OFFLINE MOBILE APPLICATION FOR MONITORING BASIC FOOD BASKET PRICES IN CÁCERES/MT: DEVELOPMENT AND IMPLEMENTATION

APLICATIVO MÓVEL OFF-LINE PARA MONITORAMENTO DE PREÇOS DA CESTA BÁSICA EM CÁCERES/MT: DESENVOLVIMENTO E IMPLANTAÇÃO

APLICACIÓN MÓVIL OFFLINE PARA EL SEGUIMIENTO DE PRECIOS DE LA CANASTA BÁSICA DE ALIMENTOS EN CÁCERES/MT: DESARROLLO E IMPLEMENTACIÓN

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ABSTRACT
Mobile applications have become increasingly present in daily life and play an important role in supporting public policies. Collecting price data on items that make up the basic food basket is essential to support strategies to combat hunger and food insecurity. Institutions such as DIEESE, PROCON, and CONAB carry out this monitoring but do not cover peripheral cities like Cáceres, in southwestern Mato Grosso. To address this gap, the Economic Observatory of the State University of Mato Grosso began local data collection, following DIEESE's methodology. Traditionally, this process is performed manually, using paper and pencil, and later entered into Excel spreadsheets, which is time-consuming and prone to errors. This study presents the development of an offline mobile application, built with Android Studio using JavaScript and integrated with Firebase, for data collection, storage, and sharing. The app provides secure authentication, direct entry on the mobile device, cloud storage, and spreadsheet export, ensuring agility, safety, and accuracy. Results show that the solution effectively replaces the manual method, reducing collection time and improving data organization and integrity. The project fully met its initial requirements, delivering a practical and scalable tool to support research and strengthen information management on basic food basket prices in municipalities not covered by official surveys.

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Keywords: Mobile Application. Price Collection. Basic Food Basket. Android. Food Security.

RESUMO
Aplicativos móveis têm se tornado cada vez mais presentes no cotidiano e desempenham papel relevante no apoio a políticas públicas. A coleta de preços dos itens que compõem a cesta básica é fundamental para subsidiar estratégias de combate à fome e à insegurança alimentar. Instituições como DIEESE, PROCON e CONAB realizam esse monitoramento, porém não abrangem cidades periféricas, como Cáceres, no sudoeste de Mato Grosso. Diante dessa lacuna, o Observatório Econômico da Universidade do Estado de Mato Grosso iniciou a coleta local de dados, seguindo a metodologia do DIEESE. Tradicionalmente, essa coleta é feita manualmente, com lápis e papel, e posteriormente digitada em planilhas Excel, processo que demanda tempo e aumenta o risco de erros. Este estudo apresenta o desenvolvimento de um aplicativo móvel offline, criado no Android Studio com uso de JavaScript e integrado ao Firebase, para coleta, armazenamento e compartilhamento de dados. O aplicativo permite autenticação segura, registro direto no dispositivo móvel, armazenamento em nuvem e exportação para planilhas, garantindo agilidade, segurança e precisão. Os resultados demonstram que a solução substitui com eficiência o método manual, reduzindo o tempo de coleta e melhorando a organização e integridade das informações. O projeto atendeu plenamente aos requisitos iniciais, oferecendo uma ferramenta prática e escalável para apoiar pesquisas e fortalecer a gestão de informações sobre preços da cesta básica em municípios não contemplados por levantamentos oficiais.

Palavras-chave: Aplicativo Móvel. Coleta de Preços. Cesta Básica. Android. Segurança Alimentar.

RESUMEN
Las aplicaciones móviles están cada vez más presentes en la vida cotidiana y desempeñan un papel fundamental en el apoyo a las políticas públicas. Recopilar los precios de los artículos que componen la canasta básica de alimentos es esencial para apoyar las estrategias de lucha contra el hambre y la inseguridad alimentaria. Instituciones como DIEESE, PROCON y CONAB realizan este monitoreo, pero no cubren ciudades periféricas como Cáceres, en el suroeste de Mato Grosso. Ante esta brecha, el Observatorio Económico de la Universidad Estatal de Mato Grosso inició la recopilación de datos locales, siguiendo la metodología DIEESE. Tradicionalmente, esta recopilación se realiza manualmente, con lápiz y papel, y luego se ingresa en hojas de cálculo de Excel, un proceso que requiere mucho tiempo y aumenta el riesgo de errores. Este estudio presenta el desarrollo de una aplicación móvil offline, creada en Android Studio con JavaScript e integrada con Firebase, para la recopilación, el almacenamiento y el intercambio de datos. La aplicación permite la autenticación segura, el registro directo en el dispositivo móvil, el almacenamiento en la nube y la exportación a hojas de cálculo, lo que garantiza agilidad, seguridad y precisión. Los resultados demuestran que la solución sustituye eficazmente los métodos manuales, reduciendo el tiempo de recopilación de datos y mejorando la organización e integridad de la información. El proyecto cumplió plenamente sus requisitos iniciales, ofreciendo una herramienta práctica y escalable para apoyar la investigación y fortalecer la gestión de la información sobre precios de la canasta básica de alimentos en municipios no cubiertos por las encuestas oficiales.

Palabras clave: Aplicación Móvil. Recopilación de Precios. Canasta Básica de Alimentos. Android. Seguridad Alimentaria.

1 INTRODUCTION

The theme of the basic food basket assumes significant relevance in the Brazilian context, as it involves dimensions related to food security, the cost of living, social assistance and the formulation of public policies (Paiva, 2014). The survey of the prices of the foods that compose it is systematically carried out by institutions such as the Inter-Union Department of Statistics and Economic Studies (DIEESE), which, since 1959, has monitored the cost of these items to subsidize actions to combat hunger and food insecurity, contributing to the promotion of adequate and healthy eating (Dieese, 2025a). Initially restricted to São Paulo, monitoring was extended to Porto Alegre in 1977 and, in 2016, reached all Brazilian capitals. Other entities, such as PROCON and the National Supply Company (CONAB), also monitor the prices of the basic food basket. In 2025, CONAB entered into a partnership with DIEESE to strengthen national Food Security and Supply policies.

Despite their relevance, these surveys only include capitals, leaving municipalities in the interior, such as Cáceres, in the southwest of Mato Grosso, 240 km from Cuiabá, without official coverage. To fill this gap, the Economic Observatory of the State University of Mato Grosso (UNEMAT) created the project "Socioeconomic Indicators: Comparative analysis of the economic growth and development indices of Cáceres and the southwest region/MT". One of the steps consists of collecting prices for the 13 items of the basic food basket in Region 3, following a methodology aligned with DIEESE (Dieese, 2016). Traditionally, researchers manually collect the prices of three brands per item, record them in Excel spreadsheets, and calculate the average price. The process, although functional, is slow, susceptible to failures and dependent on subsequent transcription by scholarship holders, in addition to seasonal variations.

Given these limitations, the proposal arose to develop a mobile application that allows direct collection on Android devices, eliminating intermediate steps and ensuring more accuracy and agility. The choice of the platform is justified by its flexibility, open source and broad community support (Monteiro, 2012; Lecheta, 2016). The app was programmed in Android Studio, in Java language, with integration with Firebase for cloud storage, meeting the demands of field collection, data security, and controlled sharing between researchers.

In this scenario, it became necessary to propose a technological solution that optimizes the collection of information on prices of the basic food basket, ensuring data reliability. The general objective of this study was to develop and implement an offline mobile application for price collection in Cáceres/MT. To achieve this purpose, specific objectives were defined: to adapt the DIEESE collection methodology to the conditions of municipalities outside the capitals; design and program the app in Android Studio, integrated with Firebase; validate the operation in the field, ensuring efficiency in the collection and export of information; and evaluate the impacts of application usage on runtime and data accuracy. When analyzing these objectives, it is clear that they dialogue directly with already consolidated advances in the use of mobile technologies in different areas, which reinforces the relevance of the proposal presented here.

In fact, the use of mobile applications for data collection in the field has grown significantly, precisely because of the possibility of greater usability, traceability, and security in the recording of information. Recent studies describe Android architectures for data capture, routine automation, and error reduction, as well as "no/low-code" solutions aimed at researchers (Crepe, 2024). In Brazil, the public health experience with the government application e-SUS Território reinforces the feasibility of the technology in the collection and management of information, including in contexts of unstable connectivity (Celuppi et al., 2024). Offline persistence with later synchronization is essential in cities in the interior, a feature offered by platforms such as Firebase/Firestore, which automatically update data when there is a network.

Price monitoring by DIEESE remains a reference for measuring purchasing power and subsidizing public policies. In 2025, technical reports pointed to significant variations between capitals (Dieese, 2025b; 2025c). The partnership signed with CONAB expanded the usefulness of the data within the scope of national Food Security and Supply policies (Dieese, 2025d). Specialized media coverage reinforces the importance of decentralized monitoring, considering different regional realities (TV Brasil, 2025; Brasil de Fato, 2025).

Food security continues to be at the center of Brazilian research. Recent studies propose integrated metrics that relate food environment and insecurity in large urban centers (Nascimento et al., 2024; De Castro Júnior et al., 2025). Others highlight the influence of household income and social programs in reducing insecurity, reinforcing the need for more detailed local data to support policies (Laurentino et al., 2025). Collection in municipalities outside the capitals, therefore, can offer relevant inputs for strategies to combat hunger and social inequality.

The literature on digital government reinforces the convergence between technology and public policies, highlighting the potential of mobile applications to strengthen transparency and expand access to information (Forti, 2024; González et al., 2023).

International experiences show that hybrid applications (offline/online), with georeferencing and data export, reduce errors, reduce costs and increase the timeliness of databases (Ndebele; Mazhindu, 2025). Thus, the adoption of an offline application to collect prices of the basic food basket in municipalities outside the scope of DIEESE is a strategic instrument to fill the gap in local data, reduce failures in the process, standardize and export information to analysis tools, in addition to strengthening the governance of information aimed at food security.

2 METHODOLOGY

The process of building the application began with a meeting between the advisor professor and the scholarship holder responsible for the development, at which time the most appropriate platform and the ideal environment for its implementation were discussed. We chose to use the JavaScript language, recognized for being an interpreted, structured and high-level programming language, with dynamic and multiparadigm typing. It is currently the main language used in web browsers, in addition to being widely used on the server side through environments such as NodeJs, capable of executing scripts outside the browser (MDN, 2021).

Once the scope and functionalities that the application should contemplate were established, it was defined that the operating system used would be Android, since, according to Monteiro (2012), the platform occupies a prominent position in the market both for the wide availability of devices and for the easy access to hardware resources, such as Wi-Fi and GPS, in addition to offering robust tools for developers through its API (Application Programming Interface). Considering these aspects, we opted for development in a native environment, which allows coding directly in the device's operating system, using Android Studio and the Java language (Lecheta, 2013).

At this early stage, some guidelines were raised to guide the development of the project, highlighting the clear understanding of the application's objectives and the alignment of expectations; the definition of functional and non-functional requirements, specifying both functionalities and performance and usability criteria; and the identification of the problems that the system should solve, mapping the limits and gaps of the existing data collection process.

Based on this analysis, the construction of a robust user authentication system was listed as priority requirements; the creation of an intuitive form that would facilitate data collection; secure and reliable cloud storage; an efficient mechanism for sharing data only among authorized researchers; and the possibility of exporting the collected information to spreadsheets, ensuring compatibility with software such as Excel.

2.1 PROJECT DEVELOPMENT

The development of the mobile application was guided by the purpose of modernizing and streamlining the price collection of the thirteen items that make up the basic food basket, replacing the Excel spreadsheet previously used by the researchers. The traditional process consisted of manually recording the values in different establishments and, later, transcribing them to the spreadsheet, a practice that took time and increased susceptibility to errors.

The items analyzed were defined based on Decree-Law No. 399, which establishes monthly consumption parameters differentiated by region of Brazil. For each product, the researchers should collect data in three different markets, on different days of the week, in order to ensure greater representativeness of the data. Table 1 presents the products and their respective quantities, according to the aforementioned decree.

Table 1

Minimum provisions stipulated by Decree-Law No. 399

Food	Region 1	Region 2	Region 3	National
Meat	6.0 kg	4.5 kg	5.5 kg	6.0 kg
Milk	7.5 l	6.5 l	7.5 l	15.0 l
Bean	4.5 kg	4.5 kg	4.5 kg	4.5 kg
Rice	3.0 kg	3.6 kg	3.0 kg	3.0 kg
Flour	1.5 kg	3.0 kg	1.5 kg	1.5 kg
Potatoes	6.0 kg		6.0 kg	6.0 kg
Vegetables (tomato)	9.0 kg	12.0 kg	9.0 kg	9.0 kg
French bread	6.0 kg	6.0 kg	6.0 kg	6.0 kg
Coffee powder	600 gr	300 gr	600 gr	600 gr
Fruit (banana)	90 pcs	90 pcs	90 pcs	90 pcs
Sugar	3.0 kg	3.0 kg	3.0 kg	3.0 kg
Lard (oil)	750 gr	750 gr	900 gr	1.5 kg
Butter	750 gr	750 gr	750 gr	900 gr

Region 1 - States of São Paulo, Minas Gerais, Espírito Santo, Rio de Janeiro, Goiás and Federal District.
Region 2 – States of Pernambuco, Bahia, Ceará, Rio Grande do Norte, Alagoas, Sergipe, Amazonas, Pará, Piauí, Tocantins, Acre, Paraíba, Rondônia, Amapá, Roraima and Maranhão.
Region 3 - States of Paraná, Santa Catarina, Rio Grande do Sul, Mato Grosso and Mato Grosso do Sul.
National - Average normal basket for the working mass in various activities and for the entire national territory.
Source: Decree Law 399 of 1938. Attached tables. The daily quantities were converted into monthly quantities.

In this way, the Excel spreadsheet was structured to automate the calculation of the total value of each item, as well as the average price per unit. The procedure consisted of the researcher recording the price of the product directly in the corresponding cell of the spreadsheet, repeating the process in three different establishments and considering three different brands for each item. This system sought to reduce occasional distortions and more accurately reflect price variation in the local market. Figure 1 presents the spreadsheet in its original form, made available to the researchers, which allowed estimating the total value of the basic food basket by adding the weighted averages of the 13 items that compose it.

Figure 1

Excel spreadsheet for price registration of the items of the Basic Basket

Produto Região 3		Local 1		Local 2		Local 3		Média		Média ponderada
		Preço Unitário	Preço total	Preço Unitário	Preço total	Preço Unitário	Preço Total	Preço unitário	Preço Total	Preço
Carne 6,6 Kg.	Coxão mole									
	Coxão duro									
	Patinho									
Leite 7,5 Litros										
Feijão 4,5 Kg.										
Arroz 3 Kg.										
Farinha 1,5 Kg.										
Batatas 6 Kg.										
Legumes (tomate) 9 Kg.										
Pão francês 6 Kg.										
Café em pó 600 g.										
Frutas (banana) 90 unid	Prata									
	Nanica									
Açúcar 3 Kg.										
Banha (óleo) 900 gramas										
Manteiga 750 gramas										
Total										

Source: Prepared by the authors (2025).

The data recording process proved to be quite meticulous, requiring the researcher to pay maximum attention during the transcription of the values to the spreadsheet, in order to avoid errors or alterations that compromise the quality of the information collected. Any inconsistency at this time can directly impact the final results of the survey, impairing comparative analysis and data reliability.

As an example, Chart 2 shows the procedure for calculating the value of rice using the Excel spreadsheet. This example illustrates the way in which the collected prices are organized, allowing the obtaining of weighted averages that faithfully represent the cost of the item in the set of establishments analyzed.

Table 2

Calculation of values

Product		Location 1		Location 2		Location 3		Average		FINAL AVERAGE
		Price Unitary	Price Total	Price Unitary	Price Total	Price Unitary	Price Total	Price Unitary	Price Total	Final Price
RICE (3 kg)	Brand 1	5,59	16,77	4,49	13,47	5,99	17,97	5,36	16,07	**18,10**
	Mark 2	6,19	18,57	5,99	17,97	6,19	18,57	6,12	18,37	
	Brand 3	6,79	20,37	6,59	19,77	6,49	19,47	6,62	19,87	

Source: Prepared by the authors (2025).

The spreadsheet was configured to calculate the simple arithmetic mean, allowing to obtain the average price of the products from the collections carried out in different locations. Taking rice as an example, presented in Chart 1, it is observed that, according to Decree-Law No. 399 of 1938, the State of Mato Grosso is part of Region 3, in which each individual consumes three kilos of this product monthly. To meet this parameter, prices of three different brands were collected in three different establishments (Chart 2).

In the case of the first brand of rice, the average unit price was obtained as follows:

$$\frac{5{,}99+4{,}49+5{,}99}{3} = 5{,}36 \qquad (1)$$

This result was then multiplied by the amount provided for in the decree (three kilos), obtaining the total value of R$ 16.07 referring to the monthly consumption per individual. The same procedure was applied to the other brands, resulting in three average unit prices. Subsequently, the arithmetic mean between these values was calculated to determine the final price of rice. Thus, the total price is obtained by the following formula:

$$Average\ Total\ Pri = \frac{Average\ unit\ price\ 1 + Average\ unit\ price\ 2 + Average\ unit\ price\ 3}{3} \quad (2)$$

This method was replicated for all items that make up the basic food basket, always considering the minimum quantities stipulated by Decree-Law No. 399 for Region 3, as described in Table 1. In this way, the spreadsheet constitutes a reliable instrument to consolidate the data collected and standardize the calculations necessary to determine the cost of the basic food basket in Cáceres.

2.1.1 Development Environment

After defining the functionalities and objectives of the application, the development stage began. To ensure greater efficiency and compatibility with the most used mobile devices, it was decided to use Android Studio as the development platform. This choice is due to the fact that Android is the predominant operating system in the national market, in addition to providing a wide range of native features that favor the creation of robust and scalable applications.

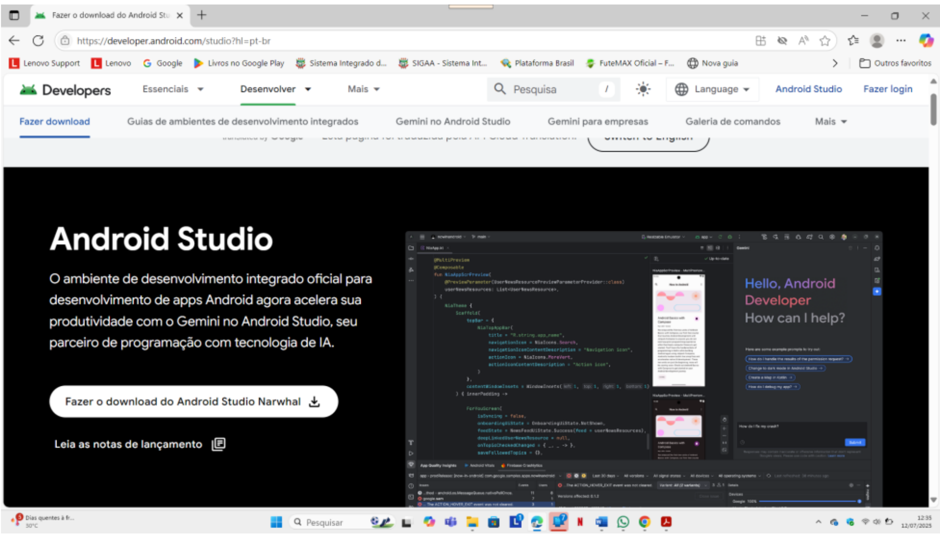
The programming language selected was Java, recognized for its versatility and consolidated integration with the Android environment. Java has extensive documentation, an active community, and libraries that facilitate the implementation of complex solutions, factors that reinforce its suitability for the project.

For the management and storage of information, Google Firebase was adopted, exploring, in particular, Firestore, responsible for the structured storage of data, and Authentication, aimed at user management. The choice for this architecture enabled the integration between local persistence and cloud synchronization, ensuring greater security, scalability, and accessibility to the data collected by researchers, even in scenarios of unstable connectivity.

In this way, the set of tools adopted - Android Studio, Java and Firebase - provided a robust development environment, with adequate support both for the construction of interfaces and for the efficient management of data and users, meeting the specific needs of the project.

Figure 2

Android SDK Download Page

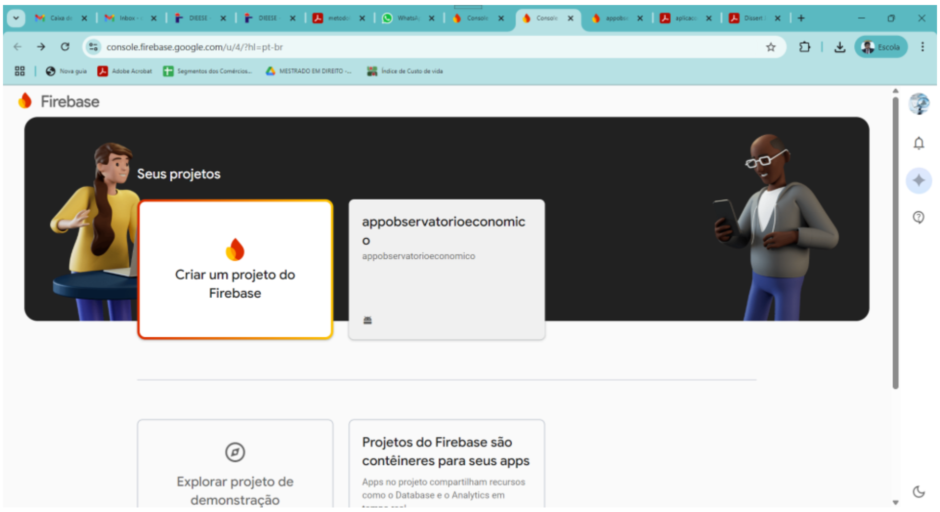


Source: Prepared by the authors (2025).

The first step in creating the project consisted of downloading and installing the Android SDK, an indispensable resource for the development of applications on the Android platform. This kit, available at the http://developer.android.com/sdk website, provides the libraries, tools and emulators necessary for the construction of the development environment. After installation, we proceeded with the initial configuration and access to the main Android Studio window, as illustrated in Figure 2, which served as the basis for starting the application coding.

Figure 3

Google's Firebase login page



Source: Prepared by the authors (2025).

After installing and configuring the development environment and emulator in Android Studio, we moved on to the mobile app construction stage. At this point, the first procedure consisted of accessing the main window of the platform and selecting the "Create New Project" option, which marks the beginning of the structuring of the application. Figure 3 illustrates this initial stage, in which the basis of the project to be developed is defined.

2.1.2 Developed Screens

The development of the application included the elaboration of different screens, each one focused on a specific function, ensuring usability, efficiency and integration with the database. Among them, the login and registration screens, the data collection form and the information search and download screen stand out.

The login and registration screen was designed to enable users to securely enter the system. From a visual point of view, dedicated fields were created for entering email and password, as well as quick access buttons for the "Login", "Register" and "Recover Password" options. To ensure the reliability of the information entered, immediate validation of the fields was implemented on the client side, offering instant feedback to the user. In terms of logic, Java programming integrated directly with Firebase Authentication, allowing for email and password authentication. In addition, error handling mechanisms were included, covering situations such as incorrect password, invalid e-mail or user not found. After successful authentication, the system automatically redirects the researcher to the main screen of the application.

As far as the form screen is concerned, it is designed to be intuitive and functional. Specific fields were made available for filling in the name of the research location, the date of collection, and the values of the foods surveyed, all of which were mandatory to avoid inconsistencies in the records. The "Send" button has been positioned clearly and objectively in order to facilitate the submission of data. The implemented logic allowed the direct connection to Firebase Firestore, storing the data in a structured way in a NoSQL database. Each submission was automatically linked to the authenticated user who performed the collection, ensuring traceability. As a complement, the app provides visual feedback after each submission, confirming the success of the operation.

The search and download screen was developed to simplify the retrieval of recorded data. In the layout, there is a field for entering the researcher's e-mail, which works as a search key. From this parameter, the application dynamically generates a list of the available forms associated with the informed email. Each item listed prominently features a "Download" button, allowing the data to be exported. At the logical level, the application executes efficient queries to Firestore, retrieving the information linked to the searched email. The data is then automatically converted to an Excel-compatible format, which is later made available for immediate download by the user.

In this way, the three main screens guarantee not only the security of access and the reliability of data collection, but also the ease of storing, retrieving, and sharing information, giving robustness and practical applicability to the application.

3 RESULTS

3.1 FIREBASE INTEGRATION

The integration with Firebase represented one of the fundamental pillars for the consolidation of the application, ensuring not only the proper functioning of the functionalities, but also the security and reliability of the data collected. The process began with the detailed configuration of the Android project in the Firebase Console, allowing the alignment of the application with the services provided by the platform.

To enable communication between the application and the cloud infrastructure, the official Firebase Authentication and Firestore libraries were implemented, which play central roles in authenticating users and storing forms with their respective data. The database was structured in a NoSQL model, optimizing the organization and retrieval of information, in order to ensure greater efficiency in the process of querying and manipulating records.

In addition to the data structure, special attention has been paid to security, with the definition and implementation of specific rules in Firebase. Such measures were responsible for ensuring the protection of sensitive information, while establishing clear access control mechanisms, so that only duly authorized users could enter, consult or share data in the system.

Figure 4

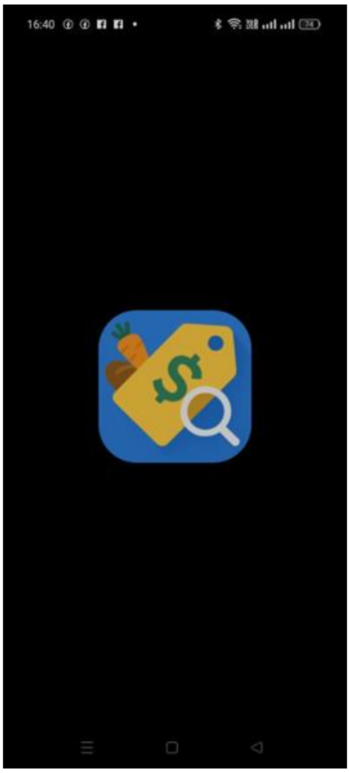
Initial image of the applications on the smartphone screen

Source: Prepared by the authors (2025).

Figure 4 shows the home screen of the mobile device, where the previously installed applications are listed. In the central part, on the left, it is possible to see the icon of the developed application, identified by the name Economic Observatory. By selecting this image, the user is automatically directed to the subsequent screen of the application, starting the process of navigating through the available features.

Figure 5

App Home Screen



Source: Prepared by the authors (2025).

Figure 5 shows the initial screen of the application, accessed after the researcher registers and receives the link to download the system. Once authenticated, the user has access to the data made available by the web service, which allows him to enter information regarding the markets surveyed, as well as record the values of the products, including brands and prices collected. In this way, the home screen works as a starting point for the structured collection of the information that makes up the application's database.

3.2 DATA FLOW

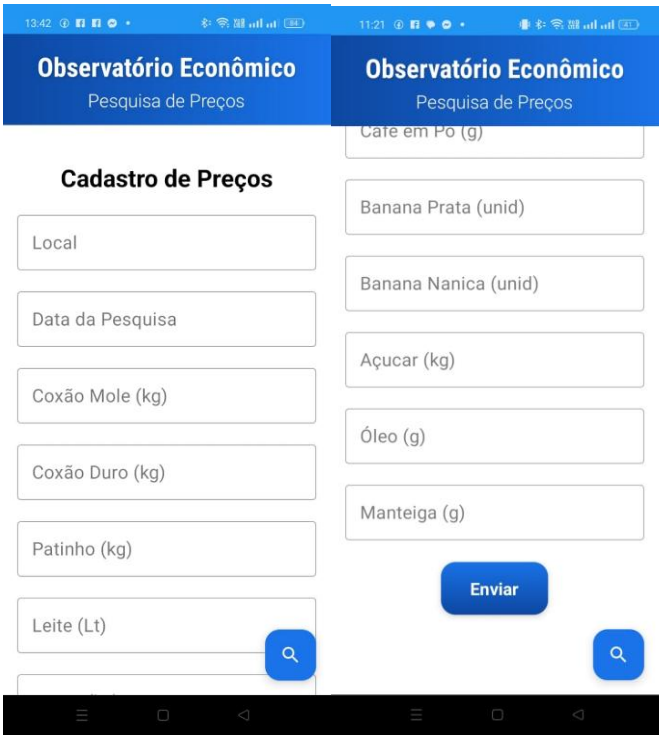
The application's data flow was structured to ensure simplicity of use, security in storage and ease of information retrieval. Initially, the user authenticates himself in the system, through login or registration, ensuring that only authorized people have access to the application. After this step, the researcher fills out the form with the research data, informing the market visited, the date of collection, the brands and prices of the products analyzed.

The recorded data is then sent and stored securely in the Firebase Firestore, which acts as the system's central database. This process ensures not only the integrity of the information, but also its availability in real time. Later, another user - or even the researcher himself - can perform queries using a specific email as a search key. The system, based on this parameter, locates the associated data in Firestore and recovers the information.

Then, the recovered data goes through a conversion process, transforming it into a user-friendly format that is compatible with electronic spreadsheets, such as Excel. Finally, the results are made available for download, allowing the researcher to organize and analyze the prices collected in a practical and efficient way. This flow ensures the automation of steps that were previously carried out manually in spreadsheets, minimizing errors and optimizing collection and analysis time.

Figure 6

App Data Flow Screen



Source: Prepared by the authors (2025).

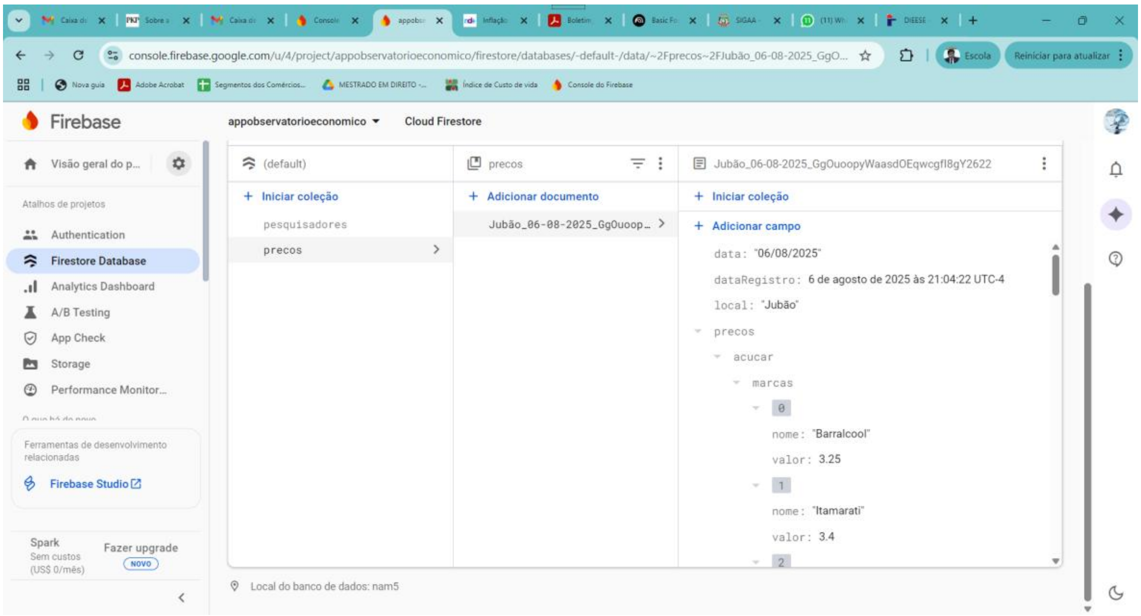
Figure 6 illustrates the data flow screen of the mobile application, highlighting the interface for recording the prices of the products that make up the basic food basket. On this screen, the researcher enters the values collected directly during the field research, and such information is immediately sent to the web interface, which was developed with the objective of allowing a consolidated and organized visualization of the data collected by the application.

After authenticating in the Economic Observatory App system, the user is directed to the price registration screen for the items in the basic food basket. In this space, he must fill out the form with information regarding the markets surveyed, the brands and the prices of each product. Once this step is complete, the data is transmitted and stored securely in the Firebase Firestore, ensuring the integrity, confidentiality, and availability of the information.

This process ensures not only the reliability of the collection, but also the efficiency of the data flow, which is then automated, reducing manual errors and allowing continuous monitoring of information through the web interface linked to the application.

Figure 7

Web interface



Source: Prepared by the authors (2025).

The Firestore database enables real-time data storage and synchronization between different devices and platforms, offering flexibility and efficiency in information management, as shown in Figure 7. In addition to allowing queries to retrieve specific data or all documents in a collection that meet defined criteria, Firestore caches the data actively used by the application, which ensures the application works even in situations of absence of internet connection.

Among its main advantages, the ability to automatically synchronize data between different devices stands out. This functionality ensures that any changes made to one device are reflected, in real time, on all others, providing collaborative and seamless experiences. In addition, Firestore sends instant notifications about updates, which expands the usability of the system and makes it easier for researchers to work together.

Another relevant point is the native integration of Firestore with other Firebase and Google Cloud services, which enhances the creation of complete, scalable, and secure solutions, aligned with the current demands of mobile application development aimed at collecting, processing, and sharing data in different contexts.

4 DISCUSSION

During the development of the app, several challenges arose, requiring specific strategies to overcome them effectively. These obstacles were particularly relevant for the consolidation of the proposed functionalities and for ensuring that the system met the needs of researchers efficiently.

4.1 CHALLENGES ENCOUNTERED

One of the main challenges was related to the learning curve required to use Firebase, since the team had to adapt to the architecture and features offered by the platform. In addition, structuring the NoSQL database in Firestore required careful modeling that allowed optimizing both storage and data queries, ensuring adequate performance and scalability.

Another critical point was the conversion of the data to Excel format, an essential step for the subsequent analysis of the information collected. This task involved the concern to ensure the compatibility between the formats and the fidelity of the exported data. Finally, the management of application states was also highlighted as a challenge, especially to maintain consistency and the correct flow of data between the different screens and interactions carried out by users.

4.2 IMPLEMENTED SOLUTIONS

To overcome these difficulties, specific solutions based on good development practices were adopted. In the case of the Firebase learning curve, the platform's official documentation and tutorials provided by developer communities were widely used, which contributed to accelerating the integration and mastery of the tools.

Regarding the structuring of the database, it was opted for a modeling based on collections and documents, according to the recommendations of Firestore itself. This choice favored the organization of data, in addition to enabling greater scalability and clarity in the manipulation of information.

To solve the export problem, third-party libraries were researched and incorporated, specially developed for the generation and conversion of data into Excel-compatible files. This enabled greater reliability in the process of transforming the information collected.

Finally, to handle state management, the MVVM (Model-View-ViewModel) architecture pattern was implemented. This approach brought greater organization to the code, facilitated the maintenance of the project and contributed to the separation of responsibilities, resulting in a more consistent and stable flow within the application.

Overall, the challenges faced and the solutions implemented throughout the development of the application demonstrated the importance of aligning programming practices, use of modern tools, and data modeling strategies to achieve satisfactory results. The process highlighted not only the need for careful technical planning, but also the value of continuous adaptation in the face of unforeseen events and limitations of the technologies used.

These experiences contributed to strengthening the robustness of the application, ensuring greater reliability in the registration, storage, and retrieval of data. In addition, the adoption of good architectural practices and integration with cloud services consolidated the solution as a viable and functional resource to support the collection and analysis of information about the basic food basket.

Thus, the results obtained are not limited to the technical implementation, but also extend to the learning acquired and the continuous improvements identified during the process. This set of advances provides important subsidies for the consolidation of the project and paves the way for broader reflections on the impact of technology in the field of economic research, naturally leading to the conclusion that synthesizes the contributions of the study and points to its future perspectives.

5 CONCLUSION

The development of the mobile application for the collection of prices of the basic food basket in Cáceres/MT proved to be a significant experience both in the technical and academic aspects. The initial proposal to create an offline solution, capable of facilitating data collection and integration with a cloud database, was achieved through the use of modern tools such as Android Studio, the Java language and Google Firebase services.

The project was successfully completed, meeting all the requirements initially established. The finished application offers essential functionalities that make it robust and functional, among which the following stand out:

- Secure user authentication, ensuring that only authorized people can access the system.
- Efficient collection of survey data, which facilitates the recording of information in the field.
- Cloud storage with Firebase, providing security, scalability, and accessibility of the data collected.
- Controlled sharing of information between researchers, allowing collaboration and dissemination of data in an organized way.
- Export of data to spreadsheets, ensuring flexibility for processing and subsequent analysis in software such as Excel.

The application proved to be a viable alternative to optimize the information collection process, reducing manual failures and ensuring greater agility in the registration, storage and retrieval of data. In addition, the integration with Firestore enabled real-time synchronization between devices and ensured the reliability of the information, even in situations of absence of internet connection.

From the methodological point of view, the experience provided relevant reflections on the importance of standardization in the collection and treatment of data, which are fundamental for the generation of consistent and comparable information. In this sense, the app plays an essential role in supporting research on food security, cost of living, and public policies, as it provides up-to-date and accessible information for the academic community, public agencies, and society in general.

Another relevant aspect is the practical contribution of the project. By making the price collection process more efficient, the app enables researchers to focus their efforts on analyzing and interpreting the results, strengthening scientific production and evidence-based decision-making.

It is important to note, however, that the development faced technical challenges, especially with regard to the learning curve of the Firebase platform and the efficient modeling of data in NoSQL database. Such obstacles, however, resulted in valuable learning and the adoption of more robust solutions, such as the implementation of good software architecture practices.

It is concluded, therefore, that the experience of this project goes beyond technological implementation, configuring itself as an exercise of integration between theory and practice, innovation and applicability. The developed application represents a tool of social and scientific impact, while opening space for future improvements, such as expansion to new regions, integration with other economic monitoring systems, and improvement of functionalities aimed at data analysis.

In summary, this work reaffirms the potential of mobile technologies as instruments to support research and society, highlighting that the combination of technological innovation and academic commitment can result in effective solutions to local and regional demands.

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