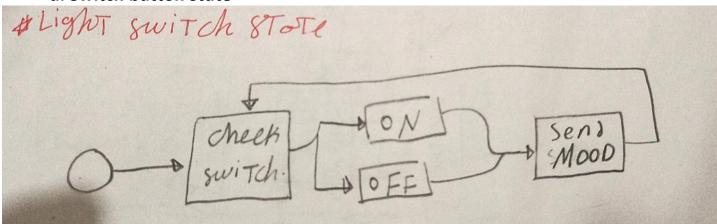
Dynamic Design Analysis

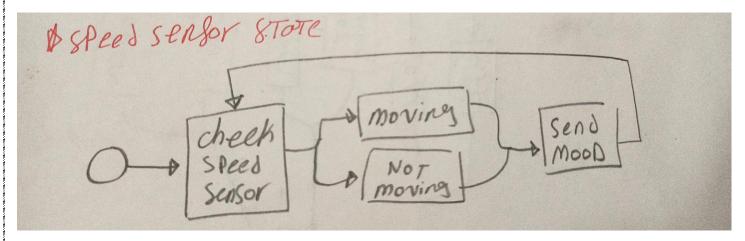
ECU1

1- Draw a state machine diagram for each ECU component

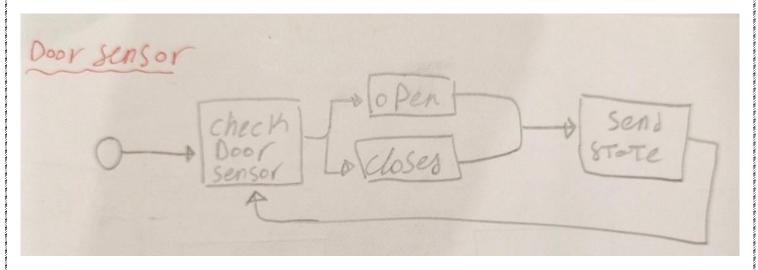
a. Switch button state



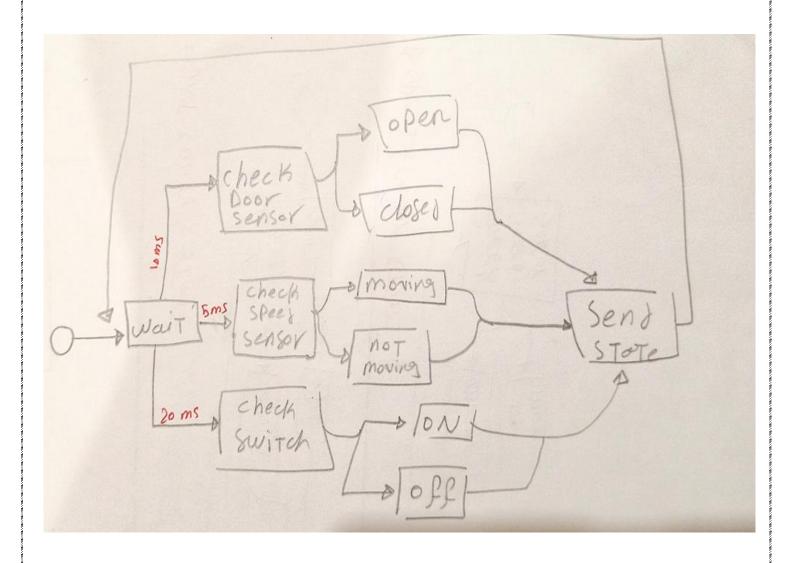
b. Car state



c. Door state



2. Draw a state machine diagram for the ECU operation



3-Draw the sequence diagram for the ECU1 This is a title Door_Sensor_state Light_switch_state Speed_Sensor_state Light_switch ECU2 Door_Sensor Speed_Sensor Comm_mang $init_DIO(Void)$ init_CAN(Void) init_Timer(Void) Init_DOOR_sensor(Void) Init_Light_Switch(void) Read_Door_state (void) Dio_Read(Dio_port Port,Dio_PinNumber PinNumber) Dio_Read(Dio_port Port,Dio_PinNumber PinNumber) Read_Door_state (void) Send_Door_state (char * data) Comm_mang_send (char* data) CAN_transmit (int CAN_Num, char* Data) Read_Light_Switch_state (void) Dio_Read(Dio_port Port,Dio_PinNumber PinNumber) Dio_Read(Dio_port Port,Dio_PinNumber PinNumber) Read_Light_Switch_state (void) Send_Light_Switch_state (char * data) Comm_mang_send (char* data) CAN_transmit (int CAN_Num, char* Data) Read_Speed_Sensor_state (void) Dio_Read(Dio_port Port,Dio_PinNumber PinNumber) ______Dio__Read(Dio__port Port,Dio__PinNumber PinNumber) Read_Speed_Sensor_state (void) Send_Speed_Sensor_state (char * data) Comm_mang_send (char* data) CAN_transmit (int CAN_Num, char* Data)

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)

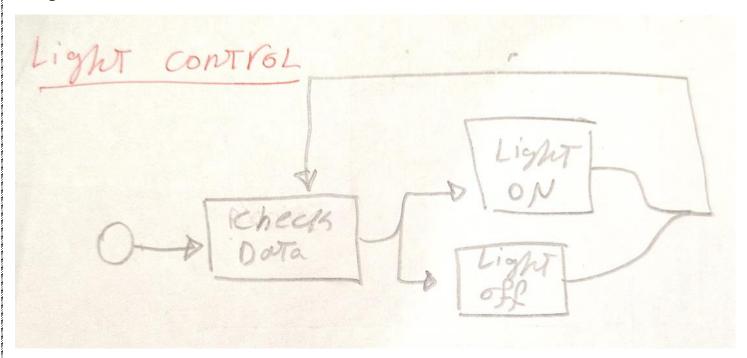
- Hyper period will be 20 ms
- Task 5ms → 4 times * 300 = 1200 microseconds
- Task 10ms → 2 times * 300 = 600 microseconds
- Task 20ms → 1 times * 300 = 300 microseconds

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

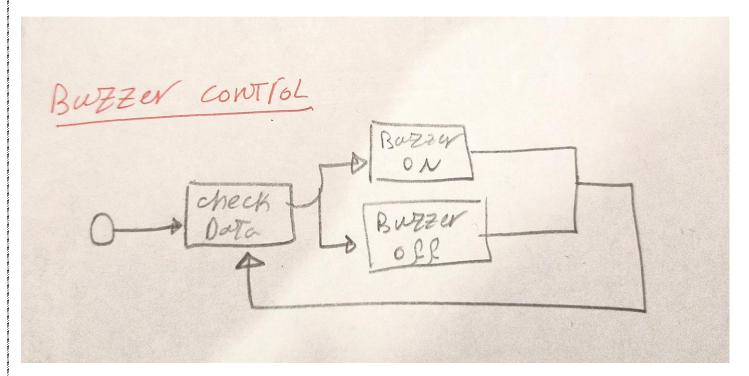
ECU2

1- Draw a state machine diagram for each ECU component

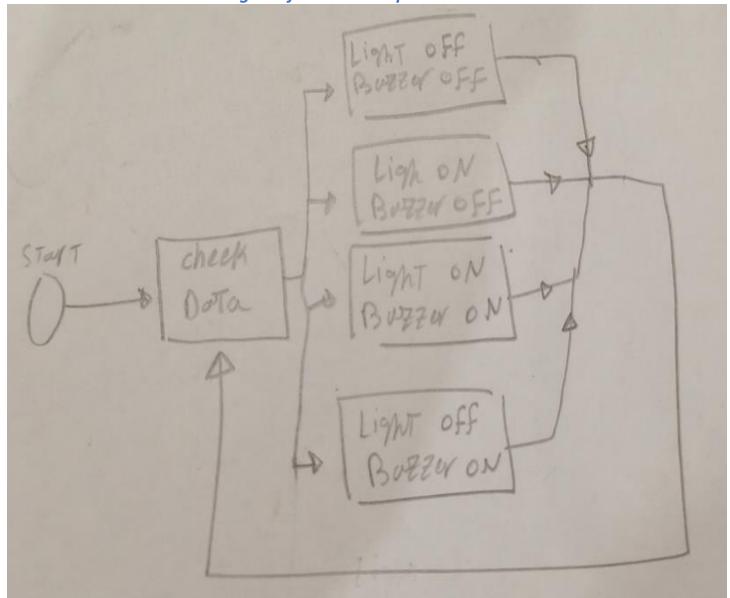
a. Lights control



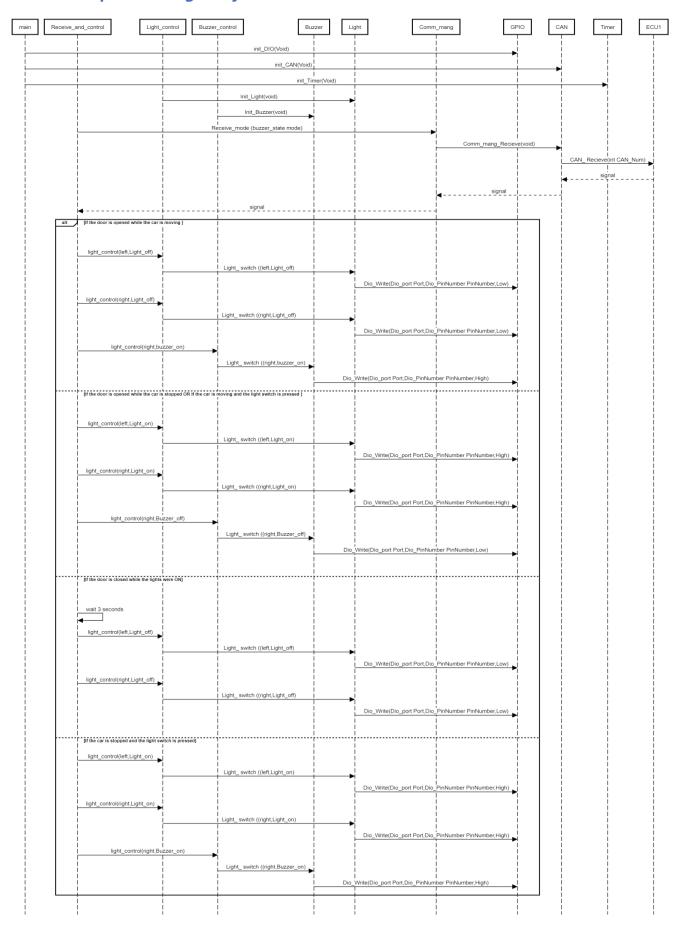
b. Buzzer Control



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%