Embedded System Characteristics in Multiple Domains

Presented by,

Team OutBreak

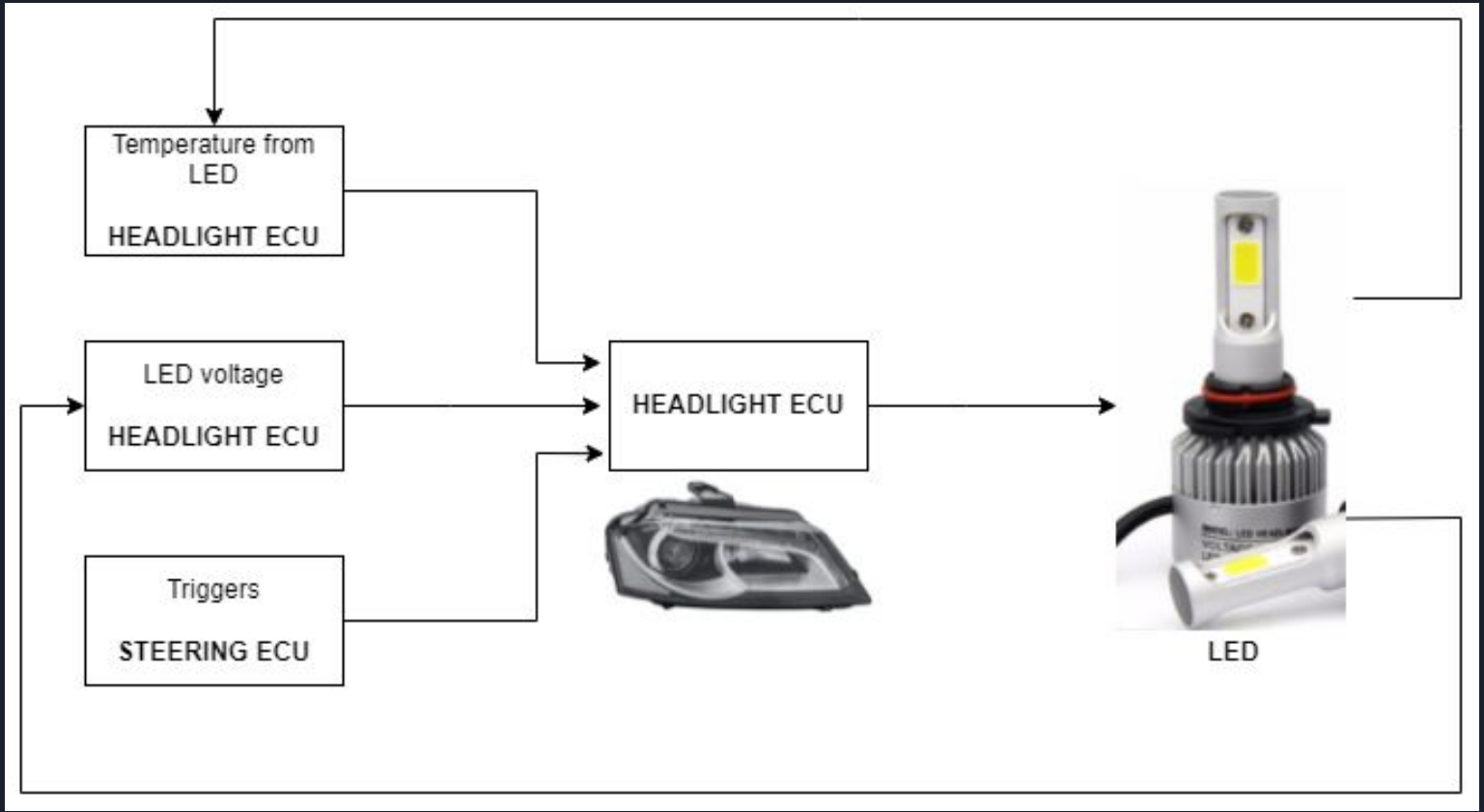
- Namık Mert Tunçbilek - 7213712
- Nijat Dashdamirov - 7213892
- Mirudhubashini Ramasamy Sridharan - 7213893
- Veli Ateş - 7213717
- Vignesh Arumugam - 7213710

AUTOMOTIVE

Embedded Systems in Car

- A Car have multiple Embedded systems which are termed as ECU [Electronic Control Unit].
- This section mainly deals with HEADLIGHT ECU.
- Requirements of Headlight ECUs are,
  - Protect LED from Open circuit & Short circuit failures.
  - Protect LED from Over temperature failures.
  - Faster response to functionality changes.
  - In Premium & Future cars,
    - Adaptive headlight turn with Steering movement.
    - Adaptive lighting with speed.
    - Lightings for pedestrians

High Level Architecture



Is this a Reactive System?

Yes, it is.

This ECU continuously check with the voltage data for output failures [open & short circuit] triggered by external environment and temperature readings for LED burnt failures.

Is this a Real-time System?

Yes, it is.

This ECU comes under Hard-real time.

All the functionality Triggers(i.e., Low beam, High Beam, Turn Indicator & Parking light) need to be responded within DEADLINE.

The Turn Indicator output should be a periodic task.

Is this a Continuous/discrete/hybrid systems?

Yes, this ECU has Discrete character in time.

Values of output voltage & temperature readings are acquired in a discrete manner in a pre-defined time [Example - Periodicity of Temperature reading is 10ms].

Is this a Dependable System?

Yes, this ECU address **Reliability** attribute by having certain number of life cycles or Warranty periods.

Availability is required, since this ECU need to ensure its functions availability as soon as BCM[Body Control Module] gets powered up. And need to exists till the power gets down.

Also this ECU have **Safety** standard ASIL ; “Automotive Safety Integrity Level”. Which highly tells the safety functions like Low Beam & Turn Indicator should be ensured even during failures.[Hazard avoidance]

Security in this system is ensured by having checksum & ID checks for updating ROM parameters.[Confidentiality]

Failure Example

Memory Failure

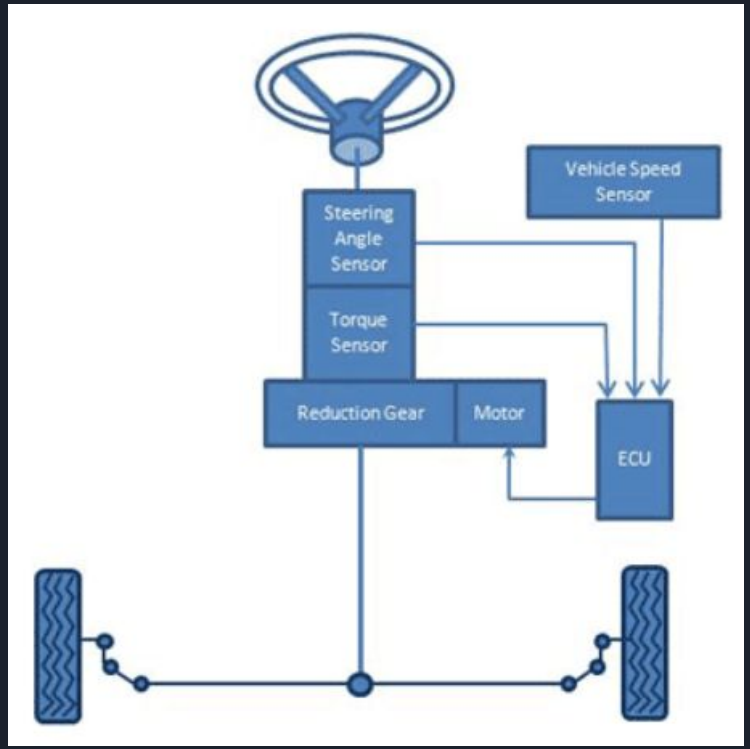
RAM block write & read fault → RAM Error → Memory Failure

It is a Persistent fault and in Bathtub curve it is at Infant mortality .

Is this a Distributed System?

In the current ECUs the Distributed system character is missing.

But in the Premium & Future cars, the Headlight ECUs will have Distributed system characteristics, for example - the Headlight ECU will interact with Steering ECU for “Adaptive headlight turn with Steering movement”



Thank You