

Smart Wine Cellar – Cave de Vin(Label D) DIOnyoS

Yujin Do
College of Engineering
Hanyang University
Dept. of Information System
Seoul, Korea
yujindo9@gmail.com

Jungi Kim
College of Engineering
Hanyang University
Dept. of Information System
Seoul, Korea
damnum3@hanyang.ac.kr

Yerin Cho
College of Engineering
Hanyang University
Dept. of Information System
Seoul, Korea
forjustice9839@gmail.com

Hyungseo Han
College of Engineering
Hanyang University
Dept. of Information System
Seoul, Korea
shorelinesquere@gmail.com

ABSTRACT

Our team is trying to develop User-Friendly wine cellar by appending additional functions to "LG wine cellar". By capturing and registering wines in "Cave de Vin(label D)", users can effectively manage their wines and wine cellar. Using wine recommendation and purchasing function can promote additional consumptions to wine and wine cellar. Also, by sharing the scene that enjoying wine on the social media, people can enjoy the marketing effect of LG wine cellar.

people who drink alone, and wine imports rose 110% year-on-year in the first half of last year. Thus, the demand for wine cellars also increased. However, there are too much information to enjoy wine, such as the way to store wine, or detailed information of the wines. But services that support people who try to get information of in the wine in Korea are poor. Therefore, our team felt the needs for a service that effectively records and manages the wine that I drink and drank, and further recommends and induces to user to purchase the wine.

TABLE 1. ROLE ASSIGNMENT

Roles	Name	Task description and etc.
Quality Assurance Manager	Hyungseo Han	He understand demand and requirement of application. They test the overall application from customers' point of view and report error and bug. They strive to maximize user experience by considering UI / UX.
Software Developer	Yerin Cho Jungi Kim	Software developers think about the software in general. They design and implement the requirements of application. They also strive to satisfy users and customers.
Development manager	Yujin Do	Development manager manages the overall project. She strive to meet the needs of customers. Also, she collects the feedback from users. After collecting feedback, she advises software developers to improve application quality.

1 INTRODUCTION

1.1 Motivation

Due to the COVID-19, the number of people who drink at home has increased significantly. Wine is one of the most popular drinks for

1.2 Problem Statement

There are many wine applications such as Vivino. However, there is a limitation that the service is based in a foreign country other than Korea. Currently, it is difficult to find information to better enjoy wine in Korea. Accordingly, the necessity of providing various wine information, wine purchase service, SNS sharing service, etc. to enjoy wine better by linking with the wine cellar to facilitate humidity and temperature control was recognized.

1.3 Solution

- (1) Available to manage wine and wine cellar effectively.
 - It is possible to manage users' wines and wine cellar in one application.
 - Effective wine management is possible by recommending appropriate wine storage methods to users.
 - Once the wine is registered, detailed information can be easily offered.
- (2) Available to create additional consumption of wine cellar.
 - By recommending new wines based on registered wines, new wines can be made, and even wine cellars can be consumed. B2B business development through collaboration with wine sellers is also possible.
 - By providing a user-friendly SNS sharing service, the promotional effect of LG Wine Cellar can also be expected.

1.4 Related Software

(1) Vivino

Vivino is the world's largest wine application, which helps users discover the perfect wine. When users scan wine label, it shows ratings, reviews, and prices of the wine. Users can easily click to purchase bottles on web or mobile in application. And it keeps track of wines which users like and recommend other wine for user.

(2) My Own Refrigerator (from GS25 convenience store)

My Own Refrigerator is a convenience store shopping service that allows user to discount, earn, pay directly from mobile. And user can store products purchased at the store. One of key features is 'Storage Box'. Users can check the storage history of purchased products and can use them later.

(3) CellWine

CellWine is an application which provides mobile wine collection. When users scan wine labels, application keeps track of cellars and log the cost and quantity of collections anytime, anywhere. And it helps users to record own rating score and flavors. It also helps users to explore different wine by giving recommendations.

(4) ThinQ

ThinQ is an application which connects washer, air conditioner, TV and other LG appliances and mobile phones. It automatically accesses the current state of products and get immediate notifications of products. Existing LG wine cellar only supports few functions. Users can control temperature of wine upper, wine lower and fridge drawer by ThinQ. And if users say, 'Hi LG, open the refrigerator door', or put your foot close to the product, the door open automatically.

2 REQUIREMENTS

2.1 Wine cellar registration screen

- (1) Select the LG wine cellar that the customer purchased.
- (2) Enter and register the serial number of the purchased product.
- (3) After authenticating the information (serial number, model), the application automatically creates the shape of wine cellar that user purchased and an empty floor of wine cellar.

2.2 Wine cellar screen - default screen after registered model

(1) Floors management menu

- (a) Wine add - on
 - (i) Customers take a photograph of the label of the wine
 - (ii) The application analyzes the label that from user-taken photograph.
 - (A) Application analyzes wine name, and date of manufacture.
 - (B) Customers enter the purchase date.

- (C) Application shows information related to the registered wine - tasting notes, average price, country, grape variety, food pairing, winery, vintage, comparison, management method, recommended glass, etc.
- (iii) After judging whether the temperature and humidity of the floor selected by the user is suitable, the application can recommend another floor
- (b) Temperature, Humidity management of each floor of model
 - (i) Inside the app, the temperature of each floor and the humidity of the model can be monitored on the left or right side of the virtual model.
 - (ii) If the customers want to adjust the temperature and humidity, then customers can modify these by pressing the mark in the application.
- (c) Wine cellar lock function
 - (i) Customers can activate lock function to full floor or floor by-floor via application.
 - (ii) To prevent theft and damage to wine cellar, customers can set alarms on locked floors.

(2) Individual wine screen

- (a) Detailed information about selected wine
 - (i) Customers choose one of the wines in their own wine cellar model.
 - (ii) The application displays detailed information about the selected wine, such as manufacture date, expiration date, purchase date, alcohol percentage, etc.
 - (iii) When customers drink a bottle of wine, user can delete the wine from wine cellar by clicking 'empty?' button.

(3) Wine history screen

- (a) Show the whole of wines that customer has drank so far.
 - (i) Display the drank wines using wine corks.
 - (ii) Recommends of wines that are likely to suit customers' taste based on the history of wine customers have drunk.
 - (iii) Recommendations are based on price, grape variety, taste and smell, and customers' nationality.

2.3 Social media quick link function

- (1) This function helps user to share wine and wine cellar which he has on social media such as 'Instagram', 'Twitter', 'Facebook' and so on.
- (2) Auto complete hashtag

When user uses 'social media quick link', user can get 'auto complete hashtag' function. Hashtag is made based on the name of wine cellar, and the name, type, taste of the wine, which helps users upload the post easily on social media.
- (3) Share my Wine Cellar User can share the image of wine cellar. By capturing the image of virtual wine cellar, user

can save the image into jpg file format or share it on social media.

(4) **Share my Wine History**

- (a) User can share ‘my wine history’
- (b) The wine he has drunk can be shown into the cork icon. The more he drinks wine, the more cork stamps will be collected.
- (c) The price of wine is shown in the image of receipt, which shows each name of wines and each price and total price.

(5) **Make my Wine Topster**

User can make ‘wine topster’, which means collage of favorite wine.

- (a) First, user sets the layout of topster. User can set the rows, columns (n*n) and background image of collage.
- (b) Second, user makes the collage based on the images of wine label which were saved in application before.
- (c) Third, user can download wine topster into jpg/png file format or can share it on social media directly.

2.4 Wine Recommendation function

- (1) **Wine promotion nearby to me** When there are discounts on wine near to user, application gives push alarm to user. It helps user to make a reservation or to buy wine at reasonable price.
- (2) **Wine Reservation** If user is looking for rare wine, user can register wine alarm which relates to wine shop. When wine is stocked, alarm goes off and lets user know that wine is available to buy. Then user can make a reservation or buy wine.
- (3) **Calendar Sync** When user synchronizes google calendar with application, it recommends wine which fits in with schedule. Recommendation can be made based on wine which user already has. If there isn’t any suitable wine, application recommends user to purchase wine from wine shop nearby.

3 DEVELOPMENT ENVIRONMENT

3.1 Choice of software development platform

Our team will develop application in the environment of Mac operating system. And our application will run on the iOS environment. We’ll use the React-Native framework that can develop Android and IOS applications simultaneously. Therefore, it’ll make it easier to develop Android OS applications in the future. Therefore, our team will use to create applications based on the ios platform, and usage of the languages will be React-Native, Java Spring, and MariaDB.

(1) **React-Native**

React Native is an open source mobile application framework developed by Facebook. It is used to develop applications for Android, iOS, Web, and UWP, allowing developers to use React in addition to native platform features. React Native has the biggest advantage of being able to create native UI for Android and iOS using JavaScript, and create high-quality UI faster than using XML/Java/Kotlin. In addition, we can quickly check changes or modifications with our eyes, making QA or feedback easier to proceed.

(2) **Spring - JAVA Framework**

The Spring Framework is an open source application framework for the Java platform. It is used as a foundation technology for the e-government standard framework recommended for use in the development of web services by public institutions in Korea.

(3) **MariaDB**

It is necessary to store and manage information about wine cellars, users of wine cellars, wine stored in wine cellars. For this, MariaDB is used. MariaDB is an open-source relational database management system (RDBMS). It is based on the same source code as for MySQL and follows the GPL v2 license. It also supports the latest SQL functions such as common table expressions (CTE), window functions, temporary data tables, and JSON functions.

3.2 Software in use

There are already two existing popular apps that manage and record purchased wine. Vivino was launched in 2010 and has recorded more than 50 million downloads so far and maintains a 4.6 rating in the Google Play Store. As it has been a long time since it was released, it has many users’ evaluations and reviews. Cellwine was launched in 2016, recording more than 50,000 downloads, and has a rating of 4.0 points in the Play Store. Both Vivino and CellWine can register wine by taking wine labels and record wine that users have been drinking so far. And users can search for a variety of wines around the world, check the ratings and information of each wine, reviews from other tasters, prices, and recommended foods that goes well with wine. Based on the wines that have been drunk and recorded so far, those two apps also recommend new wines that suit the user. Vivino also has the function to purchase wine from the application.

3.3 Task Distribution

TABLE 2. TASK DISTRIBUTION

Name	Task
Yerin Cho	App backend
Yujin Do	App frontend, UI/UX
Hyungseo Han	App backend, App frontend
Jungi Kim	App frontend, Infra

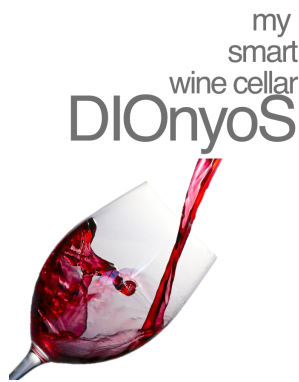


FIGURE 1. WELCOME PAGE



FIGURE 2. GUIDANCE PAGE

4 SPECIFICATION

4.1 Page

Welcome page(Figure 1) is the first screen when execute this application. If user runs the application, welcome page, which is consisted of 'Wine cellar registration' button and 'go to My Wine cellar' button.(Figure 2)

4.2 Wine cellar registration

Wine cellar registration button is for user who is first in 'DIOnyoS' application and who wants to register another wine cellar in 'DIOnyoS'. When user press this button, user has to select the



FIGURE 3. WINE CELLAR REGISTRATION PAGE



FIGURE 4. WINE CELLAR REGISTRATION CHECK PAGE

wine cellar which he purchased from horizontal scroll. And then user has to enter the serial number of the wine cellar. (Figure 3) After user ends two steps for wine cellar registration, there will be a page for check. If there isn't any error in registered information, user will push 'ok' button to go to 'My Wine cellar', which is main page. Or else, user will push 'try again' button to re-enter information for wine cellar registration. (Figure 4)

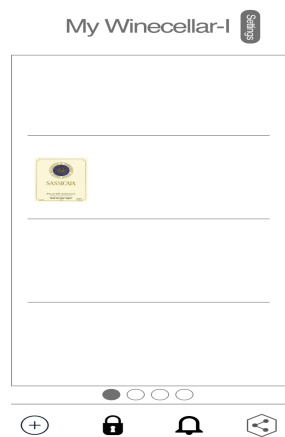


FIGURE 5. MY WINECELLAR: MAIN PAGE

4.3 My Winecellar

If user presses this button, user can go to ‘My Wine cellar’, which is main page of application. (Figure 5)

My Wine cellar is the main page of application. My Wine cellar is virtual wine cellar, which shows image of registered wine label in application. Wine cellar is consisted of 4 floors. As there is difference in the size of wine cellar, main page lets user to see wine by scrolling rows. Navigation bar is consisted of 4 icons, *plus*, *lock*, *alarm* and *share*.

4.4 Wine registration

When user presses **Plus** icon, user starts wine registration step.

- (1) User has to open camera application. After taking photo of wine label, user needs to determine whether to use the photo. If user presses ‘try again’ button, user goes to camera application again. Or else, user presses ‘use’ button, user starts wine registration step. (Figure 6) (Figure 7)
- (2) User starts wine registration step by step. Name of wine will be automatically completed by getting name from scanned-wine label database. But user needs to save vintage and date of purchase. Also, user needs to save location of wine, such as wine upper, wine lower. (Figure 8)
- (3) When user saves these information, pop up window may appear to user. If user saves wine in appropriate floor. (Figure 11)
- (4) Based on the information, wine information page is created. (Figure 9, Figure 10)



FIGURE 6. CAMERA ROLL 1

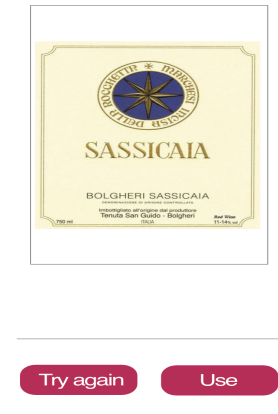



FIGURE 7. CAMERA ROLL 2



FIGURE 8. WINE REGISTRATION

//Name
//Vintage
//Date of Purchase



summary

Region
Grapes
Average Price

information

Tasting Notes

Food Paring

Management method

FIGURE 9. WINE INFORMATION

Region
Grapes
Average Price

information

Tasting Notes

Food Paring

Management method

Recommended Glasses


 empty?

FIGURE 10. WINE INFORMATION

4.5 Wine cellar Lock

wine registration

I recommend you to
store wine on wine lower

OK

FIGURE 11. FLOOR RECOMMENDATION

5:04 Lock

Set 6-digit password

Save

←
Wine Cellar Lock




 WineCellar
 Lock
 Share

FIGURE 12. WINE CELLAR PASSWORD SETTING

5:04 Lock

WineCellar Lock

Enter the 6-digit password

.....

Enter




 WineCellar
 Lock
 Share

FIGURE 13. ENTER THE WINE CELLAR PASSWORD

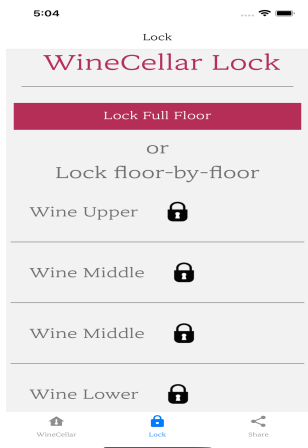


FIGURE 14. WINE CELLAR LOCK

- (1) When user presses **lock** button, user will encounter Password Setting Page. User must set the password in 6 – digit number. If the password which user sets doesn't meet the requirement, warning alert will pop-up. After user saves the password, user will go to the Wine Cellar Lock Main Page. (Figure 12)
- (2) To Lock the wine cellar, user must enter the 6-digit password first. If user enters the correct password, saved password will pop-up to let the user to know the saved password. Else if, page which lets user to enter the correct password will pop-up. (Figure 13)
- (3) After entering the correct password, user can lock the wine-cellar. If user wants to lock full floor, user can click 'lock full floor button'. Or else, user can lock floor by floor by clicking each lock button. (Figure 14)

4.6 Wine Recommendation

On the wine recommendation page, users can go to pages that check nearby wine-related events (e.g., discounts), get information about 'nearby wine shops', 'buy wine or make reservations', and 'recommend wine which fits in with their schedules'. (Figure 15)

- (1) **Wine promotion nearby to me**
 - (a) The application requests the user's location information. If the user allows the request, the map displays wine promotion around the user.
 - (b) The 'wine shop nearby to me' view under the 'map' view displays wine shops around the user. Users can set alarms for each wine shop by clicking the bell icon on the top right. If an event or promotion is held at a wine shop with an alarm set, the application sends a notification to the user.(Figure 16)
 - (c) When the user clicks the notification, wines corresponding to the event at the wine shop are displayed. The app shows the name, price, and testing notes of the wine.(Figure 17)
- (2) **Wine reservation**



FIGURE 15. WINE RECOMMENDATION



FIGURE 16. WINE PROMOTION



FIGURE 17. WINE PROMOTION ALARM



FIGURE 18. WINE RESERVATION

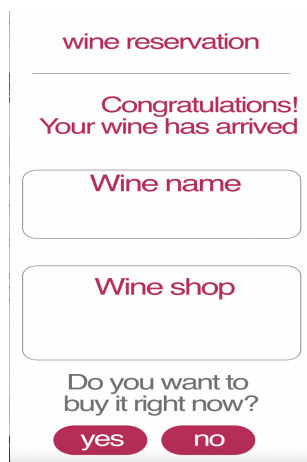


FIGURE 19. WINE ARRIVAL

On the Wine Reservation page, users can search for and reserve the wine they want to purchase.

- (a) The user can search for wine by entering the name of the wine. When the user writes the name of the wine and presses the enter button, the app shows several shops where wine entered by the user can be purchased.

The user can press the bell button on the upper right in each wine shop view to receive a notification whenever the wine he or she wants becomes available for purchase. App sends notification if the wine user wants has arrived at the wine shop. (Figure 18)

- (b) When wine that user wants arrives at the wine shop where the user presses the bell button and becomes available, the app sends a notification to the user. When the user clicks the notification, it goes to the Congratulation page. On the Congratulation page, users can see the name of the wine and the store they reserved,

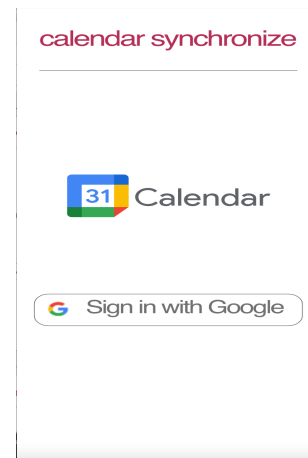


FIGURE 20. GOOGLE CALENDAR SIGN IN



FIGURE 21. GOOGLE CALENDAR SYNCHRONIZATION

and the question of whether to purchase it 'right now'. (Figure 19)

(3) Calendar synchronize

- (a) By logging in with their Google account, users can link this app with their Google Calendar. (Figure 20)
- (b) Using Google-Calendar-api, the application displays the calendar of current month. When the user clicks on the day with schedule, the schedule of the day is displayed in the view under the calendar. The daily schedule indicates the date and time, the purpose of the schedule (e.g., evening, party), and who users are meeting with. (Figure 21)
- (c) The app focuses on 'people' who are together that day. The recommended wine depends on who the users are with that day. People who share schedule with users are highlighted with white lines. If the user presses the highlighted part (button), the app goes to the 'wine information' page of the recommended wine. (Figure 22)

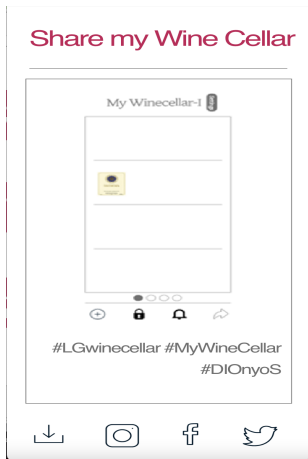


FIGURE 22. SHARE MY WINECELLAR

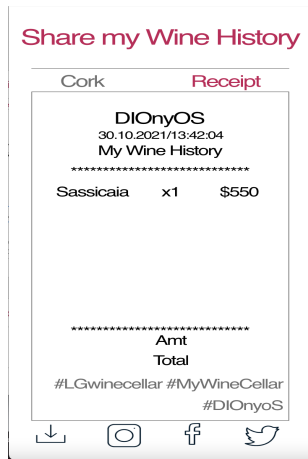


FIGURE 24. SHARE MY RECEIPT



FIGURE 23. SHARE MY CORK



FIGURE 25. WINE TOPSTER DESCRIPTION

4.7 Share

Share, which is consisted of ‘share my Wine cellar’, ‘share my Wine history’, and ‘make my Wine Topster’, lets user to share wine-related images in Instagram, Facebook, Twitter and saves images to gallery in common. When user shares these images, hashtag #LGwinecellar, #MyWineCellar, and #DIOnyoS will be automatically completed. And it can lead to promotion of wine cellar and application DIOnyoS.

- (1) **Share my Wine Cellar**
Share my Wine Cellar lets user to take screenshot of ‘My WineCellar’, which is main page. (Figure 21)
- (2) **Share my Wine History : Cork**
The number of wine which user has drunk until now appears as the images of cork. And it will look like loyalty card. So, the more user drink, the more cork user can collect. (Figure 22)
- (3) **Share my Wine History : Receipt**
Wine which user has drunk until now appears as the format of receipt. Receipt is consisted of name, number and price of

each wine. And total amount and price of wine will appear at the bottom of receipt. (Figure 23)

- (4) **Make my Wine Topster**
 - (a) Description of making topster will appear. When user clicks ‘Go’ button, user can start making his own topster. (Figure 24)
 - (b) User can set rows & columns and background image of wine topster. (Figure 25)
 - (c) User can make wine topster from setting. User can retrieve image of wine label from database. (Figure 26)

4.8 Wine information

All information appears in each container tag. Photo of label, name, wine and date of purchase of wine appear in upper tag. And summary of wine, such as region, grapes and average price of wine appear in middle tag. And information of wine, such as tasting notes,

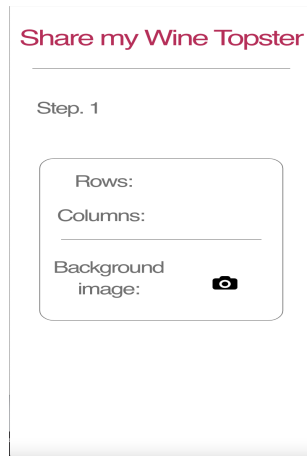


FIGURE 26. WINE TOPSTER STEP 1

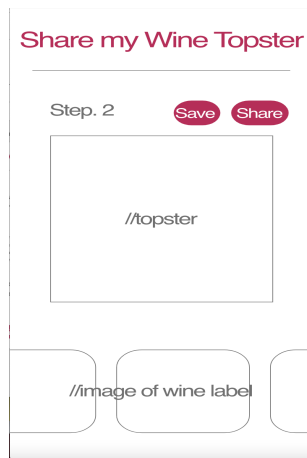


FIGURE 27. WINE TOPSTER STEP 2

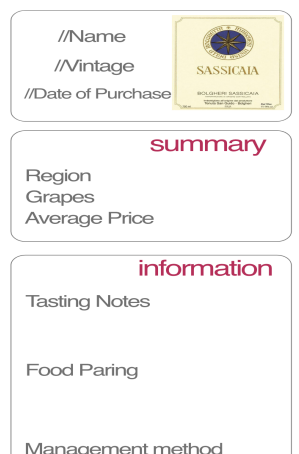


FIGURE 28. WINE INFORMATION PAGE

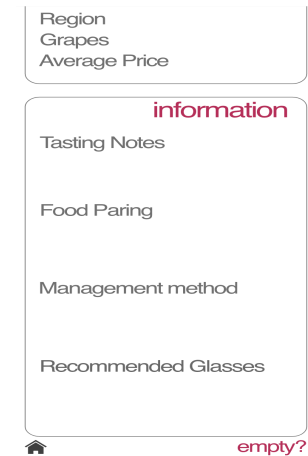


FIGURE 29. WINE INFORMATION PAGE

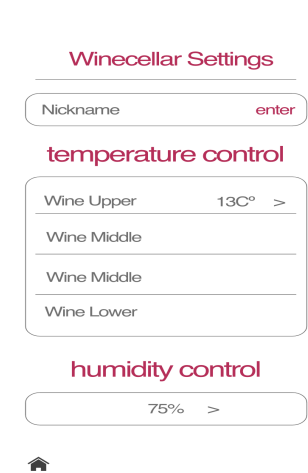


FIGURE 30. MY WINECELLAR SETTINGS

food pairing, management and recommendation glasses appear in lower tag.

4.9 My WineCellar Settings

Settings icon locates next to My Wine Cellar(main page). If user pushes settings icon, user can control wine cellar.

- (1) Nickname
The default name of wine cellar is 'My Wine cel lar-1'. User can change it and generate own nickname. Nickname allows user who has many wine cellars to distinguish one from many wine cellar.
- (2) Temperature control
A there is difference in appropriate temperature of wine, user can control temperature of each floor of wine cellar.
- (3) Humidity control
User can control humidity of wine cellar.
- (4) Image of wine label
When user clicks the image of wine label in main page, user goes to wine information page directly.

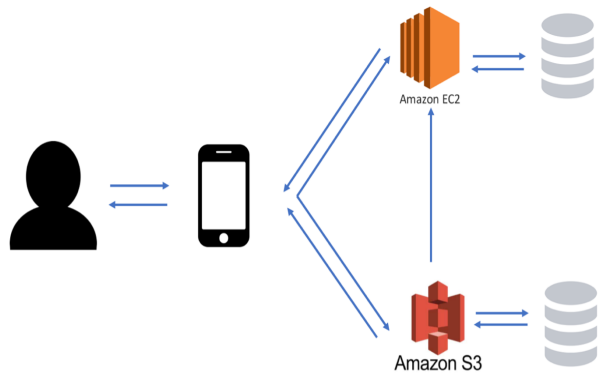


FIGURE 31. OVERALL ARCHITECTURE

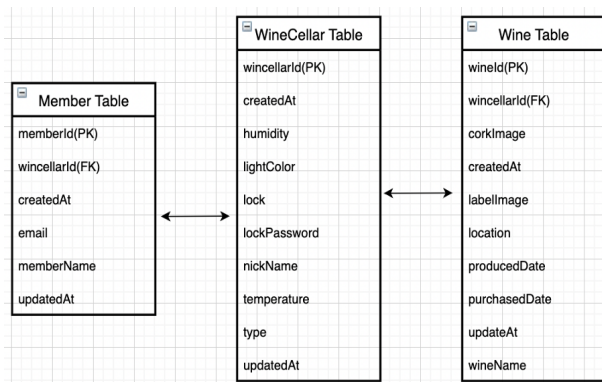


FIGURE 32. DATABASE DESIGN

5 ARCHITECTURE DESIGN AND IMPLEMENTATION

5.1 Overall Architecture

For our DIOnyoS application, we have several modules for the whole architecture. First, we used React-Native for client side. It allows the application to perform several functions and implement designs. Using the application, users can register wines in wine-cellar and easily lock the winecellars. Also, they can share the informations of wine cellars in their social media.

Second, we used Amazon AWS EC2, S3 for deployment, Spring framework for whole back-end section to receive and serve data to front-end section as REST API, and Node.js for running React-Native framework. Entire API server except acquiring wine image file is running on Amazon Web Services EC2 instance, and API server for acquiring wine image file is running on Amazon Web Services S3 instance. Below figure shows overall architecture of the service. These modules are interacting each other in the application

5.2 Database Design

5.2.1 Member Table.

- (1) memberId(PK)
identification of user

- (2) createdAt
date that user account created
- (3) email
user email
- (4) memberName
name of user
- (5) updatedAt
the date when user lastly modified their information

5.2.2 WineCellar Table.

- (1) winecellarId(PK)
identification of wine cellar
- (2) createdAt
date that wine cellar registered to database
- (3) humidity
the information of humidity that applied at wine cellar
- (4) lightColor
the information of color that currently applied to wine cellar
- (5) lock
status of wine cellar whether locked or not
- (6) lockPassword
the password to lock/unlock wine cellar
- (7) nickName
unique Name of wine cellar that decided by user
- (8) temperature
the information of temperature that currently applied to wine cellar
- (9) type
the type of wine cellar
- (10) updatedAt
the date when user lastly modified information of their wine cellar

5.2.3 Wine Table.

- (1) wineId(PK)
identification of wine
- (2) winecellarId(FK)
identification of wine cellar(wine cellar that storing wine)
- (3) corkImage
cork image of wine took by user
- (4) createAt
the date that wine registered to wine cellar
- (5) labelImage
label image of wine
- (6) location
the location of wine where it stored in wine cellar
- (7) producedDate
the date wine produced by manufacturer
- (8) purchasedDate
the date wine purchased by user
- (9) updateAt
the date when user lastly modified information of their wine
- (10) wineName
the name of wine

5.3 Directory organization

We are using 3 big modules which follow the overall architecture. First one is React Native, second one is Spring and the last one is Maria DB. Also, we have additional directory for LaTeX.

5.3.1 Server.

- (1) Server/gradle/wrapper/
This directory is a collection of services that define what logic to deal with when building the application.
- (2) Server/src/main/java/com/dionysos/winecellar/config
This directory is a collection of files to facilitate server request processing. When user initialize the application, then WebConfig.java runs automatically to prepare user's authentication requests.
- (3) Server/src/main/java/com/dionysos/winecellar/domain/auth
This directory is a collection of directories or files to handle user's authentication requests. This directory is focused on handling authentication or confirmation of user's token.
- (4) Server/src/main/java/com/dionysos/winecellar/domain/member
This directory is a collection of files to handle user request about member(user). 'Config' directory discern which requests are sent from client. After analyzation, 'Service' directory handles that request by logics that written in files in 'Service' directory. If SQL query requires, then files in 'Dao' directory create SQL query and send to database.
- (5) Server/src/main/java/com/dionysos/winecellar/domain/wine
This directory is a collection of files to handle user requests about wine. First, files from 'Api' directory receives the requests from user, and then discern which requests are sent from user. After that, files in 'Service' directory handles analyzed requests according to a set routine. If SQL query requires, then files in 'Dao' directory create SQL query and send to database. Files in 'Dto' create and maintain data objects.
- (6) Server/src/main/java/com/dionysos/winecellar/domain/winecellar

This directory is a collection of files to handle user requests about winecellar. First, files from 'Api' directory receives the requests from user, and then discern which requests are sent from user. After that, files in 'Service' directory handles analyzed requests according to a set routine. If SQL query requires, then files in 'Dao' directory create SQL query and send to database. Files in 'Dto' create and maintain data objects.

5.3.2 Client.

- (1) Welcome
 - (a) Welcome
This is the loading page of our application. When user clicks the image of wine glass, user can go to Kakao account-log in page. After log in, user encounters two red buttons, which is consisted of wine cellar registration and go to my winecellar. By using Welcome navigator, user can link to each page.
 - (b) WelcomeNavigator This is a navigation which enables transition among WelcomeScreen, LoginScreen, SelectScreen and Registration.

- (2) Log in Page
 - (a) login
This is the first page which user can log in. When user clicks 'Log in with kakao', user can log in by entering the username and password of his Kakao account. At the same time, the information of user is saved in the database.
- (3) Registration
 - (a) Registration
This is the wine cellar registration page. The input data of wine cellar registration is the serial number of wine cellar. There are two cases in the wine cellar registration process. If user enters the serial number which is in the database, the serial number and the model name of the wine cellar is shown. Else if, 'The serial number doesn't exit' message alerts and it lets user to enter the serial number again. After wine cellar registration, user can connect the physical wine cellar and wine cellar in application.
 - (b) RegistrationNavigator
This is a navigation which enables transition between SelectScreen and Registration.
 - (a) My winecellar
When user clicks the setting image, user goes to Wine-CellarSetting page. When user clicks the share image, user can share the image of wine cellar in Instagram. And '#LGwinecellar, #MyWineCellar, #DIOnyoS' hash-tags are uploaded together in Instagram posting.
 - (b) WineCellarSetting
There are three parts in wine cellar setting page. First part is nickname setting page. User can freely make the nickname of wine cellar. Second part is temperature control page. User can set the temperature of physical wine cellar by our application. Third part is Humidity control page. User can set the humidity of physical wine cellar by our application.
 - (c) WineTab
It is tab which locates in the bottom of page. By clicking wine tab, user can move to wine cellar, lock main, wine registration, wine recommendation and share navigator.
 - (d) WineCellarNavigator
This is a navigation which enables transition between WineCellar and WineCellarSetting.
- (4) lock
 - (a) lock info
This is a page for setting wine cellar password, which is for locking wine cellar. The password should be 6-digit password. When user saves the password, message which notifies that password is saved pops up.
 - (b) cellarlock

This is a page which user can lock full floor or lock floor-by-floor. Locking full floor is done by clicking red button. And locking floor-by-floor is done by clicking each lock button.

(c) locknavigator

This is a navigation which enables transition among lock info, cellarlock and locknavigation.

(5) share

(a) sharehome

This is a page which is consisted of three buttons. The first button is to link users to SharemyWineCellar. The second button is to link users to SharemyWineHistory. The third button is to link users to MakemyWineTopsterMain.

(b) MyWineTopster

This is a first page for explaining steps of making wine topster. When user reads all the direction and explanation, user clicks the go button, which links to MyWine.

(c) MyWineTopsterFirst

This is a page for making wine topster. User can set the rows and columns of wine topster. Also, he can select background image from 'Photos' in his device.

(d) MyWineTopsterNavigator

This is a navigation which enables transition among sharehome, MyWineTopster and MyWineTopsterFirst.

This is the table which shows directory, file name and module name.

5.4 Modules

(a) React Native

We use React Native to develop a wine cellar management application for the Apple device, such as iPhone and iPad. It acts as a connection between the user and the server. It also receives the user's input value, passes it to the backend and shows the stored value of database.

(b) Axios

We use Axios module for handling request and response from REST API, such as acquiring information of one's wine cellar and sending the password of wine cellar to enable/disable cellar lock function. Axios is Promise based HTTP client for the browser and Node.js. It is used to request data from API server.

(c) React

React Native is based on React. React is a free and open-source front-end JavaScript library for building user interfaces based on UI components.

6 USE CASES

6.1 Frontend UI

(a) WineCellar Main Page

(i) My WineCellar Page

This is a main page of DIOnyoS. My WineCellar Page shows statement of the physical LG winecellar. Depending on the winecellar model, the number of floors varies. The page shows the images of wine label saved in the application. The title container has two icons, which are Setting and Share. By pressing Setting icon, user

TABLE 3. SERVER DIRECTORY

Directory	File name	Module name
Server/gradle/wrapper	gradlewrapper.jar gradlewrap- per.properites	gradle
Server/src/main/java/com/ dionysos/winecellar/config	WebConfig.java	Spring
Server/src/main/java/com/ dionysos/winecellar/domain	AuthController.java AuthResponse -Dto.java LoginDto.java	Spring
Server/src/main/java/com/ dionysos/winecellar/domain/ member/	LoginMemberId.java MemberRepository.java Member.java MemberService.java ...	Spring, Lombok
/Server/src/main/java/com/ dionysos/winecellar/domain wine/	WineController.java WineRepository.java WineService.java Wine.java	RSpring, Lombok
Server/src/main/java/com/ dionysos/winecellar/domain /winecellar/	Winecellar -Controller.java Winecellar -Repository.java Winecellar.java WineDto.java ...	Spring, Lombok

goes to the My WineCellar setting page. And By pressing Share icon, user can share the image of winecellar in the Instagram with the hashtag '#LGwinecellar #MyWineCellar #DIOnyoS'.

(ii) WineCellar Tab Bar

At the bottom of the page, there are tab navigation bar which is consisted of three icons, WineCellar, Lock and Share.

(A) WineCellar

(B) Lock

Lock page is the one of main functions of the application.

(C) Share

(iii) Lock

(A) Password: Setting

Before entering Lock Page, user must set 6-digit password of the wine cellar. The password is encrypted and saved in the server's database.

TABLE 4. CLIENT DIRECTORY

Directory	File name	Module name
src/screens/welcome	Welcome.js WelcomeNavigator.js	React Native
src/screens/welcome/login	Login.js SocialWebview.js SocialWebviewModal.js	React Native Axios
src/screens/winecellar	Winecellar.js WineCellarNavigator.js WineCellarSetting.js WineTab.js	Spring
src/screens/registration	Registration.js RegistrationNavigator.js	React Native
src/screens/share	ShareHome.js ShareNavigator.js ShareWineCellar.js InstagramShare.js MyWineTopsterNavigator.js MyWineTopsterMain.js MyWineTopsterFirst MyWineTopsterSecond MyWineTopsterThird	React Native
src/screens/lock	LockMain.js LockNavigator.js LockInfo.js CellarLock.js LockGate.js	React Native
src/context	WinecellarContext.js	React
src/api	winecellarApi.js	React Native

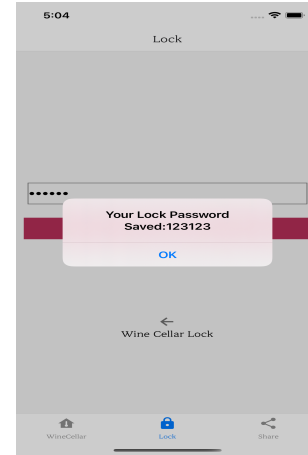


FIGURE 34. WINE CELLAR PASSWORD CHECK

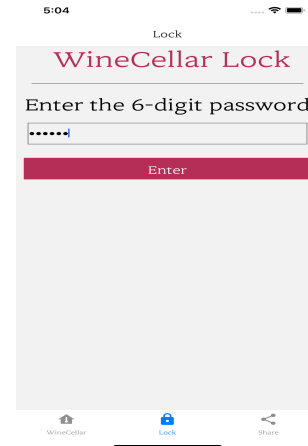


FIGURE 35. WINE CELLAR LOCK SCREEN

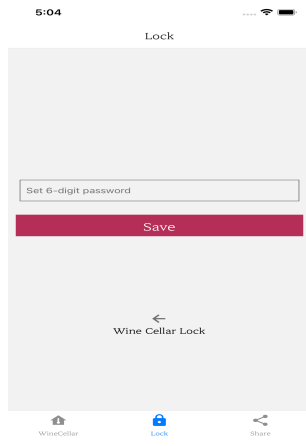


FIGURE 33. WINE CELLAR PASSWORD SETTING

- (B) Password: Saved
After pressing Save button, pop-up win-

dow appears.

- (C) Wine Cellar Main Page : Enter Password
(D) WineCellar Lock: Main Page
First, user can lock the full floor of the wine cellar by pressing the red button. Second, they can lock the floor-by-floor by pressing each lock icon.
(E) Successful Lock
When lock is successful, pop-up window appears.

Smart Wine Cellar – Cave de Vin(Label D)
DIOnyoS

