Automotive door control system design

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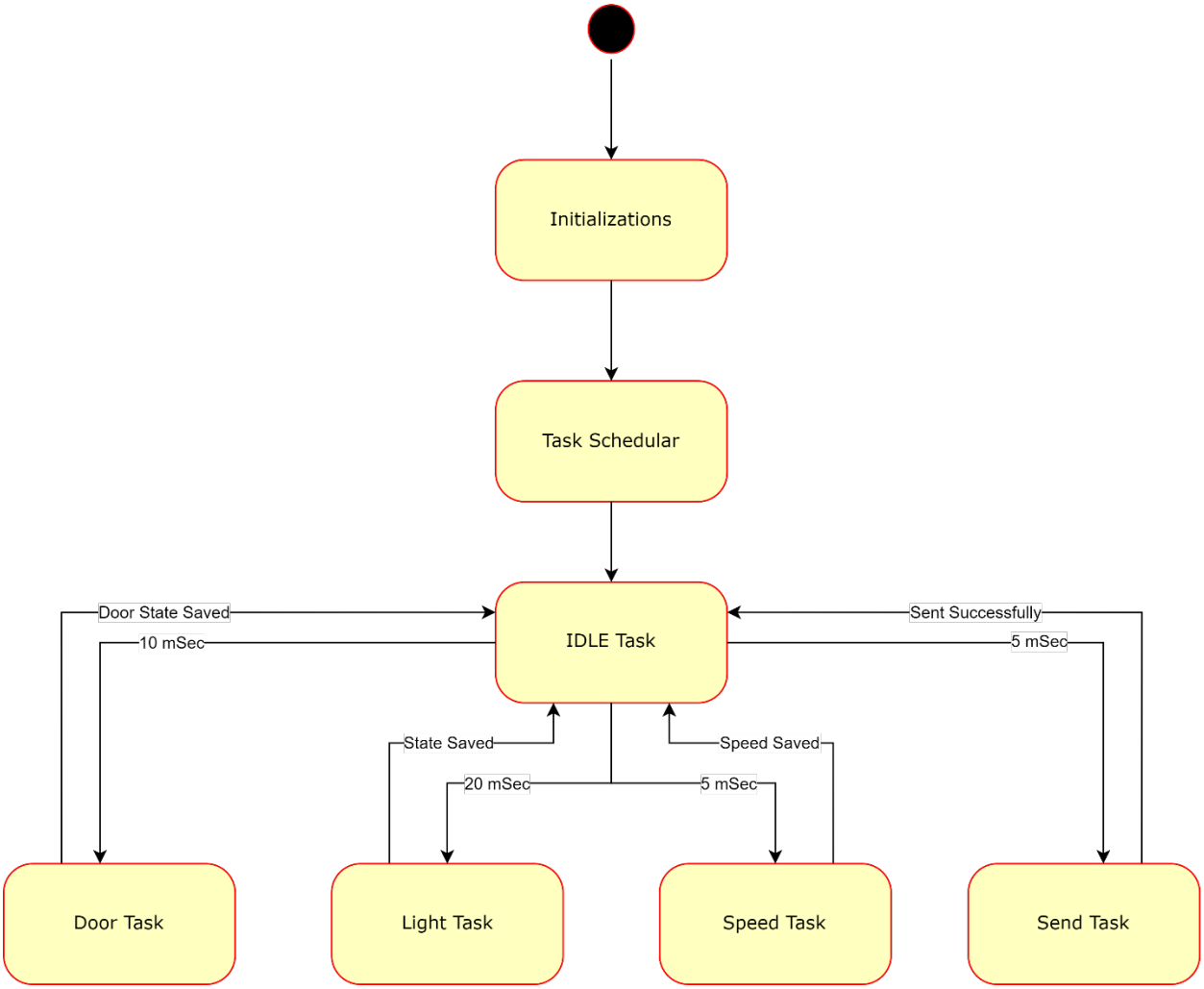
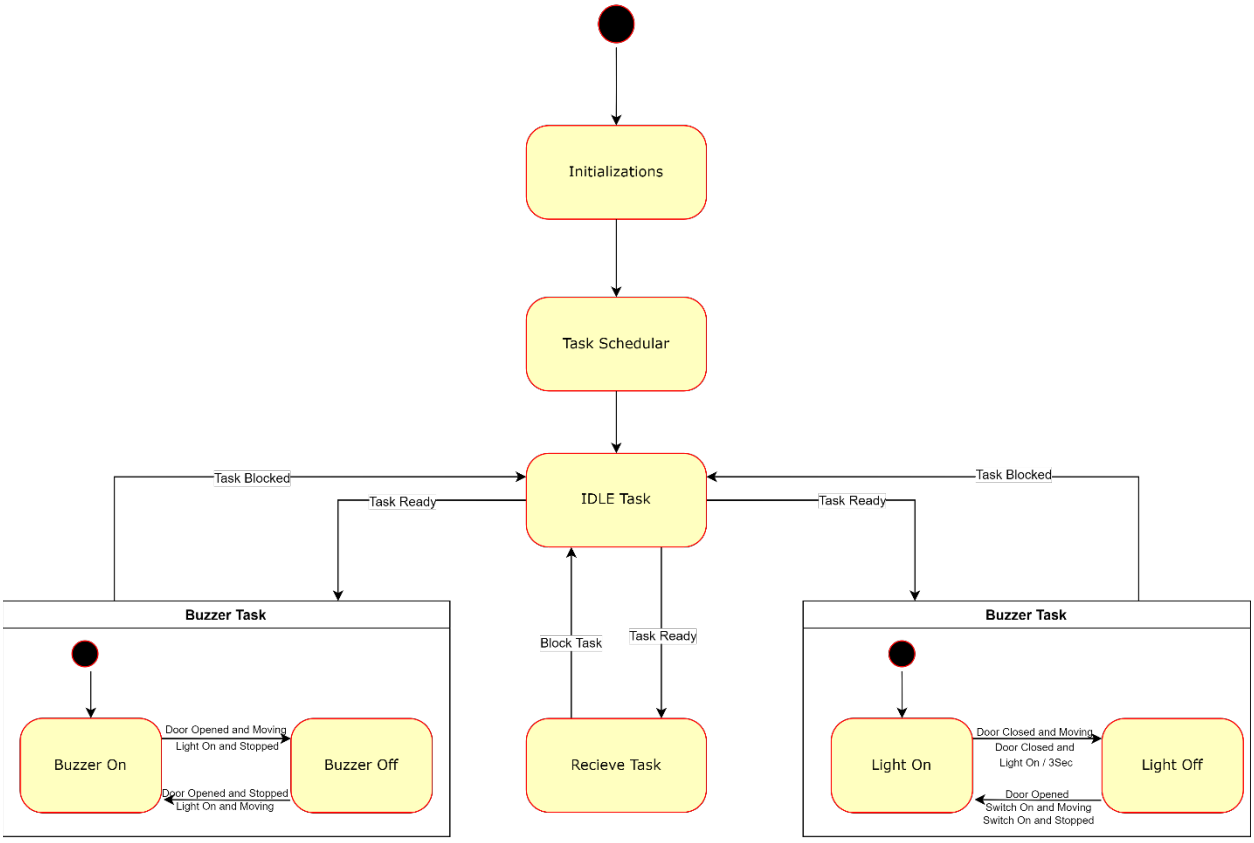
ECU 1 State Machine Diagram



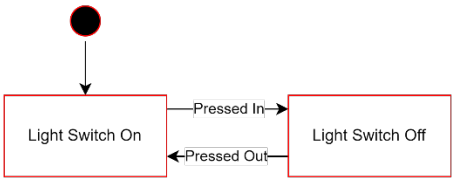
ECU 2 State Machine Diagram



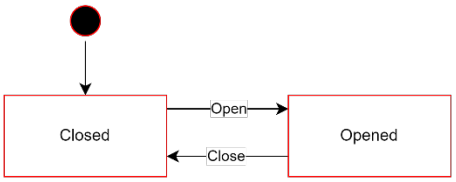
ECU Components State Machine Diagram

ECU 1

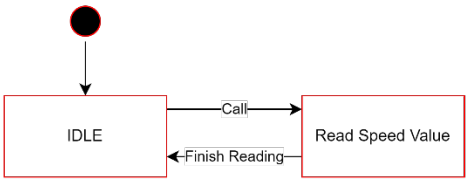
Light Switch



Door Sensor

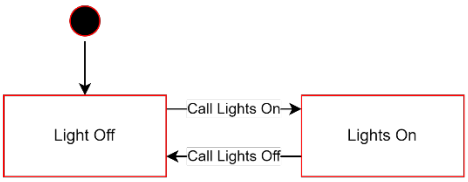


Speed Sensor

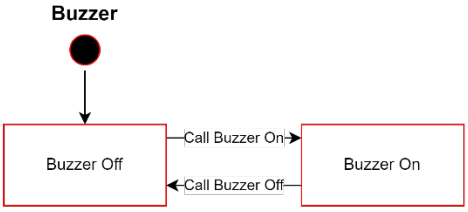


ECU 2

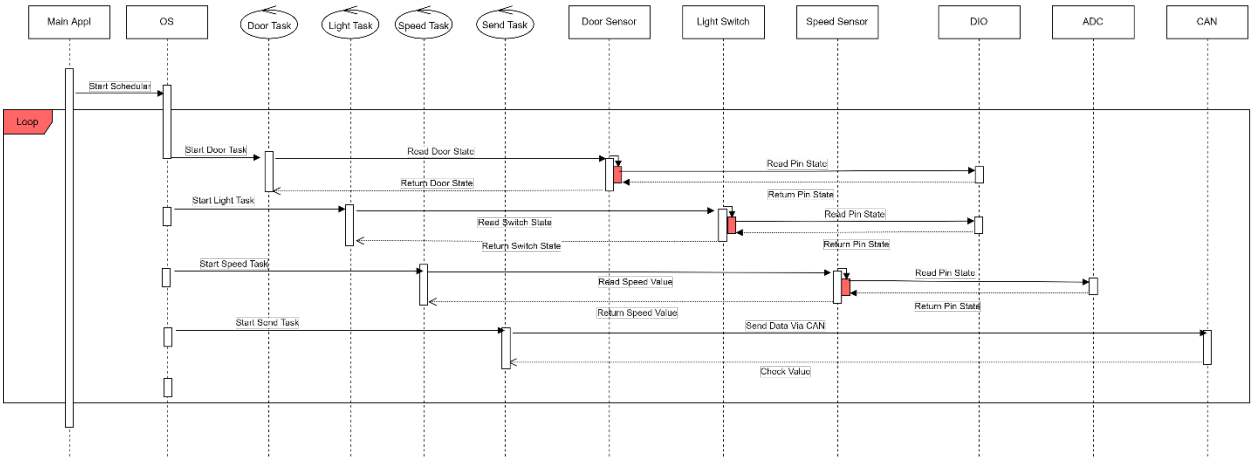
Lights



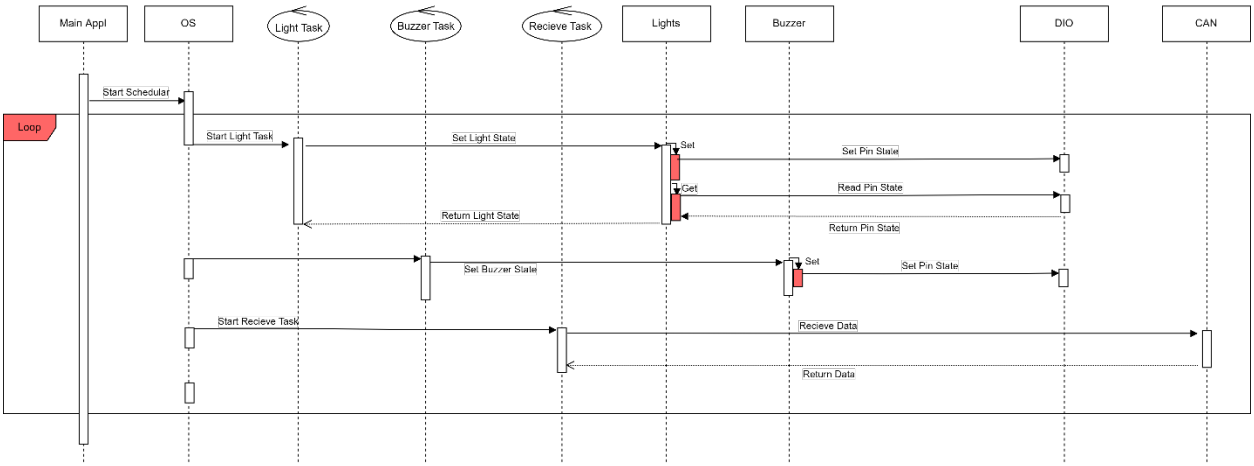
Buzzer



ECU 1 Sequence Diagram



ECU 2 Sequence Diagram



ECU 1 CPU Load

- Hyper period = 20 ms
- Estimate each task has execution time of 0.5 ms

$$CPU\ Load\ = \frac{0.5}{5} + \frac{0.5}{10} + \frac{0.5}{20} = 0.175\ =\ 17.5\%$$

ECU 2 CPU Load

- Hyper period = 5 ms
- Estimate each task has execution time of 0.5 ms

$$CPU\ Load\ = \frac{0.5}{5} + \frac{0.5}{5} = 0.2\ =\ 20\%$$

Bus Load

- Hyper period = 20 ms
- Bus Load = Bytes Send Per Second / Speed
- Number of tasks in a Hyper period = 3 tasks
- Number of tasks per second = 15 tasks
- Estimated Bytes sent by each task = 4 Bytes → include bit stuffing and CAN Framing
- Estimated Speed (Baud Rate) = 125 Kbit/s

$$Bus\ Load\ =\ Number\ of\ tasks\ per\ second\ *\ \left(\frac{Bytes_{Send}}{Speed}\right)\ =\ 15\ *\ (\frac{4*8}{125000})\ \approx\ 0.4\%$$