The SSH Cloud - Easy Purchases for Students

Engineering Design Review

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Introduction

With the rapid development of science and technology, more and more smart home technology is adopted in student dormitories to improve convenience and efficiency. Traditional home devices are being replaced by modern connected devices that provide students with the ability to remotely control and monitor their living environment. To deal with this environment, many companies have decided to produce more and more advanced smart homes and use cloud platforms to control these smart homes. However, the students who live in these smart homes are far away from local supermarkets and grocery stores. Therefore, students prefer to shop online rather than go to local supermarkets or grocery stores. Therefore, we propose to build a new page for easy purchases for students aiming to help them to shop easily online and deliver to those who live in these smart student homes. This page will be displayed on the SSH Cloud's web page, and all students who live in the smart student home is allowed to through this page. Since this page is a part of the SSH cloud, the information about students who live here is stored in the cloud's back-end memory. Smart Student House has partnered with several supermarkets that provide information about products and prices that have inventory ownership. However, the price of the item added by the student may change over time or as the base price of the product changes. As a result, students can search and order groceries and other essentials to be added to their order or delivered directly to their houses on this page. Besides, if students need to combine orders for free shipping, this page will include if any students need delivery services that day, what the total cost is, who added what, and the total cost of all items for each member of the house.

Goals and non-goals

- **Goal:** This page aims to provide an easy and convenient platform for students who live in smart homes, and help them to search, order, and have groceries delivered directly to their residences. By integrating functions into SSH Cloud, helping students to use this function more conveniently.
- **Goal:** The page will allow students to combine grocery orders with other students, reducing delivery fees by enabling group purchases.
- **Non-goal:** According to students' shopping history to recommend personalized products.
- **Non-goal:** Tracking the progress of when students' goods reached.

Design Overview

The new "Easy Purchases for Students" page will by modular web design, and each module will show different information. Besides, all modules will use the UI design, with a table-based model layout. Each line in the table will display different information relevant to the module's content. Here is the detail about the four key modules:

- The first module will display the students' personal information and the goods which they have added to their shopping cart. Each line on the table will display a product, showing its information

and price. The final line will display the total number of goods which the student has added and the total cost of these goods. (Personal Information and Shopping Cart)

- The second module will show all available products from supermarkets that have partnered with SSH. The first line will display a search box to students, allowing students to quickly search for goods which they need. The remaining lines will display product details and their current prices. Prices will change the day depending on the promotions will come and base price changes. (Online Supermarket)
- The third module will display students who are interested in combining orders with other students to save on delivery fees. Each line will represent a student who currently has a demand for free shipping, allowing others to see them who need combine orders to save delivery fees. (Collocated Students' Information)
- The fourth module complements the third module by providing details about these students who have already combine order with other students to save delivery fee. Each line will list the products details, their prices, and the total number and cost of the items for each student, giving clear information about their shared orders. (Items and Prices for Collocated Students)

The students' shopping information will be aggregated from the available data regularly. The task will run once a day to collect the items in the students' shopping carts, purchased items and information related to the collocation order, store these data in the caching system of SSH cloud platform, and delete the relevant information if a student has already purchased the item or if some students are successful in collocating the order, and if a certain student meets the conditions for sharing the order (e.g., amount of money required for the free shipping fee), the system will notify the other relevant students immediately to share the order.

Existing Data

At present, we have recorded data related to Easy Purchases for Students. All students who live in smart student homes can access the existing views as well as retrieve data from these tables.

Table	Relevant field	Relevance
Student _ info	1. Student _ id, name 2. Address	This table stores the student's personal information (student_ id is the student's unique identifier), which can be used by the page to display the student's personal information, such as name, and address to manage shopping carts
Product_ inventory	1. product_ id, name, 2. price, available_ stock	This table records the inventory of products with supermarkets, including product name, current price, and available stock. This data is used to display the list of products and provide product details for the shopping cart.

Shopping_cart	1. cart_id, student_id, product_id 2. quantity, total_price	This table records information about the items in the student's shopping cart (product_id is associated with the inventory table), and each student can see the items in his or her shopping cart and the total price on the shopping page.
collocated_order	1. order_id, student_id order_status, total_cost 2. shared_order_flag, created_at, updated_at	This table stores collocation information, including the students involved in the collocation and the total price. The data in this table can be used to display collocation requirements and collocation details to help students shop collaboratively and reduce shipping costs. And through (share_order_flag) to determine whether the collocation order reaches the free shipping threshold or not
Collocated_order_items	1. Order_id, student_id, item_id 2. Quantity, price, total_cost	Store the items and their prices added by each student participating in a collocation. This allows each student to see the items and amounts that have been purchased by other spellers.

Alternative

Aggregate data in real time when a student living in a smart student house manipulates this page.
This approach allows students to aggregate data as they perform actions on the page, such as students select items on the page and add them to the shopping cart.

- Pro: You can make sure that every time a student uses this page, they get the most up-to-date data.
- Pro: This reduces the need for regular daily data processing and optimizes system resources.
- Con: During periods of high student activity, especially when multiple students are using the system together, the system may experience delays or slower responses.
- Con: Each student operation triggers data aggregation, which may lead to excessive consumption of CPU, memory, and other resources.
- Con: Increased frequency of database queries and data processing may increase system resource usage.

Milestones

Milestone 1: Complete the relevant functionality required for the "Easy Purchases for Students" page, ensure that all modules meet the user's needs, generate complete technical documentation, and clarify the data's structure and interface.

Milestone 2: Establish back-end logic and configuration database, ensure efficient storage and processing of student shopping cart and product information, update SSH cloud, update product information and order processing in real time, ensure data synchronization and accuracy.

Milestone 3: Develop a modular front page to display students' personal information, product information, order information, and ensure that the page and back office can update data in real time.

Milestone 4: Conduct thorough testing of each module's functionality to ensure smooth operation. Optimize data processing speed and address any identified loopholes or issues during the testing process to guarantee system stability during operation.

Milestone 5: After completing the above steps, release the applicable version to students, collect relevant feedback, optimize and modify related functions, design and performance according to the feedback, ensure that the page meets the needs of students, and make final optimization and adjustment before the release of the final version.

Milestone 6: The page is officially integrated into the SSH cloud platform, and the system is continuously monitored and maintained to quickly respond and fix possible problems to ensure the long-term stable operation of the page.

Dependencies

- UI/UX Team: They were responsible for designing the layout of the "Easy Purchases for Students" page, ensuring that the interface was modular, displaying student information, online supermarket products, and details of the order. They were also required to design changes in the existing SSH Cloud interface and add entrances to new pages.
- Back-end Development Team: The team will be responsible for developing the relevant interfaces to facilitate interaction between the front-end and the SSH Cloud platform. Mainly deal with data aggregation, such as student shopping cart information, product information, etc.
- Database Team: A new database structure needs to be created to store information related to student shopping carts, collocation requests, and supermarket items.
- Notifications Team: The team is implementing a notification feature to alert students who need to place an order for free shipping when an order reaches free shipping. The team needed to create a notification template that would be used to notify students using their contact information stored in SSH Cloud.
- Performance And Optimization Team: This team is responsible for optimizing the caching and retrieval functions of the system to keep the page responsive when the page is in peak student usage.
- Legal team: The team will need to review the relevant legal agreements to ensure that the implementation of the new functionality, particularly the part where student shopping information is shared, meets the requirements of privacy and data protection.
- Testing Team: Responsible for testing the front and back-end systems and identifying any potential issues or bugs before the "Easy Purchases for Students" page is officially released.

Cost

Depending on the design of the project, it is expected that the demand for cloud storage and other related resources will increase, such as processing student order information, real-time updating of product information, etc. Systems will require higher caching and data aggregation capabilities to ensure

pages are available at peak times and support real-time data updates for notifications and product information, and servers may require higher processing power, which may lead to upgrades in server hardware or cloud service resource requirements.

Privacy and security concerns

The "Easy Purchases for Students" page does not require the introduction of new permissions, as all the student information used comes from the student information stored in the SSH Cloud platform. However, since the page involves the sharing of student information in the Purchase Order, it is necessary to apply to the Purchase Order students for permission to disclose their personal information. If permission to disclose the information is obtained from the Purchase Order students, the system needs to process sensitive personal information before allowing it to be disclosed, and at the same time, the access rights to the students' information ensure that only the authorized personnel or system modules can access or modify the user's sensitive data.

Risk

Risk	Mitigations
Students may be less inclined to use the page	Develop a comprehensive outreach strategy and actively provide relevant promotional materials to explain the benefits of the new features to students and encourage them to actively use the page, thereby increasing usage and acceptance.
Poor user experience may discourage students from using the page	Releasing a test version to students and collecting feedback before the official release to adjust the design and functionality to ensure that the page is easy to use and meets the expectations of the students.
Late updating of related product information may result in incorrect information being generated.	Realize a real-time data update mechanism and regularly check and maintain the accuracy of the data to ensure the reliability of the information.

Supporting material

Cherrett, T., Dickinson, J., McLeod, F., Sit, J., Bailey, G., & Whittle, G. (2017). Logistics impacts of student online shopping: Evaluating delivery consolidation to halls of residence. *Transportation Research Part C: Emerging Technologies*, 78, 111–128. https://doi.org/10.1016/j.trc.2017.02.021