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Development of a tool for reporting environmental infractions and crimes: "Sou Eco"

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ABSTRACT
This project provides an application for performing, checking and managing environmental complaints. The system is built on three platforms: a web application for the management of complaints, intended for the bodies responsible for environmental inspection to monitor the complaints made to the whistleblowers; and the mobile application, both for Android and iOS, intended for the population to perform complaints in urban and rural locations. The three systems are available in partnership with the State Court of Auditors (SCA).

Keywords: Environmental complaints, Mobile application, Report application.

1 INTRODUCTION

The rate of deforestation in the Amazon in 2020, released by the National Institute for Space Research (Inpe), was three times higher than the target presented by Brazil to the Copenhagen Climate Convention in 2009. There were 11,088 km of lost area, however the target was approximately 3,000 km. According to the Deter system, of the National Institute for Space Research (Inpe), in January

2022 there were 430.44 km of area under deforestation warning. The average for January in the period between 2016 and 2021 is 162 km; the current rate was 165% higher (REDAÇÃO, 2020).

It is also worth mentioning that the article "Animal trafficking is a criminal practice that harms biodiversity and facilitates the spread of diseases", published by Giulia Bucheroni on the G1 website, says that:

> According to Dener Giovanini, who is the general coordinator of the National Network to Combat Wildlife Trafficking (Renctas), about 38 million animals are taken from the wild each year in Brazil. The practice moves billions: considered the third largest illicit activity in the world, trafficking generates at least 10 billion dollars per year (BUCHERONI, 2020).

In addition, according to the records of the Municipal Department of Urban Cleaning (Semulsp), more than 600 tons of waste were removed from the rivers and streams of the city of Manaus in the last 30 days prior to April 24, 2022 (MOTA, 2022).

The preservation of the Amazon is important because it has an important role in the fight against global warming and climate change, as well as being home to numerous biodiversity and having the largest hydrogŕafica basin in the world. Its importance is a vital issue for the whole world, especially for Brazil (INPA, 2022).

Brazil, however, has not shown satisfactory progress in any of the goals of the 17 sustainable development goals of the 2030 Agenda, which include measures to combat climate change and environmental preservation (HAJE, 2021).

In this context it is important to highlight two issues: first, it is fundamental the active participation of society acting and demanding policies of environmental preservation and sustainable development; and second, we must seek effective and direct actions, employing technological tools available in the fight against environmental crimes.

The participation of society is important for the collaboration of environmental preservation and its policies, because, according to Professor José Mariano (2022) of Unesp, there must be anxieties not only with global problems, but also with the local reality, in the environment in which one lives, such as the neighborhood, the street and the house itself (FONSECA, 2022).

An environmental crime is an illegal attitude that directly attacks the environment, the wildlife that inhabits it, the biodiversity, and natural resources of this environment. In addition, article 225 of the Constitutional Charter refers to the protection of the environment and regulates several considerable principles for Environmental Law (OLIVEIRA, 2020).

The developed system offers the population an easy, practical, safe and free channel to report infractions, environmental crimes, poor provision of public services and other natures. This application comes as a technological solution that contributes to the control and inspection bodies for the defense of the environment.

To obtain control of the complaints and their follow-up, a web application is used, in which the authorized persons can have a detailing of each complaint made, access to the processing and the referrals given for the complaints.

2 MATERIALS AND METHODS

For the construction and development of the mobile application and the web application, it was necessary the knowledge of front-end and back-end.

2.1 FRONT-END

The front end is the architecture built for the interaction between the user and the machine. Because machine language is very complex for those without prior computer knowledge, it is designed to facilitate communication. For the contribution in the interaction and user experience in the use of graphical interfaces, the design was made with fundamentals of interaction design, which is a way for products to enable joint actions between the user and the application (ALTEXSOFT, 2020).

2.2 REACT NATIVE

The mobile app was made using React Native (REACT,) technology, which is a JavaScript framework created by Facebook to write real, native mobile apps for iOS and Android. Therefore, the application was developed to work on both Android and iOS platforms, being available on both.

2.3 JAVASCRIPT

Both technologies used, both for mobile and web, are developed in JavaScript (MDN,), or Typescript (superset of JavaScript). According to the Javascript documentation provided by the Mozilla Developer Network (MDN):

> JavaScript is a lightweight, interpreted, object-based language with first-class functions, better known as the scripting language for Web pages, but also used in several other browserless environments, such as node.js.

2.4 ANGULAR

The web application was made using the Angular technology (ANGULAR,), which is an open source WEB framework, developed and maintained by Google that provides tools to assist in the development of websites.

2.5 BACK END

Back-end programming is the part of the system that enforces business rules and actions through content managers, APIs, and servers. This part of the system is not accessed directly by the

user, as it is associated with the processing of data received from the front-end application for treatment. The technologies used for the development of the back end are: Node.js, Express and other services consistent with the PostgreSQL relational database to achieve data persistence.

2.6 NODEJS

Node.js (NODEJS,) came about due to the needs that arose in the development of web applications. It is a platform that allows you to create your own server and build applications on it (HOLMES, 2016). It can be used for any purpose and can be installed on any machine, running on microcomputers, microcontrollers or even smartphones (POWERS, 2017).

2.7 EXPRESS

Express (EXPRESS,) is a framework for Node's web application.js that offers minimal resources for building a web server. It is free software and is open source, with the ease of creating API's and being the basis for many other popular frameworks, such as NestJS and BluePrint (EXPRESS,).

2.8 POSTGRESQL

PostgreSQL is an open source relational database management system that uses the SQL language in conjunction with many features that store and scale the most complicated data workloads (POSTGRESQL,).

2.9 BACK END - FRONT END INTEGRATION

It is in the back-end application that the API is developed. APIs are a group of models that are part of an interface and that enable the creation of platforms in a more accessible way for developers (FABRO, 2020). The front end will consume resources made available by the APIs built on the back end to be displayed to the end user.

3 METHODOLOGY

The development of the application takes place from an extension project with the title of "Environmental Complaint System - I am Eco!", which was the planning project for the Sou Eco system, and from this planning was made the development of the same.

The planning and continuation of the functionalities were planned and organized through agile methodologies

The agile methodology is based on an incremental point of view for the specification, development, and delivery of software, and is quite suitable for the development of applications in which requirements can change rapidly during the development process (SOMMERVILLE, 2011).

The method used was Scrum, which according to Sutherland:

> Scrum is a structural framework that has been used to manage work on complex products since the early 1990s. Scrum is not a process, technique, or a definitive method. Instead, it is a framework within which you can employ various processes or techniques. Scrum makes clear the relative effectiveness of your product management practices and working techniques, so that you can continually improve the product, the team, and the work environment. (SUTHERLAND, 2016).

Unit tests were done on both the web application and the mobile application. Unit testing, according to Thomas Hamilton in a post for the website Guru99 (2022), is the testing of the program's functionality in small, sufficiently testable parts. The importance of unit testing, according to the article "What is unit testing?" on the Digité website, is to provide slight feedback on the design and implementation of the source code, which can tell you how improved or testable this code is.

4 FINDINGS

4.1 MOBILE APP

The application is easy to use because, in the act of registering and reporting on crimes and environmental infractions, the user has the convenience and quick access to the functionalities related to the complaint. The partnership of public bodies also adds credibility to the application.

On the home screen of the mobile application (Figure 1) it is possible to access the functionalities of making a report either identified or anonymous, being in charge of the user to choose the privacy of their identification, and view the reports provided, having easy access also through a side menu that has the same options as the home screen, but with the additional access to the TCE Environmental screen and access to the information of the application.

Figure 1 – Home screen of the application SOU ECO!

Source: Prepared by the author

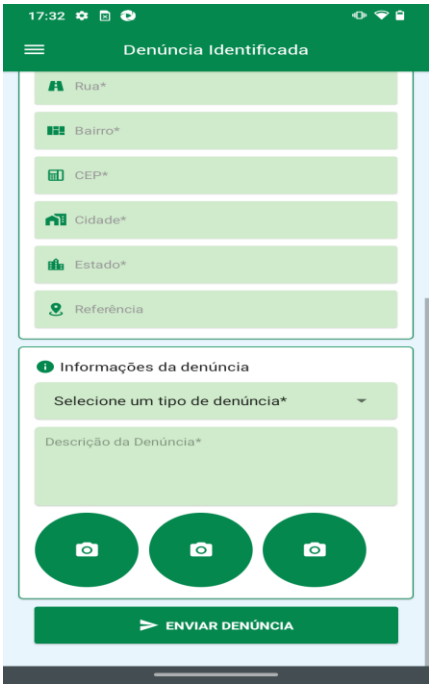
The identified complaint consists of a form with three sections (Figure 2). The first section of the form is used to obtain information from the whistleblower, such as name, email and contact phone number. The second section seeks to acquire data from the location where the report is being made, with the user being able to describe their location or the application itself by obtaining the place where the user is through an integration with Google's GPS service.

Figure 2 – Screen of the first and second section for identified complaint.

Source: Prepared by the author

The third section (Figure 3) is used by the user to submit report information, with the option to select the type of report, a field to specify the report, along with a photo submission functionality, recording the infraction, with a limit of three photo records.

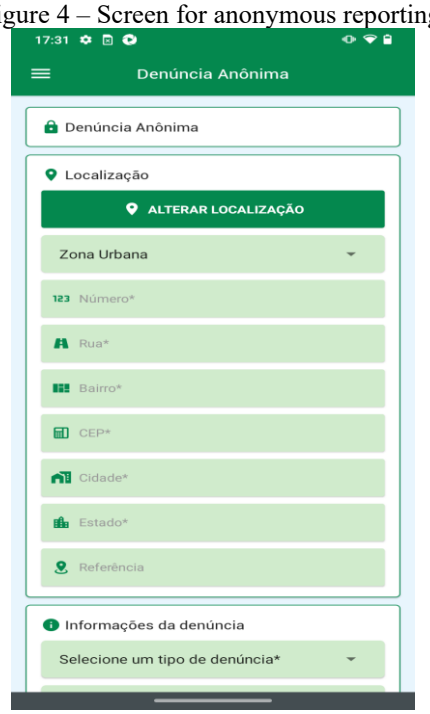
Figure 3 – Screen of the third section for identified complaint.



Source: Prepared by the author

The information that is mandatory is accompanied by an asterisk (*), requiring at least one image registration to make the report. The anonymous report (Figure 4) continues in the same flow as the identified report, but without the section to obtain the information of the whistleblower, since in this functionality the identity of the whistleblower must be preserved. If any field is required and it is not filled in by the user, the mobile application issues an alert indicating the obligation of the field that was not filled. If the user does not have an internet connection at the time of the report and has filled out the form correctly for the submission of the infraction, the application will provide an option to file the report until the user can establish an internet connection for the successful submission of the report.

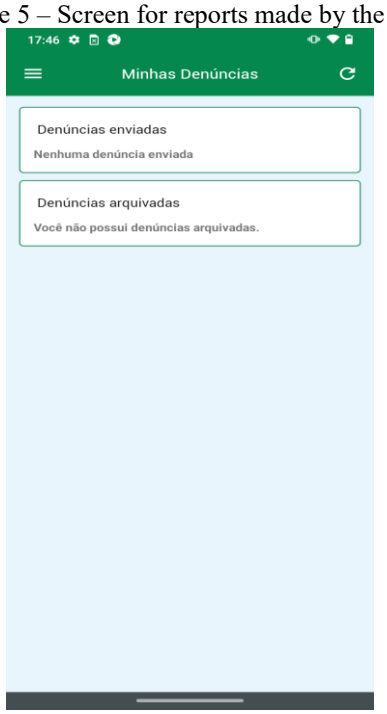
Figure 4 – Screen for anonymous reporting.



Source: Prepared by the author

In the application you can see the reports themselves within the My Reports page (Figure 5), both those sent and those that are archived. If the user does not have the opportunity to submit the report, usually due to the internet problem, the application will file this report (Figure 6) and will send it again when it has the possibility.

Figure 5 – Screen for reports made by the user.



Source: Prepared by the author

Figure 6 – Screen for reports made by the user with an archived report.

Source: Prepared by the author

From the side menu (Figure 7) you can see the three options, which can also be accessed from the home screen: an access to the home screen with the name "I am ECO!"; an access to the page of the Environmental ECA (Figure 8), which shows the environmental actions taken by the Court of Auditors of the State of Amazonas (TCE / AM); and an access to the general information of the application.

Figure 7 – Application side menu.

Source: Prepared by the author

Figure 8 – Screen of the Environmental TCE.

Source: Prepared by the author

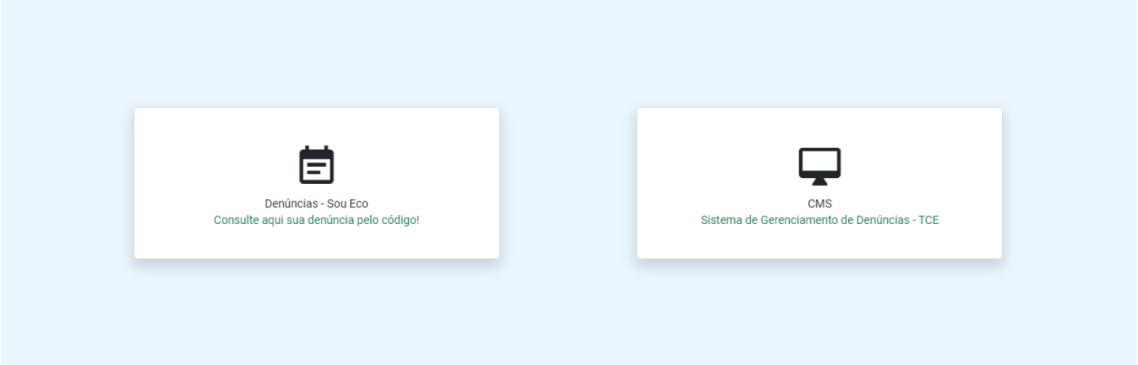
The screen that shows the Environmental ECA also discusses the 1st International Symposium on Environmental Management and Control of Public Accounts, a major event with the purpose of discussing issues related to the environment and defense of the Brazilian environmental heritage.

4.2 WEB APPLICATION

The reporting person has the possibility to follow up their reports through the web application. The initial screen (Figure 10) contains two links: the first is for the consultation of the complaint, which is accessed through the code of the complaint; the second directs to the management system of complaints made by users.

The photos that were captured and sent at the time of the report can be viewed through the first link, which upon entering displays a field for the insertion of the report code (Figure 11).

Figure 10 – Initial screen of the web application.



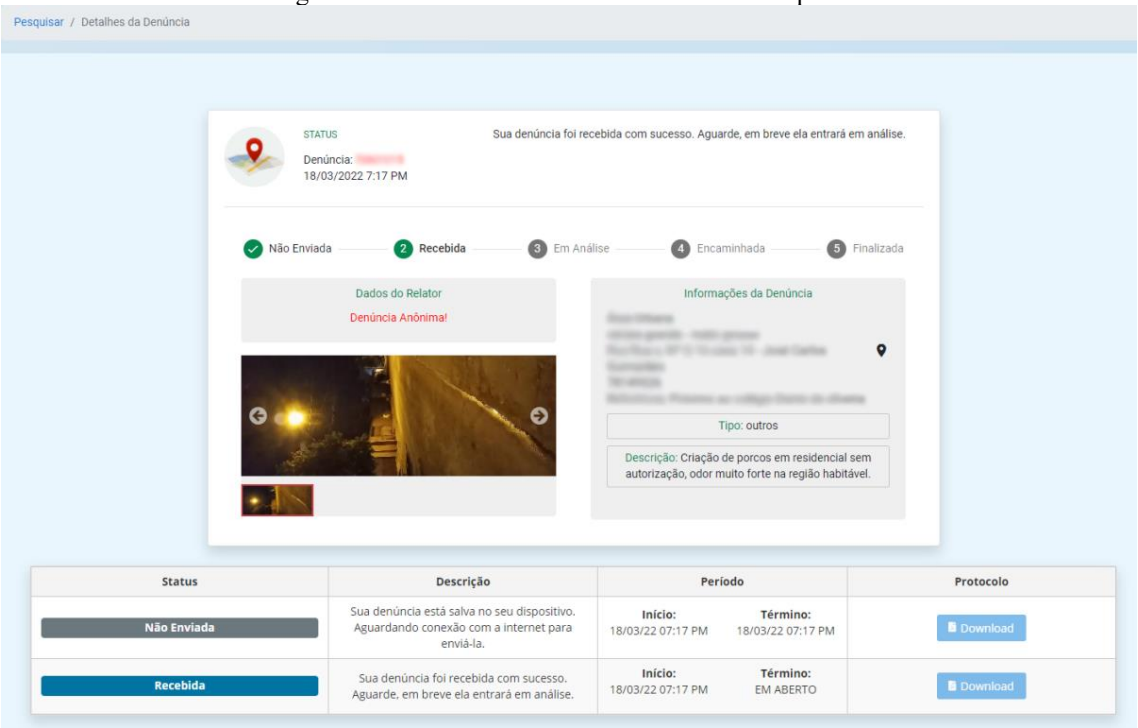
Source: Prepared by the author

Figure 11 – Screen for entering the report code.

Source: Prepared by the author, 2022.

After entering the code of the complaint made, it can be observed along with its original information and in what status the complaint is in its life period, from the state of "Not Sent" to the state "Finished" (Figure 12).

Figure 12 – Screen of the information of the complaint.



Source: Prepared by the author

5 CONCLUSIONS

Through this concern with actions and evidence of environmental crimes, since environmental preservation and the environment are not only fundamental issues, but also important for the survival of the human species, the "Sou Eco" system was developed to offer practicality and security in the reporting of crimes and environmental infractions.

Therefore, this technological solution contributes to the provocation of the control and inspection bodies in the fight against environmental crimes – because the functionalities to make the

complaint, register it with images of the infraction and send it are easily accessible. It also contributes to the execution of effective environmental policies, in addition to the fact that this application has a partnership with the State Court of Auditors (TCE). It is an opportunity to practice citizenship by combating the lack of regularity about public policies of environmental preservation.

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