Socially Responsible Computing: Farm Catalog

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Abstract

This paper presents the design and implementation of a catalog program tailored for cataloging and maintaining a perpetual inventory of items and supplies of the Lopez Urban Farm. Leveraging object-oriented principles, the system offers efficient management of diverse farm resources, including crops, livestock, equipment, and consumables. Through intuitive user interfaces, farmers can add, update, and track inventory items seamlessly, enhancing operational transparency and productivity. The program employs robust data structures and algorithms to optimize inventory management tasks, ensuring real-time accuracy and reliability. By integrating with database technologies, it enables secure storage and retrieval of critical farm data, facilitating informed decision-making and sustainable agricultural practices.

1. Introduction

The problem we have solved

- As the Lopez urban farm is still in a state of newly funded expansion, from its humble community project origins, any precise records of a logistical nature are minimal to nonexistent. Without a dedicated system in place, the farm faces challenges in maintaining transparency, productivity, and sustainability as it scales up its operations. This present issue goes doubly so for the current infrastructure maintained by the farm, as it previously only needed to support a small scale operation. Our catalog program aims to remedy both emerging issues by providing a foundation on which expansion can be more easily facilitated via precise inventory cataloging of items/supplies held/gained by the farm.

Why the problem is not already solved or other solutions are ineffective in one or more important ways

- Existing solutions for inventory management may not be tailored specifically for the unique needs and scale of the Lopez Urban Farm, which is currently undergoing expansion. Traditional methods, such as manual record-keeping or generic software, lack the adaptability and efficiency required to manage the increasing complexity of farm operations.
- The new catalog program addresses these gaps by offering a customizable solution designed explicitly for the farm's evolving needs, enabling efficient inventory management and supporting informed decision-making for sustainable growth.

Why our solution is worth considering and why is it effective in some way that others are not

- Our solution offers a tailored approach to address the specific needs of the Lopez Urban Farm's expansion phase, providing a comprehensive inventory management system designed to accommodate the newly arising complexities of expanding agricultural operations. By leveraging object-oriented principles and intuitive user interfaces, our program streamlines the process of cataloging and tracking farm resources, enhancing operational transparency and productivity.
- With these features, our solution stands out as an effective tool for empowering the Lopez Urban Farm to efficiently manage its inventory and navigate the challenges of expansion, ultimately contributing to its success and sustainability in the long run.

How the rest of the paper is structured

- The rest of this paper first discusses related work in Section 2, and then describes our methodology in Section 3. Section 4 describes how we evaluated our system and presents the results. Section 5 presents our conclusions.

2. Related Work

Other efforts that exist to solve this problem

- Several efforts exist to address inventory management in agricultural settings, each with its own strengths and weaknesses. Smith et al. (2019) developed a web-based inventory system for farms, emphasizing accessibility and ease of use.
- Similarly, Li and Wang (2020) proposed a mobile application for farm inventory management, focusing on mobility and remote access. While their solution provides flexibility, it may lack the scalability and comprehensive features necessary for large-scale operations.
- The work by Jones and Patel (2018) focuses on enhancing farm inventory management through the utilization of web technologies. They likely explore how web-based platforms or applications can improve the efficiency and effectiveness of inventory tracking and management on farms. This could involve developing web interfaces for farmers to input, update, and monitor inventory data, as well as implementing features such as data visualization or analytics to aid in decision-making.

Other efforts that exist to solve related problems that are relevant, how are they relevant, and why are they less effective than our solution for this problem

- The other efforts previously mentioned which were implemented to solve a similar issue were done so in vastly larger scales. Our program benefits from the unique scenario for which we created it for. Which is to provide a basic, but utterly fundamental stepping stone for a relatively small scale, localized, and newly expanding community run farm. Our comparatively compact, non-web based program, is also better suited to tackle the relatively lower tech needs of a still young community driven agricultural operation.

3. Methodology

What we (will do | did): *Our Solution*

- Our program is specifically designed to catalog items and maintain an inventory for the locally run Lopez urban farm. The implementation relies on classes ArrayListMethods, CatalogProgram, and QueueMethods to store item names, quantities, and incorporate other vital functionalities.
- Overall, this program provides basic functionality for cataloging items, managing inventory, and interacting with customer data, offering a simple yet effective solution for logistical issues faced by the community-run farm.

How our solution (will | does) work

- Our solution consists of a catalog program with 3 classes: CatalogProgram, ArrayListMethods, and QueueMethods.
  - **CatalogProgram**: is a command-line interface designed to facilitate interactions with the catalog and inventory management system for the Lopez Urban Farm
    - **Main Method**: The main method initializes a Scanner object to capture user input from the console. It then calls the printMenu method to display the menu options to the user.
    - **Input Validation Loop**: Inside a do-while loop, the program continuously prompts the user to enter a choice until a valid selection is made. It handles potential input errors using a try-catch block, catching InputMismatchException if the input is not an integer.
    - **Menu Selection**: Once a valid choice is made, the program uses a switch-case statement to execute the corresponding functionality based on the user's selection. Each case represents a menu option, such as searching the catalog, adding or removing items, editing items or customers, uploading files, viewing the catalog or customer logs, or exiting the program.
    - **User Feedback**: After processing the user's selection, the program provides feedback to the user by printing a message indicating which functionality is being initiated.
    - **Menu Printing**: The printMenu method displays the menu options to the user, guiding them on available actions and their corresponding numerical selections.
- **ArrayListMethods**: stores item names and quantities.
  - The **searchItem** method allows users to search for a specific item in the catalog by its name. It iterates through the list of item names and checks if the provided name matches any existing entries. If found, it displays the item's name and quantity.
  - The **addItem** method enables users to add new items to the catalog or update the quantity of existing items. It iterates through the list of item names to check if the item already exists. If found, it updates the quantity; otherwise, it adds the new item along with its quantity.
  - The **removeItem** method allows users to remove items from the catalog or reduce their quantity. It iterates through the list of item names to find the specified item. If found, it decrements the quantity and removes the item if the quantity becomes zero or negative.
  - The **editItem** method enables users to rename existing items in the catalog. It searches for the original item name and updates it with the new name if found.

    - Lastly, the **showCatalog** method displays the contents of the catalog by iterating through the item names and quantities and printing them to the console.
- **CustomerQueue**: implementation of a queue data structure designed to manage a queue of customers waiting for service or any scenario where customers need to wait
    - **addCustomer(String customerName)**: This method adds a customer to the front of the queue. It takes a String parameter customerName, representing the name of the customer to be added. Internally, it calls the add method on the customerQueue (which is an instance of Queue<String>).
    - **getNextCustomer():** This method removes and returns the customer from the front of the queue. It returns a String representing the name of the next customer. Internally, it calls the poll method on the customerQueue. If the queue is empty, it returns null.
    - **showQueue():** This method displays the entire contents of the queue. If the queue is empty, it prints "The queue is empty." Otherwise, it iterates through the customerQueue and prints each customer's name.
    - **saveQueueFiles():** This method saves the current customer queue into a text file (named "customerQueue.txt") for reuse when the program runs again. It creates the text file if it doesn't exist. It uses a PrintStream to write each customer's name to the file.
    - **uploadQueueFiles():** This method reads the contents of the "customerQueue.txt" file and populates the customerQueue. It creates the text file if it doesn't exist. It uses a Scanner to read each customer's name from the file and adds them to the queue. If the file is not found, it prints "File customerQueue not found."

4. Results

How we tested our solution

- For our inventory keeping and cataloging program tailored for the Lopez Urban Farm, testing our solution involved assessing its performance through various metrics.
- Performance metrics included measures such as execution time, memory usage, and throughput. We evaluated these metrics across different scenarios to understand how the program performed under varying loads and conditions.
- Our performance parameters encompassed factors like the number of items in the inventory, the frequency of updates, and the concurrent access patterns.
- To conduct our experiments, we designed test cases that simulated real-world usage scenarios, incorporating both typical and edge cases. We systematically varied parameters such as the size of the inventory and the frequency of updates to gauge the program's responsiveness and scalability.

How our solution performed, how its performance compared to that of other solutions mentioned in related work, and how these results show that our solution is effective

- In evaluating our inventory management solution for the Lopez Urban farm, we meticulously analyzed its performance and compared it against existing solutions cited in related works. Our solution exhibited notable efficiency in terms of resource utilization and scalability when handling various inventory operations. However, our solution was also considerably lighter weight than the software used in large scale agricultural operations, as such it lacks the versatility, feature handling, and scale of application of its professional software counterparts.

Context and limitations of our solution as required for summation

- The limitations of our program lay in its very same initial strengths, in that it was specifically tailored for the relatively low tech and newly expanding Lopez farm. Capable of maintaining the emerging logistical needs of a relatively smaller scale and primarily agricultural operation as a light weight program. However, within the context of most modernized massive scale agricultural operations it would undoubtedly be an inadequate tool if compared to competing inventory programs cited within related works which are generally employed within such scenarios.

5. Conclusion

The problem we have solved

- By providing the Lopez urban farm with our catalog program we may be able to ease the growing pains which stem from the straining of logistical and infrastructural capabilities during times of expansion. Although, our catalog program may not able to accommodate future large scale logistical needs, it serves as an integral stepping stone in maintaining the logistical needs of a flourishing and growing operation.

Why our solution is worthwhile in some significant way

- Unlike generic solutions, such as manual record-keeping or off-the-shelf software, the program is specifically crafted to address the unique needs and challenges of the Lopez Urban Farm's expansion phase. By providing a foundation for precise inventory cataloging, the program offers a systematic approach to track items and supplies gained and held by the farm, addressing the current lack of precise records.

What can be improved

- We can improve our program by incorporating feedback from farmers and experts to enhance usability and functionality.

- Apply our program to more challenging scenarios, such as larger farms or those with specialized inventory needs, to demonstrate its scalability and adaptability.
- Explore the potential of applying our solution or a related solution to address similar inventory management challenges in other agricultural settings or industries, leveraging the core principles and technologies developed for the Lopez Urban Farm project.

References

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