

# Universal Design & the PROACTIVE Project CBRNe App

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## ABSTRACT

A wide range of disaster apps are currently available on various app stores, however few existing disaster apps address the issue of CBRNe (chemical, biological, radiological, nuclear and explosive) threats. The unique ways in which citizens prepare for and respond to CBRNe incidents merit that such an app exist. But citizens are not a homogenous group, and therefore the concept of universal design will be implemented when filling this gap. The PROACTIVE project will address this by co-creating together with citizens, including vulnerable groups, an inclusive and accessible disaster app able to be used during CBRNe incidents. This article lays out the methodology PROACTIVE is currently employing in order to create and validate the disaster app for the public and states some core requirements already co-developed.

## Keywords

Disaster app, CBRNe, vulnerable groups, cocreation.

## INTRODUCTION

A plethora of smartphone applications for disaster preparedness and response are currently available on various app stores. For example, a 2014 search on an app store found 683 results (Bachmann et al., 2015) and a 2017 literature review on the topic found 57 unique apps being discussed (Tan et al., 2017). Despite the high number of disaster apps, this Information Communications Technology (ICT) has yet to be extensively developed for CBRNe (Chemical, Biological, Radiological, Nuclear and explosive) incidents. In fact, a search on the google play app store in February 2021 for the key word “CBRN” returned only 14 relevant results, one of which was a general disaster app and not CBRNe specific. These apps are mainly destined towards first responders and practitioners and tend to be reference apps or apps which are part of a larger training system. For example, the EU CBRNe Glossary app describes itself as “an information tool for practitioners in CBRNE management and response,” the CAMEO Chemicals app “is a database of hazardous chemical datasheets that emergency responders and planners can use to get response recommendations and predict hazards (such as explosions or toxic fumes),” and the CBRN app is “the app that completes the CBRN training from Bagira Systems” (Google Play, 2021). The PROACTIVE project proposes to develop a CBRNe disaster preparedness and response app for both practitioners and citizens. Indeed, the 4 March 2018 CBRNe incident in Salisbury, UK of nerve-agent poisoning and contamination in various public spaces concretely demonstrated that such CBRNe apps should not only be for practitioners but also for the general public.

Some of the principles for designing disaster apps would seem to imply that adding a new app to the myriad of available disaster apps is not necessarily the best way forward, since one must “opt-in”, or download, the app. However, more generic disaster apps will most likely not meet the needs and expectations of citizens during a

CBRNe incident. This is because these events have a high impact on society, are hard to detect or may even be invisible, have unknown consequences of exposure and often result in delayed effects from contamination. Indeed, for these reasons, CBRNe risks are considered ‘dread’ risks. ‘Dread’ risks are defined by lack of perceived control, catastrophic potential, and fatal consequences (Slovic, 2002 & Slovic et al., 2004). Further, during such incidents, citizens react and interact with practitioners in ways that are unique and particularly challenging. This is especially true since the majority of the public are almost totally unaware of the practicalities involved in these kinds of incidents, including the processes or procedures that practitioners use to deal with them in a contaminated area (hot-zone). In these instances, citizens depend more than ever on the type of communication, tactics, techniques and technology employed by practitioners. For instance, seeing practitioners arrive in hazmat suits while waiting to begin decontamination, a process which often involves disrobing, is potentially further fear inducing. During crisis, providing timely, relevant information, including how to act, via an app has been found to reduce anxiety (Bossu et al., 2018).

Further, the ways in which practitioners manage a CBRNe incident also affect the ways in which citizens behave, in terms of their cooperation and compliance. To enhance appropriate behaviours from citizens during such incidents, effective communication strategies should be prioritized over control strategies, thus increasing citizen compliance with recommended actions (Carter et al., 2014). Lastly, a well-prepared, informed and cooperative public helps to increase the effectiveness of practitioners’ response to CBRNe incidents (Krieger et al., n.d.). We believe a CBRNe disaster app helps fill in these gaps.

That said, it is important to keep in mind that the public is not a homogenous mass and individual differences may affect how citizens react and interact with practitioners during CBRNe incidents. As such, the PROACTIVE project defines ‘citizens’ as members of the public including citizens with needs that differ to the average population such as persons with disabilities, the ill (e.g. with chronic or acute health conditions), elderly, 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 with functional limitations and 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. In this context, accessibility is a key component of social sustainability and inclusiveness, contributing to usability and durability – as stated in the European Accessibility Act (European Commission, 2019). Therefore, the principles of universal design, inclusivity, accessibility and co-creation are at the core of the PROACTIVE project, which aims to provide a tool that is usable by all citizens, including vulnerable groups, and which allows for more efficient communication between citizens and practitioners.

The concept of universal design takes into account the fact that the general public is a diverse group of people, including vulnerable groups, and is based on seven principles as elaborated by Connell et al. (1997): equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort and size and space for approach and use. When it comes to internet-based content such as web platforms and smart phone apps, the Web Content Accessibility Guidelines (WCAG) are a common metric by which to measure the accessibility and inclusivity of ICT tools. Recent research using WCAG to evaluate five different disaster information sharing web-based tools found that none of the tools meet the WCAG criteria and recommends that Universal Design principles be included from the beginning of ICT tool development (Radianti et al., 2017).

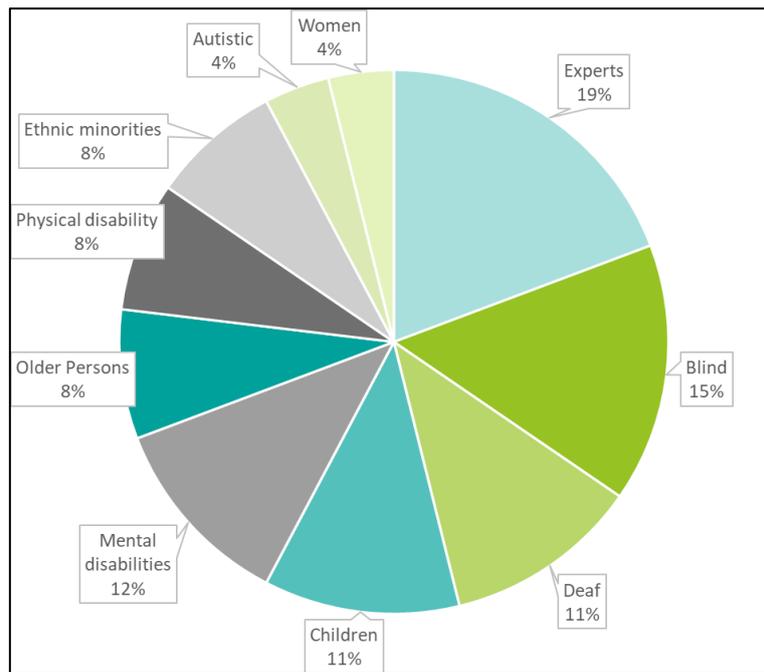
In order to ensure that the PROACTIVE CBRNe app will meet the criteria associated with universal design and WCAG, an iterative, co-creation process is being undertaken directly with the desired end-users: all citizens. Indeed, it has been proven important to involve users in the development of disaster apps for their successful uptake and use (Kouadio, 2016 & Pylos et al., 2016). This article will describe this co-creation process, the steps which have already been taken, and provide a first look at the PROACTIVE CBRNe app, which is still under development.

## THE PROACTIVE PROJECT

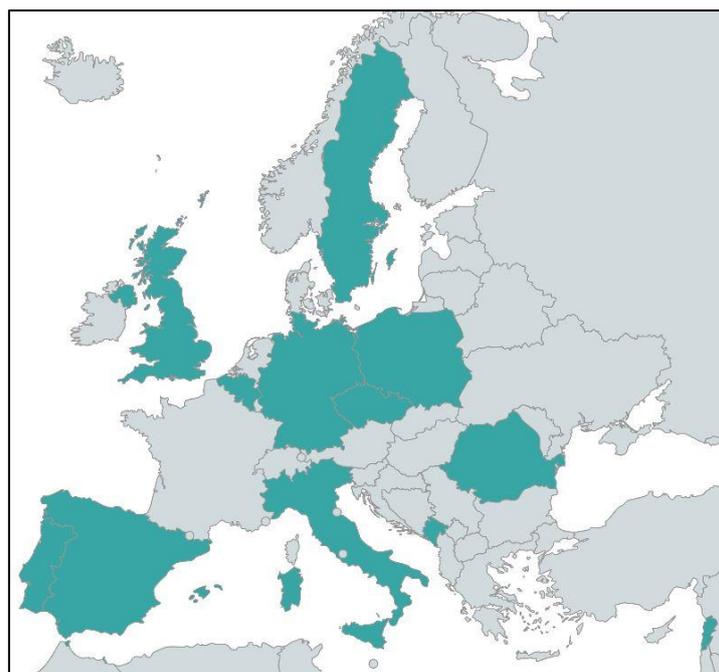
In line with the EU Action Plan to enhance preparedness against chemical, biological, radiological and nuclear security risks (European Commission, 2017) and the overall Security Union approach to fight crime and terrorism, PROACTIVE aims to enhance societal CBRNe preparedness by increasing practitioner effectiveness in managing large, diverse groups of people in a CBRNe environment. It will do so by providing actionable recommendations for improving the effectiveness of practitioner and citizen interaction during a CBRNe incident. It will also create and validate with practitioners and the public toolkits that will include a disaster app for all citizens, including vulnerable groups. The toolkit also includes an app/Web Platform dedicated to practitioners, which is not included in this paper.

**The Civil Society Advisory Board**

The co-creation process of the PROACTIVE CBRNe app is based on the active involvement of the project’s Civil Society Advisory Board (CSAB). The CSAB is made up of a diverse panel of representatives of vulnerable groups and regular citizens, thus representing human diversity (e.g. Local Authorities, Resilience Teams, representatives of mental health organisations, associations of the elderly, children, persons with disabilities, experts). At the time of this writing (February 2021), the PROACTIVE CSAB has 38 members, from individual experts (on subjects e.g. vulnerability or disability rights) to civil society organisations, and covers a wide range of different groups: experts (19%), blind and partially sighted (15%), deaf and hard of hearing (11%), children (11%), mental disabilities (11%), older persons (7%), physical disability (7%), ethnic minorities (7%), autistic (4%), women (4%) and refugees (4%), as seen in Figure 1. CSAB members currently cover the globe, coming from Belgium, Czech Republic, Finland, Germany, Hungary, Italy, Japan, Lebanon, Montenegro, Poland, Portugal, Romania, Spain, Sweden, UK, and USA (Figure 2).



**Figure 1. Pie chart of the percentage represented by different vulnerable groups in the CSAB**



**Figure 2. Map of EU countries represented in the CSAB**

The recruitment process for CSAB members will be ongoing for the lifetime of the project. In this regard, a flyer has been made. The CSAB has already begun and will continue to provide feedback on the project outputs, including app development. This will be achieved through two, iterative workstreams: (1) defining user requirements (e.g. functions, design and expected content) and giving feedback on the preliminary versions of the app during several workshops, and (2) testing the app during three live field exercises. This iterative approach will ensure that the PROACTIVE disaster app is created and continuously updated using a user co-creation process, increasing the likelihood of opting-in and ensuring vulnerable citizens' needs and expectations are met.

### Mobile App Workshops

A series of workshops will be held with the various groups of the CSAB. Throughout the various workshops, the input collected will be documented and validated using the MoSCoW (Must have, Should have, Could have, and Won't have) methodology (Clegg et al, 1994). This will ensure a core set of key functionalities are developed. These functionalities will be translated to system requirements and built into the overall system architecture ensuring a modular, flexible, scalable, robust and secure system is built. The first CSAB workshop took place on 1<sup>st</sup> October 2020. From this workshop, a series of core requirements were elaborated. The PROACTIVE CBRNe app:

- Must have:
  - A privacy policy, data protection and access to personal data consent form and disclaimer, which users are required to read and verify (tick box) electronically before they can access the system.
  - Two access levels; Registered Users enables citizens to report emergencies and view information and Non-registered users enables citizens to view information but not report.
  - The only personal information to register be a valid email address.
  - For registered users, the ability to report an incident at a specific location using a map.
  - Enable the registered user to select their preferred location when they log in.
  - Make it clear in the case of a crisis, the emergency number 112 should be used.
  - The ability to download data (pdf, videos, images, audio files).
  - Cache data for when the internet is not available and an automatic upload when it becomes available again.
  - Various settings for accessibility; Font Size & Type, Colour of Screen to support colour blindness, no flashing images to reduce issues with epilepsy, audio options/ voice control for the visually impaired/ or those with dyslexia, and sign language videos for those with limited hearing, etc.
    - The sign language used will reflect the languages used in the exercise countries (Italian, German, Belgian/Flemish).
  - Useful advice about the app itself via an FAQ page.
    - Included in this page will be a section prompting the information to be provided during an incident (route to incident, medical symptoms, etc.).
  - The option to subscribe to emails and text notifications.
    - This will be a generic message sent to all users, not targeted to the needs and requirements of the individual as this would require substantial personal data to be collected.
  - A secure REST (REpresentational State Transfer) API (Application Programming Interface) that allows for external systems to integrate, allowing for interoperability.
- Should have:
  - Novelty, e.g. cartoon characters, pictograms, symbols etc. where appropriate to reduce the issue of language barriers.
  - Signposts for users to other relevant sites/ contacts for useful information, for example accommodation, help lines, charities, etc.

- Useful advice about particular situations in the area of the app user via an FAQ page.
- References to existing apps (providing links where possible).
- The ability to trace family members who may have been involved and a means to provide reassurance that family members and friends are accounted for and safe.
- Could have:
  - A system wide avatar.
- Won't have:
  - Direct integration with other apps (to prevent privacy and security issues).

The next workshop will be held with the expert members of the CSAB on February 26<sup>th</sup>, 2021. This workshop will focus on “discussion concerning digital accessibility and different types of vulnerabilities” and will also have an interactive feedback session on the architecture design for the app. Subsequent workshops will be held with each category of the CSAB.

**Field exercises**

The PROACTIVE project intends to carry out three field exercises to test project outcomes in a real-life setting. The field exercises take place over the course of the project, with at least 4 months between exercises, allowing for an iterative process. Citizens will be active participants in each exercise (as opposed to role players), of which 10-15% will be from vulnerable groups. During these field exercises, the PROACTIVE CBRNe app will be used by end-users during a simulated CBRNe incident. These citizens will be both members of the CSAB as well as local volunteers. The exercises will help test the app in a realistic environment. The ‘hot debriefing’ method will be used to get inputs from the participants immediately following the exercise. Hot debriefing will take the form of a focus group and insights from vulnerable citizens on the accessibility of the app will be discussed. The usefulness and clarity of the information available on the app will also be a key point during the focus groups. The findings will then be used to improve the universal design of the app.

For the PROACTIVE CBRNe app to be usable during the field exercises, the system will require limited functionality. This will enable users to provide more in-depth feedback on usability and content, based on a realistic scenario. The exercise debriefing will also help the project validate the intermediate versions of the app. Table 1 describes the various functionalities and how the app will meet them.

**Table 1. Functionality requirements for the field exercises**

Functionality	PROACTIVE CBRNe app
Pre-Incident Information	PROACTIVE pre-incident materials will be available in the system for users to reference
Post Incident Information	Information post incident to be provided to stakeholders, specific to the scenario exercise as a lessons learnt.
Links Available to National apps	Countries where the field exercises are taking place that have existing apps for crises events will have the link signposted in the portal
Notification Alerts	Live notifications to be provided by Law Enforcement Agencies (LEAs) at all stages of the exercise
Existing News Feeds	News feeds from the relevant countries/ areas will be linked to the app, creating a central hub for information

**PROACTIVE Project Plan**

Due to the ongoing global pandemic, the project planning has already been modified several times. Going forward, the current planning is as follows:

- Expert members of the CSAB workshop on February 26<sup>th</sup>, 2021;
- Data breach tabletop exercises workshop on March 4<sup>th</sup>, 2021;
- Vulnerable group members of the CSAB workshops on May 12<sup>th</sup> & May 26<sup>th</sup>, 2021;
- General project workshop in September 2021;

- First field exercise in April 2022;
- Second field exercise in October 2022;
- Third field exercise in May 2023; and
- Further feedback from the CSAB on an ad hoc basis throughout the project.

## PROACTIVE CBRNe DISASTER APP PREVIEW

While still under development, a first look at the app is shown in this section. The app loads to a landing page for users containing up to date notifications, including a news feed (Figure 3). This will act as the central hub, enabling users to navigate to the other areas. This page will also act as a main notification page, providing users with live updates either directly through the PROACTIVE CBRNe app or through links to national systems and news channels.

The graphic user interface (GUI) is an Angular 9 Reactive web application that provides users with an accessible user interface to carry out the main functional interactions required of the app. The GUI is designed to cater for a diverse range of users and devices, supporting: Landscape and Portrait aspect ratios; Screen sizes from 10cm to 50+cm; iOS phones and tablets; Android phones and tables; Laptop & Desktop browsers; Chrome, Firefox, Edge, Opera and more; Screen readers & accessibility tools; Progressive Web app to provide offline functionality and asynchronous file uploads. The compatibility of the app for screen readers and other accessibility tools will be tested by the engineers using software such as the free “content structure” tool<sup>1</sup> to display the semantic structure or the free “web developer toolbar”<sup>2</sup> which displays the alternative texts for graphics. These features will also be tested live by vulnerable citizens taking part in the field exercises.

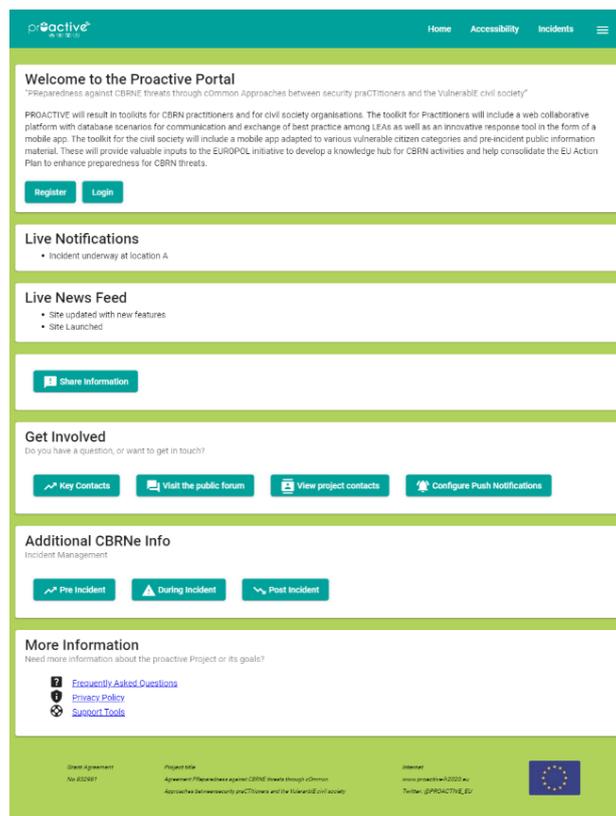


Figure 3. CBRNe app landing page

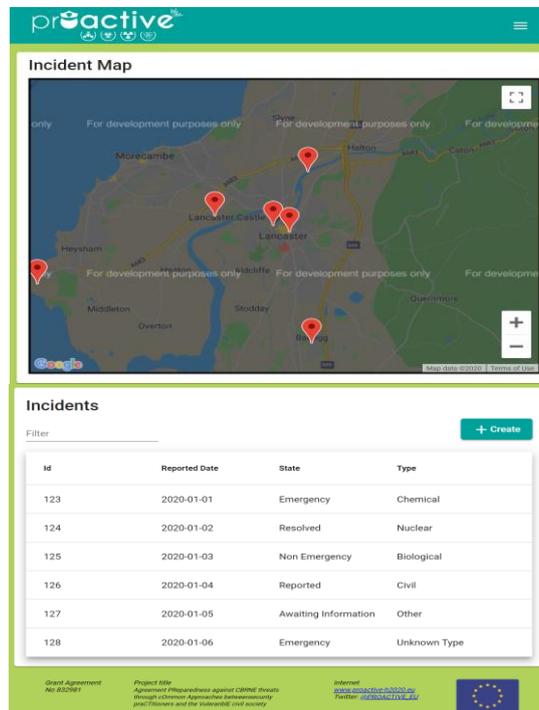
There will also be a disaster information sharing section. This will include a live updated map of current incidents along with a summary of incident status (Figure 4). Registered users will have the capability to report on an incident in their area whereas unregistered users will simply be able to access the information (as per the requirements listed in the above section). Information shown will have been either validated (for reported information) or

<sup>1</sup> [www.accessibility-developer-guide.com/setup/browsers/bookmarklets/contentstructured/](http://www.accessibility-developer-guide.com/setup/browsers/bookmarklets/contentstructured/)

<sup>2</sup> <https://chrispederick.com/work/web-developer/>

provided by LEAs.

Lastly, it is expected to have a Technology Readiness Level (TRL) of 8 at the end of the project. The final input from the CSAB will be to review the proper exploitation of the app, ensuring end users buy into the concept and understand its added value.



**Figure 4. CBRNe app Incident Map**

## CONCLUSION

Digitalisation in security and emergency management, while bringing many opportunities, also comes with challenges and can limit the accessibility of the most vulnerable of citizens. Society requires more emphasis on accessibility, through the provision of safe, secure, reliable and adaptable technological solutions for all users.

Within its Work in Progress (WiP) paper limits, this article showed how the PROACTIVE project will, based on the concept of universal design, use a user co-creation and iterative process in order to develop a new, inclusive CBRNe disaster app usable by all citizens, including vulnerable groups.

So far, creating and expanding the CSAB as well as engaging with its members turned out to be a very challenging process. Inputs from citizens are being collected through a multi-methodological approach, including workshops and field exercise participation, debriefing and evaluation. To ensure the disaster app meets the expectations of citizens, the MoSCoW methodology is being applied. Until now, the preliminary results of the co-creation process are satisfactory, with a first prototype app running.

When the project is completed, the PROACTIVE CBRNe app is expected to fill the gap in a lack of citizen oriented CBRNe disaster apps available on the market today. It will also provide the opportunity to minimise the wider “accessibility gap” in emergency management.

## ACKNOWLEDGMENTS

The PROACTIVE project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 832981.

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