POSITIONING ISSUES AND SOLUTIONS FOR THE FUTURE ECALL EUROPEAN AUTOMOTIVE SAFETY SYSTEM

Alexandru TĂBUȘCĂ[1]
Gabriel GARAIS[2]

ABSTRACT:
THE PRESENT ARTICLE FOCUSES ON SOME OF THE CHALLENGES FACED BY THE FUTURE MANDATORY SAFETY SYSTEM FOR THE AUTOMOTIVE INDUSTRY: THE ECALL SMART SOLUTION. THE TOPIC TACKLED INSIDE THIS PAPER COVERS THE DIFFERENT POSITIONING ISSUES THAT HAVE TO BE CONSIDERED IN ORDER TO ENSURE THE RELIABILITY OF THE ECALL SYSTEM. THE MAIN POSITIONING SOLUTIONS CONSIDERED ARE: GLOBAL POSITIONING SYSTEMS (GPS, GALILEO, GLONASS, BEIDOU), MOBILE NETWORKS (CDMA, GSM, LTE) AND WIFI CONNECTIONS. ALL THESE SOLUTIONS HAVE BOTH STRENGTHS AND WEAKNESSES, NEITHER OF THEM BEING IN A DECISIVE ADVANTAGE POSITION. THE CASE STUDY WILL DEMONSTRATE THE NEED FOR A REAL-LIFE SOLUTION THAT COMBINES ALL POSITIONING SOLUTIONS BASED ON A SMART PATTERN, AS TO PROVIDE BOTH FASTEST AS WELL AS MOST ACCURATE PINPOINTING OF AN ECALL EMERGENCY MESSAGE. THE SECOND PART OF THE PAPER WILL PRESENT DIFFERENT CONFIGURATION POSIBILITIES, AS WELL AS OUR PROPOSAL FOR INTEGRATION OF THE ECALL HARDWARE EQUIPMENT INTO ALL FUTURE CAR MODELS SOLD ON THE EUROPEAN AUTO MARKET. THE CONCLUSION WILL TAKE INTO ACCOUNT BOTH THE SECURITY POINT OF VIEW AS WELL AS THE ECONOMIC POINT OF VIEW, BOTH RELEVANT FOR THE FUTURE OF THE ECALL SYSTEM AS A MANDATORY INTEGRATED SOLUTION.

KEY WORDS: ECALL, POSITIONING, GPS, WIFI, MOBILE NETWORKS

INTRODUCTION

The EU Council, on March 2015, made public its position on the new eCall system that was developed and designed for the last years through a common effort of different research teams all over Europe, including Romania, with EU funding.

This new and mandatory system, for the EU automotive market, is designed in order to minimize the number of death due to traffic accidents by automatically calling the EU-wide emergency number 112. According to EU official statements, the eCall system infrastructure should be deployed and in place, ready to be used, no later than October 1st, 2017. Even since 2014, the EU adopted the decision the make eCall mandatory for all new vehicles produced or sold within its boundaries. The deadline for the car makers is March 31st of 2018 – starting from that day all companies producing cars or selling cars inside the EU will have to have this new device onboard their new cars.

[1] Associate Professor, PhD, Romanian-American University, Romania, tabusca.alexandru@profesor.rau.ro
[2] Lecturer, PhD, Romanian-American University, Romania, garais.gabriel.eugen@profesor.rau.ro

We should also mention a very important fact – the infrastructure of the eCall system should be free of charge for all consumers.

But, as in lots of cases, the devil is in the details. Using the eCall system infrastructure should, and it would most probably be, free… directly looking at it. On the other hand, all car producers must design, develop, build and integrate a new and very reliable device within all their architectural car platforms – a thing that might be quite expensive and that will be, of course, mirrored in the prices of the cars. So, the infrastructure is free but, one way or another, the user will pay for it when buying a new car. In order for the system to be able to always be in contact with the eCall points and be at ready to send data at any given moment, immediately after an accident/incident on the road, there must be a data communication channel permanently available and open, and even more, at least one backup solution should be in place – all these voice and data transmission channels have to be paid by someone. So, the infrastructure is free but, one way or another, the user will pay for it when buying a new car. Maybe the EU will strike a sort of a deal with the largest voice/data operators within EU (for example Vodafone, Orange, Deutsche Telekom etc.) in order to have direct access to their networks for the eCall system transmission without a car buyer paying a separate voice/data plan for its car. But the EU is said to actually buy a huge voice/data subscription to these operators, paying for their services – and the payment is made from the EU budget, which, much to ones' surprise, does not come from somewhere afar but from every EU citizen taxes. So, the infrastructure is free but, one way or another, the user will pay for it when buying a new car – it is not a mistake, this phrase appears three times in one paragraph in order to forcefully imprint its truth on the reader. It is not an anti-EU statement, by far – we think the EU is a great, maybe even the greatest, achievement of the European states after the second world war but we must help people understand the reality, we need to impose a better and more transparent way of communication regarding different EU projects and plans.

The eCall system, including its direct or inferred costs, is a huge step forward in assuring a safer Europe, at least from the point of view of the traffic incidents. The EU funded research projects have been a huge help for increasing the indicators regarding innovation and ICT readiness at European countries level[3].

POSITIONING AND COVERAGE - IMPLEMENTATION PROCEDURES AND TECHNOLOGIES

Within this article, we are not going to present and process all the technological aspects comprised into such a huge project as eCall. We are just going to talk about one of the parts of this technologically challenging feat – the positioning of the eCall incident report.

When the eCall in-car system is triggered, by any of the multitude of sensors placed and monitored inside the car, the message should immediately reach out and connect with the eCall central component. Let alone the economic part for the moment, this message present a technical challenge related to coverage.

There are two different aspects about coverage that come into focus, as related to eCall. The first one is linked to the position of the car that triggered the emergency message. The position is based on positioning systems relying on satellite coverage. The EU documents state as mandatory the eCall system compatibility with Galileo and EGNOS. But Galileo is still under development and its first real large-scale test will be exactly the inclusion into the eCall system. At this time, most smartphones are able to use the American based GPS, the Russian based GLONASS or even the Chinese BAIDU but almost none knows about Galileo. EGNOS is the precursor of Galileo, a legacy technology still usable to improve location

---

[3] PREDA, Ana Maria; CRIȘAN Daniela; STĂNICĂ, Lavinia, ALTĂR-SAMUEL Adam Nelu; *Transectional Analysis between Innovation and ICT Readiness for the European Union Countries*, Journal of Information Systems and Operations Management – vol.10.no2 pp.393-402, 2016

detection at an even higher grade of accuracy. We consider that, at least as backup, the GPS/Glonass support would be mandatory for improving the accuracy of the eCall positioning system. Even besides the choice of satellites for global positions, the eCall has to tackle the challenge of locations which are out of satellite reach, for different reasons: tunnels, some mountain areas, mountain passes or deep valleys, in-house areas (such as garages or parking-space buildings). This problem was recognized and approached by a lot of scientists, with different improvements and hybrid technologies being proposed in order to increase the reliability and precision of the geolocation technologies[4].

Another aspect that may pose a coverage issues to the eCall system is related to the actual means of transmitting the message – the GSM capability. There still are, in Romania as well as in all other EU countries, areas which are not covered by the GSM telecommunication operators. Even if the position of an accident might be determined, there might not be possible to get in touch with the vehicle's occupants after the accident, or with the eCall system in case they are incapacitated.

Besides the above mentioned two aspects, there is still one more that might appear in real life scenarios. Even with the supposedly best design, development and integration processes that will integrate the eCall system into the new cars, there is always the possibility that the device might not work as supposed – the positioning system might fail or the communication component might fail.

SOCIAL APPLICATIONS APPROACH
One approach that we consider to be viable in order to answer the issue we presented earlier is the integration of open access, so called social-applications, into the eCall equation. The emergency system should take advantage of the online communities, even more at this time, when internet is the "virtual home" of so many people in the EU. EU member countries internet access and penetration rates are increasing continuously and several countries already consider internet access as a right that is to be stipulated by law – starting with Finland which considered that broadband internet access should be guaranteed by law since 2010[5].

As time advances, so is the technology - keeping track of all the evolutions that surrounds us inside the modern society. The eCall system tries to implement many state-of-the-art technologies. Implementing new technologies demands a strong analysis and thus a complex process that should take into account pros and cons must be undertaken. Some technologies are valuable but not mature enough, some technologies prove to be unreliable in real life conditions and only a fraction of all available technologies are actually receiving the ok from the technical point of view. On the other hand, after graduating the technical test, not all new technologies are useful from a ROI (return on investment) point of view. New technologies usually tend to have a definite drawback - they demand other new technologies. For example, new implemented hardware need not only new software but also highly trained, re-trained again, personnel to use it. New hardware devices demanded in systems such as eCall, that have a remote driven architecture, must have compatible and fully reliable networking communication channels assigned, in order to reliably connect all the needed component systems.

The main issue for future eCall automotive systems remains remote connectivity assurance – a problem that can be minimized, at least at this point in time, only through assuring redundant connection channel systems. At the same time, clearing costs for the use

---

[4] ELGAMOUDI Abulasad, SHAHZAD Aamir, LANDRY Rene; *Contribution to develop a generic hybrid technique of satellite system for RFI geolocation*, Proceedings of Applied Sciences and Technology (IBCAST), 2017

[5] TĂBUȘCĂ, Silvia-Maria; *The Internet Access as a Fundamental Right*, Journal of Information Systems and Operations Management – vol.4.no.2 pp.206-212, 2010

of data in roaming type of usage for GSM transmitting channels (implemented in the EU starting with June 2017) offers a more reliable opportunity to engage communication even if the owner of the vehicle travels beyond its legacy national borders. In this way, data communication can be more reliable and can be used for sending more complex information. Receiving the data through a GSM channel can also be extended from basic information to more complex types of transmission, such as video feed for example. But again, another issue still remains - the data traffic is dependent on the contract/subscription used for transmitting through the GSM system channel.

Another scenario that can add new and important information, but can also raise new issues at the same time, is the use of GPS social software, such as WAZE[6] - the Israeli initially company bought by the internet giant Google. The aforementioned application displays for the vehicle's driver not only maps and routes but also real-time information related to traffic, speed and optimized roots that take real traffic into calculation. Based on this complex sets of data, the application can optimize the rooting variables and provide a better travelling solution for the drives. The user of such a system is registered to the network using his name and phone number or by means of providing a social media account (such as Facebook). The eCall system can also take advantage of using such systems, in order to have an incident image enhanced with real-time traffic indicators. In figure 1, we present a screen capture of the Waze application (Android flavor).

Figure 1 – Waze software as a real traffic indicator

Adding such open access systems, such as Social GPS applications, to the eCall scanning system can also bring new issues as well as new opportunities. Indeed, adding an application like Waze in order to obtain more detailed information regarding real-time traffic near the accident sites has the huge advantage of the raw quantity of data made available. On the other hand, issues for such systems are related to the confidentiality of using such information (from the drivers point of view) as well as to the reliability of the information.

---

[6] http://www.waze.ro/despre-waze/

These issues are not insurmountable – the confidentiality issue can be tackled, legally, as simple as adding a paragraph to the Waze license agreement, while the erasing of location/sensitive data can be done automatically either at the exit point from Waze application or at the entry point inside the eCall system. The use of complex AI algorithms can help solve the accuracy and reliability issues based on statistics and mathematics approaches to large sets of data. Unfortunately, based on a misguided perception of an incident or out of malevolent intention, the information inserted into such a social application might be quite often misleading, requiring very focused approaches in order to tackle this[7]. The computing power and the advanced algorithms available today can greatly help with this issue[8]. The big data algorithms used today are even able to become part of the election processes in huge countries, like the United States of American or United Kingdom, through possible manipulation-like online posts and news delivery[9].

The information that we consider eCall should integrate from such applications are related especially to the speed of drivers that are located near the accident sites and the numbers of vehicles involved in the accident. On the other hand, the eCall system can also provide information back to the Waze system – making officially sanctioned information available to the social application users.

Statistical information from Waze website shows that the number of active users of this system only in Bucharest has grown in last two years from 2000 users to more than 15000 users, as presented in the figure 2.

Figure 2 – Waze user growth in last two years for Bucharest area (Romania)[10]

Such a system based on real-traffic information can add more information about the number and speed of vehicles at a given location on the map, using GPS positioning systems (such as GPS, GLONASS, Baidu or the future Galileo). These are valuable information of

---

[7] BARNWAL Rajesh, GHOSH Nirnay, GHOSH Soumya; *Enhancing Reliability of Vehicular Participatory Sensing Network: A Bayesian Approach*, Proceedings of Smart Computing (SMARTCOMP) IEEE International Conference, 2016

[8] PETROȘANU Dana-Mihaela; PÎRJAN, Alexandru; *Implementation solutions for deep learning neural networks targeting various application fields*, Journal of Information Systems and Operations Management – vol.11.no.1 pp. 154-168, 2017

[9] GRASSEGGER Hannes, KROGERUS Mikael; *The Data That Turned the World Upside Down*, Stanford University - Public Policy Program, https://publicpolicy.stanford.edu/news/data-turned-world-upside-down, published: January 28, 2017, last access: July 29, 2017

[10] Image available from: http://wazestats.com/active.php?city=25

real-time traffic that are useful not only for gathering info about the speed of vehicles - the eCall Center system should be able to communicate with the users of the Waze system, clustered on a specific area around the accident.

After researching the application architecture of the Waze system (the Android flavor), we consider that an external, approved, application such as eCall, can be integrated with the capability of sending text messages or visual alerts, both within the Waze application screen as well as directly to the mobile phones of the registered users. By these means, eCall can inform or even instruct the drivers around an accident area on how to act, what to do, for optimizing emergency intervention times (clear a certain traffic lane, move aside, avoid certain streets, etc.) or how to even handle the victims before the emergency team arrival.

CONCLUSION

The social media and socially oriented open access applications can help today with a lot more than simple exchange of courtesy messages or advertisements. They can be used for real social engineering applications and even for emergency solutions, such as EU's eCall system. Social application might lack the accuracy of centralized systems but have the huge advantage of being free - from both the eCall point of view and from the users point of view, because the application, the internet access and the messaging system is already in place, used and tested. Another great advantage is the starting point for collecting data – whereas the emergency system, by architecture, relies on one device (the in car eCall hardware component), the social applications such as Waze start with a possible input data stream coming from thousands of sources in the same pinpointed area. If we can find a reliable way to transform these data into accurate and trustworthy information, the social applications role will become even predominant. A further step for eCall would be to integrate other smart devices and technologies, to employ cutting edge technical approaches in order to put to good use all the advancements that our eSociety of this century can offer. The integration of autonomous vehicles or drones would be a logical next step, with both technologies becoming more and more mature and trusted every day. As a future direction of study, we aim to present a further paper on reliability of data, in a comparison study, between a set of social applications and a set of commercially available software titles.

REFERENCES

1. **BARNWAL Rajesh, GHOSH Nirnay, GHOSH Soumya**; *Enhancing Reliability of Vehicular Participatory Sensing Network: A Bayesian Approach*, Proceedings of Smart Computing (SMARTCOMP) IEEE International Conference, 2016
2. **ELGAMOUDI Abulasad, SHAHZAD Aamir, LANDRY Rene**; *Contribution to develop a generic hybrid technique of satellite system for RFI geolocation*, Proceedings of Applied Sciences and Technology (IBCAST), 2017
3. **GRASSEGGER Hannes, KROGERUS Mikael**; *The Data That Turned the World Upside Down*, Stanford University - Public Policy Program,
4. https://publicpolicy.stanford.edu/news/data-turned-world-upside-down,
5. published: January 28, 2017, last access: July 29, 2017
6. **PETROŞANU Dana-Mihaela; PÎRJAN, Alexandru**; *Implementation solutions for deep learning neural networks targeting various application fields*, Journal of Information Systems and Operations Management – vol.11.no.1 pp. 154-168, 2017;
7. **PREDA, Ana Maria; CRIŞAN Daniela; STĂNICĂ, Lavinia, ALTĂR-SAMUEL Adam Nelu;** *Transectional Analysis between Innovation and ICT Readiness for the European Union Countries*, Journal of Information Systems and Operations Management – vol.10.no2 pp.393-402, 2016;
8. **TĂBUŞCĂ, Silvia-Maria**; *The Internet Access as a Fundamental Right*, Journal of Information Systems and Operations Management – vol.4.no.2 pp.206-212, 2010;