ISSN 2409-2665
Journal of Logistics, Informatics and Service Science
Vol.9 (2022) No.1, pp.195-212
DOI:10.33168/LISS.2022.0113

Drive-Thru Service System Development for Medicines and Insurance Claim

Seonyong Eom, Seokjin Shin, Min Choi

Department of Information and Communication Engineering, Chungbuk National University, Chungbuk, Republic of Korea

mchoi7812@gmail.com

Abstract. Due to the recent corona crisis, contactless services of medical institutions are attracting international attention. On the other hand, the current Indemnity medical insurance system has an overly complicated procedure in which patients have to visit the hospital, and obtain documentary evidence and submit it to the insurance company, and medical institutions have to issue papers document to each patient. In this paper, we propose a system that implements a non-contact payment and receipt system using drive-thru and simplifies insurance claims by using a smartphone web app that utilizes data collected during the payment process. If you use a pharmacy in a drive-thru manner and proceed with payment and insurance claims through a smartphone web app, the burden of quarantine at the pharmacy will be reduced, and it is possible to aim for the effect of increasing the billing rate of the actual cost insurance by eliminating unnecessary administrative elements between the customer and the insurance company in the Indemnity medical insurance claim process.

Keywords: Automated medical insurance claims, pharmacy, web app

1. Introduction

To prevent the spread of infectious diseases due to the recent corona crisis, it is necessary to introduce drive-through treatment and telemedicine, so the Korean government authorities are taking the lead in developing and distributing a standard drive-through model in the medical field (Kwon, Ki Tae, et al., 2020).

In addition, since the implementation of the division of labor (July 2000), the importance of store locations such as hospitals/pharmacy has increased. In fact, due to the advantage of securing sales if it is located only next to a competent medical institution without any special business activities, the medical blind spots were rather increased as pharmacies were moved to a location close to hospitals and clinics (Bueon Jin-Ok, Lee Hye-Jae, 2019).

Therefore, the system proposed in this paper aims to prevent the spread of infectious diseases by preventing unnecessary contact by introducing a drive-through model to the pharmacy and to reduce the disadvantage of new stores due to the location of the pharmacy by improving the accessibility of the pharmacy.

On the other hand, the current indemnity insurance claim system has an overly complicated procedure in which patients have to visit the hospital one by one, obtain documentary evidence, and submit it to the insurance company, and medical institutions have to issue paper documents to each patient. According to the results of a survey by related organizations such as the Korean Financial Consumers Federation, half (47.2%) of respondents said that they had given up on insurance claims.

Implementing a smartphone web app that assists in claiming medical insurance for indemnity by implemented using drive-thru accessories reduces costs wasted due to complex administrative procedures between insurers and users and increases insurance claims rates It can increase customer satisfaction.

The goal of the research project is to research and develop a drive-through drug dosing and insurance claim system, and the main development goals are as follows.

1. System solutions for drive-thru drug dosing - Development of a web-based drive-thru dosing solution that can be used without being tied to a specific hardware terminal
2. Mobile web-based medication management/credit card payment/receipt issuance management system - Receipt management for insurance claims to insurance companies
3. Provision of claim automation service for medication history to simplify medical expenses insurance claims - User simply enters the necessary information Through mobile web, no app installation required, the claim document is automatically completed and sent to the insurance company's email address

2. Related works

Irrespective of the lockdown situation in different countries, medical institutions must be facilities that continue to operate during the COVID-19 situation (Hussain, Rabia, and Dalia M. Dawoud, 2021). Several pharmacies are introducing drive-through pharmacy services to improve access to medicines while ensuring the preventive measures proposed by the World Health Organization. Here, the purpose of introducing drive-thru is to curb the spread of infectious diseases by reducing human-to-human interactions in pharmacies (Bukhari, Nadia, Huma Rasheed, and Bismah Nayyer, 2020). Drive-thru pharmacies provide valuable and convenient services during this pandemic by maintaining social distancing and reducing patient visits to large pharmacies (AlAbbasi, H. K., et al., 2021).

Shuang-Ho Hospital in Taipei, Taiwan, implemented a drive-thru pharmacy service to give patients in need a more effective way to refill medications. Drive-thru pharmacies provide convenient access to get your prescriptions filled in less time than regular pharmacy services. After drive-thru services were implemented, there was an overall increase in prescription dispensing rates. According to the survey, over 90% of patients were satisfied with the drive-thru service. Future promotion of the service could help patients effectively utilize drive-thru pharmacy prescription refills and enhance disease management (Lin, Yuh-Feng, et al., 2013).

In Malaysia It is safe to consider that drive-thru pharmacy as a relatively novel service since it was started as a pilot project at Pulau Pinang Hospital in 2008 (Che Noriah, O., et al., 2010). The experiment was proven to be a success and thus, drive-thru pharmacy was made as one of the key performance indicators (KPIs) for Minister of Health in 2010 (Bahagian Perkhidmatan Farmasi, KKM., 2011). The move was to allow patients to collect repeated medications at their convenience and ease the congestion in the pharmacy (Liew, J. E. S., Abdul Gapar, A. A. b. & Shim, 2020).

Positive perceptions were found regarding customer perceptions of drive-thru pharmacy services in Jordan. More than half of respondents believe that the introduction of drive-thru services has improved the efficiency of pharmacy services and that good pharmacies should have drive-thru services, and drive-thru pharmacy services are friendly service. Drive-thru pharmacy services can improve customer satisfaction with pharmacy operations (Diri, Reem M., 2020).

“Drive-Thru Pharmacy Service” was first introduced in 1990 by Walgreens, the second-largest pharmacy chain in the United States (Myers, Alice, 2011). Drive-thru has shown many possibilities through digitization in recent years. For McDonald's, which introduced a context-aware recommendation system to its drive-thru, a popular recommendation model in e-commerce scenarios relies on a user profile or purchase history to generate a recommendation, but this information is difficult to obtain in the drive-thru use case, we leverage a new recommendation model that leverages guest order behavior and contextual characteristics (e.g. location, time, weather) for drive-

thru recommendations, which is superior to Burger King's existing recommendation solutions (Wang, Luyang, et al., 2020).

However, drive-thru has a limited interaction time. Users can see people spending significantly more time on digital channels like apps or the web compared to drive thru. They have more interactions to navigate menus, create customizations, add items, and more. This happens naturally because the user does not feel the pressure of the people behind them (Joe Guszkowski, 2021). Web pages accessed while using the drive-through system implemented in this paper are maintained even after the user leaves the pharmacy. People use web pages at home to make insurance claims. As a result, users are freed from the pressure of waiting people and interact more with the pharmacy.

Today, insurance companies are still investing in computerized business processes to achieve efficiencies and reduce costs. According to industry estimates, digital production can save about 20-30% of the cost of non-life insurance products and 15-20% of the cost of life insurance. In addition to cost benefits, digital transformation also creates opportunities for collaboration between them. Direct insurance gross income from general insurers' direct business through the Internet is steadily increasing (Min, So-Yeon, and Jong-Hee Lee, 2017). Subsidizing indemnity medical expenses claims using a web page provided through drive-thru has the effect of reducing administrative costs for insurers and increasing customer exposure to actual insurance services, which in turn can increase customer satisfaction with indemnity medical insurance.

In Korea, The Health Insurance Review & Assessment Service (HIRA) processes many health insurance claims coming from many healthcare providers. Adopting and using various information technologies was a rational choice for HIRA. Claim management heavily dependent on human resources has a fundamental problem dealing with appropriate claim processing when complex organizational issues are involved. Claims review and assessment processes impose heavy administrative costs on handling HI claims. IT infrastructure solutions have tremendous potential for creating safe and effective work processes (Verma, Rajesh, et al., 2021).

The web application is platform independent and can work on any mobile operating system. Developed using HTML, CSS and JavaScript. The web app runs on an external server. Native apps require installation, but web apps can be easily accessed via a mobile web browser (Park, Young-Taek, et al., 2012). The system implemented in this paper is implemented as a web app method that allows you to use the app immediately by opening the Camera app and shooting the QR code displayed on the screen.

3. System design

As shown in Figure 1, this system is divided into four major components. The first is the dashboard, where pharmacists check vehicles coming into the drive-thru and take

prescriptions from customers. The pharmacist enters the patient information on the dashboard and temporarily stores the patient information on the server.

The second is an outdoor panel. When the pharmacist uses the dashboard to inform that the preparation is complete, the customer gets on the vehicle and moves to the window where the medicine is delivered to receive the medicine. At the same time, a QR code for claiming insurance money is displayed on the outdoor panel, and the user can take a QR code using the basic camera app on a smartphone to proceed with an insurance claim.

The third is a user-side web app. When a customer enters additional information for claiming insurance and a signature to authenticate himself through the web application, the server collects the information entered by the pharmacist and the customer and sends an email to the insurance company selected by the customer for a claim.

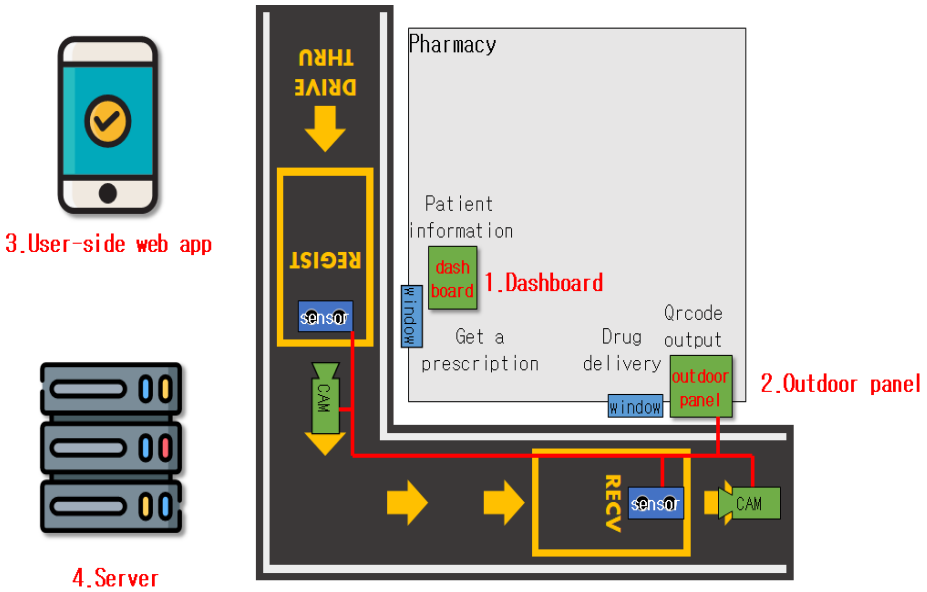

Fig. 1: Drive-thru accessories

4. Using technology

The server was developed with Java 11-based Spring Boot framework. The Spring Framework supports various services related to Dependency Injection (DI), Aspect-Oriented Programming (AOP), and persistence to facilitate dynamic web development and data management. Spring Boot is a sub-project of Spring Framework that helps you to start a Spring project that needs to write a large amount of XML without writing XML.

The server is built as an executable jar file, and as it does not contain platform-dependent code, any platform that can run java can run this server. To save development costs, the environment is mainly composed of open source.

Improving the performance of a web app by dynamically loading only the resources needed for the process, rather than replacing the web page every time during the insurance claim process, can provide a superior user experience. Therefore, the interface is implemented in a SPA(Single Page Application) method using React in this system. To use React in the Spring Boot project, Maven's build plugin, frontend-maven-plugin, is used, and this plugin builds the React project during the project build process and merges it with the Spring Boot project.

The server program executes distribution using jenkins. When the source code is pushed to github, jenkins detects it and automatically builds it, then runs a simple shell script to deploy to the development server and then run the server.

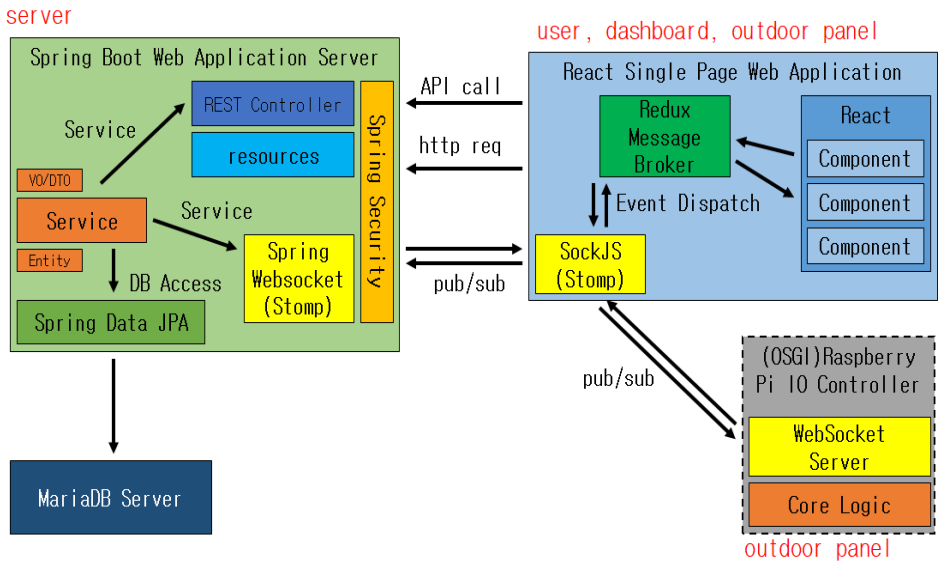

Fig. 2: Technology applied to the system

Table 1: Applied platform and library

Category	Name	Version
Platform	OpenJDK11	11.0.8.10-1
Build Tool	Maven	3.6.3
Build Tool (Maven Plugin)	frontend-maven-plugin	1.10.0
Framework	Spring Boot	2.3.3

DBMS	MariaDB Server	10.5.6
Java Library (Util)	Lombok	1.18.12
Java Library (Email Transfer)	javax-mail	1.5.0-b01
Java Library (Modify PDF)	PDFBox	2.0.21
Java Library (Using For vehicle plate recognition)	openCV	4.5.0
Configuration Management	Git	2.23.0
CI/CD	Jenkins	2.235.2
Javascript Library (UI)	react	16.13.1
Javascript Libbray (State Manage)	redux	7.2.2

5. Indemnity medical insurance claim process

When a customer enters the drive-thru zone, the server detects it. The server publishes the information to the pharmacist's dashboard, which receives it and displays the prescription information input page for the customer.

Each order of work is divided into phases so that the work proceeds sequentially, thereby eliminating the possibility of errors that may cause the order to be reversed. The main operations for each phase are as follows.

Table 2. Main operations for each phase

Phase	Operation
start	When a guest arrives at the drive-thru zone, a sensor attached to the outdoor panel detects it and notifies the server.
appendScriptionInfo	The server issues a UUID to identify the billing process, starts a new billing session with the issued ID, and informs the devices (dashboard, outdoor panel) in the pharmacy the ID of the billing session.
drugPrep	When the pharmacist dispenses the medicine and presses the Done button, a QR code generated based on the billing session ID is displayed on the outdoor panel.
claim_selectCompany	The customer scans the QR code and proceeds with the insurance claim process. From this point on, the pharmacy can accept new customers.

claim_createCompPrev iew	The customer enters all the information into the web app and sends the entered information to check the finished document.
claim_sendEmail	When you click the Send E-mail button, the server completes the pdf document for actual cost insurance claim based on the information entered so far and sends it to the insurance company.
complete	Completion of indemnity medical insurance claim

The workflow between the four components of the system is as follows.

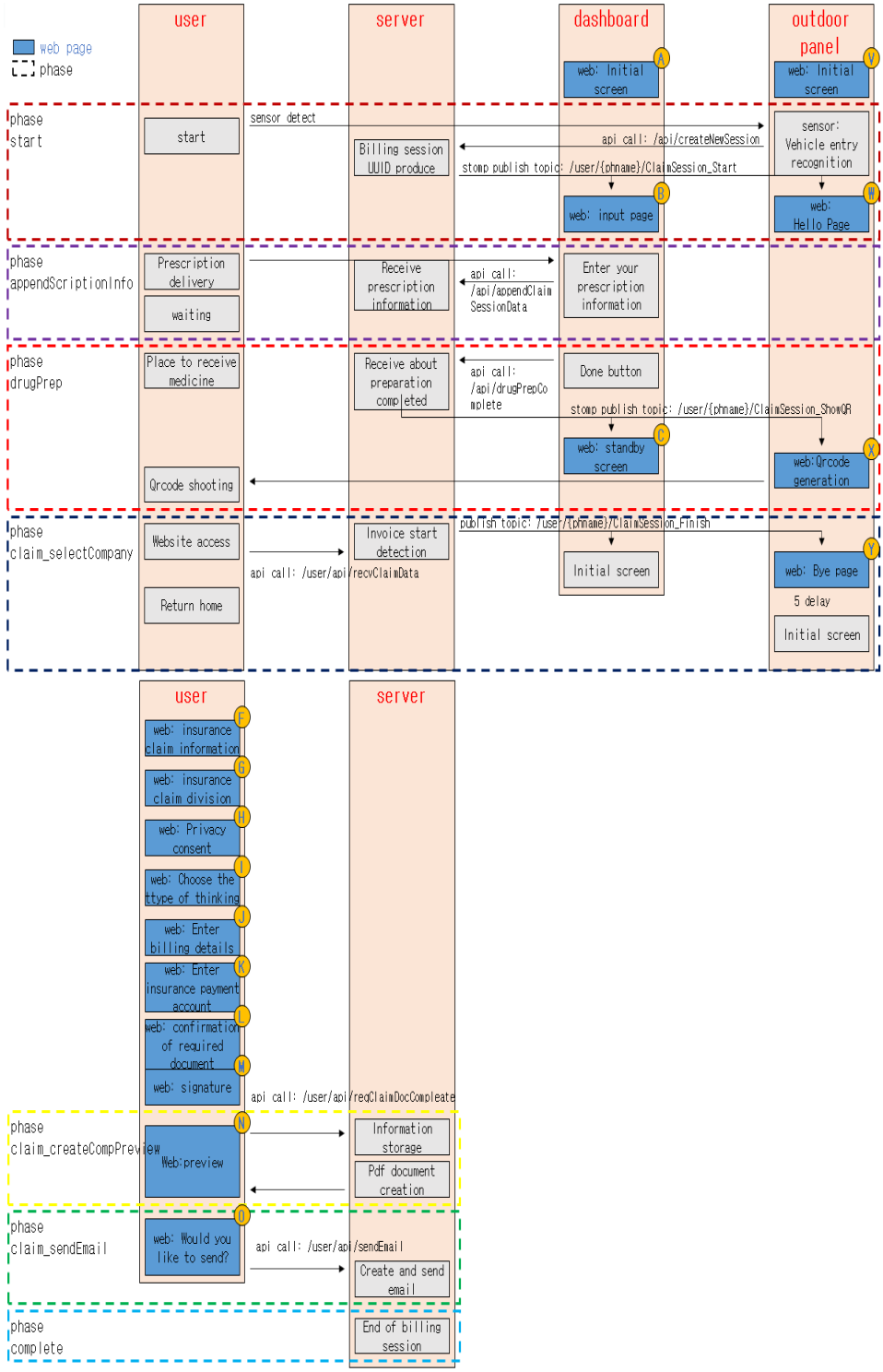

Fig. 3: Flow diagram for all processes

6. Implement

Dashboard, outdoor panel, and guest-side web application must receive information from the server, update the UI, and respond to user input. For these dynamic web functions, the web framework React was used.

React implements SPA (Single Page Web Application) as a JavaScript library for user interfaces. React makes dynamic web development easier by dividing the UI into components and allowing each component to manage the state.

React route was used to control access rights and classify the device used, so that the guest web app, dashboard, and outdoor panel were all accessed through different URLs.

Table 3. URL and permission required for each part

URL	Description	Permission Required
/dashboard	Web app for pharmacist's tablet or POS machine	Yes
/panel	Web app displayed on monitor installed for drive-thru guests	Yes
/user	frontend-maven-plugin	No

To access the URL that requires permission, you must log in using the account assigned to each pharmacy. After logging in, you will be redirected to the accessed page.

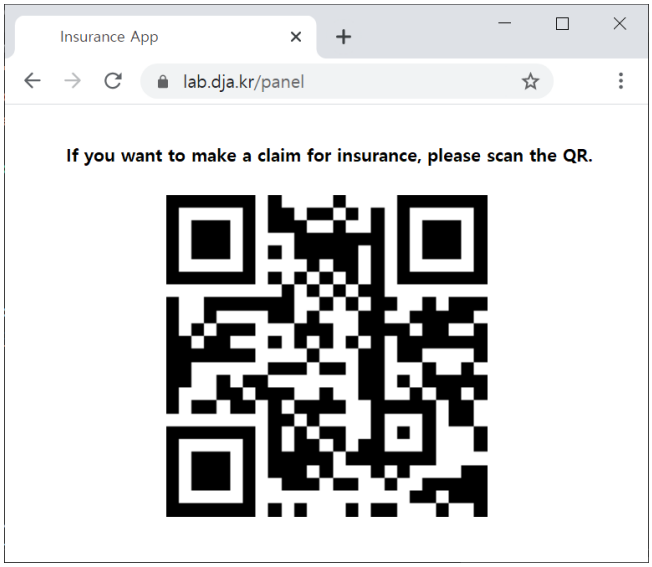

Fig. 4: Outdoor panel QR code page

When the pharmacist completes entering the prescription information on the dashboard, a QR code is displayed on the outdoor panel as shown in Figure 4. When a customer scans a QR code using a smartphone, a web page for claiming insurance is opened.

Fig. 5: Web application for insurance claims

Figure 5 is a web application that includes the entire process for claiming insurance money. The user enters the required consent for insurance claim, accident type, hospital information, accident details, insurance payment account, and proceeds with electronic signature.

In Korea, the Electronic Signature Act has been amended from June 10, 2021, and the electronic signature has the same effect if the electronic signature is selected in the form of signature, affixing, or signature in accordance with the provisions of the Act or the agreement between the parties.

The system combines the information entered by the pharmacist and the customer to complete the insurance claim document suitable for each insurance company. In the final step, when the user checks the completed document and presses the OK button, a pdf of the insurance claim document is sent to the insurance company's email address.

Because this system is MVC, the analysis and pharmacist's web are viewed, and the server is playing. It has a slight taste. The ER diagram of the database to be migrated in this project is as follows.

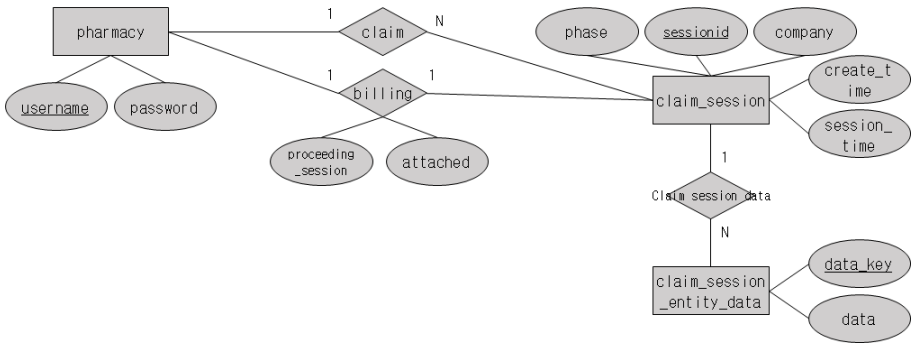

Fig. 6: Database design

a) pharmacy entity: ID and password for accessing the system are separately managed for each pharmacy so that multiple pharmacies can use the system at the same time.
b) claim_session entity: manages the claim session, the process of using the drive-thru by the customer. When a customer enters the pharmacy's drive-thru zone, the pharmacist initiates a new claims session. Behaviors detected by the server (vehicle entry, movement, drug preparation completion, QR code shooting, etc.) are managed with the phase attribute. Only one vehicle must enter the drive-thru zone to facilitate interaction with the pharmacist, so the claim sessions currently being claimed are managed mutually exclusively. When the first session starts, the attached property is true, and new guests cannot be received until the corresponding property is switched to false. However, after the customer scans the QR code, there is no need to interact with the pharmacist anymore, so we switch the attached property to false.
c) Claim_session_entity_data entity: This is where the data entered by the pharmacist

and the data entered by the customer are collected during the drive-thru usage process. Manage data with key/value structure. This system provides 5 POST APIs for interface between dashboard, outdoor panel, and insurance claim app.

Table 4: POST API provided by the server

Purpose	Caller	URL	Request Body	Response Body
Start billing session	Dashboard	/api/createNewSession		result, sessionID
Completion of preparation	Dashboard	/api/drugPrepComplete	sessionID	result
Insurance claim start	User App	/user/api/recvClaimData	sessionID	result
Information input complete	User App	/user/api/reqClaimDocComplete	sessionID, company, args(Map<Str, Str>)	result, docs(images)
billing completed	User App	/user/api/sendEmail	sessionID	result

The customer opens the web app by taking a QR code containing sessionID (UUID), which is a unique identifier for the claiming session, and attaches the sessionID when calling the server API in the customer's web application to identify which pharmacy the customer is making a claim at. made it possible Similarly, the pharmacist has the sessionID until the attached state of the billing session started by the pharmacist changes to false.

As shown in Table 5, the service tier of the server is divided into three main services.

Table 5: POST API provided by the server

Service Name	Main Feature
Billing Session Management Service	Drive through the drive-thru and insurance claim process
PDF document creation service	Insert data collected from billing session into pdf document
Email sending service	Send insurance claim documents by e-mail
Pharmacy account management service	Manage accounts by pharmacy and grant access to services

To generate a pdf document for automatic insurance claim, first, the original pdf document and metadata specifying the data input location are required. In this project, the original pdf document, and metadata in json format were saved in the resource

folder. The original pdf document is suffixed with _doc.pdf, and json metadata is suffixed with _metadata.json format to facilitate file scanning.

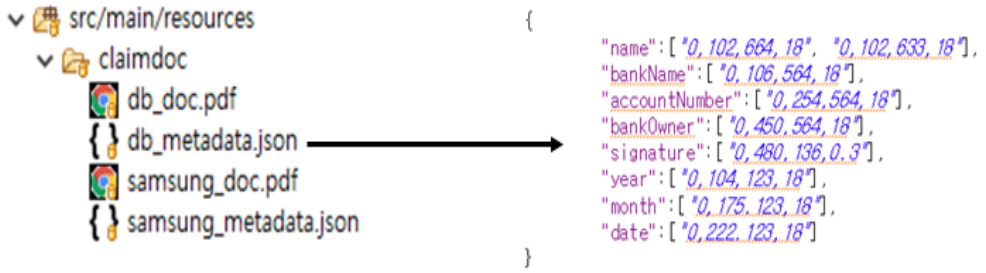

Fig. 7: Invoice pdf original and metadata for Samsung fire and Dongbu insurance claim

“name” and “bankName” are data keys, and a string consisting of 4 numbers such as “0, 102, 664, 18” indicates the location where data is to be inserted. From the beginning, the number of pages, x, y, and font size. As an exception, in the case of "signature", since it is an image, it is displayed with a magnification (0.3 magnification of the current original image).

```
@Slf4j
@Builder
@Getter
public class ClaimDoc
{
    @Singular
    private Map<String, ClaimDocObjectPosition> textPostions;
    private String company;
    private byte[] originalDoc;

    private final ImageUtil imgUtil;
    private static final String SIGN="signature";
    private static final String BANK="bankName";
    private static final String YEAR="year";
    private static final String MONTH="month";
    private static final String DATE="date";
    private static final TimeZone tz = TimeZone.getTimeZone("KST");
```

Fig. 8: Database design

The ClaimDoc class method receives a map that collects the data entered by the pharmacist and the user, converts the string data into an image, and inserts it in the appropriate location defined in the metadata to complete the pdf document. In addition, keys that require special processing before inserting into pdf documents such as signatures (images) or dates (conversion required to match the time zone) are specially processed.

7. Performance envaluation

A test scenario was performed to check the number of simultaneous connections using Apache JMeter3 on the client PC. The Error % value of the Summary Report was checked. Also, the Number of active threads value was checked in Active Threads over Time.

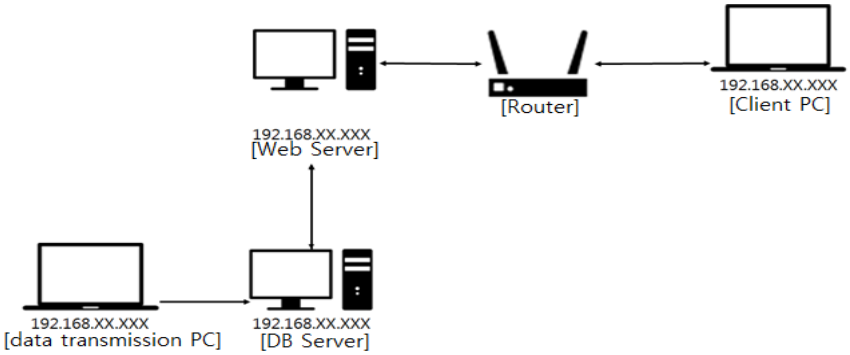

Fig. 10: Test environment

The data transfer device loads the database into the database, and tests whether the data is displayed normally on the client PC. In addition, the average response time (eg, login request, etc.) is measured in the above test environment. The program execution environment is as follows.

Table 7: The program execution environment

Execution environment	Server	[Server software test environment] OS : Linux Server SW : Apache Tomcat 8.5(Was), NginX(web) Server Program : Spring Framework, Node.js
	DB Server	Server database test environment] DB Type: Aurora MySQL 5.6.10a Instance Type: Intel Core-i7
	Client PC	OS: MS Windows 10 S/W: Postman v5.5 or higher or Advanced REST Client 10.0 or higher Web browser: MS Internet Explorer 11 or Google Chrome
Hardware test environment	Server	CPU : Intel(R) Xeon(R) CPU E5-2686 v4 @ 2.30GHz * 2 Memory : 4G SSD : 80G
	DB Server	CPU: 1 Memory: 2G SSD: -
	Client PC	CPU : Intel Core i7-6700 3.40 GHz RAM : 8.00 GB SSD : 238 GB HDD : 931 GB
network test environment	1000 Mbps LAN	

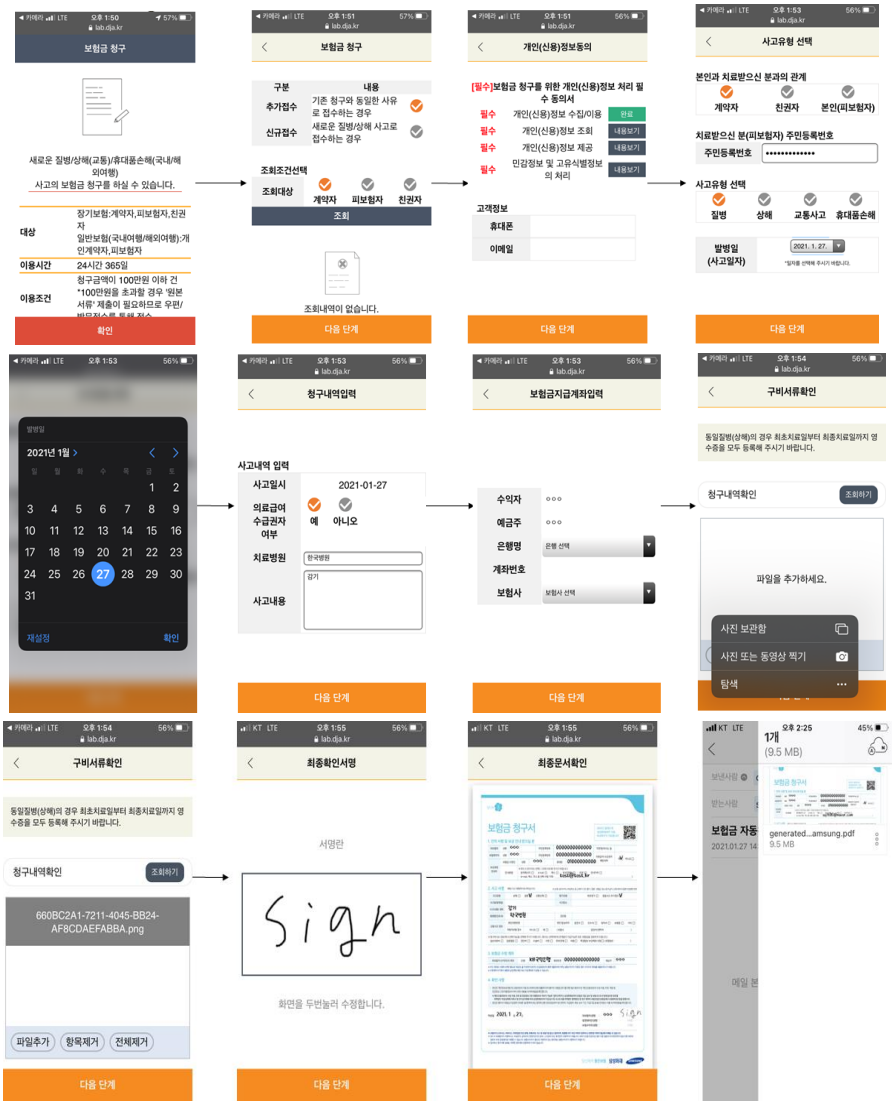

Fig. 11: The entire process from insurance claim to email confirmation

Each login request takes 20, 18, 17, 18, 16, 19, 25, 18, 14, 19, 19, 17, 17, 16, 19, 21, 27, 19, 16, 17ms, which is an average of 18.6ms. Response time was taken. In addition, as a result of repeating the claim process 10 times to check whether the claim was generated and submitted normally, all passed.

In order to check the performance of server-client simultaneous connection request processing, we tested the simultaneous client connection per single server.

200 users (Active Threads) are created in Apache JMeter, and the created user connects to the server for 1 minute. The jMeter test example data is as follows. It showed response speed of less than 1000ms with 200 concurrent users.

242	HTTP Request	200	OK	text	TRUE	503	258	10
142	HTTP Request	200	OK	text	TRUE	503	258	26
44	HTTP Request	200	OK	text	TRUE	503	258	6
49	HTTP Request	200	OK	text	TRUE	503	258	6
49	HTTP Request	200	OK	text	TRUE	503	258	6
246	HTTP Request	200	OK	text	TRUE	503	258	6
146	HTTP Request	200	OK	text	TRUE	503	258	14
130	HTTP Request	200	OK	text	TRUE	503	258	10

Fig. 12: jMeter test example data

8. Conclusion

The system proposed in this paper introduces a drive-thru model to the pharmacy and implements an application that assists the medical insurance claim process using drive-thru accessories.

Through this, the contact between the pharmacist and the customer is minimized to minimize the quarantine burden on the pharmacy, and the accessibility to the pharmacy is increased to solve the accessibility problem due to the distance from the medical institution.

In addition, it is possible to increase the satisfaction of consumers with pharmacy and insurance services by simplifying the claim process of medical insurance for indemnity that many pharmacies users miss or do not claim due to difficulties in the claim process.

References

Kwon, Ki Tae, et al. (2020). Drive-through screening center for COVID-19: a safe and efficient screening system against massive community outbreak. *Journal of Korean medical science*, 35(11).

Bueon Jin-Ok, Lee Hye-Jae. (2019). Where is the pharmacy professionalism going in the system of professions in Korea?. *Korean Association of Health and Medical Sociology*, (51), 81-109.

Hussain, Rabia, and Dalia M. Dawoud. (2021). Drive-thru pharmacy services: a way forward to combat COVID-19 pandemic. *Research in Social and Administrative Pharmacy*, 17(1), 1920-1924.

Bukhari, Nadia, Huma Rasheed, and Bismah Nayyer. (2020). Pharmacists at the frontline beating the COVID-19 pandemic. *Journal of Pharmaceutical Policy and Practice* 13(1), 1-4.

AlAbbasi, H. K., et al. (2021). Implementation and effectiveness of drive-through medication pick-up and home delivery services. A patient safety initiative during

COVID-19 pandemic. *Journal of Patient Safety and Risk Management*, 26(4), 179-186.

Lin, Yuh-Feng, et al. (2013). First drive-through pharmacy services in Taiwan. *Journal of the Chinese Medical Association*, 76(1), 37-41.

Che Noriah, O., et al. (2010). Customer's satisfaction on the implementation of drive-through pharmacy in Penang General Hospital, Penang, Malaysia–pilot study. *Eur J Publ Health*, 20, 245-287.

Bahagian Perkhidmatan Farmasi, KKM. (2011). Polisi Operasi Farmasi Ambulatori (hospital and klinikkesihatan). Edisi; 2011.

Liew, J. E. S., Abdul Gapar, A. A. b. & Shim. (2020). Evaluation of drive-through pharmacy service in Queen Elizabeth Hospital Malaysia. *Journal of pharmaceutical policy and practice*, 13(1), 1-8.

Diri, Reem M. (2020). The impact of COVID-19 outbreak on reassessing the need for drive thru community pharmacy: Cross-sectional study. *Journal of Microscopy and Ultrastructure*, 8(4), 162.

Myers, Alice. (2011). Drive-through businesses. *American Business History and Civil Liberties*.

Wang, Luyang, et al. (2020). Context-Aware Drive-thru Recommendation Service at Fast Food Restaurants. *arXiv preprint arXiv:2010.06197*.

Joe Guszkowski. (2021). Drive-thrus are getting smarter." Restaurant Business, Restaurant Business, www.restaurantbusinessonline.com/technology/drive-thrus-are-getting-smarter.

Min, So-Yeon, and Jong-Hee Lee. (2017). The Design of IoT-based Drive Through Service System for Customers in Distribution Stores. *Journal of the Korea Academia-Industrial cooperation Society*. 18(11), 151-157.

Verma, Rajesh, et al. (2021). Impact Of Digitalization On Marketing Of Insurance Products. *Academy of Marketing Studies Journal*, 25(5), 1-8.

Park, Young-Taek, et al. (2012). Health insurance claim review using information technologies. *Healthcare informatics research*, 18(3), 215-224.

Jain, V., Nalwaya, R., & Manjula, R. (2017). Comparative Study of Native and Web-Based Mobile Application. Corpus ID: 54057274