

TRUST-E DEMONSTRATORS

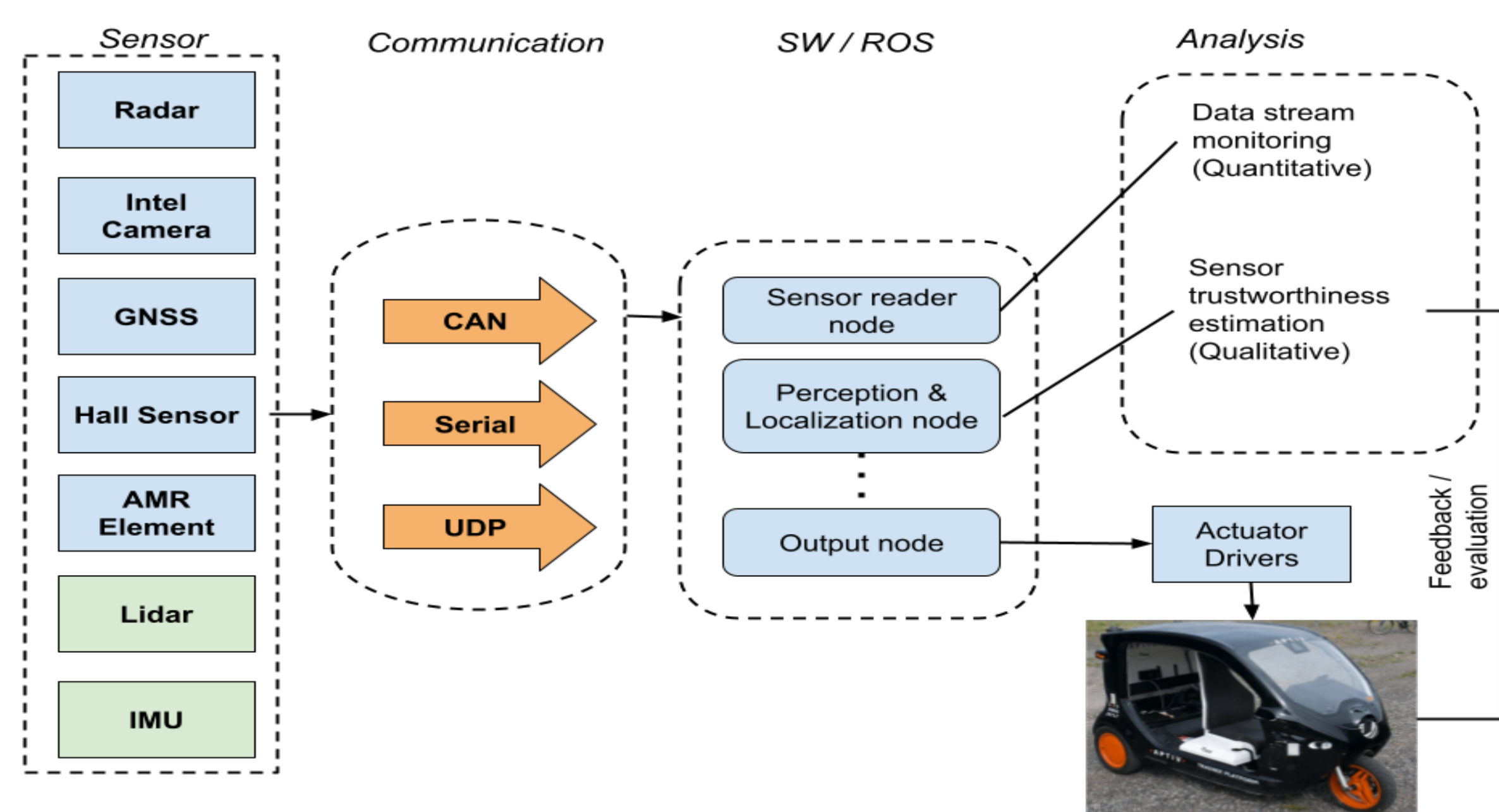
Trustable (sensor-driven) electronics – for Automotive, Aviation and Industrial Applications

URBAN VEHICLE

CONTRIBUTORS: Aptiv (S), Fraunhofer ENAS (D), Robert Bosch (D), XenomatiX (B), and Imec (B).

SYSTEM OVERVIEW:

- Function (urban delivery vehicle):** Localization and mapping.
- Sensors:** Radar, camera, GNSS, Hall sensor, AMR, lidar, and IMU.



FAULTS:

- Unavailability of one or more sensors, e.g., GNSS in underground.
- Fault injection, e.g., over heating.

RELIABILITY & SAFETY ENHANCEMENT:

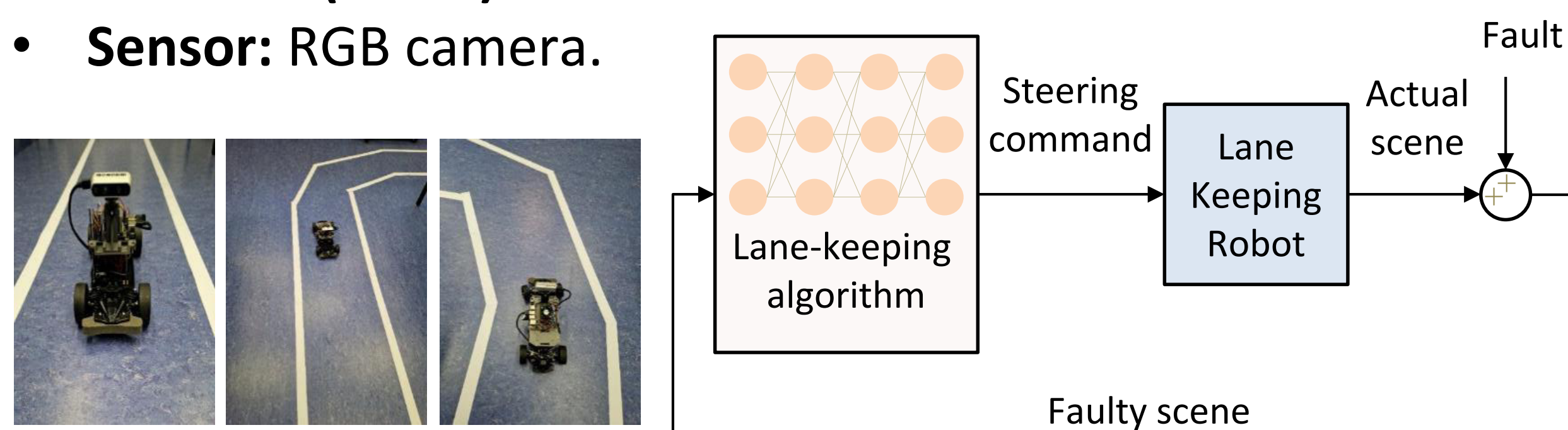
- Sensor condition monitoring and diagnostics:** Individual sensor solutions for on-board health monitoring.
- Estimating sensor trustworthiness:** Multi-sensor consensus filtering approach for estimation.

LANE KEEPING ROBOT

CONTRIBUTOR: Universität Siegen (D).

SYSTEM OVERVIEW:

- Function (robot):** Drive between two lane marks.
- Sensor:** RGB camera.



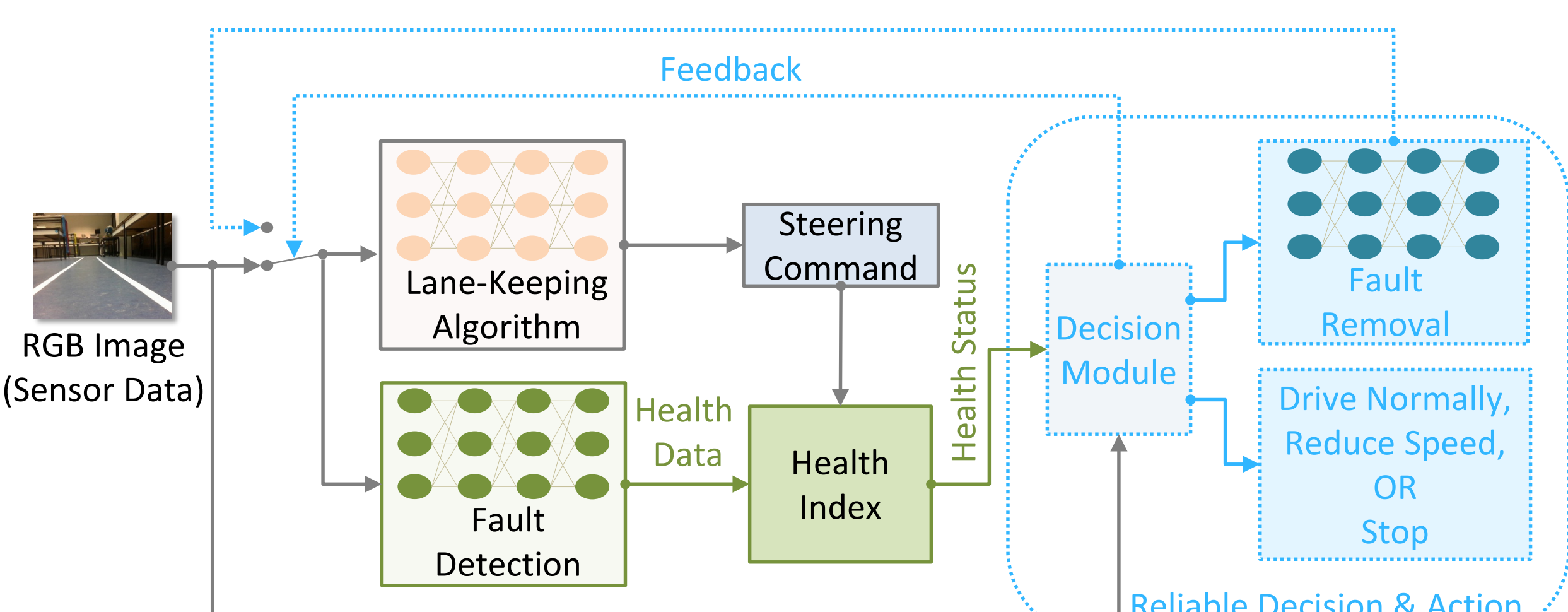
FAULTS:

- To the RGB image data.
- In-house tool to inject a fault.

Intensity	Type				
	Blur	Rain	Crack	Speckle noise	NCAC*
Slight					
Medium					
Extreme					

*NCAC: No chromatic aberration correction

RELIABILITY & SAFETY ENHANCEMENT:



ALTERNATE MOBILITY

CONTRIBUTORS: Qamcom (S), RISE (S), and KTH (S).

SYSTEM OVERVIEW:

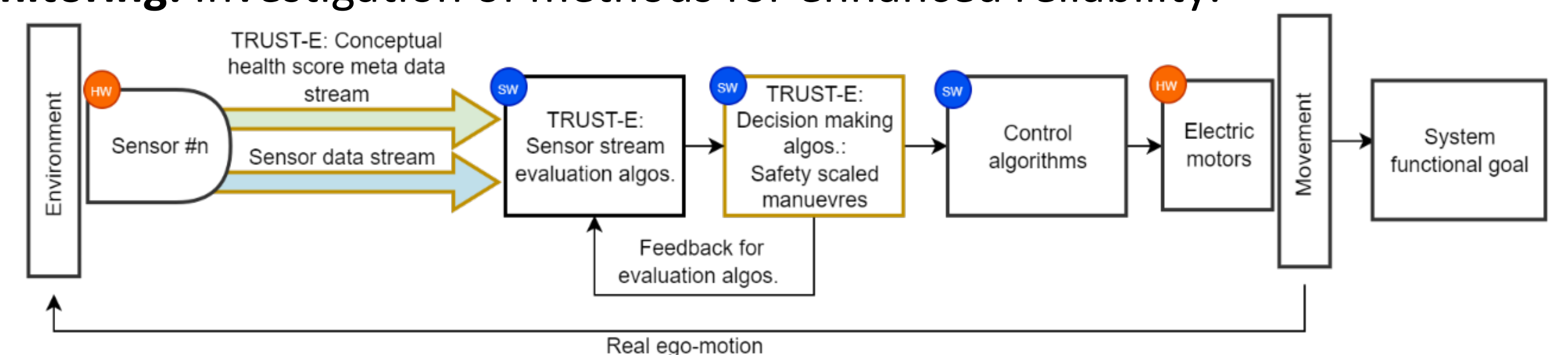
- Function (general AGV platform):** AI door detection, RGB object detection, path planning, path following, and autonomous braking.
- Sensors:** RGB-D camera and 4D radar, IMU, and 2D lidar.

FAULTS:

- To the RGB-D camera and IMU.
- Sensor inaccuracy and Kalman filter algos.

RELIABILITY & SAFETY ENHANCEMENT:

- Fault detection:** During pre-control and post-control operation.
- Health monitoring:** Investigation of methods for enhanced reliability.

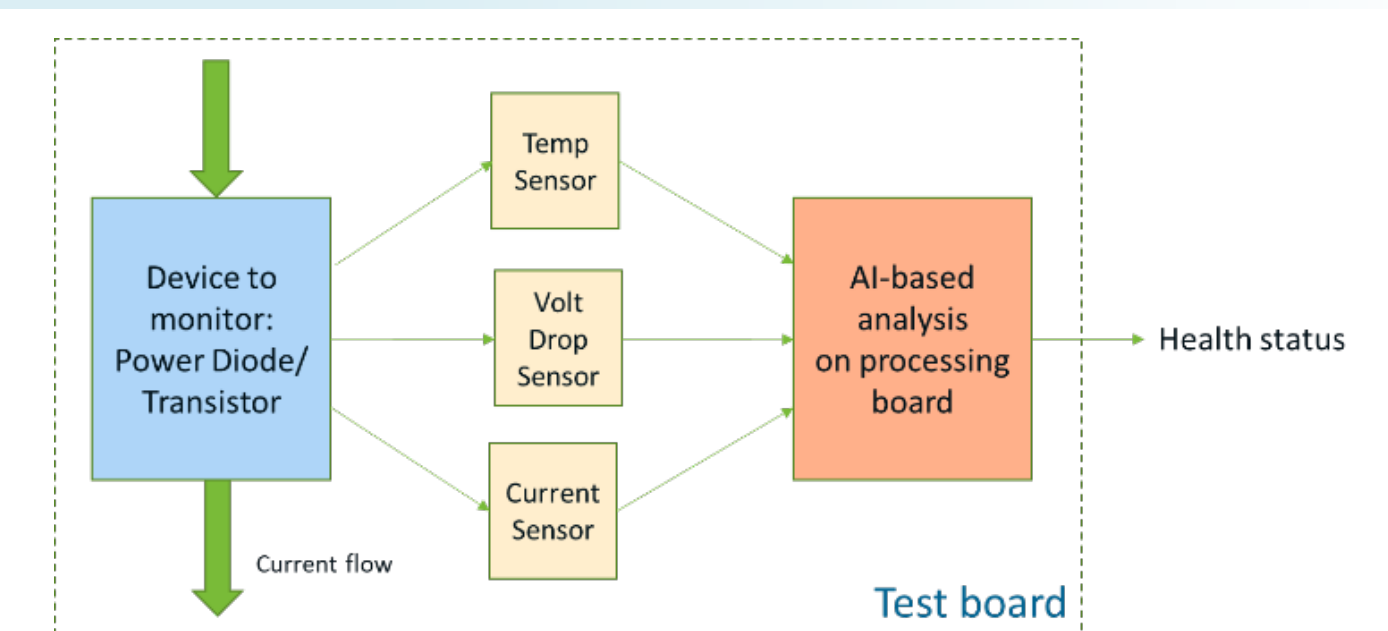


INDUSTRIAL DEMONSTRATORS

CONTRIBUTORS: Nexperia (D), Synective Labs (S), KTH (S), Fraunhofer ENAS (D), and Siemens (D)

SYSTEM OVERVIEW:

- Function (Power SIP):** Monitor critical health parameter on die level. Sensors: temperature, voltage drop, and current.
- Function (Sensor Box):** System level hardware self monitoring circuits for multi-sensor boards (e.g. acceleration sensor, magnetic sensor).

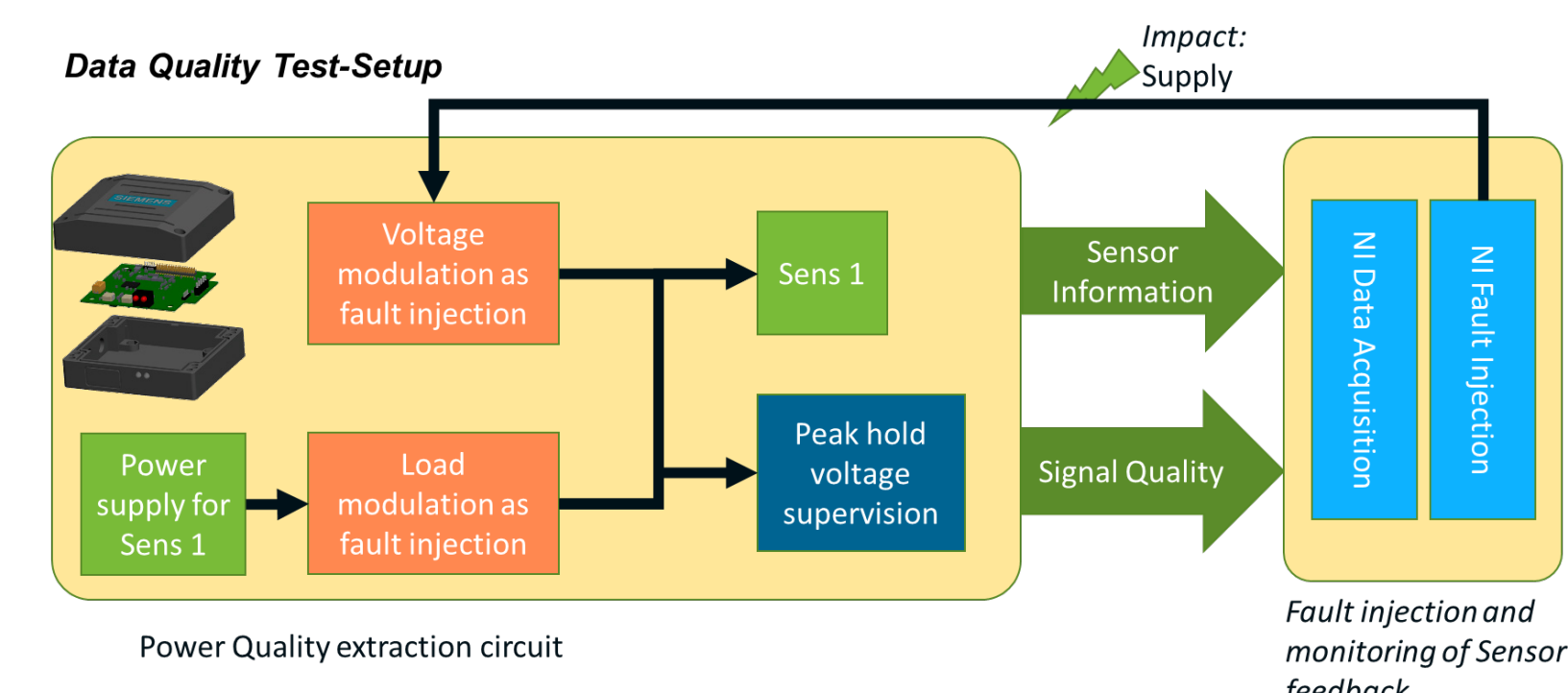


FAULTS:

- Device failure due to thermal stress (Power SIP).
- Fluctuations of power supply (Sensor Box).
- External/internal interferences (Sensor Box).

RELIABILITY & SAFETY ENHANCEMENT:

- Condition monitoring:** Circuit to monitor the relevant health data of a power module.
- Health & lifetime estimation:** Avoid unexpected fail of electronics and resulting downtime.
- Data quality evaluation:** Reliability of the monitoring by supervising output data quality.

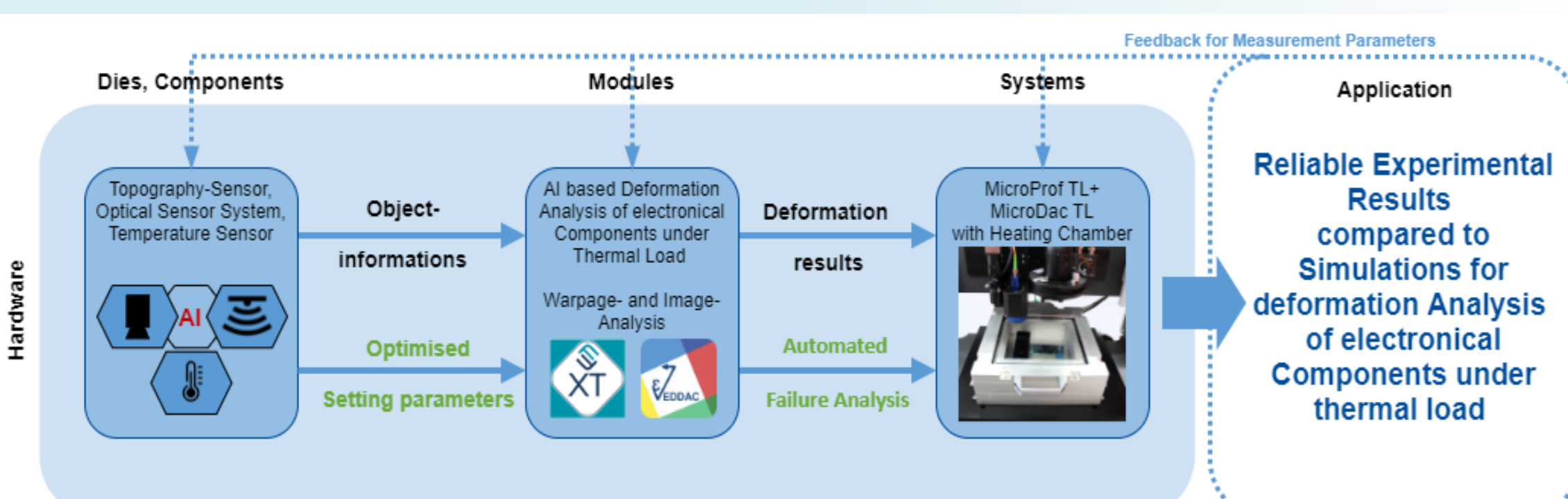


3D MEASUREMENT SYSTEM

CONTRIBUTORS: Chemnitzer Werkstoffmechanik (D), Berliner Nanotest und Design (D), Fraunhofer ENAS (D), Formfactor FRT Metrology (D), scalable minds (D)

SYSTEM OVERVIEW:

- Function (measurement):** Measure 3D deformation of electronical components under thermo-mechanical loading.
- Sensors:** CMOS camera and chromatic confocal sensor.



FAULTS:

- Solder joint fatigue.
- Delamination/interface cracks.
- Failure of die-attach due to thermo-mechanical loading.

RELIABILITY & SAFETY ENHANCEMENT:

- Analyses:** Automated digital image correlation (DIC) analyses and topography measurement using AI solutions including optimized heating chamber.
- Identification:** Failure-critical areas of PCB.

