**Dynamic design**

1. ECU1
2. State machine diagram of the components

* Door

initiate

After 10 ms

Idle

Turn\_On

SendStatus

GetStatus

Turn\_Off

CAN\_SendStatus()

DoorSensor\_u8TurnOff()

DoorSensor\_u8TurnOn()

DoorSensor\_vidGetStatus()

* Speed

initiate

SpeedSensor\_vidGetStatus()

After 5 ms

Idle

Turn\_On

SendStatus

GetStatus

Turn\_Off

CAN\_SendStatus()

speedSensor\_u8TurnOff()

speedSensor\_u8TurnOn()

* Light

initiate

LightSwitch\_vidGetStatus()

After 20 ms

Idle

SendStatus

GetStatus

CAN\_SendStatus()

1. State machine diagram of the operation

Initiate components

Initiate Timer

Initiate OS and start

Idle

Every 5ms

Every 10ms

Every 20ms

Speed

Light

Door

Return to idle state

1. Sequence diagram of the ECU

App

Speed

Light\_Switch

Door

Comm\_Mang

CAN

GPIO

Timer

loop

LightSwitch\_vidInit()

SpeedSensor\_vidInit()

DoorSensor\_vidInit()

CANM\_vidInit()

CAN\_vidInit()

Timer\_vidInit()

GPIO\_vidInitPin ()

GPIO\_vidInitPin ()

GPIO\_vidInitPin ()

GPIO\_vidSetPinDir()

GPIO\_vidSetPinVal()

Timer\_vidStart(5)

Timer\_ISR()

SpeedSensor\_vidSendStatus()

SpeedSensor\_vidGetStatus()

CANM\_SendStatus(‘S’, SpeedStatus )

CAN\_u8Send(&canData)

GPIO\_u8GetPinVal()

SpeedSensor\_u8TurnOn()

GPIO\_vidEnablePin(ENABLE)

SpeedSensor\_u8TurnOff()

GPIO\_vidEnablePin(DISABLE)

Timer\_ISR()

SpeedSensor\_vidSendStatus()

SpeedSensor\_vidGetStatus()

CANM\_SendStatus(‘S’, SpeedStatus )

CAN\_u8Send(&canData)

GPIO\_u8GetPinVal()

SpeedSensor\_u8TurnOn()

GPIO\_vidEnablePin(ENABLE)

SpeedSensor\_u8TurnOff()

GPIO\_vidEnablePin(DISABLE)

5ms

DoorSensor\_vidSendStatus()

DoorSensor\_vidGetStatus()

CANM\_SendStatus(‘D’, DoorStatus )

CAN\_u8Send(&canData)

GPIO\_u8GetPinVal()

DoorSensor\_u8TurnOn()

GPIO\_vidEnablePin(ENABLE)

DoorSensor\_u8TurnOff()

GPIO\_vidEnablePin(DISABLE)

Timer\_ISR()

SpeedSensor\_vidGetStatus()

CANM\_SendStatus(‘S’, SpeedStatus )

CAN\_u8Send(&canData)

GPIO\_u8GetPinVal()

SpeedSensor\_u8TurnOn()

GPIO\_vidEnablePin(ENABLE)

SpeedSensor\_u8TurnOff()

GPIO\_vidEnablePin(DISABLE)

5ms

Timer\_ISR()

SpeedSensor\_vidSendStatus()

SpeedSensor\_vidGetStatus()

CANM\_SendStatus(‘S’, SpeedStatus )

CAN\_u8Send(&canData)

GPIO\_u8GetPinVal()

SpeedSensor\_u8TurnOn()

GPIO\_vidEnablePin(ENABLE)

SpeedSensor\_u8TurnOff()

GPIO\_vidEnablePin(DISABLE)

DoorSensor\_vidSendStatus()

DoorSensor\_vidGetStatus()

CANM\_SendStatus(‘D’, DoorStatus )

CAN\_u8Send(&canData)

GPIO\_u8GetPinVal()

DoorSensor\_u8TurnOn()

GPIO\_vidEnablePin(ENABLE)

DoorSensor\_u8TurnOff()

GPIO\_vidEnablePin(DISABLE)

5ms

SpeedSensor\_vidSendStatus()

LightSwitchvidGetStatus()

CANM\_SendStatus(‘S’, SpeedStatus )

CAN\_u8Send(&canData)

GPIO\_u8GetPinVal()

LightSwitch\_vidSendStatus()

1. CPU load

execution time =

total time(Hyper-period time) = 20ms

CPU load =

1. ECU2
2. State machine diagram of the components

* Light

initiate

initiated

CarStatus

Moving

stop

DoorStatus

Light\_ON

Light\_OFF

open

DoorStatus

open

Check light

lightStatus

close

close

ON

Wait 3 seconds

Not pressed

pressed

OFF

* Buzzer

initiate

initiated

Turn\_On\_Buzzer

Turn\_Off\_Buzzer

CarStatus

Moving

stop

DoorStatus

open

DoorStatus

open

Not pressed

close

close

LightStatus

pressed

CarStatus

moving

stop

1. State machine diagram of the operation

Initiate components

Initiate Timer

Initiate OS and start

Idle

Every 5ms

Check status

Do action

1. Sequence diagram of the ECU

App

Buzzer

Light\_Source

Comm\_Mang

CAN

GPIO

Timer

loop

LightSource\_vidInit()

Buzzer\_vidInit()

GPIO\_vidInitPin()

GPIO\_vidInitPin()

CANM\_vidInit()

CAN\_vidInit()

Timer\_vidInit()

Timer\_vidStart(5)

CAN\_xRecieveMassage()

Buzzer\_u8ChangeStatus()

GPIO\_vidSetPinVal()

GPIO\_vidSetPinVal()

LightSource\_u8ChangeStatus()

1. CPU load

execution time =

total time(Hyper-period time) = 5ms

CPU load =