Technology at the Service of Society: A Support System for the Reception of Citizens in Natural Disaster Situations

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Abstract. *The Acolhe project was developed in response to the challenges faced by both the government and civil society in Pernambuco due to climate change, which has led to extreme events and natural disasters. With the support of FACEPE and in collaboration with various entities, especially the Executive Secretariat of Social Assistance of Olinda/PE, the Acolhe system was designed to aid public authorities in the registration and management of unsheltered citizens during emergency situations. With its potential applicability in other cities, the system represents a significant advance in natural disasters readiness and response in Pernambuco.*

Resumo. *O projeto Acolhe foi desenvolvido em resposta aos desafios enfrentados pelo governo e pela sociedade civil de Pernambuco diante das mudanças climáticas, que têm gerado eventos extremos e desastres naturais. Com o apoio da FACEPE e em parceria com várias entidades, em especial a Secretaria Executiva de Assistência Social de Olinda/PE, o sistema Acolhe foi projetado para auxiliar o poder público no cadastramento e gerenciamento dos cidadãos desabrigados em situações de emergência. Com potencial para ser utilizado em diversos municípios, o sistema representa um avanço significativo na prontidão e resposta a desastres naturais em Pernambuco.*

1. Context

Climate change and its impacts are already a reality for the global population (Thomas, 2010), and the events that confirm this perception are also felt locally. Studies indicate a change in the precipitation pattern in Pernambuco in recent years (Silva et al., 2017), leading to extreme maximum events in various regions of the state, often resulting in disasters.

Considering the studies most related to mitigating the damage from these disasters, including disaster management perspectives (Price & Vojinovic, 2008; Tingsanchali, 2012) and human factors (Aerts et al., 2018; Tellman et al., 2020), two fundamental issues stand out: (i) the greater impact on populations with higher social vulnerability, experiencing a higher number of deaths and material losses; and (ii) the need for the state and the population to be prepared during normal times for a quick and effective response and support for those affected when events occur. During the 2022 rains, the challenge for the government and civil society of Pernambuco was to develop

a solution that could collect, centralize, and manage data and information for the reception of displaced and homeless families across various municipalities, as well as support systems to alert the population.

In this context, the aim of this project was to refine the requirements, develop, test, and implement the Acolhe system—a support system for the reception of citizens in risk areas during emergency situations resulting from natural disasters. The system is designed to assist public authorities in registering and managing citizens displaced by the rains or other natural disasters. Its development was supported by the Foundation for Science and Technology Support of the State of Pernambuco (FACEPE) and involved a partnership with the Executive Secretariat for Social Assistance of Olinda/PE, CUFA-PE, the Civil Defense, and the Secretary of IT of the state of Pernambuco.

2. Adopted Process

The development of the Acolhe project followed a methodological approach based on *SCRUM* principles, characterized by its iterative and incremental nature, focusing on delivering value aimed at agility and flexibility (Sutherland, 2014). The Product Owner, represented by a committee from SEAS-Olinda including the Executive Secretary of Social Assistance, the Directorate of Basic Social Protection, and the Directorate of Special Social Protection, along with stakeholders from FACEPE, SECTI/PE, and SEDEC-PE, were responsible for defining the product's functionalities.

The project execution team consisted of 6 PhD professors, 3 full software engineers, and 3 junior software engineers, divided into three groups: (a) *Back-end*, (b) *Front-end*, and (c) *Specification and testing*, ensuring modularity. Moreover, each development cycle, known as a sprint, spanned a 15-day period during which the respective team executed the tasks and solutions proposed by the *SCRUM Master*.

In each sprint, following agile testing best practices, test scenarios were developed concurrently with the code. Unit tests, which verify the individual functioning of components and modules, end-to-end tests using automated testing tools like *Cypress*, and manual tests were performed at the end of each sprint, validating the system's usage scenarios.

3. Results

3.1. System Requirements

The Acolhe system was developed as a management platform for emergency situations resulting from natural disasters. Its functionalities include, in simplified form: (i) registration, visualization, editing, and closing of **shelters** and their needs; (ii) registration, visualization, and editing of **families** and their members, with the possibility of importing data from the Federal Single Registry (CadÚnico), indicating specific situations such as disability, health problems, disappearance, or death, and tracking the mobility (entry/exit) of these families in the shelters; (iii) registration, visualization, and editing of **volunteer personnel** and their mobility in the shelters; (iv) **search** and visualization of shelters, families, and individuals, which include advanced filters and dashboards (Figure 1); and (v) creation and **exportation of reports** containing an overview of the system or a view of a specific shelter. Additionally, an environmental education and sustainability module containing educational materials is included.
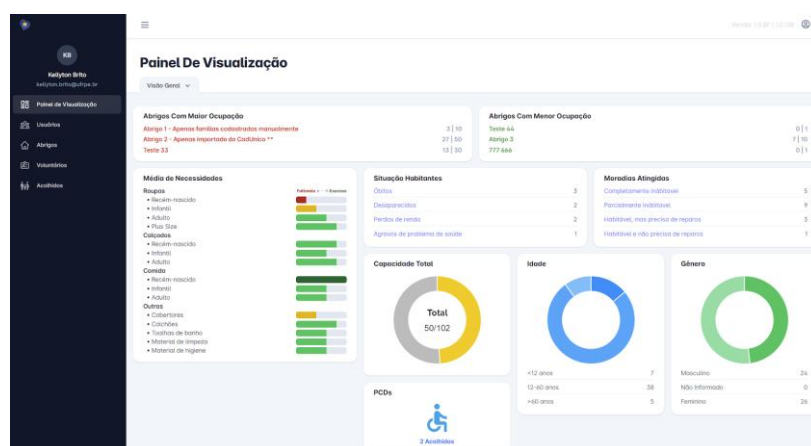
Figure 1: View with consolidated dashboard of all registered shelters

3.2. System Validation

The system was implemented and validated continuously, involving key stakeholders. Additionally, a broad team from SEAS-Olinda was involved in defining the requirements and in the tests and system validation. Notable milestones include the first in-person training in June 2023 with the SEAS-Olinda team, composed of 40 secretariat members. The second milestone was the delivery and validation of the solution, confirmed by the Executive Secretary of Social Assistance and his team with a signed minute, achieving an SRL-9 (Societal Readiness Level), indicating that the solution was tested in a real environment.

The rainy period of 2023 was milder; thus shelters were not needed, and the system remained unused. However, a cooperation base between SEAS Olinda and UFRPE was established, with a commitment to make the system and technical support available for its use during the likely rains of 2024, along with a technology transfer process.

By providing a robust infrastructure for the reception of affected families, the project aims to expand its application to other municipalities, potentially benefiting the entire state of Pernambuco or other states. Acolhe also represents an important step in integrating technology with social assistance. A test version is available at acolhetestes.innovagovlab.org. More details, demonstrations, and usage instructions are available in online videos[1].

Acknowledgements

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