

Development of Online Food Ordering System for University Students to Maintain Healthy Eating Habits

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Abstract— Healthy diet is one of the key components that the university students must maintain for keeping themselves active and sincere to their studies. Hence, a system automates this process will be an excellent reward for them as university students are always engaged to various activities. The proposed online food ordering system developed with the aim to reduce the reason for university students to pick up an unhealthy eating habit and ease the process for university students to order their meals. The inspiration of this proposed system is to enhance a similar system such as, “UI Dining” which is a mobile application that provides nutritional information and the complete menu of the dining services within the campus developed by the University of Illinois for their students, and “Foodpanda Malaysia” which is a food delivery service started with one goal in mind, which is to be the most convenient food delivery service in Malaysia. The developed system allows the students to order meal through online mobile application, provides ingredient and nutritional information of all menus, reduces reason for students to skip a meal or eat something that is not nutritious, and help them to avoid consuming ingredients that they are allergic to.

Index Terms— Android application, food ordering system, healthy eating habits, mobile application, university students, web application.

1. Introduction

In this fast-developing era, most of the people are slowly forced into a busy lifestyle where they rarely willing to spend more time on eating healthily. This especially applied to university students who often have a busy schedule for assignments, presentations, exams, club activities, and so on. Online food ordering system appeases the needs of busy individuals like students who place their order online and receive delivery within a few minutes (Zulkarnain, 2015). The researcher discovered this opportunity to replace the traditional offline food ordering environment with an online environment as researches have shown that online environment offers more interactive and personalized marketing compared to the traditional offline environment (Burke, 2002).

Busy students who did not maintain regular eating practices will face negative effects such as weight loss, weak immunity, craving for junk food, and most importantly, impaired concentration during classes. Based on a study done from a sample of 1719 Malaysian adult, 51% of them agreed that they hardly able to eat healthily due to lack of time and busy lifestyle (Sharkawi et al., 2014). A similar result is found from another study done from a sample of 35 university students, students want to spend as little time as possible on preparing food during

exam period (Deliens et al., 2014). When students studying in university, most of them will spend their breakfast time, lunch time, or even dinner time on the university campus. Therefore, the university dining service plays an important role in student’s eating behavior. This also means that during lunch hour especially, the dining hall will be crowded with students and lecturers. An observation study shows that due to a long queue in the dining hall, some students switch to the supermarket for instant noodles or other foods are resulted in a study done in China (Tian et al., 2014). This shows that a crowded dining hall will be a reason for university students to eat something fast and convenient, but not nutritious enough as a main meal. A support to this statement is a study done with the gathered answer to 115 questionnaires. Among 32 attributes that influence the dining hall customer, time management is one of the most influential attributes (Nadzirah et al., 2013). Which means the students emphasized on the time taken for them to order and get their food.

From all the facts shown above, it proves that university students nowadays overlooked the importance of healthy eating habit due to their busy lifestyle. This is a problem that we should not leave it alone as it can result in serious consequences. As stated in a study of long-lasting effects on under-nutrition, under-nutrition can lead to the poor mental development and education performance (Vinicius et al., 2011).

Based on the problems stated above, a dining system needs to be developed to reduce the reason for students to skip a meal and increase their awareness of food’s nutrition. This system should allow students to order their meal more efficiently and time-saving while also keep track of their nutrition intake. This research intends to propose a system that can aid the students to regain their healthy eating habit and stay energetic for their studies.

2. Materials and Methods

To develop the online food ordering system, the system needs to encompass 3 applications consisting the following components:

Web Application for Restaurant Operator:

- Manage restaurant menu (view / add / edit / delete)
- Manage order (view / update status)
- Manage promotion (view / add / edit / delete)
- Record reports such as daily sales report. (Additional feature)

Android Application for University Student:

- View promotions published by the restaurants
- View restaurant details
- View available menu with ingredient and nutritional information provided by each available restaurant
- View and edit student account
- Make order
- Pay order cashless
- Search menu based on requirements
- View menu suggestion based on health condition. (Additional feature)
- Top-up credits using online banking. (Additional feature)
- Keep track of nutrition intake for the week. (Additional feature)
- Remember food preference. (Additional feature)

Web Application for System Admin:

- Manage admin, restaurant, and student accounts (view / add / edit / delete).
- Top-up university student's account credits.
- Generate top-up receipt.
- Generate reports. (Additional feature)

The system has to be built considering the technical issues explained below.

2.1 Choice of Programming Language

JSF is also known as Java Server Faces, a technology which compiles a series of APIs for representing user interface components and managing their state, events, input validation, page navigation, and accessibility (Oracle, 2018). JSF is designed to leverage existing standard user interface and web-tier concepts flexibly without restricted by a protocol, specific markup language, or client device (Oracle, 2018). Flexibility aside, ease-of-use is always the primary goal for JSF. JSF architecture making it simple to communicate between the presentation layer and application code while clearly defines a separate line between application logic and presentation layer (Oracle, 2018). JSF UI components are enabled to render to various client devices as well as the UI component classes included with JSF encapsulates the component functionality instead of the client-specific presentation (Oracle, 2018). Other than that, JSF enhances the design and maintainability of the application by integrating Model-View-Controller (MVC) design pattern into the architecture. JSF Java can be chosen as the programming language to develop all 3 applications. Minimal Java can be used to develop the android mobile application for students, while majority of the system can be developed using JSF Java. The reason Java can be chosen due to the fact that Java is the most popular programming language when it comes to Android application development. Besides, Java is also the primary official language for Android, which makes it most supported from Google and Play Store (Adam,

2017). Due to the fact that Java is popular and widely discussed, it makes Java easier to learn as there are tons of Java resources on the web, in the libraries, and classes. Therefore, JSF Java can be chosen as the programming language so that the developer can maximize the productivity and efficiency on developing the system.

Furthermore, JSF can be chosen because it allows HTTP requests mapping to the component specific event handler and manage them as a stateful object on the server (Oracle, 2017). JSF technology enables the developers to develop web applications that implement the finest grained separation between presentation layer and behavior logic that is usually offered by client-side UI architectures (Oracle, 2017). Moreover, JSF is an UI framework for building Java-based web applications with rich user interfaces that can overcome the challenges such as creating custom user interface components (Qusay, 2004). In consideration for the system users, JSF web applications are built and run on a Java server and render the UI back to client, which means that the web application is lighter on the client-side (Qusay, 2004). The last reason for choosing JSF is that JSF provides web application lifecycle management by the help of controller servlet, and a rich collection of component model with component rendering and event handling (Qusay, 2004).

2.2 Choice of Interactive Development Environment (IDE)

When it comes to Android application development, Android Studio can be the first IDE choice as it is designed specifically for Android development to be faster and simpler compare to other IDEs like Eclipse. Besides, Android Studio provides a more stable performance compared to other all-purpose IDEs as Android Studio is developed specifically for Android Java development which requires lower system needs in comparison (Mehul, 2015). Other than that, the smart auto completion implemented in Android Studio doesn't just work with the first few letters of the methods, instead it searches for any methods of fields which contains that few letters. For example, when "viewby" is typed, auto completion will suggest "findViewById".



Figure 1: Android Studio code snippet

Furthermore, Android Studio implements an Autosave feature which will automatically save all the files by default after finishing typing. This secures the developer's effort in case of any accident such as unexpected shut down before saving the progress.

In the case of web application development for the proposed system, Netbeans can be used as the IDE. Netbeans can be

chosen as the IDE because it comes with built-in SQL support which makes the development related to the database a lot easier compare to others like Eclipse (Azharuddin, 2012). Besides, Netbeans provides numerous features that enable built-in support for JSF, including versatile editor enhancements for Facelets pages, JSF managed beans, Facelets templates and composite components (Netbeans, 2018). Therefore, developing the proposed system in Netbeans will boost the productivity and save the unnecessary time and effort for getting used to the IDE. In addition to that, the developer can save the time and effort on setting up JSF environment on the IDE as JSF is well supported by Netbeans.

2.3 Choice of Database Management System

After investigating the features of different DBMSs, MySQL can be chosen as the DBMS for this system. First of all, MySQL can be chosen because it is open source and fully supported by Netbeans IDE, which is the chosen IDE for this system. Netbeans website even offers an installation bundle which consists of the Netbeans IDE, GlassFish Server and MySQL DBMS (Netbeans, 2008). Although Java DB is fully supported by Netbeans and Java is the programming language chosen for this system, Java DB is not chosen as it will cause inconvenience for the future development since it only supports Java programming language. MySQL with a wide range of supported programming languages provides more options for future development. Furthermore, MySQL provides self-healing replication clusters which improve the scalability, performance, and availability of the database (Oracle, 2018). Based on the DBMS popularity ranking done by DB-Engines, MySQL ranked 2nd while MsSQL ranked 3rd and Java DB ranked 57th (DB-Engines, 2018). This means that there are more resources available online for MySQL compared to MsSQL and Java DB.

2.4 Choice of Operating System

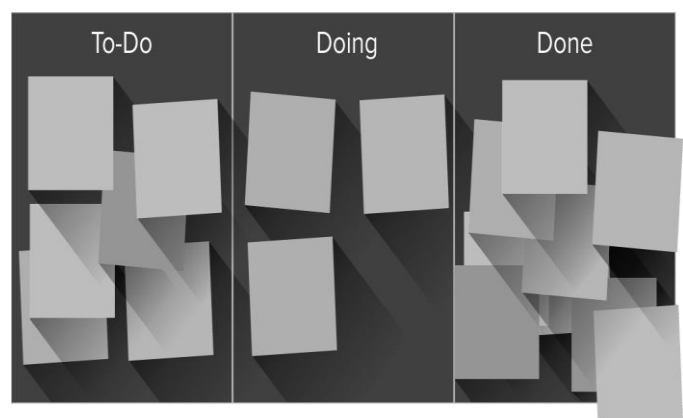
The operating system (OS) that can be chosen for this system is Android for the mobile application and none specific OS can be chosen for the web applications as web application runs on web browser regardless of the type of OS. Android can be chosen because Android is the most popular and commonly used OS in the mobile industry. This statement is supported by the Worldwide Smartphone Sales to End Users by Operating System in 2016 which stated that 352 million out of 432 million smartphones sold are Android operated (Gartner.com, 2017). Besides of its' popularity, Android development mainly uses Java, which is another popular and commonly used programming language. Which means developing Android mobile application using Java programming language is easy to learn as there are plenty of resources around the net. Furthermore, Android is a lot easier and cheaper to publish the project and let it go live. All it takes is to sign up and upload the APK with a one-time payment of 25\$ and wait for several hours before it goes public (Adam, 2016).

Based on the technical research, the developer can gain more confidence in the choice of development tools and a bigger picture on how to build the system architecture for this system. This is an important research to be done as choosing the right development environment will maximize the developer's productivity and efficiency in the process of developing the proposed system. In conclusion, the developer can use Java programming language on Android Studio to develop the mobile application for student-side while using JSF Java on Netbeans to develop the web applications for the entire proposed system with MySQL as the Database Management System. The proposed system can be developed operating on Android OS together with any internet browsers on desktop or mobile devices.

2.5 System Development Methodology

The research on the system development methodology suggests that Kanban can be selected as the Software Development Methodology for this system. Due to the fact that Kanban is designed for a team to work with. Besides, instead of "customers", this system refers to the target user groups which consist of university students, restaurant operator, and system admin to collect requirements and feedback.

Kanban is a framework that focused on visual effect to implement Agile that identify what to construct, when to construct and how much to construct. A Kanban board is a significant tool to implement the Kanban development method for system. The Figure 2 demonstrates the simplest board used in Kanban. These Kanban cards aid the communicate status at a glance. In addition, using a different color of cards can also be used to represent different details. For example, Green cards could represent designs, Blue cards could represent functionalities. Besides, the amount of work-in-progress will match the developer's capacity and new works can only be added when there is an empty space on the Kanban board. This improves the flexibility, transparency, and output of the development process (Smartsheet.com, 2016). Figure 3 shows



the general overview of Kanban in a graphical manner.

Figure 2: Kanban board example (Smartsheet.com, 2016)

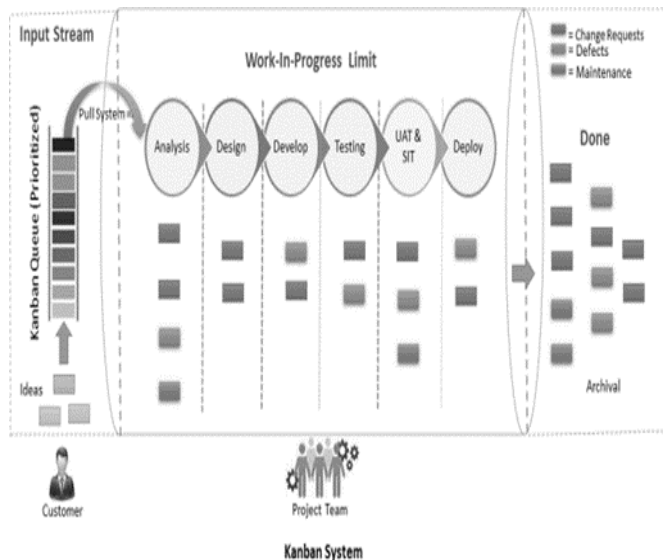


Figure 3: General overview of Kanban methodology (Vikash, 2015)

The first stage of Kanban method includes identifying Workflow where, the developer will first identify the major processes in the system, such as requirements gathering, data analysis, design, development, testing, and deployment. Then, the developer can start gathering information and requirements by conducting an interview, and questionnaires to the target user groups. After analyzing the findings and deciding the unit of work, the developer then can look at the overall flow to plan and describe the typical process steps according to the priority (Paul, 2017).

The next stage is Visualizing Workflow, where the Kanban board is constructed along with the value stream map that arranges the tasks according to their priorities. In the case of the proposed system, the Kanban board will have several columns, which are Backlog, Coding-in-progress, Internal Testing, External Testing, and Done. Backlog consists of tasks arranged according to their version and their priority in the version, Coding-in-progress column consists of tasks that the developer is currently developing, and Internal Testing column consists of the tasks that are pending for Unit Testing and Integration Testing by the developer. Next, External Testing column consists of tasks that have passed the internal testing and are pending to deliver to the customer for User Acceptance Testing (UAT). Once, all the task of a version is placed in the External Testing column, the system will be delivered to the customer for UAT. Lastly, Done column consists of tasks that have passed the User Acceptance Testing. After the Kanban board and its' columns are constructed, Kanban cards will be prepared to represent tasks on the Kanban board. Every Kanban cards will have task details such as description, priority, deadline, and completion criteria (Paul, 2017). Different color of Kanban cards will be prepared as well to represent different types of

task. Figure 4 shows the example of the Kanban board that can be used for the system.

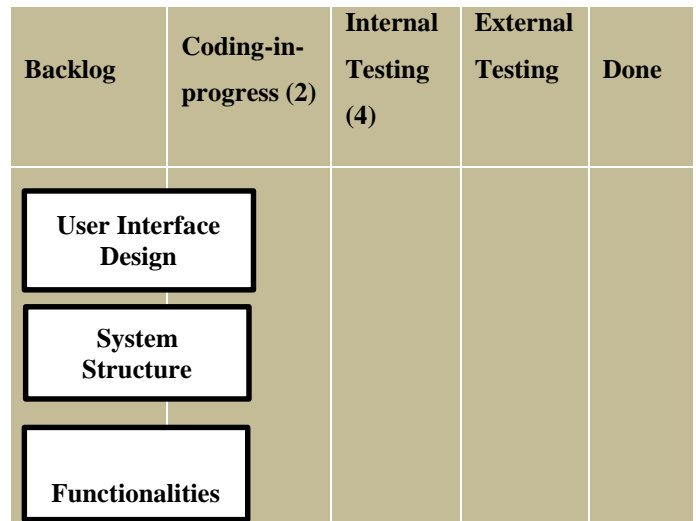


Figure 4: Example Kanban board to be used for the system

The third stage is to Set Work-In-Progress (WIP) Limits. Setting WIP limit for each stage or column in the Kanban board will depend on the developer's capacity and capability. This will allow the developer to focus on the current tasks and avoid too much of task switching (Paul, 2017). In this case, the WIP limit for the Coding-in-progress column will be set as 2 to keep the developer focused and to avoid over-multitasking, and the WIP limit for the Testing column will be 4 due to several functions can be tested together as integration testing. The number of WIP limits are set this way to ensure that the developer will be able to produce a quality product and perform in-depth testing. The WIP limit will then be written on the Kanban board as shown in the Figure 4 as a reminder.

After all the setup, the system can finally move to the execution stage with the Kanban board well prepared. In this stage, the developer can start to fill up the Backlog with Kanban cards based on their version and their priority in the version, then the developer can pull tasks into the Coding-in-progress column to start developing the system. When the Coding-in-progress or Internal Testing column reached the WIP limit, the developer can stop pulling in a new task and focus on clearing the congested column first (Paul, 2017). The flow of work shown on the Kanban board will be monitored and analyzed by the developer whenever a problem occurs. Once the problem is identified, the developer can then measure his effectiveness by tracking the workflow, the cycle time for each task, then brainstorm for improvements to increase the quality of work (Paul, 2017).

Lastly, whenever the tasks of an entire version are placed in the External Testing column after Internal Testing column, it will be sent to the target user groups for UAT and review purposes. If there are some changes required for the version, it will be recorded and placed on top of the Backlog so that the changes

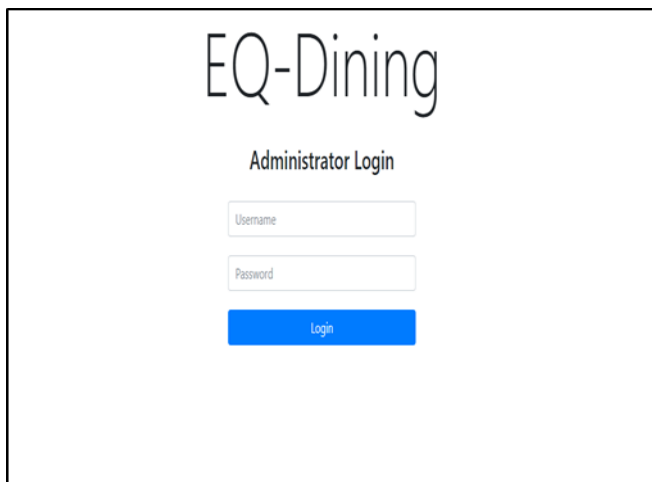
can be done as soon as possible. The cycle then keeps executing until all the tasks are moved in to the done column after the target user groups accepted them.

3. Results and Discussion

The objective of the system is achieved successfully and the output of the system is conversed through the following sections.

3.1 Screen for System Admin

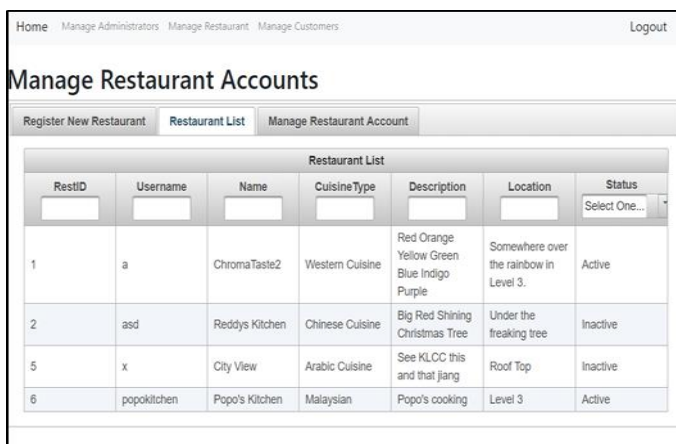
Upon launching the System Admin application, Login Page will be displayed as indicated in Figure 5. Users are required to log in the system with valid credentials before they can proceed any further.



The image shows a login page for 'EQ-Dining'. It has a title 'EQ-Dining' and a subtitle 'Administrator Login'. Below the subtitle, there are two input fields: 'Username' and 'Password'. At the bottom, there is a blue 'Login' button.

Figure 5: UI for System Admin Login Page

Upon successful login to the System Admin application, Home Page will be displayed with a navigation bar on top for users to navigate to their desired features which consists 'Manage Administrators', 'Manage Restaurant', and 'Manage Customer' option as indicated in Figure 6.



The image shows a web application interface for 'Manage Restaurant Accounts'. At the top, there is a navigation bar with links: 'Home', 'Manage Administrators', 'Manage Restaurant', and 'Manage Customers'. Below the navigation bar, there is a 'Logout' button. The main content area has a title 'Manage Restaurant Accounts' and three tabs: 'Register New Restaurant', 'Restaurant List', and 'Manage Restaurant Account'. The 'Restaurant List' tab is selected. Below the tabs, there is a table with the following data:

RestID	Username	Name	CuisineType	Description	Location	Status
1	a	ChromaTaste2	Western Cuisine	Red Orange Yellow Green Blue Indigo Purple	Somewhere over the rainbow in Level 3.	Active
2	asd	Reddys Kitchen	Chinese Cuisine	Big Red Shining Christmas Tree	Under the freaky tree	Inactive
5	x	City View	Arabic Cuisine	See KLCC this and that jang	Roof Top	Inactive
6	popokitchen	Popo's Kitchen	Malaysian	Popo's cooking	Level 3	Active

Figure 6: UI for System Admin List Restaurant Page

The system can generate the receipt of the latest top-up transaction as indicated in Figure 7.

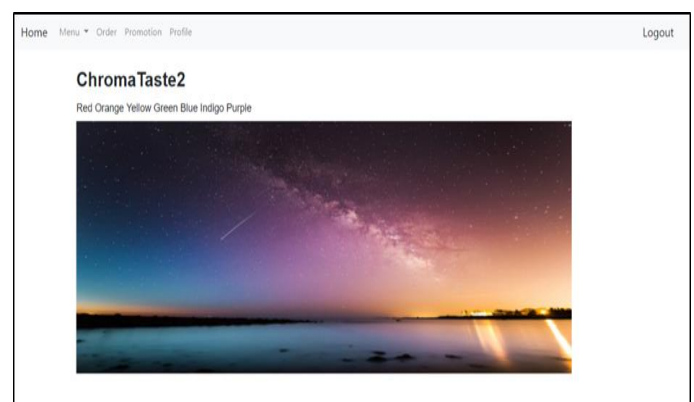


The image shows a receipt for a top-up transaction. It has a blue header with the text 'Customer ID: 37', 'Top Up Amount: RM 123.0', 'Original Balance: RM 1000.0', 'Current Balance: RM 1123.0', and 'Receipt No: 213'. To the right of the header is the logo for 'A.P.U. ASIA PACIFIC UNIVERSITY OF TECHNOLOGY & INNOVATION'. Below the header, the text 'Payment for EQ-Dining account Top Up' is displayed. The receipt also shows 'Username: izzactan', 'Name: Issac Tan', and 'Receipt Date: 2018-02-25'. At the bottom right, it says 'Issued By: SAdmin(SuperAdmin)'.

Figure 7: UI for Top Up Receipt

3.2 Restaurant Operator Application

Upon successful login to the Restaurant Operator application, Home Page will be displayed with a navigation bar on top for users to navigate to their desired features. Every Restaurant Operator account is bound to manage one restaurant and the restaurant name, description, and photo will be displayed on the Home Page as indicated in Figure 8.



The image shows a restaurant home page. At the top, there is a navigation bar with links: 'Home', 'Menu', 'Order', 'Promotion', and 'Profile'. Below the navigation bar, there is a 'Logout' button. The main content area has a title 'ChromaTaste2' and a subtitle 'Red Orange Yellow Green Blue Indigo Purple'. Below the subtitle, there is a large image of a night sky with a rainbow and a cityscape.

Figure 8: UI for Restaurant Home Page

The 'Menu' on the navigation bar and select 'Food', the user will be navigated to this page showing the first tab. This tab is used to add new food to the restaurant's food menu as shown in

Figure 9. Under this tab, a Wizard form is used to facilitate the food adding process with validations applied.

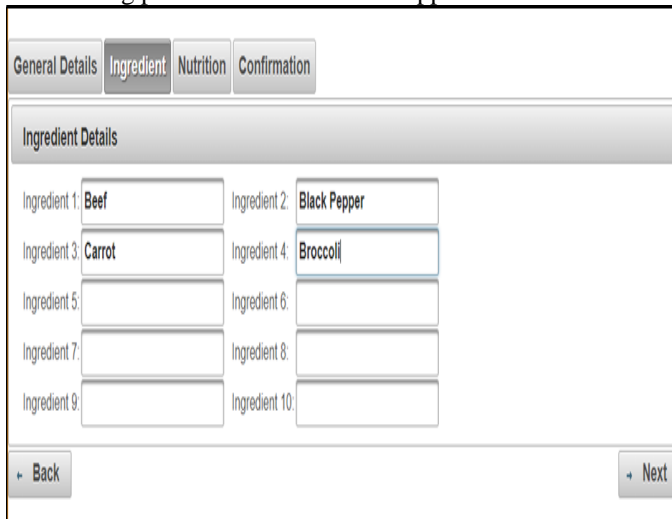


Figure 9: UI for Restaurant Add New Food Page

3.3 Customer Application

Upon launching the Customer mobile application, Home Page will be displayed with the promotions published by all the restaurants. If there is a pending order ready for pick up, “Your order is ready!” message will be displayed as shown in Figure 10.



Figure 10: UI for Customer Home Page

Upon clicking on the drawer icon placed in the top left corner, the navigation drawer will be displayed showing the navigation options available as shown in Figure 11.

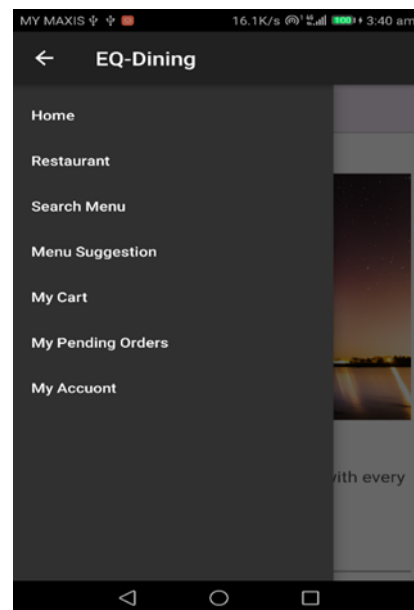


Figure 11: UI for Customer Navigation Drawer

If ‘Restaurant’ is clicked in the navigation drawer, users will be navigated to the Restaurant Page which shows the list of restaurants on the campus as shown in Figure 12.

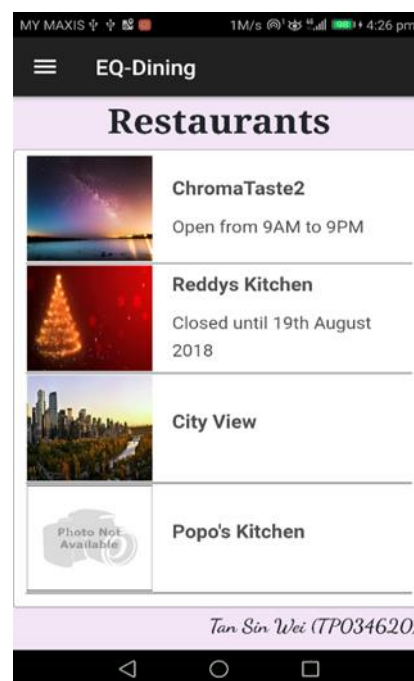


Figure 12: UI for Customer Restaurant Page

By clicking any restaurant in the Restaurant Page, the user will be navigated to the Restaurant Details Page showing the

restaurant details and menu options. However, if the restaurant is closed, the menu options will not be rendered and a “Restaurant is CLOSED” message will be displayed instead.

If ‘Menu Suggestion’ is clicked in the navigation drawer, users will be navigated to the Menu Suggestion Page in Figure 13 which shows the menu suggestion options based on health condition. Upon clicking on the blue exclamation mark icon, a dialog will be displayed showing the kind of menu will the system suggest based on the selected health condition.



Figure 13: UI for Customer Menu Suggestion Page

For testing the system, Unit Testing, User Acceptance Testing, and Integration Testing are executed with rewarding outcome. More than 200 test cases are tested on this system and resulted in more than 200 ‘As expected result’. In functionality wise, it is an excellent result. However, there are a few concerns being pointed out by the users during User Acceptance Testing. It is obvious that there are a lot of space for improvement in terms of the system UI as both System Admin and Restaurant Operator have given negative feedback about it. Other than that, useful suggestions are given by all three users and those simple ones are implemented by the developer. Whereas those suggestions that are too complicated can be added into the system future enhancement plan by the developer.

4. Conclusions

In conclusion, the proposed system has achieved the objectives, which are allowing the students to order their meal via online mobile application, and provide ingredient and nutritional information of all the menus for the students. This helps to reduce the reason for students to skip a meal or eat something that is not nutritious enough as a main meal and help them to avoid consuming ingredients that they are allergic to. Throughout the entire development process of this system, the developer needs to enhance the programming skills on Java JSF

and the MVC framework which will benefit the developer. Although this system has achieved a commendable satisfactory level from the user, the developer and users have discovered a few limitations in this system that should be addressed in the near future. From the aspect of System Admins, they can only generate the receipt for the latest top up transaction made. This limits the System Admin from keeping track on the top-up transactions and generate a receipt for the past top-up transactions. From the aspect of Customers, the “Your order is ready!” notification can be seen in the application’s Home Page. Besides, in the case where the order consists of foods from multiple restaurants, the notification will be triggered if all the restaurant has done processing the foods in that order.

Based on the user’s feedbacks, one of the greatest future enhancement for the system will be the reporting feature. The system does facilitate their major operations; however, the reporting and accounting operations are still to be performed in the old way. By implemented reporting features, the System Admins and Restaurant Operators are able to generate reports automatically and effortless. Report such as Top Up Transaction History will be one of the reports the developer intended to develop in the future as it helps the System Admins to keep track on the past top-up transactions and generate a receipt for it. Other than that, an Activity Log will be included in the future enhancement plan to allow the Super Admin to monitor the activities done in the system by all the System Admins. Monthly Sales Report and Best Seller Report will be considered in the future enhancement plan as well as it can help the Restaurant Operators to calculate their revenue and make decisions on their menu. Furthermore, the next major enhancement will be focused on the Customer’s mobile application. Android Push Notification will be implemented so that the customer doesn’t need to keep checking on the application’s Home Page or My Pending Orders Page. This will enhance the system to achieve the objectives further. Moreover, a stronger and more professional menu suggestion algorithm will be implemented in the future so that the menu suggested to the customers based on their health condition will be more accurate and specific. Lastly, the future enhancement that needs to be implemented in the entire system is UI improvement as the current UI is just around the satisfactory level. More attractive colors, backgrounds, designs, and animations will be added to the entire system in the future so that the users are not simply using it, but they will look forward to using it.

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