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Crisis Management Center,
dispatcher's communication subsystem,
radio communication subsystem

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INTEGRATED SYSTEM OF CRISIS MANAGEMENT OF A SMALL-SIZED TOWN

The paper described a Crisis Management System for a small-sized town. The architecture of system is described and discussed is role of the following subsystems: dispatcher's communication, radio communication, vehicle movement follow-up, visual supervision and alarm messaging. It was emphasized that the system discussed contains discrete-operation transport telematics solutions. Methods of information transmission and processing are discussed, giving the opportunity of priority traffic organization change in the separated city area.

ZINTEGROWANY SYSTEM ZARZĄDZANIA KRYZYSOWEGO MIASTA MAŁEJ WIELKOŚCI

W artykule opisano System Zarządzania Kryzysowego miasta małej wielkości. Podano architekturę systemu i omówiono rolę podsystemów łączności dyspozytorskiej, łączności radiowej, śledzenia ruchu pojazdów, nadzoru wizyjnego i powiadamiania alarmowego. Podkreślono, że przedstawiony system zawiera rozwiązania telematyki transportu o działaniu dyskretnym. Omówiono metody transmisji i przetwarzania informacji, które dają możliwość priorytetowej zmiany organizacji ruchu w wydzielonym obszarze miasta.

1. INTRODUCTION

The need of integration of rescue and public safety services with application of telematics methods results from a necessity of simultaneous operation of many specialized systems in the case of hazard. Territorial dispersing of specific management centers in the town and lack of coordination of operations between them may lead to the impaired efficiency of its functioning. This results in a situation where the effects of existing hazards are remedied not quickly enough resulting in casualties and material losses. These losses are to be avoided or at least reduced if there are integrated management centers in the town, taking over the competences in the crisis situations. These centers have to be equipped with appropriate competences concerning rescue procedures supported by the existence of a telematic

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equipment enabling appropriate information transfer (telecommunication solutions) and appropriate processing (information solutions).

2. SYSTEM ARCHITECTURE

Systems serving the coordination of rescue actions further on called Crisis Management Systems (SZK) cover with their reach all services engaged in the rescue actions. The basic task of SZK is making the rescue actions more efficient by coordination of all services participating in the action. In addition, SZK performs also a prevention function enabling preventing hazards in the area of system operation.

Architecture of a typical SZK system is shown on Fig 1. The system coordinates operation of the following services:

1. Police
2. Rescue Paramedics
3. Fire Brigade
4. Power services

All the above services are equipped with communication tools (appropriate communication solutions) both stationary and portable.

The Crisis Management Center includes the following subsystems:

1. dispatcher's communication subsystem
2. radio communication subsystem
3. traffic follow-up subsystem
4. visual supervision subsystem
5. alarm messaging subsystem

All the above subsystems enable the remote fulfillment of coordination functions handled from Supervision Center. The Supervision Center collects information from the subject areas, analysis of events is performed and rescue action is lead in the initial phase of operation.

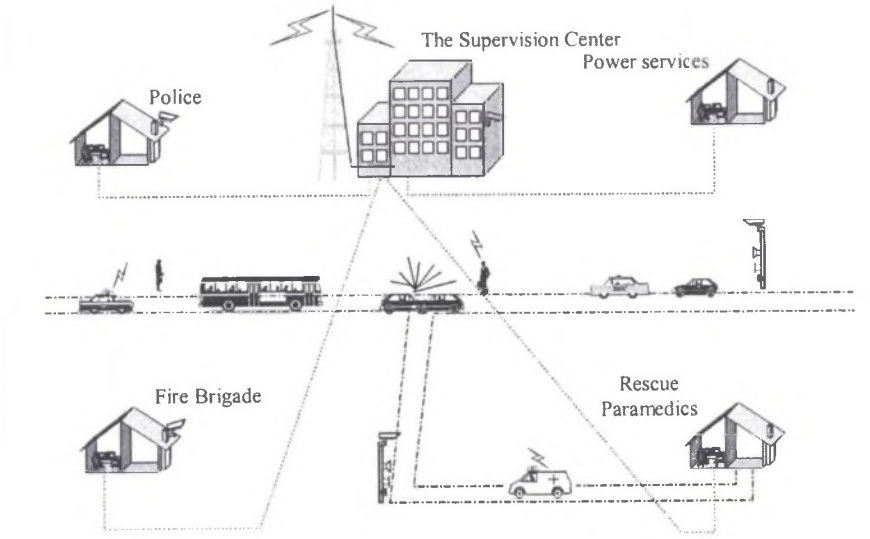

Fig.1. System architecture

Information to the Supervision Center flows through:

1. telephone call (traditional method),
2. notification with use of the alarm messaging subsystem,
3. observation of strategic town facilities with use of visual supervision subsystem.

The subordinate services taking part in the rescue actions are informed through:

1. dispatcher's communication subsystem,
2. radio communication subsystem,
3. public telephone network – in the case of selected services, for example municipal cleaning services.

The person performing a function of coordinator uses the following commodities constituting the equipment of Supervision Center:

1. vehicle traffic follow-up subsystem – applies to the rescue service vehicles,
2. developed database containing information about the subordinate region coordinated with an electronic map – enables for example an immediate finding of location with a specific address or address of a specific location
3. developed system of dispatcher's and radio communication,

The Supervision Center fulfills usually a supervisory role in relation to the remaining users of available communication systems. The Supervision Center has defined groups of users, such as fire brigade and authorizations are given to their specific members. These authorizations decide about the order of notification about the event and about system functions available from a specific terminal. The Supervision Center has also event archivization i.e. keeping the recorded audio and video information and data in other forms. These data often constitute a precious investigation material or auxiliary proof for the persecution.

The Supervision Center is responsible for operation of dispatcher's and radio communication subsystem. Namely from the Supervision Center it is possible to carry out administration work related with operation of the a.m. subsystems.

3. DISPATCHER COMMUNICATION SUBSYSTEM

The idea of operation of a dispatcher's communication system consists in an active role of the dispatcher in the initiation of telephone connection between the system subscribers. The dispatcher's communication system renders impossible connection of the calls among the subscribers independent from the dispatchers. Each time the dispatcher takes part in the call connection independently of whether the call was initiated by himself or by the subscriber.

This architecture is dictated by a particular role of the dispatcher, being a coordinator of the rescue action. System subscribers are representatives of cooperating police services, medical emergency, fire brigade and power energy services. This system is independent from the public network i.e. it does not use any element of the public network, thus increasing the safety of operation.

Dispatcher's subsystem besides realization of its basic function constitutes also the base for teletransmission level, transmitting signals from other subsystems between the facilities belonging to the cooperating services.

4. RADIO COMMUNICATION SUBSYSTEM

The radio communication subsystem is a trunked network TETRA (*Terrestrial Trunked Radio*) [4]. Idea of this network consists in granting a group of users the access to a common group of free channels, while the group of channels is always lesser than the group of users. This solution allows to avoid a situation where one user is linked permanently with one channel, then it is possible to serve more users sharing the common resources of channels. Based upon statistic distribution of calls we may design a system characterized by a satisfactory level of availability for the users.

The principle of granting access to the channel is based upon queuing of calls with selection of priorities depending of profile of each user. A subscriber with for example leader profile has always a higher priority in the access to the channel than the others subscribers, subordinate to him. It is also possible to discern the call with a special code switched on for example by pushing a special pushbutton on a portable or traveling terminal, meaning that the situation is special. The subscriber using such function achieves an immediate access to the free channel bypassing the queue. Such solutions are common in power industry and in railways.

The TETRA system uses usually three types of terminals: portable, traveling and stationary. The first two types are radio terminals, stationary terminal is, however, the digital system apparatus connected by a digital cable tract with a basic system station or (less frequently) with a radio transmitter outside the building.

All three types of terminals differ with the range of emitted signal power. For the obvious reasons, the weakest of all is the portable terminal, with power of few watts. The traveling terminal has power of several tens of watts. An unique feature of TETRA system designed especially for the purpose of being used by rescue function is function of transiting

calls. In the case when a system user having a portable terminal approaches the boundary of radio coverage and distances himself from the base station, then the function of base station is taken over, especially for his use, by a traveling terminal with a significantly higher power of signal. This terminal transits the call from the portable terminal to the base station and back. This feature constitutes an ideal solution in the case of operations located in difficult area, for example in a deep trench, where the radio signal from a remote base station is weaker than the signal from rescue service vehicles located nearby.

In accordance with the national radio frequency plan, the TETRA system operates in the band 410 MHz. The bandwidth of radio channel is 25 kHz. The system, besides basic service – voice connection, enables transmission of data of various types with a rate of 28 kbit/s. The function is used for sending the following information:

1. VLS (*Vehicle Location System*) [1] – data from a GPS receiver are send through the traveling terminal TETRA to the Supervision Center.
2. patient's health condition – data from the onboard medical equipment for the ambulance are sent through a traveling terminal TETRA to the intense care ward in the hospital.

Information concerning the present location of vehicles constitute a basis of leadership decision taken in the Supervision Center. Due to the geographical coordinates being constantly fed in, the VLS system marks the location of the followed vehicle on the electronic town plan. Using the database cooperating with the VLS system, the coordinator from the Supervision Center is able to find any closest (predefined) object, such as hydrant, gas valve etc.

Due to the VLS system it is also possible to coordinate the action of a typically dynamic character such as convoying monetary values, dangerous cargos etc. In such situations it is required to stop the traffic of other vehicles. The VLS system allows to reduce the traffic stop considerably and to the necessary minimum.

The VLS contributes directly to the raising of safety level within the area covered by its operation. A more rapid arrival to the call location frequently allows to save human life or protect the property. From the economical point of view this system introduces significant savings, enabling superfluous travels of vehicles belonging to the coordinated services.

Due to the possibility of sending information about health of the patient being transported in the ambulance used by the Crisis Management Center the time of giving a necessary medical assistance is shorter. The necessary medical preparations are being undertaken before the patient arrives to the hospital and there may be also a decision taken about transfer of the patient to another hospital better equipped for the particular type of treatment.

Remarkable is also the content of diagnostic functions contained in the onboard equipment itself, enabling remote notification about the malfunctions of equipment or extinction of operating material resources such as oxygen. This information may also be sent through the TETRA System.

5. SUBSYSTEMS OF ALARM MESSAGING AND VISUAL SUPERVISION

The subsystems of alarm messaging and visual supervision constitute the supplement to the Crisis Management Center.

The subsystem of alarm messaging consists of a number of alarm columns appropriate to the area of supervised territory. They consists of a call pushbutton, microphone and loudspeaker. The alarm column is pained to a bright color so it is easily remarkable. By pushing the pushbutton the person calling for help establishes contact with the SZK coordinator. The alarm messaging system cooperates with the electronic map of the town informing the coordinator about location of the active column. The further handling of this call depends of the course of call and assessment of the situation by the SZK coordinator. All calls to the messaging system are automatically recorded with the recording of contents of the call, date and hour. Connections between the alarm columns and the Supervision Center are realized using copper cables through an additional module of dispatcher's communication. The call handling and management of alarm messaging are fully integrated with this subsystem.

Alarm columns are frequently equipped with visual supervision. The visual supervision subsystem consists of an appropriate number of cameras located in the vital points of the town, frequently installed on an additional support directly over the alarm column. Such position enables a possibility of an immediate check and validation of information provided by caller, easy connection of the cables and power supply and discourages the vandals wanting to damage the column.

The visual signal from the cameras is transmitted through copper cables with a rate 8 Mbit/s using the VDSL technology [2]. Such transmission rate allows to send the picture with a rate of 10 frames per second. For cameras located at the larger distance from the center, converters are used enabling use of optical wire transmission [3].

At the Supervision Center's side there is a possibility to control the movement of these cameras and zooming. Visual material from all cameras is encoded and archived on disks with a possibility of transfer to other carriers. Recording of the visual material is started up by movement detector integrated with the camera and parametrized detection areas and sensitivity levels. Visual recording constitute frequently precious information material for police or persecutor.

6. SUMMARY

The contemporary telematic systems enable coordination of operations of rescue and public safety services. Only with application of these systems the services may reach the required efficiency of operation in crisis situations and in the presence of danger.

The Crisis Management System contains solutions of transport telematics with discrete operation. Discrete manner of operation consists in inclusion of supervisory systems with priority character enforcing a specific method of transport control in special cases, into town transport telematics systems operation in a continuous way. This is due to the use of extended measures for collection, transmission and processing of information.

The described Crisis Management System equipped with the aforesaid telematics measures was built in one of Polish small sized towns in Pomorze. The hitherto operating results are satisfactory.

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