

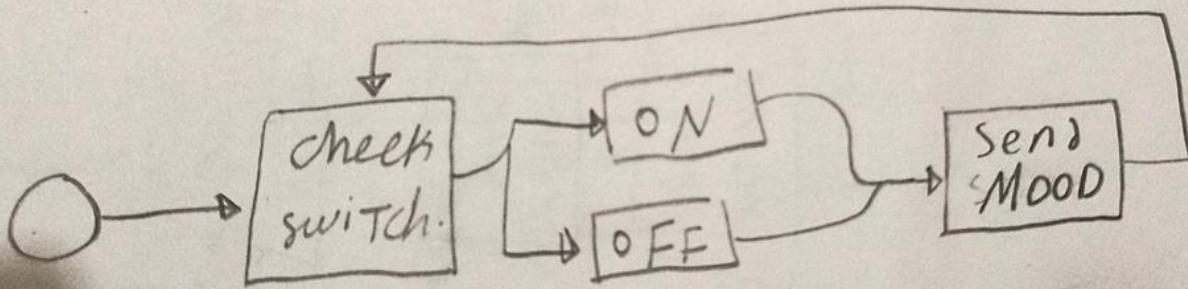
Dynamic Design Analysis

ECU1

1- Draw a state machine diagram for each ECU component

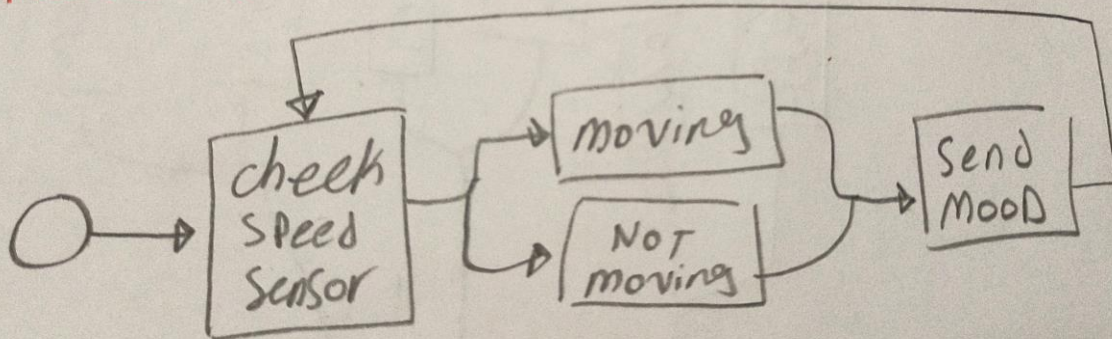
a. Switch button state

Light switch state



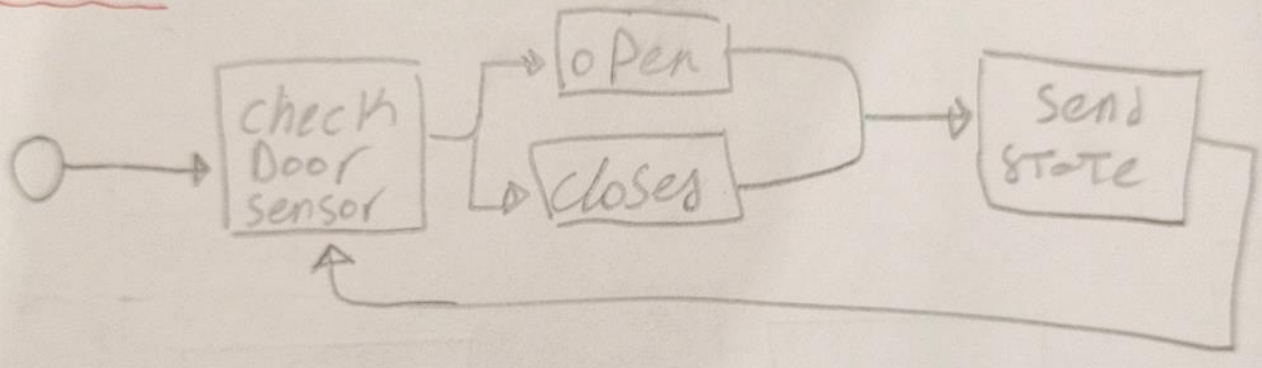
b. Car state

Speed sensor state

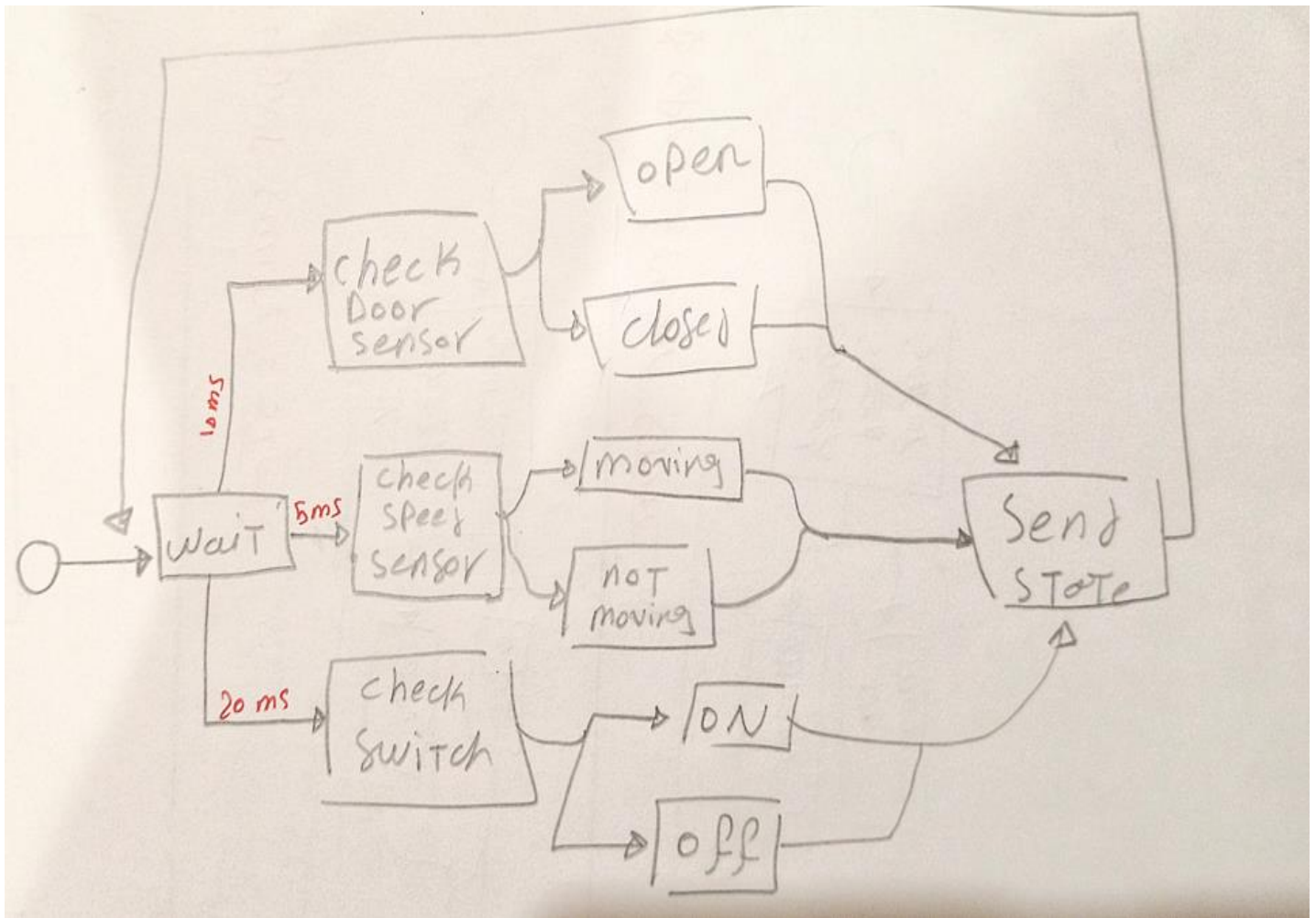


c. Door state

Door sensor

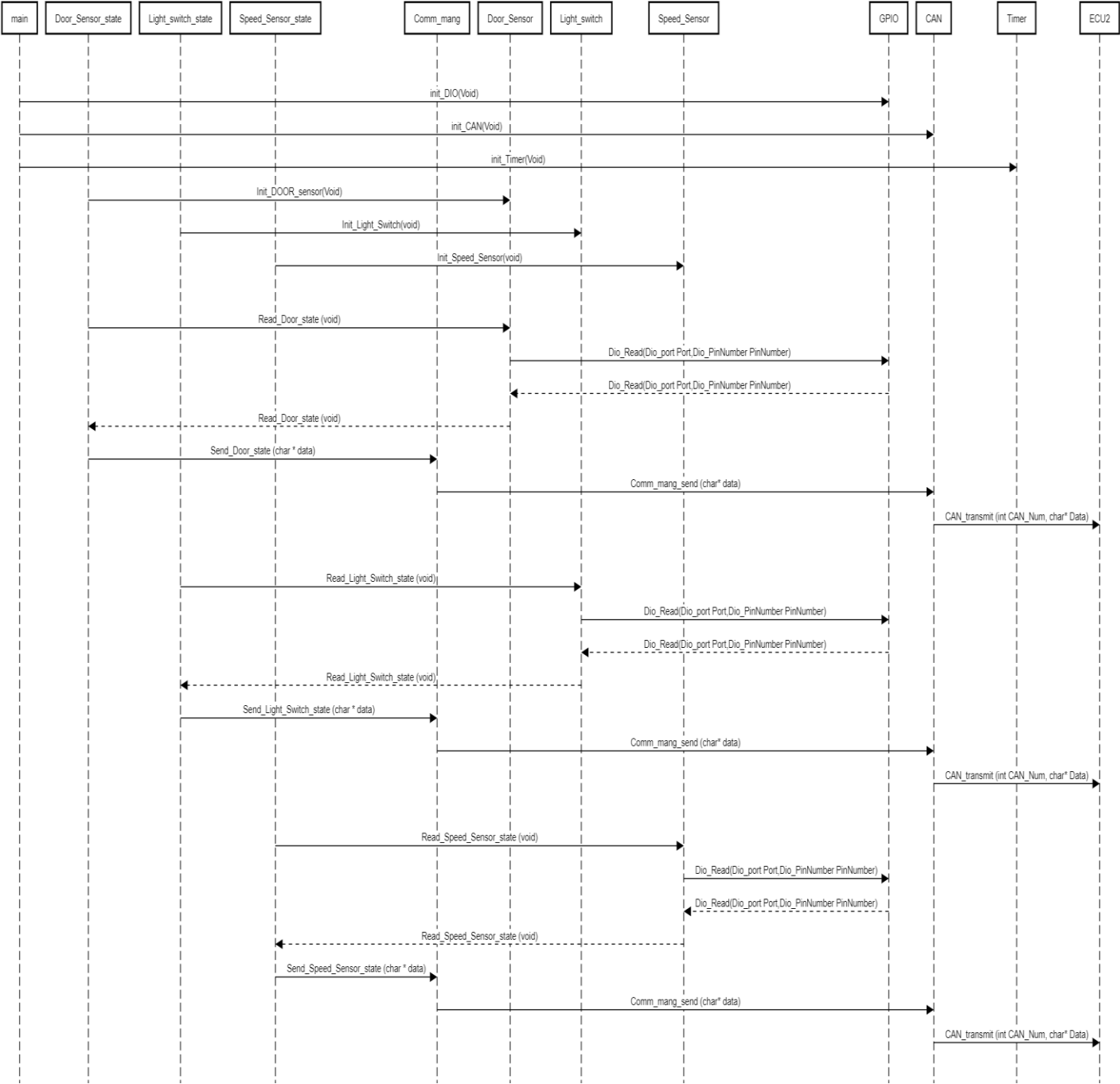


2. Draw a state machine diagram for the ECU operation



3-Draw the sequence diagram for the ECU1

This is a title



4- Calculate CPU load for the ECU1

theoretical calculations

- *we can assume that every task takes 300 microseconds to execute*

(Include task execute(read values and sending) & debouncing & any other delay in system)

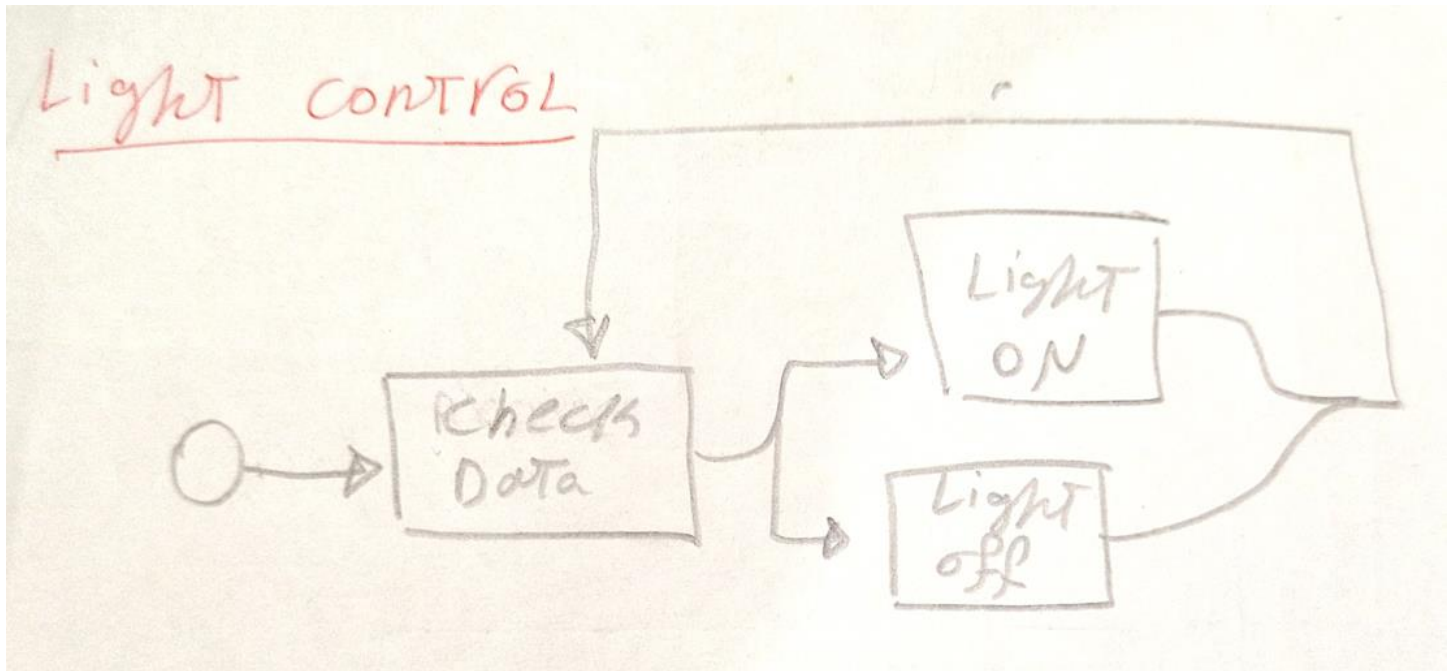
- *Hyper period will be 20 ms*
- *Task 5ms → 4 times * 300 = 1200 microseconds*
- *Task 10ms → 2 times * 300 = 600 microseconds*
- *Task 20ms → 1 times * 300 = 300 microseconds*

CPU load for ECU1 = $(1.2+.6+0.3)/20 = 10.5\%$

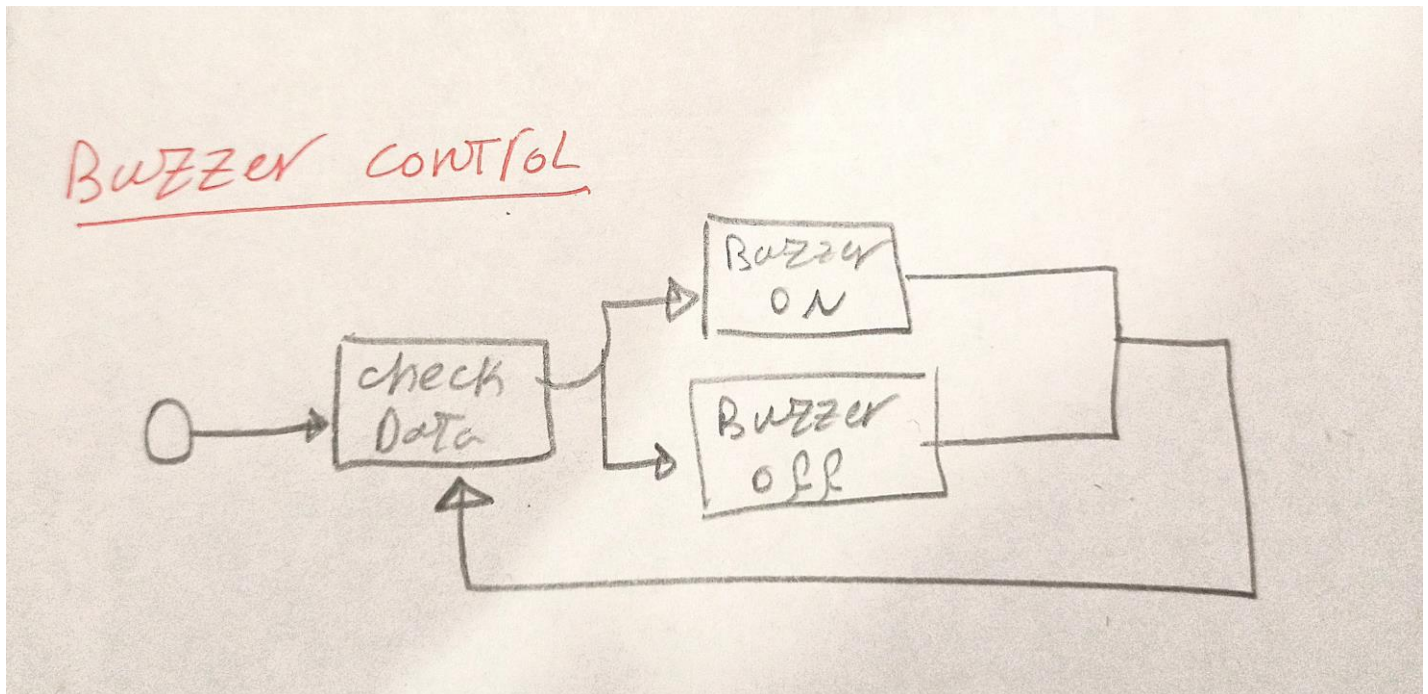
ECU2

1- Draw a state machine diagram for each ECU component

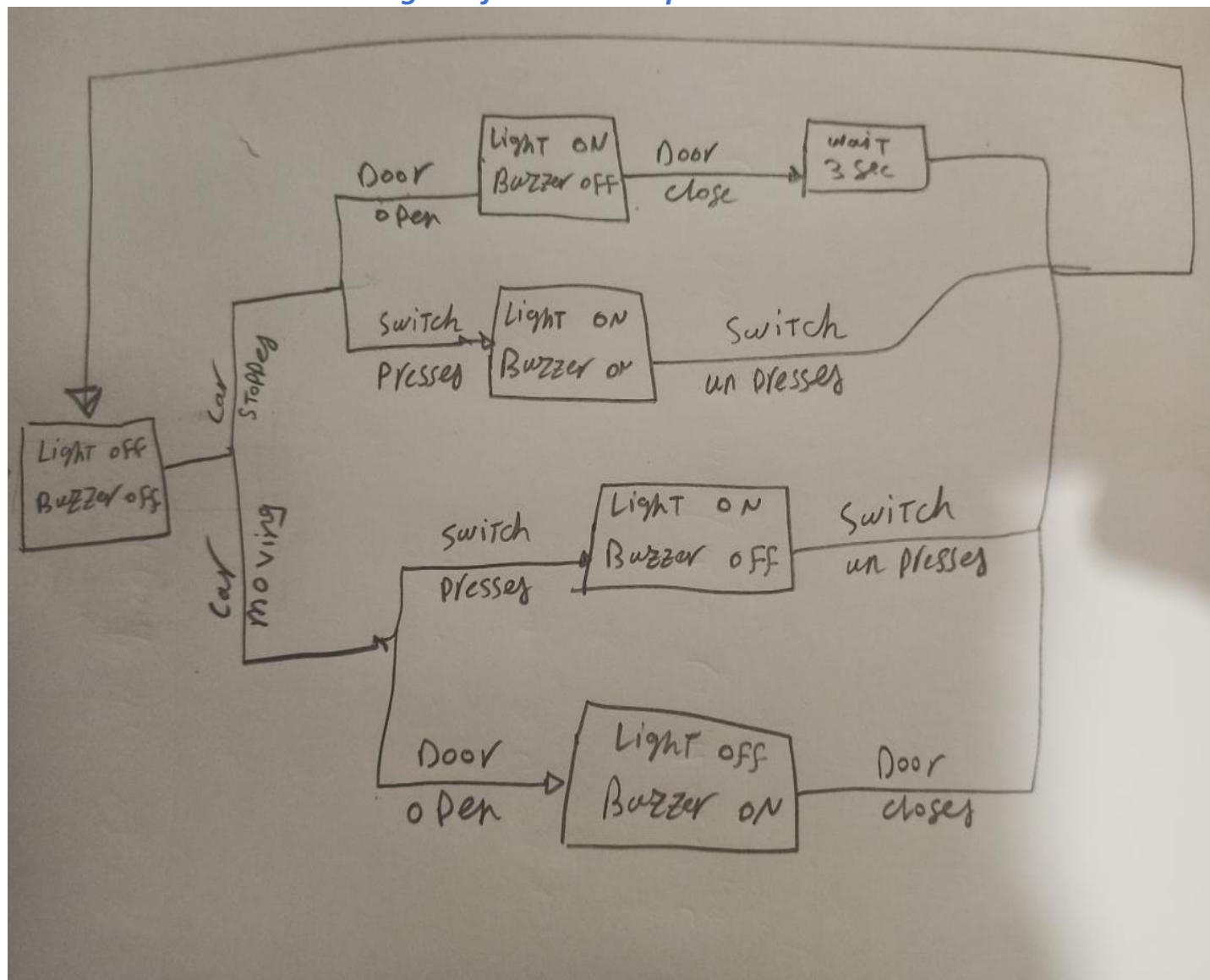
a. Lights control



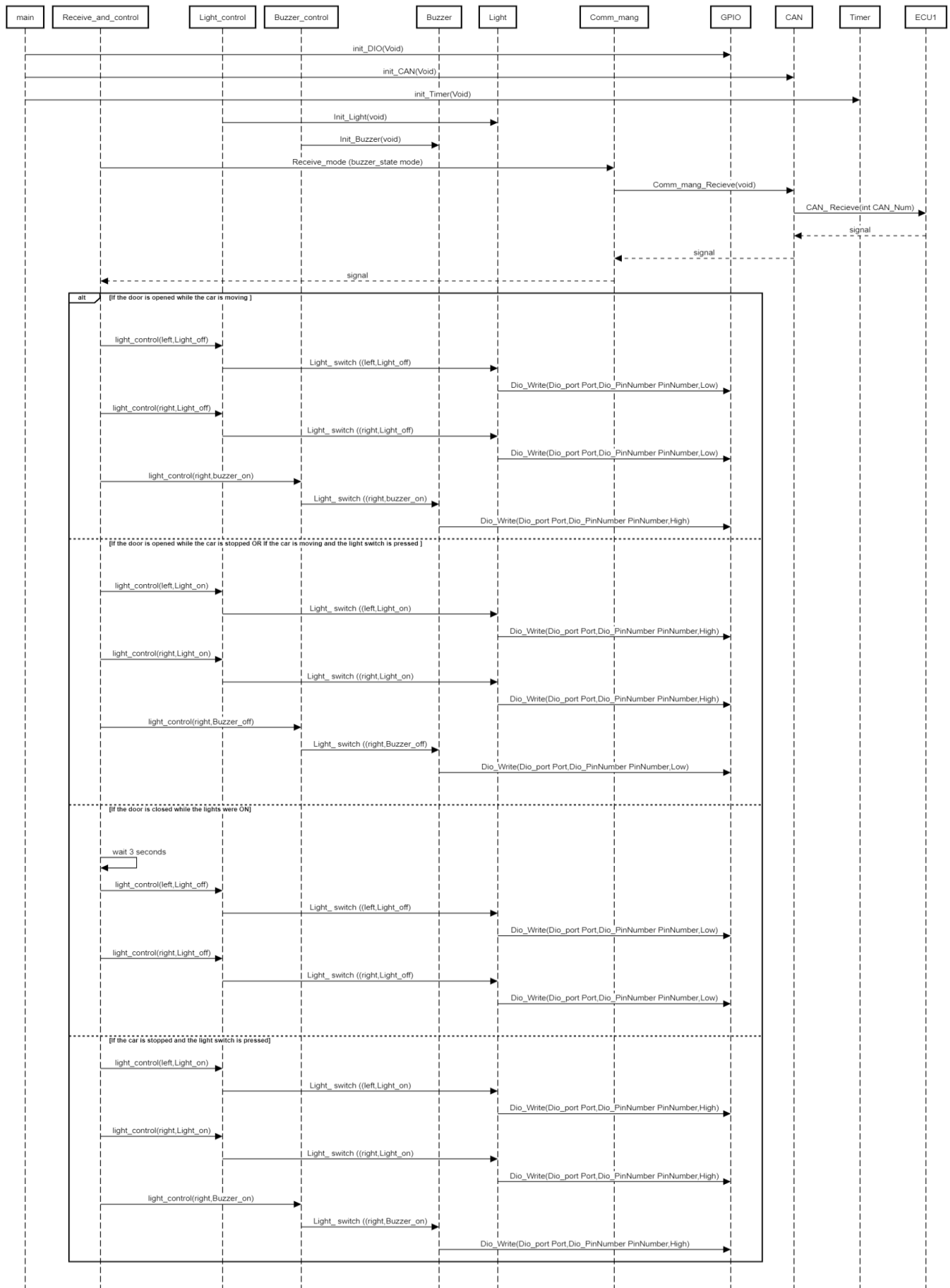
b. Buzzer Control



2. Draw a state machine diagram for the ECU operation



3-Draw the sequence diagram for the ECU2



4- Calculate CPU load for the ECU

theoretical calculations

- *In this microcontroller has only one task with 5 MS periodicity .it check if there are data received or not*
- *we can assume that task takes 300 microseconds to execute*

(Include task execute(read values and sending) & debouncing & any other delay in system)

CPU load for ECU1 = (300)/5000 = 6%

5- Calculate bus load in your system: With what percentage of system bus was busy per 1 second

Single-Wire CAN Hardware

Single-wire CAN interfaces can communicate with devices at rates up to 33.3 kbit/s (88.3 kbit/s in high-speed mode). Other names for single-wire CAN include SAE-J2411, CAN A, and GMLAN. Typical single-wire devices within an automobile do not require high performance. Common applications include comfort devices such as seat and mirror adjusters.

Assuming that can bus rate is 33.3Kbits/s

In ECU1 we use can bus 7 times in one Hyper period 20ms

- *so, $7 * 50 (1 \text{ sec}/20\text{ms}) = 350$ (number of time we use can bus in in one sec)*
- *each time we send 1 byte*
- *$350 * 8 = 2800$ bits*
- *the average CAN bus load = $2800/33300 = 8.4\%$*