

# SSH – Recipe suggestion function

## Engineering Design Review

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## Introduction

The SSH camera system is designed to enhance the capabilities of the SSH Cloud by providing real-time information on the contents of the fridge by using image processing and image recognition algorithms. However, students feel the need to search for different recipes and dishes to cook based on the ingredients present in their fridge which is often time consuming. Many recipes also require ingredients which aren't readily available in the fridge leading to another search for recipes for which most ingredients are already available.

To address these challenges, we propose to enhance the capability of our app by extending SSH Cloud with a recipe suggestion function which, using the data about available ingredients from the SSH Camera, and a database of recipes suggests possible recipes using those ingredients. It may also be further developed to suggest recipes for which most ingredients are available and only some need to be purchased. Adding these features aligns with our interests of simplifying tasks for students and providing a smart solution for daily chores to ensure students can free up time for their academic and other extra-curricular activities.

## Goals and non-goals

- **Goal:** Suggesting recipes based on the contents of the fridge using a recipe database
- **Goal:** Suggesting ingredients to add to the fridge for recipes for which most ingredients are already available.
- **Non-Goal:** Keeping track of the date and time of when an ingredient was added to the fridge.
- **Non-Goal:** Calculating the cost of the ingredients needed to be added to the fridge for different recipes

## Design Overview

The new Recipe Suggestion function will be displayed in the SSH App and the SSH Cloud webapp in a new page linked to the pre-existing SSH Camera page. The recipe suggestions page will consist of:

- A list of suggested recipes
- The list of ingredients in the fridge owned by the user used in recommended recipes
- Options to filter results and sort by different criteria
- A list of recipes which require more ingredients than those currently available

Each recipe will also have different attributes like difficulty, time required and cuisine the recipe belongs to. The suggested recipes will be displayed in a list ordered by the number of ingredients it requires, time required and difficulty of the recipe. This information is aggregated from the data obtained from the SSH Camera and stored in the ingredient database. This data is then matched to that of our recipe database to recommend users with different recipes which use the ingredients available.

This can be achieved by using different SQL queries on our recipe database with the following tables:

Table	Relevant Fields	Relevance
Recipes	recipe_id, recipe_name, cuisine_id, difficulty	Storing basic information about each recipe
Ingredients	ingredient_id, ingredient_name, quantity_available	Stores information about the ingredients used in different recipes. This data is also used to match to our existing Ingredients database
Recipe_Ingredient	recipe_id(FK), ingredient_id(FK), quantity_required	Defines the relationship between different ingredients and recipes and the quantity required for the same

Another section will be added for recipes for which most ingredients are already present in the fridge but only some need to be bought. The recipes requiring the least amount of ingredients needed to be bought will be placed at the top.

## Existing data

Presently, we store the following data relevant to the recipe suggestion function:

Table	Relevant Fields	Relevance
student	student_id, student_name, ssh_id	Stores the information of students living in a house and their SSH accounts to link to the ingredients they own
ingredient	ingredient_id, ingredient_name, ssh_id(FK)	Stores the information about ingredients present in the fridge and their owners

## Existing utility functions

We have the existing AI functionality of the SSH Camera to recognize different ingredients present in the fridge. The SSH Camera is capable of storing information about the owner of different ingredients present in the fridge which allows us to recommend users with recipes for which ingredients the user owns.

For this feature we just use this existing technology to recognize different ingredients present in the fridge belonging to different residents and recommend different recipes based on the obtained information and matching it with the information present in the recipe database.

This process is run only when items are added or removed from the fridge to maintain the same operating costs and prevent overloading the server with database calls.

## Alternatives

### User Assisted Inventory Management

Users manually scan or enter ingredients via the SSH App as they add items to the fridge. The app then keeps track of items and suggests recipes based on this input.

*Pros:* Reduces the need for complex image processing, lower computational and storage requirement and straightforward implementation.

*Cons:* Relies heavily on user input, which may reduce convenience and accuracy and less automated than an image-recognition-based system.

### AI-Powered Recipe and Shopping Suggestions Based on User Patterns

The SSH Cloud learns user habits over time, suggesting recipes based on common preferences, cooking history, and typical shopping patterns.

*Pros:* Provides personalized, predictive recipe suggestions and can optimize for user convenience and preferences.

*Cons:* May take time to build accurate user profiles, still relies on baseline inventory management for real-time suggestions and complex to implement.

## Milestones

*Milestone 1:* Development of the Recipe database containing various dishes and meal options. The recipes can be classified by their different cuisines and difficulty.

*Milestone 2:* Implement backend logic to connect the ingredient database with the database of recipes. Implementation of the Recipe Matching Algorithm that uses detected ingredients to

suggest recipes. This will enable us to test the functionality and evaluate the performance on test data.

*Milestone 3:* Develop the recipe suggestion function further to include recipes for which most ingredients are available by using various SQL commands on our existing database. We can demonstrate this with a temporary UI to customers to gain feedback.

*Milestone 4a:* Get the notification team to write text for the notifications. Implement backend changes to send notifications through our existing SSH Camera app.

*Milestone 4b:* Allow the design team to come up with a suitable design for the new page. The design can go through an accessibility review. We can demo the final design to customers.

*Milestone 5:* The notification changes and page contents can go through localisation. The recipe suggestion feature can then be included in the next SSH release.

*Milestone 6(Optional):* Develop a feature that allows the user to add recipes to the database for further variety in available recipes.

## Dependencies

- *UI team:* Will need to design the recipe suggestion page, changes to existing views to link to the suggested recipes status page and implement the new and changed pages.
- *Database team:* We will need a new set of foreign keys to connect the ingredients and recipes databases and set up relations between the two for faster and more accurate recipe suggestions.
- *Cloud Infrastructure Team:* Manage and optimize the SSH Cloud infrastructure, ensuring reliable data storage, recipe suggestion processing, and data transmission.
- *Notifications team:* Need to create a template for the notifications regarding new suggestions for recipes.
- *Localisation team:* The page contents as well as the contents of the new notification email will need to be localised.

## Cost

We do not anticipate any meaningful increase in operating costs as a result of the new functionality proposed here. The recipe suggestion functions are basic SQL commands which require minimal processing power compared to the existing functionality of the SSH Camera which uses AI image processing to identify different ingredients.

The recipe suggestions will only be updated when new items are added or removed from the fridge, which furthermore reduces operating costs compared to refreshing after short intervals (i.e. hourly).

# Privacy and Security Concerns

All the data about ingredients present in the fridge obtained from the fridge is already present in the SSH Cloud and is protected by several encryption processes and is available to the users. As such there is no need to add other security features to the SSH Camera.

However, the history of recipes used by different users can be stored on the SSH Cloud for better recipe recommendations, exposing user dietary preferences. This can be mitigated by encrypting sensitive data both in transit and the server end.

## Risks

Risks	Mitigation
Users may perceive the product as intrusive or worry about how their personal data, dietary habits, and inventory data are used or shared.	Emphasize transparency in data usage, reinforce privacy safeguards in marketing materials, and provide clear messaging around data protection practices.
Students might not make use of the feature	Highlight the feature’s convenience and potential cost saving. Notifications about recipe suggestions will also increase with engaging more users
If the AI frequently misidentifies ingredients, users may become frustrated, leading to negative reviews and damaging the product's reputation.	Clearly communicate the AI’s capabilities and limitations in marketing materials, ensure robust testing and continuous improvement of AI accuracy and offer users the ability to manually correct inventory.

## Supporting Material

Consumer Technology Association (CSA), April 2021. The Smarter Kitchen  
CES, January 2022. The Kitchen 2030: How Food & Cooking Will Change in the Future