Overview of the European Project PRYSTINE and main Achievements

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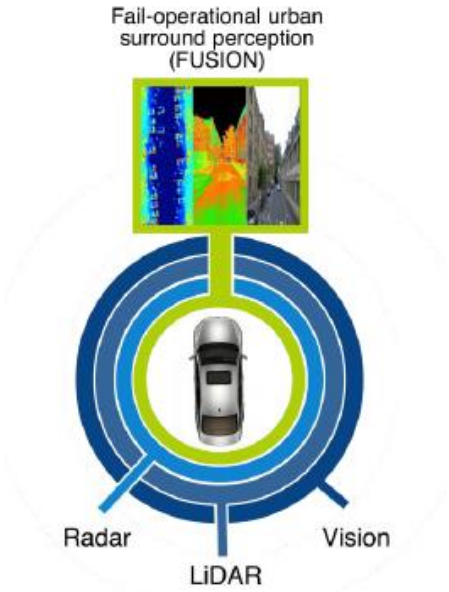
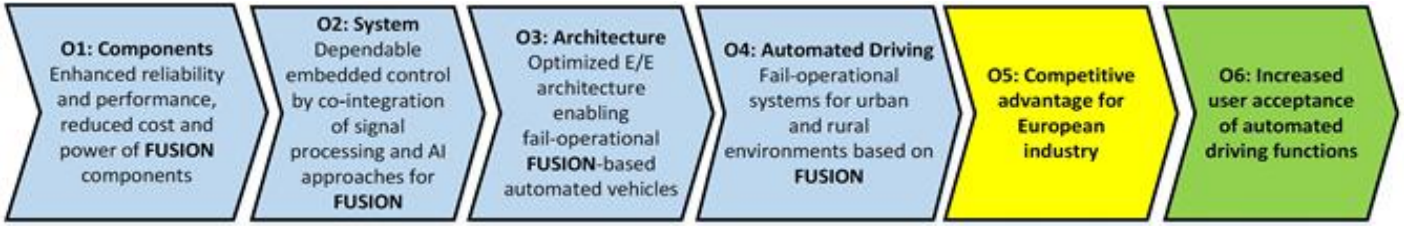
Background – 1

- Top-level Goal: *realize Fail-operational Urban Surround perceptION (FUSION), based on robust Radar and LiDAR sensor fusion and control functions, so as to enable safe automated driving in urban and rural environments*.
- Expected Outcomes:
  - Fail-operational sensor-fusion framework at component level with dependable embedded E/E architectures
  - Safety compliant integration of Artificial Intelligence (AI) approaches for object recognition, scene understanding, and decision making within automotive applications.
  - Validation of reference FUSION hardware/software components for AVs in industrial demonstrators.



Background – 2

- We realized the Vision by means of these project objectives



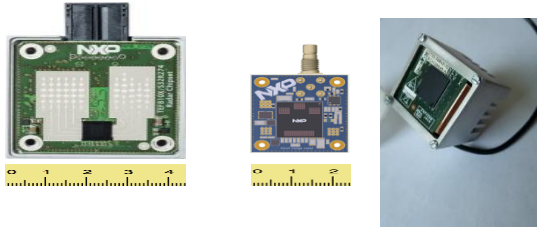
- and with this consortium
  - 60 partners (from 14 European and non-European countries)
  - Different partner's profiles (OEMs, Semiconductor companies, Technology providers, Universities and research institutes)

Results – 1

- Many results at component level …

LiDAR: 1D MEMS Micro-Scanning incl. 2G AURIX™ safety controller (IFAT, TUG)

LiDAR: 2D MEMS Micro-Scanning (Murata, OKM, VTT)



CMOS RADAR transceiver + 3 Transmit and 4 Receive antennas integrated in a single package (NXPNL)

- And at system level …

PRYSTINE prototype vehicle

Lidar sensors integration

Results – 2

- Evaluation with “real” end-users.
- Experiments in driving simulators in specific UCs
- Main achievement:
  - When the driver is continuously kept in the control-loop, this provides benefits to the driving task, especially during the distraction events, by improving driving safety and reducing the driver required efforts.
  - Safety is improved by PRYSTINE w.r.t. the BL, considering objective measurements (reduction of # of accidents, near misses and events under safe conditions).
  - Participants regarded the PRYSTINE system as particularly useful, effective, assisting and desirable.
  - Participants reported they would like to use the PRYSTINE system frequently and reported that the system was easy to use.
  - Generally, participants have a good opinion about autonomous vehicles (AVs).

Conclusions

- PRYSTINE developed many HW/SW components for FUSION, many of them integrated in real demonstrators.
- In particular, the concept of FUSION, has been implemented on the “Maserati” passenger-car, to enable safe AD in urban and rural environments.
- We performed also tests with real end-users, focusing on the trade-off between humans and automation.
- Main findings are:
  - People like the system and regard it as preferable or equal with respect the BL
  - People would like to have it on their own car and use
  - People evaluate positively the TOR, but more information on the reasons could be appropriate

Recommendations

- Integration of components and design of the experiments is very time-consuming and this should be carefully planned.
- Redundancy can be guaranteed only using FUSION, that is different sensors covering the same area. More work is necessary to optimize the sensor suite in terms of trade-off between costs and performances
- Important to have this kind of tests and that people can try the system, even if in simulator (more safety, controlled environment, etc.).
- Some limitations in the set of covered scenarios and in the number of involved participants: extension of tests/experiments towards this direction.
- Address some possible categorizations (such as gender issue, novel/expertise, age, culture, and so on).