Abstract

Automated functions for real scenarios have been increasing in the last years in the automotive industry. Many research contributions have been done in this field. However, other problems have come to the drivers:

- When should they (the drivers or the new automated systems) be able to take control of the vehicle?

This question has not a simple answer; it depends on different conditions, such as: the environment, driver condition, vehicle capabilities, fault tolerance, among others.

In this paper a survey on arbitration and control solutions in ADAS is presented, analyzing the ADAS functions available in the market, and its relation with the different control actions.

CONTRIBUTIONS

- A survey on arbitration and on autonomy levels for co-driving. What if the automated vehicle (co-system) “wants” to go to the right and the driver wants to go to the left?
- An approach using controllers implementing fuzzy rules.

ARBITRATION

- Nowadays computerized vehicles cannot ensure full autonomy in all situations, i.e., co-driving is still necessary to ensure safety.
- Level of automation: a combination of tasks delegated at a level of abstraction with some authority and resources to be used to perform the task. E.g., for UAVs [Clough02], it is not [Pollard & Morignot13].
- Can be 2-dimensional [Clough02] [Parasuraman et al.00].
- Arbitration comes from the fact that 2 decision makers must harmonize their advice on the unique path followed by the vehicle [Flemisch et al.12].
  - Choosing a level of automation of the vehicle.
  - Is dynamic, to adapt to the driver's state and to the situation.
  - Is based on ability, authority, responsibility and control.

Fuzzy Logic Approach for Sharing Control of a Vehicle

- Decision making and intention detection concepts are usually based in the combination and evaluation of measurable parameters to infer a probability value.

RULE BASE:

IF VDD level is high AND TTC level is low THEN Fully control level is HIGH.
IF VDD level is low AND TTC level is high THEN Fully control level is LOW.
IF Drowsiness level is high AND TLC is low THEN Fully control level is HIGH.
IF Drowsiness level is low AND TLC is high THEN Fully control level is LOW.

CONCLUSION & FUTURE WORK

- Federate authors on a unique spectrum of autonomy layers for ITS.
- Arbitration as solving conflicts between the driver and the co-system, based on dynamic autonomy layers of the vehicle.
- A proposed implementation in simulation using fuzzy rules.
- Future work: As a human study (in a simulated vehicle), observe the behavior of drivers during long driving periods in the simulator. Topics: Adaptation of the co-system to the driver (based on driver monitoring); Initiatives of the driver (autonomy level change).

Key factors for vehicle control in the market

- Legislation: New Car Assessment Programme (Euro NCAP)
- Cost: customers are willing to pay more for advanced systems (ADAS) [10]
- Market indicator: ADAS will have a high influence on the market in few years Safety: Electronic systems are critical for modern automobiles [12].
- Technology availability:
  - Interconnections.
  - Fusion.
  - New infrastructures
  - Sensor technologies

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