Concept of a Telematics System Model in Crisis Management

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Abstract. The paper is about the concept of a telematics system model in crisis management. It presents current telematics solutions in crisis management. The authors show that there are many telematics domain systems ranging from monitoring, traffic management, and ending with the exchange of information. However, there is the lack of a solution that will connect them together. In this paper the authors present the concept of an integrated telematics system. The elaboration discusses organizational issues, risk analysis, structural specifics, the specifics of the components, costs and benefits, and an implementation plan. The purpose of this solution is to improve a rapid response to emergency situations, i.e. public events, traffic accidents, disturbances and other situations. That concept takes into account current needs arising from the topic.

Keywords: Telematics system · Crisis management

1 Introduction

Everyday there is a likelihood of risk posed by the forces of nature or human activity. Every year, all over the world, we have to deal with ever more unpredictable in the effects weather anomalies. Occurrence of floods, hurricanes or blizzards often takes the form of natural disasters resulting in casualties. Moreover, we live in a time of conflict, war, ethnic unrest and terrorism daily consuming millions of lives.

A characteristic for of the existing threats is not impossible to determine, namely, the time, place and geographical scope of their occurrence in order to prevent and minimize the effects of risks and to save lives of victims involved in crisis management. The crisis management process can be divided into four phases: prevention, preparation, response and recovery. Prevention and preparation phase is to minimize the possibility of an emergency. The main purpose of the organization is to respond to rescue and emergency assistance to the injured. Reconstruction and aims to restore the state of a crisis situation before it occurs involves the reconstruction of the damaged infrastructure [1, 3].

J. Mikulski (Ed.): TST 2015, CCIS 531, pp. 180–187, 2015.
DOI: 10.1007/978-3-319-24577-5_18

Each of these phases is characterized by the need to process large amounts of information. The processing of information in the event of emergency response consists primarily of collecting, updating and transferring information. The information collected include potential sources of risk, a database of available forces and means that can be used in case of emergency. The information collected will help to develop procedures to be followed by aggregating data, analyzing the effectiveness of emergency response plans, simulating possible scenarios for emergency events.

Information and communications systems can accelerate the speed of information transmission between rescue groups and command centers. The smooth operation of telematics systems allows for quick and effective aid organization which directly affects the lives and health of victims.

The crisis management telematics systems use [2]:

- monitoring subsystem,
- fixed communications subsystem,
- subsystem management and maintenance.

A monitoring center is a place of collective representation of events. Its location is dictated by a locational and organizational solution adopted in the city government. Regardless of the location, monitoring is required within easy reach of the authorities responsible for crisis management and information it mapped and processed. Monitoring centers have a monitoring large monitor screens, the server and the database of monitored events. An example of the use of monitoring in crisis management may be cameras on the dams, so you can continuously monitor water levels and warn the impending danger. Another application of monitoring is to put it in places in big groups of people such as railway stations, shopping malls, movie theaters or places of a religious nature that may be exposed to terrorist attacks.

For the purposes of crisis management centers in the region (provincial and district/municipal and local) the following networks should be organized [1]:

- telephone communications,
- radio,
- information (local and WAN), providing access to a variety of decision support applications and information management.

A telephone communication subsystem is a fixed backhaul network using fiber optic cable routes usually and metal, and as backup tracks - radio lines. ICT network created MAN (Metropolitan Area Network) provides physical and logical connection management positions communications nodes and the transmission of information in accordance with the needs. During the routine activities of crisis management they are mainly used for telecommunications services provided by local operators. Fixed telephony is used daily for communication between crisis management units. It is the fastest way to provide information about the threat [2].

Telephone communication between users of fixed telephony and mobile users (radiotelephone) enables quick contact e.g. with facility security personnel or with the services directly working in the area during the rescue. With this service, a user logs on to the system using a stationary terminal, and after authentication to communicate with the radio network users [2].

The analysis of the communication system requirements for crisis management to monitor changes in the electronic communications market shows that the most appropriate technology to organize the system is used in the IP network (Internet Protocol) and the corresponding control operation of the network nodes (soft switch), according to the architecture of IMS (IP Multimedia Subsystem). The IMS architecture can provide a variety of services such as voice, video and data. The proposed technology makes it possible to build a logically uniform for all users communication system with its own addressing. The main advantage of this architecture is the ability to create a system using previously used the infrastructure and equipment i.e. the public telecommunications networks, telephone internal networks, data networks and the Internet [1, 4].

The computer network uses the IP protocol for the purposes of transmitting a VoIP signal (Voice over Internet Protocol) in order to more quickly respond to threats to safety of people and fixed assets.

The telephone network enables the provision of telephone services and fax transmission to all its users and tele- and video-conferencing services users selected at regular and backup jobs. An ability to perform video conferencing allows for a more realistic image of the enormity of the disaster and to present its range. It is possible to have a reciprocal access to the services users and data. This way, all users of the system have constant access to the list of forces and resources that can be committed, emergency procedures, emergency response plans. In this way an access is ensured to databases of the crisis management system, electronic mail, electronic exchange of documents (EDI - Electronic Data Interchange), as well as the access to the Internet and its services, data networks (e.g. The police, the state fire brigade, ambulance) [1].

An additional service and convenience is a teleconference which relies on the statement of a telephone call between more than two telephones. A teleconference eliminates the problem of changing the details of the original information, which is possible in the case of a multiple transmission of information to the next caller. This can occur if the effect of “deaf phone” and information such as the number of victims modified.

The communication system should be managed and maintained in accordance with the recommended by the ITU-T layered model of management for telecommunications, which includes the following layers of management: network elements, network, services and business management. This subsystem should allow for the continuous management of the network, including monitoring, recording and reproduction of the events with the use of geographic information system GIS (Geographic Information System). Management and maintenance of the communication system should correspond to the recommendations of the international and national levels. The function of management and maintenance should be possible in all phases of the system, such as system planning, compiling and running interconnection, operation and reconfiguration and recovery communication system.

Moreover, in the context of developing, mobile and additional services used by the authorities of crisis management, emergency services and public safety consist in:

– user number portability to other end of the telephone network and set its telephone and permissions (i.e. Nomadic landline users), so profile and slogan (PIN) used by the user to log on to the network,
– prioritizing calls, enabling the user a higher priority, indicating a high priority call, or even disconnecting lower priority,

- voicemail, allowing users to leave and listen to messages on the functioning telephone system with voice messages left, browsing a voice mail using a web browser,
- notifying information services, providing selected users (senior command) with transmit subordinate short, urgent text messages or voice,
- telephone communication between users of fixed-line and mobile users (radiotelephone),
- telephone service through the Internet or a network of cooperation,
- it is also possible to use a set of e-mail services and its integration with cameras,
- access to the central book of contacts in order to obtain information on telephone numbers, e-mail addresses and other useful data, for example a department, a supervisor, a position,
- access to a central application, which means that the user may have access to the same data in the place of residence as in the workplace,
- services and severance virtual meetings are useful for management teams and crisis management and other management groups at central and provincial levels.

There is no doubt that modern telematics systems contribute significantly to improvement of communication between emergency services and affect the response time in the event of an emergency. Hopefully, a continuous development of technology will create an ideal system of early warning and alert in the future and unify the crisis management system for the whole country [1].

2 Regional Warning System RSO

The Regional Warning System is a service alerting the general public about local hazards. On August 31, 2014 r. RSO pilot testing ended in all provinces. Its implementation was made possible thanks to the implementation of Terrestrial Digital Television, as well as cooperation between the Polish Television, the Ministry of Administration and Digitization and Institute of Meteorology and Water Management (IMGW).

RSO covers the entire country. Implementation of the project as of 1 January 2015 was done by a pilot in the period of December 2013 - August 2014 in all provinces: the first stage by the end of December 2013 (Lubusz, Mazovia, Podlasie, Greater and West), the second stage by the end of March 2014 (Lower Silesia, Lublin, Lesser Poland and Subcarpathian), the third stage by the end of June 2014 (Lodz, Opole, Silesia and Świętokrzyskie), the fourth stage by the end of August 2014 (Bydgoszcz, a Pomeranian and Warmia Masurian).

Messages/warnings disseminated within the RSO include the following thematic categories:

- overall,
- meteorological
- hydrological,
- water levels (water gages).

A free mobile application of the Regional Warning System is available in stores with applications for each operating system (Android, iOS, Windows Phone). The application can found in stores under key words "RSO" and "Regional Warning System". It provides access to messages generated by the provincial disaster management centers provincial offices throughout the country (each province). In order to familiarize yourself with the specific error simply "download" RSO app, and then select any region. Moreover, the "drivers" of RSO may contain traffic information. The application is also provided in the section containing the guides of conduct in emergency situations.

Action of RSO. A message (warning) is generated by the provincial disaster management center on the website of the office of the provincial and digital terrestrial television (Regional TV), and telephone applications.

Messages appear on the TV screen in the form of inscriptions. They briefly inform and refer the details, for example a specific page teletext. The TVs customized hybrid TV (i.e. connecting TV to the Internet), you can switch to a site that offers such movie information on the threat.

RSO Mobile application provides access to messages generated throughout the country.

3 The Concept of the Telematics System Model

Intelligent Transportation Systems are a wide collection of various technologies (telecommunications, information technology, and automatic measurement) and the management techniques used for transport in order to protect lives of road users and to improve efficiency of the transport system and to protect natural resources (Fig. 1.).

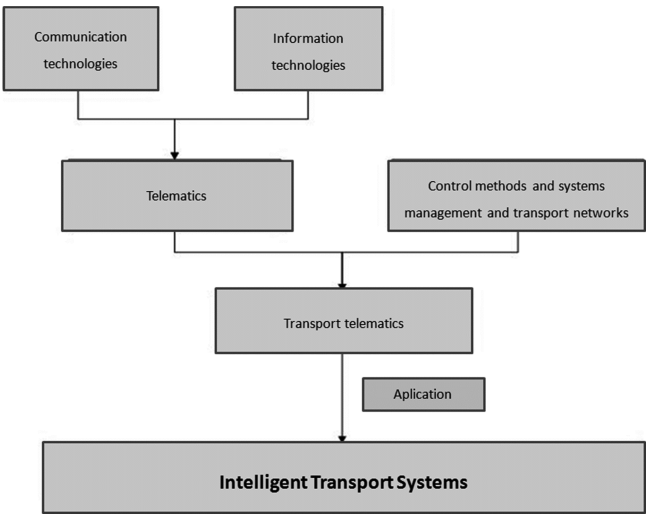

Fig. 1. Intelligent transport systems [5]

Intelligent Transportation Systems are a combination of information and communications technology for a transport infrastructure and vehicles in order to improve safety, increase efficiency of transport processes and environmental protection. ITS improves conditions in the field of multi-modal travel, dealing with private and public means of transport by road, air and maritime transport. Results of the research on the benefits of using intelligent crisis management system are provided in Fig. 2.

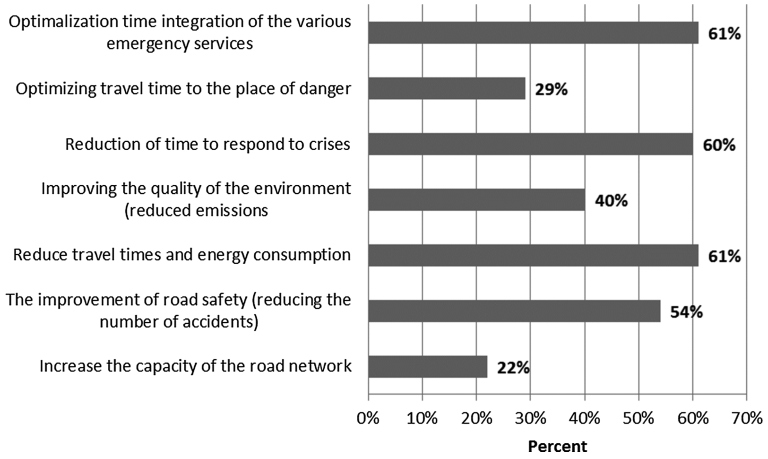

Fig. 2. The impact of the crisis management ITS [own study]

One of the most important tasks of the state aims to introduce intelligent transport solutions to establish the ITS architecture, which is a series of links (logical, physical and communication) between the elements that make up systems of Intelligent Transport Systems in order to create a scalable, easy to maintain and manage solution.

A domestic architecture does not indicate a specific technology or a vendor, thereby becoming open systems that increase competitiveness of the implemented solutions. Currently in Poland ITS solutions are "islands", it means that they individually meet the predetermined role but when combined they can lead to a situation when these systems are not compatible and will not be able to work together without bringing the same potential benefits. Figure 3 is the physical architecture of ITS.

The model shows the concept of regional integration with an intelligent warning system transport system. Regional integration and ITS warning system are the source of knowledge that can take full advantage of the crisis.

The results of subjective evaluation by the user of the ITS system is shown in Fig. 4. The research area is divided into 14 areas in Wroclaw. The study was conducted among 147 people. Surveys were carried out in Wroclaw in the area of major and minor interchanges, at bus stops and public transport. It assesses the main assumptions that are made in the project implementation of intelligent transport system in Wroclaw.

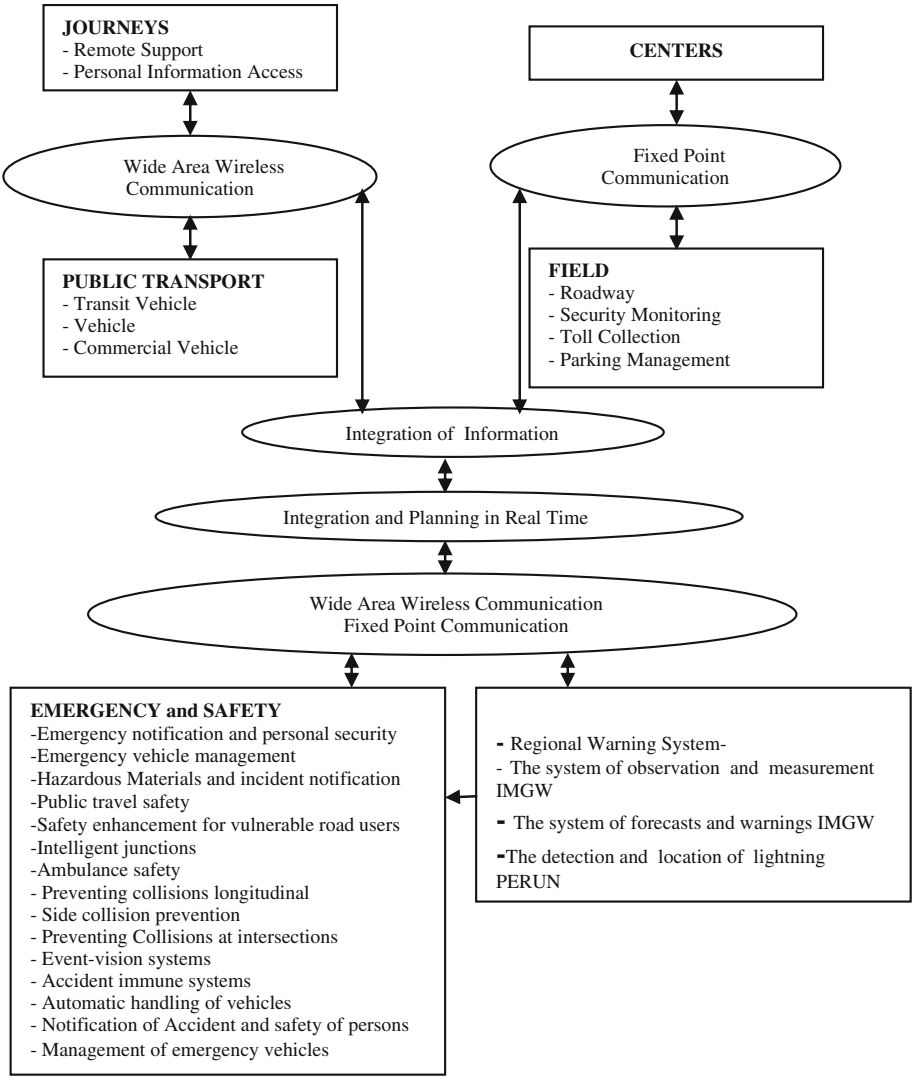

Fig. 3. The model of the crisis management system [own study]

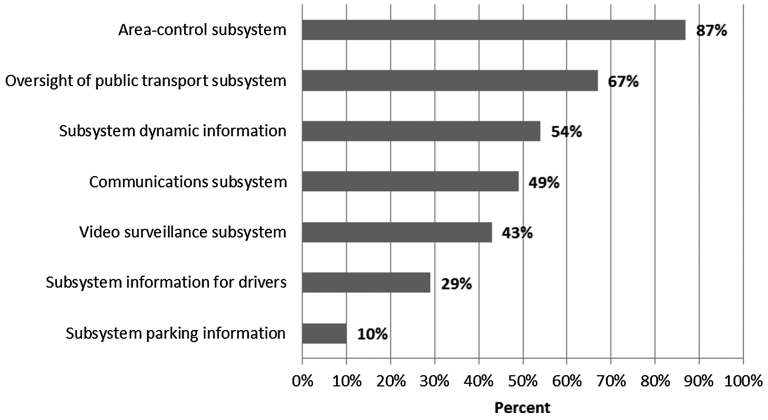

Fig. 4. The model of the crisis management system [own study]

4 Conclusion

According to studies into crisis management attention should primarily be paid to an area-control subsystem, the oversight of public transport subsystem and subsystem dynamic information. According to the research cited above, areas require continuous improvement. As far as crisis management is concerned, the least important subsystems are subsystem of parking information and an information subsystem for drivers. The authors present the concept of crisis management system. Only through the use of the full measurement information, security can be efficiently managed locally and globally.

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