Practitioner Perspectives of the PROACTIVE CBRNe Disaster App

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ABSTRACT

To help practitioners better meet the needs of the public at large when managing diverse groups of people during a CBRNe (Chemical, Biological, Radiological, Nuclear and explosive) incident, the PROACTIVE project is developing a CBRNe smartphone disaster app which aims to improve the efficiency of the communication between law enforcement agencies, policy makers and citizens. By using a co-creation methodology with both civil society organisations and CBRNe practitioners, PROACTIVE ensures the app will meet the needs and expectations of both end-user groups. This work-in-progress paper focuses on a workshop carried out with practitioners to test the first mobile app prototype. The results demonstrate that the prototype mobile app is in line with practitioners expectations but that there is room for improvement, such as more visuals, and new features, such as translation, should be added. Looking forward, the app will be updated before being tested in upcoming field training exercises.

Keywords

CBRN, Disaster apps, Co-creation, Universal Design, user interface.

INTRODUCTION

In line with the EU Action Plan to enhance preparedness against Chemical, Biological, Radiological, Nuclear and explosive (CBRNe) security risks (European Commission, 2017) and the overall Security Union approach to fight crime and terrorism, the EU H2020 project PROACTIVE (PReparedness against CBRNE threats through cOmmon Approaches between security praCTItioners and the VulnerablE civil society) aims to enhance societal CBRNe preparedness by increasing practitioner effectiveness in communicating and managing large, diverse groups of people in a CBRNe environment.

CBRNe incidents present unique challenges for disaster management and crisis communication. This is due in part to the fact that CBRNe risks are considered 'dread' risks, which are defined by lack of perceived control, catastrophic potential, and fatal consequences (Slovic, 2002; Slovic et al., 2004). This is compounded by the fact that public awareness of CBRNe incidents is low (Hall et al., 2020). Indeed, very few members of the public at large are aware of the specialised actions taken by first responders (e.g., wearing of PPE (Personal Protective Equipment) or setting up decontamination tents), or the unique requirements of casualties (e.g., disrobing, showering). For this reason, the public depend even more than in other types of disasters on the communication, tactics, techniques and technology employed by practitioners (Hall et al., 2020). These communication challenges could potentially be overcome or at least reduced if a dedicated CBRNe disaster app was available. While many disaster apps are on the market, few address the CBRNe topic (see Petersen et al., 2021).

That said, it is important to keep in mind that the public is not a homogenous mass and a switch must be made from interacting with the public on a 'one-size-fits-all' basis towards more nuanced planning and preparing to deal with the range of individuals that together constitute a diverse 'public', e.g., disabled persons, older persons (Petersen et al., 2019). As such, the PROACTIVE project defines 'citizens' as members of the public including

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citizens with needs that differ to the average population such as persons with disabilities, the ill (with either chronic or acute health conditions) or members of an ethnic minority or of a vulnerable group. Vulnerable groups may include children, pregnant women, persons with disabilities, chronic medical disorders or addiction, older persons who have functional limitations and/or health restrictions, institutionalized individuals as well as their companions and the people that care for them. Vulnerable citizens also include persons with limited proficiency of the respective national languages or with restrictions regarding use of transportation.

To help practitioners better meet the expectations and needs of the public at large when managing diverse groups of people during a CBRNe incident, as well as overcome their unique communication challenges, the PROACTIVE project is developing the PROACTIVE mobile app.

THE PROACTIVE APP

The app aims to improve the efficiency of the communication between Law Enforcement Agencies (LEAs), policy makers and citizens. Mobile apps are an efficient and effective way to exploit bi-directional communication capabilities as well as modern data analytics capabilities to support users in overall decision-making processes. The PROACTIVE app has been designed with the following three main functionalities in mind.

First, since research demonstrates that providing information around the status of the attack as it happens and what the public need to do is imperative in reducing feelings of anxiety or panic (Carbon et al., 2021; Gavel et al., 2021), the app has been developed to support communication through multiple methods; live alerts/ notifications, pre-incident information, sharing images and incident updates. Further, content will also be shared via multiple formats; text, images, videos with subtitles, audio files, etc.

Second, since evidence and information gathering is important during any CBRNe attack for CBRNe practitioners (Gavel et al. 2021), the app has been developed to support the public in sharing information about the incident directly to LEAs through a reporting feature.

Third, exchanges between Civil Society Organisations (CSOs) representing vulnerable groups and first responders have been found to be rare (Arnold et al., 2021). To aid in filling this gap, a contacts section is available in the app to enable key organisations to be listed for reference during an incident. This is available to LEAs and the general public.

To ensure the app is designed in accordance with the principles of Universal Design (Connell et al., 1997), initial focus was placed on civil society requirements, with a first workshop reported in Petersen et al., 2021. These requirements were then combined with the experience of the app developers and input from the project's desk research phase to inform the development of the core functionalities and Graphic User Interface (GUI) of the app. These led to the development of the first prototype app as seen in Figure 1. The prototype app in this paper has been developed as a web app, accessible from any web browser, for the ease of beta testing. It is intended to be transferred to or redesigned where necessary for a mobile app in a later stage.

METHOD

Following the development of the first mobile app prototype, a workshop was held with practitioners using an applied research approach. The research was conducted with a goal to provide a first evaluation of the tool by practitioners. This was done through the collection of detailed feedback following a short usability test.

Recruitment

The practitioners for these workshops were recruited from the PROACTIVE Practitioner Stakeholder Advisory Board (PSAB). The PSAB aims to represent an international panel of experts from different areas of knowledge and practice and with diverse levels of experience in emergency management or CBRNe response, such as LEAs, fire brigades, medical responders, the military, civil protection, research/academia, government agencies, policy officers, transport practitioners such as rail security experts, and various NGOs who best represent the agencies who would have to respond in the event of a CBRNe incident (e.g., the Red Cross). As of December 2020, the PSAB was made up of 79 members from 21 different countries.

Sample of Participants

All members were invited to join the workshop and, in the end, 18 participants attended. Only one participant was a woman. Eight participants were from fire fighting organisations, eight were from law enforcement agencies, three were from the military and three were from industry. They came from the following countries: Belgium,

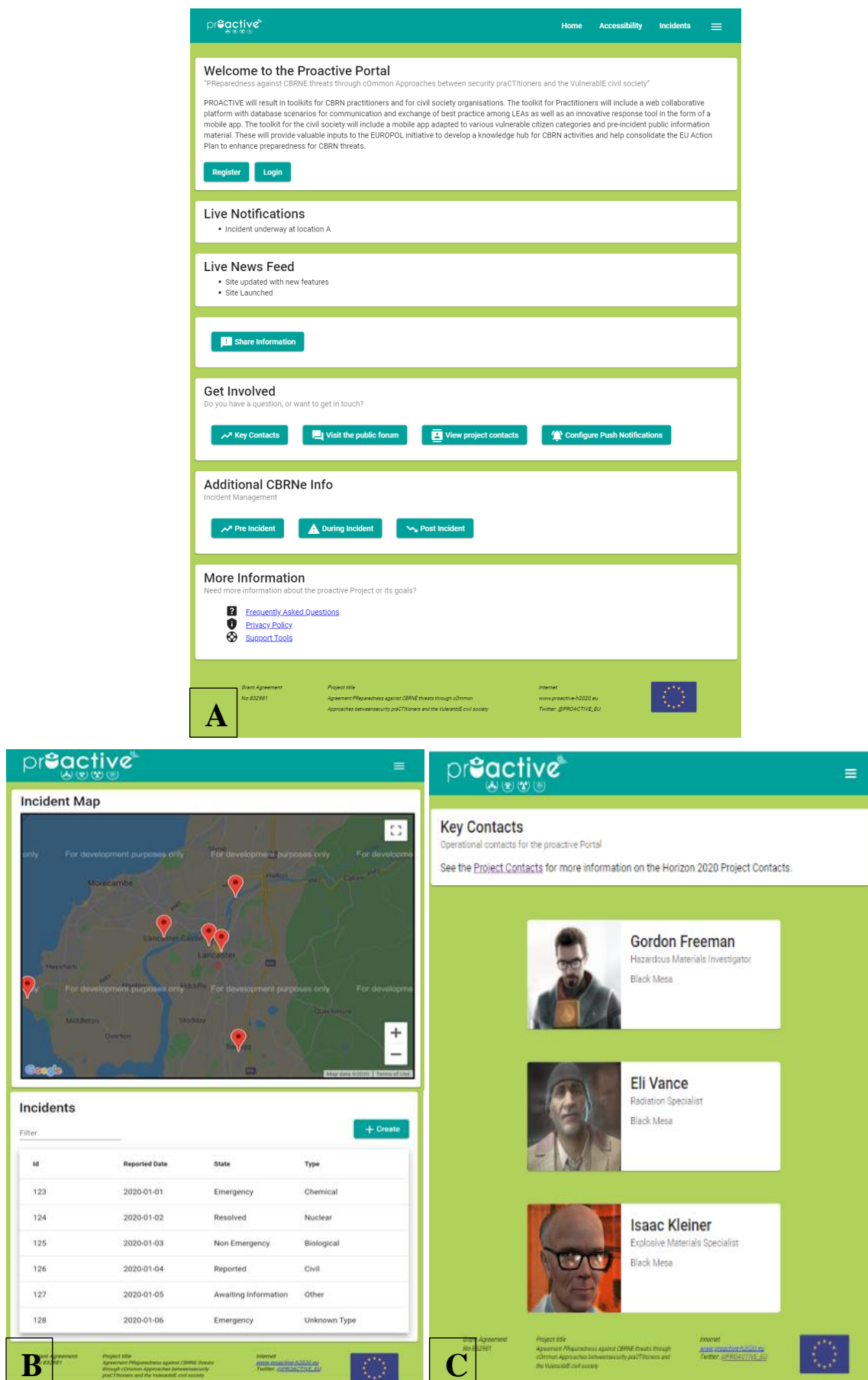*WiP Paper – Usability and Universal Design of ICT for Emergency Management*
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Figure 1 First iteration of the app homepage (A), incident map page (B) and contacts page (C)

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Greece, Ireland, Italy, France, Spain, the Netherlands and the United Kingdom, with two representing European-wide organisations.

Workshop format

The workshop was conducted on 25 February 2021, online, due to the Covid-19 situation at the time. The workshop took the form of an incident-based discussion, on overview of the app and a live questionnaire.

For the incident-based discussion, participants were provided a fictitious CBRNe scenario, involving a suspected chemical attack set on a train carriage, and asked questions about their reactions to such situations. Questions were generic such as "what is your initial response?", "how would you prioritize your actions?", or "how would you identify vulnerable groups?" and were meant as jumping off points for discussion.

Afterwards, the PROACTIVE app was presented via a live demonstration of all the existing app features. Then, the live questionnaire was asked to all participants. The live questionnaire questions were designed to answer the following research questions:

RQ1: Would the PROACTIVE app support CBRNe incident management?

RQ2: How could app functionality, design and accessibility be improved?

The questions were of two formats: open answers and ranking. The list of answer options for the ranking questions were randomised.

1. Based on first impressions, what design improvements would you make in the App?
2. Please rank the existing features in the App in terms of how useful you would find them:
    a. Pre-Incident Information
    b. Contact details of LEAs and Vulnerable Citizen Organizations
    c. Live alerts during an incident
    d. Sharing information (including location and images of an Incident)
    e. Forum and/or Direct Messaging between LEAs and Citizens
3. Please rank the stages during an incident based on when you would find the App most useful?
    a. Pre-Incident
    b. The initial stages of an incident
    c. Holding Area
    d. Decontamination Process
    e. Humanitarian Aid Centre
4. Are there any additional features you would like to see in the App?
5. Please rank the following categories of information in order of usefulness
    a. General guidelines on what to do during a CBRNe Incident (Evacuation/ Decontamination/ Next Steps)
    b. First Aid Information
    c. Information on how to find loved ones, including pets
    d. Contact details of relevant organization who can provide support during and post incidents.
    e. Guidelines specific to vulnerable citizens and the support available
6. Are you aware of any existing Apps offering similar support during an Incident?
7. How could the App support accessibility?
8. Now you understand a little bit more about the App, how many stars would you give it?

RESULTS

When asked to list design improvements, participants would improve the visuals by including (more) videos/photos/symbols/icons/pictograms (7 participants), including one participant who suggested a "flashing icon for info updates on home page." Participants (2) also requested that the map be better integrated and that the app overall be "easier to use."

The ranking of the existing features can be seen in Table 1, where *live alerts during an incident* is ranked highest. The ranking of the usefulness of the app in a given incident stage can be seen in Table 2, where *the initial stages of the incident* is ranked highest. The ranking of the information category's usefulness can be seen in Table 3, where *general guidance* is ranked highest.

When asked if there were any additional features they'd like to see in the app, three participants said no. Two participants mentioned location/positioning features, two mentioned translation, and two mentioned accessibility, with an additional one mentioning "vulnerable citizen related guidance." Further suggestions, coming from one

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participant each, included listing the agencies involved in the response, providing technical values about the incident, a symptoms checklist, having a live camera feed from the app for transmission to first responders, and that the photos/videos be uploaded directly to the LEA secure cloud.

When asked if they were aware of existing similar apps, eight participants said either "no" or "not for CBRN." Other apps listed were: CBRNHAZMAT, toxic freight, CBRNE, JESIP, SAM, RO-Alert, LastQuake, B-Alert, What3Words, 999eye, Good Sam, and Citizen Aid.

When asked how the app could support accessibility, seven participants made suggestions relating to voice commands (e.g., "text to speech" suggested by two participants, "speech to text" by another, or even "can be used with a screen reader"). Five participants suggested ways to make it user friendly (e.g., "keep it simple" or "pictograms"). Three participants made suggestions relating to visual impairments (e.g., "zoom," "high contrast option" and "colourblind mode for images/mapping"). Three participants requested translation. Big buttons was another request from two participants with yet another suggesting large font size. Lastly, one participant mentioned that "police phones are mostly high secured and not suitable for general apps."

When asked to rate the app out of five stars, the app received an average of 3.9 stars.

DISCUSSION

Usefulness of the PROACTIVE app

With an overall ranking of 3.9 stars out of 5 (the common way of rating apps in both Android and Apple app stores), it seems that the practitioners are very satisfied with the PROACTIVE app. Workshop participants believe the app will be most useful to send live alerts during an incident, which correlates to the fact that they felt the app would be most useful in the beginning of an incident. Of course, for the app to useful at the onset of an incident, this would imply that the citizens have already opted-in to the app, which may not be the case. Indeed, a recent representative study of German citizens found that only 16% have downloaded a disaster app (Kaufhold et al.,

Table 1 Ranking of the app's features' usefulness

Ranking	Score	Feature
Highest	3.94	Live alerts during an incident
	3.35	Pre-Incident Information
	3.35	Sharing information (including location and images of an Incident)
	2.41	Contact details of LEAs and Vulnerable Citizen Organizations
Lowest	1.94	Forum and/or Direct Messaging between LEAs and Citizens

Table 2 Ranking of the app's usefulness in a given incident stage

Ranking	Score	Feature
Highest	4.35	The initial stages of an incident
	3.29	Holding Area
	2.82	Pre-Incident
	2.65	Decontamination Process
Lowest	1.88	Humanitarian Aid Centre

Table 3 Ranking of the information category's usefulness

Ranking	Score	Feature
Highest	4.47	General guidelines on what to do during a CBRNe Incident (Evacuation/ Decontamination/ Next Steps)
	3.16	First Aid Information
	2.95	Contact details of relevant organization who can provide support during and post incidents
	2.53	Guidelines specific to vulnerable citizens and the support available
Lowest	1.9	Information on how to find loved ones, including pets

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2020). As research demonstrates that involving users in the creation of apps helps ensure their uptake and use (e.g., Tan et al., 2017), the PROACTIVE project is also carrying out co-creation workshops with the civil society, the first of which were already reported in Petersen et al., 2021 and Petersen et al., 2022.

Interestingly, while the Pre-incident Information was ranked as the second most useful (tied with sharing information), the time period of pre-incident was ranked third highest. However, workshop participants felt that general guidelines on what to do during a CBRNe incident would be the most useful category of information to include on the app. Therefore, it can be said that practitioners believe the app would be very useful both to educate the public at large ahead of time as well as to inform them during an incident.

Regarding the desire for translation, the app static content was initially provided in English (to reflect NATO standards and the working language of EU funded projects). That said, it is planned for the static content to be manually changed to Italian, German and Belgian/Flemish to match the languages spoken in the upcoming field training exercise the PROACTIVE project will run.

Co-creation Led to the Identification of Areas for Improvement

Workshop participants listed many different avenues to improve the PROACTIVE app, ranging from design aspects such as the inclusion of more visuals to accessibility features such as text-to-speech and speech-to-text. While often accessibility is seen through the lens of disability, workshop participants also mentioned things that would make the app difficult for practitioners to use, such as the fact that if they were wearing gloves as part of their PPE, they would need the buttons to be bigger, or that police phones have high security protocols and that might impact accessibility. This furthers the claims from Connell et al. (1997) that when applying the principles of universal design, one makes things better for the greatest extent of users as possible.

Most practitioners confirm that the PROACTIVE app will fill in a gap

When asked if they were aware of smartphone apps similar to the one demonstrated during the workshop, 42% of participants immediately said no. For the apps listed by participants, they fall into two categories of which neither fill the same gap as the PROACTIVE app. First, several of the apps listed are disaster apps, but they do not focus on the CBRNe topic. For example, the app LastQuake is a disaster app focusing on earthquakes (Bossu et al., 2018). These apps are not intended to be replaced by the PROACTIVE app but to exist alongside one another, filling in their own niches. The other category of apps listed are apps that are dedicated solely to practitioners (e.g., CBRNHAZMAT, toxic freight, JESIP) and are not intended for joint use by practitioners and the public, once again demonstrating the uniqueness of the PROACTIVE app. That said, it is intended in the new version of the app to signpost users to other relevant apps, and it will include all the apps participants mentioned and more. Furthermore, the PROACTIVE app exposes a secure REST API that allows for external systems to integrate and the integration API can be used by authorised partners to push data into the system in real time, allowing for integration between the PROACTIVE app and these other disaster apps.

FUTURE WORK

Going forward, the avenues for improvement identified by workshop participants will be combined with those found from similar workshops carried out with civil society organisations (carried out and described in Petersen et al., 2022) and a new version of the web app will be created. It will then be transferred/redesigned to a mobile app format, and this new version of the app will then be tested in a real-life setting as the PROACTIVE project intends to carry out three field training exercises. The field exercises take place over the course of the project, with at least 4 months between exercises, allowing for an iterative process. During these field exercises, the PROACTIVE CBRNe app will be used by end-users during a simulated CBRNe incident, feedback will be collected via questionnaires and during hot debriefs, and improvements made in an iterative manner. In total, there will have been five iterations of the app before arriving at the finalised version and concluding the research.

CONCLUSION

This paper presents the results of a questionnaire about the PROACTIVE CBRNe disaster app. Overall, the app was found to be in line with participants' expectations of such an app and ways for improvement were identified. The app is seen as being most useful for during the early stages of a CBRNe incident to send out live notifications and sharing information about the event. It is also seen as useful in the pre-incident stage where information materials could be used to educate the public at large on the unique facets of CBRNe response. When the project is completed, the PROACTIVE CBRNe app is expected to enable practitioners to effectively communicate and manage diverse groups of people before, during and after a CBRNe incident.

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