



# **Safety relevant imaging based applications for level crossings**

**Sicherheitsrelevante Anwendung bildbasierter  
Technologien an Bahnübergängen**

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# Institute of Transportation Systems

## Institut für Verkehrssystemtechnik

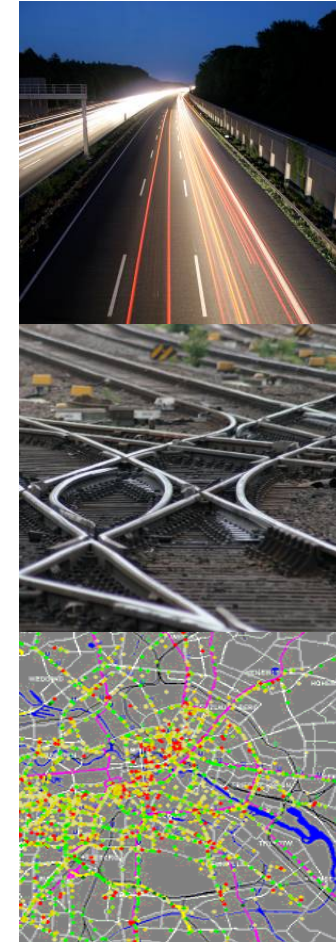
Residence: Braunschweig and Berlin  
Since: March 2001  
Director: Prof. Dr.-Ing. Karsten Lemmer  
Employees: Presently 100 employees  
from various scientific disciplines

### Range of tasks

- Basic research
- Creating concepts and strategies
- Prototype development

### Fields of research

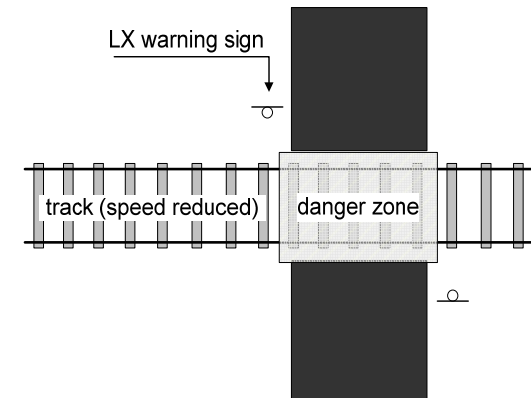
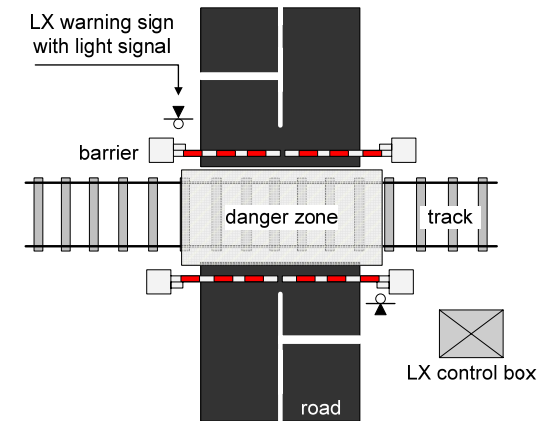
- Automotive
- Railway systems
- Traffic management





# 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



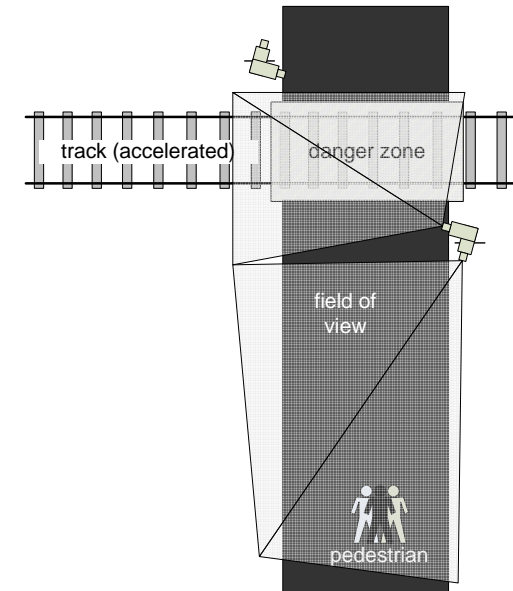


# Motivation

## ➤ 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

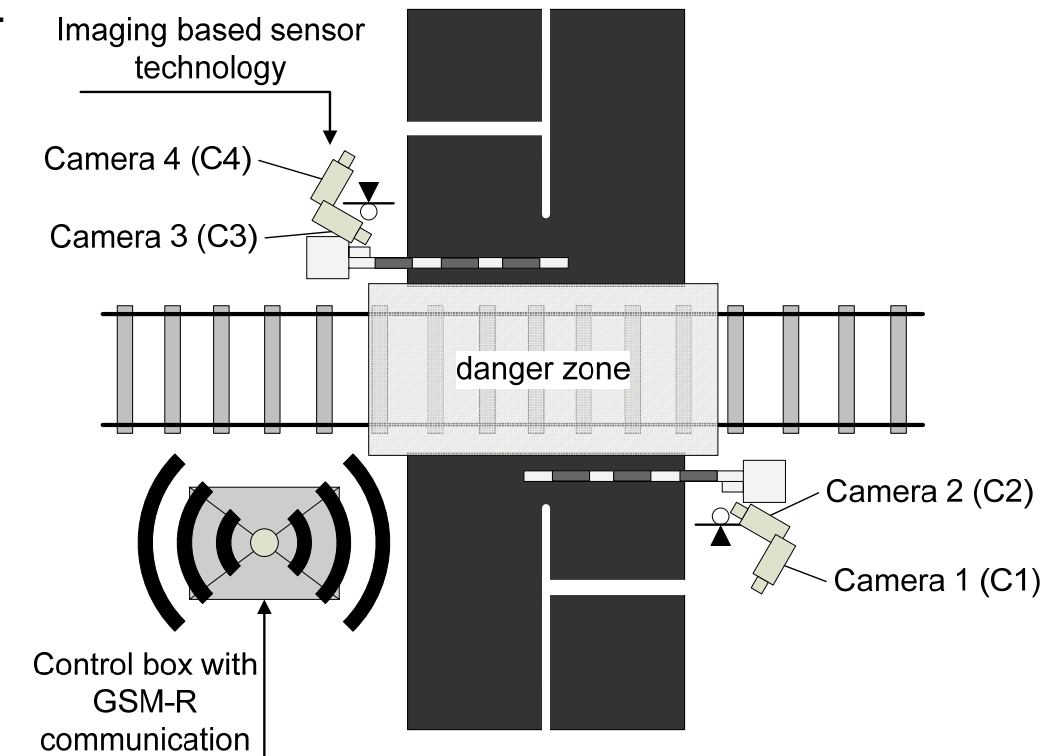
- High availability and reliability
- Designed for rough environment
- Available in day and night times → object detection must be available under all light and weather conditions
- Replacement and/or assistance of human and/or technical operations
- At least same safety ←  → Affordable safety
- **Alternatives 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

## System architecture

- Level crossing secured with half-barriers and flash lights.
- Four camera systems, two at each barrier.
- Each camera systems consists of one camera for visible ranges and one for non-visible ranges, such as Infra Red camera.
- Control box with a GSM-R module







# Imaging based concept

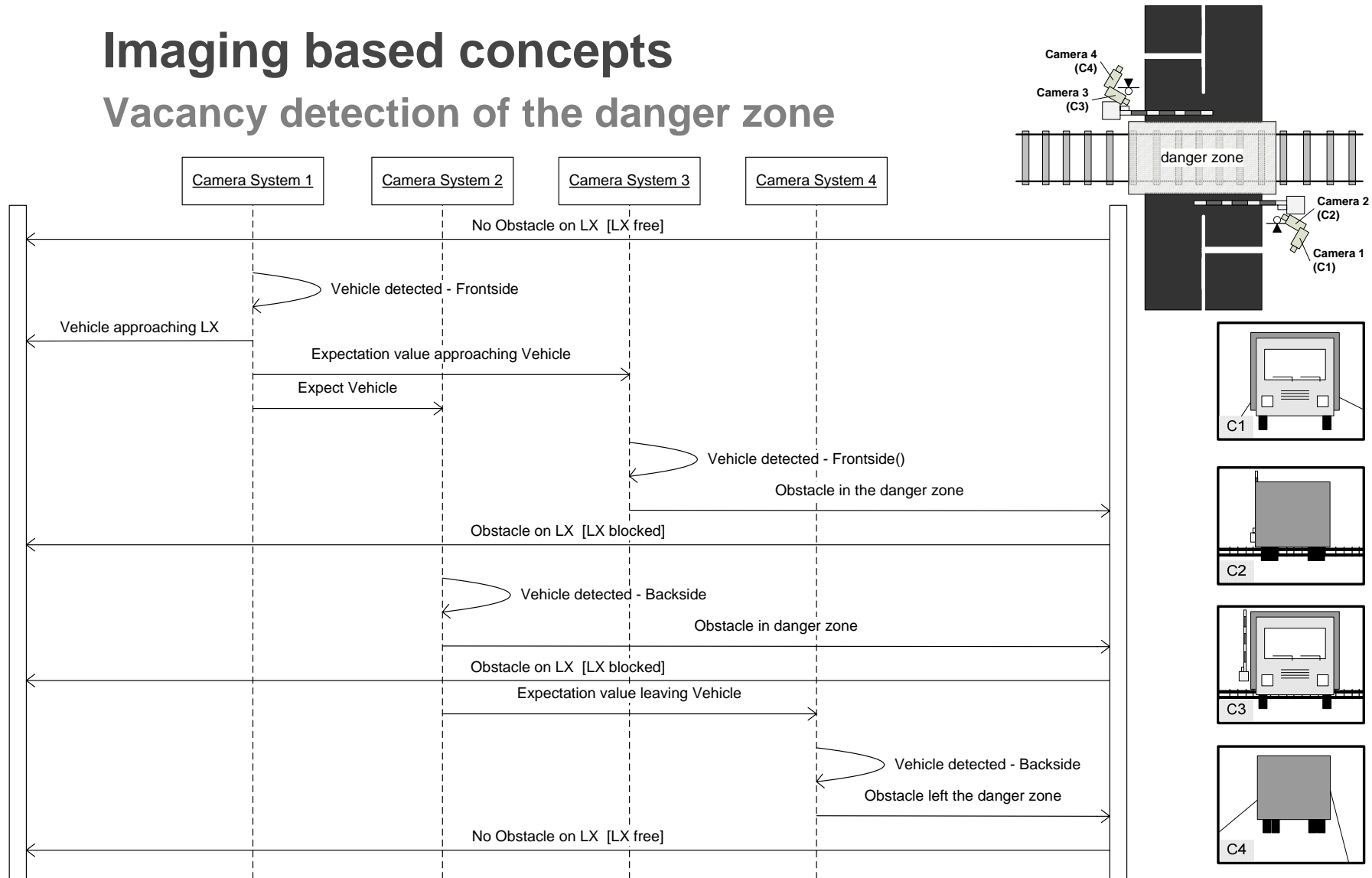
## Applications

- **Two Applications can be performed by the system**
  - Danger zone monitoring during a train is running towards the LX
    - Detecting an approaching train
    - Monitoring of the danger zone for vacancy proving
    - Sending the live pictures taken by the system via GSM-R to the approaching train in real time
    - Presenting the live pictures on a screen in the driver's cab
    - Sending a warning or an "Emergency Stop" Command to the approaching train via GSM-R if an obstacle is detected in the danger zone
  - Vacancy detection of the danger zone while a road vehicle crosses the LX
    - Monitoring of the roadside approach areas
    - Communicating the approaching road vehicle to the securing system of the LX and – if technical or operational necessary – to the interlocking for locking the signal via GSM-R



# Imaging based concepts

## Vacancy detection of the danger zone





## 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 have 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 will be presented in the near future.



# Thank you for your attention



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