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Sistema de reconhecimento facial para segurança em creches.

Facial recognition system for daycare security.

Sistema de reconocimiento facial para seguridad de guarderías.

Layara Miranda Campos
layaramiranda61@gmail.com

Mariana Ocireu de Souza
marianaocireu@gmail.com

Nicole Milanez Oliveira
email3nm4797100@gmail.com

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Resumo:
Este trabalho aborda o tema de um sistema de reconhecimento facial para segurança em creches, é composto por um aplicativo e um site expositivo. O objetivo desse trabalho é auxiliar na diminuição de problemas relacionados na cotidiano desse ambiente. O processo de retirada das crianças da creche está envolto em uma série de problemas, os principais e mais preocupantes são os sequestros, confusões de crianças e invasões a instituição, que além de comprometer a integridade fís que ica das crianças também compromete a integridade moral e a reputação da creche Para desenvolver o projeto, a metodologia a ser utilizada incluirá abordagens qualitativas e exploratórias Os resultados que esperamos alcançar são a personalização no atendimento, otimização do tempo, diminuição de desentendimentos e ocorrências relacionadas a sequestros, além de promover uma maior colaboração e aprendizado tecnológico entre gestores e professores, tomando o atendimento mais fácil e menos conflituoso. Em conclusão, a falta de protocolos rigorosos de segurança pode resultar em acidentes evitáveis e situações de risco, que o sistema busca amenizar.

Abstract:
This work addresses the theme of a facial recognition system for security in nurseries, which composed of na application and na exhibition website. The main objective of this work is to assist in the reduction of problems related to the daily life of this environment. The process of removing children from the child garden is involved in a series of problems, the main and most worrying are kidnappings, confusion of children and invasions of the institution, which in addition to compromising the physical integrity of the children also compromises the moral integrity and reputation of the daycare. For that, the methodology to be used will include qualitative and exploratory approaches. As a result, we hope to achieve personalization in service, optimization of time, reduction of misunderstandings and occurrences related to kidnappings, in addition to promoting greater collaboration and technological learning between managers and teachers, making care easier and less conflictive, in conclusion, the lack of strict safety protocols can result in avoidable accidents and risky situations, which the system seeks to mitigate

Resumen:
Este trabajo aborda el tema de um sistema de reconocimiento facial para seguridad em guarderías, compuesto por uma aplicación y um sitio web expositivo. El objetivo de este trabajo es ayudar a reducir los problemas relacionados com la vida cotidiana em este entorno. El proceso de retiro de los niños de la guardería está rodeado de uma serie de problemas, los principales y más preocupantes son los secuestros, la confusión de los niños y las invasiones a la institución, que además de comprometer la integridad física de los niños también compromete la moral y la reputación de la guardería Para desarrollar el proyecto, la metodología a utilizar incluirá enfoques cualitativos y exploratorios. Los resultados que esperamos lograr son um servicio personalizado, optimización de tiempos, reducción de malentendidos e incidentes relacionados com secuestros, además de promover uma mayor colaboración y tecnología. Aprendizaje entre directivos y profesores, haciendo el servicio más fácil y menos conflictivo. Em conclusión, la falta de protocolos de seguridad estrictos puede resultar em accidentes evitables y situaciones de riesgo, que el sistema busca mitigar.

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1. Introduction

The present study addresses the application of facial recognition technology in daycare centers through a mobile application, with the aim of enhancing children's safety and facilitating access control for parents and guardians. The research will focus on the technical, legal, and ethical feasibility of this solution, considering the specific context of early childhood education institutions.

The justification for this study is based on the ongoing concern for the safety of children in daycare centers, a concern shared by parents, educators, and administrators. Facial recognition technology offers significant potential to improve access control systems by reducing the risk of unauthorized access and facilitating identification in emergency situations. However, the sensitive nature of this environment requires a thorough analysis of the legal, ethical, and pedagogical aspects involved.

The central problem lies in the lack of effective security measures in daycare centers, which can increase the risk of incidents such as kidnappings, abductions, or unauthorized access, threatening both the well-being of the children and the reputation of the institution. For instance, Caldas (2023) reported the case of a child who was mistakenly handed to the wrong guardian, causing disturbances in three cities in Santa Catarina. The research question guiding this study is: how can the implementation of a facial recognition system in daycare centers contribute to children's safety, while ensuring the privacy and rights of those involved?

The hypothesis of this study is that implementing a facial recognition system in daycare centers, adapted to the specific regulations of this niche and with appropriate precautions, will enhance children's safety while committing to privacy rights and data protection.

The overall objective of this study is to evaluate the applicability and impacts of facial recognition technology in daycare centers, considering technical, legal, ethical, and pedagogical aspects, with the goal of proposing a model that ensures children's safety without infringing on fundamental rights.

To achieve this objective, specific goals have been outlined, including conducting a literature review on the use of facial recognition in various contexts, with a focus on educational settings; analyzing Brazilian legislation and current safety regulations for early childhood education institutions to identify the implications of using facial recognition systems; identifying the benefits and risks associated with implementing this technology in daycare centers, considering the perspectives of parents, educators, administrators, and children; and proposing a facial recognition system model adapted to the needs of daycare centers, respecting the privacy and rights of children and their guardians.

The research will have na exploratory and descriptive nature, using a qualitative approach. Data collection techniques will include: literature review, interviews, document analysis, and case studies.

To develop the application, six main tools and languages will be used, guided by classical authors, whose concepts will inform the pursuit of excellence. In building the application, we will rely on the tool Expo, as mentioned by Fuentes (2023). The programming language structure of the application, React Native, will be based on the ideas of Sereno (2018). The core concept guiding the system's functionalities will be Computer Vision, as described by Milano and Bazorro (2010). Regarding the OpenCV library, whose purpose is to match pairs of characteristics, we will follow the guidelines of Barelli (2018). The database and platform connected to the system will be defined based on Firebase's official documentation (2023). For back-end development, we will use Node.js, as explained by Moraes (2017).

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2. Theorethical Background

In this chapter, the theoretical foundation for the development of the project will be documented, presenting and describing the technologies, tools, and concepts from renowned authors.

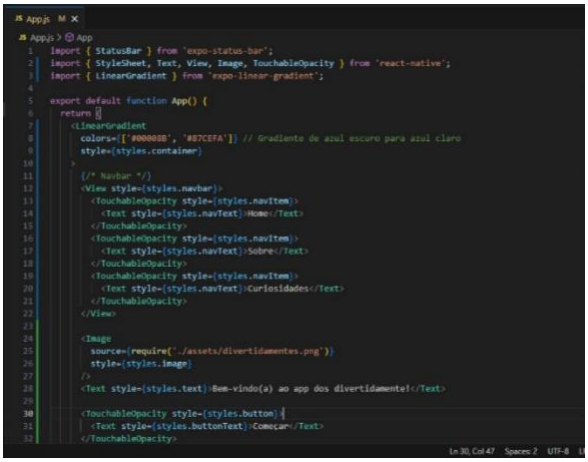
2.1. Expo

According to Fuentes (2023), Expo is a tool used in mobile development with React Native that enables easy access to the device's native APIs without requiring any dependency installation or code modification.

Expo is a tool that facilitates application development, allowing adaptation for iOS, Android, and the web. Based on JavaScript or TypeScript, it supports running programs in Android and iOS emulators. Below, we will examine a coding example executed in the Visual Studio Code platform in React Native for emulation on Expo.

In Figure 1, we present a basic coding example using the React Native framework. In this image, the code imports several React extensions and the structure of the mobile application.

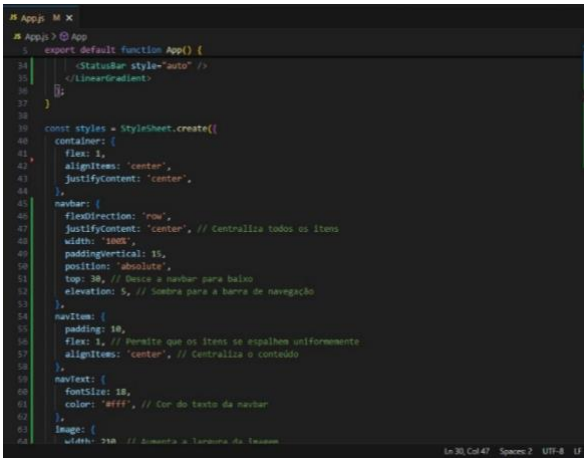
Figure 1 – React Native Code Example



Source: Own Authorship, 2024.

In Figure 2, we observe the continuation of the application structure with the addition of screen styling.

Figure 2 – React Native Code Example Two



Source: Own Authorship, 2024.

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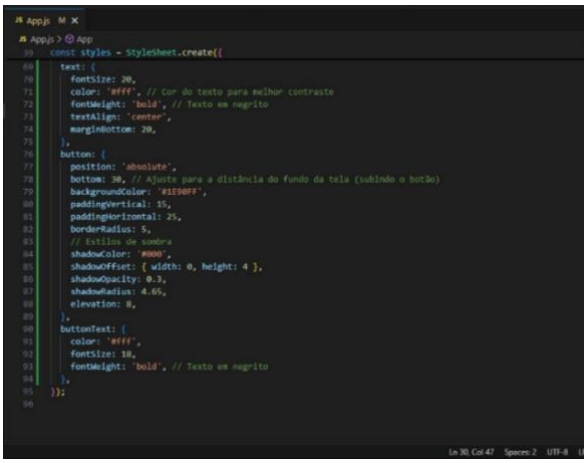
Figure 3 provides the complete styling for the mobile application, where each part of the previously discussed structure is more presentable.

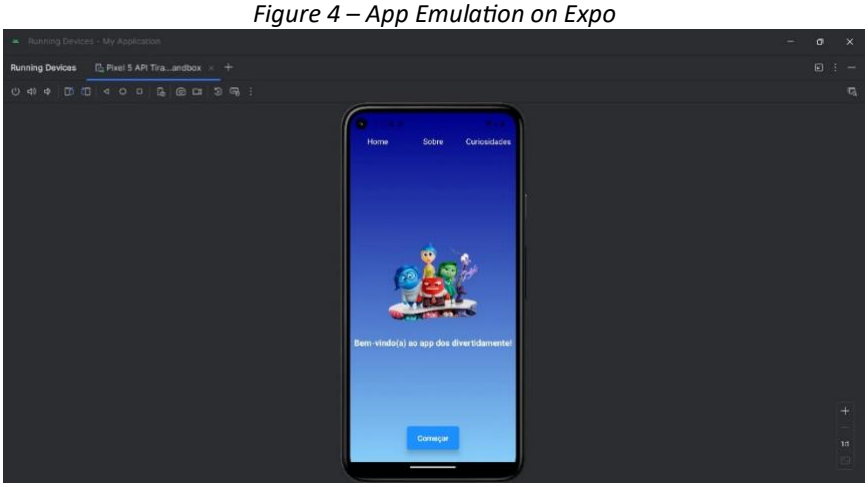
Figure 3 – React Native Code Example Three



Source: Own Authorship, 2024.

In the figure below, we see the application's emulation via the Expo tool, providing a full view of the functionality programmed in React Native.

Figure 4 – App Emulation on Expo



Source: Own Authorship, 2024.

2.2. React Native

In accordance with Sereno (2018), React Native is a technology that allows the development of hybrid applications solely using JavaScript, with the option to utilize native device code when necessary. Below, we will explore some key functions of this language:

- StyleSheet: Style sheet generator.
- Text: Enclosure for text.
- Image: Image object.
- View: A generic box that can shape the code.
- Component: Component to be utilized.
- PropTypes: Properties of instances.
- GetData(username): A function that uses the fetch API to retrieve the response and convert it into a styled format.

- from ‘react-native’: Allows abstraction of native Android and iOS code to adapt the app for both operating systems.
- Input extends Component: A function that defines the properties of components and serves to validate and initialize variables with empty values.

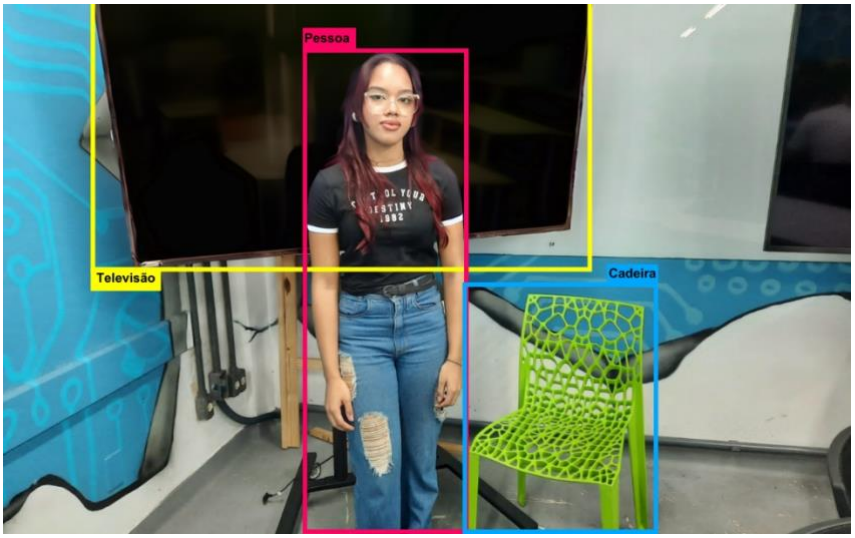
2.3. Computer Vision

Milano and Bazzorro (2010) describe computer vision as a science in which the computer extracts meaningful information from images, enabling the recognition and processing of objects, beings, colors, among others.

Piteri and Rodrigues (2011) demonstrate that computer vision is used in various fields and situations, such as in medicine to detect diseases, in elections with biometric registration, and in security with facial recognition and differentiation of faces. Below is na example of computer vision:

Figure 5 is a simulation of what computer vision would identify in the image, such as the chair, the television, and the person, delineating where each item is located and naming it in the caption.

Figure 5 – Computer Vision Exemple



Source: Own Authorship, 2024.

2.4. OpenCV

According to Barelli (2018), OpenCV is a cross-platform library that facilitates computer vision and image processing, most commonly used in facial identification cases. OpenCV makes the task of manipulating and processing images more efficient and straightforward, delivering all necessary processing in a short amount of time.

According to Delai and Dutra (2012), it stands out among other libraries because it offers over 15 functions, is compatible with more than 500 programming languages, is free, and is na open-source library, which allows for widespread use.

The library has international recognition and is widely promoted by its partners and investors, including Microsoft Azure, Intel, Roboflow, and many other well-known technology and security companies.

Among the functions offered, according to the official documentation (2024), are resizing, rotation, cropping, filtering, histogram equalization, among others.

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In Figure 6, we have an example of using OpenCV, where the differentiation stored by the library is based on the detection of 5 points called features, which are distinct for each individual.

The green rectangle defines the entire face, and the colored markings within it define distinct features, with red and blue indicating the eyes, green for the nose, and pink and yellow for the corners of the mouth.

Figure 6 – Feature Recognition Example

Source: OpenCV, 2019.

Marked these points, the distance between them is measured, along with the size of the features and variations such as identified or unidentified points that deviate from this pattern. All these features are encrypted in ordered pairs and displayed only when requested.

2.5. Firebase and FireStore

According to the official firebase documentation (2023), it is a Backend-as-a-Service (BaaS) platform, which provides a ready-made back-end infrastructure for application developers, full of resources, without worrying about hosting.

It's a cross-platform development platform created by Google that provides dozens of utilities, such as databases, authentication and more. The Firestore feature can store information collected in the system, and the model is based on document orientation.

2.6. Node.js

According to Pereira (2018), Node.js was developed in 2009 with the intention of demystifying and replacing blocking web systems such as Java, PHP and .Net, in order to make life easier for programmers who previously had difficulty using these resources.

Moraes (2017) explains that Node.js is na event-driven JavaScript environment that uses Google's V8 mechanics to emulate the company's browsers. In addition, Node.js is a better option than others because it is lighter and more efficient when compared, and it performs better in the case of heavy traffic.

3. Method

This study used na applied exploratory and descriptive research methodology with a qualitative approach, combined with a case study and UX (User Experience), divided into three parts: requirements gathering, development and testing, and evaluation of results.

Gil (2022) points out that exploratory and descriptive research with a qualitative approach aims to understand phenomena in depth. Exploratory research investigates little-known issues, while descriptive research seeks to characterize the object of study. This combination makes it possible to understand the nuances and meanings of a phenomenon, resulting in more contextualized knowledge.

Initially, interviews were conducted with directors, educators, caretakers and people involved in the niche to identify the needs of these environments in terms of access control and security, as well as analyzing the technological and financial limitations of daycare centers. Still in the initial phase, research was conducted into cases in which the lack of security measures in these institutions resulted in invasions, kidnappings, among other accidents, understanding how the necessary requirements could be applied.

Once the application and functionalities had been properly planned, the process of programming the application using React Native, which was identified as the best alternative for the medium, began, modeling the appearance and usability taking into account the project's target audience and expected scope. The tests were carried out with the same people involved and with stakeholders outside the project.

To validate the project and evaluate it, the feedback received was taken into account, in addition to applying the function point method. The feedback comments were 98% positive, confirming that the potential user tended to appreciate the application. The calculation of function points resulted in x%, thus demonstrating that the programming and methodology used were satisfactory in technical terms.

4. Results and discussion

Although the project has been positively validated, there are still a range of managers who express concerns about privacy and data protection, reinforcing the importance of adopting clear policies to ensure the responsible use of information and its protection. We believe that the implementation of the project, provided it is well conducted and transparent in terms of data use, will be well received, with positive reports from managers and employees, leading to good publicity results.

Challenges have been identified with the cost of implementation, which can be a little high when taking into account training in its use. This can make it difficult to adopt in smaller institutions or those with limited resources, concentrating on a more niche audience. This factor suggests the need to consider incentives or partnerships with companies or institutions to enable the use of this technology on a larger scale.

These results show that, although the system is efficient and brings clear benefits in terms of safety, it still has points that need to be adjusted and improved, which is crucial if the project is to continue. The continued use and adaptation of this system has great potential to transform security in daycare centers, provided that good use practices and compliance with legal and ethical standards are adopted in parallel.

5. Final considerations

This study highlights the importance of increasing security in daycare centers through facial recognition technology. It is essential to emphasize that security in these environments is not only vital but also a constitutional right, provided for in law 221 of 2016, reinforcing the project's importance.

The proposal aims to facilitate access control, minimize issues such as abductions or mistaken identities among children, while also acknowledging the need to respect the privacy and rights of the guardians. It is crucial that the use of this technology be accompanied by clear and strict guidelines from the institution, ensuring that security is strengthened without compromising fundamental rights and is handled carefully by the staff.

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We emphasize that there are still areas for improvement, such as data security, the need for training, reducing implementation costs, and adapting institutions to the technology. Although constant improvements are necessary, with the rise of this topic and the relevance of the system, we believe that it will be widely applied and disseminated in the future, with platforms, companies, groups, and partner NGOs supporting it.

We believe that the careful application of this system can, in fact, enhance the security dynamics in daycare centers, providing greater peace of mind for parents and guardians while creating a safer, more welcoming, and agile educational environment during this process.

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The author(s) of the work declare(s) that no Artificial Intelligence (AI) tool/service was used during the preparation of the manuscript, with the entire text being produced and the responsibility of the authors.

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