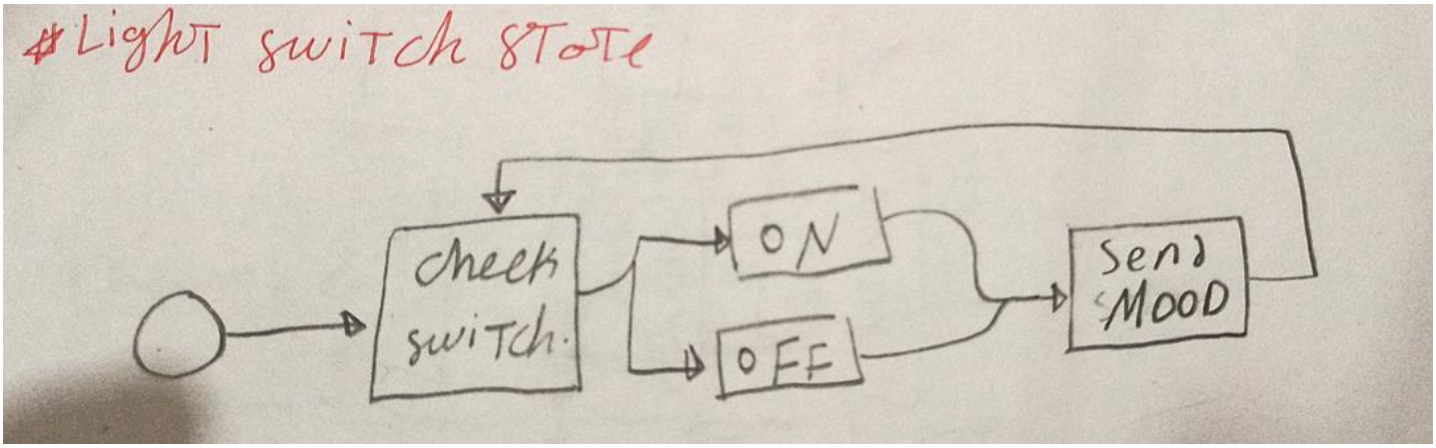
Dynamic Design Analysis

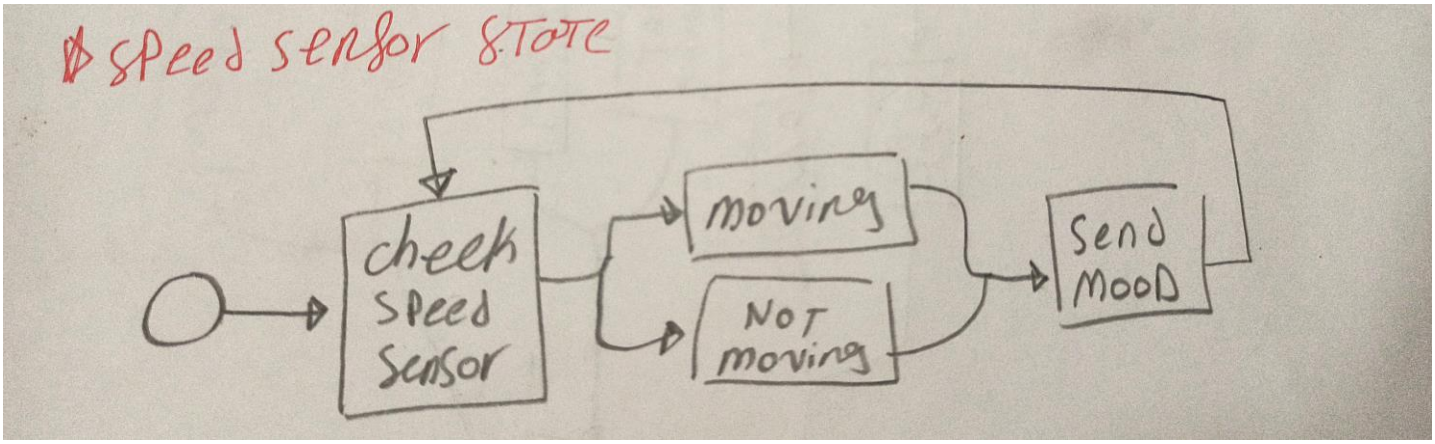
ECU1

1- Draw a state machine diagram for each ECU component

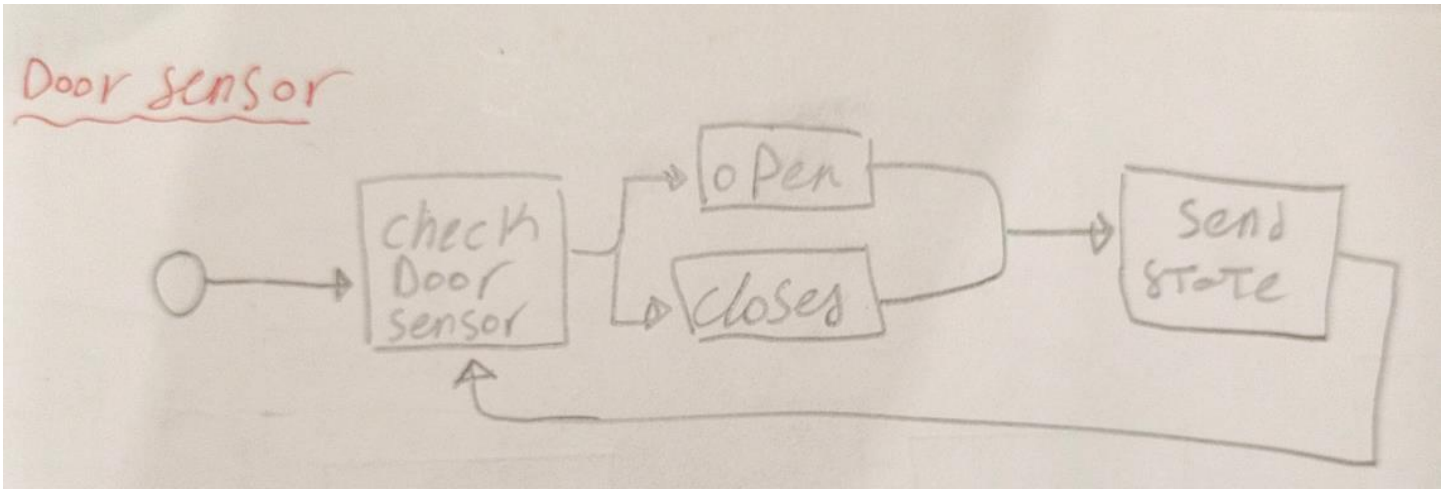
a. Switch button state



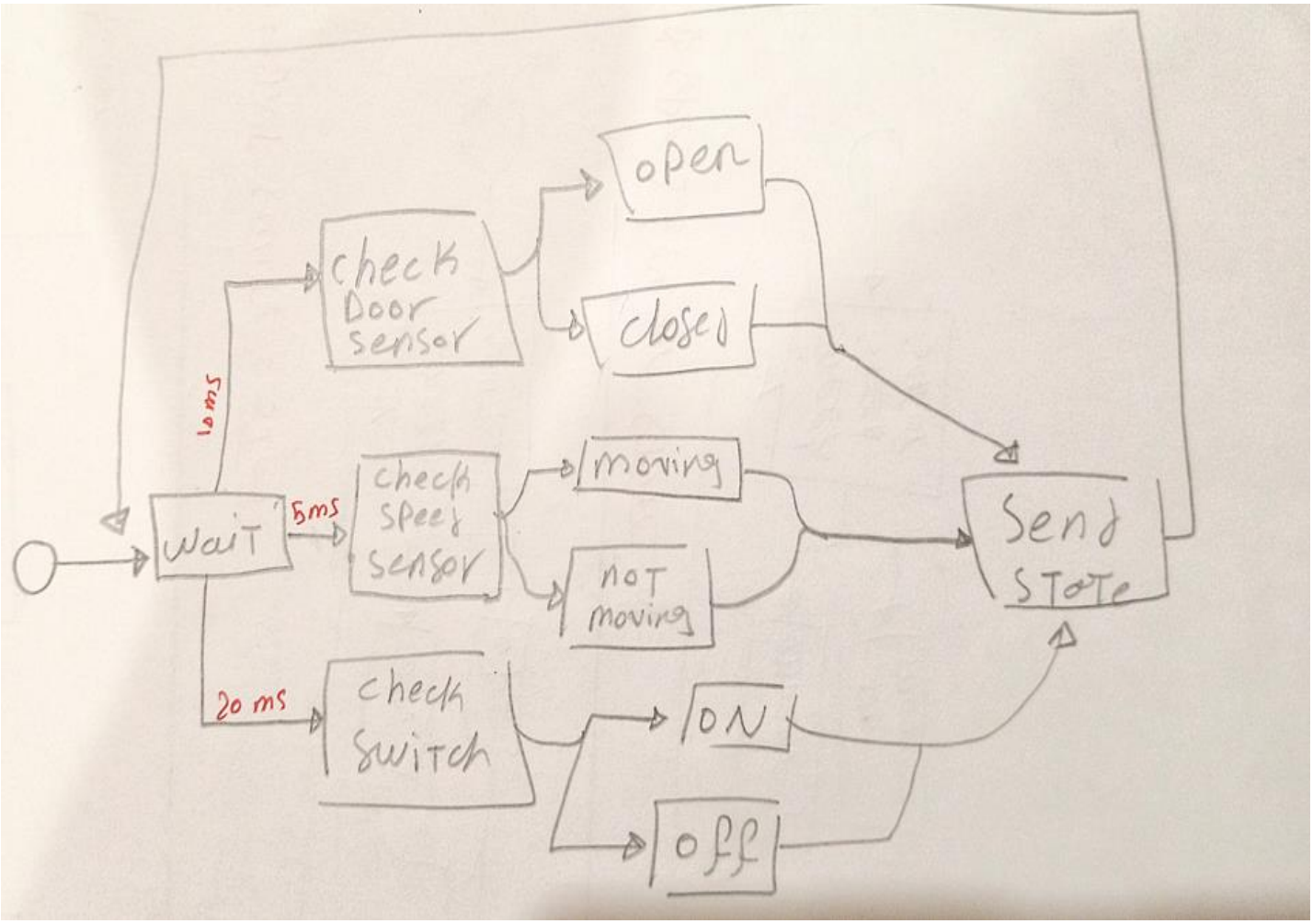
b. Car state



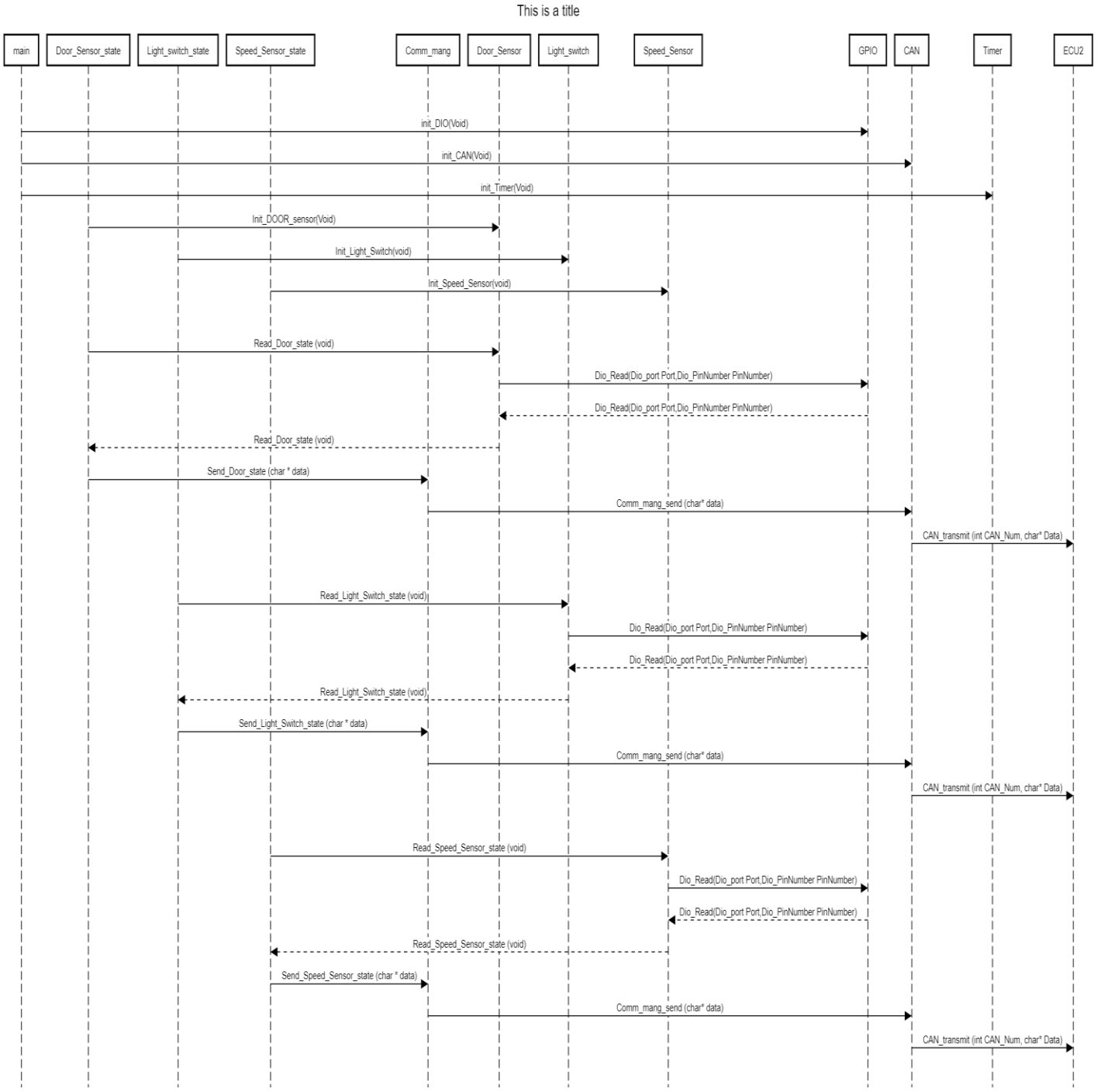
c. Door state



2. Draw a state machine diagram for the ECU operation



3-Draw the sequence diagram for the ECU1



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)

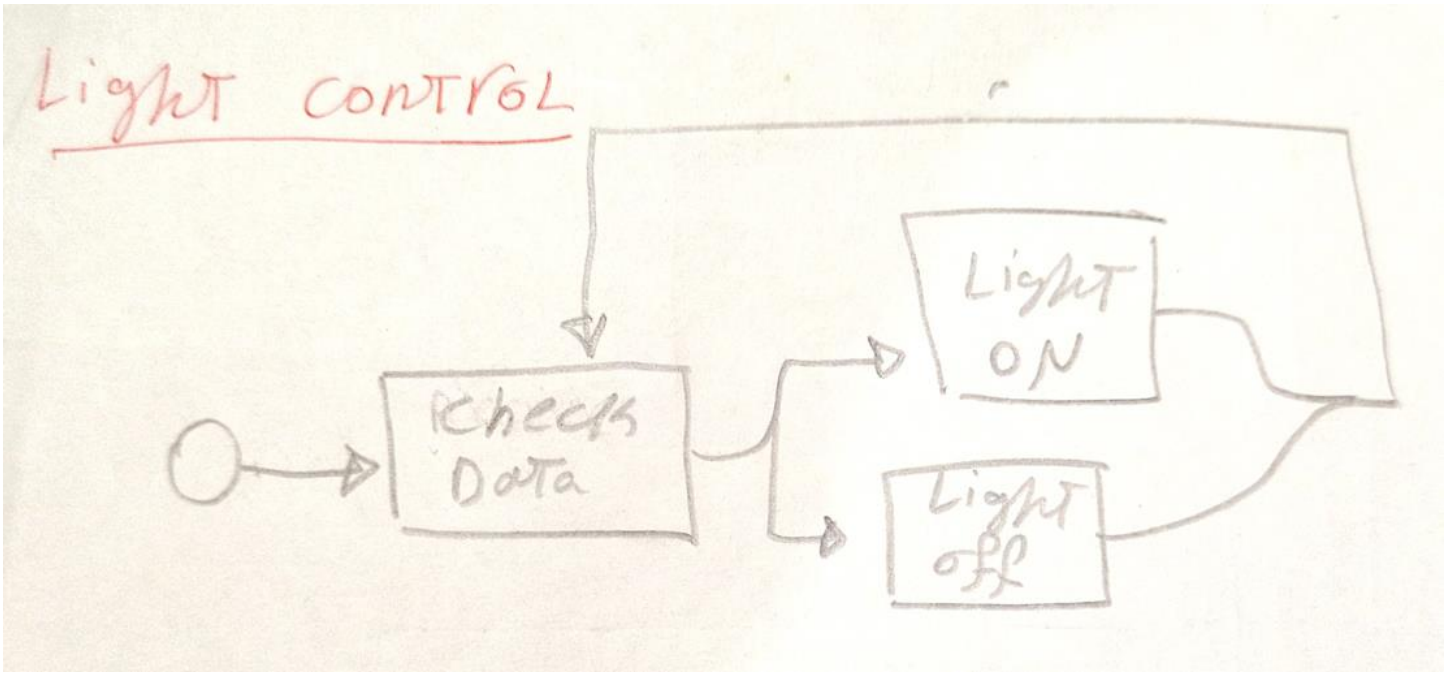
- ***Hyper period will be 20 ms***
- ***Task 5ms ➔ 4 times * 300 = 1200 microseconds***
- ***Task 10ms ➔ 2 times * 300 = 600 microseconds***
- ***Task 20ms ➔ 1 times * 300 = 300 microseconds***

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

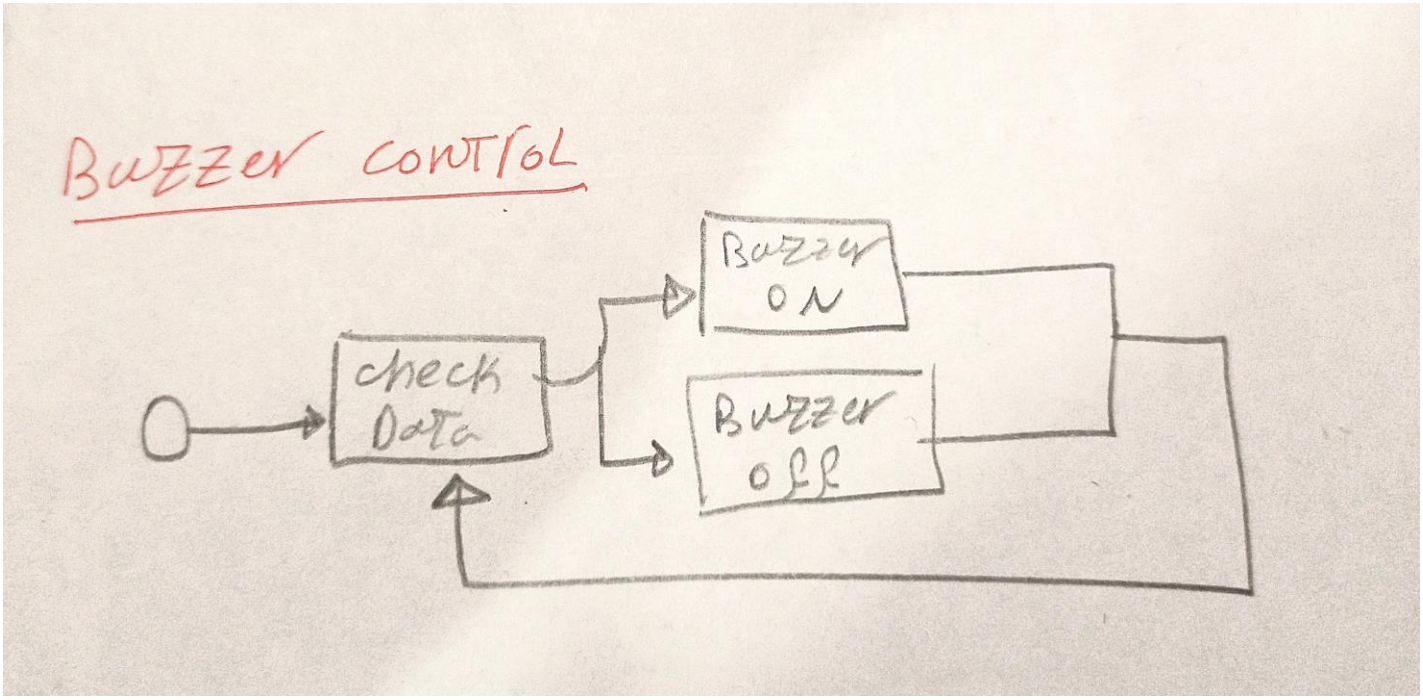
ECU2

1- Draw a state machine diagram for each ECU component

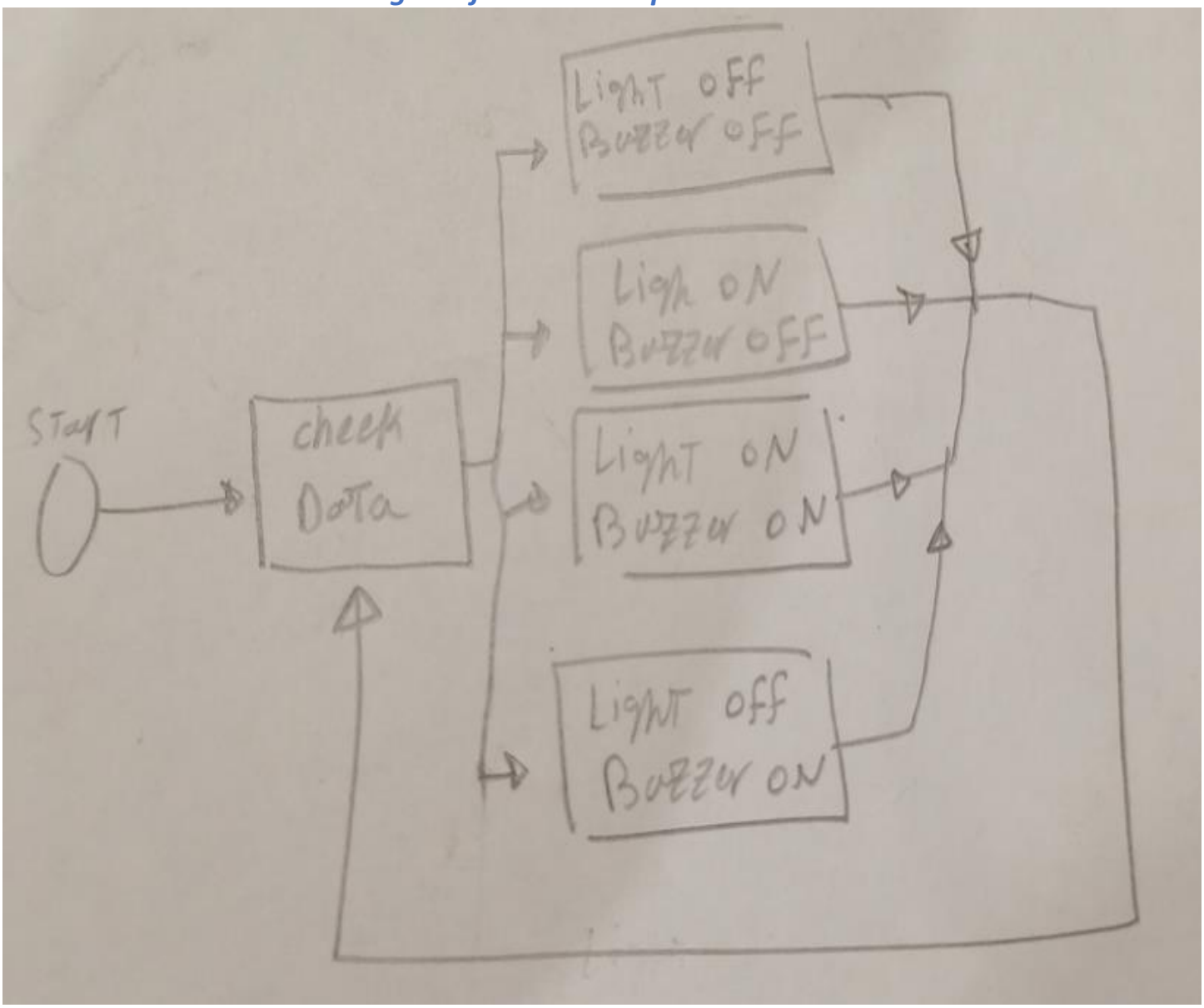
a. Lights control



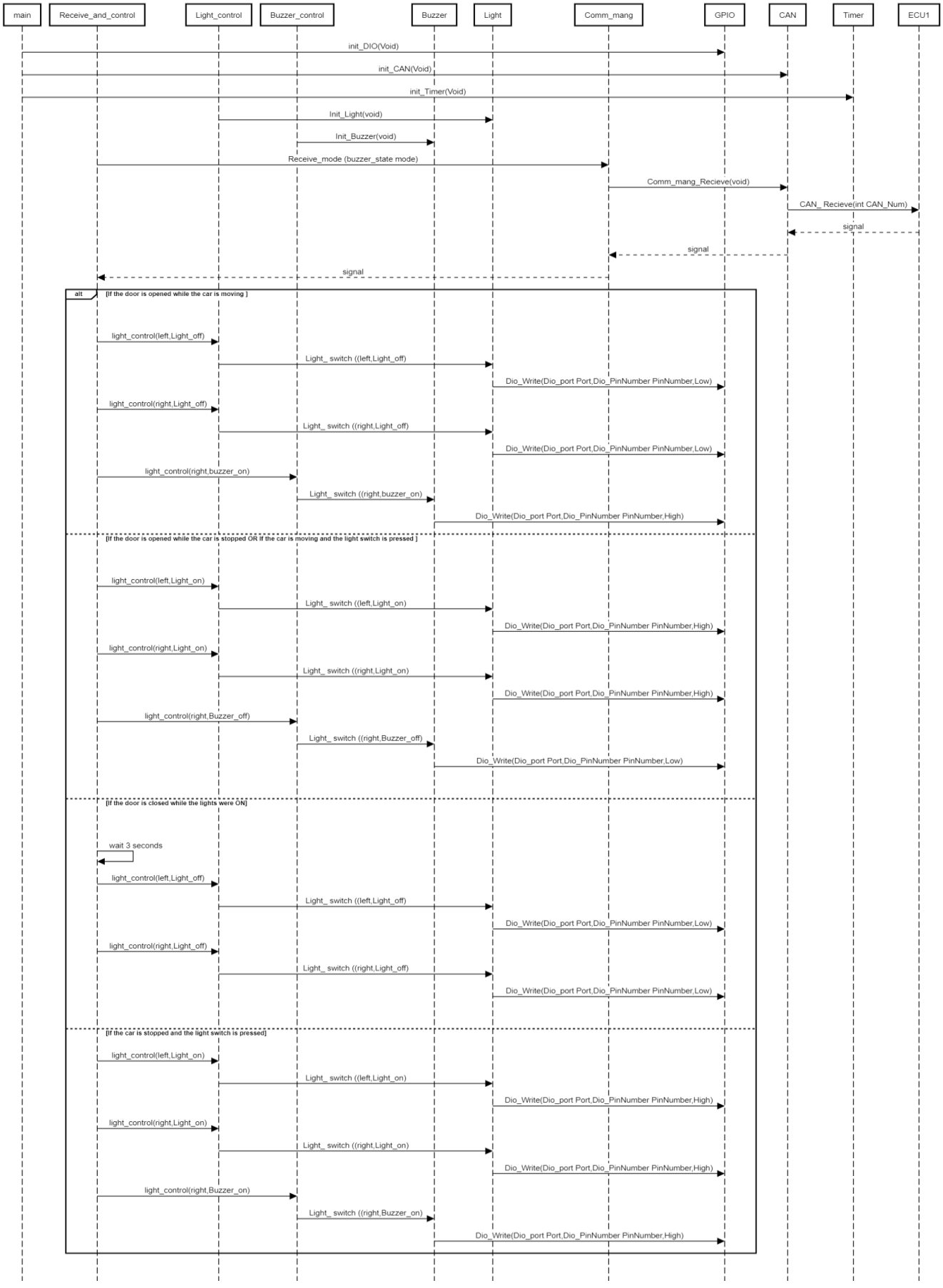
b. Buzzer Control



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 sec/20ms) = 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%***