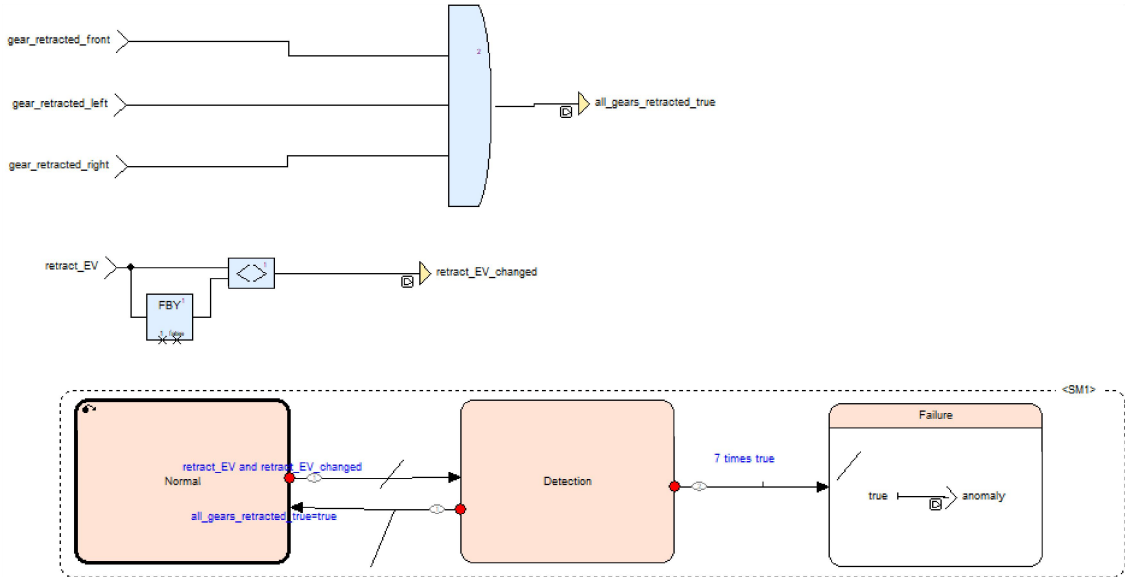

Figure 8: View of C7_retract_EV_sensors_gear_retracted (C7_retract_EV_sensors_gear_retracted)

Table 46: State Machines of C7_retract_EV_sensors_gear_retracted

State Machine	Comments and Information
SM1	

Table 47: States of C7_retract_EV_sensors_gear_retracted

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 48: Transitions of C7_retract_EV_sensors_gear_retracted

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** all_gears_retracted_true = true	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** retract_EV and retract_EV_changed	

3.1.9. C8_retract_EV_sensors_gear_extended Operator

Declared as **`public node`**

3.1.9.1. Comments and Information

C8_retract_EV_sensors_gear_extended Comments:
This operator deals with the case where the signal retract_EV and gear extended sensors information are given. We need this operator to judge where the corrsponding sensors are work.

3.1.9.2. Interface

Table 49: Inputs of C8_retract_EV_sensors_gear_extended

Name	Type	Comments and Information
gear_extened_front	bool	
gear_extened_left	bool	
gear_extened_right	bool	
retract_EV	bool	

Table 50: Outputs of C8_retract_EV_sensors_gear_extended

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.9.3. Locals

Table 51: Locals of C8_retract_EV_sensors_gear_extended

Name	Type	Properties		Comments and Information
any_gear_extended_true	bool	default	true	
retract_EV_changed	bool	default	false	

3.1.9.4. Operator Hierarchy

diagram : C8_retract_EV_sensors_gear_extended
  state-machine : SM1
    state : Detection
    state : Failure
    state : Normal

3.1.9.5. Graphical and Textual Diagrams

3.1.9.5.1. View of C8_retract_EV_sensors_gear_extended (C8_retract_EV_sensors_gear_extended)

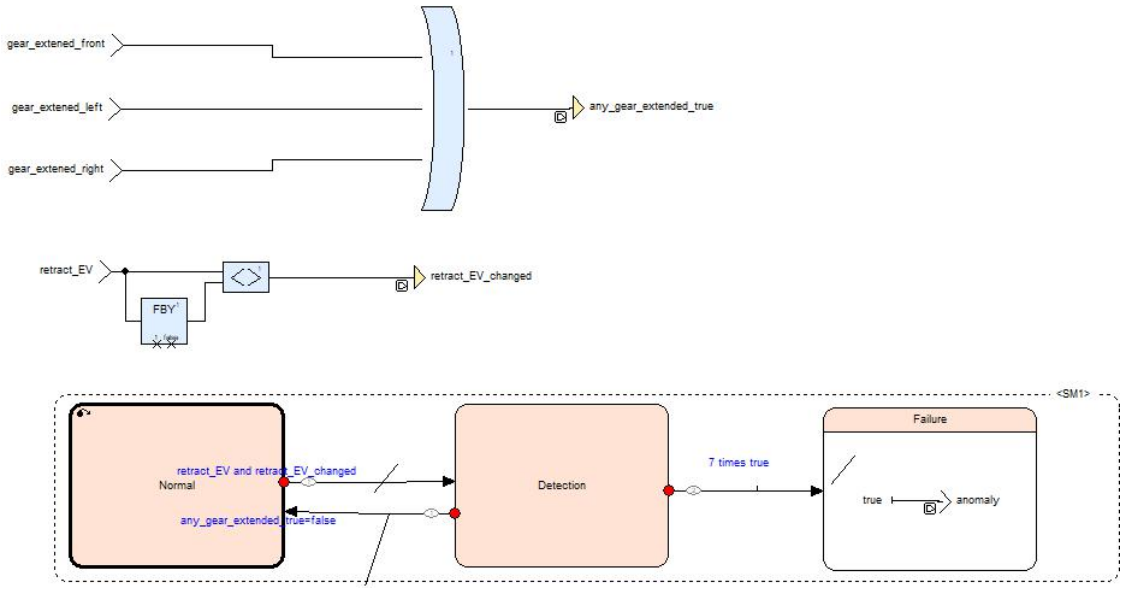

Figure 9: View of C8_retract_EV_sensors_gear_extended (C8_retract_EV_sensors_gear_extended)

Table 52: State Machines of C8_retract_EV_sensors_gear_extended

State Machine	Comments and Information
SM1	

Table 53: States of C8_retract_EV_sensors_gear_extended

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 54: Transitions of C8_retract_EV_sensors_gear_extended

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** any_gear_extended_true = false	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 7 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** retract_EV and retract_EV_changed	

3.1.10. C9_general_EV_circuit_pressurized_high2low Operator

Declared as **`public node`**

3.1.10.1. Comments and Information

C9_general_EV_circuit_pressurized_high2low Comments:
This operator deals with the case where the signal general_EV and circuit pressurized sensors information are given. We need this operator to judge where the corrsponding sensors are work.(high to low)

3.1.10.2. Interface

Table 55: Inputs of C9_general_EV_circuit_pressurized_high2low

Name	Type	Comments and Information
general_EV	bool	
circuit_pressurized	bool	

Table 56: Outputs of C9_general_EV_circuit_pressurized_high2low

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.10.3. Locals

Table 57: Locals of C9_general_EV_circuit_pressurized_high2low

Name	Type	Properties		Comments and Information
general_EV_changed	bool	default	false	

3.1.10.4. Operator Hierarchy

diagram : C9_general_EV_circuit_pressurized_high2low
state-machine : SM1
state : Detection
state : Failure
state : Normal

3.1.10.5. Graphical and Textual Diagrams

3.1.10.5.1. View of C9_general_EV_circuit_pressurized_high2low (C9_general_EV_circuit_pressurized_high2low)

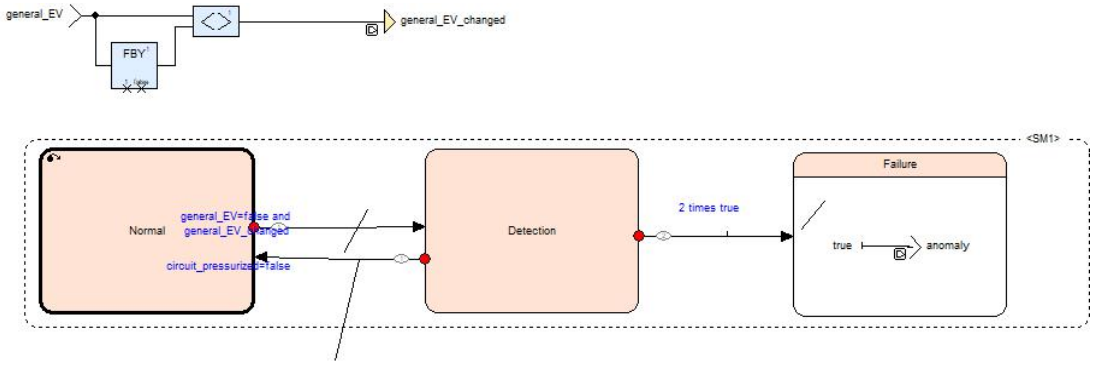

Figure 10: View of C9_general_EV_circuit_pressurized_high2low (C9_general_EV_circuit_pressurized_high2low)

Table 58: State Machines of C9_general_EV_circuit_pressurized_high2low

State Machine	Comments and Information
SM1	

Table 59: States of C9_general_EV_circuit_pressurized_high2low

State	Comments and Information
SM1:Detection	
SM1:Failure	
SM1:Normal	

Table 60: Transitions of C9_general_EV_circuit_pressurized_high2low

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:Detection **Target:** SM1:Normal	1	**Condition:** circuit_pressurized = false	
Source: SM1:Detection **Target:** SM1:Failure	2	**Condition:** 2 times true	
Source: SM1:Normal **Target:** SM1:Detection	1	**Condition:** general_EV = false and general_EV_changed	

3.1.11. Compute_logical Operator

Declared as **`public node`**

3.1.11.1. Comments and Information

Compute_logical Comments:
This operator is main logical operator to deal with the run logic and give the information of "Electro-Valve".

3.1.11.2. Interface

Table 61: Inputs of Compute_logical

Name	Type	Comments and Information
door_closed_front	bool	
door_closed_left	bool	
door_closed_right	bool	
door_open_front	bool	
door_open_left	bool	
door_open_right	bool	
gear_extended_front	bool	
gear_extended_left	bool	
gear_extended_right	bool	
gear_retracted_front	bool	
gear_retracted_left	bool	
gear_retracted_right	bool	
gear_shock_absorber_front	bool	
gear_shock_absorber_left	bool	
gear_shock_absorber_right	bool	
handle	bool	

Table 62: Outputs of Compute_logical

Name	Type	Properties		Comments and Information
gear_locked_down	bool	default	false	
gears_maneuvering	bool	default	false	
general_EV	bool	default	false	
open_EV	bool	default	false	
close_EV	bool	default	false	
extend_EV	bool	default	false	
retract_EV	bool	default	false	

3.1.11.3. Locals

Table 63: Locals of Compute_logical

Name	Type	Properties		Comments and Information
all_doors_closed_true	bool	default	false	

all_doors_open_true	bool	default	false	
all_gears_absorber	bool	default	false	
all_gears_extended_true	bool	default	false	
all_gears_retracted_true	bool	default	true	
analogical_switch	bool			

3.1.11.4. Operator Hierarchy

diagram : Compute_logical_1
state-machine : SM1
state : all_door_closed
state : Close_doors
state : extend_EV_smi
state : Extend_gears
state : gears_extended_and_close_doors_smi
state : gears_retract_and_close_doors_smi
state : general_EV_END
state : general_EV_sim
state : general_EV_stop
state : initialization
state : Open_door
state : open_EV_smi
state : retract_EV_smi
state : Retract_gears

3.1.11.5. Graphical and Textual Diagrams

3.1.11.5.1. View of Compute_logical_1 (Compute_logical)

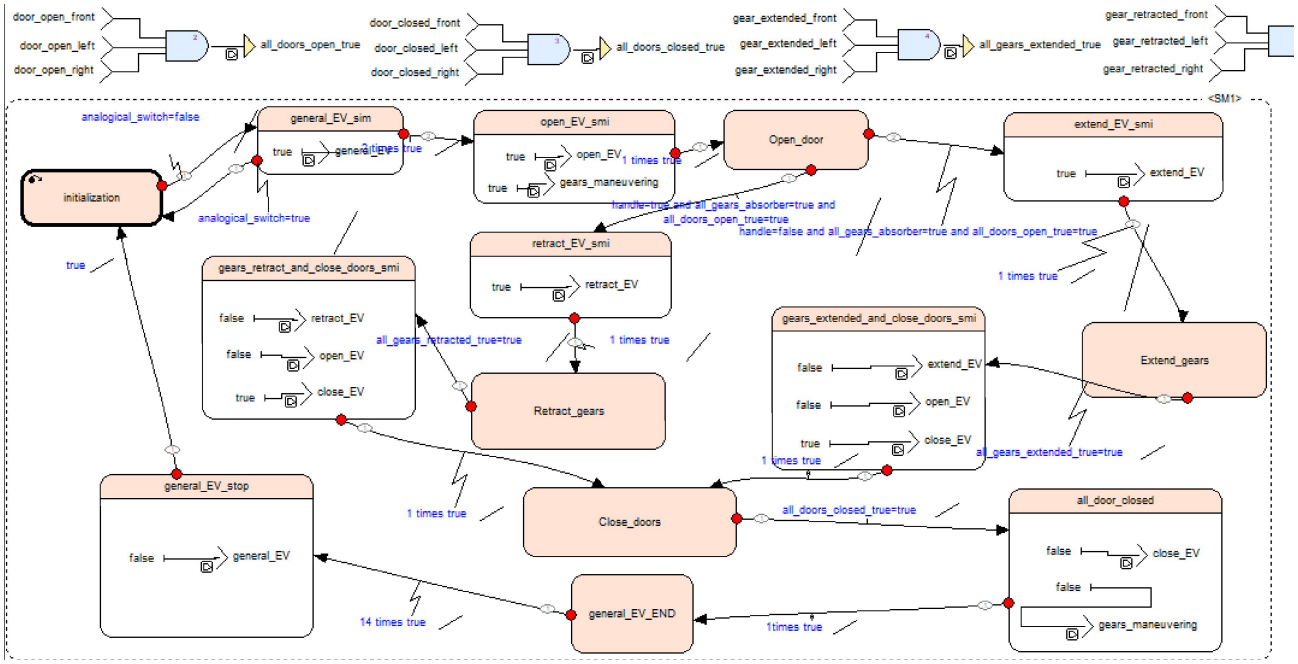

Figure 11: View of Compute_logical_1 (Compute_logical)

Table 64: State Machines of Compute_logical_1

State Machine	Comments and Information
SM1	

Table 65: States of Compute_logical_1

State	Comments and Information
SM1:all_door_closed	
SM1:Close_doors	
SM1:extend_EV_smi	
SM1:Extend_gears	
SM1:gears_extended_and_close_doors_smi	
SM1:gears_retract_and_close_doors_smi	
SM1:general_EV_END	
SM1:general_EV_sim	
SM1:general_EV_stop	
SM1:initialization	
SM1:Open_door	
SM1:open_EV_smi	
SM1:retract_EV_smi	
SM1:Retract_gears	

Table 66: Transitions of Compute_logical_1

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:all_door_closed **Target:** SM1:general_EV_END	1	**Condition:** 1 times true	
Source: SM1:Close_doors	1	**Condition:** all_doors_closed_true = true	

Target: SM1:all_door_closed			
Source: SM1:extend_EV_smi **Target:** SM1:Extend_gears	1	**Condition:** 1 times true	
Source: SM1:Extend_gears **Target:** SM1:gears_extended_and_close_doors_smi	1	**Condition:** all_gears_extended_true = true	
Source: SM1:gears_extended_and_close_doors_smi **Target:** SM1:Close_doors	1	**Condition:** 1 times true	
Source: SM1:gears_retract_and_close_doors_smi **Target:** SM1:Close_doors	1	**Condition:** 1 times true	
Source: SM1:general_EV_END **Target:** SM1:general_EV_stop	1	**Condition:** 14 times true	
Source: SM1:general_EV_sim **Target:** SM1:initialization	1	**Condition:** analogical_switch = true	
Source: SM1:general_EV_sim **Target:** SM1:open_EV_smi	2	**Condition:** 2 times true	
Source: SM1:general_EV_stop **Target:** SM1:initialization	1	**Condition:** true	
Source: SM1:initialization **Target:** SM1:general_EV_sim	1	**Condition:** analogical_switch = false	
Source: SM1:Open_door **Target:** SM1:retract_EV_smi	1	**Condition:** handle = true and all_gears_absorber = true and all_doors_open_true = true	
Source: SM1:Open_door **Target:** SM1:extend_EV_smi	2	**Condition:** handle = false and all_gears_absorber = true and all_doors_open_true = true	
Source: SM1:open_EV_smi **Target:** SM1:Open_door	1	**Condition:** 1 times true	
Source: SM1:retract_EV_smi **Target:** SM1:Retract_gears	1	**Condition:** 1 times true	
Source: SM1:Retract_gears **Target:** SM1:gears_retract_and_close_doors_smi	1	**Condition:** all_gears_retracted_true = true	

3.1.12. Handle_control Operator

Declared as **`public node`**

3.1.12.1. Comments and Information

Handle_control Comments:
This operator is aim to deal with the handle and automatically control the analogical switch.

3.1.12.2. Interface

Table 67: Inputs of Handle_control

Name	Type	Comments and Information
handle	bool	

Table 68: Outputs of Handle_control

Name	Type	Properties		Comments and Information
analogical_switch	bool	default	true	

3.1.12.3. Locals

Table 69: Locals of Handle_control

Name	Type	Properties		Comments and Information
handle_state_changed	bool	default	false	

3.1.12.4. Operator Hierarchy

diagram : Handle_control
state-machine : handle_control
state : Normal
state : Waiting

3.1.12.5. Graphical and Textual Diagrams

3.1.12.5.1. View of Handle_control (Handle_control)

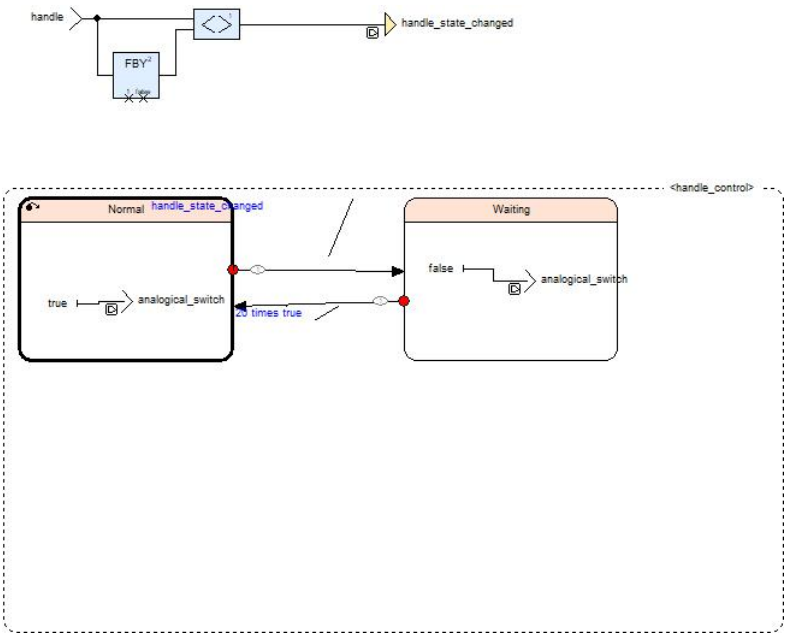

Figure 12: View of Handle_control (Handle_control)

Table 70: State Machines of Handle_control

State Machine	Comments and Information
handle_control	

Table 71: States of Handle_control

State	Comments and Information
handle_control:Normal	
handle_control:Waiting	

Table 72: Transitions of Handle_control

Source/Target	#	Conditions/Actions	Comments and Information
Source: handle_control:Normal **Target:** handle_control:Waiting	1	**Condition:** handle_state_changed	
Source: handle_control:Waiting **Target:** handle_control:Normal	1	**Condition:** 20 times true	

3.1.13. Monitor_system Operator

Declared as **`public node`**

3.1.13.1. Comments and Information

Monitor_system Comments:
This operator is to monitor the state of sensors with the help of computing logical outputs.

3.1.13.2. Interface

Table 73: Inputs of Monitor_system

Name	Type	Comments and Information
door_closed_front	bool	
door_closed_left	bool	
door_closed_right	bool	
door_opened_front	bool	
door_opened_left	bool	
door_opened_right	bool	
gear_extended_front	bool	
gear_extended_left	bool	
gear_extended_right	bool	
gear_retracted_front	bool	
gear_retracted_left	bool	
gear_retracted_right	bool	
circuit_pressurized	bool	
general_EV	bool	
open_EV	bool	
close_EV	bool	
extend_EV	bool	
retract_EV	bool	

Table 74: Outputs of Monitor_system

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	

3.1.13.3. Operator Hierarchy

diagram : Monitor_system_1

3.1.13.4. Graphical and Textual Diagrams

3.1.13.4.1. View of Monitor_system_1 (Monitor_system)

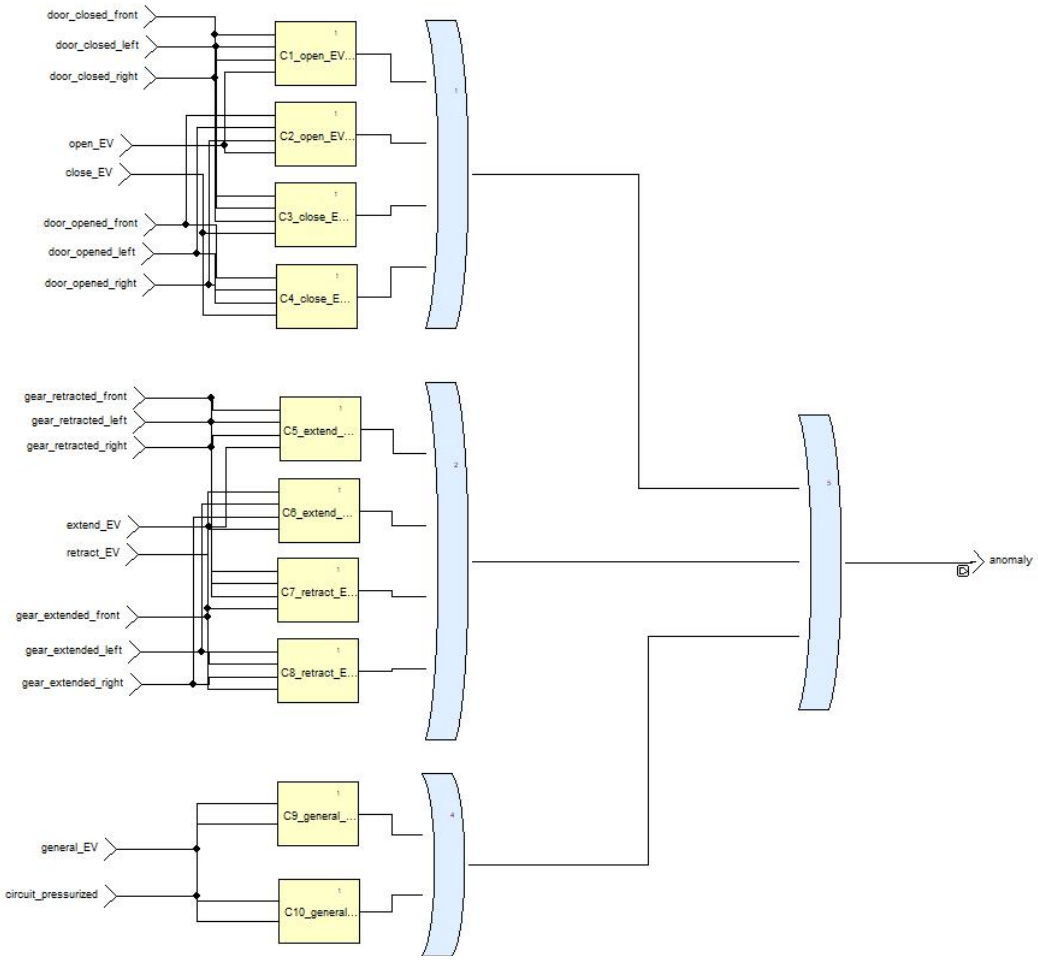

Figure 13: View of Monitor_system_1 (Monitor_system)

3.1.14. Sensor_voter_system Operator

Declared as **`public node`**

3.1.14.1. Comments and Information

Sensor_voter_system Comments:
This operator is the main voter for the sensors. If the sensors have problem, this system will give the anomaly information.

3.1.14.2. Interface

Table 75: Inputs of Sensor_voter_system

Name	Type	Comments and Information
handle_1	bool	
handle_2	bool	
handle_3	bool	
gear_extended_f1	bool	
gear_extended_f2	bool	
gear_extended_f3	bool	
gear_extended_l1	bool	
gear_extended_l2	bool	
gear_extended_l3	bool	
gear_extended_r1	bool	
gear_extended_r2	bool	
gear_extended_r3	bool	
gear_retracted_f1	bool	
gear_retracted_f2	bool	
gear_retracted_f3	bool	
gear_retracted_l1	bool	
gear_retracted_l2	bool	
gear_retracted_l3	bool	
gear_retracted_r1	bool	
gear_retracted_r2	bool	
gear_retracted_r3	bool	
gear_shock_absorber_f1	bool	
gear_shock_absorber_f2	bool	
gear_shock_absorber_f3	bool	
gear_shock_absorber_l1	bool	
gear_shock_absorber_l2	bool	

gear_shock_absorber_l3	bool	
gear_shock_absorber_r1	bool	
gear_shock_absorber_r2	bool	
gear_shock_absorber_r3	bool	
door_closed_f1	bool	
door_closed_f2	bool	
door_closed_f3	bool	
door_closed_l2	bool	
door_closed_l1	bool	
door_closed_l3	bool	
door_closed_r1	bool	
door_closed_r2	bool	
door_closed_r3	bool	
door_open_f1	bool	
door_open_f2	bool	
door_open_f3	bool	
door_open_l1	bool	
door_open_l2	bool	
door_open_l3	bool	
door_open_r1	bool	
door_open_r2	bool	
door_open_r3	bool	
circuit_pressurized_1	bool	
circuit_pressurized_2	bool	
circuit_pressurized_3	bool	

Table 76: Outputs of Sensor_voter_system

Name	Type	Properties		Comments and Information
door_closed_front	bool			
door_closed_left	bool			
door_closed_right	bool			
door_opened_front	bool			
door_opened_left	bool			
door_opened_right	bool			
gear_extended_front	bool			
gear_extended_left	bool			
gear_extended_right	bool			
gear_retracted_front	bool			
gear_retracted_left	bool			
gear_retracted_right	bool			
gear_shock_absorber_front	bool			
gear_shock_absorber_left	bool			
gear_shock_absorber_right	bool			
handle	bool			
circuit_pressurized	bool			
anomaly	bool	default	false	

3.1.14.3. Operator Hierarchy

diagram : Sensor_voter_system_1

3.1.14.4. Graphical and Textual Diagrams

3.1.14.4.1. View of Sensor_voter_system_1 (Sensor_voter_system)

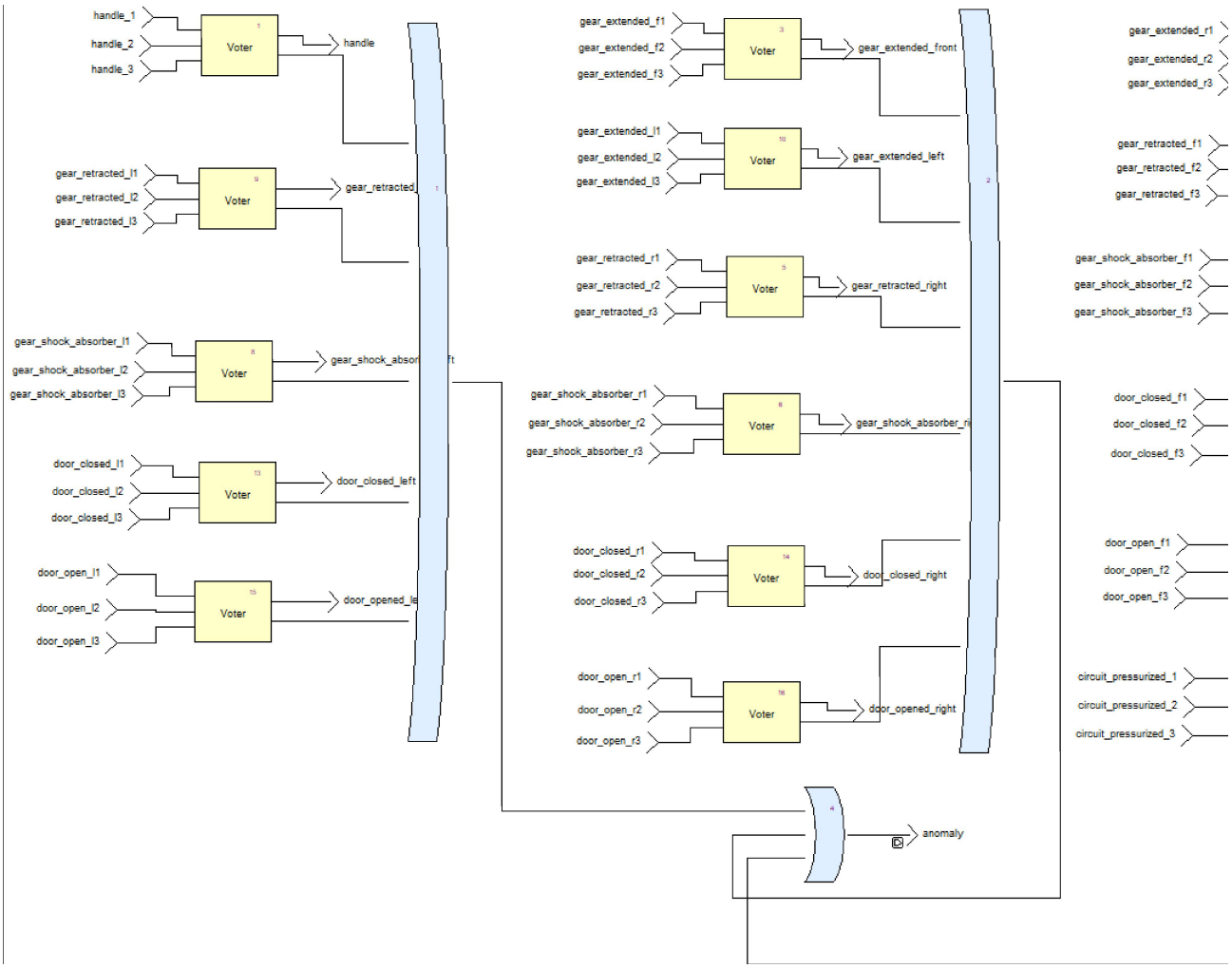

Figure 14: View of Sensor_voter_system_1 (Sensor_voter_system)

3.1.15. System Operator

Declared as **`public node`**

3.1.15.1. Comments and Information

System Comments:
Ths main system which contains all information of sensors and other auxiliary sub-systems.

3.1.15.2. Interface

Table 77: Inputs of System

Name	Type	Comments and Information
handle_1	bool	
handle_2	bool	
handle_3	bool	
gear_extended_f1	bool	
gear_extended_f2	bool	
gear_extended_f3	bool	
gear_extended_l1	bool	
gear_extended_l2	bool	
gear_extended_l3	bool	
gear_extended_r1	bool	
gear_extended_r2	bool	
gear_extended_r3	bool	
gear_retracted_f1	bool	
gear_retracted_f2	bool	
gear_retracted_f3	bool	
gear_retracted_l1	bool	
gear_retracted_l2	bool	
gear_retracted_l3	bool	
gear_retracted_r1	bool	
gear_retracted_r2	bool	
gear_retracted_r3	bool	
gear_shock_absorber_f1	bool	
gear_shock_absorber_f2	bool	
gear_shock_absorber_f3	bool	
gear_shock_absorber_l1	bool	
gear_shock_absorber_l2	bool	
gear_shock_absorber_l3	bool	

gear_shock_absorber_r1	bool	
gear_shock_absorber_r2	bool	
gear_shock_absorber_r3	bool	
door_closed_f1	bool	
door_closed_f2	bool	
door_closed_f3	bool	
door_closed_l2	bool	
door_closed_l1	bool	
door_closed_l3	bool	
door_closed_r1	bool	
door_closed_r2	bool	
door_closed_r3	bool	
door_open_f1	bool	
door_open_f2	bool	
door_open_f3	bool	
door_open_l1	bool	
door_open_l2	bool	
door_open_l3	bool	
door_open_r1	bool	
door_open_r2	bool	
door_open_r3	bool	
circuit_pressurized_1	bool	
circuit_pressurized_2	bool	
circuit_pressurized_3	bool	

Table 78: Outputs of System

Name	Type	Properties		Comments and Information
anomaly	bool	default	false	
gear_locked_down	bool	default	false	
gears_maneuvering	bool	default	false	

3.1.15.3. Operator Hierarchy

diagram : System_1

3.1.15.4. Graphical and Textual Diagrams

3.1.15.4.1. View of System_1 (System)

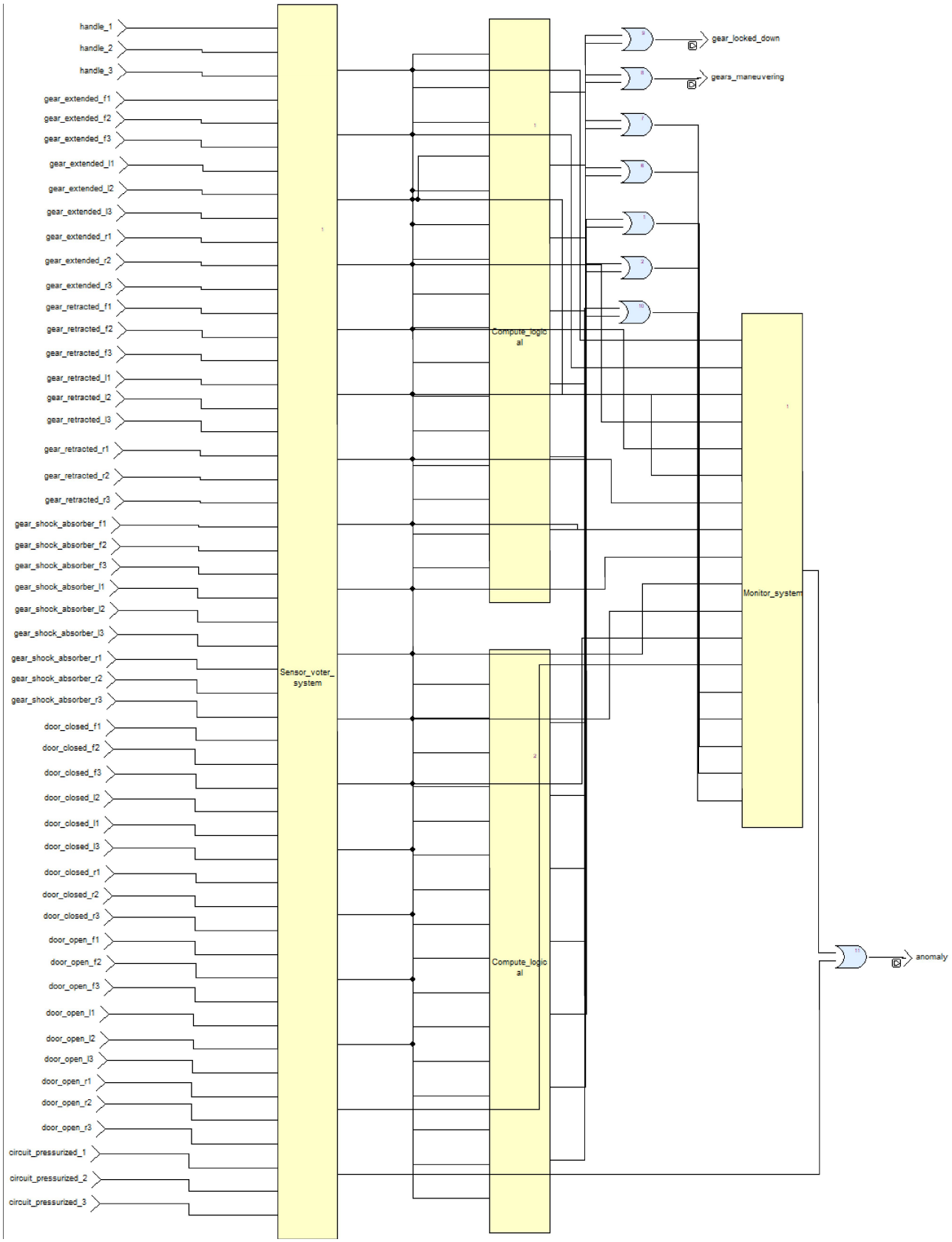

Figure 15: View of System_1 (System)

3.1.16. Voter Operator

Declared as **`public node`**

3.1.16.1. Comments and Information

Voter Comments:
This operator is a voter system in order to judge the state of sensor and delete the damaged sensor.

3.1.16.2. Interface

Table 79: Inputs of Voter

Name	Type	Comments and Information
sensor_3	bool	
sensor_2	bool	
sensor_1	bool	

Table 80: Outputs of Voter

Name	Type	Properties		Comments and Information
output	bool			
error	bool	default	false	

3.1.16.3. Operator Hierarchy

diagram : Voter_1
state-machine : SM1
state : State1
state : State2
state : State3
state : State4
state : State5

3.1.16.4. Graphical and Textual Diagrams

3.1.16.4.1. View of Voter_1 (Voter)

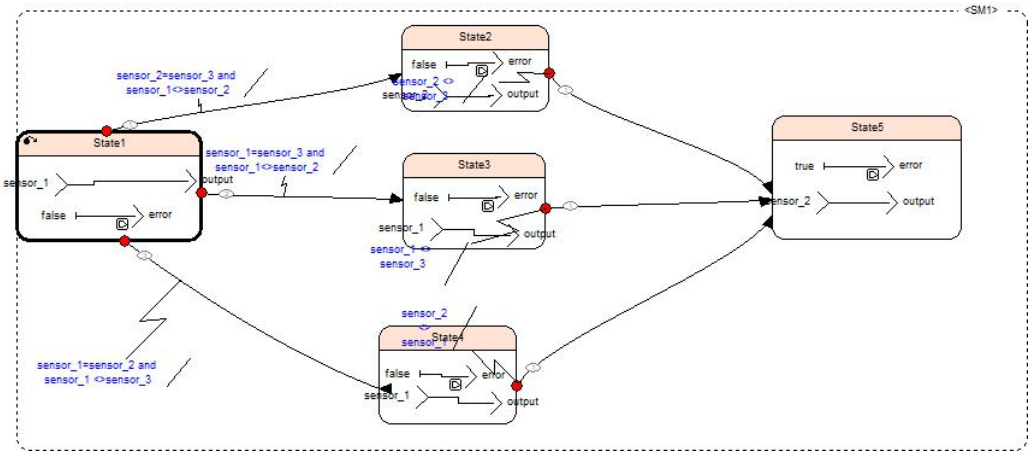

Figure 16: View of Voter_1 (Voter)

Table 81: State Machines of Voter_1

State Machine	Comments and Information
SM1	

Table 82: States of Voter_1

State	Comments and Information
SM1:State1	
SM1:State2	
SM1:State3	
SM1:State4	
SM1:State5	

Table 83: Transitions of Voter_1

Source/Target	#	Conditions/Actions	Comments and Information
Source: SM1:State1 **Target:** SM1:State2	1	**Condition:** sensor_2 = sensor_3 and sensor_1 <> sensor_2	
Source: SM1:State1 **Target:** SM1:State3	2	**Condition:** sensor_1 = sensor_3 and sensor_1 <> sensor_2	
Source: SM1:State1 **Target:** SM1:State4	3	**Condition:** sensor_1 = sensor_2 and sensor_1 <> sensor_3	
Source: SM1:State2 **Target:** SM1:State5	1	**Condition:** sensor_2 <> sensor_3	
Source: SM1:State3 **Target:** SM1:State5	1	**Condition:** sensor_1 <> sensor_3	
Source: SM1:State4 **Target:** SM1:State5	1	**Condition:** sensor_2 <> sensor_1	

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