Application "Pomoc" – emergency calls with geo-location

Marcin Przybyszewski
[1]ITTI Sp. z o.o., Poznań, Poland
mprzybysz@itti.com.pl

Anna Stachowicz
ITTI Sp. z o.o., Poznań, Poland
astachowicz@itti.com.pl

Tomasz Olejniczak
ITTI Sp. z o.o., Poznań, Poland
t_olejniczak@itti.com.pl

Michał Choraś[1,2]
[2] University of Science and Technology, UTP Bydgoszcz, Poland
chorasm@utp.edu.pl

Jan Zych
University JKU in Kielce Faculty of Social Sciences, Poland
janzych@cyberman.com.pl

ABSTRACT

Location of emergency events is one of the crucial aspects during rescue actions. However, there are situations, when people calling for help are not able to provide their precise location (due to e.g. being lost). In the same time, people use mobile phones with advanced capabilities every day. Thus, the idea behind application "Pomoc" ("Help" in Polish) presented in this paper is to make use of already available feature of mobile phones, i.e. GPS (General Positioning System) receiver. Application enables citizens to make emergency call (using European emergency call number 112) and send GPS location to Public Safety Organizations (PSOs), and from the PSOs side – to receive this call and locate it on the map through the desktop part of the application. Application is developed within the European Community's Seventh Framework Programme project SOTERIA: On-line and Mobile Communications for Emergencies (http://soteria.i112.eu/). End users of SOTERIA project are citizens and PSOs.

Keywords

Mobile application, geo-location, emergency calls.

INTRODUCTION

Considering emergency calls – most of the callers (or even all of them) require immediate help for themselves or other people. It may affect their heath or life. In such situation one of the most essential aspects is location of the person/of the event. However, sometimes people calling for help are not able to provide their exact location, due to different reasons, e.g. they are not in the familiar place, they are lost, there is no other people who may know the location. In all these cases automatic location capability (as precise as possible) will help emergency services to perform rescue action. Location during emergencies is the subject of many research works in different contexts. It is studied from the perspective of involvement of citizens/volunteers, their support in rescue activities and crisis mapping (Hanssen, 2015; Zook, Graham, Shelton, and Gorman, 2010) as well as considering different ways of obtaining location information. Location can be assessed using available sensors e.g. in smartphones (Radianti, Dugdale, Gonzalez and Granmo, 2014), using social media content (Flizikowski, Przybyszewski, Stachowicz, Olejniczak and Renk, 2015; MacEachren, Robinson, Jaiswal, Pezanowski, Savelyev, Blanford, and Mitra, 2011) or using dedicated devices (Haugstveit, Rake and Eide, 2015).

In this paper, emphasis is put on the emergency situations, when individual person calls for help using European emergency call number 112 and when is no need of wide social media content mining nor involved citizens/ volunteers. Nevertheless, precise location of the caller is still needed. Thus, citizens should be equipped with means to provide information about exact location to PSOs and from the other side, PSOs should be equipped

with tools to be able to receive and interpret this information. That is why, application "Pomoc" is proposed, enabling citizens to call the number 112 and send GPS location simultaneously, and from the PSOs side – to receive it through the desktop part of the application. Application does not require Internet connection to make neither call nor send location. Although similar applications are already available for some countries (described in the next section), it is important to provide one dedicated to the local emergency system. Application "Pomoc" is intended to be used in Poland ("Pomoc" is the Polish word for "Help") and to be integrated with local 112 system. Use cases in which the application "Pomoc" would be the most helpful are: being lost in the woods, mountains, on the road or during mass events (festivals, concerts or sports events).

The first validation of the application has been performed through the end-users' feedback. Its realization and results are described in this paper. The main questions to be answered were users' acceptance, trust and their expectations for this kind of applications.

Currently application is developed in its intermediate stage, i.e. mobile application for citizens and mock-up version of the desktop part for PSOs. None of them is integrated with 112 emergency call system yet.

RATIONALE AND RELATED WORKS

In 1991 the single European emergency call number 112 for European Union (EU) has been established by the Council Decision of 29 July 1991 (91/396/EEC)[1]. It was further regulated by the Directive 2002/22/EC[2] and Commission Recommendation - 2003/558/EC[3]. This emergency call number currently operates in all 28 EU member states, free of charge, available 24/7 and reachable by both landline and mobile phones. Location of the caller is realized in some capacity, which is required by EU Directive 2002/22/EC: *"Member States shall ensure that undertakings which operate public telephone networks make caller location information available to authorities handling emergencies, to the extent technically feasible, for all calls to the single European emergency call number 112".*

In the most of the EU countries - in public fixed network location is assumed according to the data about the physical address of the termination point. Regarding mobile networks – it is indicated by the cell ID, sector ID or including also timing advance technology (the same technologies are used in Polish 112 system). Solutions based only on cell ID/sector ID depends of the size of the cell (from a few meters to 10-30 km). This means that one of the most important problems in the current solutions is not sufficient accuracy of the location (EENA-1, 2014). Precision of the location could be increased e.g. by using mobile applications. The European Emergency Number Association[4], specified requirements for 112 applications (EENA-2, 2014). They are related to the 112 call itself, data protection issues and location capabilities. One of the mandatory requirements says that "*Handset-based accurate caller's location information shall be sent to emergency services when available and at the same time of the voice call (…)*."

Applications, which enable citizens to perform the following actions:

- call emergency services
- send text message to emergency services
- send precise GPS-based location to emergency services

already exist. The comparison of their functionalities is presented in Table 1. User acceptance of such applications has been proved by the fact that application Suomi 112 has been used for emergency calls more than 500 times[5]. Moreover, they had been downloaded from application stores: Suomi 112 - 127,275 times[5], 112 Iceland or "Ratunek" - more than 10,000 times.

[1] Council Decision of 29 July 1991 on the introduction of a single European emergency call number (91/396/EEC), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991D0396:EN:HTML

[2] Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive), http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0022&from=EN

[3] Commission Recommendation of 25 July 2003 (2003/558/EC) on the processing of caller location information in electronic communication networks for the purpose of location-enhanced emergency call services, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003H0558&from=EN

[4] http://www.eena.org/

[5] http://www.digia.com/en/Company/News/Almost-130000-downloads-of-the-112-Suomi-application--the-new-version-includes-a-positioning-accuracy-display/

Application	Call 112	Send precise GPS-based location	User profile	Area of operation	Smartphone /Dedicated device
Suomi 112[6]	Yes	Yes	No	Finland	Smartphone
112 Iceland[7]	Yes	Yes	No	Iceland	Smartphone
112 Denmark[8]	Yes	Yes	No	Denmark	Smartphone
112 Canary Island[9]	Yes	Yes	Yes	Canary Island	Smartphone
"Ratunek"[10] (Polish word for "rescue")	No, it calls mountains and water rescue services	Yes	Yes	Polish mountains and water areas	Smartphone
"Pomoc"	Yes	Yes	Yes	Poland (intended)	Smartphone

Table 1. Applications with functionalities of calling 112 and precise location

Although the number 112 is the same for the whole EU, it operates locally, since it needs to ensure connection with the local PSOs. Consequently, all of the abovementioned applications are dedicated to be used in particular country or a region, in particular language. That is why, application "Pomoc" has been designed, to provide functionalities of calling the number 112 and sending GPS coordinates planned to be used in Poland and to be integrated with Polish 112 system.

APPLICATION "POMOC"

Application "Pomoc" intended to ease the process of calling emergency services and providing geo-location. It is divided into two parts, with the following functionalities:

- the mobile application for citizens:
  - calling the emergency number 112
  - sending GPS-based location
  - sending additional information in the form of user profile
- the desktop application for PSOs:
  - receiving the calls
  - displaying location on the map
  - receiving message with the user profile.

At this stage of development, the prototype supports only Polish language and is available only for Android operating system at last version 4.4.

Mobile Application for Citizens

Graphical User Interface of application "Pomoc" is presented in Figure 1. In order to call the number 112 and send geo-location user needs to press the application 3 times. The procedure of pressing button 3 times in a row is important to prevent non purposive use (the number of steps was inspired by other solutions of this kind). Screen with "0" will appear only when GPS capability is unavailable, which is indicated in red colour, operating GPS is indicated in blue. Application is available directly from the phone's desktop through the dedicated widget.

[6] https://play.google.com/store/apps/details?id=fi.digia.suomi112
[7] https://play.google.com/store/apps/details?id=is.stokkur.savage.android
[8] http://www.112app.dk/
[9] http://www.112canarias.com/info/
[10] http://www.ratunek.eu/

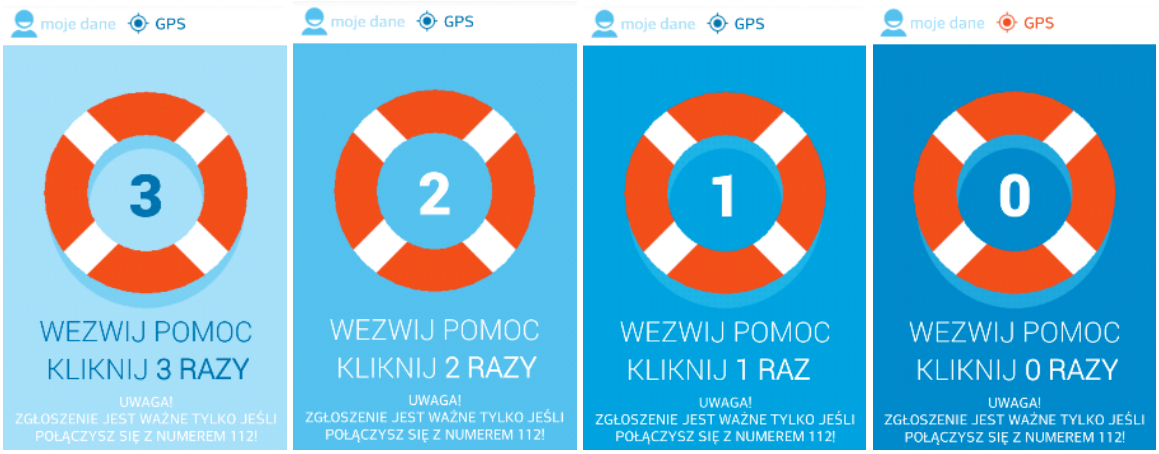

Figure 1. "Pomoc" Graphical User Interface – following screens

When GPS capability is available and connection can be established, a screen "Location sent" (written in polish – "LOKALIZACJA WYSŁANA") as presented in Figure 2 is displayed to the user. It means that geo-location has been sent to 112 emergency centre (together with the information included in the user profile) and application tries to call 112 centre in the same time. Moreover, at the bottom of the screen it is also showed the message for user "Attention! notification/information sent to emergency centre is valid only when phone call conversation will be established as well" (written in Polish). Such information aims at preventing the situation when user assumes that 112 centre received her/his message, but due to technical reasons message didn't reach the 112. When location cannot be sent due to GPS unavailability or other issues, user will see information: "Sending location in progress" written in Polish (Figure 3).

Figure 2. "Pomoc" Graphical User Interface – "Location sent to 112 centre"

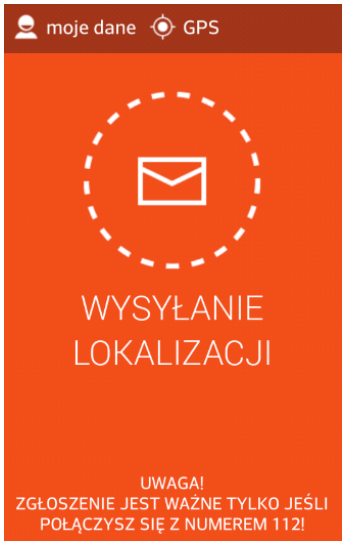

Figure 3. "Pomoc" Graphical User Interface – "Sending location in progress"

User may introduce information about her/him in the user profile (Figure 4). It includes name, gender, year of birth, ICE (In Case of Emergency) number and additional important messages (e.g. allergies, chronic illnesses). User profile is filled by the user manually. It is suggested to introduce it beforehand, during the installation process, because in case of emergency there may not be enough time to do this. However, it can be changed at any time. All these information are sent to PSOs and could potentially be helpful to carry out effective rescue action.

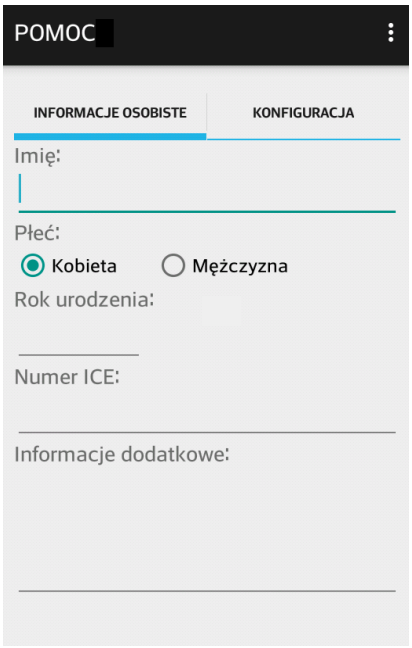

Figure 4. "Pomoc" – user profile

Desktop Application for PSOs

Desktop part of the application dedicated to emergency services aims at handling the messages and geo-location of users. Messages sent by citizens via mobile application "Pomoc" are displayed to 112 centre operator together with location and all associated information included in the user profile (Figure 5).

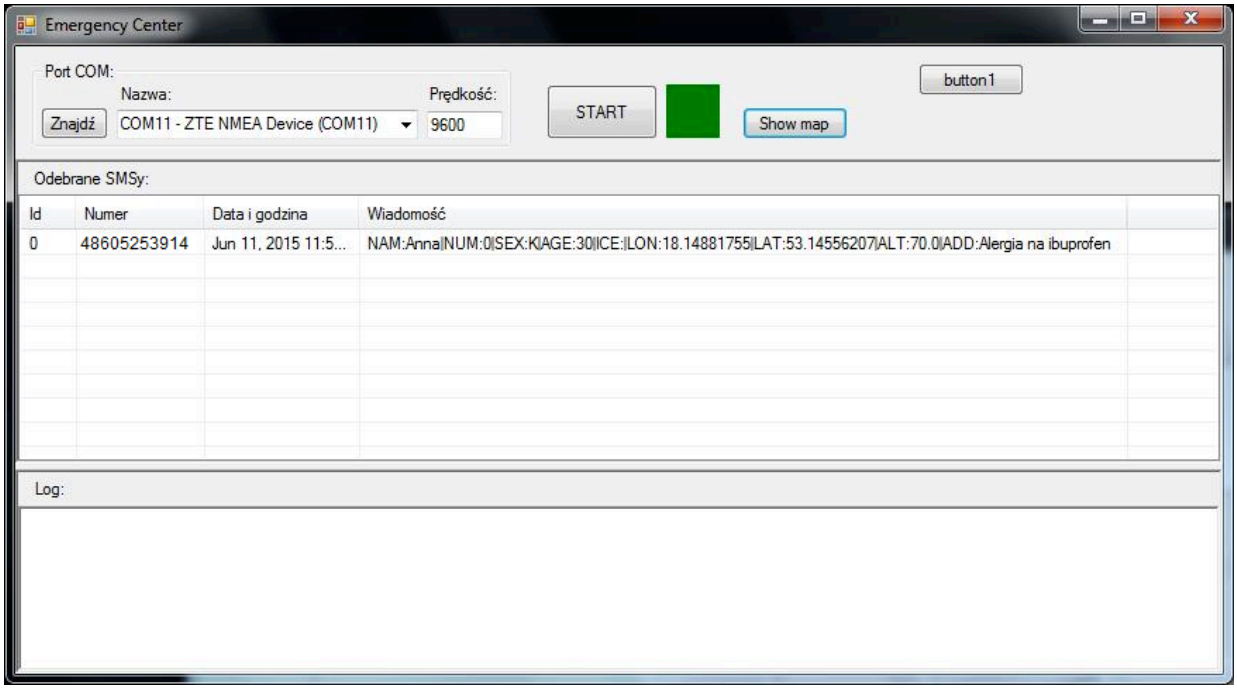

Figure 5. "Pomoc" Graphical User Interface for PSOs

By pressing "Show map" button – user is able to see exact location of the sent message visualized on the map (Figure 6).

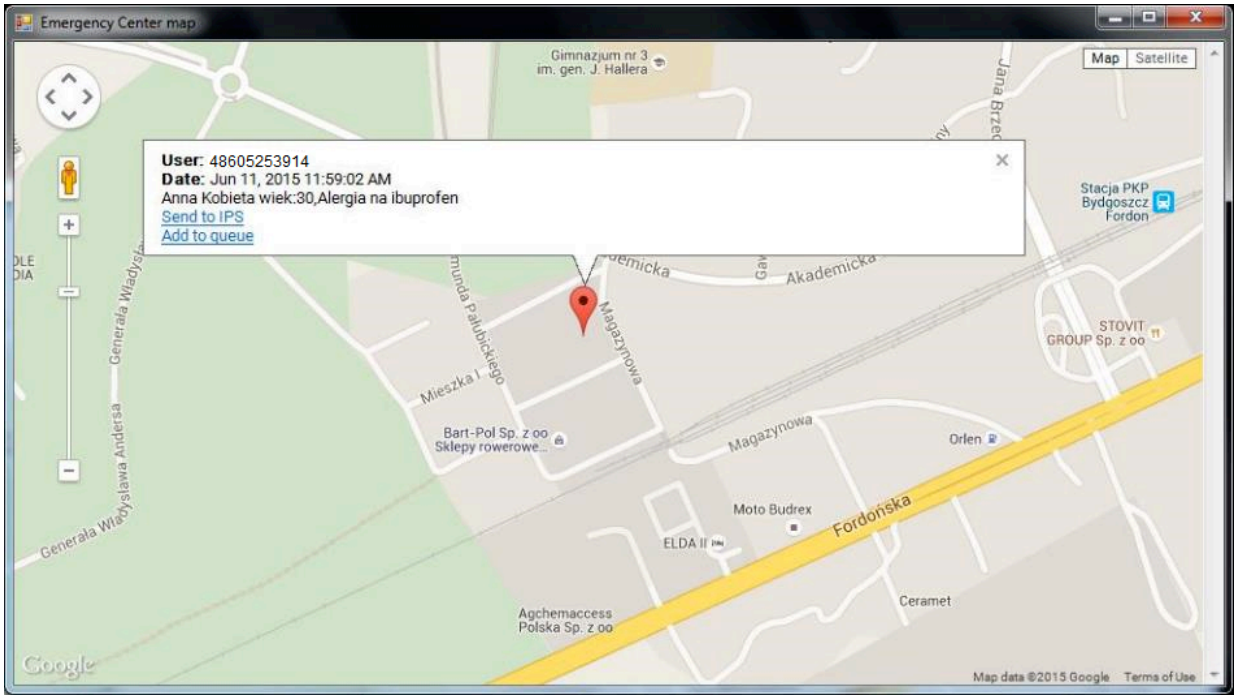

Figure 6. "Pomoc" – location of the sent message

Rescue services have an access to user phone number, so in case of disconnection or the need of further information, they can call user back or send text message.

VALIDATION THROUGH END-USERS' FEEDBACK

First validation of the application with potential end-users, took place during workshop on 17.12.2015 at the Jan Kochanowski University in Kielce, Poland, at Social Science Faculty at the University's Branch in Piotrków Trybunalski, Poland. The main questions to be answered were users' acceptance, trust and their expectations for this kind of applications. During the workshop application "Pomoc" was demonstrated and respondents have been asked to fill the questionnaires.

There were 38 students involved in workshop, 19 from the faculty of public security (first group) and 19 from the faculty of crisis management (second group), both form the National Security studies. They are treated in the study as citizens, but they are also future PSOs representatives, which broadens their point of view. Four of the students are already involved in PSOs, being volunteer fire fighters for 2-5 years, but generally students are not considered as experts PSOs yet. In order to provide experts' point of view - application "Pomoc" was presented to four representatives of PSOs. They are workers of crisis management centres and emergency call centres (ranging from 3-5 to 15-25 years of experience). These provided perspective of relatively "young" representatives of crisis management area as well as long-term workers.

Results

In the begging of the survey - both citizens and PSOs have been asked about using technologies on the daily basis and all of them use smartphones and computers (including laptops and tablets). All citizens use social media, 65% use instant messages services, but none of the citizens use application supporting the number 112. But the reason of that might be that there is only one such an application in Poland, and it is dedicated only for mountains and water regions (not actually integrated with 112 system). This shows potential niche, that could be filed by application "Pomoc".

The results of the question related explicitly to the location capabilities revealed some diversity in answers (see Figure 7). Number of respondents in all charts for citizens is N=38 and for PSOs is N=4.

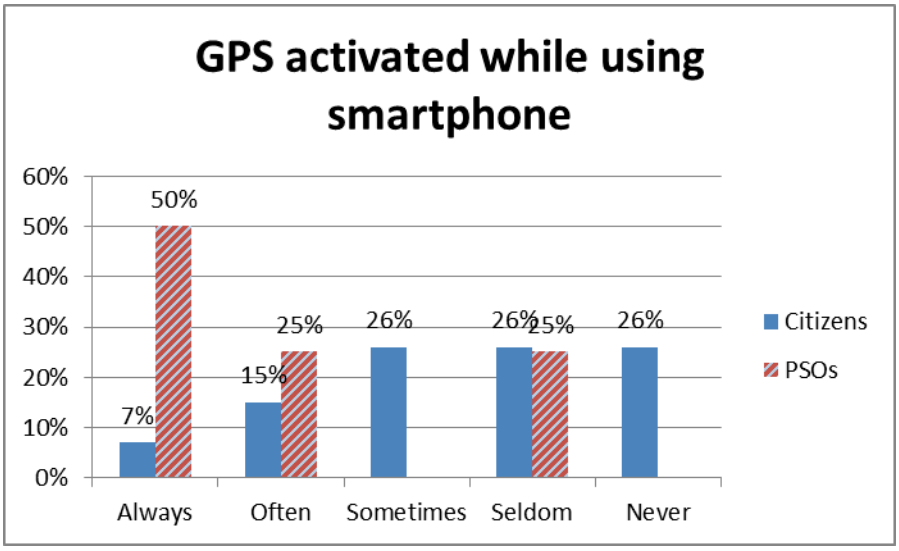

Figure 7. GPS activated while using smartphone

However, the answers were quite different when the question concerned GPS location during emergency (see Figure 8). Answers show different perspective of using GPS when it comes to security/safety reasons, especially among citizens. Thus, considering the pervasive use of smartphones and the fact that people are eager to share their location during emergencies for their own good – application such as "Pomoc" could be approved and used by citizens.

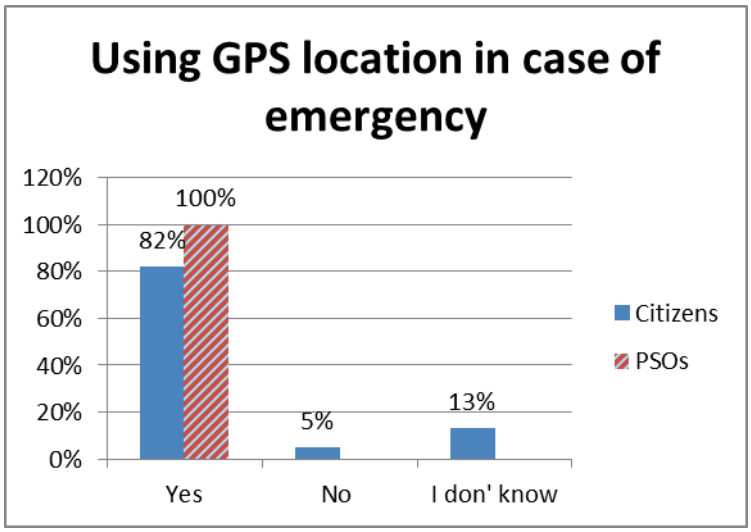

Figure 8. Using GPS location in case of emergency

Answers to all questions may be determined by the fact if the respondent experienced emergency situation when she/he had a problem with location of the event. Among those who experienced emergency situation there were 6 cases (from totally 34) when there was the problem with location of the event. Considering PSOs - all of them experienced emergency situation and the problem with exact location (ranging from 1 to 10 such situations). Fortunately, all respondents received help (e.g. by asking other people about location, looking on the paper map, talking with 112 centre operator), however looking for location in such a way takes much more time and increases the stress.

All PSOs representatives and 68% of citizens claimed that they would be interested in using application "Pomoc". Moreover, generally majority of citizens agreed on usefulness of application "Pomoc" in some capacity, as presented in Figure 9.

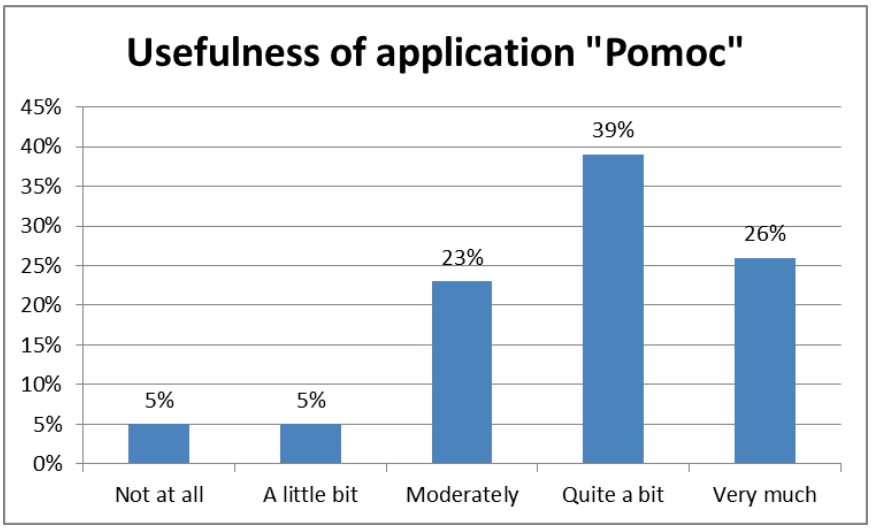

Figure 9. Usefulness of application "Pomoc"

Nevertheless, interesting comparison is between the groups of citizens. In the first group application needed a while (c.a. 5-7 minutes) to work due to indoor location and problems with GPS signal. In the second group application worked smoothly after activation. This situation has direct influence on respondents' opinions. In the first group (Figure 10) the majority of respondents indicated application usefulness as "Moderately" and in the second group (Figure 11) – all respondents found application useful. This shows how much reliability of the solution influences user's trust and acceptance.

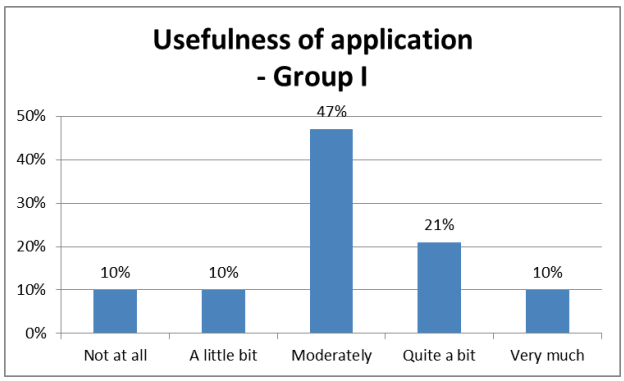

Figure 10. Usefulness of application – with technical problems

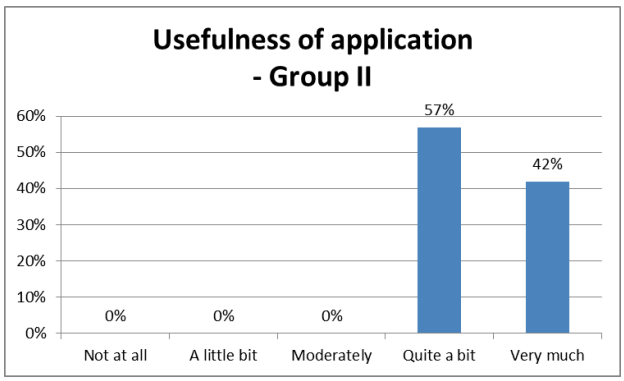

Figure 11. Usefulness of application – without problems

PSOs indicated application as useful – "Quite a bit" and "Moderately" (50%-50%), which shows that they still see some limitations of the application. Both citizens and PSOs are very sceptical to any immature technologies, which was highlighted by them during this and previous studies (Flizikowski, Hołubowicz, Stachowicz, Hokkanen, Kurki, Päivinen and Delavallade, 2014). Every difficulty and every software error which hits the user will significantly affect the perception of the reliability of the application. The conclusion is that the user's first experience with the application will decide whether she/he will use it again. The results are similar to the results of the testing of the training system "Gambler" (Zych 2015).

On the other hand, all respondents appreciated advantages of application, such as enabling fast location and fast emergency call/notification, increasing citizens safety, easy to use, intuitive interface, free of charge and not requiring Internet connection.

Challenges

Potential end-users of application "Pomoc" have been asked about disadvantages and possible obstacles in implementing such application. Among citizens - the biggest concerns were about the deficiencies in 112 system

and range of GPS signal and mobile networks. Among the PSOs – the most important were concerns of reliability of the solution and to be in line with all legal aspects. Both groups highlighted possible unwillingness of citizens to use this application as a potential difficulty and expressed worries about the use of it by older people. Almost all respondents (95%, both citizens and PSOs) indicated a need for training in the use of application "Pomoc". The most anticipated is a special learning environment - an interactive simulator. Such a specialized simulator running on-line via the Internet should precede the implementation phase of the application "Pomoc". Respondents had also interesting ideas how to improve application. The most popular was to enable automatic activation of the GPS capability while using application "Pomoc". Very interesting were also suggestions to add radio and Wi-Fi-based (Wireless Fidelity) location (which could be helpful in indoor location). From the authors' perspective one of the biggest challenges in such a solution would be the integration with 112 emergency call system. This is highly organized system, within the crisis management centres, which needs mature solutions, tested and approved by the authorities. Moreover, scalability of the solution needs to be examined, how it works with the high number of calls, e.g. during mass disasters. The limitation of performed survey is low number and low diversity of respondents, thus, at the further stages of development – wider tests and validation need to be conducted. All expressed disadvantages, concerns and ideas will guide the further works on application, following user needs and expectations.

SUMMARY AND FURTHER WORKS

Application "Pomoc" presented in this paper aims at addressing the need of automatic and precise location of the caller in 112 emergency call system, taking advantage of the GPS capability in smartphones. First validation among potential users revealed positive attitudes towards it, however indicated also limitations and users' concerns. It was confirmed that any solution related to emergency or crisis management should be highly reliable to be trusted. As a response to the biggest challenges – possible future works could include wider tests to examine reliability of the solution and its scalability. Further technical developments could provide automatic GPS activation (after user approval), improvements for disable people, e.g. voice commands, additional location solutions e.g. Wi-Fi-based and availability for other mobile operating systems. Additionally, legal aspects such as user privacy (user consent and possibility of withdrawal) and security of user data, should be analysed and implemented. Finally, talks with 112 centre operators and local authorities towards integration with 112 system, as well as educational and information campaign would be needed.

The most important aspects, which should be realized in the first place are technical improvements, wide tests and talks with 112 centre operators and local authorities.

ACKNOWLEDGMENTS

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 606796 (SOTERIA Project).

REFERENCES

1. EENA-1 Operations Document (2014) Caller Location in Support of Emergency Services, http://www.eena.org/uploads/gallery/files/pdf/2014_11_21_EENA_2_2_2_v2%200_FINAL.pdf (last visited: 26.01.2016)
2. EENA-2 Operations Document (2014) Smart phones Apps, http://www.eena.org/uploads/gallery/files/operations_documents/2014_02_25_112smartphoneapps.pdf (last visited: 26.01.2016)
3. Flizikowski A., Hołubowicz W., Stachowicz A., Hokkanen L., Kurki T., Päivinen N. and Delavallade T. (2014) Social Media in Crisis Management – the iSAR+ Project Survey, Proceedings of the 11th International ISCRAM Conference – University Park, Pennsylvania, USA
4. Flizikowski, A., Przybyszewski, M., Stachowicz, A., Olejniczak, T. and Renk, R. (2015) Text Analysis Tool TWeet lOcator–TAT2, Proceedings of the 12th International ISCRAM Conference – Kristiansand, Norway
5. Hanssen, Ø. (2015) Position Tracking in Voluntary Search and Rescue Operations, Proceedings of the 12th International ISCRAM Conference – Kristiansand, Norway
6. Haugstveit, I. M., Rake, E. L. and Eide, A. W. (2015) Practitioner-Centered, Long-Term Testing of an ICT-

based Triage System for Emergency Management, Proceedings of the 12th International ISCRAM Conference – Kristiansand, Norway

7. MacEachren, A. M., Robinson, A. C., Jaiswal, A., Pezanowski, S., Savelyev, A., Blanford, J. and Mitra, P. (2011) Geo-twitter analytics: Applications in crisis management, Proceedings of the 25th International Cartographic Conference, Paris, France
8. Radianti, J., Dugdale, J., Gonzalez, J. J. and Granmo, O. C. (2014) Smartphone sensing platform for emergency management, Proceedings of the 11th International ISCRAM Conference – University Park, Pennsylvania, USA
9. Zook, M., Graham, M., Shelton, T. and Gorman, S. (2010) Volunteered geographic information and crowdsourcing disaster relief: a case study of the Haitian earthquake, Available at SSRN 2216649
10. Zych J. (2015) The Gambler – an IT system for training officers of the Polish Air Force, [in:] Information Technology Meets Management in Knowledge Economy, Scientific Editors: J. Swacha, K. Muszyńska, Warsaw.