自動車安全のためのHMI概念モデル：DESH-G

HMI Abstract Model for Automotive Safety Based on DESH-G

伊藤昌夫
株式会社ニルソフトウェア
nil@nil.co.jp

Masao Ito
NIL Software Corp.
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Abstract

- Now, it becomes more important that the relationship between the car and the driver, because we have to think about it partially in the autonomous car era.
- There is little industrial experience in this field, especially as for safety. Because;
  - Most of the driver usually are NOT professional operator (conf. power plant)
  - The circumstances around the car are very complicated (conf. airplane, railway)
- We propose an approach to design the abstract HMI model in the concept phase, especially from the viewpoint of safety.

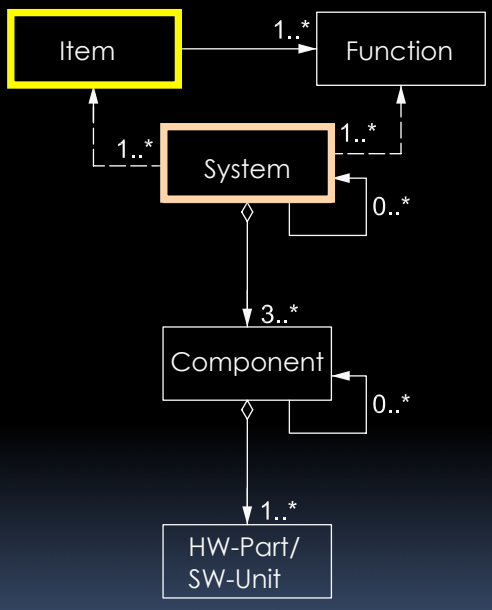
Relating Works

- Finding Hazards and Threats
  - *Masao Ito: Finding threats with hazards in the concept phase of product development. In European Conference on Software Process Improvement, Springer Berlin Heidelberg. pp. 277-284,2014*
- Driver Model
  - *Masao Ito: Controllability in ISO 26262 and Driver Model. In European Conference on Software Process Improvement (pp. 313-321). Springer International Publishing. pp. 313-321, 2015*
- Preliminary Architecture
  - *Masao Ito, How can we deal with the concept phase in the functional safety standard for automobiles ?, in proceedings of Safety-Critical Systems Symposium 2016 (SSS'16), 2016*

All works were mainly for the concpt phase of ISO 26262 (Part 3)

item ?

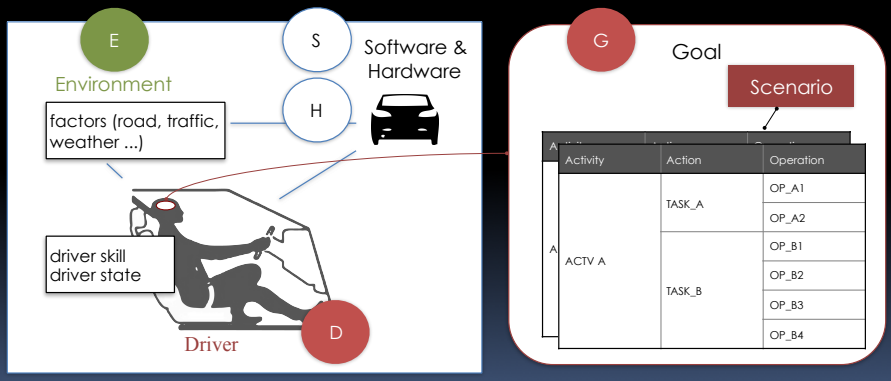
- The "item" is not the system in the meaning of ISO 26262 standard; It is an abstract object, and a system is generated from the item. For example;
  - The auto-cruise control system is an item
  - The ACC implemented in the X type of a car is a system
- As for system, we have many analyzing methods, but there is little for the "item".



ISO 26262 Part 10 Fig. 3

DESH-G model

- DESH-G schema covers the environment, driver and goal as well as hardware and software.



DESH-G model

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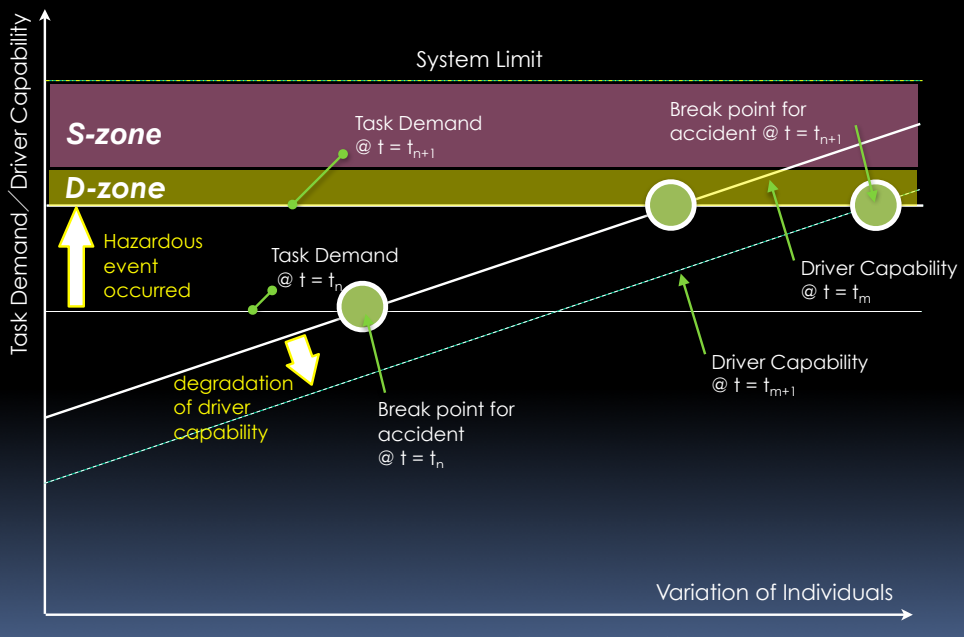
Safety vs. Harm Situation as for controllability



Task Demand vs. Driver Capability

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DESH-G interfaces

- Basic schema

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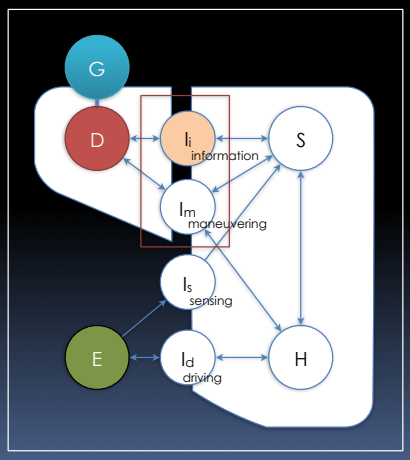

I_i: Interface for information provision

I_m: Interface for maneuvering

I_s: Interface for sensing the environment

I_d: Interface for reaching out to the environment

Interface Schema (basic)

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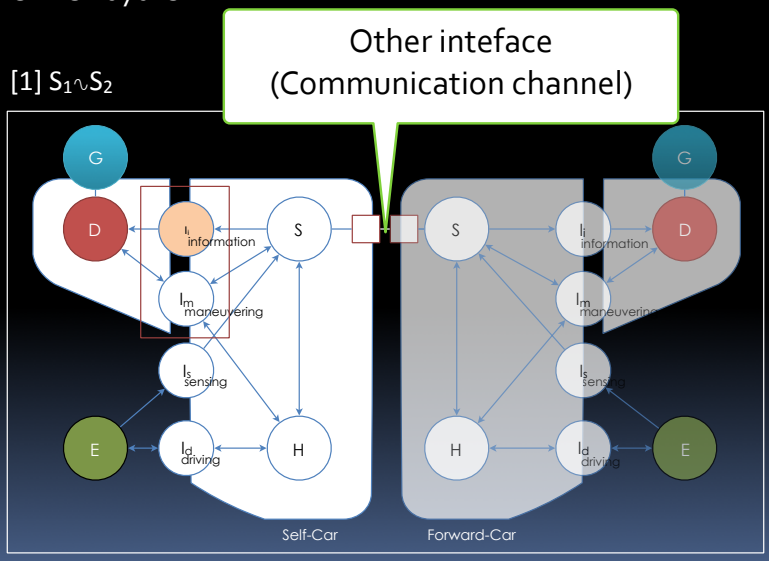
DESH-G interfaces

- In CACC, we have another interface to comunicate with the other system

[1] $S_1 \backsim S_2$



Interface Schema (CACC)

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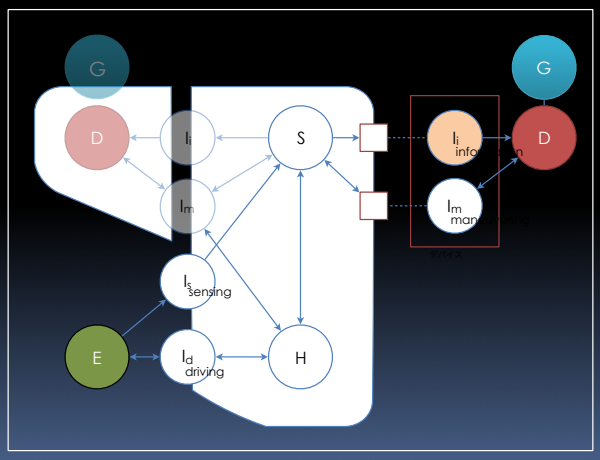
DESH-G interfaces

- In RPA (Remote Parking Assist), the driver is outside of a car. The system communicates with the mobile device.

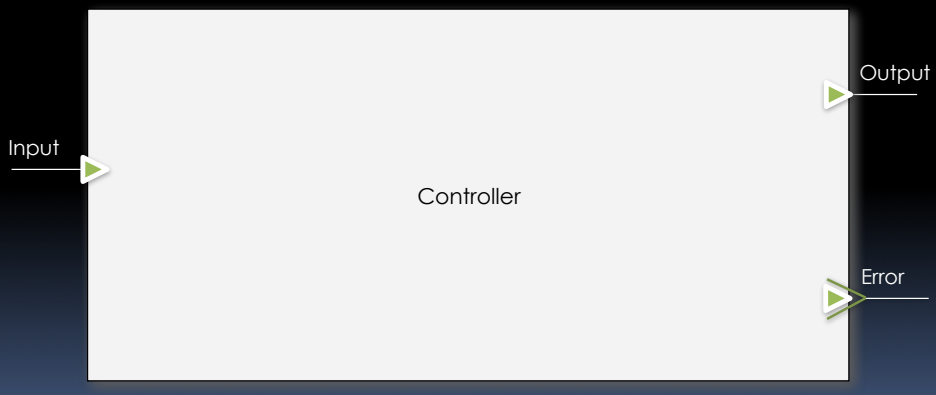
[2] S∿d



Interface Schema (RPA)

Preliminary Architecture

- Preliminary architcture comes from the interface with which we argued like;



Meta-architecture w/safety mechanism

Discussion

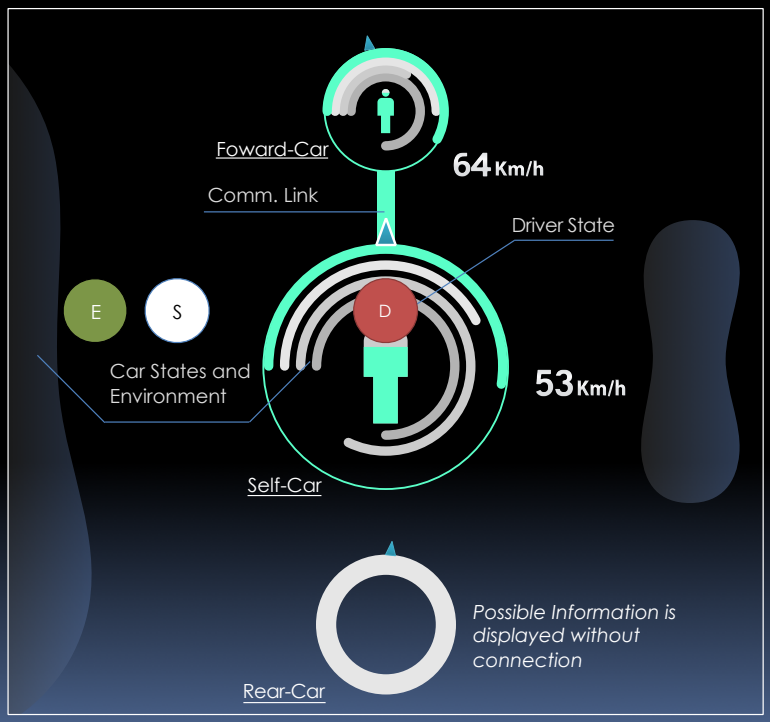
There is a long history of the human computer interaction in the field of the software system.

Communication Breakdowns

- False alarm
  - *a misconception on the user's part leads her to find evidence of an error in her actions where none exists.*
- Garden path
  - *a misconception on the user's part produces an error in her action with respect to the prescribed procedure, the presence of which is masked.*

Suchman, Lucy: Human-machine reconfigurations: Plans and situated actions. Cambridge University Press (2007)

Sample implementing DESH-G



Display (via li) w/Information from other interface

Summary

- We identified four interfaces (i.e. I_i, I_m, I_s, I_d) in the DESH-G model. In order to think about the automobile safety, consolidation of those interfaces is important especially in the concept phase of system development.
  - This idea also allows us to find the hazards and introduce the preliminary architecture.
- Time duration is important for the driver to make the correct decision, if the system doesn't show its plan in an appropriate manner, driver might be in the state of "false alarm" or "garden path" especially being in the D-zone.
- We can use the finding in the design of HCI of the computer system when thinking about the HMI of the car.