ETH zürich

Center for Sustainable Future Mobility (CSFM)

LROD: Long-range obstacle detection for railway driver assistance systems

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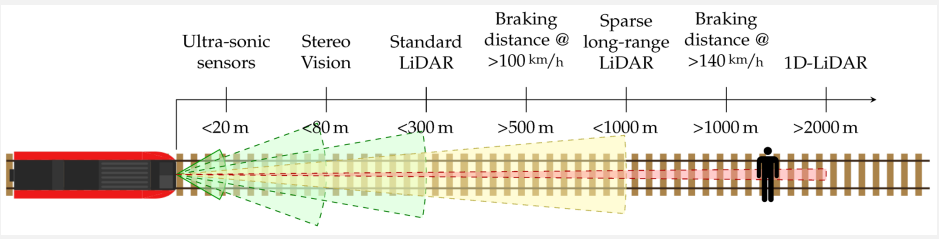
1 Introduction

Increasing demand for transportation by rail necessitates the expensive construction of new tracks or the development of new modes of operation for a denser usage of the railway network. In combination with rising rail vehicle speeds, this requires new and more advanced safety systems to ensure the safe and reliable operation of the network. Obstacle detection aims to prevent collisions with humans, infrastructure, trees or other objects on the tracks.

2 Related Work

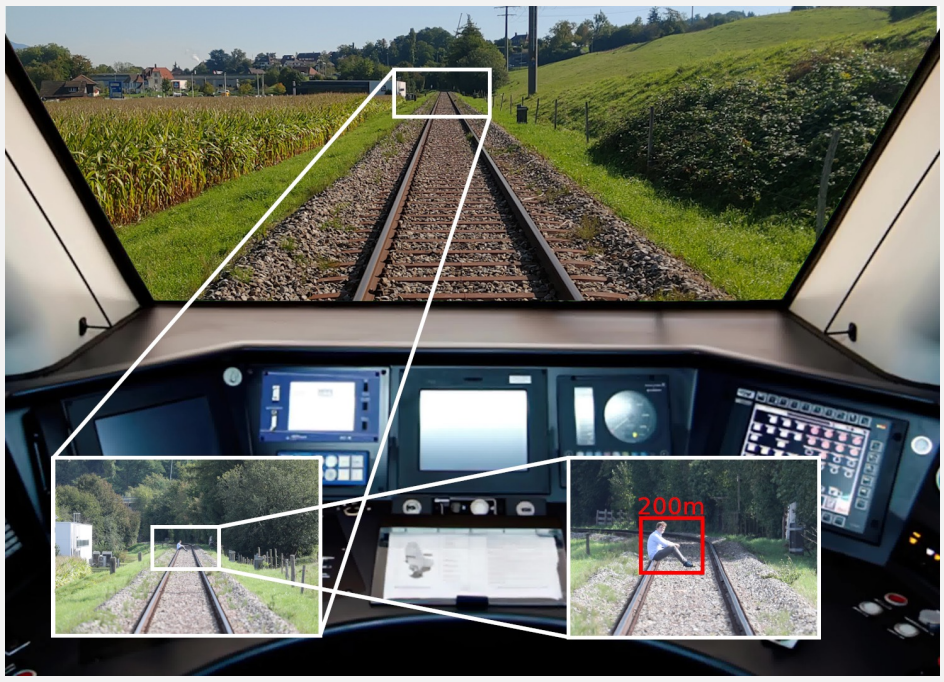
Existing methods[1,2], for example known from the automotive industry, fail to provide the required range for the operation of the train. Further, sensor modalities such as Radar do not provide the required resolution or suffer from low reflectivity off of non-metal objects.



1. Durrant, D. R., Haseeb, M. A., Emami, D., & Gräser, A. (2018). Multimodal Sensor Fusion for Reliable Detection of Obstacles on Railway Tracks.
2. Haseeb, M. A., & Gräser, A. (n.d.). Long-range obstacle detection from a monocular camera.

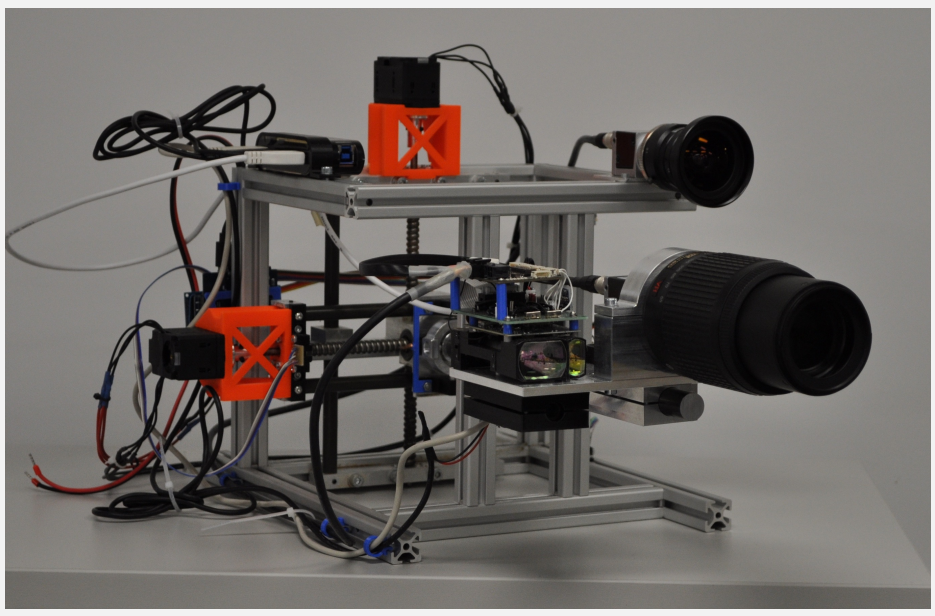
3 Method

Through high-focal length optics, long-range LiDAR and an actuated sensor mount, we search for, detect and located obstacles on the track ahead.



4 Hardware

The developed sensor setup consist of a fixed overview camera, a high-focal length detail camera and a long-range 1D LiDAR, both of which are mounted on a custom high-precision gimbal to precisely position obstacles even at high range.



5 Anomaly Detection

Detecting anything which doesn't belong onto the tracks is a challenging task. Standard obstacles, such as humans or animals, can be detected using standard object detectors, but these will fail to model more complex real world scenarios, such as fallen over trees, trash or other unknown obstacles. We solve this using a custom developed anomaly detection model based on the proxy task of detecting a normal empty railway track.

6 Conclusion

- Long-range obstacle detection requires the fusion of various sensor modalities to provide the range required for save operation.
- High-precision actuation and sensing mechanisms have been developed for this task.
- Custom anomaly detection models can detect arbitrary obstacles which were unknown at training time.

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