

Implementation Problems of Automatic Emergency Information System - eCall

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ABSTRACT

The concept of eCall automatically informing system of traffic accidents is one of the key-points of the European initiative eSafety and aims to create a Pan-European system of quick notification of traffic accidents. The system will use the telephone 112 or E112. The accident data will be transferred to emergency points. The estimation of costs and profits of the eCall system within the E-MERGE project and research SeiSS6 shows a possibility of avoiding even 2500 deaths a year and diminishing the results of accidents by about 15% on European scale. This paper presents rules of the eCall system operation and introduces some problems associated with the system implementation. The paper includes the eCall infrastructure, legal problems and the data transmission from a vehicle to a PSAP centre. The following technical issues are being discussed as well: accidents detection, ICT communication and data transmission in the voice channel.

KEYWORDS: eCall, 112, traffic accidents, telematics, ITS

1. Introduction

The concept of eCall automatically informing system of is one of the key-points of the European initiative eSafety and it aims to create a Pan-European system of quick notification about traffic accidents. The eCall refers also to the „Intelligent car” initiative that is aimed at creation of safe and ecological transport solutions. Automatic informing about traffic accidents is a service that will be available in every EU country and every new car produced in the EU. This will be the only Pan-European service that will not require any additional agreements or special equipment. In the case of a serious crash, special detectors mounted in vehicles will automatically start emergency procedure in the on-board eCall unit.

This system will establish a connection based on E112 number. The rescue message consists of an MSD (Minimum Set of Data) transmission and a voice connection between the vehicle and a PSAP centre. The European Commission analysed many data transmission specifications that were proposed by private companies and chose the in-band voice channel transmission as the only satisfactory solution. PSAP operators will be also notified if the call was triggered manually or automatically. In the case of automatically triggered call and no voice response from the people inside the vehicle it is crucial to send emergency services as soon as possible. According to the results of the analysis conducted within the E-MERGE project financed by the European Commission, the eCall system will decrease the time of response by 50% in rural and 40% in urban areas. A rapid

treatment of injured people in consequence will decrease the number of deaths and mitigate the severity of injuries. The first hour after the accident is crucial to life and health of crash victims.

2. Principle of operation

The eCall system enables to inform rescue workers about accident's exact whereabouts by manual and automatic emergency calls. A manual call is activated by the driver/passenger with a special button next to the driver/passenger and an automatic call is made in specified conditions after detection of a crash. The eCall device will connect via the GSM network with the emergency service so it can transmit electronic data and initiate a voice connection. Notification is received by the emergency centre – a regional public service answering point that operates within the emergency telephone number 112.

The on-board eCall device will transmit a Minimum Set of Data (MSD) with the accident information and will try to initiate a voice connection between an emergency centre and the vehicle (Fig. 1). People in the vehicle during the talk with a trained e-Call operator can provide additional important information about the collision. The minimum set of data means the accident information which contains the time, exact location, vehicle data (VIN), eCall status (information about the notification type – automatic/manual) and the information about the GSM operator. The content of MSD notification is as follows:

There is a possibility of commercialization of the message-receiving phase. The eCall will be using the existing mobile network of the European emergency number - 112. When it comes to E112 number, there is a possibility of eCall device's authorization.

Commercial solutions within automatic emergency calls are offered by: PSA (Peugeot Société Anonyme), T-Mobile Traffic, Ford, GM Onstar, Volvo OnCall, MAIF (Maryland Automobile Insurance Fund) but in the last 15 years their share in the market is less than 0.4%. This kind of service is offered only in high-end automobiles.

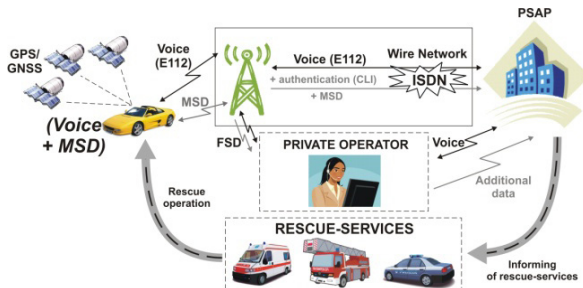


Fig. 1. Scheme of the eCall system
Source: [own work]

3. Accident detection and positioning

The eCall system enables to inform rescue workers about accident's exact whereabouts by manual and automatic emergency calls. A manual call is activated by the driver/passenger with a special button next to the driver/passenger and an automatic call is made in specified conditions after detection of a crash. The eCall device will connect via the GSM network with the emergency service so it can transmit electronic data and initiate a voice connection. Notification is received by the emergency centre – a regional public service answering point that operates within the emergency telephone number 112.

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Table 1. MSD Structure

Byte no.	Name	Description
1	Control	Bit 7: 1 = Automatic activation Bit 6: 1 = Manual activation Bit 5: 1 = Test Call Bit 4: 1 = No Confidence in position Bit 3: Entity type could be added Bit 2: Entity type could be added Bit 1: Entity type could be added Bit 0: Entity type could be added
2	Vehicle identification	VIN number according ISO 3779
3	Time stamp	Timestamp of incident event
4	Location	GNSS Position Latitude (WGS84) and Direction of Travel (Based on last 3 positions)
5	Service Provider	Service Provider IP Address
6	Optional Data	Further data on e.g. crash information encoded in the XML Format

Table 2. Accident description with an AIS index

AIS index	Injury
0	Without injuries
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Unsurvivable
0	Without injuries

4. Standardisation of the eCall system

The European Commission took actions on improving eCall regulations. The EC approached the ETSI (European Telecommunications Standards Institute) and CEN (Comité Européen de Normalisation) to develop open standards for the eCall system functionality. Most important issues were stated in the communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: eCall: time for deployment. These issues are:

- CEN approval of the structure of eCall Minimum Set of Data,
- 3GPP approval of the eCall discriminator ('eCall flag'), included in Release 8 of the technical specifications with which the mobile telecommunications systems must comply. This discriminator will differentiate between 112 calls from mobile terminals and eCalls, and also between manual and automatically triggered eCalls. This will permit Member States to design the

eCall response infrastructure in the way that best fits their emergency response infrastructure (i.e. centralised/decentralised, the same PSAP that receives the 112 calls, or a different PSAP with a filtering function, a public organisation or a private one recognised by the public authority). Member States must inform mobile network operators operating in the country of the most appropriate PSAP to route eCalls.

- ETSI-MSG and 3GPP approval of the core technical specifications defining the protocols for sending the MSD from the vehicle to the PSAP operator. The solution agreed is that the data will be transmitted via an in-band modem along with the voice call. It is an open standard and there will be no licence fees for using the in-band modem for the eCall service.
- CEN approval of the core operating requirements for the Pan-European eCall service, defining the general functional and operational principles.

Work group CEN TC 278 WG 15 is responsible for preparing complex requirements for Pan-European eCall system. Researchers agreed on system standards and in autumn 2008 they started final phase of negotiations. We can expect that the final version of operational requirements will be accepted as "technical conditions". Work group CEN TC 278 WG 15 is also working on private service providers' cooperation with PSAP centres. Scheme of this cooperation is the following: in the case of emergency call a private eCall service provider will initiate connection with the vehicle, receive and decode the MSD message. Next, a notification will be passed to the PSAP. Private service providers can run additional services such as: vehicle supervision or car monitoring and fleet management. Compatibility of eCall devices with the PSAP centres requires the system assumptions for all European countries. Among many prepared standards, there are two key types: the data transmission standard and minimum set of data (MSD) sent from the eCall device installed in the vehicle to the PSAP centre. At the beginning of 2009 the European Committee for Standardization CEN (Comité Européen de Normalisation) has finished the work on MSD. However, methods and data transmission protocols are not defined in the document approved in February 2009 - CEN/TS 15722. Furthermore, CEN/TS 15722 standard requires legalization on the territory of European Union. Beside MSD it is necessary to prepare the data transmission protocol. The ETSI (European Telecommunications Standards Institute) and 3GPP representatives (3rd Generation Partnership Project - common mobile network standardization project) have already started working on the protocol. Producers provided data transmission devices, which were further examined. The in-band modem created by the Qualcomm company proved to be the best

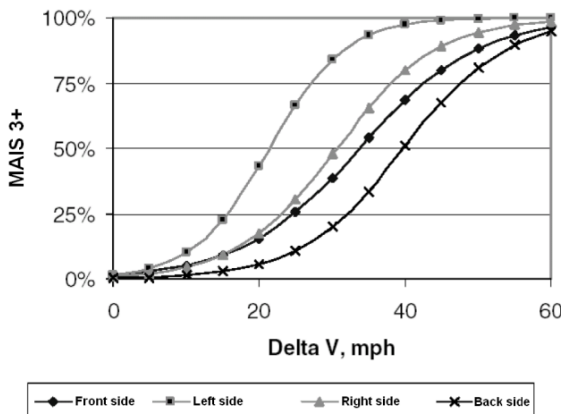


Fig. 2. Serious injury probability (MAIS 3+)

Source: [own work]

possible solution for a reliable transmission of MSD. The use of this modem fulfils all expectations in the field of MSD transmission and it does not require any modifications of the existing infrastructure and emergency number centre. During the tests with an unmodified PSAP centre, the operator had a voice connection with the vehicle in 2 seconds after the activation of eCall service. Moreover, this modem can be adjusted to two-way communication and MSD transmission giving better than expected connection speed 1.37 second – for standard conditions and 2.1 seconds for poor transmission conditions.

5. Conclusion

eCall devices will be mounted in all new-registered vehicles. In the case of a serious crash the vehicle detectors will automatically trigger the on-board eCall system that will start an E112 connection. It was assumed that the data will be transmitted in the voice channel (in-band transmission) according to the system functionality that requires simultaneous transmission of voice and accident's data. The emergency message (MSD) will include the most important information about the vehicle and its location. MSD data will be decoded and displayed on a PSAP operator's monitor. The location and direction of movement identification will be based on GPS data.

According to rapid growth of traffic in the EU countries and limited possibilities of building new road infrastructure, it is necessary to take actions that are aimed at improving the traffic flow and road safety. The implementation of the eCall system may save many human lives but it has to be preceded by preparation of standards and procedures that would be common for all EU countries. The implementation phase includes field tests on the territory of each EU country. However the true challenge will be the achieving of European interoperability between all devices produced by different manufacturers and with different PSAP centres.

In order to decrease the transportation's impact on the environment and to reduce the costs resulting from transportation, the implementation of the Intelligent Vehicle Systems (part of the eSafety initiative) has begun. One of the three aims of the so called "intelligent car" initiative is the liquidation of obstacles associated with implementation of modern technologies on the automotive market. It requires cooperation of member states on the international forum and cooperation with the partners operating in the field of road safety. The European Commission developed the eSafety platform, which is an initiative connecting many concerned parties from both public and private sector. The eSafety forum, which was developed in 2003, associates currently over 150 associations and public

administrative agencies. Formulated reports are an incentive for a development of a public policy and industrial initiatives. On a constantly increasing intensity of traffic and limited possibilities of development of the road infrastructure, it is necessary to undertake actions leading to increase in traffic's smoothness and to passive and active solutions associated with the safety of traffic. The implementation of the eCall system can save many lives. However, it must be followed by the formulation of standards and procedures that will be launched in all of the European countries. Tests verifying the correctness of system's performance in particular countries are foreseen as one of the stages leading to the system implementation. However, a real challenge is achieving a compatibility of devices produced by various producers with head offices all over the Europe. In Poland, it is necessary to undertake actions associated with developing concepts of structure and system's performance, including cooperation with private entities providing services in the field of eCall system. In this field the Motor Transport Institute cooperates with other research and research and development entities, and private entities, including one of major Polish operators of telecommunication services. A test stand for an on-board study of eCall devices is being prepared. This will enable conducting further research in this field.

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