

AUTOMATED CALL TO 112 IN CASE OF CAR ACCIDENTS – USING AN E-SAFETY ROBOT

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ABSTRACT:

AUTOMATIC SYSTEMS HAVE A GREAT SIGNIFICANCE, BUT THE SYSTEMS THAT REQUIRE AND USE ROBOTS' CHARACTERISTICS ARE IMPORTANT AS WELL, ALLOWING AN EFFICIENT DIVERSITY REGARDING THEIR CONSTRUCTION AND DEVELOPMENT. STATISTICS SHOW THAT IN EU, IN THE LAST 10 YEARS, ON AVERAGE OF APPROXIMATELY 40000 PEOPLE LOST THEIR LIVES EVERY SINGLE YEAR IN ROAD ACCIDENTS, WHILE ANNUAL FINANCIAL LOSSES WERE EVALUATED TO APPROXIMATELY 25 BILLION EURO. STUDIES REVEALED THAT THE NEGATIVE EFFECTS OF A ROAD ACCIDENT INCREASE EXPONENTIALLY WITH THE INCREASE OF THE TIME PAST BETWEEN THE IMPACT MOMENT AND INTERVENTION MOMENT. TODAY, IN EU, THE AVERAGE TIME TO INTERVENTION IS AROUND 30 MINUTES. IN ALL EU MEMBER STATES, A „SINGLE INTERVENTION SYSTEM FOR EMERGENCIES” IS IMPLEMENTED AND WORKING THAT IS CONNECTED TO 112 EMERGENCY NUMBER. IT IS EXPECTED THAT THE TIME BETWEEN IMPACT AND INTERVENTION CAN BE REDUCED UP TO 50% THROUGH THE USE OF E-CALL. THIS SYSTEM INVOLVES AUTOMATIC CONTACTING OF 112 IN CASE OF AN ACCIDENT, BY A DEVICE INSTALLED ON THE CAR (A ROBOT), AS WELL AS PRIORITY CONNECTION TO THE CLOSEST STATION OF 112 SYSTEM AND THE TRANSMISSION OF A MINIMAL SET OF USEFUL DATA FOR INTERVENTION. EU CURRENT REGULATION REQUIRES FROM 2017 THAT HOMOLOGATION OF VEHICLES, FOR SEVERAL TYPES OF VEHICLES, HAS TO BE DEPENDENT BY THE EXISTENCE AND FUNCTIONALITY OF SUCH TYPE OF ROBOT INSTALLED ON THE VEHICLES. THE ARTICLE PRESENTS THE SYSTEM FEATURES AND NEW FUNCTIONALITIES DEVELOPED IN IHEERO PROJECT BASED ON ECALL TECHNOLOGY.

KEY WORDS: 112, ECALL, ROAD ACCIDENT, VEHICLES HOMOLOGATION

INTRODUCTION

Globalization, as well as the fast development of IT&C technologies, creation and development of new business models in digital economy, the extension of internet usage in all aspects of our economic, social, cultural life have led to the unprecedented development and numerical increase of all forms of transport. People mobility for business, tourism, work, learning and so on increased, while using all available ways to travel (land, air, water).

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More and more transport vehicles move around, carrying merchandise, medicine, help, supplies and so on. On the other hand, the transport infrastructure required for them is still not sufficiently developed in a lot of EU countries, and the drivers' set of skills is not yet significantly improved in order to be sure that they would successfully address the new challenges.

Because of this, a large number of terrible accidents are happening as we speak on highways and roads, with casualties or heavy injuries. Considering this, both at EU level as well as local government level, considerable efforts are done to prevent or limit the consequences of these accidents. To address this, the Single intervention system for emergencies (SISE) was developed and implemented in all EU countries, by using a single emergency call number, 112⁴.

EU CONCERNS FOR LIMITING THE OUTCOMES OF ROAD ACCIDENTS

European Commission has developed and partially funded the eCall (Emergency Call) project, that creates an automated call system from a vehicle when a road accident occurs. The platform is developed as a component of a EC road safety program that is implemented on the existing infrastructure of 112 emergency platform and allows the location identification for the vehicle that announces the road accident (E112). The new eCall emergency call system will be operational in all EU states and will send a minimal standardized set of data (Minimum Set of Data–MSD) directly to system operators that can then send the proper intervention crews to the intervention site⁵. The MSD will be specific to the crashed vehicle and relevant for the accident.

A general view on the eCall communication system is presented in Figure 1 below.

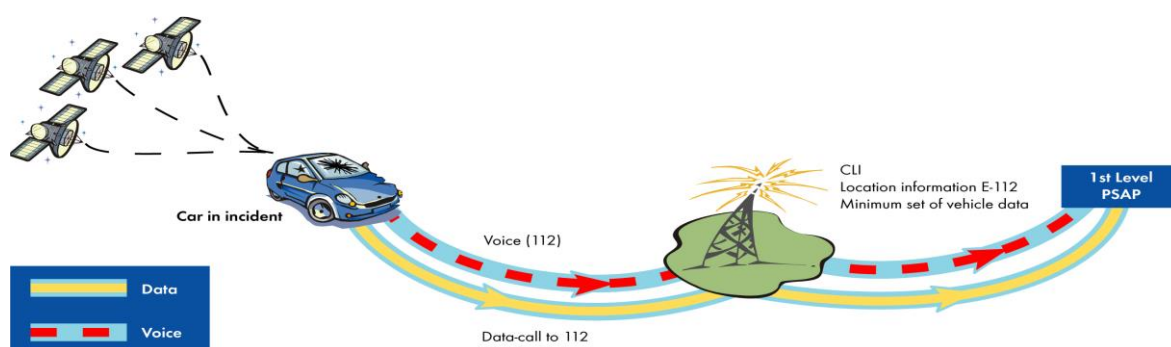


Figure 1. eCall system architecture⁶

„Public Safety Answering Points (PSAPs)” are organised on 2 levels:

- 1st level PSAP – they receive the emergency calls
- 2nd level PSAP- they receive 1st level PSAP calls and send the intervention crews⁷.

Regardless of the activation method, either manual or automatic, a supplementary voice connection is initiated between vehicle and PSAP. In this way, any vehicle passenger that is

⁴ Directive 2009/136/EC of the European Parliament and of the Council of 25 November 2009 amending Directive 2002/22/EC on universal service and users rights, <http://www.europarl.europa.eu/oeil/popups/ficheprocedure.do?lang=en&reference=2010/2274%28INI%29>

⁵ Proposal of the European Commission for a decision of the European Parliament and of the Council on the deployment of the interoperable EU-wide eCall (16 June 2013) - COM(2013) 315 final - 2013/0166 (COD)

⁶ EENA –Operations Document -112 Service Chain Description (10.06.2011)

⁷ EENA –Operations Document -112 Service Chain Description (10.06.2011)

able to answer some questions can provide supplementary details about the accident to the PSAP operators⁸.

EC had continued to develop, for 3 years (January 2011 up to december 2013), the IT&C platform for eCall emergency system based on 112 through HeERO (*Harmonised eCall European Pilot*) EU funded project.

9 European states that formed the HeERO consortium of partners have worked together in order to ensure implementation, interoperability and harmonization of the 112 single emergency number in EU. As such, the countries of Croatia, Czech Republic, Finland, Germany, Greece, Italy, Holland, Romania and Sweden had a major goal within the project: preparation of the local infrastructure needed for providing a sustainable eCall service for the european citizens and sharing this experience with the rest of the member states or EU associated countries.

The general objective of the HeERO project was preparation for later implementation of the needed infrastructure in EU, in order for the Pan-European harmonized interoperable emergency alert system service within vehicles to become a reality.

When a terrible car accident happens within EU, the eCall system will automatically call E112 (Picture 2). The eCall modem allows the transfer of messages from the In-vehicle System (IVS), through the cell network, to the PSAP, that identifies the eCall MSD. The MSD data submitted allows vehicle localization, allowing the identification of the exact place, date and hour of the accident, as well as the Vehicle Identification Number (VIN) as well as other relevant information concerning the accident, thus significantly reducing the required time to respond and intervene for the intervention crews (firemen, ambulance, police, guardians, mountain rescue, etc.)

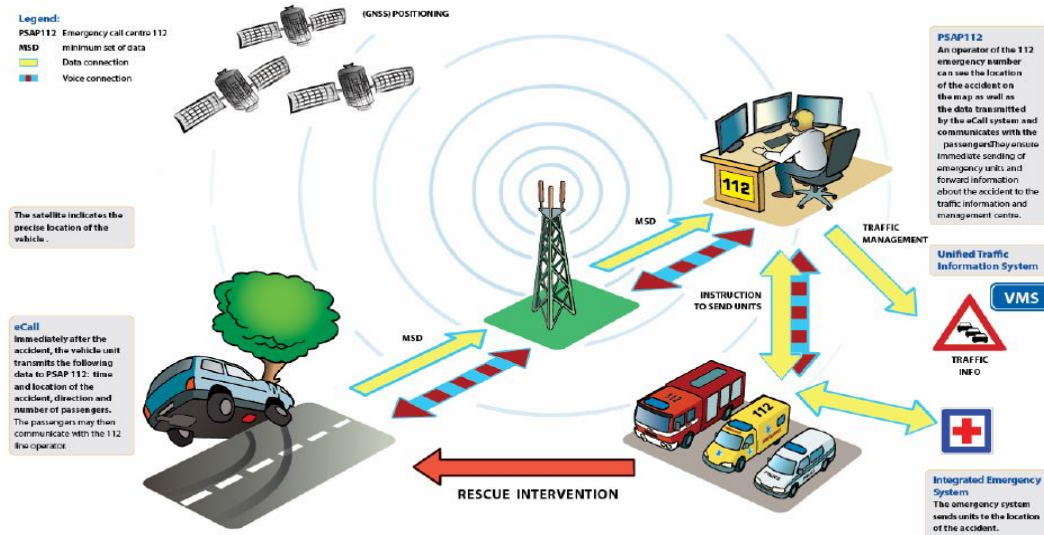


Figure 2. Communication from IVS in case of a road accident [4]

Following the DECISION No 585/2014/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 May 2014 on the deployment of the interoperable EU-wide

⁸ Studiu privind transportul și mobilitatea în cadrul Regiunii SUD-VEST Oltenia, universitatea din Pitești, Departamentul Autovehicule și Transporturi, ISBN: 978-606-633-512-6, <http://por2014-2020.adroltenia.ro/wp-content/uploads/2015/12/Studiu-TM-SVO-pentru-publicare-pe-site-1.pdf>

eCall service, the member states have to implement the PSAP infrastructure required to manage eCall emergency calls no later than 1st of October 2017.

It is estimated that by using eCall more than 2500 lives will be saved each year⁹, as well as considerably limiting the risk of secondary accidents, reducing the traffic jams duration, waste of fuel and CO2 emissions, as well as faster victims treatment with a lot better recovery chances for them.

It is also estimated that the EU losses caused by road accidents are above 160 bn Euro/year and by using eCall system on vehicles a significant reduction of 20 billion Euro/year of losses will be achieved. The studies conducted so far predict that the eCall system will contribute to achieving the EU major goal of reducing terrible accidents and deaths by 50%¹⁰.

The eCall platform required the development of cooperation systems and provided information for the traffic management centers, allowing later and further development of intelligent transport systems¹¹. Each EU member state had the task to build its own national eCall platform, as a part of the European platform.

NEW APPROACHES FOR INCREASING ROAD SAFETY IN EU

EU is proposing an European space of road safety achievable within 2010-2020 timeframe, based on the efforts of all member states.

Analysis concerning road safety have proven that, in 2015, the average rate of death in EU road traffic was 51,5/1 million inhabitants (picture 3), while in Romania that was a lot higher than the average, more than 95/1million inhabitants¹².

⁹ Safety Forum – The eCall Project – eCall Expert Meeting Helsinki April 2005

¹⁰ <http://www.heero-pilot.eu/view/ro/ecall.html>

¹¹ Cezar Botezatu, Bărcă Claudiu, Intelligent vehicle safety sustems-eCall, Journal of Information Systems & Operations Management Vol. 2 No.2 / December 2008, Editura Universitară, Bucuresti, ISSN: 1843-4711, pg. 495-507

¹² Siguranța rutieră: potrivit ultimelor statistici, sunt necesare noi eforturi pentru salvarea de vieți omenești pe drumurile UE, Bruxelles, 31 martie 2016, la http://europa.eu/rapid/press-release_IP-16-863_ro.htm

	2010	2014	2015	2014-2015	2010-2015
Belgium	77	65	67	4 %	-10 %
Bulgary	105	91	95	4 %	12 %
Czech Republic	77	65	70	7 %	-8 %
Denmark	46	32	30	-8 %	-35 %
Germany	45	42	43	3 %	- 5 %
Estonia	59	59	50	- 15%	-16 %
Ireland	47	42	36	-15 %	-22 %
Greece	112	73	74	2 %	- 36 %
Spain	53	36	36	0 %	-32 %
France	64	53	54	2 %	-13 %
Croatia	99	73	82	13 %	- 18 %
Italy	70	56	56	1 %	-17 %
Cyprus	73	52	66	27 %	- 5 %
Latvia	103	106	94	-11 %	-14 %
Lithuania	95	91	82	- 10 %	-19 %
Luxemburg	64	64	58	- 9 %	0 %
Hungary	74	63	66	3 %	- 13 %
Malta	36	24	26	10 %	-27 %
Holland	32	28	28	0 %	-12 %
Austria	66	51	56	10 %	-14 %
Poland	102	84	77	-8 %	-25 %
Portugal	80	61	60	-2 %	-33 %
Romania	117	91	95	4 %	-21 %
Slovakia	67	52	58	11 %	-13 %
Slovenia	65	48	51	6 %	-22 %
Finland	51	42	48	15 %	- 3 %
Sweden	28	28	27	- 2 %	0 %
UK	30	29	29	- 1 %	-4 %

EU	63	51	51,5	1 %	-17 %
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Picture 3 Statistics regarding deaths in road accidents fatalities/ millions of habitants¹³

Under these circumstances, in order to reduce the harsh effects of road accidents, EC discussed a number of measures concerning the technical readiness of vehicles, transport of dangerous cargo and road safety. EC decided, in its political strategy, 7 major goals that will be targeted through national and EU level rules and regulations:

Improvement of the level of education and training for the traffic participants; improvement of the road infrastructure and vehicles safety; increase of use for intelligent transport systems, as eCall use for vehicles, for example; improvement of emergency response services as well as ambulance and wounded participants' reception and care; protection of vulnerable traffic participants, like walking people and bicycle users¹⁴.

In order to achieve this, EU level regulation was needed, as well as local government and responsible national public bodies regulations that would provide both single management of intervention from specialized institutions, as well as their use of resources for road accidents.

Thus, the EC and member states are debating a set of measures for road safety increase through improvements in infrastructure as well as its equipment with intelligent warning systems through the use of cutting edge IT&C technology. As such:

- In order to reduce the number of casualties, the EC developed in September 2016 a general roadmap for implementation of intelligent transport systems that would be able to cooperate by providing bidirectional communication between vehicles as well as between them and road infrastructure, and between different road infrastructures. These systems would allow vehicles to warn each other, either directly (automated emergency breaking) or through road infrastructure (to signal the approach of incoming road maintenance works for example).
- EU adopted last year the needed legislation to force all producers of new cars in EU of certain types (M1, N2) to equip them with eCall system, starting with 1st of March 2018. That means that every new vehicle of these types will be connected to eCall from the factory. The Gartner market research company estimates that, by 2020, there will be more than 250 million connected vehicles on the roads¹⁵. As eCall platform is an open system, it will relay as well useful information for other beneficiaries, like traffic management centres, for examples, that would announce the citizens and traffic participants with information regarding notified road events¹⁶. It is estimated that this approach will enhance the emergency services response to events with 50% in rural areas and 40% in urban areas.
- As the number of light commercial vehicles on the roads is increasing, leading to an increase of the risk for them to get involved in road accidents, the possibility of mounting intelligent speed limiters on these vehicles is analyzed, considering as well the related benefits of such idea to environment protection and climate change.

More than that, in European Official Journal 12/17.01.2017 were published 2 Regulations¹⁷, that setup a single framework for implementing eCall services and checking

¹³ Siguranța rutieră: potrivit ultimelor statistici, sunt necesare noi eforturi pentru salvarea de vieți omenești pe drumurile UE, Bruxelles, 31 martie 2016, la http://europa.eu/rapid/press-release_IP-16-863_ro.htm

¹⁴ Transportul rutier: norme privind traficul și siguranța, la http://www.europarl.europa.eu/atyourservice/ro/displayFtu.html?ftuId=FTU_5.6.5.html

¹⁵ <http://easyengineering.ro/masinile-asistenti-pe-roti/>

¹⁶ Dorin Dumitrescu, Solution and final results of HeERO Romanian Pilot – HeERO Workshop 12-13 dec2013, Budapest

¹⁷ EU Regulation no. 2017/78 from 15th of July 2016 establishing administrative provisions for the EC type-approval of motor vehicles with respect to their 112-based eCall in-vehicle systems and uniform conditions for

procedures for it. They are completely compulsory and have to be implemented in all member states. The Regulation¹⁸ decides administrative compulsory requirements for EU vehicle type homologation regarding 112 based eCall systems that are installed in vehicles, as well as single requirements concerning private information and user data protection for the users of these systems, while the Regulation¹⁹ decides the technical requirements and testing procedures for EU vehicle type homologation regarding the 112 based eCall systems that are installed in vehicles, its' components and separate 112 based eCall systems' units that can be installed in vehicles, together with the applicable single standards and exceptions from the set rules.

I_HeERO – AN EU PROJECT IN IMPLEMENTATION

Starting with 1st of January 2015 EU continued to partially fund a new stage of the HeERO project, called I_HeERO, that will continue to be implemented until 31st of December 2017 and involves a consortium of partners from 11 European States (Bulgaria, Cyprus, Czech Republic, Finland, Germany, Greece, Italy, Ireland, Portugal, Romania and Slovenia), including 58 commercial partners and 26 development partners²⁰.

Besides the further development of the needed PSAP infrastructure needed for the Pan-European eCall system development, the project also proposes²¹:

- Extension of eCall service for heavy vehicles and dangerous cargo freight, as well as for big busses traveling long distances
- eCall implementation for 2 wheels' vehicles
- defining and conformity evaluation of PSAP, that would be a legal requirement for eCall management of 112 based PSAP service.

These measures are extremely important, especially considering the fact that vulnerable participants (people on foot, bicycle users and motorcycle users) represent almost half of the casualties, and in urban areas this percentage is even higher²². The analysis of this data and the circumstances that generate road accidents leads to the conclusion that besides old and improper infrastructure, the main two reasons that would cause road accidents with casualties are people on foot indiscipline (22% of accidents) and unadapted speed (19,5%).

the implementation of Regulation (EU) 2015/758 of the European Parliament and of the Council with regard to the privacy and data protection of users of such systems; Commission Delegated Regulation (EU) No. 2017/79 of September 12, 2016 Establishing Detailed Technical Requirements and Test Procedures for the EC Type-approval of Motor Vehicles with Respect to Their 112-based eCall In-vehicles Systems, of 112-based eCall In-vehicle Separate Technical Units and Components and Supplementing and Amending Regulation (EU) No. 2015/758 of the European Parliament and of the Council with Regard to the Exemptions and Applicable Standards

¹⁸ EU Regulation no. 2017/78 from 15th of July 2016 establishing administrative provisions for the EC type-approval of motor vehicles with respect to their 112-based eCall in-vehicle systems and uniform conditions for the implementation of Regulation (EU) 2015/758 of the European Parliament and of the Council with regard to the privacy and data protection of users of such systems

¹⁹ Commission Delegated Regulation (EU) No. 2017/79 of September 12, 2016 Establishing Detailed Technical Requirements and Test Procedures for the EC Type-approval of Motor Vehicles with Respect to Their 112-based eCall In-vehicles Systems, of 112-based eCall In-vehicle Separate Technical Units and Components and Supplementing and Amending Regulation (EU) No. 2015/758 of the European Parliament and of the Council with Regard to the Exemptions and Applicable Standards

²⁰ <http://iheero.eu/about-iheero/>

²¹ <http://iheero.eu/about-iheero/>; George Căruțașu, Cezar Botezatu, Mihai Botezatu, *Expanding eCall from cars to other means of transport*, International Conference Applied Informatics in Economy and Information Technology "e-Society – Knowledge and Innovation", November 3-4, 2016, Romanian-American University, Bucharest, in: Journal of Information Systems & Operations Management, Vol. 10 No.2 / December, 2016, ISSN 1843-4711, http://jisom.rau.ro/editorial_board.html

²² Strategia națională de siguranță rutieră 2016 – 2020, <http://cursdeguvernare.ro/tara-cu-cea-mai-mare-rata-de-morti-pe-sosele-masurile-europei-pentru-a-diminua-numarul-acestor-victime.html>

Taking this into consideration, the Romanian government considers that priority measures have to address these causes first and is already considering a series of supplementary measures besides the one concerning implementation and operation of the automated eCall system, like increasing the penalties for breaking the law by all traffic participants (people on foot as well as drivers for all types of vehicles, 2 or 4 wheeled vehicles)

A current major goal for EU is to reduce, by 2020, the number of casualties in road accidents by 50%. In order to provide an increased security for transport, innovation and implementation of ideas have to be supported through a number of supplementary measures that would complement those for implementing the eCall technology²³, such as:

- Harmonization and implementation of road safety technologies – such as driver assistance services, intelligent speed limiters, warning sensors for safety belt, infrastructure-vehicle interfaces and improvement of the technical readiness of vehicles.
- Development of an action plan and strategy concerning road accidents with victims and emergency systems that would include single definitions and standardised classifications of injuries and casualties.
- Training, education for all traffic participants, support for use of safety equipment (safety belts, protective gear, safety devices).
- Special care provided to vulnerable users, like people on foot, bicycle users and motorcycle users, including training effort for them and specific regulations.
- 11th of March 2014, EU Parliament adopted the single minimal requirements for technical periodical assessment of vehicles' readiness, registering documents for vehicles and technical traffic checks for commercial vehicles. The agreement with the member states, that will be officially approved by the European Council, will contribute to road safety improvement and crossborder recognition of the technical readiness assessment certificate.

In the business environment, some vehicle builders have already taken steps in including the new IT&C systems for road safety. The Ford models have already provided since 2012 the Emergency Assistance function for emergency situations, through the SYNC connection system. In the event of a vehicle accident that would trigger the explosion of an airbag or the interruption of the fuel intake, this technology would use a connected cell phone that initiates a direct call to local emergency services in the local language used in that area, thus alerting the emergency response crews and providing information with vehicle localization²⁴.

Ford is already experienced in this field, and how the company is improving this system with the help of an integrated modem, providing to car owners the eCall service, that automatically contacts emergency systems after an accident and communicates vehicle localization and the fact that the driver is either conscious or not. Ford will keep offering the older emergency assistance package for the cars that are not equipped with FordPass Connect. In order to be able to benefit from the integrated Wi-Fi hotspot capabilities, a Ford MY2018 model (vehicles produced after the second half of 2017) has to be equipped with the hardware.

²³ “CARTE ALBĂ Foaie de parcurs pentru un spațiu european unic al transporturilor – Către un sistem de transport competitiv și eficient din punct de vedere al resurselor”, <http://eur-lex.europa.eu/legal-content/ro/TXT/PDF/?uri=CELEX:52011DC0144>

²⁴ <http://www.capital.ro/un-parteneriat-intre-ford-si-vodafone-promite-sa-aduca-internetul.html>

CONCLUSIONS

EU has achieved the development and implementation of a Single intervention system for emergencies (SISE), reachable at the common single number 112 through a conversation with a human operator from a PSAP. As it was at first designed for communication with fixed emplacement devices, that have a known localization, the system had to manage later on the calls from mobile devices as well. Caller localization is extremely necessary for intervention efficiency reasons, while using the needed resources for each intervention from an optimal resource center. At each member state level, the SISE structure includes a carefully distributed network of intervention resource centers and a network of PSAPs that are interconnected. In order to reduce the harsh effects of road accidents, for a series of vehicle types that require CE type homologation it was already adopted and it will be applicable starting with 31st of March 2018 a solution consisting in an IVS (In-Vehicle System) that in case of a road accident will initiate, manually or automatically, a call to 112 and will transmit as well a minimal standardized set of data that will include the geographical coordinates of the accident location. This eCall system has already reached implementation phase in EU for some types of vehicles. Starting with 31st of March 2018, as previously stated, these types of vehicles will have to be equipped with an IVS that will respect the compulsory technical requirements in order to get EU type homologation. This IVS is practically a robot²⁵ that operates automatically in case of a road event. It is desired that the eCall system will be expanded to other types of vehicles, a fact that would require the update and modification of the standardised minimal data set, as well as other functions. The localization is automatically provided by the IVS in case of a road accident.

112 and eCall systems are complex systems, with nation wide network structures that have to be integrated in a global single network, as well as dedicated networks for certain specific sectors, like transport, energy, communications, etc. For efficiency, the connections and integration will be provided by intelligent systems – robots, reducing the human intervention to a minimum. It is a worthy challenge provoked by the high pace of technological and IT&C development. The depth of integration of eCall system with the other currently existing systems at vehicle, road, service, technical assistance, security assistance or insurance levels is dependant on the IVS chosen to be implemented. A series of questions still remains unsolved yet, such as: will this new device handle the new requirements for eCall system extension for other types of vehicles (2 or 4 wheeled vehicles), transport for dangerous cargo or by PSAPs? Will it be efficient? How much will be the associated costs? The whole 112 system as well as the eCall system based on 112 will be efficiently connected together and with the rest of the infrastructure systems in EU and outside of EU. Some answers will come from the robot producer solutions, that have already approached the subjects and will continue to do so in the following years.

²⁵ G.Carutasu, M.A.Botezatu, C. Botezatu, M. Pirnau, “Cloud Computing and Windows Azure”, in ECAI Proceedings, Electronics, Computers and Artificial Intelligence, vol 8, ISSN 1843-2115, http://ecai.ro/Arhiva/ECAI-2016%20VOLUMES/POSTER/ECAI-2016_paper_13.pdf

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