Federal Office
for Information Security

Deutschland
Digital•Sicher•BSI•

Vulnerability analysis of sensor systems in modern cars - Optical ADAS

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Content

1. Vulnerability analysis at BSI
    - Motivation for vulnerability analysis
    - Goals
2. Test environment and results
    - Test environment
    - Simulation on TV
    - Testing with objects
3. Outlook
4. Conclusion

1. Vulnerability analysis at BSI

Motivation for vulnerability analysis

...the past

- ADAS largely uncritical
- e.g. ABS, light-/ rain sensor, tire pressure monitoring system
- only as support the driver
- attack from outside the car difficult

...the present

- ADAS takes over individual control
- e.g. emergency braking system, lane keeping system, adaptive cruise control
- system acts without further interaction of the driver
- additional information channels into the cars

...the future

- self driving cars at a higher autonomy level (SAE 4 & 5)
- can operate without a driver
- decisions based on AI

Goals

...point out vulnerabilities and risks
- BSI task: inform and advice
- prevent abuse

...development of minimum standards
- BSI task: certification
- dialog with OEMs & authorities
- cross-manufacturing verifiability

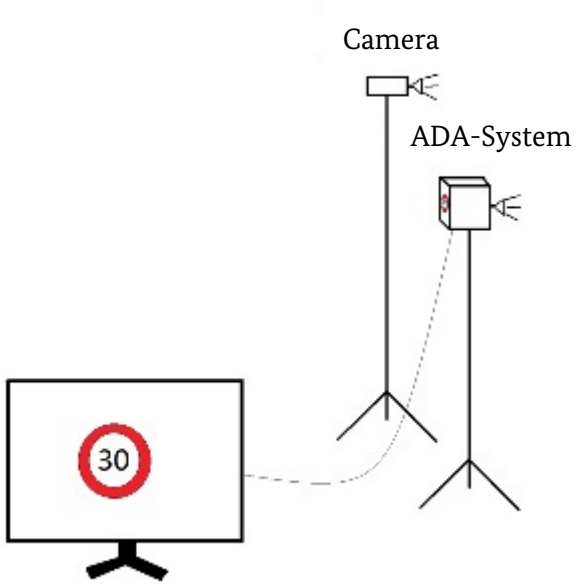
...new technologies
- BSI task: support and advice
- Improvement of recognition performance
- Ensure safe information channels into the car

2. Test environments and results

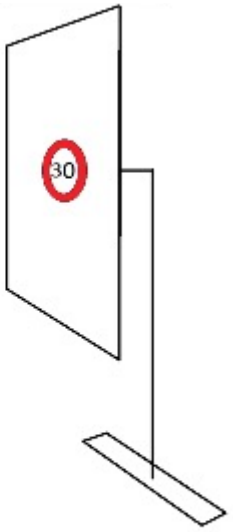
Test environment

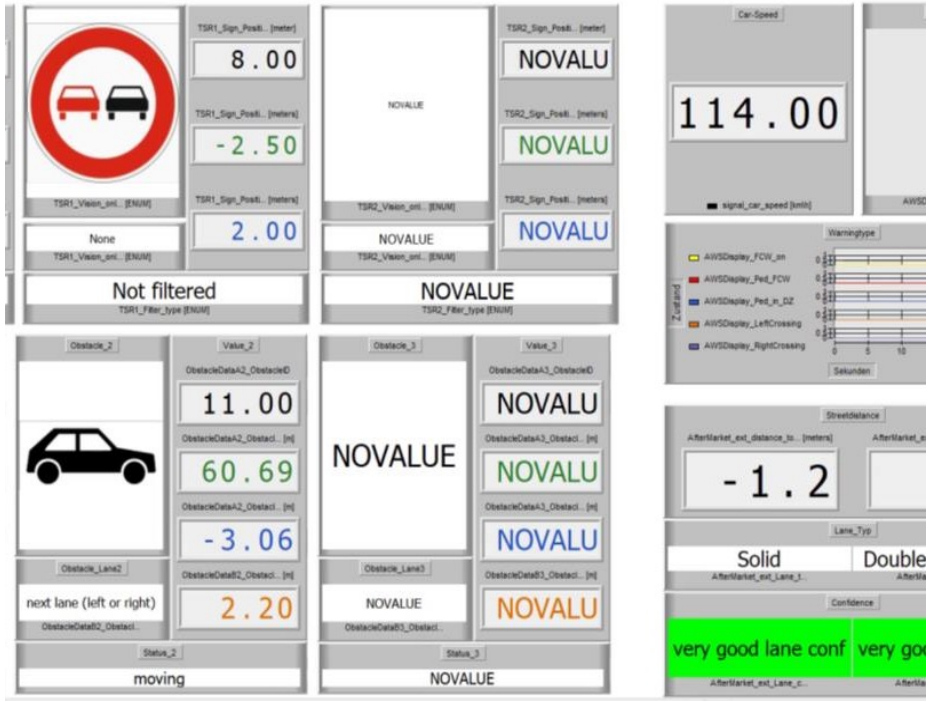
...test setup

- retrofit ADAS with mono-camera
- 3D simulation software on TV-screen (65 inch)
- evaluation with GUI, CANBus frames and display of the system



TV with simulation software





GUI to extract information from CANBus

Simulation on TV

Recognition car: 10/10

Recognition sign: 4/10

Recognition sign: 4/10

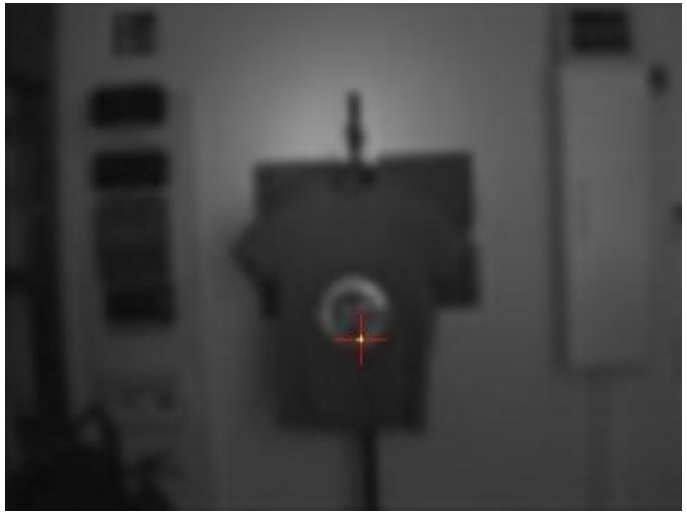
Recognition truck: 10/10

Recognition obstacle: 0/10

Testing with objects

- demonstration of selected objects in laboratory environment and on a test track using an ordinary car.

Test track at ATC Aldenhofen



T-Shirt with traffic sign in laboratory

3. Outlook

Further evaluation

...hardware
- integration of additional sensors
- integration of external signals (GNSS, V2X, etc.)
- integration of sensor fusion

...test environment
- simulation of sensor data and sensor models
- set up of automatic HiL and SiL test methods
- cross plattform testing of different manufacturers

...AI-procedures
- evaluation of different attack techniques on AI systems
- development of test procedures for AI

4. Conclusion

Conclusion

- higher intelligence = higher automation = more potential vulnerabilities
- new information channels = new attack vectors
- AI recognition process = difficult to verify the output of the system

Thank you for your attention!

- Kontakt

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