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Agropecuária.App – Dairy Cattle Farming Module: Cash Flow Management System

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Abstract
Dairy farming is a key productive chain in both global and Brazilian agribusiness. The practice of sound financial management is essential for optimizing the activity's results and ensuring responsible resource management. The adoption of information systems ("software") to assist in decision-making processes in rural enterprises has become increasingly frequent. In this context, the objective of this study was to develop a system for managing cash flow in dairy farming. The study was conducted in four stages. The first stage involved identifying financial variables through a literature review. Next, these variables were categorized. In the third stage, the system was developed using Python for the backend and web technologies (HTML, CSS, and JavaScript) for the frontend, with MySQL serving as the database. Finally, in the fourth stage, the system underwent a validation process. The results of the study demonstrate the system's functionality, illustrating its interfaces, inputs, processes, and outputs. The system presented in this study serves as an important tool for efficient cash flow management in dairy farming. With adaptations, the system could also be applied to other animal production chains, such as poultry farming, swine farming, sheep farming, goat farming, and others.

Keywords: *Agribusiness; Dairy Cattle; Software Development; Financial Management.*

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I. Introduction

In 1950, the global population was approximately 2.5 billion people. By 2022, it had reached eight billion, as reported by UNFPA (2025). In addition to this significant increase over the past seven decades, projections based on WPP data (2025) estimate approximately 10 billion people by 2050 and 11 billion by 2100. The historical growth of the world population, as well as its projected increase, highlights the position of the agribusiness sector worldwide as a supplier of various types of inputs (food, cotton, ethanol, biodiesel, timber, etc.) to society. At the global level, Brazilian agribusiness stands out prominently, ranking among the leading producers and exporters of several commodities, such as soybeans, corn, coffee, sugar, beef, and poultry (USDA, 2025; FAO, 2025).

Within global and national agribusiness, among animal production chains, dairy farming plays a particularly important role. According to data from the report *"Agribusiness Projections: Brazil – 2023/24 to 2033/34"*, published by MAPA (2024), milk production in the country is expected to grow at an annual rate of 1.7% over this period, increasing from the current production of 36.2 billion liters per year in 2024 to a total of 43.1 billion liters per year in 2034.

Complementary to agribusiness are the Sustainable Development Goals (SDGs) launched by the United Nations (UN) in 2015 to be achieved by 2030 (UN, 2024). The SDGs comprise 17 goals, including: 2 – Zero Hunger and Sustainable Agriculture; 8 – Decent Work and Economic Growth; and 12 – Responsible Consumption and Production. In order to achieve Sustainable Agriculture, Economic Growth, and Responsible Production in dairy farming, the presence of effective financial management of the activity is essential.

In Brazilian livestock farming, a large proportion of producers have limited knowledge of the financial and economic performance of their activities, mainly due to the lack of efficient financial control, as pointed out by Costa and Pereira (2013). According to these authors, the management of a considerable number of producers is guided by intuition and experience (the empirical method), with few adopting management systems to support decision-making.

In the context of the financial management of any enterprise, the use of cash flow statements is extremely important for monitoring past financial inflows and outflows, as well as those projected for the future (accounts payable and accounts receivable), as highlighted by Crepaldi (2006). Based on cash flow analysis, it becomes possible to observe economic and financial indicators that support the manager's decision-making process. Among the main indicators are: Cash Flow Present Value, Cash Flow Margin, Internal Rate of Return, among others (Quintino et al., 2018; Artuzo et al., 2015).

The choice of information systems ("software") to support decision-making processes in rural enterprises has become increasingly common. Cash flow management on rural properties can be carried out using various digital tools, including spreadsheets and management systems. Spreadsheets allow structures to be tailored to the specific needs of the activity but require the user to develop all configurations and indicators. In contrast, management systems offer ready-made solutions, facilitating use but with less flexibility for customization.

In the literature, several studies demonstrate initiatives aimed at developing systems for financial management and/or operational management in agricultural and livestock activities. Among these studies are Silva (2022), Nunes (2022), Schaffer (2021), Alves (2017), Zampiér (2015), and Marques (2014). In the case of cattle farming, several applications are available for on-farm management, such as JetBov (JetBov, 2025), iRancho (iRancho, 2025), and Farmin (Farmin, 2025). However, most of these tools are paid, which may limit their universal accessibility.

Therefore, considering the aforementioned context, the objective of this study was to develop a system for cash flow management in dairy farming activities. The proposal involved developing a system with essential (minimalist) functionalities to manage financial inflows and outflows on rural properties, with the aim of supporting producers in their decision-making processes.

II. Material And Methods

The study was developed in four stages. In the first stage, a survey of financial variables was conducted based on a literature review. Subsequently, these variables were categorized. In the third stage, the system was developed. Finally, in the last stage, the system underwent a testing process. Figure 1 illustrates the stages involved in the development of the study.

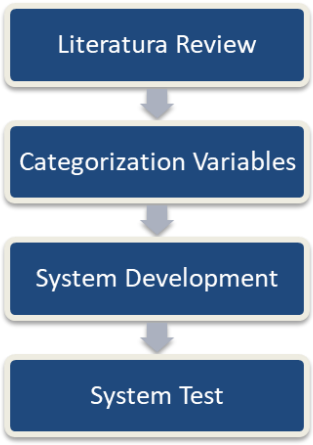


Figure 1 – Steps of development

For the development of the system, an initial survey of financial variables related to dairy cattle farming was carried out based on the literature. This survey was conducted using books and scientific articles, through searches in scientific databases such as Web of Science, Scopus, SciELO, and Google Scholar.

Based on the survey of financial variables in the first stage, a categorization process was performed. The division for expenses and accounts payable was made into type, category, and subcategory. In turn, the division for revenues and accounts receivable was made into category and type of category. In the Appendix of this document, the entire categorization process can be viewed.

The system development was divided into backend, frontend, and database components. For the backend, the Python programming language was used, along with the following libraries: (i) Flask (for communication between the backend and frontend) and (ii) MySQL Connector (for connection to the MySQL database). For the frontend, resources from the standard web framework were used, namely HTML, CSS, and JavaScript. For the database, MySQL was used, with XAMPP as the local server. In addition, the system development environment was PyCharm Community Edition.

To test the developed software, a mapping of all possible activities (step by step) that the user could perform in the system—registration, reading, editing, and deletion—was carried out. Based on this mapping, all possibilities were tested in order to verify whether they were being executed correctly.

III. Results And Discussion

The results and discussion of this study focus on describing the operating process of the developed system (AGROPECUARIA.APP – Dairy Module). To this end, the structural aspects (Use Case Diagram and Data Flow Diagram) are first described, followed by a description of the functionalities present in each system interface. Figure 2 presents the Use Case Diagram.

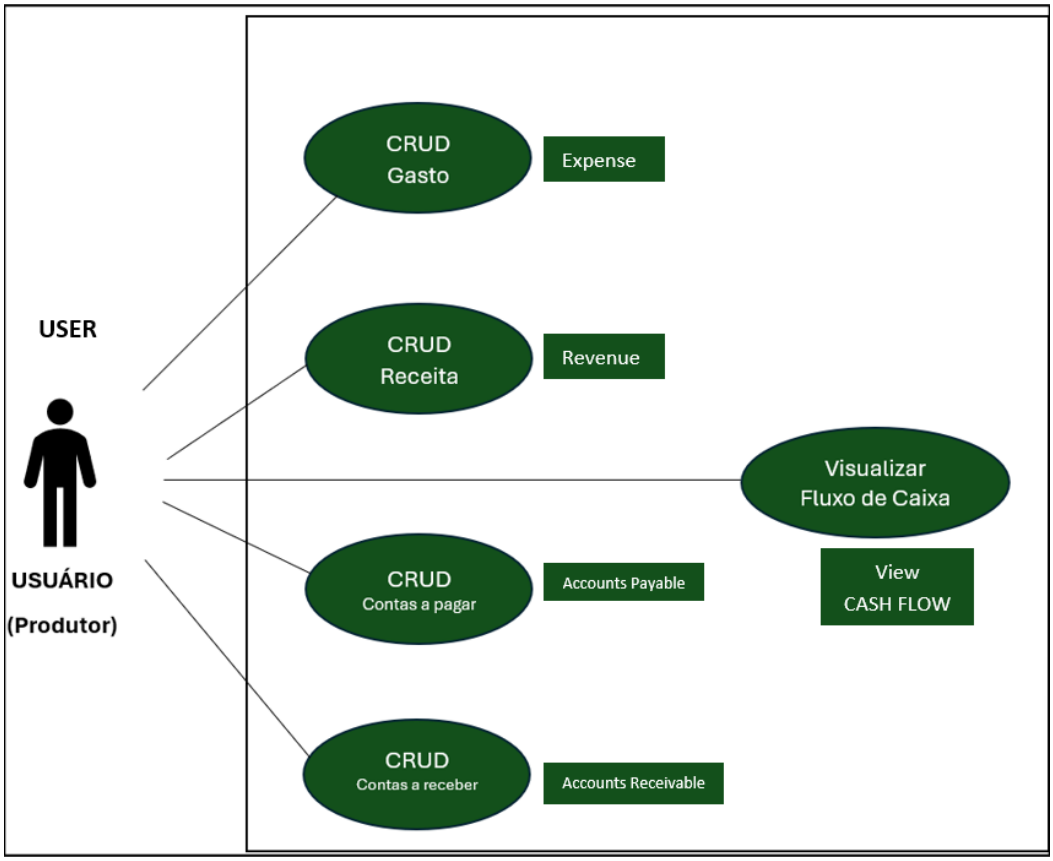


Figure 2 – Use Case Diagram

The use case diagram, presented in Figure 2, represents the functionalities of the "Dairy" module in AGROPECUARIA.APP, which assists the user (producer) in managing the cash flow of dairy production. The operations include the creation (C), retrieval/read (R), updating (U), and deletion (D) (CRUD) of records related to expenses, revenues, accounts payable, and accounts receivable, as well as enabling a consolidated view of cash flow, thereby facilitating financial analysis and control of the business.

Figure 3 presents a relational database diagram composed of four tables: "expenses," "revenues," "accounts payable," and "accounts receivable," designed to manage the finances of the AGROPECUARIA.APP – Dairy Module. The "expenses" table stores recorded expenditures, with details such as description, quantity, unit and total values, purchase date, payment method, type of expense, category, subcategory, and notes.

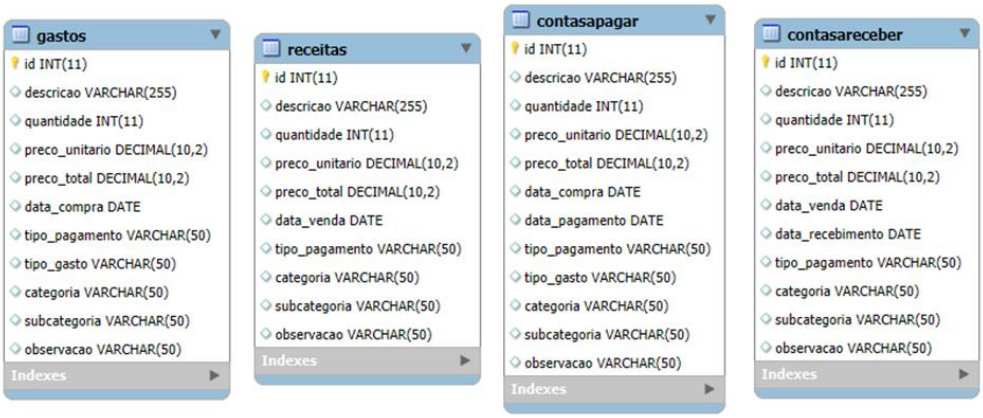


Figure 3 – Entity-Relationship Diagram

The "revenues" table records income or sales, including information similar to that of expenses, but focused on the revenue generated. The "accounts payable" table centralizes information on outstanding expenses, while the "accounts receivable" table is intended for amounts yet to be received. These data can be used to monitor inflows, outflows, payments, and receipts in an organized and detailed manner.

The interface shown in Figure 4 is the homepage of the AGROPECUARIA.APP – Dairy Module. This interface serves as a navigation dashboard, offering options organized into buttons to enter and consult cash flow information related to dairy farming activities, such as expenses, revenues, accounts payable, and accounts receivable. In addition, there is a dedicated button to access the cash flow, allowing for integrated analysis of financial transactions. The simple and functional structure facilitates data management and the monitoring of the user's financial operations.

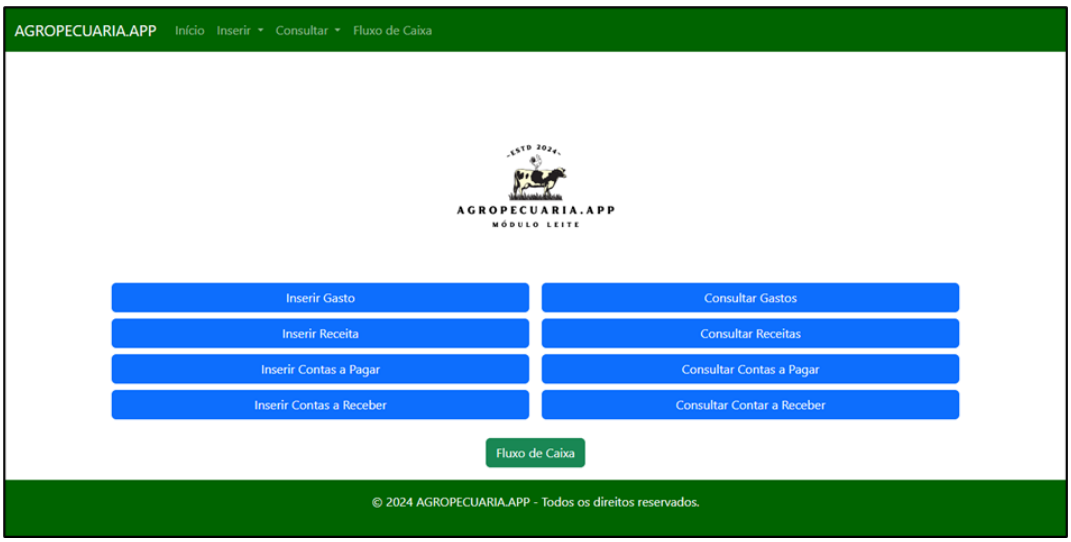


Figure 4 – Home Page (Main Interface)

The form shown in Figure 5 is used for recording expenses, allowing the user to enter details related to a cost, expense, or investment. The fields include an expense description, quantity, unit price, purchase date, payment method, type of expense, category, subcategory, and an optional note. After completing the information, the user can click the "Save" button to store the data in the system's database.

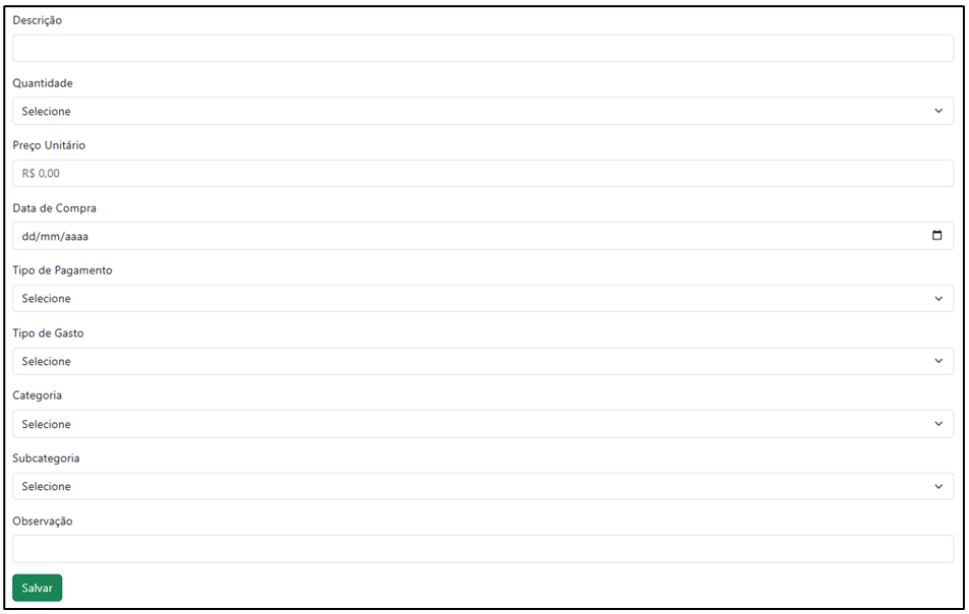


Figure 5 – Expense Registration Interface

Subsequently, the user can perform queries on the registered data (Figure 6). The form shown in Figure 6 is used to query expenses, allowing information to be filtered according to several criteria. The available fields include a date range (Start Date and End Date), a textual description, the quantity related to the expenses, the payment method, the type of expense, as well as category and subcategory. For the most part, the fields are identical to those presented in Figure 5, since this is a query of data that were previously registered.

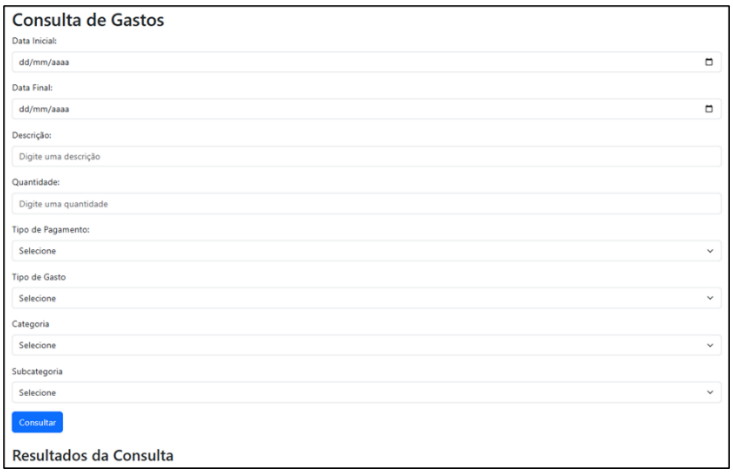


Figure 6 – Expense Consultation Interface

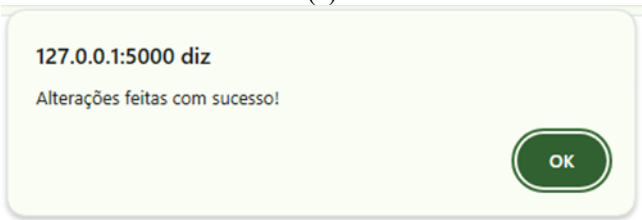
After filling in the desired fields, the user can click the "Search" button to view the filtered results, which will be displayed in the section entitled "Query Results" (Figure 7). The objective is to provide a practical tool for organizing and performing a detailed analysis of expenses in dairy production.

Figure 7 – Expense Query Results

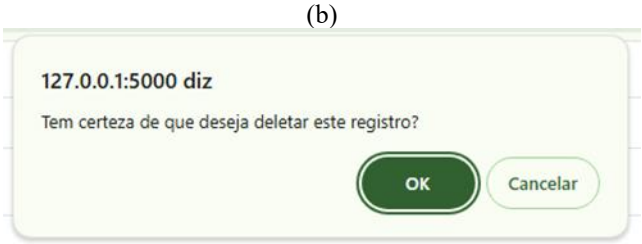
In addition to the processes of registering and querying an expense record, it is also possible to edit and delete a record, as illustrated in the "Actions" column in Figure 7. If the user clicks on the "Edit" option, they are redirected to a new interface with the same fields present in the expense registration form (Figure 5). However, in the case of editing, the fields are pre-filled with the corresponding data of the selected record.

After modifying the desired field, the user must click "Save Changes," and a confirmation window (Figure 8(a)) will appear, requesting confirmation. If the user confirms the modification, another confirmation window (Figure 8(b)) will appear confirming the changes. In addition to the editing option, as shown in the interface illustrated in Figure 7, the user may also delete a record. When clicking the "Delete" button, a confirmation window (Figure 8(c)) will appear, requesting confirmation of the deletion. The confirmation processes through pop-up windows described in this paragraph are standard measures used in systems to prevent accidental errors by the user.

(a)



(b)



(c)

Figure 8 – Alerts for saving (a), editing (b), and deleting (c) records

Between Figures 5 and 8, the processes of creating, reading, updating, and deleting (CRUD) an "Expense" record in the database are presented. For the other items shown on the main interface (Figure 4), such as "Revenue," "Accounts Payable," and "Accounts Receivable," the same functionalities (CRUD) are also available. Therefore, interfaces very similar to the "Expense" item were developed, with only the specific characteristics of each item being adjusted.

Finally, Figure 9 presents the Cash Flow interface, in which the table is organized into columns representing the months of the year (from January to December) and rows with financial categories, such as "Expenses," "Revenues," "Accounts Payable," and "Accounts Receivable." It is emphasized that the data presented in the Cash Flow are derived from information previously entered by the user.

Figure 9 – Cash Flow

It should be noted that the system presented in this study represents the first version, which includes essential tools for the management of a small rural property focused on dairy cattle farming. Subsequently, using the current version as a basis, a second version will be developed, encompassing a broader range of functionalities. This proposal is in line with the "spiral model" of digital system development in software engineering described by Pressman (2011), which considers the construction of a system in versions (layers) followed by improvements and corrections relative to the previous one. Complementarily, it can be stated that the proposed system is characterized as a Decision Support System (DSS) applied to the agribusiness sector. DSSs are highly relevant to the advancement of the sector, as they enable improvements in the efficiency of production systems.

IV. Conclusion

The AGROPECUARIA.APP system presented in this study functions as an important instrument for achieving efficient cash flow management in dairy farming. As a main limitation, it can be noted that, in the area of financial management, the developed system currently presents only individual records of inflows and outflows; therefore, it does not include charts to optimize the data analysis process for the manager (rural producer).

Future studies, through adaptations, should incorporate graphical visualizations, thereby addressing the main current limitation of the system. In addition, other improvements may be applied in the future, such as the inclusion of additional financial analysis structures, such as the Income Statement (IS) and the Balance Sheet (BS), together with their respective indicators. The system can also be easily adapted to be used for the same purpose in other animal production chains, such as poultry, swine, sheep, and goat farming, among others.

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