PRESENCE DETECTION SYSTEMS - EFFICIENCY OF USE, BEST PRACTICE

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Abstract. *One of the features of the development of modern society is the growing need to restrict access to various objects. The main task of the State Border Guard is to ensure the inviolability of the state border, including the prevention of illegal crossing of the state border. Nowadays, presence detection systems are often used for this purpose - devices or functions of a security television system that generate an alarm when movement is detected in the field of view of the camcorder. The aim of the current study is to analyze the efficiency of the use of presence detection systems used in the structural units of the State Border Guard.*

Keywords: *border surveillance, photosensor, presence detection system.*

Introduction

The functions of the Border Guard are to ensure the inviolability of the state border and to prevent illegal migration [Law on the State Border Guard, Section 4].

One of the most important areas of activity of the Border Guard is the organization and implementation of border surveillance measures. *"Border surveillance"* means the surveillance of borders between border crossing points and the surveillance of border crossing points after the end of working hours in order to prevent persons from evading border checks [REGULATION (EU) 2016/399 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2016 governing the movement of persons across borders (Article 2 (12) of the Schengen Borders Code)].

In order to ensure the performance of its functions in the field of border surveillance, the Border Guard shall:
- carry out border control, ensure and control the observance of the regime of the state border, state border zone, patrol zone, border control zone, border zone, border zone and border crossing point regime;
- prevents the movement of goods across the state border outside the border crossing points [State Border Guard Law, Section 5].

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Article 15 of the Schengen Borders Code requires Member States to make adequate use of appropriate resources and staff to carry out border control at their external borders, ensuring an efficient, intensive and uniform level of control. Such effective, intensive and uniform control of external borders is unthinkable without the skilful use of appropriate technical resources.

Border Guard performs extensive use of various technical means necessary for border surveillance in order to implement border surveillance measures effectively.

Analyzing the statistical data compiled by the Border Guard, it can be concluded that the number of persons that crossed the external land border of the Republic of Latvia illegally remains high enough. In 2018, a total of 202 persons were detained for crossing the "green" border illegally, 57 persons in 2019, 30 persons in 2020, 458 persons in 2021, and 64 persons in 3 months of 2022.

An important element in the control of the state border of the Republic of Latvia is the presence detection systems, which are used to detect signs of border violations, locate and detect border violators at the state border and in the border zone, at border, territorial sea and inland waters [Cabinet Regulation No.675 "Regulations on Technical Means for Border Control and Surveillance" Paragraph 3].

Characteristics of Presence Detection Systems Used in Border Guard

Presence detection system - a set of components that, in any weather conditions, allows to determine and identify the presence of object, the direction of its movement. Presence detection systems eliminate the need for continuous secondment of border guards in the border surveillance post, ensure continuous surveillance of the border guard facility or a specified border surveillance post.

Currently, the Border Guard uses different types of Presence Detection Systems:
- *SMARTDEC;*
- *Buck Eye;*
- *Burrel;*
- *DefenGuard.*

Each of these Presence Detection Systems consists of different components, various technical solutions and technologies are used to ensure their functioning in order to ensure fast, accurate and complete flow of information between the components of the Presence Detection System and the end user.

SMARTDEC presence detection system *(manufacturer in Estonia).*
Basic components:
- *Photo sensor* - detects the presence of the subject, takes photos, transmits the captured photos (by radio) to the bridge. The photo sensor is equipped with day and night Full HD cameras (shooting speed - 2 photos per second), infrared light source and passive infrared motion sensor (PIR);
- *Bridge* - receives information from the photosensors and transmits it to the central server via the network of the mobile operator (GSM bridge) or radio communication network (RADIO bridge). In the process of information transmission, the bridge uses GSM 2G / 3G / 4G (850, 950, 1850, 1900, 2100 MHz) frequencies.
- *Central server* - receives the information transmitted from the bridge, processes it and transmits it to the end user via the internal network of the Information Center of the Ministry of the Interior in the relevant Border Guard Division of the territorial administration of the SBG.
- *Programmer* - allows programming of SMARTDEC components of the presence detection system. Any smart device (mobile phone, notebook) with "Smartexp" application and "Bluetooth" option with data transmission possibilities in GSM network can serve as a programmer. An additional connector is required to program the system.

Fig.1 Components of the SMARTDEC presence detection system
(compiled by the authors)

Presence detection system BUCKEYE *(manufacturer in the USA).*
Basic components:
- *Photo sensor* - detects the presence of an object, takes photos or videos of it, transmits the captured photos or videos (by radio) to the base station. Radio frequencies in the range of 902 to 928MHz are used for information exchange. The photosensor software is able to select the frequency of information exchange automatically, eliminating the possibility of interference. The sensor's standard antenna can retransmit information up to 3.2 km. The photosensor can also act as a repeater, thus increasing the information transmission distance. The photo sensor is equipped with day and night Full HD cameras, infrared light source and passive infrared motion sensor (PIR), programming terminal and external 12V battery.
- *Base station* - receives information from photosensors and transmits it to the end user's workstation via the mobile operator's network (GSM).
- *Workstation with software* - allows you to review, list, manage received information and alarm messages, request a test image and sensor status information, change sensor and base station settings, receive system notifications.

Fig.2 Components of the BUCKEYE presence detection system
(compiled by the authors)

Presence detection system BURREL *(manufacturer in the USA).*
Basic components:
- *Photosensor* equipped with a GSM antenna, infrared lighting, a camera, a microphone, a light indicator, a display and a motion detector.

Motion detection working distance is up to 20 m. Motion detector operational time - 1 seconds.

When the subject is detected, it is photographed or filmed. The built-in camera can record up to 30 seconds long video or take 1 to 3 photos. The captured photos or videos are saved on the memory card (maximum capacity of 32GB) and forwarded to the e-mail address provided by the operator. That is, a SIM card with a data connection is required for proper operation of the photosensor.

Photosensor is powered by 12 AA batteries or a pluggable external 6V battery.

Photosensor can be controlled manually - in person or remotely via SMS commands. During the manual test, the operator uses the sensor control buttons and the built-in display to change the sensor configuration. Remote control of sensor operation takes place via SMS commands sent to the SIM card number of the respective photosensor. The SMS command is a code received by the photosensor and running according to a defined algorithm.

Fig. 3 Presence detection system BURREL components
(compiled by the authors)

DEFENGUARD presence detection system *(manufacturer in Slovakia)*
Basic components:
- *MS-Q seismic sensor* - generates and sends an alarm signal in case of movement in the sensor's operational area. Motion detection is

based on the seismic activity shown by a living being or the movement of a vehicle, which can be detected by a sensor.

The MS-Q seismic sensor can operate in two modes:

- *Seismic mode* - the sensor senses the seismic activity of living beings or transport;
- *Sector mode* - the sensor shows the direction of travel in one of the four sectors. One sector of the sensor is a 90° angle in the horizontal plane, while four sectors form a circular motion detection zone.

Interchangeable antennas are used to transmit information. The antenna transmits information at a frequency of 433MHz. Depending on the type of antenna, the transmission distance can vary from 150 m to 15000 m.

- *TV camera* - monitors the area adjacent to the MS-Q seismic sensors. The TV camera is equipped with an infrared light source and can operate efficiently even at night. It can be used to visually detect the presence of pedestrians at a distance of 100 m. The TV camera is activated manually or automatically if the MS-Q seismic sensor is activated. Video recording is transmitted by the TV camera as an analog video signal in the 2.4 GHz band using additional antennas.
- *TV Repeater* - A device that reproduces an analog video signal. As a result, the range of information transmission is increased (to overcome radio shadow areas). Just like a TV camera, the TV repeater repeats alarms and system announcements.
- *Base receiver* - a device whose main task is to convert the received (from the TV camera) analog video signal into digital format and transmit it to the operator's workstation (via the Internet).

Fig.4 Components of the DEFENGUARD presence detection system
(compiled by the authors)

Presence detection system application "KUS @", its operational possibilities

In order to optimize the operation control of the Presence Detection Systems, the processing, grouping and archiving of the received alarms, the Vilyaka Border Guard Regional Board developed the Presence Detection System application "KUS @" for the control of the operation of the Presence Detection Systems "BuckEye" and "Burrel" and the processing of the received signals.
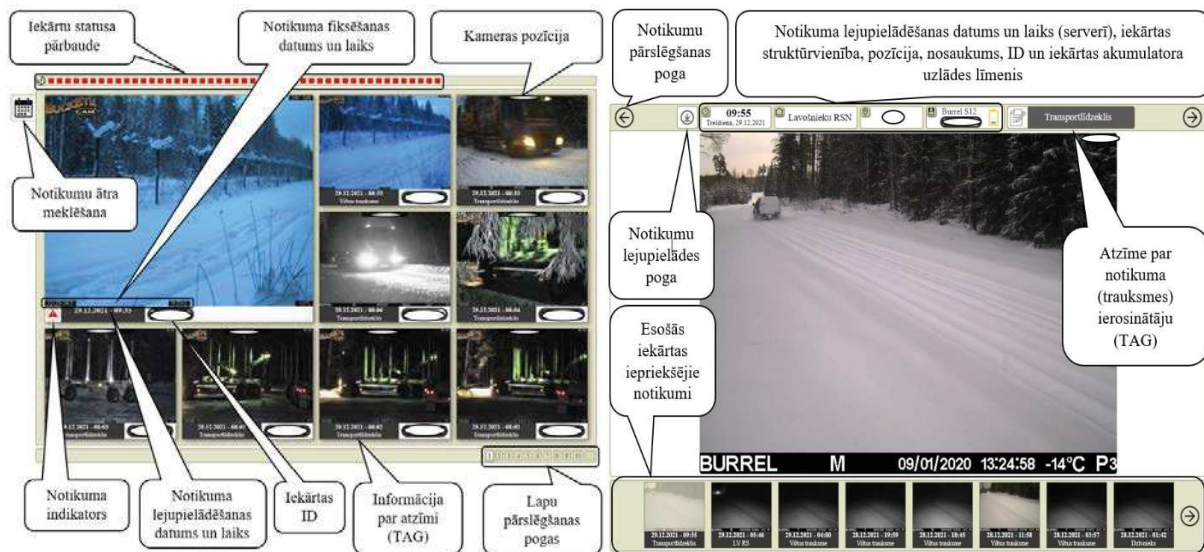

Fig.5 Presence detection system application KUS @ interface
(compiled by the authors)

The KUS @ presence detection system application provides an overview of alarms in a user - friendly way with information about the type of sensor and the time of the event download. A list of devices with information on their status, event statistics and administration section is available, while creating an event archive [Unpublished materials of the Border Guard]. To ensure the four - eye principle, alarms for presence detection systems are displayed both at the workstation of the Border Guard Division of the relevant Border Guard Territorial Administration (*local level*) and at the Operational Management Division of the relevant Border Guard Territorial Administration (*regional level*). The network of the Ministry of the Interior of the Republic of Latvia is used to ensure the protection of the information flow.

Practical aspects of using presence detection systems

Presence detection systems shall be determined by the head of the relevant Border Guard Division. When planning the installation of Presence Detection Systems in a specific border surveillance area, the following aspects shall be taken into account before deciding on their location:

- *results of the risk analysis and peculiarities of the surveillance of the relevant border surveillance section* - possibilities and routes of movement of possible offenders and vehicles, settlements and access roads, season, information received from local residents about ongoing activities in the relevant border surveillance section, advance information, current offenders *modus operandi*, etc.;
- *quality of the mobile communication network at the place of installation of the presence detection systems* - before the installation of the presence detection systems, the signal quality of the mobile operator's communication network is measured at the spot. The measurement is performed using the Android application "OpenSignal". The measurements obtained during the survey are analyzed, processed and a graphical representation of the signal quality of the mobile operator's communication network on a topographic map is developed for each border guard department. Measuring the signal quality of this type of mobile operator's network is necessary because mobile operator's websites do not always provide accurate information on network coverage (especially along national borders).
- Number of Presence Detection Systems available *in the relevant Border Guard Unit - The most important and priority* sections of the border surveillance section that require the installation of Presence Detection Systems and their possible operation should be carefully assessed.

Conclusion

During the process of elaboration of the work, researching the Presence Detection Systems used to ensure border surveillance measures, analysis of their technical parameters and usability, tactics and techniques of practical use, as well as legal regulation of the use of Presence Detection Systems, the authors concluded that the Presence Detection Systems are sufficient and effective means of ensuring and effectively enforcing border surveillance measures. Analyzing the statistics collected by the Border Guard on detainees in connection with illegal crossing of the "green" border, the authors concluded that in the last 2 years, about 20% - 25% of the total number of

persons crossing the "green" border have been detained with the help of Presence Detection Systems. Considering the fact that the border surveillance units of the Border Guard structural units are only partially "covered" by the Presence Detection Systems, in the opinion of the authors, such an indicator of the efficiency of the Presence Detection Systems is sufficiently high. The Presence Detection Systems used in the Border Guard allow to detect and identify the presence of objects in the relevant section of the border surveillance section and to organize and take appropriate measures in a timely manner to detain offenders and prevent violations of the regime.

Analyzing the available information on the Presence Detection Systems used by the Border Guard authorities in Latvia's neighboring countries, the authors concluded that they are very similar, for example, DEFENDEC Presence Detection Systems are widely used in Estonia, "Burrel" type Presence Detection Systems in Lithuania and Poland, etc.

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