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THE SAFETY ON A RAILWAY CROSSING BY MEANS OF SYSTEM OF VIDEO ANALYTICS

Amochaeva G.P., Seisenbaeva G.S., Mussina G.I.

E.A. Buketov Karaganda State University, Karaganda, Kazakhstan, gulsaya-19@mail.ru

In this article we describe the development of technical requirements and software for video analytics used at railway crossings in order to determine the stopped vehicles. The work describes the scheme of the video analytics system, working observing zones, graphical illustrations of the video analytics system and its components. The program described in the work defines the stopped vehicles at the crossing and gives a signal to obstructing traffic lights to stop the locomotive. There are times when the program gives out the raw data. The program defines vehicles, but the fight against false positives implies the use of additional technical means.

Keywords: system of video analytics, railway crossing, working zone of the crossing, technological zone, zone of floor inventory

Introduction

Today there are a lot of unprotected railway crossings. On these crossings there are a large number of road accidents, happening because of collision of the train with motor transport. Also there are no such technical means which would fix existence of hindrances for train driving and in case of detection automatically countercurrent traffic lights were switched on, thereby they would stop the train in advance. Development of such system is very actually. In our opinion, the system of video analytics can perform this function.

Proceeding from above, the purpose of the research is development of logic of a program shell for definition the hindrances to train driving.

For achievement of the set purpose it is necessary to solve the following problems which characterize the requirement to this system:

a) detection of the stopped (blocked) motor transport in a working zone of traffic;

b) detection of large-size fixed foreign objects in a working zone of traffic;

c) detection of motor transport moving, ignoring the warning alarm system in a working zone of the crossing.

3. Object of the research

The main problem of the research was consideration the questions of construction the space-distributed hardware-software and algorithmically decentralized structure capable to process video images gradually, and calculation of the route for efficient data transmission on the network.

Object of the research of this work was creation of a security system which would trace the situation in a zone of monitoring the railway crossing.

The video system is intended for the automated definition of existence of hindrances to driving of railway transport in a working zone of the experienced zone of the operated railway crossing.

The video system is intended for functioning as a part of automated control system of the experienced zone of the operated railway crossing as a source of information on current state of a railway crossing [1]. The object is the experienced zone of the operated railway crossing including the crossing itself, the room of the person on duty on crossing and the adjacent territory (figure 1).

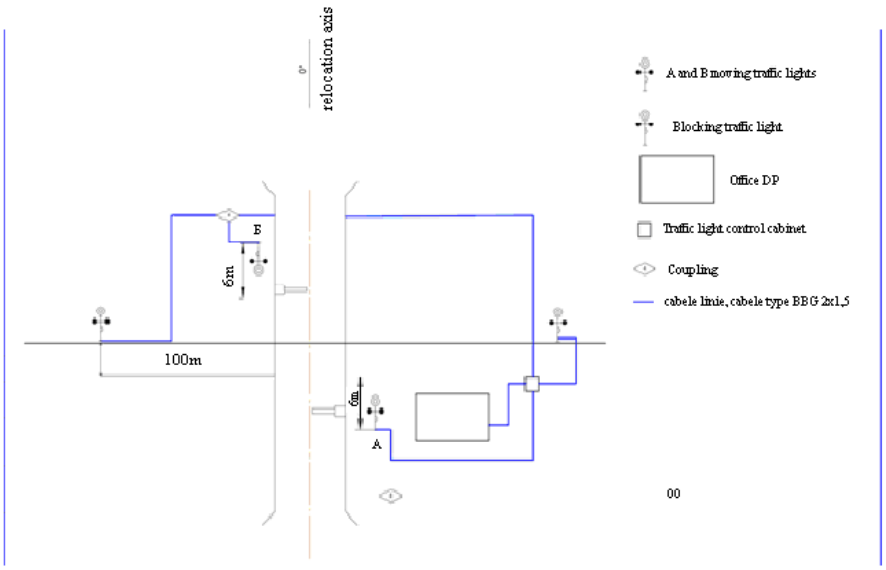

Fig.1. Cable scheme of system of video analytics on the crossing of 840 km

According to this scheme the system of video analytics traces motor transport passing through the railway crossing [2]. In case of motor transport stop on the crossing more than 180s, the system switches on countercurrent traffic lights for braking of the locomotive.

The system of video analytics consists of two server cases:

- server case 1, in this case power supply units of IP cameras and servers are installed (fig. 2);
- video server in complex with the automated workplace.

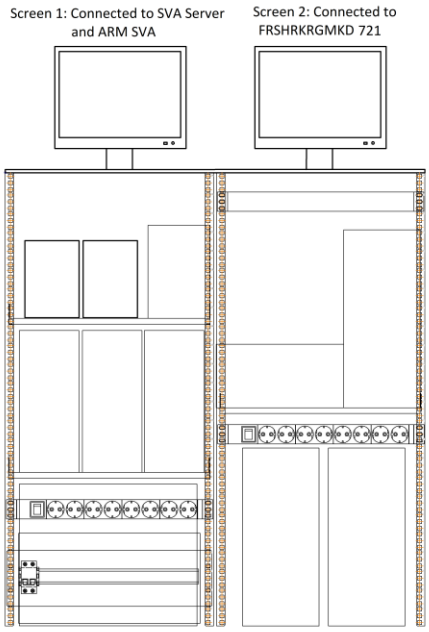

Fig. 2. Server cases

For the video system the following zones on the object are essential:

a) working zone of the crossing – the open space limited by the lines going parallel to railway tracks from outer side on both sides of the crossing at the distance of 1 m from them and the lines

going parallel to the roadbed crossing railway tracks, also from outer side, on both sides at the distance of 1 m from roadbed;

b) zone of floor inventory of the existing system – the area before working zone including the barrier established at the moment and crossing traffic lights;

c) zone of floor inventory of experiment operation that is the open space located away from the working zone of the cxrossing and a zone of floor inventory of the existing system behind the room of the person on duty on crossing in which the inventory of the experienced zone is located;

d) technological zone that is a case with processing equipment of the control system of crossing and the territory, adjacent to it.

Data on the operation conditions and environment characteristics

Components of the video system are operated on the object in the following conditions:

a) the technical means which are external sources of data on the condition of railway crossing that are operated in the conditions of TBR1;

b) the technical means intended for the analysis of the entering data and also providing informational exchange that are operated in the class U4.1.

c) low illuminating intensity at night. Mainly, takes place on the sites remote from large settlements.

d) the number of the processed digital television video signals - not less than 4;

e) depth of storage of video series archive – not less than 300 hours of the continuous record on the canal;

e) quantity of alarm entrances – not less than 2;

g) quantity of alarm exits – not less than 3.

2. Requirements to characteristics of interrelations of the video system with interfacing systems and ways of information exchange.

The video system has to interact with dispatching remote workplace in automatic (sending messages and video data on the basis of logic of processing of video analytical events) and automated (sending results of inquiries, change of the condition of output signals according to the decision made by the dispatcher) the modes with use of network protocols of TCP/IP family [3].

For realization of the task it is offered to use the Bellman-Ford algorithm on finding of the shortest way in the column. The choice was made in its advantage since the Deykstra algorithm though is more perfect, but is more difficult in realization and possesses huge disadvantage that is much more larger consumption of hardware at realization. Thus, the program will allow to use efficiently network resources, reducing the load of a network and to transfer information more quickly and efficiently [4, 5]. The logic of work of SVA is given in figure 3.

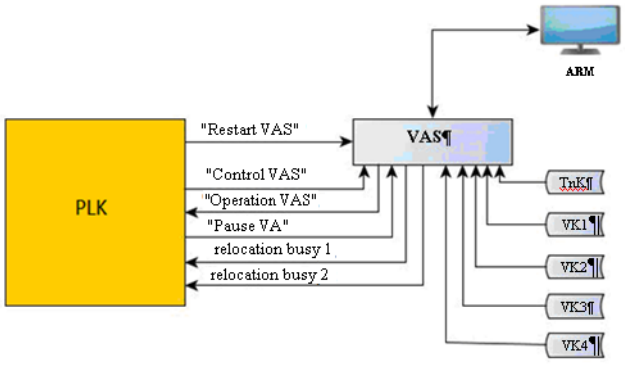

Fig. 3. Logic of VAS work

Results of definition the stopped motor transport on the crossing are given by video analytics in figure 4.

Source	Event	Part	Additional information	Date	Time
Pause BA	Closed			21.02.2017	19:06:27
Moving busy	Relay is on			21.02.2017	19:06:27
Pause BA	Open			21.02.2017	19:06:42
Pause BA	Closed			21.02.2017	19:06:43
Moving busy	Relay is on			21.02.2017	19:06:43
Pause BA	Open			21.02.2017	19:07:56
* Stop camera	Stopped car			21.02.2017	19:15:08
Pause BA	Closed			21.02.2017	19:15:19
Moving busy	Relay is on			21.02.2017	19:15:20
Pause BA	Open			21.02.2017	19:16:59
* Stop camera	Stopped car			21.02.2017	19:18:40
Moving busy	Relay is on			21.02.2017	19:19:05
Pause BA	Closed			21.02.2017	19:19:45
Moving busy	Relay is on			21.02.2017	19:19:46
Pause BA	Open			21.02.2017	19:19:55
Pause BA	Closed			21.02.2017	19:30:08
Moving busy	Relay is on			21.02.2017	19:30:09
Pause BA	Open			21.02.2017	19:30:24
Moving busy	Closed			21.02.2017	19:37:12
Pause BA	Relay is on			21.02.2017	19:37:12
Pause BA	open			21.02.2017	19:38:04

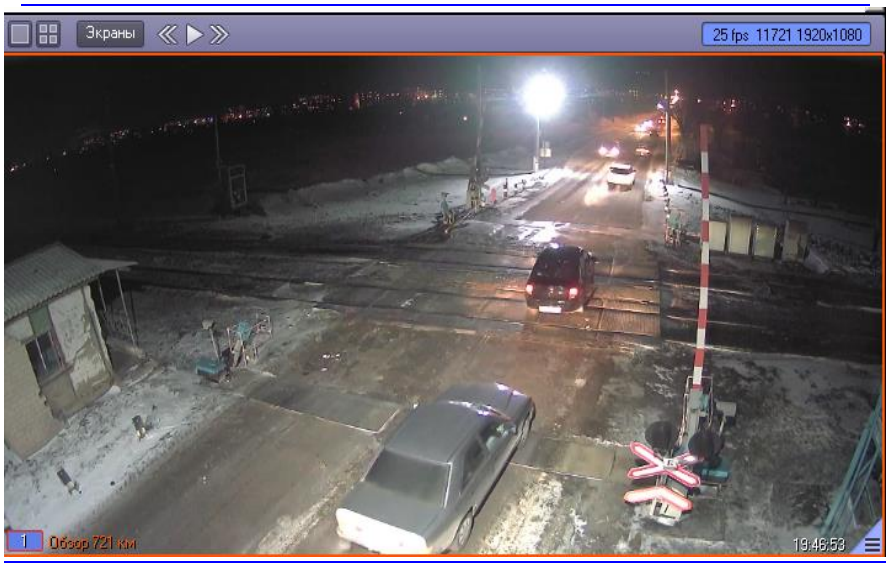

Fig.4. Fixing motor transport video analytics

Conclusion

This article researched hardware and software tools for analyzing video objects and made their selection from the DSSL nomenclature for organizing an adaptive decentralized complex of visual identification of vehicles at the crossing and their movements with the functions of autonomous intellectual image processing. The created program can be integrated into existing video monitoring systems for the most optimal use and speed of data transmission, as well as reducing the load from

networks. Methods are proposed, an algorithm and software implementation of the mechanism of dynamic tuning (adaptation) of the structure of the complex optimizing it in terms of the number of computing resources used and an effective way of transmitting information for solving the current task of identification are developed.

By results of work it is possible to draw conclusions that the offered approach and the created program of formation of a complex of means of the video analysis, can be used in practice when the organization and functioning the composite distributed systems of the video analysis of objects since the program allows to use most efficiently resources of the network and to considerably reduce the loading level.

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