



# Automotive door and lights system design (Dynamic design)

Egypt Future work is digital

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## I. Overview of system components

### A. ECU 1

ECU 1 is a microcontroller responsible for receiving data from three sensors

- The vehicle speed (Analog input with the speed value)
- The light switch (A digital input switch has two states on or off)
- Door state sensor (detect if the door is closed or open)

And resend the data received from the sensors to ECU 2 Via can bus

### B. ECU 2

ECU 2 is a microcontroller responsible for controlling three devices

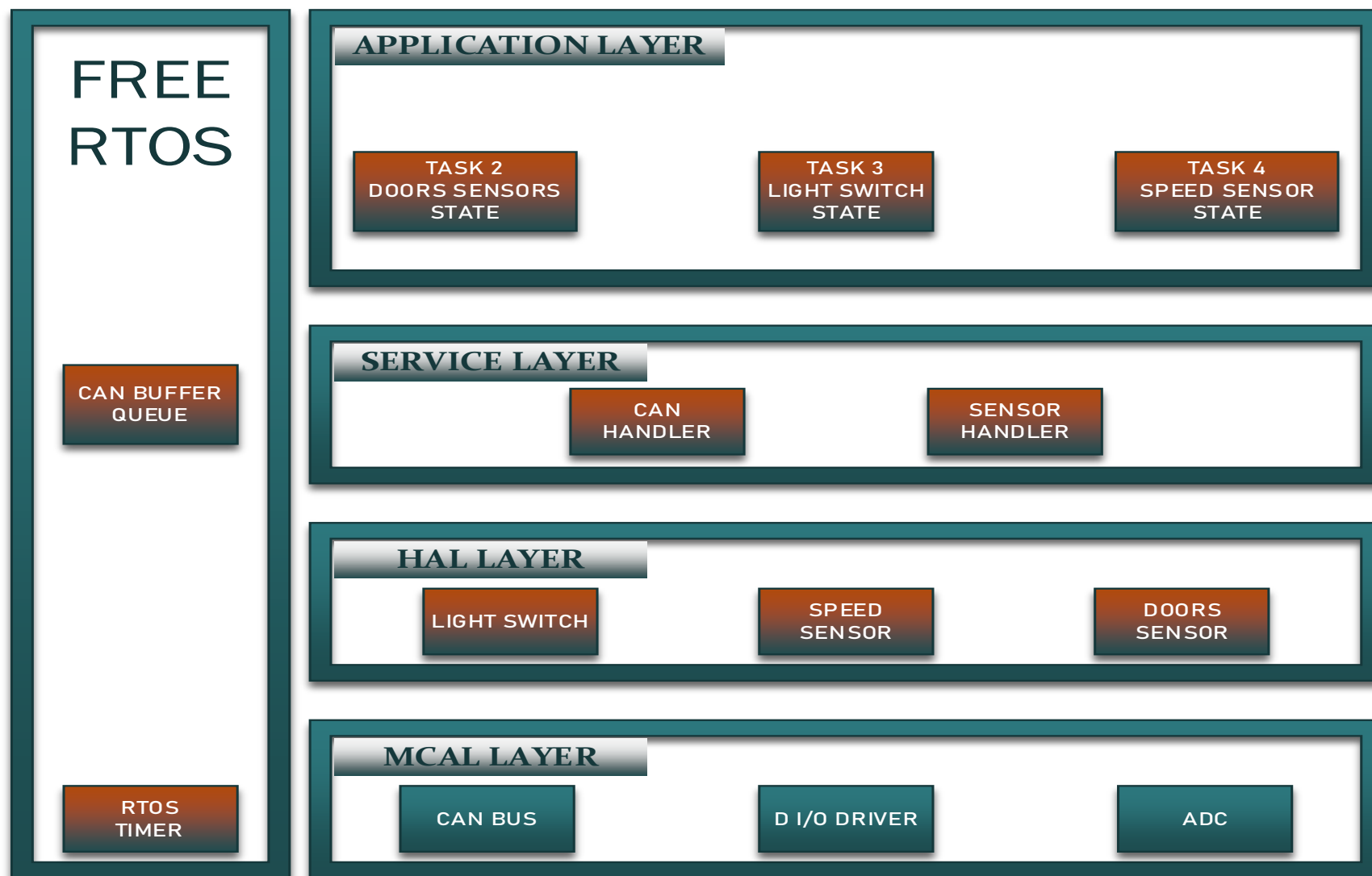
- Left lights (by a switch with two states ON/OFF )
- Right lights (by a switch with two states ON/OFF )
- The buzzer

ECU 2 also take the decision according to the received data from ECU.1

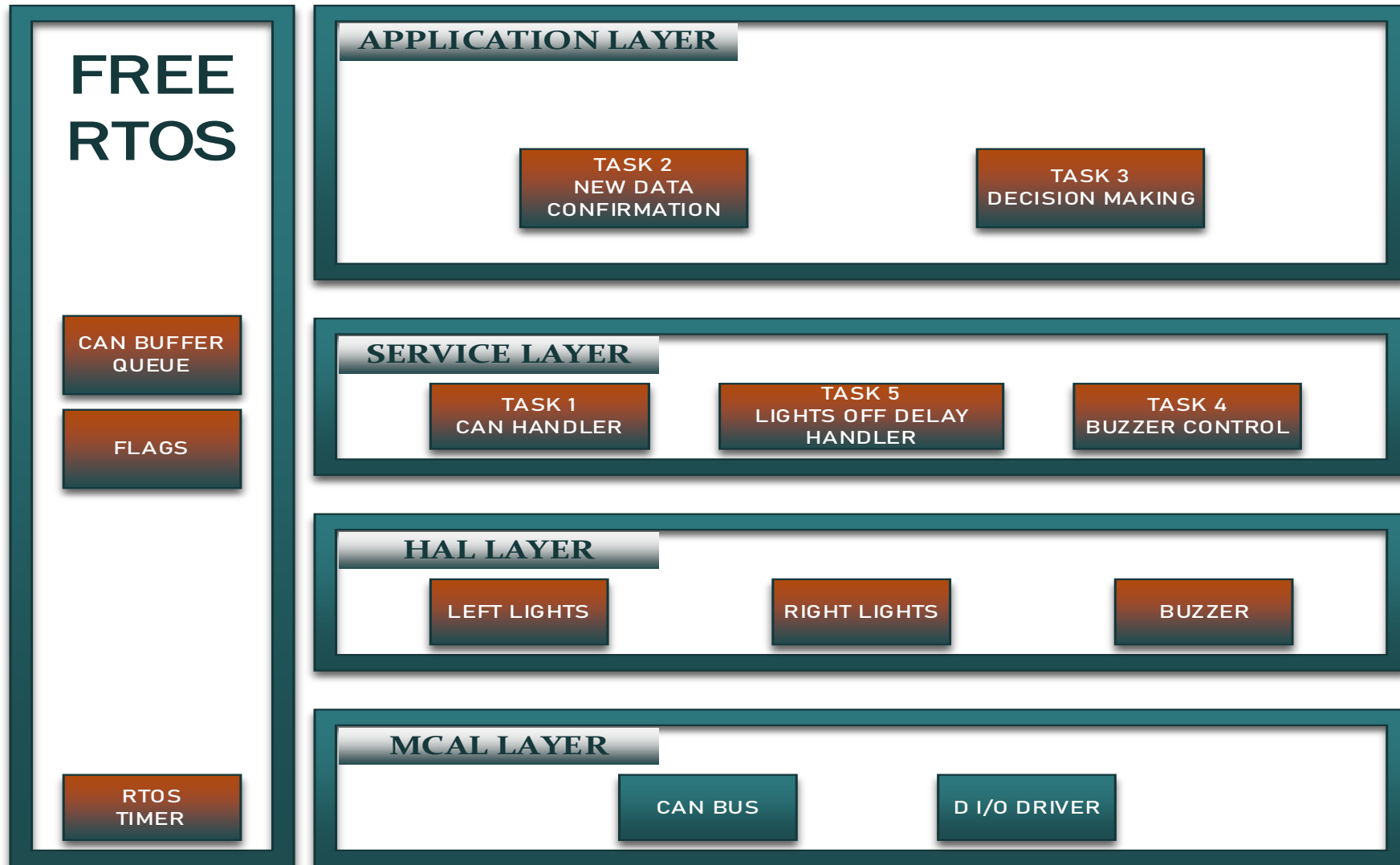
## II. Layered architecture

The layered architecture for each ECU according to AUTOSAR principles

## A. ECU 1 Layered architecture



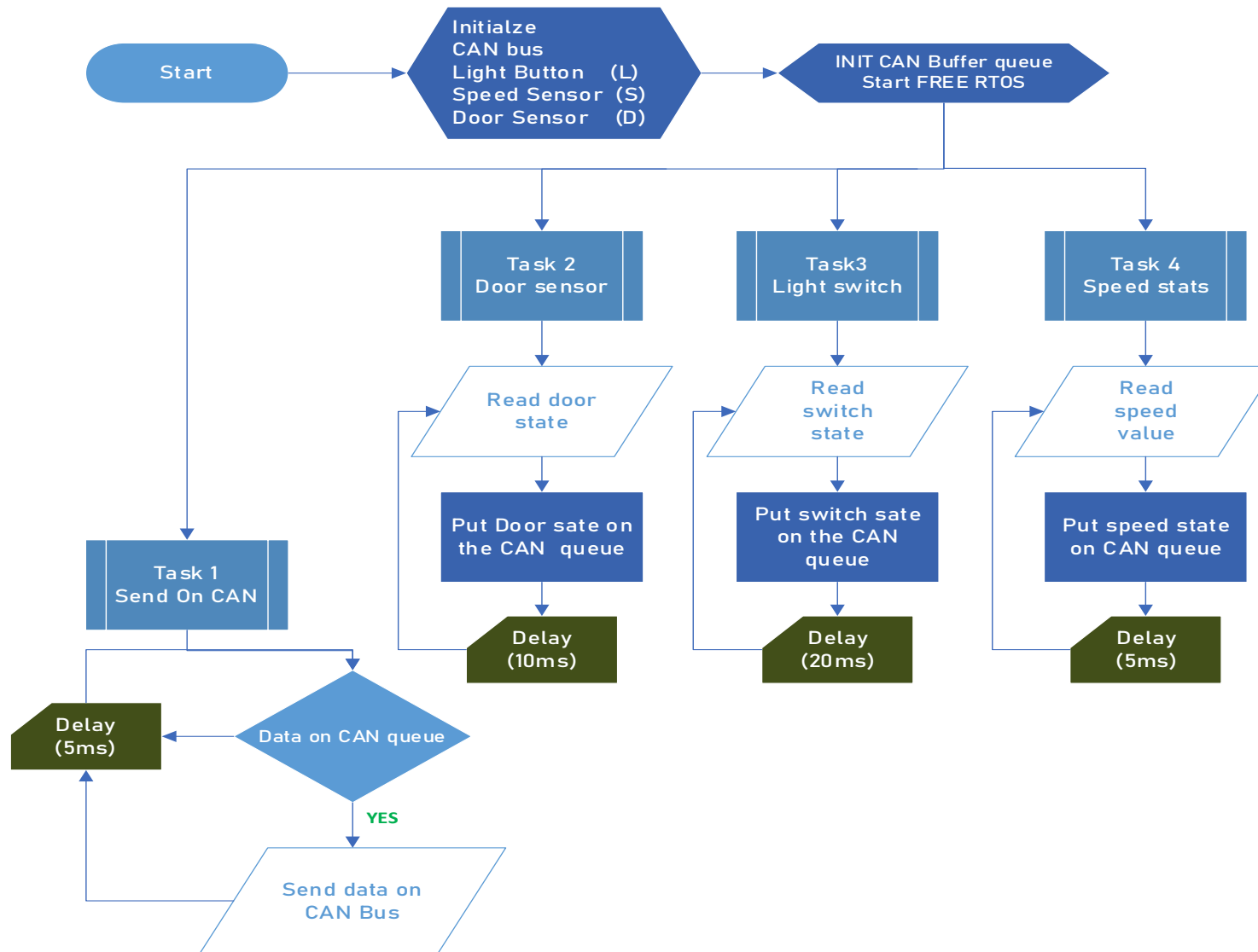
## B. ECU 2 Layered architecture



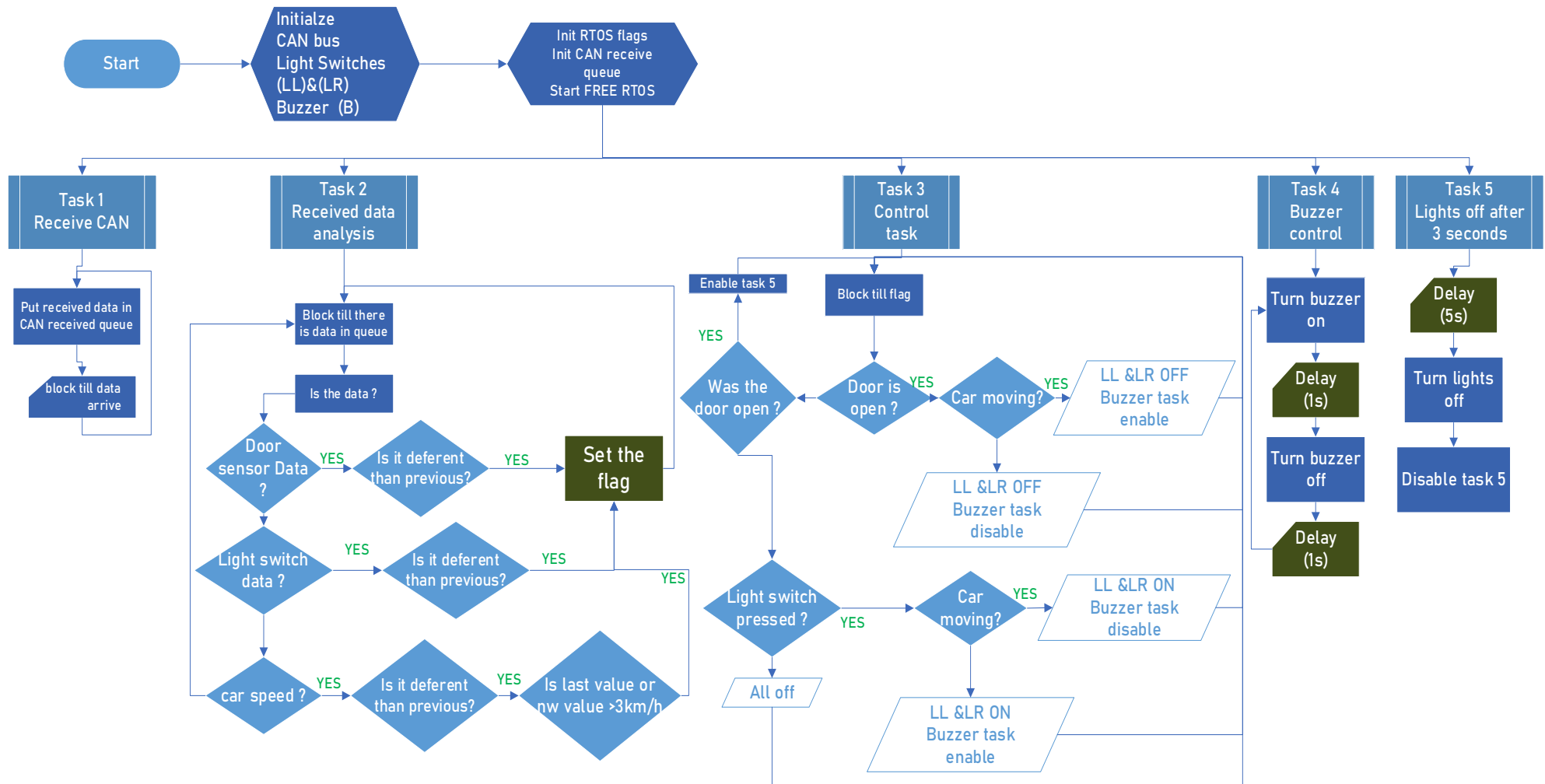
### III. Flowcharts

Each flowchart explain the how the program will flow in each microcontroller used

#### A. ECU1 FlowChart

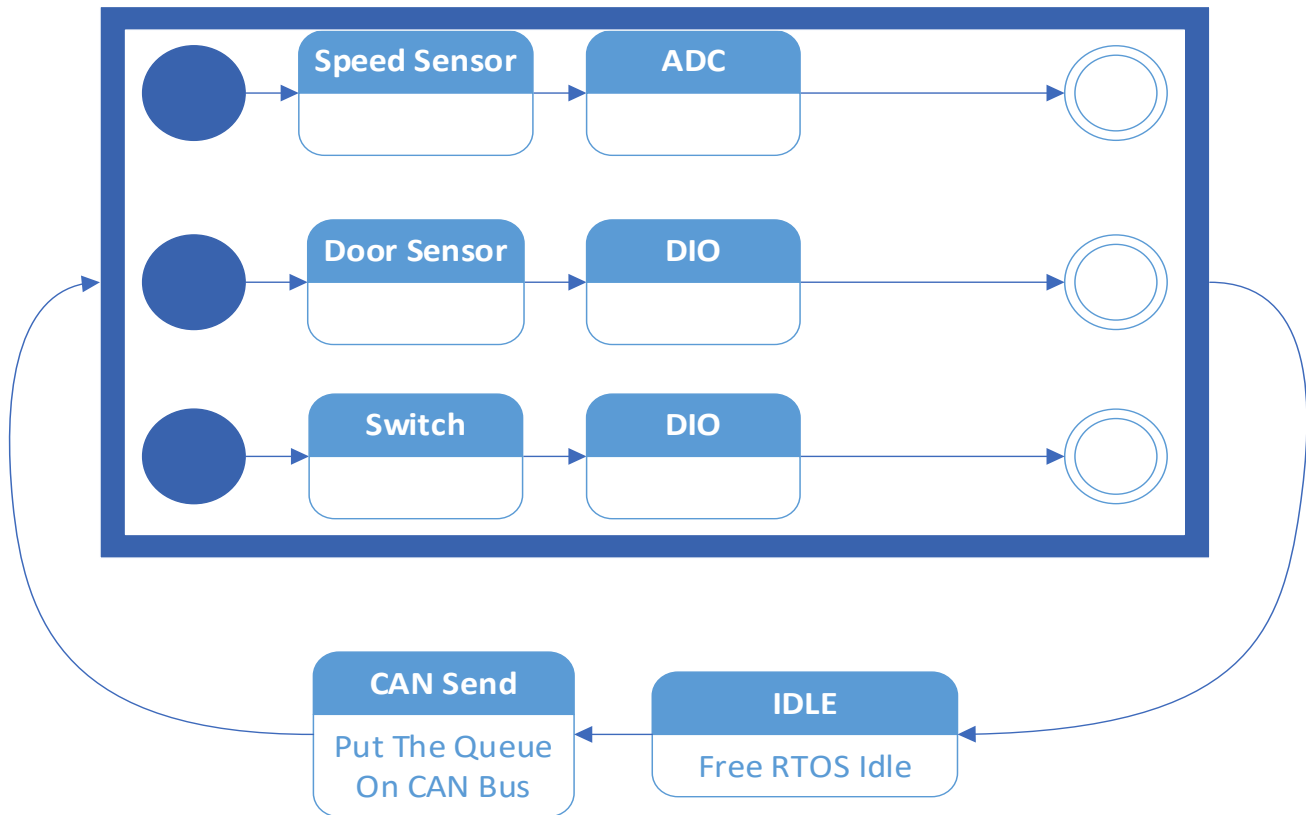


## B. ECU 2 FlowChart

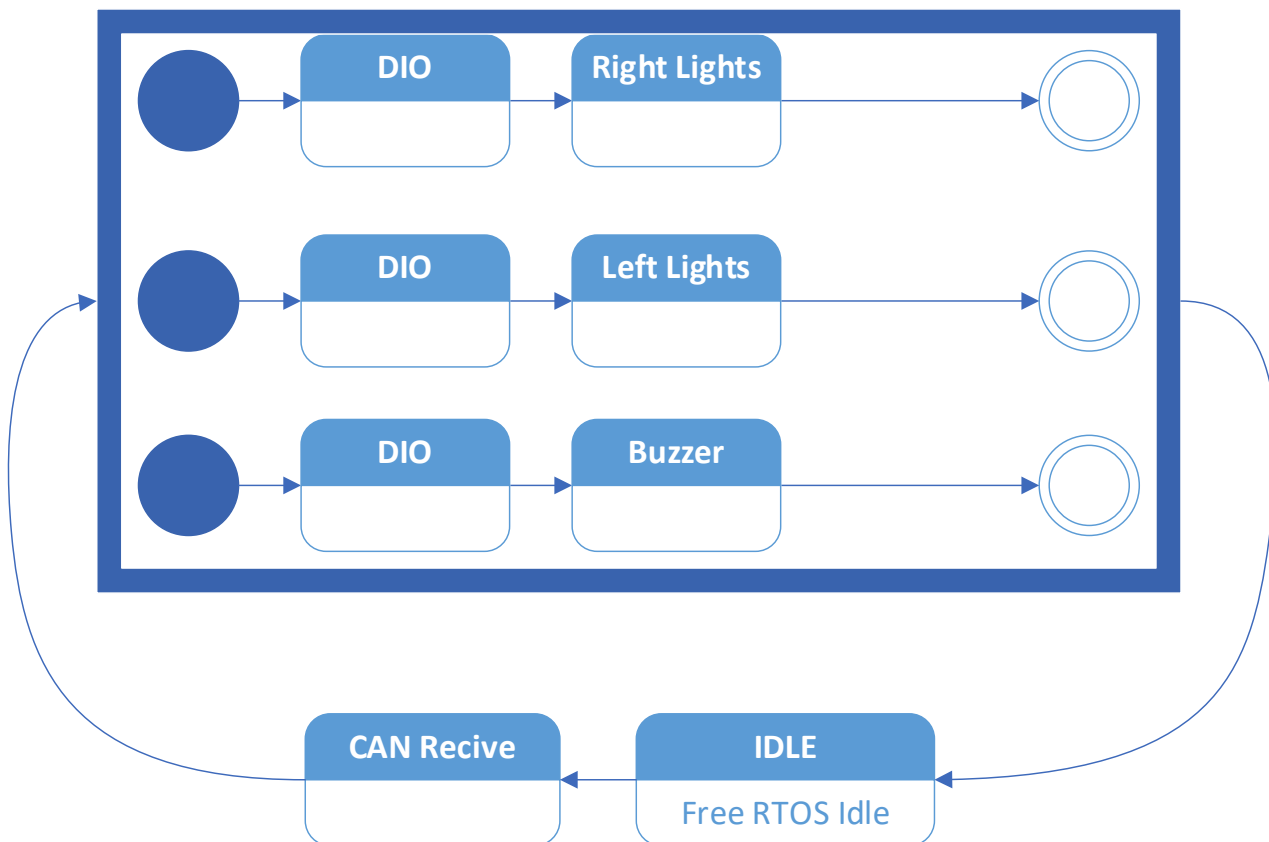


## IV. State machine diagram

### A. ECU 1 state machine diagram for each component

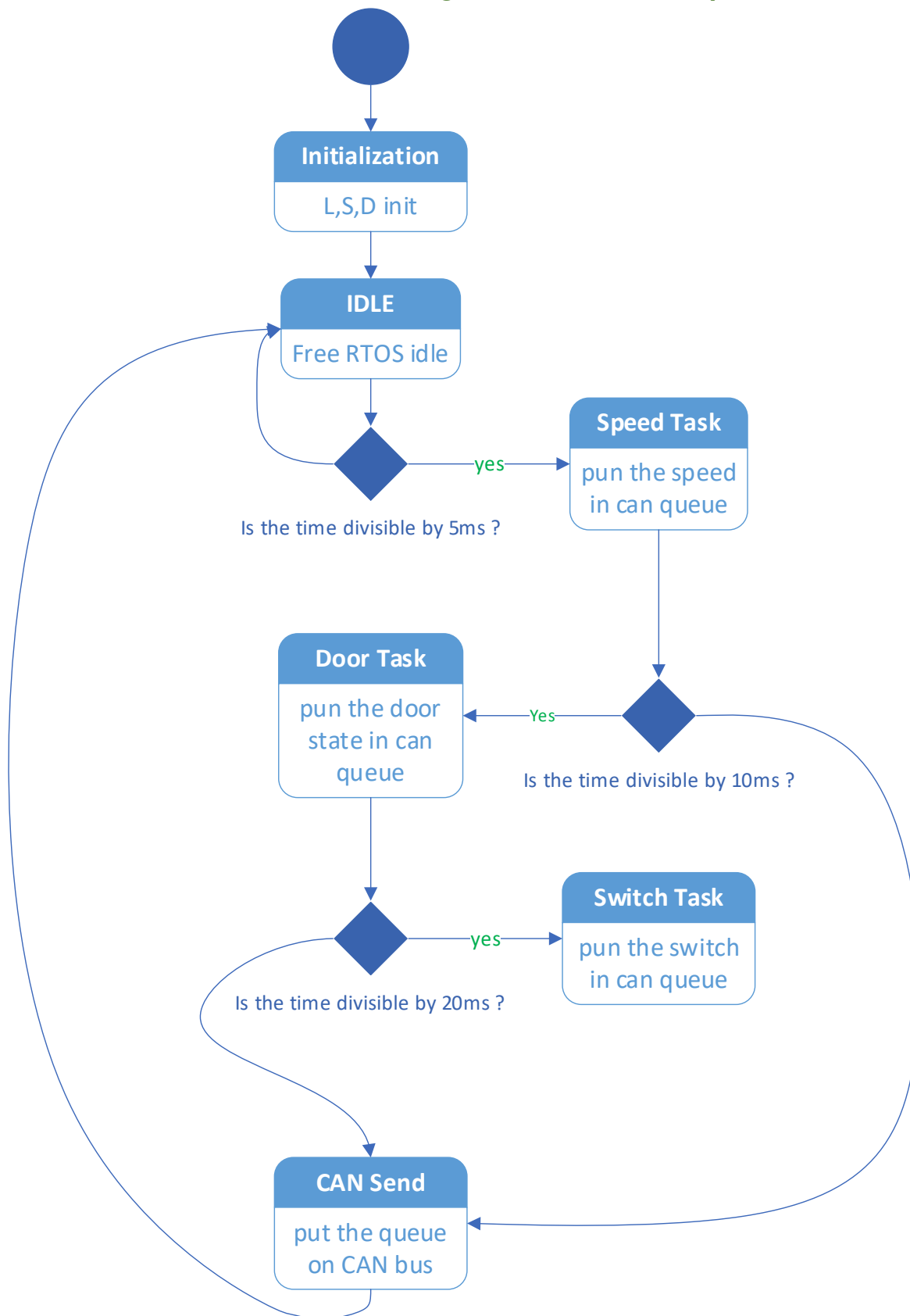


### B. ECU 2 state machine diagram for each Component

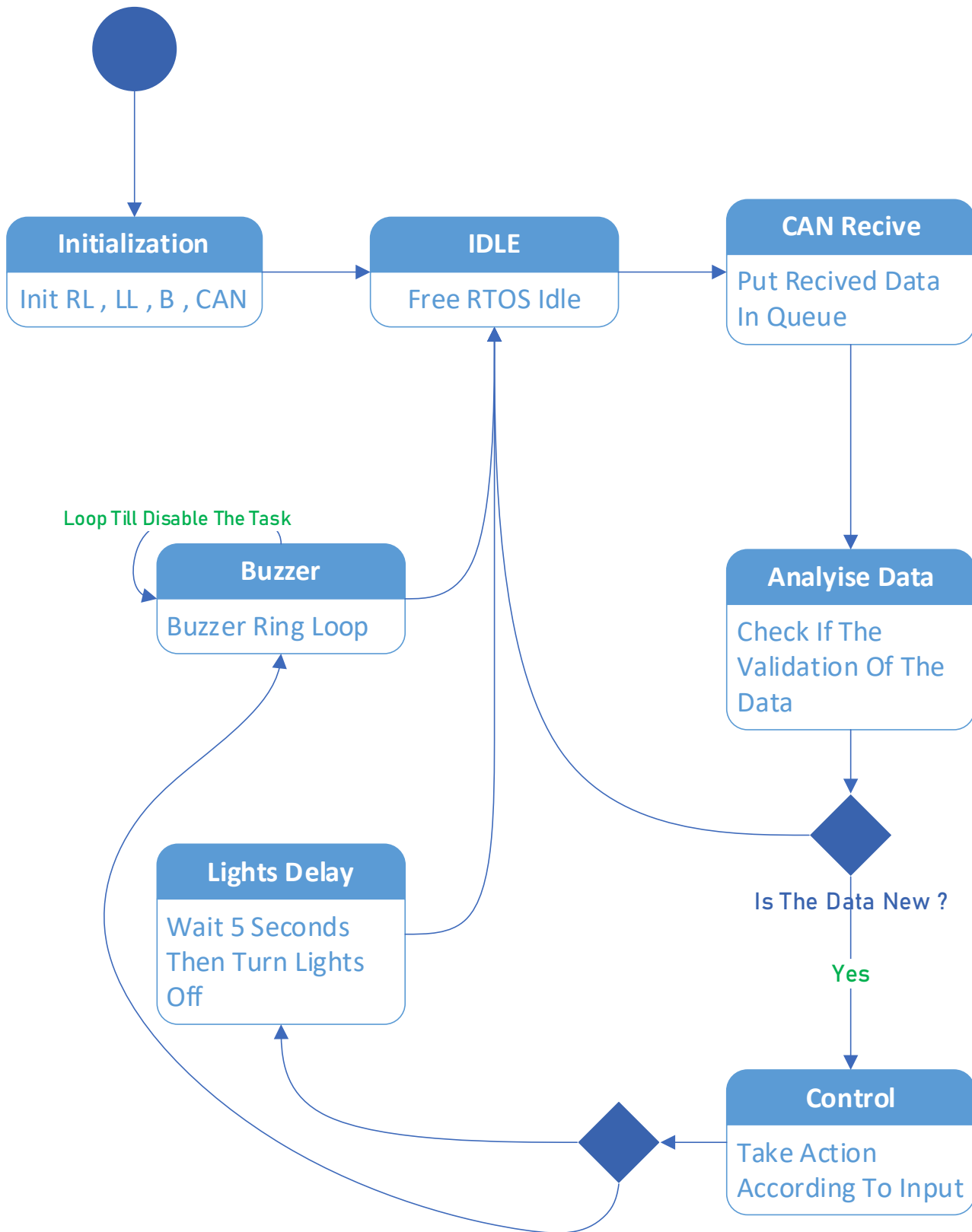




## C. ECU 1 state machine diagram for each Operation

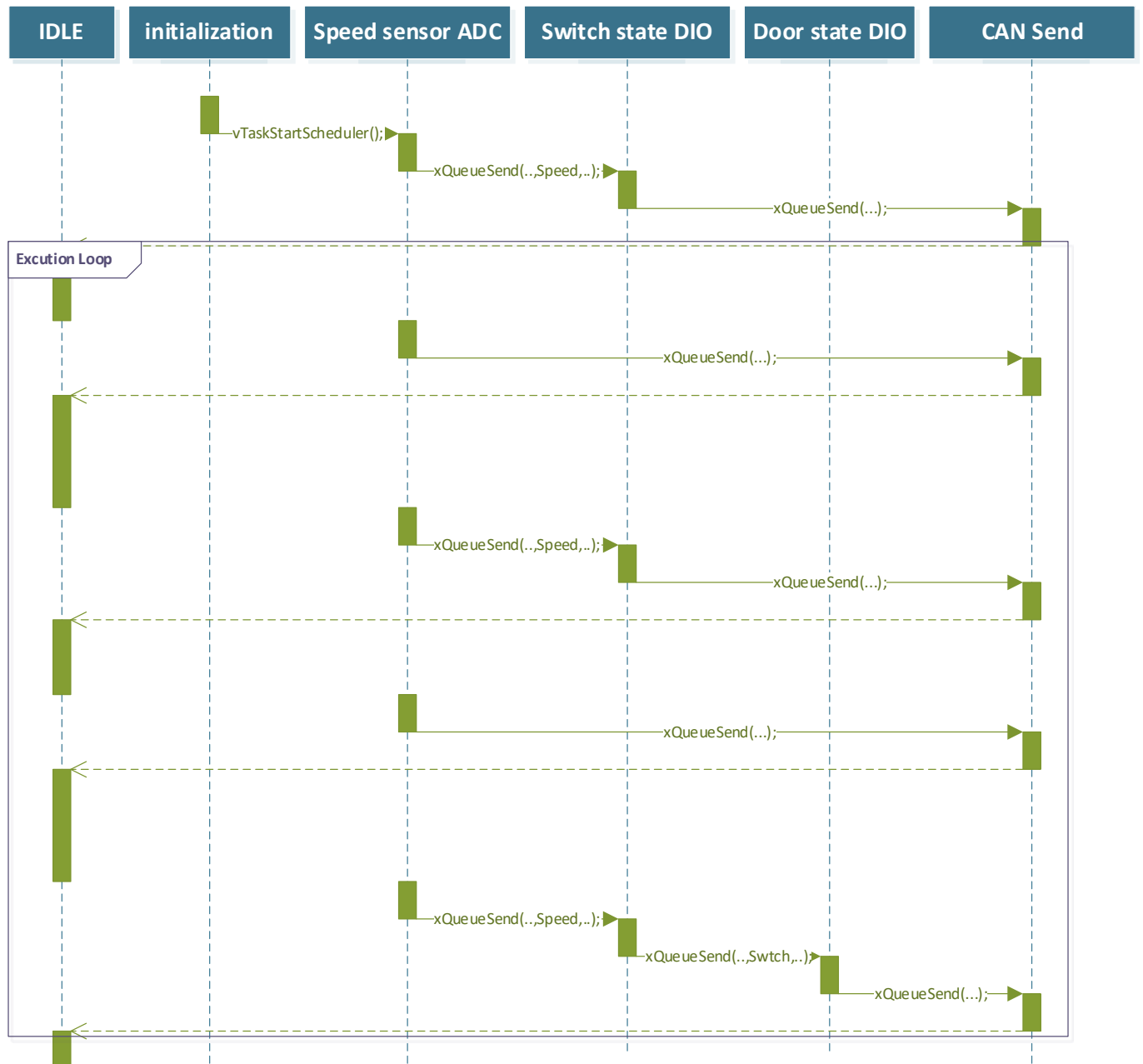


## D. ECU 2 state machine diagram for each Operation

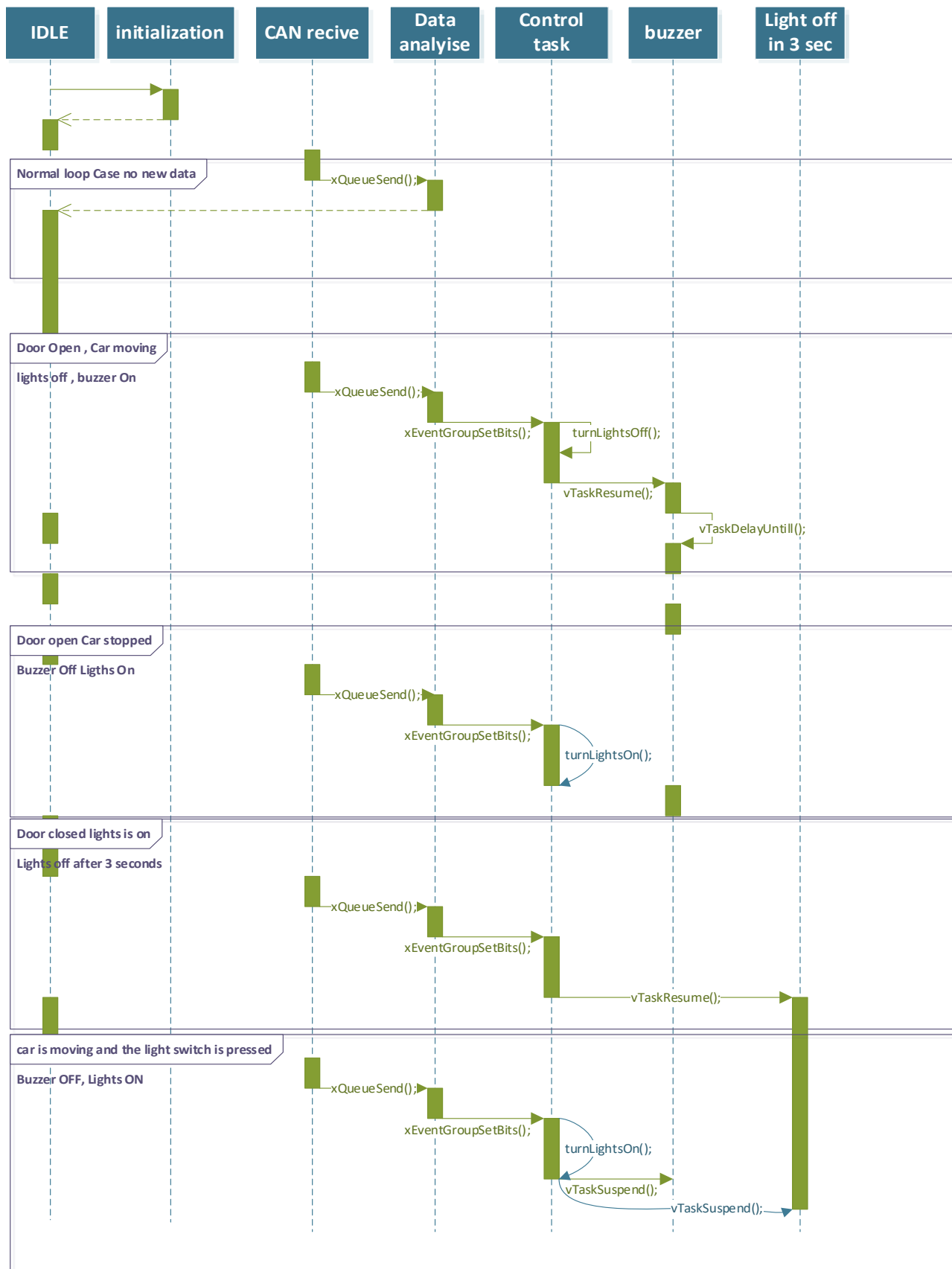


## V. sequence diagram

### A. ECU 1 Sequence diagram



## B. ECU 2 Sequence diagram



## VI. SimSo simulation and estimated CPU load

Simulating the estimated task execution time on each ECU as follows

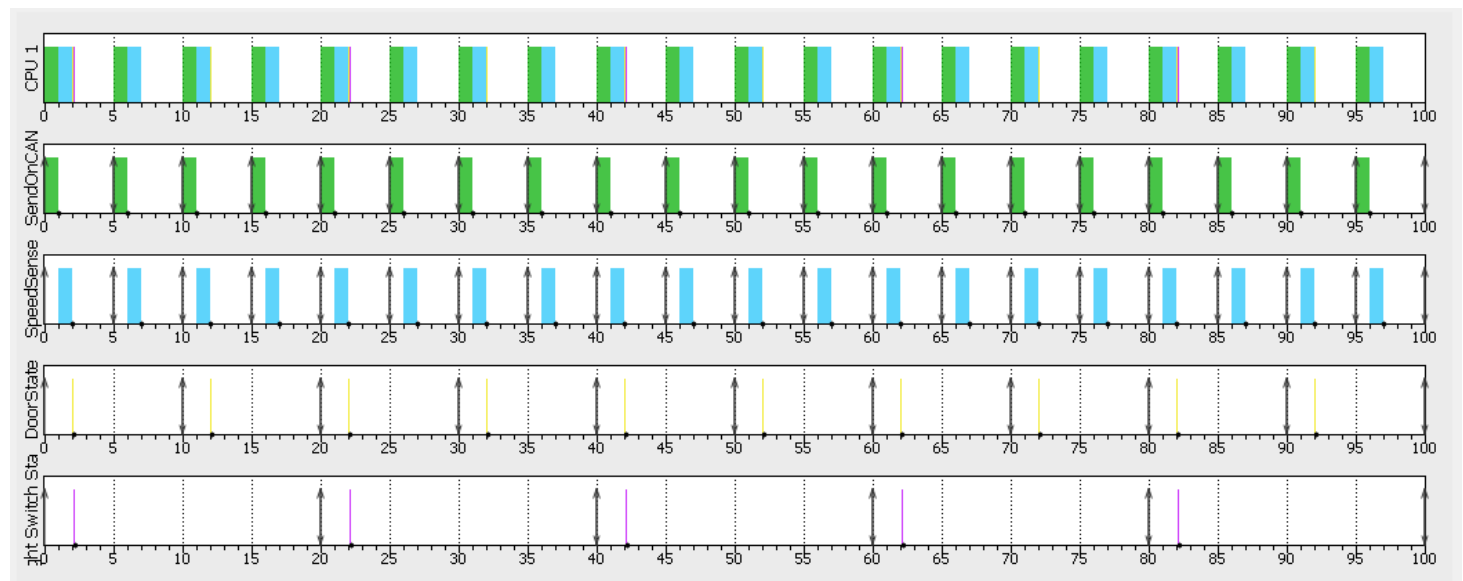
### A. ECU 1 Tasks

id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by	priority
1	SendOnCAN	Periodic	<input checked="" type="checkbox"/> Yes	0	5.0	-	5.0	1.0	▼	5
2	SpeedSense	Periodic	<input checked="" type="checkbox"/> Yes	0	5.0	-	5.0	1.0	▼	4
3	DoorState	Periodic	<input checked="" type="checkbox"/> Yes	0	10	-	10	0.1	▼	3
4	Light Switch State	Periodic	<input checked="" type="checkbox"/> Yes	0	20.0	-	20.0	0.1	▼	2

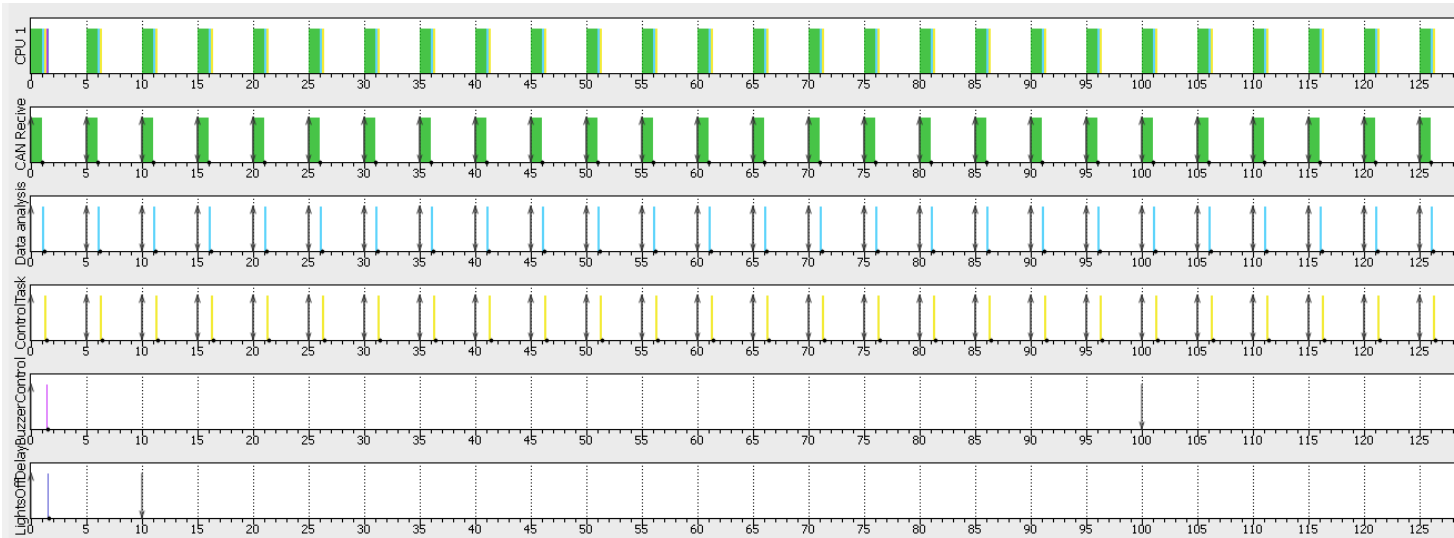
### B. ECU 2 Tasks

id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by	priority
1	CAN Receive	Periodic	<input checked="" type="checkbox"/> Yes	0	5	-	5	1	▼	5
2	Data analysis	Periodic	<input checked="" type="checkbox"/> Yes	0	5	-	5	0.2	▼	4
3	ControlTask	Periodic	<input checked="" type="checkbox"/> Yes	0	5	-	5	0.2	▼	3
4	BuzzerControl	Periodic	<input checked="" type="checkbox"/> Yes	0	1000	-	100	0.1	▼	1
5	LightsOffDelay	Periodic	<input checked="" type="checkbox"/> Yes	0	1000	-	10	0.1	▼	1

### C. ECU 1 Gantt chart



D. ECU 1 Gantt chart



E. ECU 1 CPU load

Observation Window:

from 0.00 to 100.00 ms

Configure...

	Total load	Payload	System load
CPU 1	0.4150	0.4150	0.0000
Average	0.4150	0.4150	0.0000

F. ECU2 CPU load

Observation Window:

from 0.00 to 1000.00 ms

Configure...

	Total load	Payload	System load
CPU 1	0.2802	0.2802	0.0000
Average	0.2802	0.2802	0.0000