AI Cooking Manger – Ghost CookKing

Bulgogi Warriors

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Abstract — **Our team is trying to create an AI cooking assistant - Ghost Cooking King - using NUGU speaker. The ultimate goal is to give a user experience such as having a skilled kitchen assistant. The service is linked to LG's Signature Kitchen Suite and recommends some dishes depending on the ingredients that already exist in the refrigerator and user order. (like exotic, easy-cook etc.) As you select a recommended dish and amount of your cooking, shopping lists are provided. When you start cooking, you will be informed of the optimal time and intensity of the fire and detailed methods to cook step by step as if a person is next to you. This service could be improved when combined with smart kitchen, such as automatically adjusting the intensity of fire, timer, stove hood, the oven, etc.**

Role Assignments

Roles	Name	Task Description and etc.
User	Lee Won suk	Responsible for looking at the software through the perspective of an average user and giving feedback on the user experience. It's done by assuming the user's point of view and trying out if the interface is user-friendly.
Customer	Kouadio, Laura	Main responsibility is to give the requirements of the software and when the features are delivered to review them. Through the whole process of development communicates with the development team about the way the project is going.
Software Developer 1	Valiukenas, Airidas Tomas	Responsible for writing and developing software features and satisfying the needs of the customer. Implements the features of the project and if needed, adapts to the feedback given.
Software Developrt 2	Lee Jun I	Responsible for writing and developing software features and satisfying the needs of the customer. Implements the features of the project and if needed, adapts to the feedback given.

Roles	Name	Task Description and etc.
Developer manager	Ju Sang Han	Supervises the development of the service, managing deadlines and evaluation of software features. Also gathers information from user and customer if everything is going according to the needs expressed by them.

I. INTRODUCTION

A. Motivation

We focused on Cooking Manager that makes more comfortable with cooking, and made this service. Although the number of single-person households has increased and delivery services in the COVID-19 era have become rapidly popular, there are many problems such as high prices, too much food to eat alone, and trash such as plastic. Most of the people who live alone, when they first start living alone they start chasing the dream of cooking, but after cooking for a few days, they lose interest in cooking and live a life of not cooking ever again. However, people still feel the need to cook alone, and most people are willing and want to cook if the conditions are met. Probably, there are surplus ingredients, difficulties in cooking itself (entry barriers), and the hassle of washing dishes so even those who do not cook at all want to cook well alone. (we will do a survey) So we thought it would be nice to teach users how to cook using an AI speaker. However, people want to follow step by step tutorials through YouTube or cookbooks, but it is difficult to follow the process as it is, and it is too much for beginners to memorize the entire process. Also, it is too hectic to refer to videos or read books while cooking in the kitchen. Therefore, if users are a beginner, they will be interested in cooking, and a teacher right next to them. Further, if a user is used to cooking, this service will provide a user experience like having a kitchen assistance.

In addition to making the cooking stage easy, we were also interested in making the preparation stage comfortable. It would be convenient to know what recipes you can cook with the remaining ingredients in the refrigerator and how much shopping you need. We plan to make an AI agent to recommend on its own according to the needs of users. For example, if a user makes a command

such as exotic, easy-to-cook, or special food for anniversaries, suitable recipes are recommended.

B. Problem statement

There's few problems for a novice during cooking.

- There is a big entry barrier for beginners to start cooking.
- There is a hassle when you search the recipe for the dish they want to eat.
- There is a desire to cook comfortably.
- There is a difficulty in controlling the seasoning and amount of cooking.
- There is a desire to know what dishes can be made with leftover ingredients. If there are not enough ingredients in the refrigerator, it is convenient to purchase only the ingredients needed to make the dish.
- There is difficulty in cooking while referring to the recipe in real time. (If your hands are busy and wet, it is difficult to refer to the recipe or operate the electronic device.)

We can easily solve these concerns using a combination of AI speakers with electronic appliances.

C. Research on any related software

i) SuperCook

There are various applications on the app stores and counterparts on the web that work by inputting ingredients, and it gives you a recipe you can do with the ingredients. An example: SuperCook – it is both a web and a mobile application in which you can select ingredients from various categories and after every ingredient inputted the service updates what recipes you can make with the ingredients you have. You can filter out what meals or cuisine that you want. You can also have a profile to make the process easier.

ii) Hub Cooking

A service out in the market is Google Home's Hub Cooking. The way it works is you can say to the AI speaker assistant that you want a recipe. It gives you a recipe and after you choose it either through voice commands or through touch control, you can ask for a list of ingredients. After that you can navigate through the steps of the cooking process using voice commands.

iii) Giga Genie

There is an artificial intelligence speaker service called KT's Giga Genie. Giga Genie also supports smart recipe functions. It's the '10,000 recipes'. The main feature of '10,000 recipes' is that they actually support the recipes of people who are famous for cooking. For example, it can bring recipes from famous Korean celebrities such as Baek Jong-won and Kim Soo-mi. It also supports the ability to send recipes brought into mobile phones.

iv) TinyChef

TinyChef is a mobile app which can function through Alexa or Google Home or simply through the usual phone interface. Its main features are the ability to search for recipes with different filters, also it can plan the meals based on dietary requirements and make shopping lists. Another feature is the ability to one-click purchase the delivery of the groceries. Furthermore, it has the recipe step-by-step guidance feature.

v) Cooksy

A different kind of service is Cooksy. It's a new project that is an AI based gadget that can be attached in the kitchen which can help through the cooking process. It observes the process of you cooking live, by watching the temperature, ingredients. It can also lead through the recipe with the help of voice commands.

II. REQUIREMETS

A. Requirement 1

"The AI speaker should understand what the user said". To accurately perform the user's works and preferences, the speaker must be able to understand human conversations (syntax).

B. Requirement 2

"The AI speaker should speak slowly with simple words and short sentences". In order to be used by people from all ages, the AI speaker needs to make sure that what he is saying is understandable for everyone. The AI speaker should avoid using complicated or technical terms which a commoner would probably not understand. The AI speaker also needs to make short sentences to avoid overwhelming the user with too much information.

C. Requirement 3

"The AI speaker should connect to systems and appliances". The recipe is essential in the cooking process. In order to satisfy the needs of users and to implement the service, AI speakers need to be linked with related applications and related products.

D. Requirement 4

"The AI speaker should take into account the user's tastes". Even though the user probably only has ingredients in his fridge that he loves, the AI speaker should make sure not to propose a recipe which may not suit the user's tastes. For example, some people only like certain ingredients when they are cooked and not when they are raw. Since the speaker may be used by a whole family, the speaker should be able to propose recipes according to the person who will be cooking (for example, each member of the family has his own profile).

E. Requirement 5

"The AI speaker should take into account how much time the user has to cook". In order not to propose a recipe which is too long to make, the AI speaker should ask the user how much time he has for cooking before proposing a recipe. The AI speaker should allow a sufficient margin of time for the user not to feel pressured or stressed.

F. Requirement 6

"The AI speaker should propose several recipes to the user, maybe one hot and one cold". In order to maximize the chances that the user is satisfied with the AI proposal, the latter should propose at least 2 recipes, maybe one cold plate and a hot one. The AI speaker may also take the season outside to do a recommendation.

G. Requirement 7

"The AI speaker should wait for the user to say he is done with one step before announcing the next one". The AI speaker should be able to understand a small oral command from the user (like "ok, next step" for example) before announcing the next step.

H. Requirement 8

"Appliances like oven or induction should not operate itself until received the user's permission". The user might miss the speaker's order during the cooking process. Without permission, appliances should not operate automatically to avoid accidents.

I. Requirement 9

"Connected appliances should turn off after a certain amount of time." In terms of safety, the speaker should turn off the linked appliances to avoid accidents. In addition, by setting up the time, users can circumvent overcooking. People with edgy tastes are sensitive to all kinds of matters.

III. DEVELOPMENT ENVIRONMENT

A. Choice of Software Development Platform

a) Which platform and why? (e.g., Windows, Linux, Web, or etc.)

We will go to use Windows 10 and macOS. Windows 10 is a series of personal computer operating systems produced by Microsoft. According to the data onto 'Usage share of operating systems', in the area of desktop and laptop computers, Microsoft Windows is generally above 70% in most markets and at 77% globally. Then, it could be familiar to both of users and developers and decided to use. On the other hand, macOS is a Unixbased operating system and is a popular choice since lots of people prefer using Mac so we also choose it for developing.

b) Which programming language?

i) Python 3.8

Python is an interpreted, high-level and general-purpose programming language. Created by Guido van Rossum and first released in 1991. We use python for developing backend server. because it is one of the most popular programming language for developing an artificial-intelligence-related-program. Moreover, it can be run on various OS, including Microsoft Windows, Mac OS, and Linux OS.

ii) Javascript

Javascript is a high-level, interpreted scripting language that conforms to the ECMAScript specification. Javascript has flexible grammars: freedom from indentation, loose type checks. Also, it adopts modern programming paradigms and has convenient and great features: function programming, reactive programming. We use JavaScript for our android application development.

B. Cost estimation for your built

Name of software	Cost
AWS EC2	0
Nugu play builder	0
Github	0
Notion	0
Jupyter Notebook	0

C. Software in Use

a) AWS EC2

AWS has significantly more services, and more features within those services, than any other cloud provider–from infrastructure technologies like compute, storage, and databases–to emerging technologies, such as machine

learning and artificial intelligence, data lakes and analytics, and Internet of Things. This makes it faster, easier, and more cost effective to move your existing applications to the cloud and build nearly anything you can imagine. AWS also has the deepest functionality within those services. For example, AWS offers the widest variety of databases that are purpose-built for different types of applications so you can choose the right tool for the job to get the best cost and performance.

b) Jupyter notebook

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more.

c) Flask

On top of python, we use Flask framework for the server. We will construct a server with AWS EC2 and control it with Python and Flask framework. Flask is famous for its lightness, simplicity, and speed.

d) React Native

React Native is a JavaScript framework for writing real, natively rendering mobile application for Android. It's based on React, Facebook's JavaScript library for building user interfaces, but instead of targeting the browser, it targets mobile platforms. React Native applications are written by JavaScript.

e) Android Studio
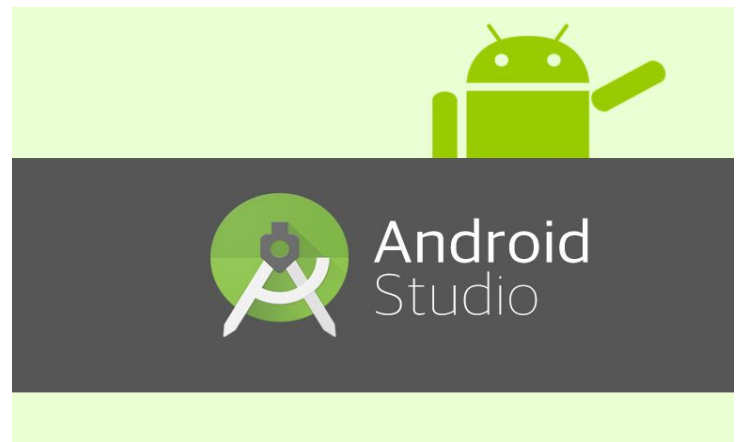
The IDE itself is based off the very popular IntelliJ IDEA from JetBrains and is being offered by Google for free. On the other hand, Eclipse is more mature than ever and Google's ADT plugin which transforms the popular IDE into a fully featured Android developing environment has become very stable. Instead, lots of developers want to get associated with Android application because of incredible growth. Besides, Android Studio platform developers also use Eclipse to develop applications, but always thought of Eclipse like a "StudentProject IDE (Integrated Development Environment)" and learned about it

f) GitHub

GitHub is a Git repository hosting service, but it adds many of its own features. Git is a command line tool and GitHub provides a Web-based graphical interface. It also provides access control and several collaboration features, such as a wikis and basic task management tools for every project. This will help us to co-work each other and see our own code more easily. In addition, various open sources of sign language will be provided and will help us use them directly and indirectly.

D. Task Distribution

Name	Task
Lee, Jun I	Backend & NUGU
Valiukenas, Airidas Tomas	Frontend
Lee Wonsuk	Backend & NUGU
Ju Sanghan	Backend & NUGU
Kouadio, Laura	Frontend

(we will do this at next design part)

IV. SPECIFICATIONS

1) Log – in Page

a) Sign up for the application

To use the application the user first must Sign-in with his created profile. There are 2 fields to input information and if the user's inputted information is correct, on pressing the login button the user is signed in and redirected to the home screen of the application.

b) Sign up

To be able to sign-in the user must create an account. On the sign-up page there are 3 fields for the user to input his information. Once the user inputs the correct information and presses the sign-up button and verifies his email, an account is created with which the user can sign-in to the application.

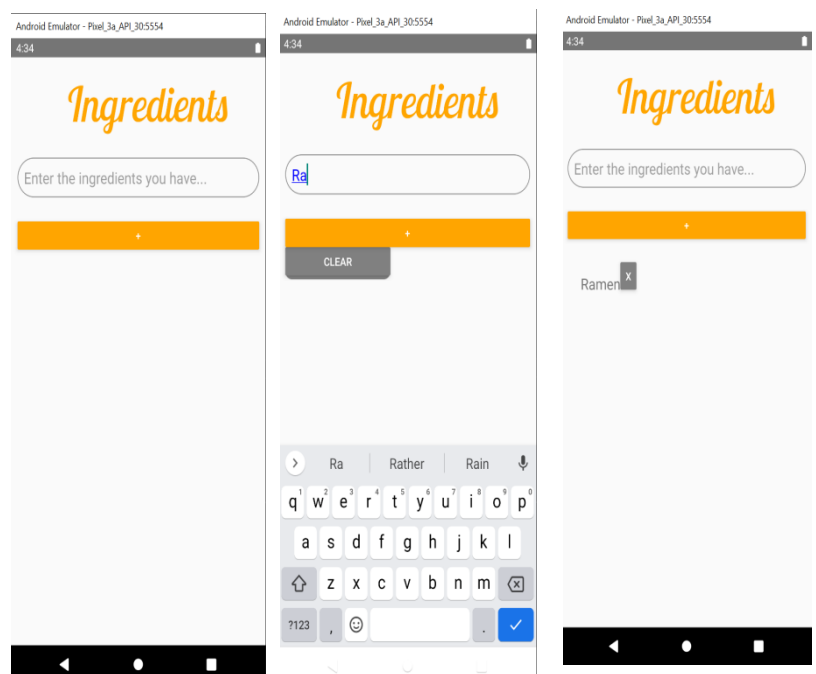| Directory	File Names	Module Name
App	App.js AppButton.js AppTextInput.js Allergy.js AllergyStyles.js ConfirmSignUp.js CookingStart.js Home.js Ingredient.js IngredientStyles.js SignIn.js SignUp.js styles.js	Application
Dataset	1000.json	None
SE	SE Latex.pdf SE assignment 2.docx	Documentation
root	Backend.py	Backend

2) Main Pages

a) Allergy Management

The user might have some ingredients he can't eat because of allergies. The application has a special page on which the user can add every ingredient which should not be included to the recipes proposed by Ghost_Cook_Cooking. The user simply has to go the "allergy" section and enter the ingredient in the search bar. As soon has the user starts typing, a clear button appears, allowing the user to erase everything in the search bar all at one. Once he is done, he can press the button "+" to add the ingredient to the list of allergies. It is possible for the user to remove an ingredient from the list at any time by pressing the "x" next to the name of the ingredient. The server will take in account the ingredients in the "allergy" list before proposing a recipe.
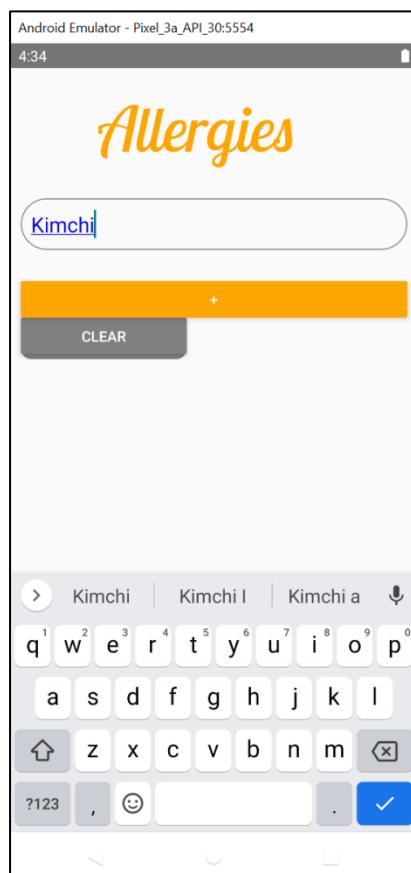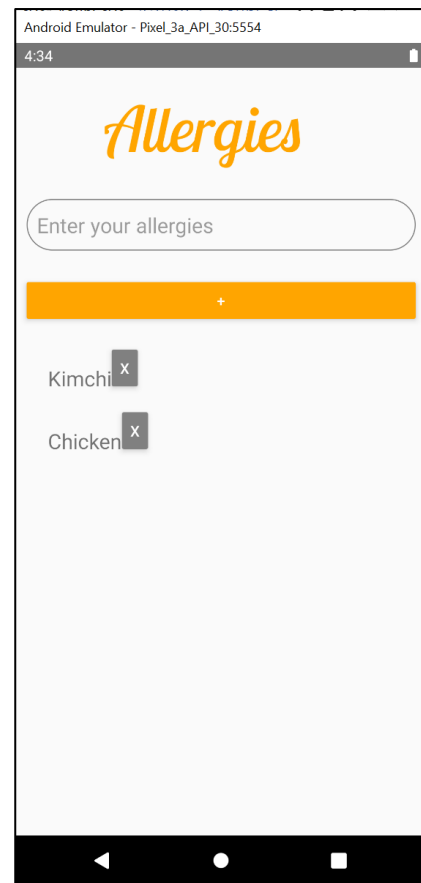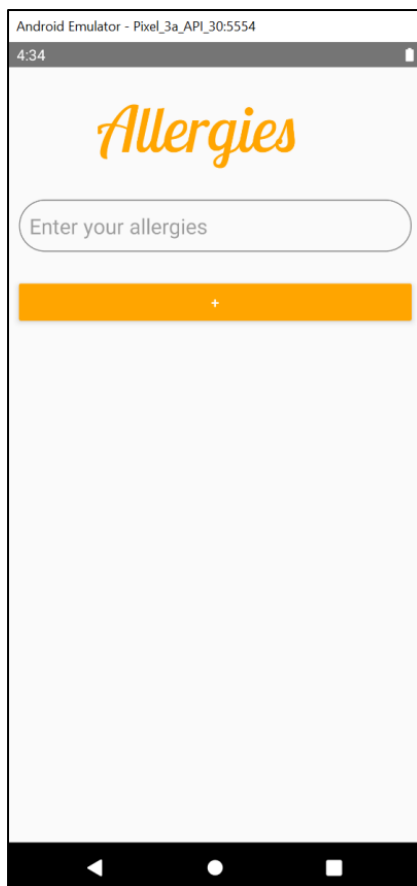
b) Ingredients Management

The ingredient page allows the user to enter every ingredient he has at home to cook. Based on that list of ingredients, the Ghost Cooking application will propose a suitable recipe. To enter an ingredient, the user simply has to insert its name in the search bar and then press the "+" button. As soon has the user starts typing, a clear button appears, allowing the user to erase everything in the search bar all at one. It is possible for the user to remove an ingredient for the list at any time by pressing the "x" next to the name of the ingredient.

c) Guidelines during the cooking process:

After calculation, Ghostcooking application will propose several recipes to the user. The user will then be able to choose one option and start cooking. To do so, will only have to press the "요리를 합시다″ button, located under the bell. After pressing that button, the NUGU speaker will start explaining the first step of the recipe of the user. In the aim to maximize the chances that the user will succeed to make the given recipe, videos or images will be displayed through the application to help the user understanding what the NUGU speaker is explaining.

Android Emulator - Pixel_3a_API_30:5554

4:34

Ghost cooking

요리를 합시다

맛있는 음식을 같이 만듭시다
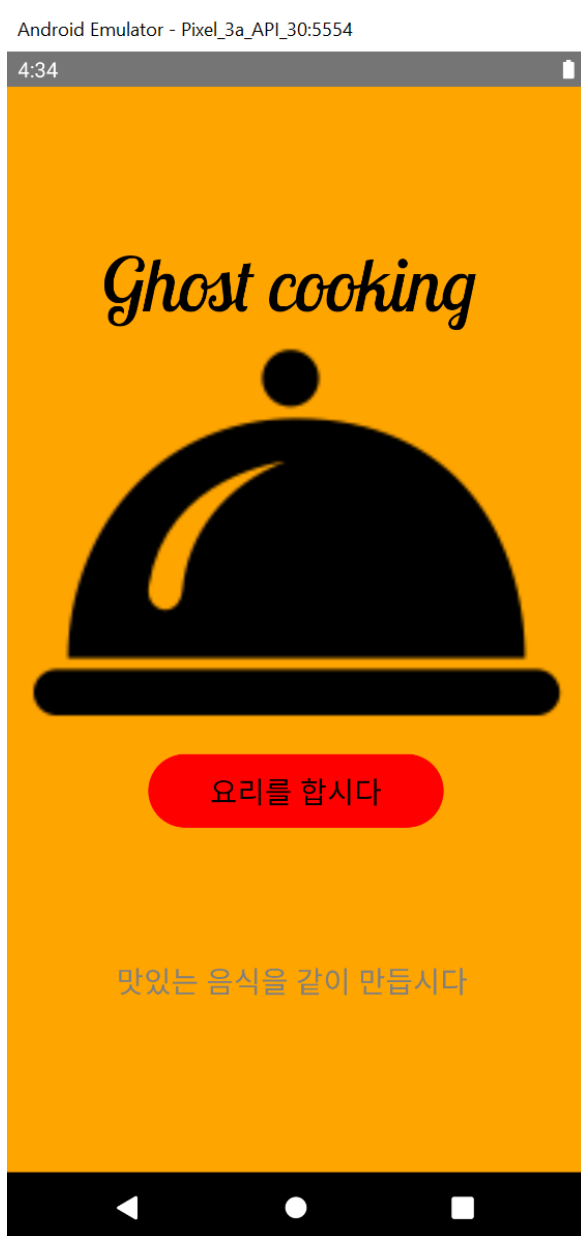
3) NUGU Speaker

a) NUGU speaker is waiting for the user to speak.

```
Recipe_making(A):

    current_step ← 0

        while current_step ≤ lenght_of_the_recipe:

            NUGU announces the step "current_step"
              while users_speech not equal to "Next
                 step":
                    wait ()

            current_step ← current_step + 1

            NUGU announces the step "current_step"
```

NUGU announces "The recipe is finished, congratulations" The cooking stage takes different times for each user's proficiency, so the app is waiting until the user's sign is called. Additionally, implement a function that repeats the current step every certain period in consideration of volatility of information in oral.

This screen appears after selecting the food to make. Users can stop it by talking to the NUGU speaker, but users also can stop or end the ongoing process through press the pause button and end button below.

b) If there's a smart cooktop connected to it, it prevents it from going beyond the set cooking time.

```
Recipe_making(A):
    current_step ← 0
    while current_step ≤ lenght_of_the_recipe:
        NUGU announces the step "current_step"
        if current_step implies "cooking process":
            Start_time ()
            Timer_activated =1

        while users_speech not equal to "Next
            step":
                wait ()
                if timer_activated is equal to 1
                and start_time () ≥ limit:
                    NUGU announces
        "Time out, I stopped the oven"

                    STOP the oven and
                    break the while loop

        current_step ← current_step + 1

    NUGU announces the step "current_step"
```
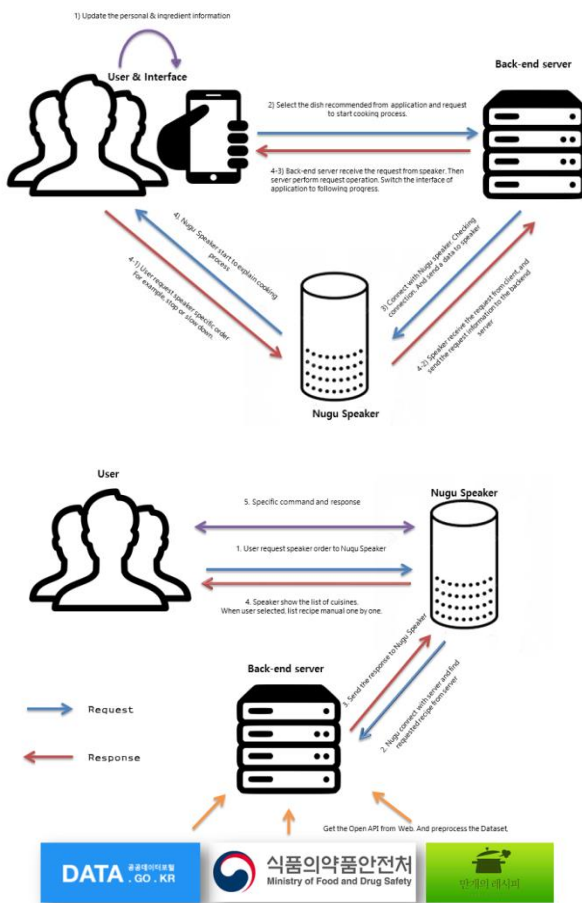
NUGU announces "The recipe is finished, congratulations"

Currently, We know that AI speakers cannot manage the entire kitchen. Still, automatic fire control and timer functions will bring convenience in the sense of suggesting future development directions.

V. ARCHITECTURE DESIGN & IMPLEMENTATION

1. Overall Architecture

When the user asks about the ingredient or food name through a NUGU speaker, the parameters are delivered to the backend proxy based on the data learned by the NUGU play builder. And based on the parameter, we return the insufficient ingredients and cooking methods to the user as an output. Also, We implemented the app to make the information simpler and more visualized

2. Directory Organization

A. Function parts

i. _load_index : Processing the Dataset. When we first requested and received information through open api, the dataset was too messy. Pre-processing is performed to change it to look cleaner and better. Eliminate useless words.

ii. _find_recipe : Indexing similar dishes. Choose one of the recipes that has the highest intersection of ingredients.

iii. find_recipe : use to return the recommended recipe name and recipe method.

iv. make_response: make response body for NUGU play builder.

B. Flask parts

i. When NUGU speaker send the request to flask parts, it received the formatted request body useing get_json(). After sending to functional part, make it into the form of data we want. After that, through the make_response mentioned above, NUGU speaker recognizes the backend parameter and answers the parameter to the user.

C. NUGU Play Builder

i. Create user utterance model

1. Intent: intent refers to a user's intention. Intent can be divided to custom intent and built-in intent. Custom Intent refers to Intent defined within Play, and Built-in Intent is an Intent provided by NUGU play kit that is expected to be commonly used in many fields, so it has been trained in advance. One of our intent is call bring.ingredients. It's used to bring the ingredient from user's utterance.

2. Entity: Entity is created and defined based on the type. The Entity type consists of Custom and Built-in Entity type. In order to understand a person's speech, it is necessary to learn various and many entities. When there are multiple words referring to one entity, it can normalize by adding synonyms.

ii. Create Action

Action: Action is to deal with the intents defined in the User Utterance Model, which was created in

anticipation of the user's utterance, when they are actually analyzed through the NLU engine, that is, action serves to answer or perform commands on the user's utterance within the play.

Utterance Parameter	{{INGREDIENT_ONE}} {{INGREDIENT_TWO}} {{INGREDIENT_THREE}} {{RCP_NAME}}
Backend Parameter	{{RCP_NM}}, {{RCP_METHOD}}, {{REMAIN_RPT}}

NUGU Play Builder's speech processing is as follows:

> Intent recognizes and performs action according to our speech. Through the action performed, the utterance parameters are delivered to the backend proxy, and through functioning, the backend parameter returns to speaker and answer to user what the user needs