ECU1 Dynamic Design

Draw a state machine diagram for each ECU component

There are mainly three ECU components: Light Switch and door sensor, speed sensor. The light switch and door sensor have the same debouncing state machine, so they inherit it from the switch state machine.

The switch state machine

The idea of the state machine is to double check the switch to make sure that's pressed/released.

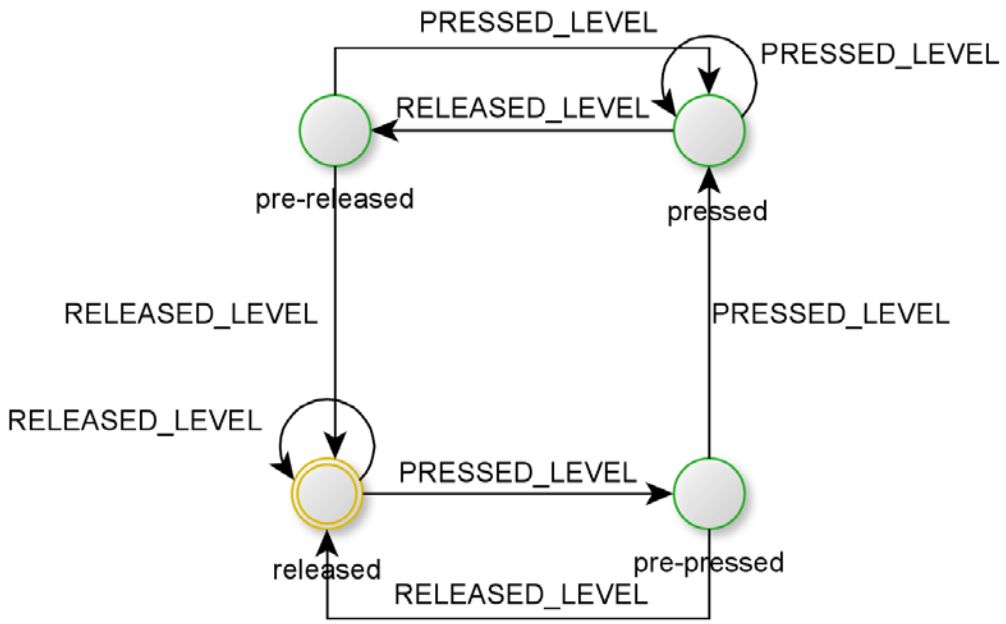

Figure 1 Switch state machine

The speedometer

Finding the period can be done by calculating the time between two rising edges. Each rising edge is an internal state machine at its own.

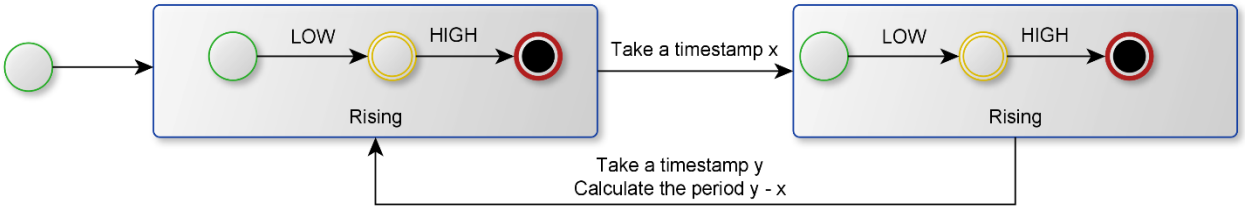

Figure 2 The Speedometer Time measurement State Machine

Draw a state machine diagram for the ECU operation

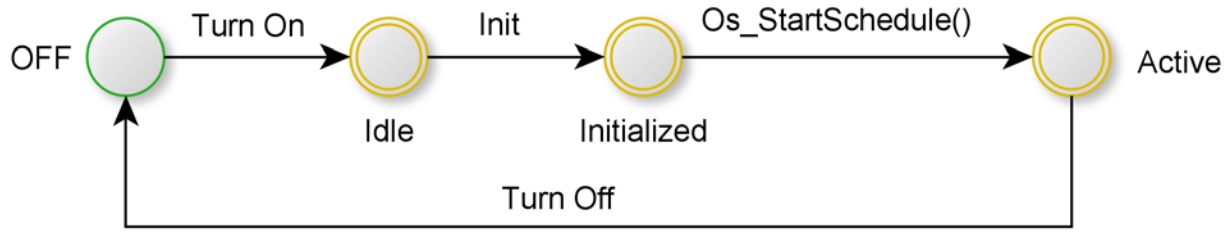

Figure 3 ECU1 State Machine

Draw the sequence diagram for the ECU

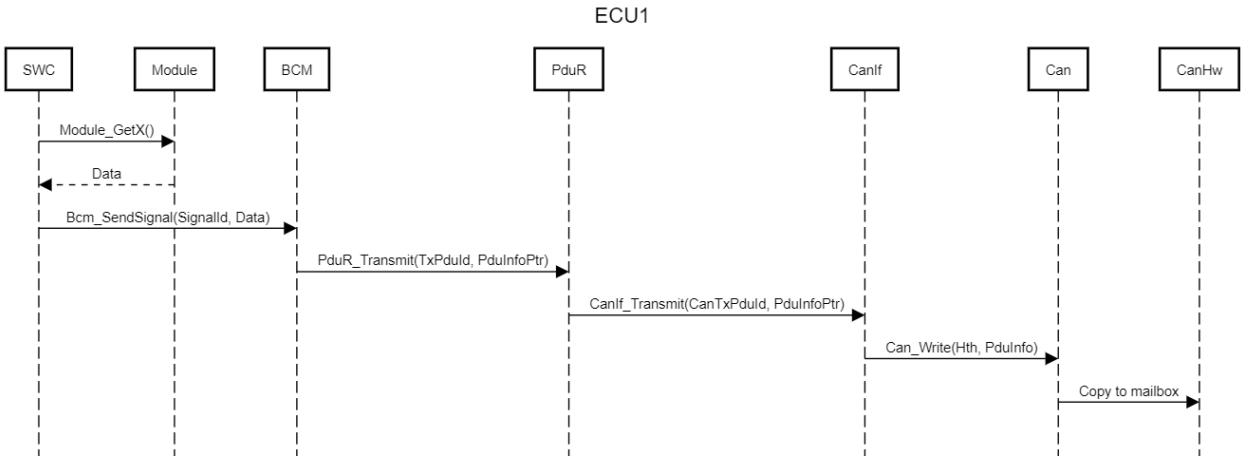

Figure 4: Sequence Diagram for ECU1

Calculate CPU load for the ECU

The following table contains the execution time for non-IO tasks. The execution time is to be assumed.

Task	Execution time in ms	Period in ms
Speedometer_Update()	2	10
DoorStatus_Update()	1	10
LightStatus_Update()	1	20
SpeedStatus_Update()	1	5

The CPU load:

$$\sum_{i=1}^{n=4} \frac{e_i}{p_i} = \frac{2}{10} + \frac{1}{10} + \frac{1}{20} + \frac{1}{5} = 0.55$$

ECU2 Dynamic Design

Draw a state machine diagram for each ECU component

There are mainly two ECU components: Light and buzzer controllers.

The light controller state machine

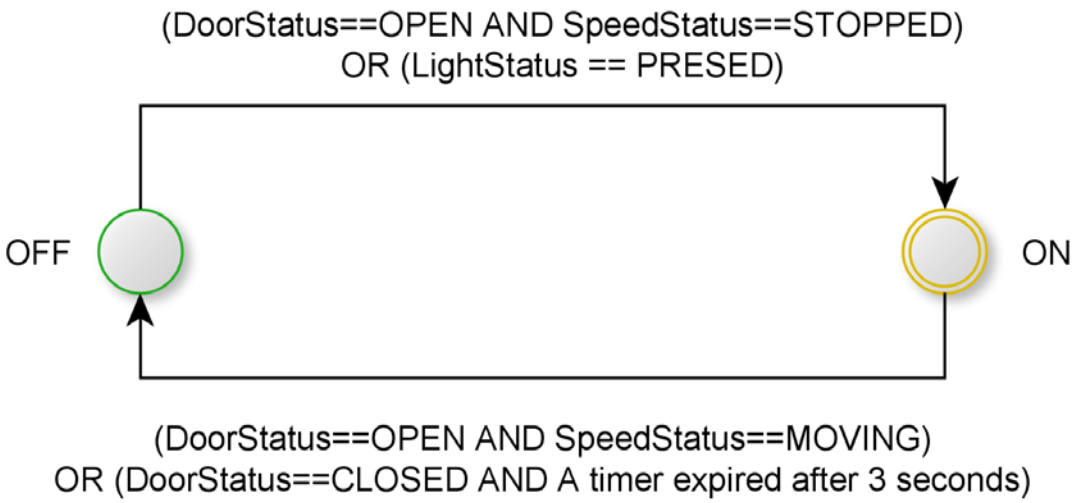

Figure 5 Light controller state machine

The Buzzer Controller state machine

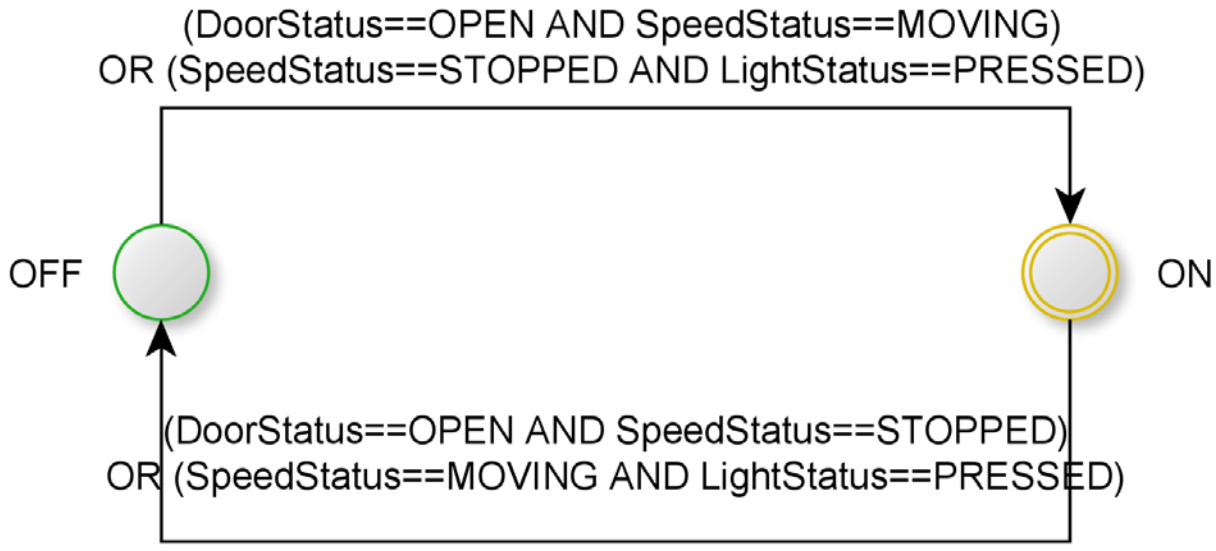

Figure 6 Buzzer State Machine

Draw a state machine diagram for the ECU operation

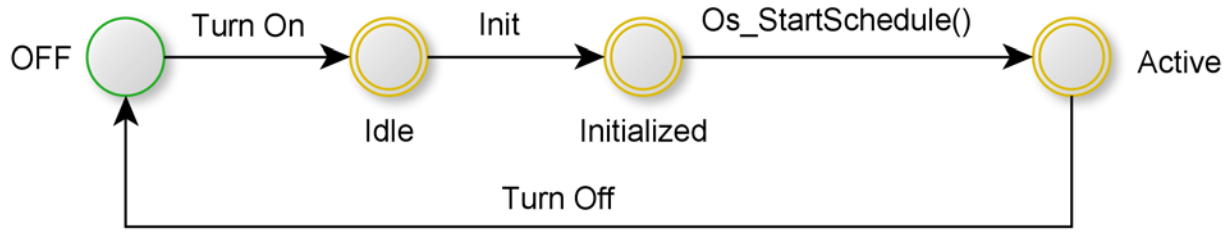

Figure 7 ECU2 State Machine

Draw the sequence diagram for the ECU

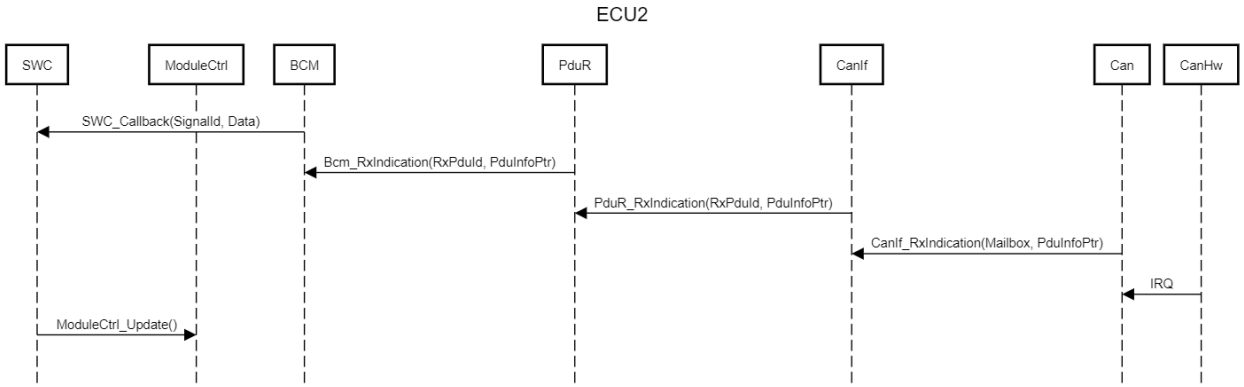

Figure 8: Sequence Diagram for ECU2

Calculate CPU load for the ECU

The following table contains the execution time for non-IO tasks. The execution time is to be assumed.

Task	Execution time in ms	Period in ms
BuzzerCtrl_Update()	1	10
LightCtrl_Update()	1	10

The CPU load:

$$\sum_{i=1}^{n=4} \frac{e_i}{p_i} = \frac{1}{10} + \frac{1}{10} = 0.2$$