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INTEROPERABILITY REQUIREMENTS OF ITS EMERGENCY SERVICES

The paper discusses basic function and interoperability requirements of emergency service in ITS (Intelligent Transport Systems) environment. Several automotive telematic functionalities are analysed in terms of value to the end users. Basic user requirements for emergency services are reviewed. Holistic functional design with proper integration of emergency system and other related ITS services is suggested.

WYMAGANIA INTEROPERACYJNOŚCI USŁUG AWARYJNYCH ITS

Referat opisuje podstawowe funkcje i wymagania interoperacyjności usług awaryjnych w środowisku ITS (Inteligentne Systemy Transportu). Analizowane są różne funkcje telematyczne w aspekcie ich wartości dla użytkownika końcowego. Przedstawiono podstawowe wymogi użytkownika dla usług awaryjnych. Zasugerowano holistyczny projekt funkcjonalny z właściwą integracją systemu awaryjnego z innymi usługami związanymi z ITS.

1. INTRODUCTION

Emergency system and service is one of the most important segments of Intelligent Transport Systems (ITS). As the ITS applications and automotive telematic market continue to grow, new solutions that connect the automobile to the rest of the world become very important. In this new environment Emergency Roadside Assistance and Personalized information are two telematic applications with the highest value to users (see Figure 1).

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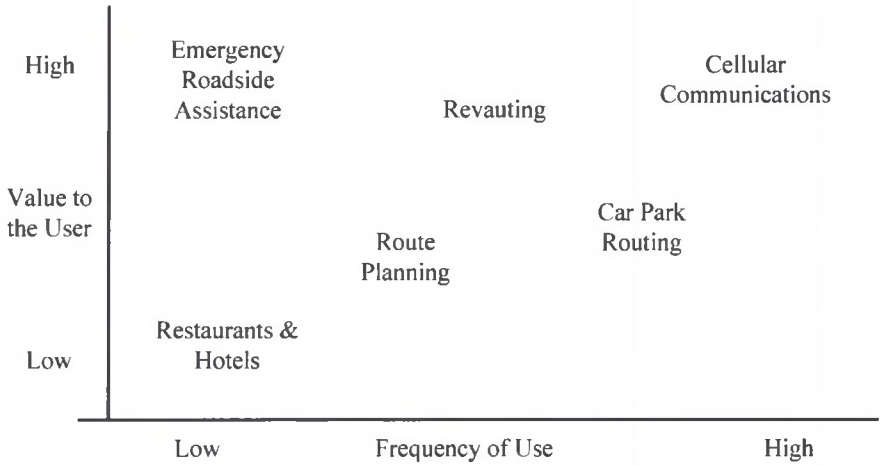

Fig.1. Market potential of ITS service

Existed automotive telematics include safety and security functionalities such as:

- ▷ remote door lock/unlock
- ▷ air-bag deployment notification
- ▷ remote engine diagnostics
- ▷ roadside assistance
- ▷ hands-free cellular voice communications
- ▷ traffic information.

Advanced emergency system integrate emergency call system (with common 112 number), mobile communications (GSM, GPRS, UMTS) positioning/location system, digital maps and different in-vehicle equipment. Traditional telematics solutions and advanced ITS-oriented applications are discussed in references [5], [9].

This paper aims to review basic task of Emergency Service and user requirements related with ITS interoperability requirements. For basic aspects of interoperability (technical, functional/logical, contractual/institutional, policy measures for interoperability) are discussed.

According to the systems engineering methodology, the top level requirements are decomposed into a set of lower level functional requirements consistent with the top-level interoperability requirements.

2. USER REQUIREMENTS

Basic function of emergency system is to detect that the vehicle is involved in accidence, identify vehicle location and initiate a "May Day" call to relevant emergency authority [6]. Single entry point to emergency call centres must be defined for region or country. The hand-over procedure from a communications service provider to the emergency authority must be defined. Agreement also includes filtering the false calls.

Incident detection time shall be determined to provide appropriate trade-off between the probability of detection and false alarm rate. A measurable goal can be to detect life threatening incidents with a high probability (greater than 99%) within a short time (less than 1 minute).

The system shall provide incident classification capabilities allowing the authority to plan a proper response.

Emergency system shall support "real-time" collection, management and incident information statistics, response actions and status, and traffic network status.

3. EMERGENCY SYSTEMS DESIGN WITH INTEROPERABILITY REQUIREMENTS

An emergency systems design problem with explicit formulated interoperability requirement can be defined as follows:

$$SDR = (USR , OPR , FCN , THR , PER , COR , TOR , STR)_{p, s, t}$$

where: SDR denotes the system design requirements,
USR denotes the user needs and other stakeholders requirements of ITS,
OPR denotes interoperability requirements,
FCN denotes ITS functions,
THR denotes technology,
PER denotes performance requirements,
COR denotes the cost requirements,
TOR denotes the trade-off requirements,
STR denotes the system test and integration requirement,
p, s, t denote population, space and time as *backdrop* variables.

The space of functional system design (with interoperability requirements) of ITS is denoted as FS(ITS) and defined as follows:

$$FS(ITS) = \{ FSD : FSD = (Z , DSZ , TSZ , SSZ)$$

Z is an "example" system that satisfies the requirements with respect to initial state of Z and time & space subscales (TSZ & SSZ) }

Each element $FSD_i \in FS(ITS)$ is called the functional system design. It can be said that Z is in the functionality space.

The illustration of functional system design problem with interoperability requirements is given in Figure 2.

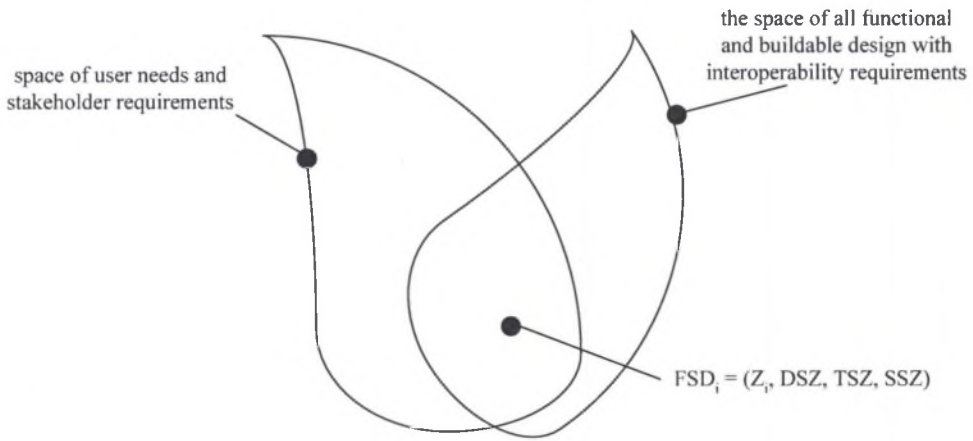

Fig.2. Illustration of functional design problem with interoperability requirements

After conceptual development and system function specification, the functional system design must be implementable by buildable system design. It has a *mode of behavior* that exhibits the functionality of the functional system design. Components of buildable system are hardware, software and bioware components in the specified technology.

4. INTEGRATION WITH OTHER ITS SERVICES AND TOOLS

ITS emergency services are linked with several other ITS services and tools such as on trip information, access control, route guidance, urban traffic management, etc. (see Figure 3).

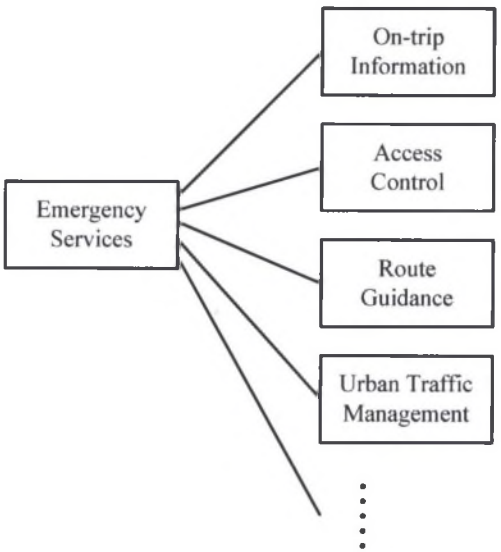

Fig.3. Integration of ITS services

In architectural design emergency intervention "high level" function includes lower level functions:

- acquiring emergency call
- providing access and maintain common emergency data
- managing emergency intervention
- managing emergency vehicles
- providing emergency control to operator.

Technology for advanced emergency service and incident management combine cellular communications (GSM, GPRS, UMTS), satellite positioning (GPS), digital mapping (GIS) and incident detection technologies.

5. CONCLUSIONS

Technological marketing research (oriented to user requirements specification) and systems engineering methodology can be basis for effective design and deployment of Emergency services in ITS environment. ITS applications enhances safety and improve emergency response ny integrating emergency call system ("112"), positioning system, GSM/GPRS/UMTS communications, in-vehicle telematics with other ITS services such as on-trip information, access control, route guidance, urban traffic management, etc. Technical, functional and institutional interoperability require identification and proper coordination between the various acters involved in deployment of advanced ITS-oriented emergency services.

Development of pan-European Emergency Management System requires integration of several initiatives to a common solution within "e-safety" environment. Basic challenge is appropriately cooperation among the set of many involved stakeholders.

ACRONYMS:

GIS – *Geographic Information Systems*
GPRS – *General Packet Radio Service*
GSM – *Global System for Mobile Telecommunications*
ITS – *Intelligent Transport Systems*
UMTS – *Universal Mobile Telecommunications System*
TM – *Technological Marketing*
WAP – *Wireless Application Protocol*

BIBLIOGRAPHY

[1] AFSCM (1996): Systems Engineering Management Procedure
[2] BERTHON P. et all (1999): Marketing and Technical Managers. European Journal of Marketing, Vol.33, No. 7/8, pp. 772-792, 0309-0566
[3] BOSNJAK I. (1996): High-Tech Marketing. Faculty of Transport and Traffic Sciences, Zagreb, ISBN 953-6221-52-7
[4] BOSNJAK I. et all (2003): Integration and Cross-Country Diffusion of Intelligent Transport Systems in CEE. Proceedings of 10th World Congress on Intelligent Transport Systems and Services, Madrid, Paper No. 2722
[5] CHEN K. and J. C. MILES (editors) (1999): ITS Handbook 2000, PIARC, ISBN 1-58053-103-2
[6] KAREN (2002): List of European User Needs. EC, D2.02
[7] SONG X. M. and PARRY (1992): The R&D-marketing Interface in High Technology Firms. Journal of Product Innovation Management. Vol. 9, No. 2, pp. 91-112
[8] SRINIVASAN D. et all (2004): Evaluation of Adaptive Neural Network Models for Freeway Incident Detection. IEEE Transactions on Intelligent Transport Systems, Vol. 5, No. 1, pp. 1-11, ISSN 1524-9050
[9] Proceedings of 10th World Congress on Intelligent Transport Systems and Services, Madrid, 16-20. 11. 2003

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