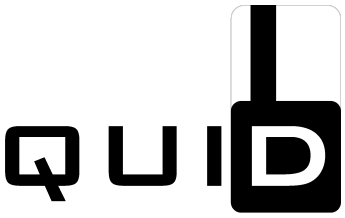
Project 3: Usage Research Data Modeling

Group 6



QUID
Quality User Interface for Dining

In collaboration with
Owens Food Court at Virginia Tech

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This project involves converting data elicitation and analysis results into Usage Data Modeling. It includes user models, flow models, hierarchical task inventory, task sequence models and finally, working environment models.

CS/ISE 5714 - Usability Engineering - Fall 2023

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1. System Concept Statement

Quality User Interface for Dining (QUID) is a redesigned Point Of Sale (POS) interface developed specifically for Owens Food Court at Virginia Tech to improve the cashier experience at the register while processing transactions. QUID will resolve the improper layout strategy, which often yields incorrect item selections and presents a lack of distinction in food items or frequently purchased commodities like drink cups or compostable boxes, to reduce processing time and voided transactions. QUID will ensure only available items are displayed, provide consistent and commonly used names on button labels, and process payments with less intervention. For example, when a consumer selects a restaurant, QUID prominently displays the restaurant's logo and color theme, creating a visually distinct environment. Crucially, QUID generates payment confirmations, bolstering transparency and trust in financial transactions. QUID, backed by its cashier-friendly interface, represents a comprehensive solution for Owens Food Court, promoting operational excellence and consumer satisfaction.

2. Tailoring of Scope and Process

We extensively tailored our scope for this milestone according to feedback and project requirements. It became clear through discussion that there are very few true users of the Point of Sale (POS), namely the dining hall managers and the cashiers who directly operate the POS themselves. With the professor's consultation, we eventually discovered the potential interactions that a consumer has with the POS, though not nearly as involved as the manager or cashier. As such, we focused much of this report on the manager and cashier interactions within the system.

In selecting appropriate models, we recognized the physical nature of the many interactions that take place in the dining hall environment: consumers show up with food in-hand, oftentimes presenting a prepackaged item with a barcode, swiping a credit card, or tapping a Hokie Passport. Similarly, there are many artifacts present in the dining hall environment, such as, staff use “cheat sheets” at each workstation to indicate item availability; staff use clerk cards and clerk card checkout sheets to log in and out of POS stations; and receipts are generated for credit card sales. Accordingly, there was a natural wealth of information leading us to generate working environment models in the form of artifacts and physical models .Conversely, we deemed machine work role models an inappropriate fit for our project, so we tailored our scope to remove this element.

3. List of Models Used

Following are the models used in the report:

- **User Model**
    1. Work role model
    2. User Classes

- **Usage Model**
    1. Flow Model

- **Task Structure Model**
    1. Hierarchical Task Inventory

- **Task Sequence Model**
    1. Usage Scenarios
    2. Step-by-step task sequence model
    3. Essential use case task sequence model

- **Work Environment Model**
    1. Artifact Model
    2. Physical Model

4. Justification for the Chosen Models

A. User Models

We chose User Models (work role, sub role) because they help to give a broader perspective on tasks being carried out in the workplace that affect the regular process of payments and to get an understanding of how work roles further define the tasks various people can perform. It helped us look at activities in a more pure form and helped us understand the roles across the cashier register. Regarding user classes, we chose it too because it helps in showing the characteristics, knowledge and skills that are needed in our users including consumers. This will guide us to think about how we can align the system with these different classes.

B. Usage Model (Flow Model)

Our project consists of a dining hall system which contains different work areas including shops and cashier stations. This presents a dynamic system where the

consumers need to move between shops and cashiers, and managers need to supervise the system to provide assistance when issues occur. Therefore, we thought it will be meaningful to make a flow model which will help us to picture the dynamic and interactions in our project.

C. Hierarchical Task Inventory

Our group developed a hierarchical task inventory (HTI) to convey the complex nature of the tasks performed by each of the major work roles present in the dining hall system. The HTI effectively communicates the various prerequisites required to complete a given task, with the unique context of a given work role or sub-role for that task. The HTI served as a framework for the development of our step-by-step task sequence models and guided the creation of our usage scenarios - it was an integral part of the model development process.

D. Task Sequence Models

Since most of the critical tasks in our project are mainly Human-System related, we used Step-by-step task sequence model and the Use case task sequence model more often. These models are good in showing the interaction between the user (e.g., Cashier) and the system as detailed steps. Moreover, both these two models show areas of improvements for the current system. For instance, identifying the barriers in the Step-by-step task sequence model shows directly areas for improvements. Regarding the Use case task sequence model, the way it is structured where steps are general and abstract, it also helps to easily generate ideas to conduct these steps more efficiently and easily. Although the consumers are not the main focus in this project, we also constructed one Usage scenario model to show how consumers can be involved in the process in addition to the POS users. Since we are more interested in the consumer experience, we thought it would be better if we show it as a narrative using a Usage scenario model.

E. Working Environment Models

Due to the physical nature of our system, we elected to develop artifact and physical models. Our artifact model showcases the tangible artifacts present throughout the current POS system and the dining hall, and the interactions these artifacts have within the current system. Our physical model showcases the dining hall layout, giving context to the consumer ordering process, the location of queues within the dining hall, and the physical space constraints cashiers face at the POS.

5. The Models

A. User Models

1. Cashier

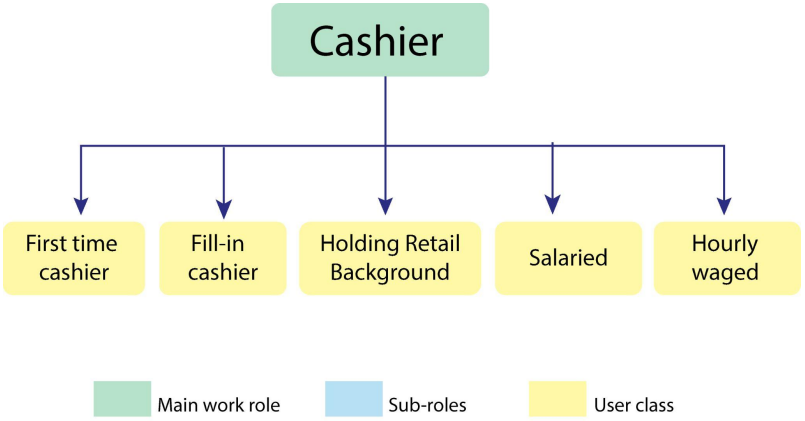


Figure 1: Cashier work role model

First Time Cashiers: Our cashier work role can be decomposed into various unique user classes, each with their own nuances. Firstly, Owens and Virginia Tech Dining as a whole employs many first-time cashiers who have no previous experience with a POS. These first-time cashiers are unique in that they lack experience with operating a POS but also bring a completely unaltered perspective on how they might like to interact with a POS.

Fill-in Cashiers: Next, Owens has various "fill-in" cashiers, these are workers who may typically operate as food preparers or customer service representatives, but in times of severe checkout backlog, are required to fill in as a temporary cashier. Fill-in cashiers are unique in that their job mostly consists of duties not involving a POS, and these users do not have the same day-to-day interaction and knowledge as full-time cashiers.

Previous Retail Experience: Our next user class is a cashier with previous retail experience. In interviews with cashiers, we found that many users who were satisfied with the current POS had previous retail experience where they operated a retail-oriented POS at their previous job. The current Owens POS interface has many parallels with large retail chains, which allows for directly transferable skills for cashiers with a retail background.

Salaried vs. Hourly Wage: Next, we further differentiate salaried cashiers from hourly waged cashiers - this can initially be perceived as nonstudents as compared to

students, as all students are on hourly wage, but furthermore - salaried employees have the most extensive wealth of experience interacting with the Owens POS, while hourly waged employees generally have less experience.

2. **Manager**

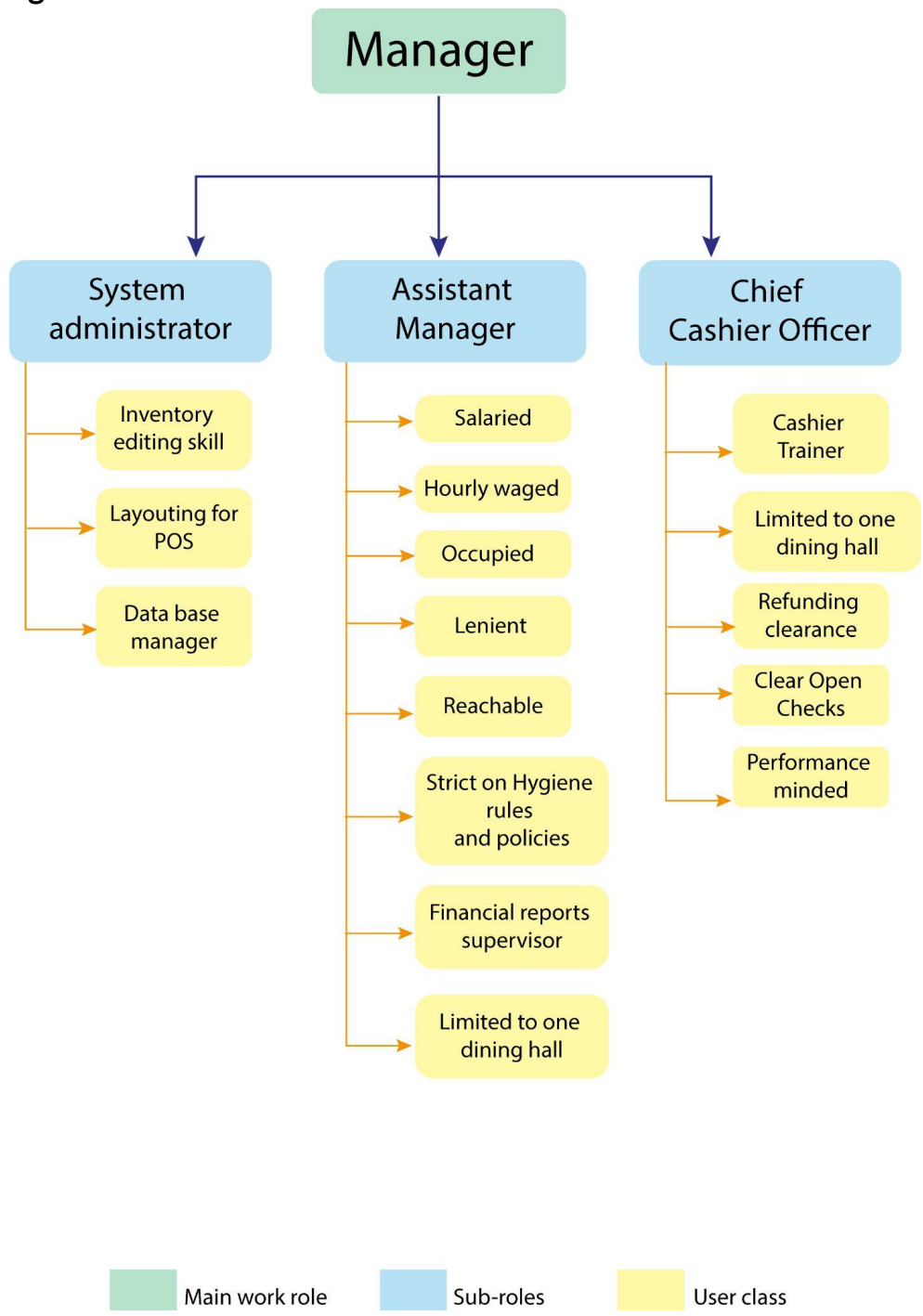


Figure 2: Manager work role model

The second main work role model, the manager, is similarly decomposed albeit firstly into distinct subroles**.** These subroles include a system administrator, assistant manager, and chief cashier officer.

System Administrator: The system administrator is the architect behind the POS interface design, and orchestrates all menu changes, item updates, and price adjustments. This manager is the most well-versed with the POS, and perhaps has the most knowledge of any dining hall worker on the POS.

Assistant Manager: The next sub-role for managers is the assistant manager. Assistant managers are mostly charged with keeping the dining hall as a whole running smoothly, paying attention to worker performance, maintaining shop cleanliness and food output as well as cashier performance. Assistant managers can occasionally fill-in for cashiers, and do so effectively as assistant managers almost always have cashier experience before their tenure as an assistant manager. Assistant managers have a unique perspective of a former cashier, despite their varied duties.

Chief Cashier Officer: The last sub-role for managers is the chief cashier officer. Chief cashier officers are responsible for training cashiers, certifying cashiers, maintaining cashier performance levels, and clearing refunds. Chief cashier officers can similarly fill in for cashiers, though this happens much less frequently than an assistant manager filling in. Chief cashier officers have prior experience working with the POS as a former cashier, but also have unique access to performance metrics of individual cashiers, and the ability to analyze best practices for POS operations on a cashier-by-cashier basis.

3. Consumer

Figure 3: Consumer work role model

Our last main work role is the least directly involved with the POS, but is still a crucial component of all POS interactions, the consumer. The consumer can be decomposed into three distinct sub-roles: a Grab and Go consumer, an Online Order consumer, and an offline buyer - each of these with their own distinct attributes.

Grab and Go: Grab and Go consumers solely grab ready-made "Grab and Go" foods with pre attached barcodes, with no custom food items or add-ons. These consumers are the quickest to ring up at the POS, as the barcodes allow for the scanning and instant addition of an item to a ticket, and all grab and go items have price tags directly attached, allowing the consumer to instantly lookup the price without cashier intervention.

Order Online: The next consumer sub-role is online ordering. These consumers use the Grubhub app to customize their food orders and place orders online ahead of picking up their food. These consumers prepay for their food online, so the only intervention required from the cashier is the verification of identification for the online order consumers to pick up their food and leave. As such, online ordering consumers are the fastest to be processed through the cashier area and require no usage of the POS.

Offline Buyer: Lastly, our final sub-role for the consumer is an offline buyer, these are the consumers most involved with the POS. Offline buyers place food orders in house and have the ability to customize their food to their liking - customization results in extra inputs required by the cashier for proper charging. Offline buyers place the greatest load on the dining hall, as they take time to place their orders. These consumers then have to convey their food order and its potential customizations to the cashier for proper charging.

B. Usage Model

1. Flow Model

In our flow model below, all processes involving user interfaces are colored pink - this includes the GrubHub UI, Hokie Dining App UI, and Database UI. Next, we distinguished all individuals in the system with a light tan to help map each individual's interactions within the system. We elected to further distinguish the cashier as light pink as they are at the heart of the system. Next, we made the Point of Sale and its subcomponents a light blue. The interaction and exchange of information is shown using fluid arrows with definition around it. Using the insights from interviews and field visits we mapped out the flow model as below.

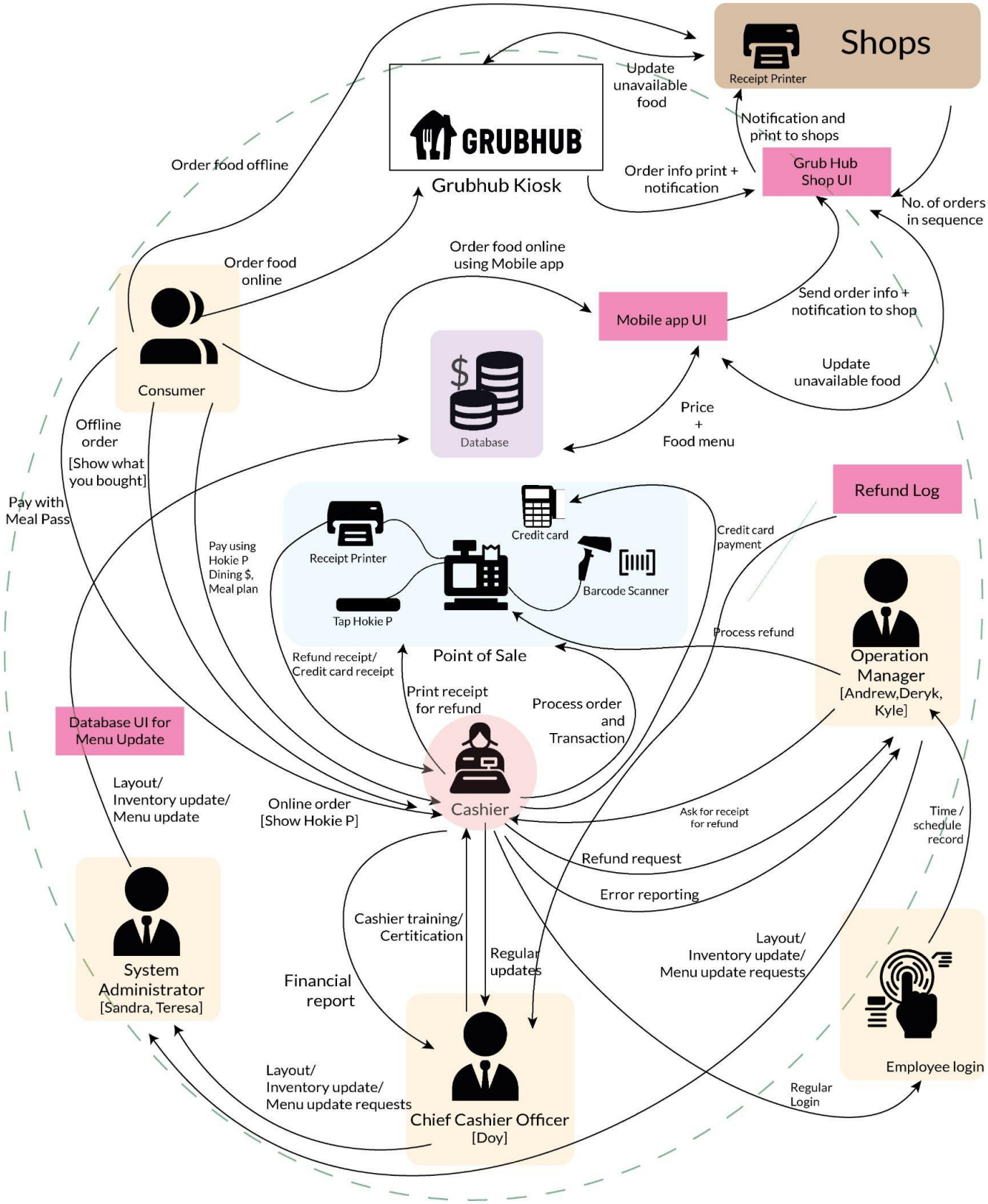


Figure 4: Flow model

C. Task Structure Model

1. Hierarchical Task Inventory - Manage POS operations

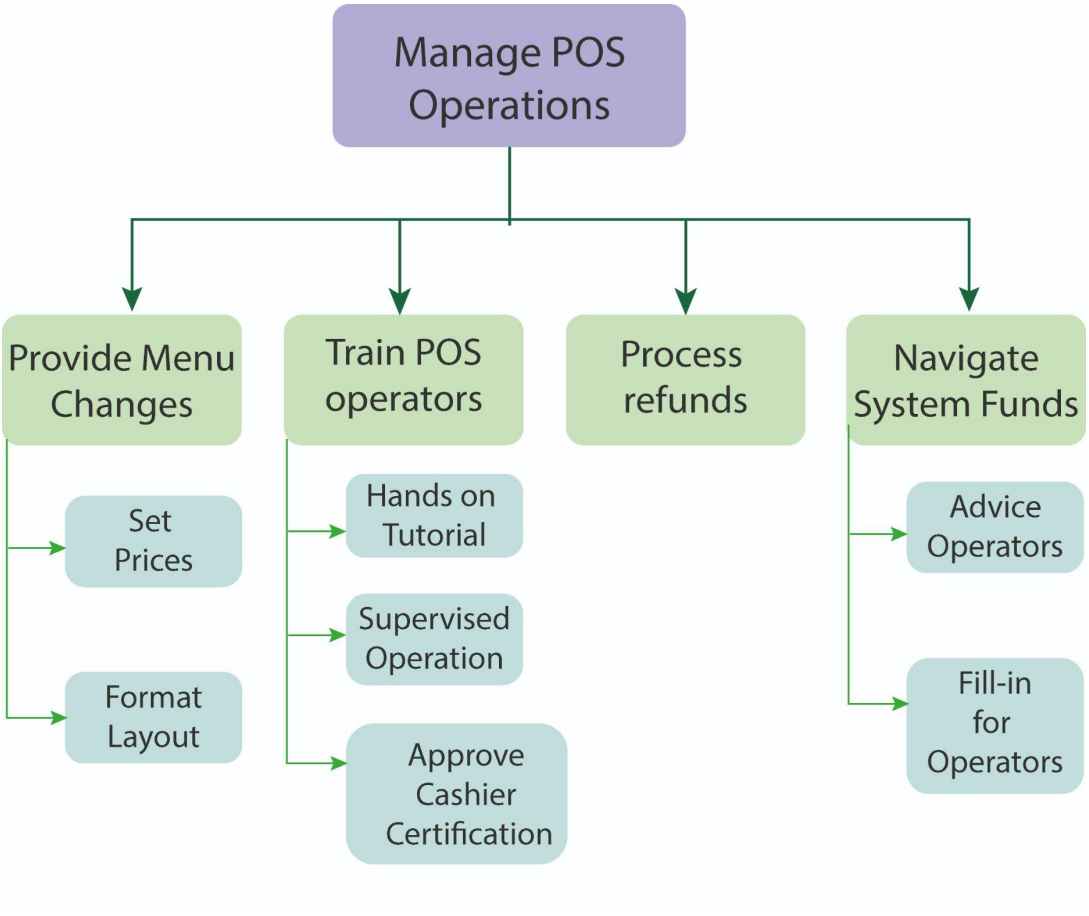


Figure 5: Manage POS Operations Hierarchical Task Inventory

For our group's hierarchical task inventory models, shown above - we first decomposed the tasks of one major work role - the manager role at Owens into its sub-roles. The first distinct sub-role is the system administrator who is in charge of updating menu pages, prices, available items, and the overall POS interface. Next is the assistant manager sub-role, these individuals are in charge of maintaining performance on the dining hall floor - they can help with worker placement, assess worker performance, step in to help cashiers, and more. Lastly, the final sub-role is the chief cashier officer, this individual is directly responsible for all cashiers on the floor, can clear open checks or provide refunds, can certify cashiers, and can fill in to help cashiers. These subroles are each uniquely captured within the Manage POS Operations tree.

2. Hierarchical Task Inventory - Operate POS

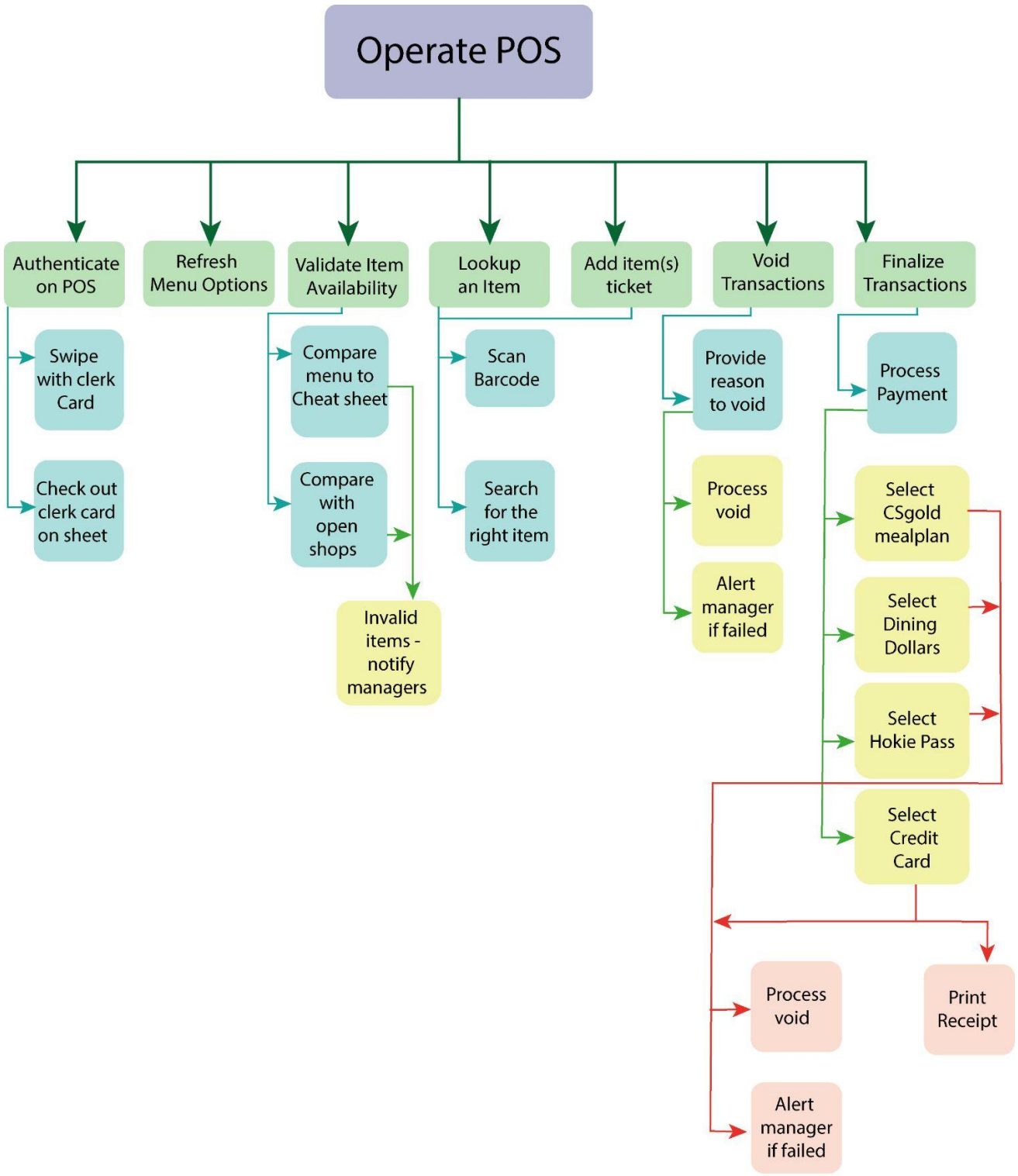


Figure 6: Operate POS Hierarchical Task Inventory

Next, we decomposed the tasks of the cashier's work role. The cashier has no distinct subroles but is made up of many user classes. The key tasks of a cashier are decomposed as follows: authenticating or deauthenticating on the POS, refreshing menu items, validating item availability, looking up an item, adding an item to a ticket, voiding a transaction, and finalizing a transaction. All tasks, except for refreshing menus, can be further decomposed into subtasks. Some tasks have extensive decompositions and branching, like finalizing a transaction, which has further branches down the tree.

D. Task Sequence Models

1. Usage Scenario: A Refund Task on a Busy Day at Owens Food Court

It is a busy day at Owens Food Court on the campus of Virginia Tech. The cashiers are working tirelessly to serve the consumers, where both queues are being used, with consumers waiting on both the left and right sides. David, a student in a rush, found himself on the right side of the queue, while Anna (another student) on the left side patiently waited her turn. As David and Anna approached the cashier's station, they both placed their food orders on the counter. While processing their orders simultaneously, the cashier instructed Anna to swipe her Hokie Passport first for payment. However, because he was in a rush, David misunderstood and swiped his Hokie Passport first.

Realizing the mix-up, the cashier promptly asked both David and Anna to wait momentarily, explaining that a refund would be necessary to resolve the situation. The cashier also informed the other consumers in line to either hold their positions or find other queues to prevent further delays. The cashier started to search for the manager, who possesses the authority to process refunds. After a brief hunt, the cashier finally found the manager, who came and started with a sincere apology to David and Anna for the inconvenience they had experienced.

The manager initiated the refund process by first printing the existing receipt, which displayed the incorrect payment. Next, using the POS system, the manager highlighted the erroneous transaction items and clicked the "Void" button, selecting the Refund option. The system prompted the manager to swipe their clerk card and enter the refund amount in dollars, which was then transferred to the manager's account. During this process, the cashier extended another heartfelt apology to the consumers while they were waiting. Understandably, they were not thrilled with the situation, having endured a long day at school, feeling both hungry and tired. David, however, couldn't help but feel partially responsible for the mix-up due to his haste.

To complete the refund process, the cashier requested David's Hokie passport to swipe it, ensuring that the money was correctly added back to his account. The

manager, on the other hand, instructed the POS system to print a fresh receipt for the cashier before leaving the cashier workstation. The cashier expressed his thanks to the manager for their assistance and proceeded to finalize the purchasing process. Starting with Anna's order, followed by David's, the cashier made sure to apologize once more for any inconvenience caused by the earlier confusion.

This incident served as a valuable lesson for the cashier, who now took extra care to communicate clearly with each consumer about who should pay first to prevent any future misunderstandings. As the day continued, the cashier continued to serve new consumers, striving to provide a smoother and more efficient transaction process for all.

2. Step-by-step task sequence model

2.1 Item Lookup on POS

Task Name: Cashier using the POS System for Item Lookup.

Task Goal: The goal is to find specific food items using the POS system and ensure a smooth checkout experience.

Task Trigger: A consumer, after buying a Danish pastry, attempted to use the barcode scanner at the cashier's counter, but it failed.

Cashier:	**POS system:**
1. Initiates the item lookup process in the POS system.	2. Displays options for item categories (e.g., beverages, sweet food, prepackaged, grab-n-go).
3. Navigates through the available item categories on the POS system to narrow down the search.	
4. Selects the relevant category based on the consumer's food item, in the current scenario it is “pre packaged” category.	5. Displays a list of items within the selected category.
6. Scrolls through the list of items to find the Danish Pastry.	

⚡ **Barrier**: Food item not found in the selected category.

Response to barrier:

7. Returns to the main menu and consider searching in other categories.	
9. Selects “Sweet food” category.	8. Displays options for item categories.
11. Adds the item to the consumer's transaction.	10. Displays a list of items within the selected category. This list includes “Danish pastry”.
12. Proceeds with checkout.	

2.2 Consumer Payment Processing

Task name: Processing a consumer Purchase

Task goal: Assisting a consumer in making a purchase and handling transactions.

Task trigger: A consumer finishes ordering food from a store in the food court during their lunch break on a Tuesday afternoon and approaches the cashier's counter to make a payment.

Cashier:	**Consumer:**
1. Greets the consumer as they approach the counter.	2. Either tell the cashier the food items they've ordered or place their food bowl on the counter for checkout.
3. Uses the common POS system to find and confirm the food items the consumer ordered.	

⚡**Barrier**: Consumer communicates the wrong order, and the item has already been added to the cart by the cashier.

Response to barrier:

4. Removes the items that are mistakenly added from the cart and request the consumer to provide the correct list of items they have purchased. 5. Proceeds to the checkout process and asks the consumer to proceed with the payment.	6. Unsure about the available payment methods, asks the cashier to provide different payment options.

Step Goal : Gain a clear understanding of the available payment options.

8. Provides information on different options. 10. Informs the consumer that they can make a self-payment by either tapping or swiping their Hokie passport.	7. Inquires about the various payment methods available. 9. Choose a Hokie passport as a suitable payment method for their purchase and proceed with payment. 11. Proceeds to swipe the card for payment. 12. Payment successful.

2.3 Insufficient Fund Failures

Task Name: Handle Transaction Failure due to Insufficient Funds

Task Goal: To address the transaction failure problem by seeking assistance from the manager.

Task Trigger: During a food payment, an error occurred, indicating insufficient funds on the card. This led to a pause in the point-of-sale system until the matter was resolved.

Cashier	Consumer
1. Informs consumer about insufficient balance and asks to continue payment with other modes of payment such as a credit card. 3. The POS is on the transaction failed stage and is not able to proceed further.	2. Is ready to proceed with credit card payment.

⚡**Barrier**: It is a challenge for the cashier, as they lack the authority to resolve the issue and must seek a manager's assistance.

Response to barrier:

Cashier	Manager
4. Contacts a manager to report the issue and request assistance. 8. Proceeds with the transaction.	5. Responds to the cashier's call and arrives at the checkout counter. 6. Uses their authorized card to the Point of Sale (POS) system to review the transaction and assess the situation. 7. Authorizes the system to skip or bypass the insufficient funds issue for the current transaction and proceed with it.

3. Essential use case task sequence model

3.1 Voiding Process

Task: Voiding an item that was wrongly selected
Goal: To void an item, so a wrong transaction can be avoided
Trigger: A consumer notifies the cashier or cashiers notice by themselves

User Intention	System Responsibilities
1. Cashier: Express intent to void an item	
2. Select the wrong item from the added items list	3. Highlight the selected item
4. Click "Void" button	5. Show a dialog box with "Reasons to Void" options
6. Select a "Reason to Void" option	7. Request to confirm the "Reason to Void" option choice
8. Confirm the selected "Reason to Void" option	9. Remove the selected wrong item from the added items list

3.2 Hokie Passport Refund Process

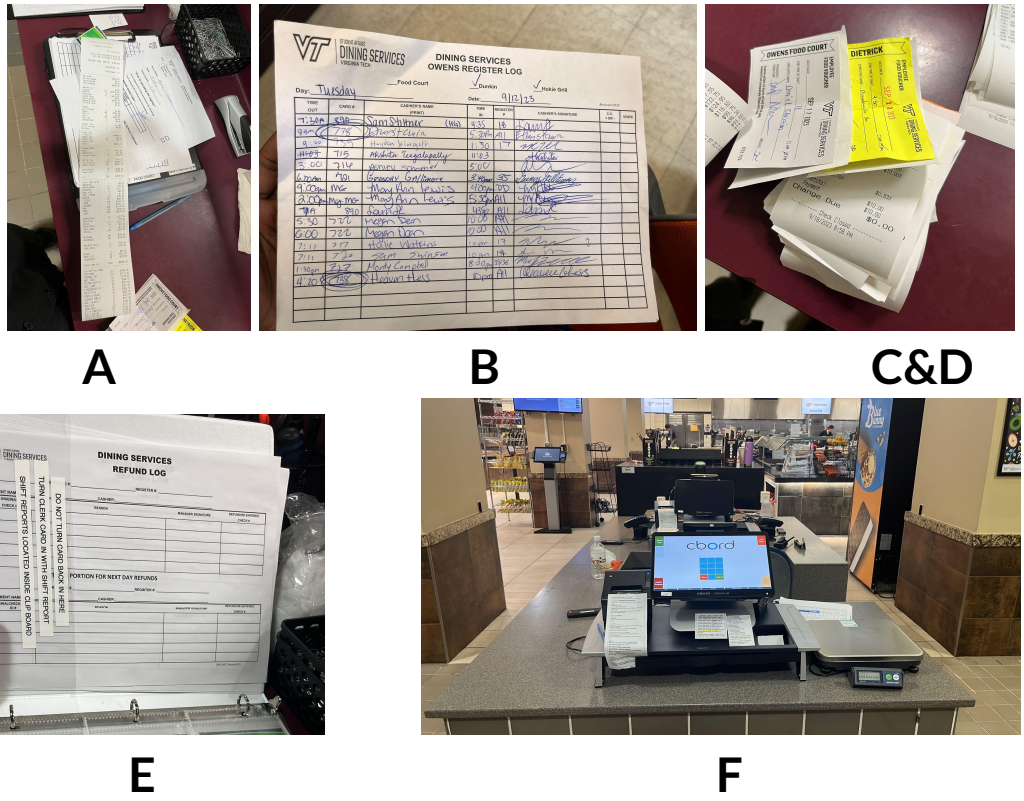
Task: Doing a refund using the POS system for a consumer who paid via Hokie Passport
Goal: To refund an item in which a wrong payment transaction was made
Trigger: A cashier notifies the manager about the need for a refund

User Intention	System Responsibility
1. Manager: Express intent to do a refund	
2. Print existing receipt which has the wrong payment	
3. Express intent to cancel the wrong transaction	
4. Select the wrong transaction items	5. Highlight the selected items for the wrong transaction

6. Click “Void” button	7. Show dialog box of “Reason to Void” options
8. Select the “Reason to Void” No.20 (the Refund option)	9. Ask to swipe in Manager clerk card
10. Swipe in Manager clerk card	11. Ask to enter the Refund amount
12. Enter the Refund amount	13. Transfer the Refund amount to manager account
	14. Ask to swipe in consumer payment card
15. Cashier: Swipe in the Hokie Passport that was used for the original wrong payment	16. Add money back to consumer account
17.Manager: Ask to print new receipt for cashier	18. Print new receipt for cashier

E. Working Environment Models

1.Artifact Model



A B C&D

E F

Figure 7 (A-F): Artifacts

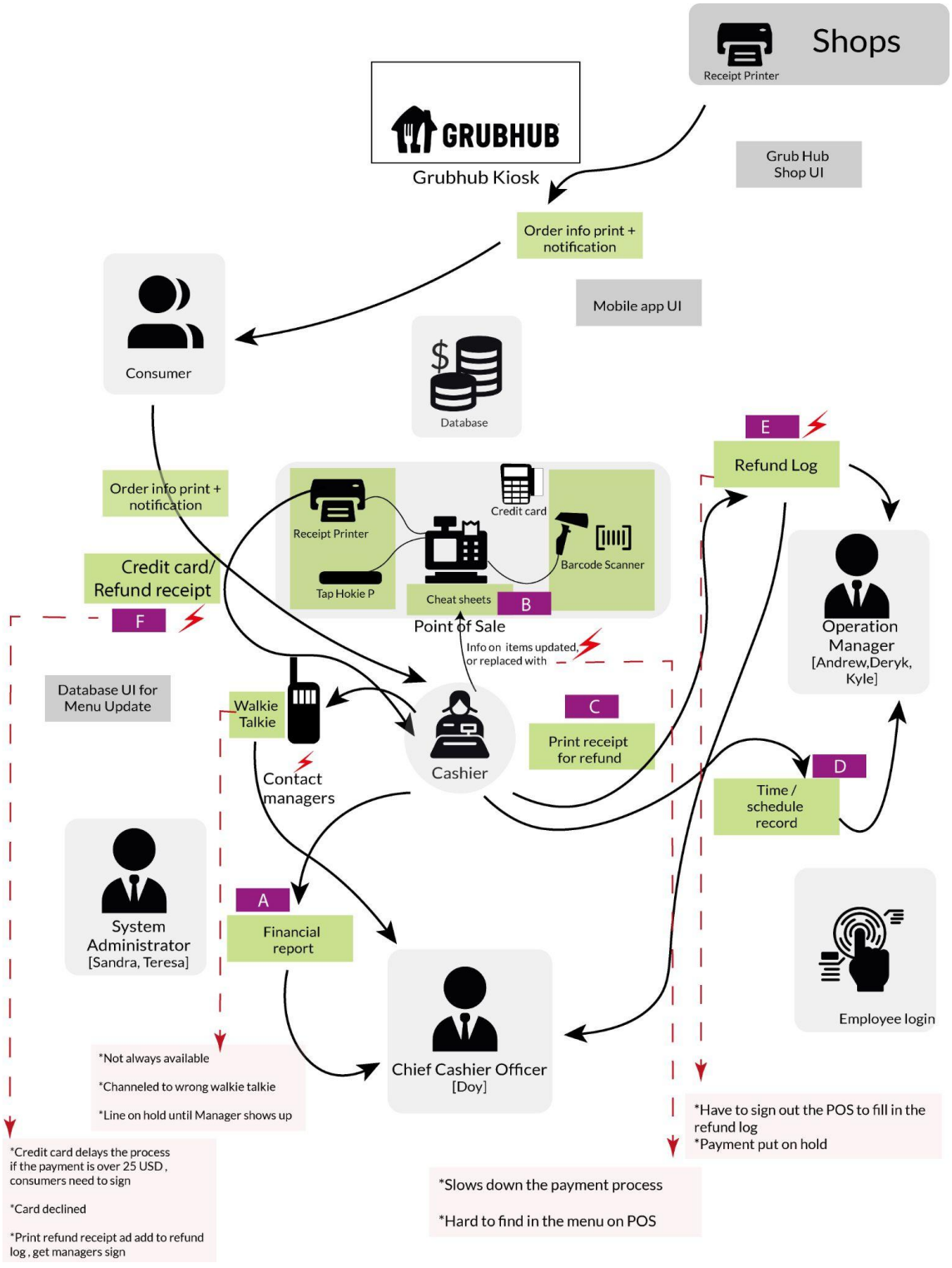


Figure 8: Artifacts model(green highlight-artifact, Pink for connection in page above with images , Flash sign- for barriers)

2. Physical Model

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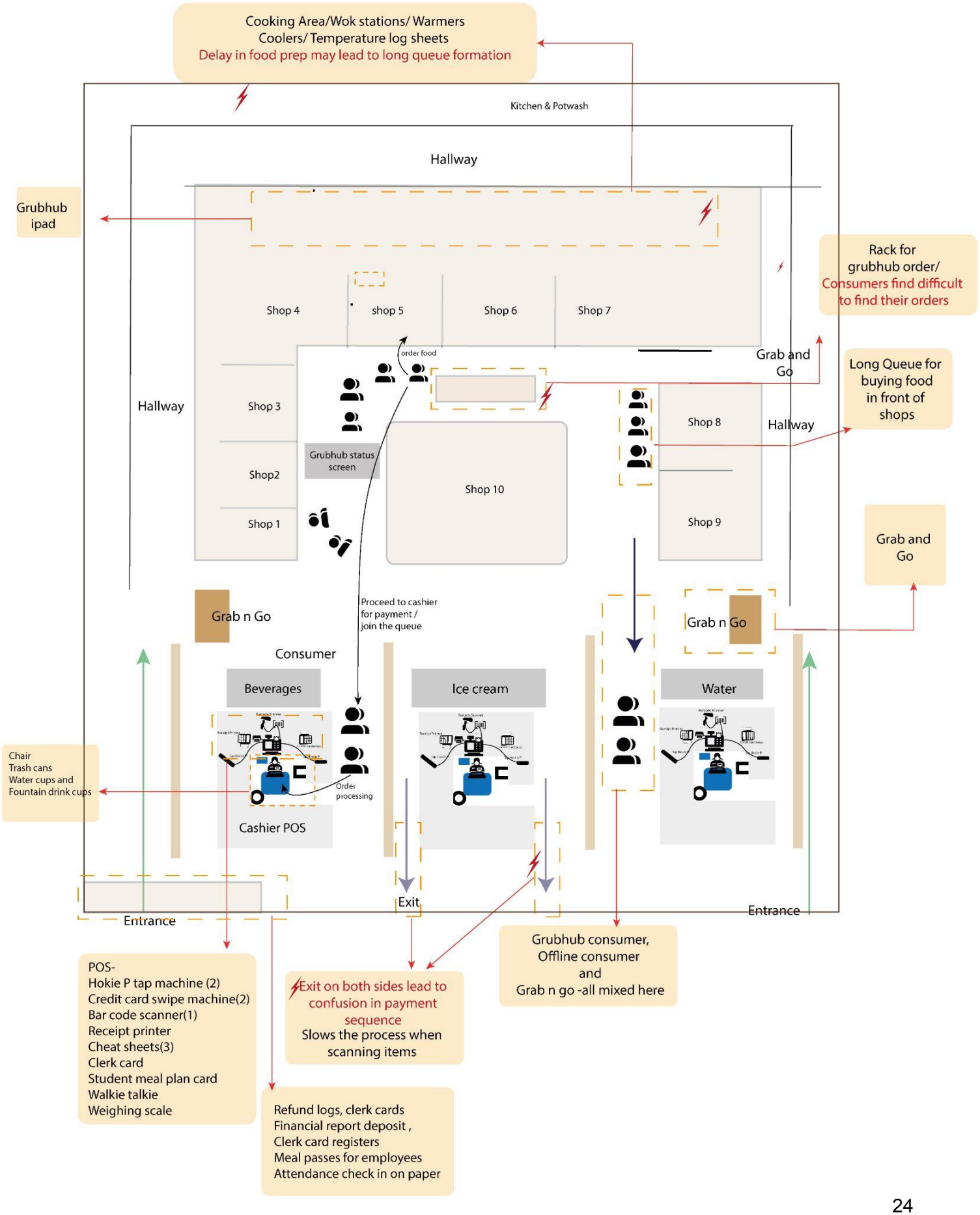
Physical Model followed by this page

Fig.9 : Physical Model


Cooking Area/Wok stations/ Warmers
Coolers/ Temperature log sheets
Delay in food prep may lead to long queue formation
Kitchen & Potwash
Hallway
Grubhub ipad
Rack for grubhub order/ Consumers find difficult to find their orders
Shop 4
shop 5
Shop 6
Shop 7
order food
Grab and Go
Long Queue for buying food in front of shops
Hallway
Shop 3
Shop 8
Hallway
Grubhub status screen
Shop2
Shop 10
Shop 1
Shop 9
Grab and Go
Grab n Go
Proceed to cashier for payment / join the queue
Grab n Go
Consumer
Beverages
Ice cream
Water
Chair
Trash cans
Water cups and
Fountain drink cups
Order processing
Cashier POS
Exit
Entrance
Entrance
POS-
Hokie P tap machine (2)
Credit card swipe machine(2)
Bar code scanner(1)
Receipt printer
Cheat sheets(3)
Clerk card
Student meal plan card
Walkie talkie
Weighing scale
Exit on both sides lead to confusion in payment sequence
Slows the process when scanning items
Grubhub consumer,
Offline consumer
and
Grab n go -all mixed here
Refund logs, clerk cards
Financial report deposit ,
Clerk card registers
Meal passes for employees
Attendance check in on paper

6. Barriers Summary

Throughout the development of our various models, we encountered various barriers - these barriers are summarized below.

Barriers	**Source Model**
Confusing Cashier Interface	Step-by-step task sequence model
Order Errors and Voids	Step-by-step and Essential use case task sequence model
Real-Time Food Item Updates	Flow Model
Payment Method Clarity	Step-by-step task sequence model
Communication with Chief Cashier Officer	Artifacts Model
Cheat Sheets	Artifacts Model
Payment Errors	Essential use case task sequence model and Artifacts Model
Refund Process	Essential use case task sequence model
Payment sequence confusion/ Paying for someone else accidentally	Physical Model
Difficulty finding grubhub order	Physical Model
Delay in food preparation leading to longer wait time	Physical Model

Confusing Cashier Interface: One major problem we identified was the confusing interface of the POS. It caused delays in transaction processing and introduced several operational issues. For instance, locating food items required cashiers to manually browse through menu pages and item categories, and some items could be assigned to multiple categories, making them hard to find. This problem could easily be fixed by adding a search bar to the interface.

Order Errors and Voids: Another design-related issue was the handling of order errors, if a customer provided an incorrect name for a food item or when a cashier selects a wrong food item, the entire order must be discarded as void. Because the number of voids is considered a performance evaluation, each voided transaction has an impact on a cashier's performance evaluations. This barrier could be resolved through the implementation of a method to rapidly remove incorrect selections without a performance penalty to cashiers.

Real-Time Food Item Updates: There is no method to update food items available for purchase in real time. All food items are displayed in the interface regardless of availability in the dining hall. This makes the search for food items complicated and time-consuming.

Payment Method Clarity: There is no clear process in place to inform consumers of available payment methods. This has led to consumers asking questions at the checkout, which is inconvenient, especially during busy times.

Communication with Chief Cashier Officer: If a cashier wants to communicate with the chief cashier officer currently this process relies on walkie-talkies, which occasionally experience connectivity issues or route connections to the wrong person. Additionally, the chief cashier officer might not always be available, which can cause delays in issue resolution. When this issue occurs, the queue is placed on hold until the manager arrives.

Cheat Sheets: The use of a manual cheat sheet near the cashier to track updated or replaced items is time-consuming. Cashiers must manually search the list and then locate items in the POS system, slowing down the payment process.

Payment Errors: If the payment via hokie passport fails due to insufficient funds, and payment subsequently fails via alternative payment methods, the entire customer queue will be put on hold until the operations manager arrives and resolves the issue. Additionally, if using a credit card, if the payment exceeds $25 the customer needs to sign. Occasionally, the card reader can decline during signatures which prompts the use of a different card. These small inconveniences can result in a significant burden during peak hours.

Refund Process: The current refund process involves manual entry of various details, including bill numbers, refund reasons, and cashier and manager names and signs on a refund log placed on a table away from the POS system. This process is time-intensive and puts the cashier station on hold.

Payment Sequence confusion: Customers form a line on either side of the POS system, thus making it challenging to manage the line for the cashier. When dealing with one consumer for processing the payment, there were instances that the person on the other side of the POS accidentally paid for the other consumer. This then demands for corrective measures of refunding, leading to holding the line for the refund process to be completed.

Difficulty finding grubhub order: Once food is ready the consumer is notified about the food being ready for pickup. With up to 20-30 orders on the rack and counter it becomes difficult to identify the order even though there is a bill attached on it. This has led to picking up the wrong order or a long waiting time assuming the shop rang it by mistake or sometimes leading to forever search of the food in the racks.

Delay in food preparation: Due to lack of communication with the kitchen, chef or the preparation team there are instances where the amount of food that should be made available is not met on time. The poor location of kitchen and shops makes it hard to always keep the kitchen staff in loop.