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A Survey on Object Tracking Based System at Rail-Road Crossing

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ABSTRACT: Now a day's safety and security are the most discussed topics in the rail-road and railway transportation field. While trains are more convenient for travel and for transporting goods, they have become a greater danger over the years as their speed has increased. On current railway system it, is becoming ever necessary to install safety elements to avoid accidents. One of the causes that can provoke serious accidents is the existence of obstacles on the tracks, either fixed or mobile. In this paper the system is tuned towards detecting and evaluating abnormal situations induced by users in railway road crossing. Then ideal trajectory of detecting objects will be identified which will help to discard dangerous situations.Four hazard scenarios are tested and evaluated with different real video image sequences: presence of the obstacle in the rail-road crossing, presence of the stopped vehicles line, vehicle zigzagging between two closed half barriers, and pedestrian crossing the area.

KEYWORDS: safety, transport system, railway-road crossings, tracking.

I. INTRODUCTION

Consider as a weak point in road and railway infrastructure, improving rail-road crossings safety became an important field of academic research and took increasing railway undertaking concerns. Improving the safety of people and road–rail facilities is an essential key element to ensuring good operation of the road and railway transport. Statistically, nearly 44% of rail-road users have a negative perception of the environment, which consequently increases the risk of accidents. The proportion of accidents at railway-road level crossings is not very high for the society, but these accidents are very dangerous.

The risk of fatal outcome in an accident at a level crossing is twenty to forty times greater than in an average road accident. Intensive users (mostly car drivers) are highly exposed to the risk, and the population living in the vicinity of level crossings is the most endangered one. Special cases are multi-fatality accidents and especially accidents involving school buses. In the case of a school bus accident, the emotional component of Promet- Traffic-Traffico, ten triggers public campaign requiring higher safety level, which often results in institutional improvements.

The method starts by detecting pixels affected by motion as a pretreatment phase. To detect and separate objects, this method consists in clustering moving pixels by comparing specific energy vectors associated to each target and each pixel affected by motion. Once the targets are extracted from the current frame, the objective is to track them. To achieve that, an object's tracking method based on optical flow is applied. The tracking process starts by computing optical flow of corner points, extracted by Harris operator, using the Lucas–Kanade algorithm.

II. MOTIVATION

The initial idea first carried out in the framework of the SELCAT project and then through the PANsafer project, was to introduce some technological components in the management of railroad crossings. The technical approach, which was developed and tested in life situations, can be summarized in Fig. 1.

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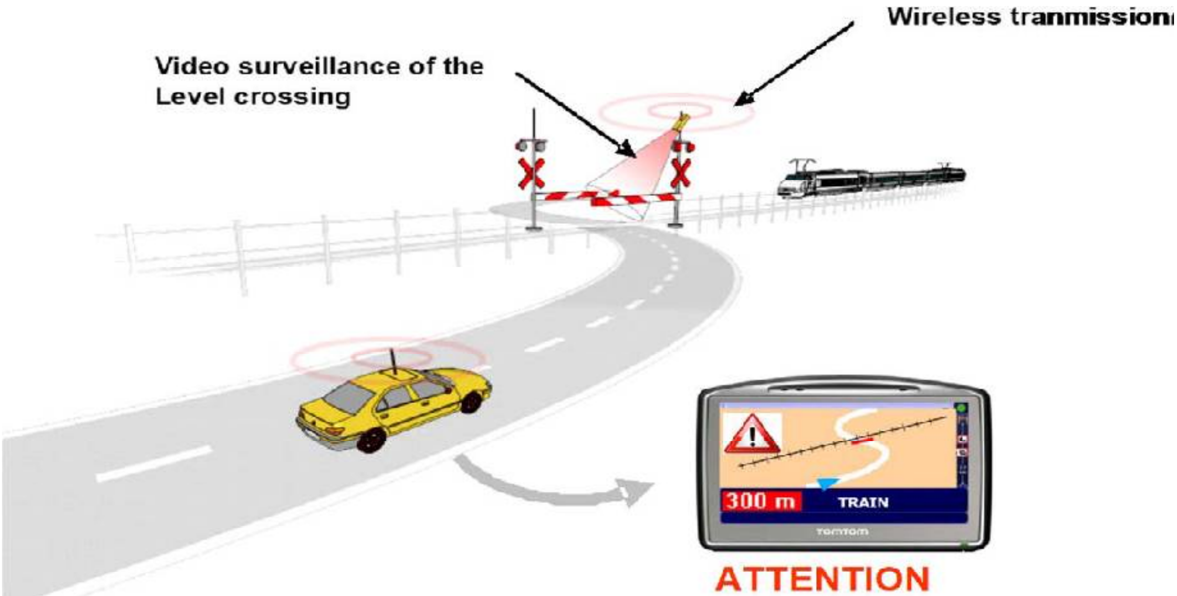

Fig. 1.General presentation of the architecture of the PAN safer project.

One can see a general view of the architecture for detection and communication systems implemented in the PANsafer project. This architecture can be summarized in two points:
• one equipment dedicated to the detection of potentially dangerous situations due to video sensing and image processing (this will constitute the main part of this paper);
• one equipment of communication whose role is to send to the users approaching the railroad crossing the status of the railroad crossing. These two equipment devices are installed in the railroad crossing environment. In the proposed system an object's tracking method based on optical flow is applied.

III. MEATHOD OF SOLUTION

The tracking process starts by computing optical flow of corner points, extracted by Harris operator, using the Lucas–Kanade algorithm. To make the tracking process more robust against noise and to rectify the optical flow for each pixel, a Kalman filter (KF)-based iterative process is designed. The following sections detail the steps introduced above: Optical Flow Propogation, Kalman Filtering.

Optical Flow Propagation

To propagate the optical flow result from textured areas into untextured ones, we consider that the optical flow of all pixels of an extracted target has a Gaussian distribution. The mean
and standard deviation of Harris points' optical flow are the parameters of this distribution, i.e., $P(ft(x))$ =1σx√2πe12_ ft(x)−mxσx_2σx = σhx+ dσx . where$P(ft(x))$ expresses the horizontal distribution of the optical flow at the considered pixel. The same expression for the vertical distribution $P(ft(y))$ is also considered. $Mx$is the mean of the optical flow of Harris points in the x-axis. The deviation $\sigma x$is calculated from the combination of σhx, which is the deviation of the optical flow of Harris points in the x-axis, and $d\sigma x$, which is the deviation of unknown noise. The derivation $d\sigma x$is experimentally fixed at four pixels.Then define the optical flow research area as a circle whose center coordinates are (mx,my), with a radius equal to the module of (σx, σy).

Kalman Filtering

To make the tracking process more robust against noise and to rectify the optical flow for each pixel, a KF-based iterative procedure is designed. The KF-based iterative algorithm tries to provide an optimal solution during a maximum of four iterations. An optimal solution is obtained when the estimated optical flow is inside the research area and verifies a similarity constraint.

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IV. CONCLUSION

In this paper, themethod starts by detecting and tracking objects seen in the monitoredzone by a video camera. The second stage of the methodconsists in predicting for each tracked object the idealtrajectory allowing avoidingpotential dangerous situations. The development carried out on the communication system within PANsafer allows us to define some perspectives in terms of progressive deployment.

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