Safety relevant applications at level crossings by means of imaging methods

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Motivation

- Many level crossings (LX) exist all over Europe
- There are numerous incidents at LX with high damages to material and persons
  - The technical equipment of the LX only with flash lights or semi-barriers is not relevant for incidents
  - Many accidents occurred due to mistakes in noticing or obeying the warning signs

Main Problem:
- Safe and expensive technology vs. economic interests
Motivation

- **Main Target:**
  - New LX securing technology, which is
    - Adequate in safety
    - Affordable in investment and maintenance
    - Available and reliable during operation
    - Supporting technology to existing LX technology

- These targets can be achieved by using imaging methods for LX securing technologies
State of the art and innovative approaches

- **State of the art**
  - Monitoring of LX danger zone
  - End of train monitoring
  - Train departure dispatching by the driver
  - All applications are only supporting tools without safety relation

- **Innovative approaches**
  - Catenary monitoring
  - Obstacle detection
Imaging based concept

- **Technical system requirements**
  - High availability and reliability
  - Designed for rough environment
  - Available in day and night times → object detection must be available under all light conditions
  - Replacement and/or assistance of human and/or technical operations

  - At least same safety ↔ Affordable safety

- **Alternatives of realization**
  - Support of existing control and safety technology
  - Replacement and extension of existing operational functionalities by using imaging sensors (like video or infrared) combined with analyzing software
Imaging based concepts

- Level crossing secured with half-barriers and flash lights.

- Four camera systems, two at each barrier.

- Each camera system consists of one camera for visible ranges and one for non-visible ranges, such as Infra Red camera.
Imaging based concepts

Camera System 1

Vehicle approaching LX

Expectation value approaching Vehicle

Expect Vehicle

No Obstacle on LX [LX free]

Vehicle detected - Frontside

Obstacle on LX [LX blocked]

Vehicle detected - Backside

Obstacle in danger zone

Camera System 2

Expected Vehicle

Camera System 3

Vehicle detected - Frontside()

Obstacle in the danger zone

Camera System 4

Vehicle detected - Backside

Obstacle left the danger zone

No Obstacle on LX [LX free]
Demonstration

Because of a wide operational area of such a technology, it is necessary to perform realistic tests.

Especially with regards to the safety criticality of such an application, first tests will be done in a non-public area.

For the field tests, a road-rail vehicle and a minivan will be used, in the first steps.

After an initial phase of tests, a demonstration unit will be developed, that can be mounted at an LX in a non-public area.
Conclusion

The implementation of imaging methods using camera based technology can help increasing the safety of railways especially at level crossings.

To implement such an innovative system, intensive test campaigns are necessary in which the multiple requirements regarding safety targets, availability, maintainability and security can be evaluated.

Innovative systems using camera based technology form an economical advantageous alternative to existing track-fixed monitoring units still reaching the required safety regulations formulated by standard books, laws or other official documents all over Europe.

The Institute of Transportation Systems of the German Aerospace Center in Braunschweig will develop such a system and evaluates it in different field tests. First results could be presented in the next year.
Thank you for your attention

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