

# Digital Design Project

## Aircraft Engine Overheat Detection and Intervention

### Description

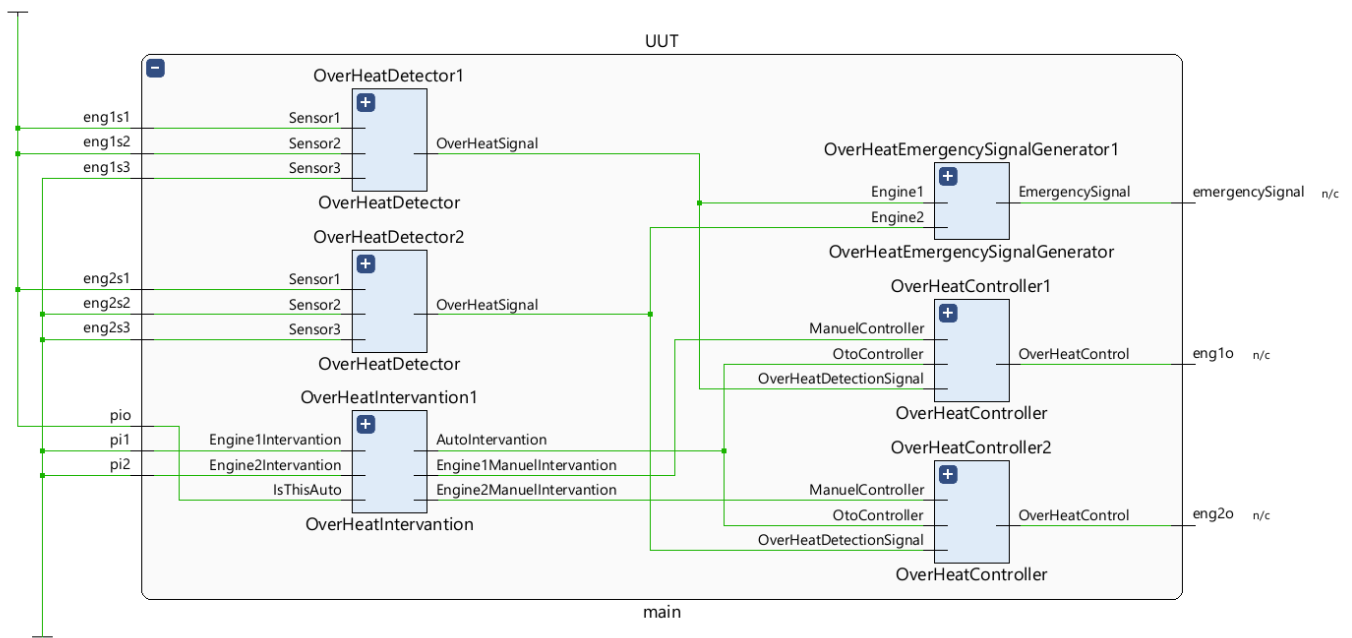
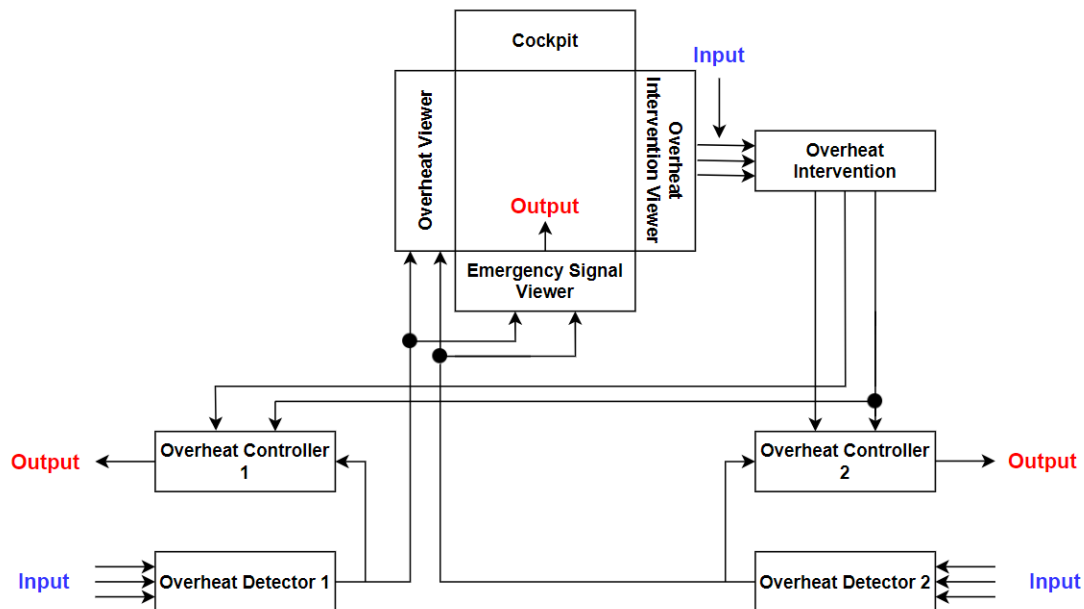
Every type of Aircraft have protection system for undesired conditions. One of them is Overheat in Engines. Unfortunately, at some condition, engine start to heat over than usual. If critical point was crossed, some Compressor, Combustion Chamber and Turbine are damaged that unfixable. Then, the airplane suffers permanent loss of performance. For this reason, Aircrafts have overheating protection.

### How it Work?

We have 2 engine and every ones have 3 discrete sensor. We assume that if at least 2 of the sensor gives high signal, that means overheat occurring. Intervention has 2 different types: Manuel and Auto. This is decided by pilot. If pilot select auto intervention, he/she don't need intervention by him/herself. But, if pilot select manuel intervention, When he/she hears the warning signal, he/she have to press the interention buttons.

### Block Diagram and Explanation

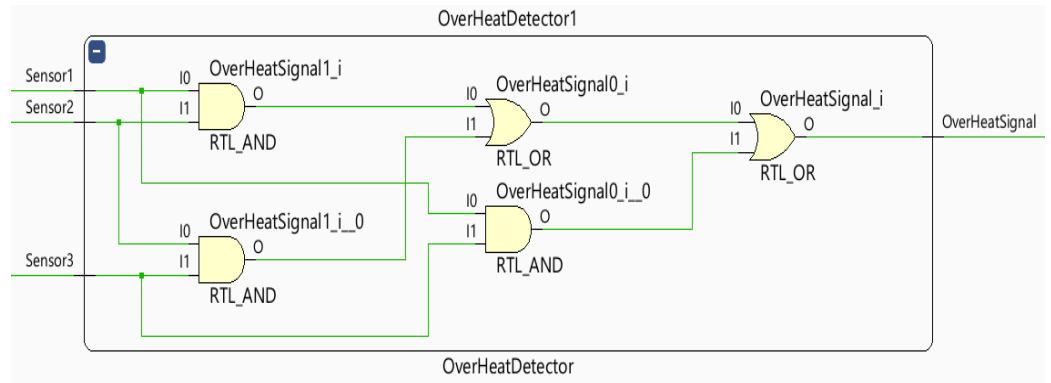
Seen below, There are 3 input and 3 output part. The lowest part, inputs represent the engine sensor inputs. Outputs represent Our control system that can be balance the heat of both of engines. Above part, inputs represent the pilot intervention by using control buttons and Output represent warning signal.



## Inner Structure and Truth table of Integrated Logic Circuits

### 1.Overheat Detector

Truth Table			
X1	X2	X3	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

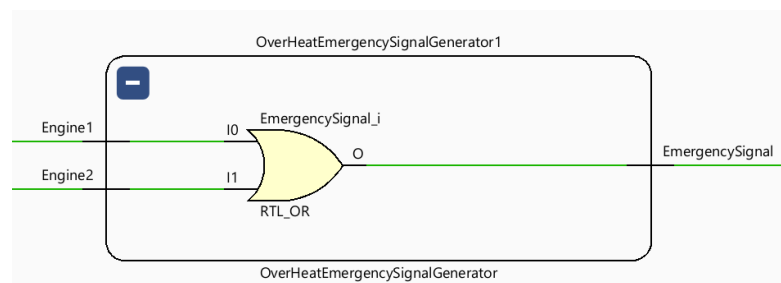


X1 , X2 and X3 represent the value of our sensors.As I mention above, we need at least 2 of them should be high for generating output signal.

$$Y = X1 . X2 + X2 . X3 + X3 . X1$$

### 2.Emergency Signal Viewer/Generator

Truth Table		
X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	1

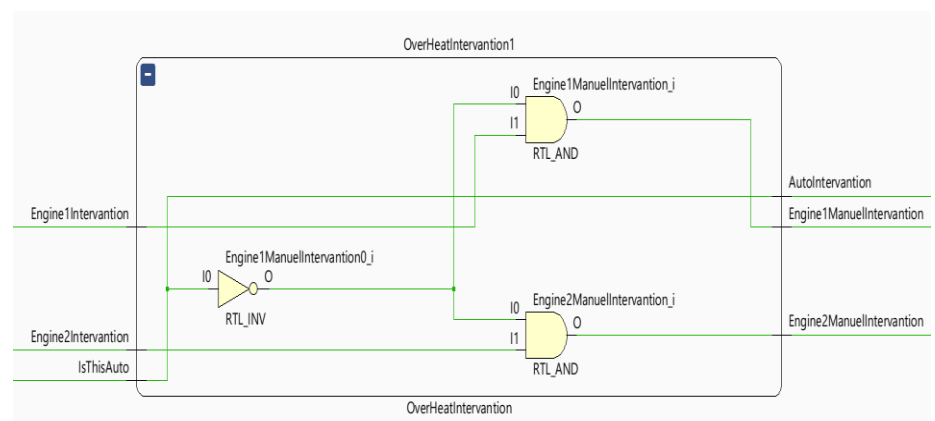


X1 and X2 represent the value of output of overheat detector.This signal generated for give warning signal to pilot.

$$Y = X1 + X2$$

### 3.Overheat Intervention

Truth Table					
X1	X2	A1	Y1	Y2	A2
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	1	0
0	1	1	0	0	1
1	0	0	1	0	0
1	0	1	0	0	1
1	1	0	1	1	0
1	1	1	0	0	1



X1 and X2 and A1 represent the value that set by pilot.X1 and X2 turns on the overheat control unit by manually.

A1 is represent the Is This system work manually or automatically ? If its low, system work manuel and X1 and X2 values directly transmit to overheat controller, but if its high, X1 and X2 is not transmit, because of pilot select the auto invervention.And system decide itself to turn on or off the controller system.

Y1 and Y2 represent the if A1 selected manuel , which controller turns on , but if A1 selected auto mod, our signal does not transmit, so Y1 and Y2 will be off. Lastly, A2 is bypass line for transmit auto data to overheat controller.

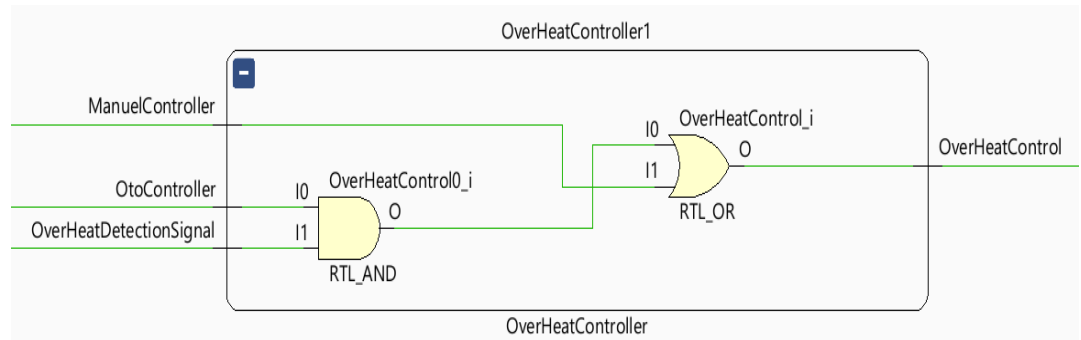
$$A2 = A1$$

$$Y1 = !(A1) . X1$$

$$Y2 = !(A2) . X2$$

#### 4.Overheat Controller

Truth Table			
X1	X2	X2	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1



X1 , X2 and X3 represent Manuel Controller,OtoConrtoller and OverHeatDetectionSignal respectively. 2 different signal transmitted from Intervention to Controller.One of them ManuelController another one is OtoController. If Intervention system send us manuel signal, its directly transmit to output because of or gate behave like bypass.But, if Oto control signal comes, we dont deal with manuel signal and look at overheat detector output signal. But, when look at firstly, seen there is a problem.Because if Manuel and Oto signal comes same time, that's mean System not check overheat output and directly transmit manuel control signal.But, in the intervention module, if the pilot activates the auto option, the manual values will not be transmitted , so the output signals will automatically be zero.For this reason, these possibilities have already been erased and that's why it' colored red.In short, signals in this combination cannot be input to this system.

$$Y = X1 \mid (X2 \& X3)$$

#### Example Scenario

Scenario 1				
	Engine 1	Engine 2		Pilot
Sensor1	1	0	Auto	1
Sensor2	1	1	Engine 1	0
Sensor3	0	0	Engine 2	1

Clearly seen above, Engine 1 is overheat but Engine 2 is not.Then,Pilot select auto but also select intervention to engine 2. Result show us Overheat Controller 1 is active but Controller 2 is deactive despite Pilot select intervantion manually to Engine 1.Because system does not allow this situation.

left_engine_s1	1
left_engine_s2	1
left_engine_s3	0
right_engine_s1	0
right_engine_s2	1
right_engine_s3	0
pilot_int_1	0
pilot_int_2	1
pilot_int_auto	1
overheat_control_1	1
overheat_control_2	0
emergencySignal	1

End of the report.

Student Information;

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