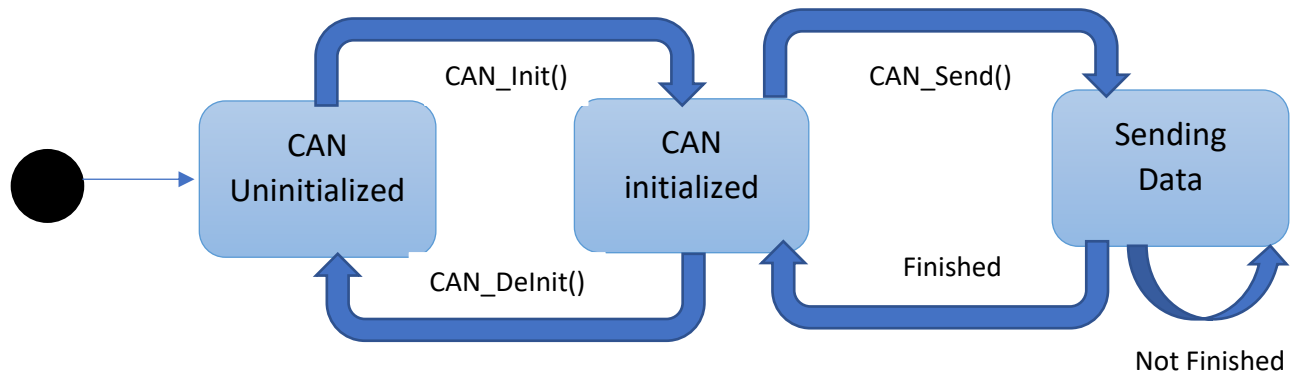


Dynamic Design

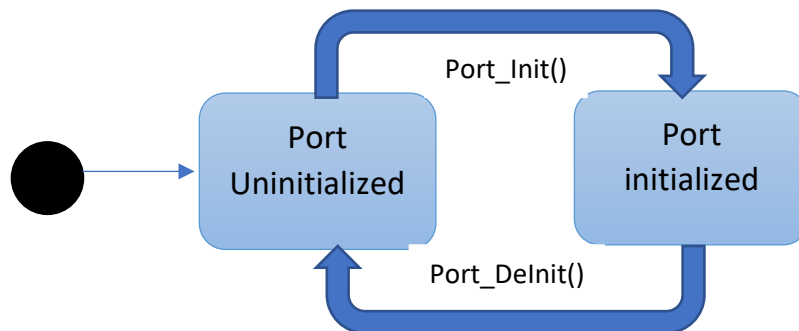
ECU 1

1- State Machine Diagram for Each ECU Component

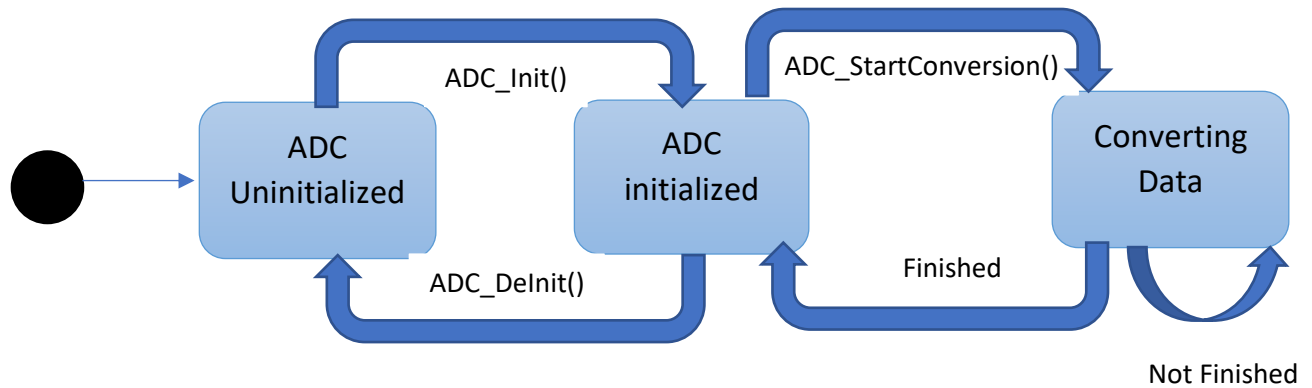
1.1- CAN



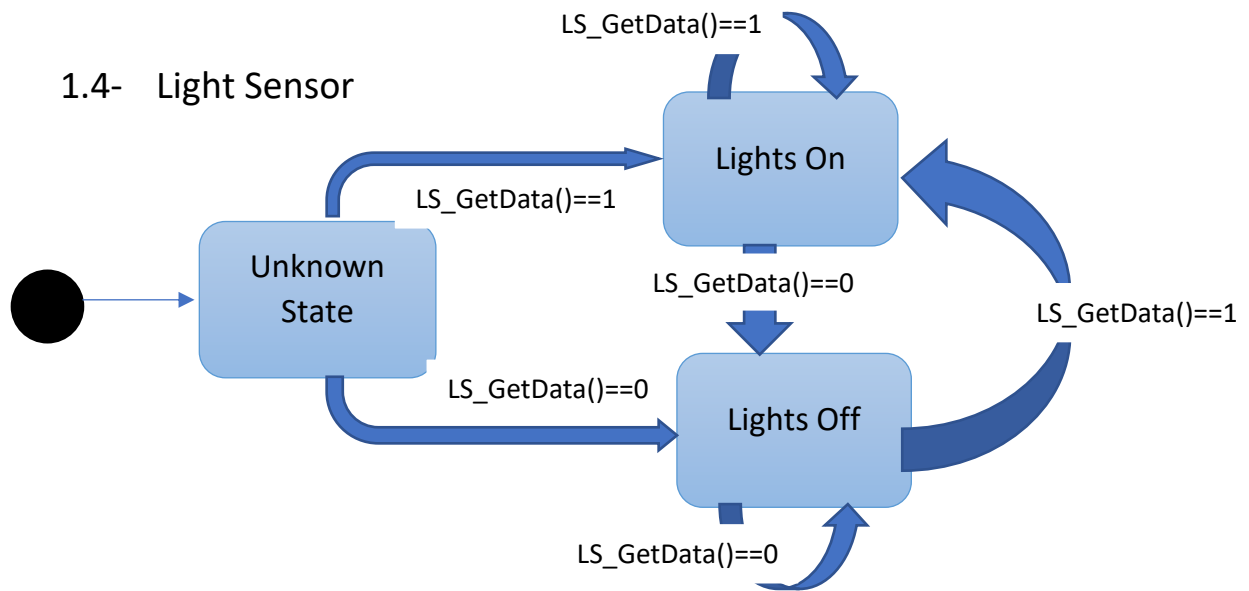
1.2- Port



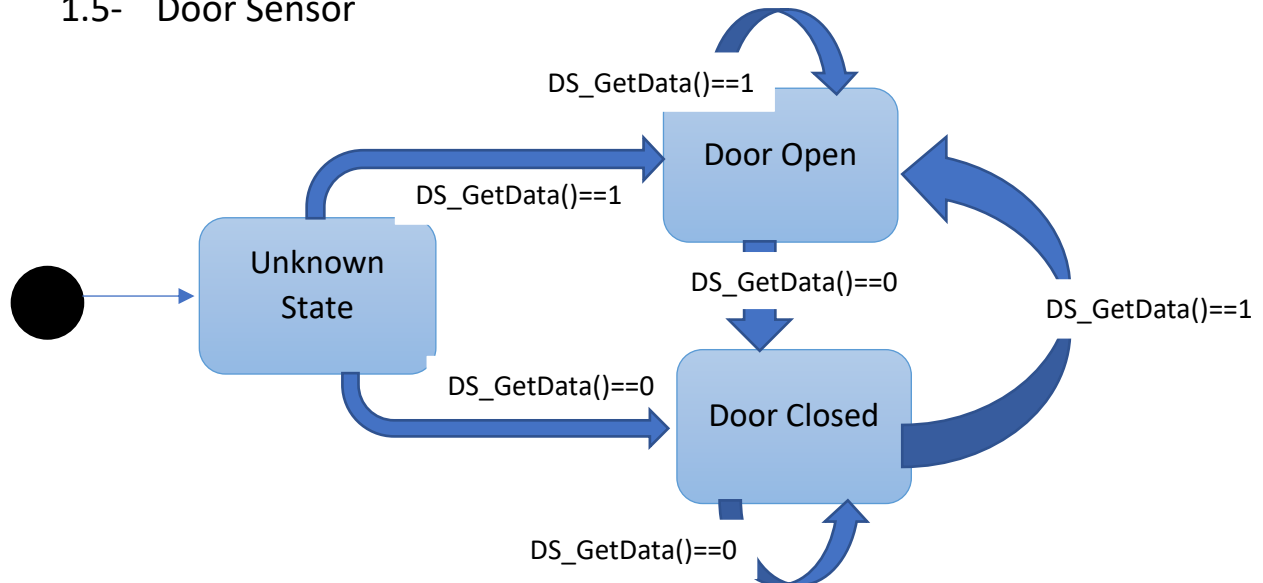
1.3- ADC



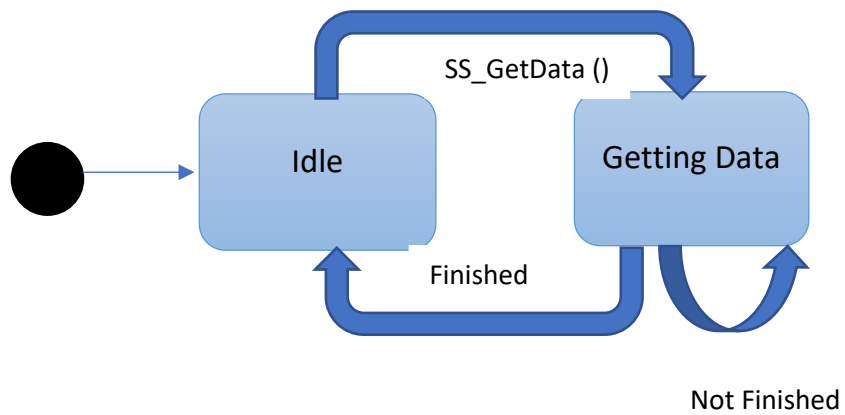
1.4- Light Sensor



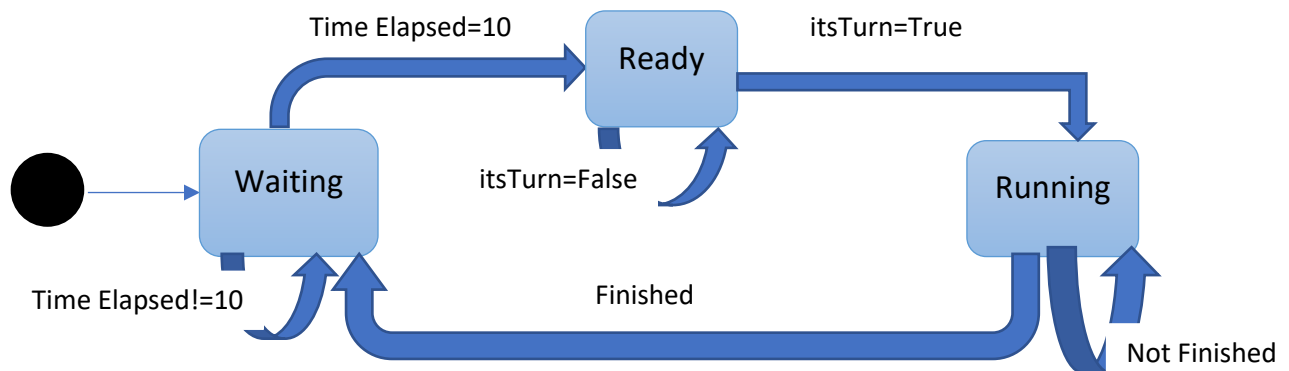
1.5- Door Sensor



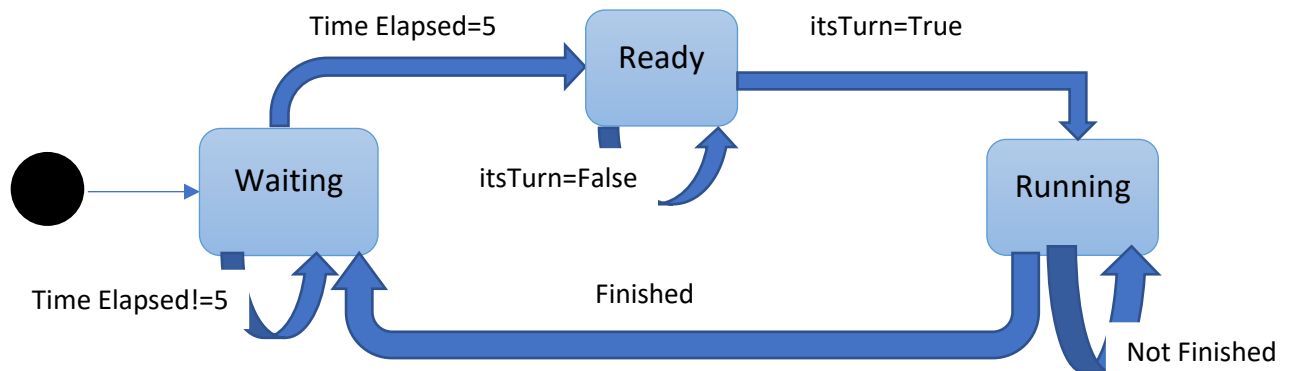
1.6- Speed Sensor



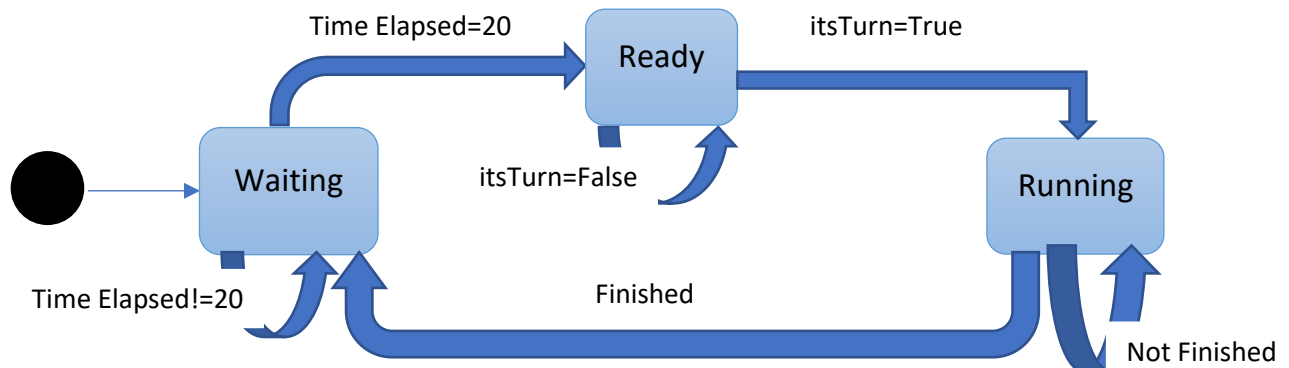
1.7- Door State Task



1.8- Speed State Task



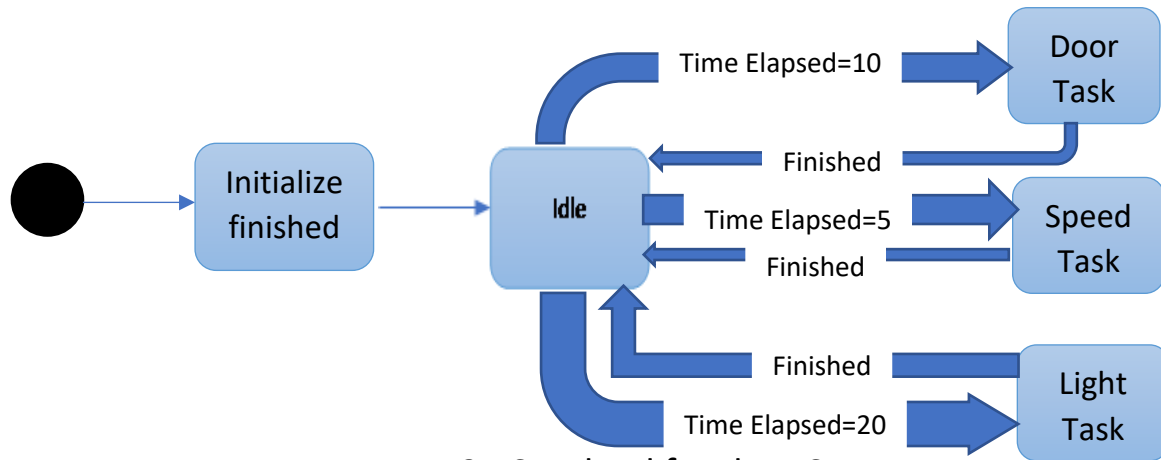
1.9- Light Task



Important Note:

Communication Manager, Handler and DIO modules are NOT finite state machines as they don't hold any internal data that affects their behavior.

2- State Machine Diagram for The ECU Operation

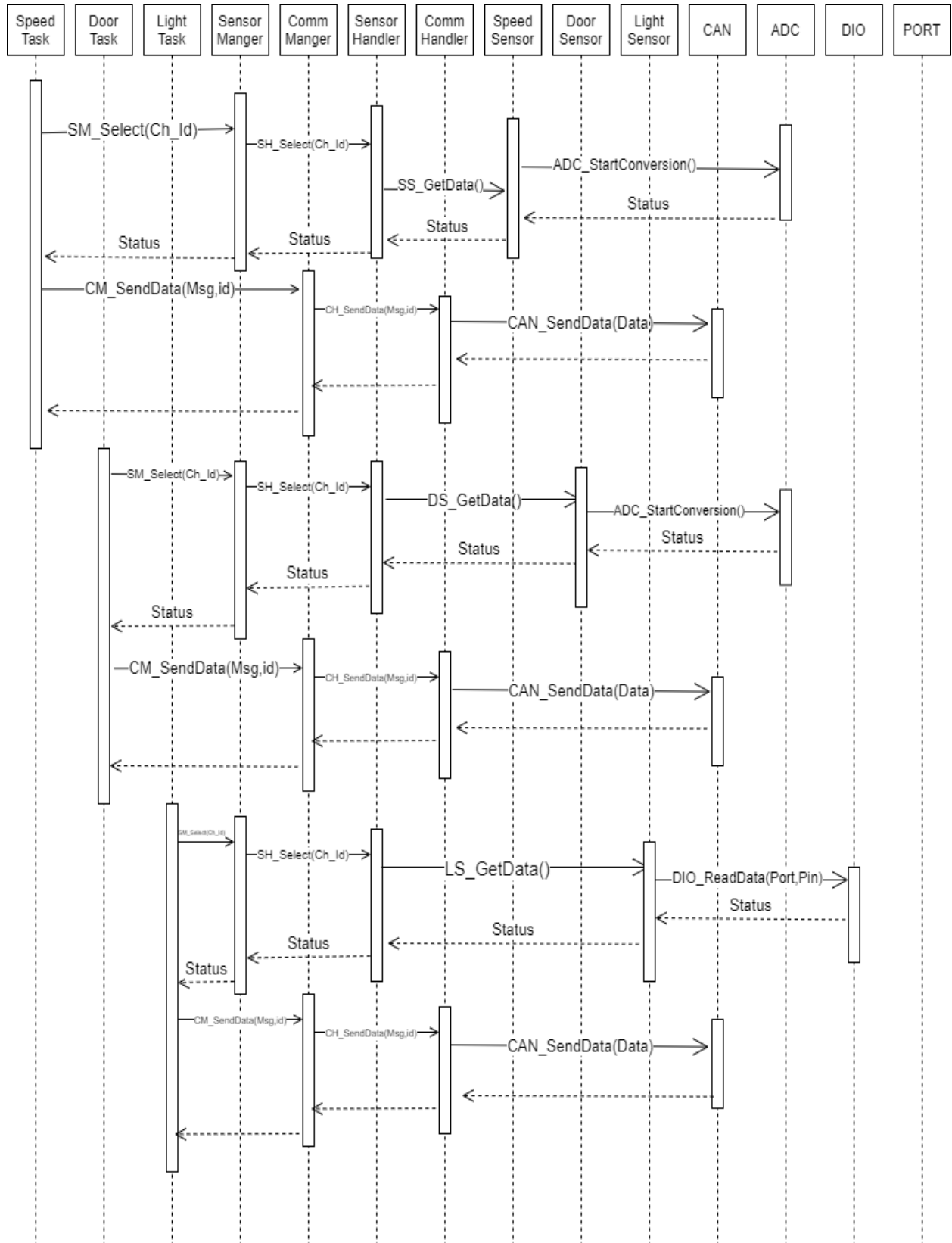


3- CPU load for the ECU:

Assume That the Tasks Execution Time Are equal and = 1ms

$$U = \frac{E_1 + E_2 + E_3}{H} = \frac{1 * 1 + 1 * 2 + 1 * 4}{20} * 100 = 35\%$$

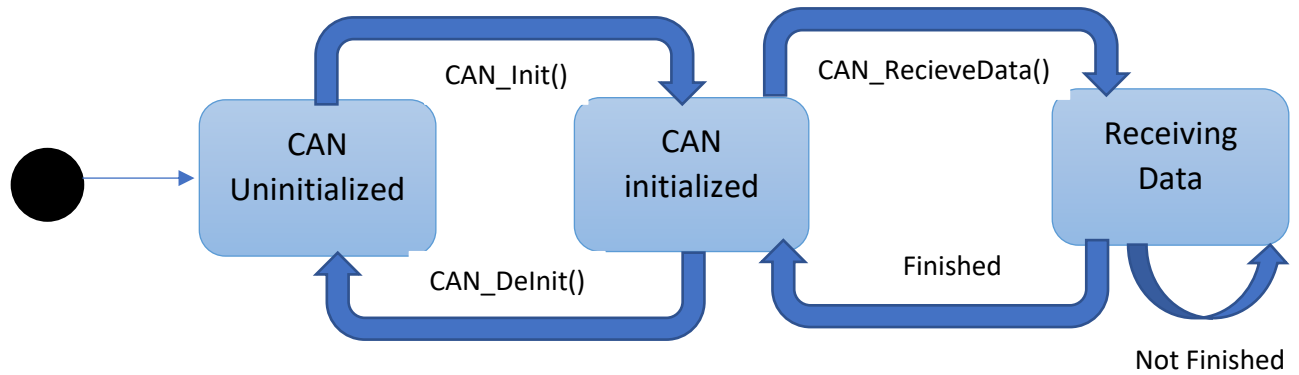
4- The Sequence Diagram for the ECU



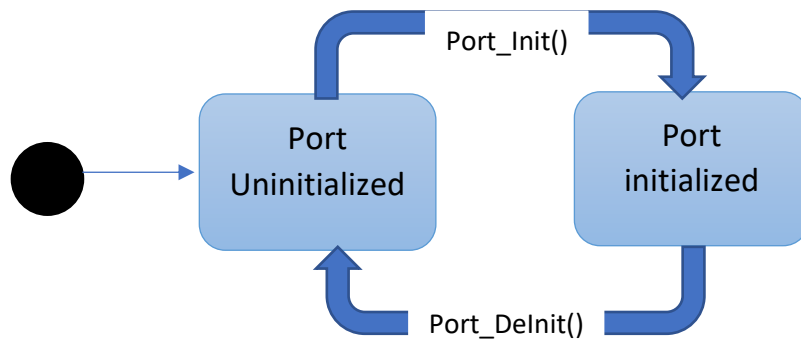
ECU2

1- State Machine Diagram for Each ECU Component

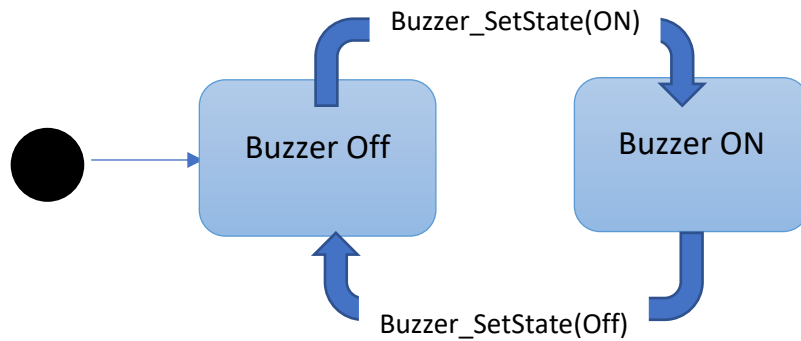
1.1. CAN



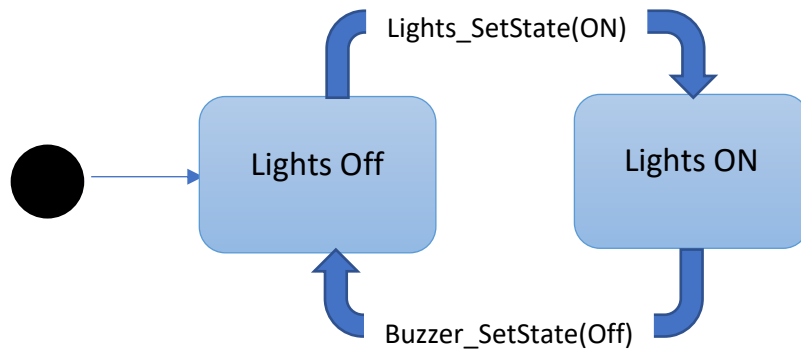
1.2. Port



1.3. Buzzer



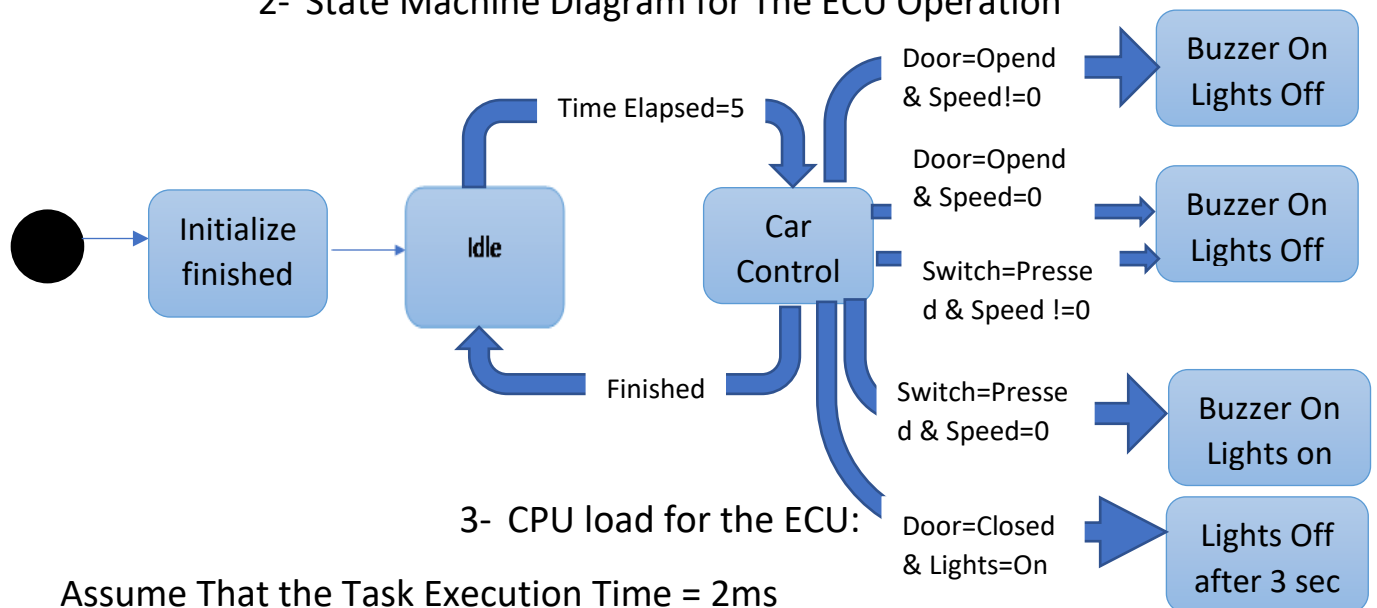
1.4. Lights



Important Note:

Communication Manager, Handler and DIO modules are NOT finite state machines as they don't hold any internal data that affects their behavior.

2- State Machine Diagram for The ECU Operation



3- CPU load for the ECU:

Assume That the Task Execution Time = 2ms

$$U = \frac{E_1}{H} = \frac{2 * 1}{5} * 100 = 40\%$$

For Bus Load: Assume: Frame = 32 bit & bitrate =50 kb/s

$$\text{So: } t_{\text{frame}} = \text{Frame} * \frac{1}{\text{bitrate}} = 32b * \frac{1}{50000} = 640\mu s$$

$$\# \text{ of } \frac{\text{Frames}}{\text{second}} = \frac{1000}{5} + \frac{1000}{10} + \frac{1000}{20} = 350f/s \text{ so,}$$

$$\text{BusLoad} = 350 * 640\mu s * 100 = 22.4\%$$

4- The Sequence Diagram for the ECU

