Implementation of User Interface and User Experience (UI/UX) in Rational Unified Process Methods in DevelopmentE-Commerce System

Nita Novita[(✉)], MAris Ganiardi, Indri Ariyanti, and Delta Khairunnisa

Informatics Managemebnt Department, Politeknik Negeri Sriwijaya, Palembang, Indonesia
`nitanovita_polsri@yahoo.com`

Abstract. One of the most widely used software development methods is the Rational Unified Process (RUP) method. The reason for using this method is because this method uses an object-oriented paradigm that more closely models the actual state of the system, is iterative and focuses on the needs of the user. Usually this method is widely used in medium to large scale software development. Although many have advantages, the RUP method does not include the activities and characteristics of the user. This research tries to implement user interface and user experience (UI/UX) with usability characteristics (easy to use) in the RUP method. The purpose of this implementation is to improve the quality of analysis and design on the RUP method. The software that will be used in this research is an e-commerce web application. This web application is used because it has many variations of users.

Keywords: Culinary · E-Commerce · User Interface · User Experience · RUP

1 Preface

The increasing use of the internet in everyday life has resulted in more and more types of software being created by developers. Initially the internet was only used as a medium for distributing information and communicating, but now the internet is more widely used for transactions, file exchange, social media, video streaming to learning. One type of software that is popular during the Covid-19 pandemic is an e-commerce web application. By using this application, buying and selling goods can be done without having to meet directly between traders and customers.

E-commerce web applications include the type of web application at the upper middle level in terms of the completeness of the features it has. The more features an e-commerce web application has, the more complicated the process will be. To develop e-commerce web applications requires software development methods and models. There are many methods and models that can be used in developing e-commerce web applications including the water fall method, prototyping method, agile method, SCRUM and rational unified process (RUP) [9].

Rational unified process (RUP) is the most widely used method in software development. The advantage of this method is that it is able to model the real world in more

detail so that it is easier for developers, users and stakeholders to understand. The notation used is semi-formal object-oriented in the form of Unified Modeling Language (UML) diagrams that are easy to learn and understand. The stages in the RUP Method are inception, elaboration, construction, and transition [5].

The more forms of software used by humans in their daily activities, the RUP method is less relevant to use in software development. The RUP method only emphasizes problem solving for users and stakeholders without involving the activities, caracteristics, and psychology of the users. In addition, the RUP method does not involve where the software works and the hardware that accesses it.

Currently developing a study on the participation of user experience (UX) in the development of various products. So the resulting product is not only completed functionally, but the product can really be used comfortably by users. There have been many researchers who have researched the application of UX, including [6] conducting research related to comfort level factors in using smart TVs in a room. [8] conducted research related to the provision of information on four-wheeled vehicles.

Not to be left behind in software development also involves UX in its development model. Usually this UX is combined with the user interface (user interface, UI) on the software page. So the combination of UX and UI wants to use the software comfortably and achieve the goal. For that we need a research that combines UX/UI in a software development model. [11] researching integrating UX/UI in Agile software development models.

In this study, implementing the user interface and user experience (UI/UX) on the RUP method in the development of e-commerce web applications. With the user interface and user experience (UI/UX), in the RUP method, the development of e-commerce web applications will clarify the grouping of users who use e-commerce web applications based on the characteristics, activities, psychology of the users. Scenarios and story boards that will explain the activities of the user, and the design of the application interface that will be used.

2   Basic Theory

2.1   User Experience

According [7] user experience is how the user feels about every interaction the user is facing with what is in front of the user when using it. To get a good user experience, a product must have a match between product features and the needs of the user. This will determine whether the product is valuable or otherwise. Then if the product is easy to find and easy to use when the user uses it for the first time, then the product can make the user feel happy when using it.

[13] a group of Human-Interaction Computer (HCI) researchers conducted a survey of 275 user experience professionals and academics to find out what user experience means. After analyzing respondents' answers, they identified some common features in people's definitions of user experience contributions, as follows:

1. User experience is seen as a person's response when they use a device, product, service or object through a user interface.

2. User experience is dynamic, so it can change before, during or after use and it depends on the context or experience when using devices, products, services and objects.
3. User experience responses are subjective. Influenced by user background, previous experience and many other factors.

2.2 User Interface (UI)

The user interface is the way programs and users interact. It can be interpreted that the user interface is a way for users to interact with computers, smartphones, tablets or other devices that are visual, understandable by users of the application, and programmed in such a way that they can be read by the system and can execute the right commands [14].

Interface design is a complex process involving designers, target audiences, and clients. It is an iterative process, with phases of user research, developing ideas, experimenting, building and further testing, all of which contribute to creating interactive designs to get the right user experience [16].

2.3 E-Commerce

Electronic Commerce (e-commerce) is a new concept that is usually described as the process of buying and selling goods or services on the World Wide Web Internet [12] or the process of buying and selling or exchanging products, services and information through information networks including the internet [15].

There are actually several types of e-commerce business based on collaborating with business partners, customer service, which are provided in the buying and selling process services or in the e-commerce. The types of e-commerce businesses that are widely carried out in Indonesia today are:

1. Classifieds or List of Classified Ads
   Classifieds or classifieds listings are the simplest form of e-commerce business. This form of business is in the form of services provided by the company to bring together sellers and buyers. Companies provide space for sellers to display or showcase their wares. Buyers who are interested in the seller's merchandise directly contact the seller. Sellers and buyers are free to make transactions anywhere according to their agreement. The e-commerce company is not responsible for the course of the transaction.
2. Marketplace C2C (Customer to Customer)
   This e-commerce company is a company that provides a place as a media for promoting merchandise for sellers and e-commerce companies also provide payment method services for online transactions. This is the main characteristic of the C2C Marketplace e-commerce business form. In general, e-commerce parties will provide Escrow services or third party accounts.
3. Shopping Mall
   The shopping mall e-commerce business form is an e-commerce company that provides services more or less the same as the C2C Marketplace business form, but the sellers in the e-commerce are only big brands that already have names in local or international markets.

4. B2C (Business to Consumer) online shop
   Basically this form of business focuses more on selling goods or products belonging to the e-commerce company itself. So that all profits from selling products are purely owned by e-commerce companies and are not shared with other parties. This type of business is one of the most developed forms in Indonesia, but developing this form of business is certainly not easy. In addition to the need for very large capital, the availability of supply of goods and the sales system must all be handled by e-commerce parties themselves.
5. Social media shop
   This form of e-commerce business can develop along with the increasingly uphill development of social media. The potential of social media is now being used directly by e-commerce companies by building businesses based on these social media. At first Facebook provided a fanpage that could be used to offer goods for sale. Fanpage is a special page like a blog that provides various information according to the wishes of the owner, ranging from companies, education, services, physical products, artists, communities and many others. Currently, social media is the main land for the development of this form of business. by Facebook, but with the recent shift in social media trends that have also opened up new competitors such as Instagram and Twitter.

2.4 Rational Unified Process (RUP)

The software development method that will be used in this research is the Rational Unified Process (RUP). RUP is an object-oriented software development method with process stages as shown in Fig. 1.

Through Fig. 1. it can be seen that the RUP has two stages of dimensions, namely:

1. The first dimension is drawn horizontally. This dimension represents the dynamic aspects of software development. This aspect is described in development stages or phases. Each phase will have a major milestone that marks the end of the beginning of the next phase. Each phase can consist of one or more iterations. This dimension consists of the stages of Inception, Elaboration, Construction, and Transition.
2. The second dimension is depicted vertically. This dimension represents the static aspects of the software development process which are grouped into several disciplines. The software development process which is described into several disciplines consists of four important elements, namely who is doing, what, how and when. This dimension consists of Business Modeling, Requirements, Analysis and Design, Implementation, Test, Deployment, Configuration and Change Management, Project Management and Environment.
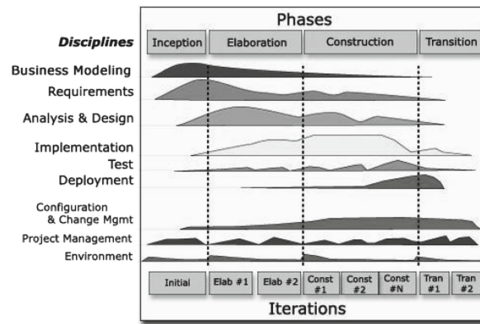
Fig. 1. RUP Phases [5]

3   Research Methodology

The steps involved in conducting this research are as follows:

1. Analysis of the RUP Model
   The first stage in this research is to study and analyze the stages of the rational unified process (RUP) model in software development. How to study and analyze it is done by studying literature from various sources such as books, journals, and software development documents. From this stage, various shortcomings are found in the RUP model.
2. UI/UX Concept Analysis
   The second stage of this research is the same as the first stage. The second stage is to study and analyze the concepts and rules of UI/UX in software development. How to study and analyze it is done by studying literature from various sources such as books, journals, and software development documents. From this stage, various advantages are obtained from the UI/UX model.
3. Implementation of UI/UX on the RUP Model
   The third stage of research is implementing the concept of UI/UX on the RUP model in software development. Implementation aims to clarify the stages of the RUP model, namely the inception stage which emphasizes the need elicitation process and elaboration which emphasizes software design. In needs elicitation by using the concept of UI/UX, the orientation of needs elicitation is focused on analysis and user personas. In software design add software prototyping that makes it easier for users and stakeholders to understand the software workflow.
4. UI/UX testing on the RUP Model on e-commerce web application development
   In this forth stage, implementing the UI/UX concept in the RUP model is carried out in the third stage of research on the development of e-commerce web applications. The trial was conducted on the development of an e-commerce web application at sarapan pagi rumah kito. Sarapan pagi rumah kito is a stall that sells Palembang culinary, such as: pempek, martabak, and roti. The owner of sarapan pagi rumah kito which is located on Mesjid Street Kenten Palembang is Pak Rahman.

- Need elicitation
  Needs elicitation carried out in the development of e-commerce web applications is to collect needs and data in sarapan pagi rumah kito. The method used in this need elicitation is that the researcher observes sarapan pagi rumah kito. The technique used to collect needs and data is direct observation of the workflow that occurs and interviews with the owner of sarapan pagi rumah kito and their customers.
- E-Commerce system modeling
  Modeling the systems and business processes that occur in sarapan pagi rumah kito. The modeling and process are made based on the results of observations and interviews conducted in the first stage. In the modeling of this system, users who are involved in business processes at the Warung Kuiner Rumah Kito are also found. The system model also describes the interactions between users in the system.
- Analytics and user personas
  Analytics and user personas are part of the concept of UI/UX. This section will explain how to define users, user classifications, descriptions, and user activities in detail. From this analysis and persona it will also be determined how to test the application to be made.
- Software description
  The interaction between the user and the e-commerce web application will be illustrated through a use case diagram. This diagram will illustrate the features available in e-commerce web applications that can be used by users.
- Application Design
  Application design is made based on functional requirements obtained from system modeling and requirements gathering. Based on the RUP model, the design of an e-commerce web application is in the form of diagrams using UML notation such as class, activity, and sequential diagrams. In designing e-commerce web applications, the UI/UX concept adds a new artifact, namely the application structure that will describe the interconnectedness of the software interface and prototyping which will describe the software in general.
- E-commerce web application development
  Making e-commerce web applications using the PHP programming language, Code Igniter Framework and its DBMS using MySQL.

5. E-Commerce Web Application Testing
   Testing of e-commerce web applications is carried out in two ways, namely testing the functionality of e-commerce web applications using black box testing methods. Testing is done by creating scenarios that ensure the output of the e-commerce web application is in accordance with user needs. The second test is done by asking for feedback from users related to the use of e-commerce web applications. User feedback in the form of a questionnaire that measures the level of ease and satisfaction of using e-commerce web applications by users.

4   Result and Discussion

4.1   System to be Created

The new system that will support the buying and selling transaction process at sarapan pagi rumah kito is to develop an e-commerce system. In this system, a web application will be made that makes it easy for orders made by buyers who are around sarapan pagi rumah kito those outside the city of Palembang. The e-commerce web application provides culinary ordering features available at sarapan pagi rumah kito. In this feature, the buyer just has to choose the cuisines to be ordered. Then select the form of payment whether you want to transfer via bank or pay on the spot. For culinary introductions that have been ordered can be delivered, while orders outside the city can be sent via delivery services such as JNE. Payment for orders outside the city of Palembang via bank transfer. Before placing an order, the buyer must register on the e-commerce web application.

4.2   User Personas

The next step after conducting user analysis is to describe users through user personas. The user persona contains data about the user's profile which contains the user's age, occupation, and residential address, characteristics, influencing factors, level of proficiency in using technology, likes and dislikes, and frequently used electronic devices. One of the results of the persona obtained is shown in Table 1.

4.3   Use Case Diagram

The use case diagram is a form of analysis of an e-commerce web application. If the analysis and users place more emphasis on users, the use case diagram emphasizes more on the characteristics of e-commerce web applications. From the diagram, the actors involved, the features of the e-commerce web application, and scenarios involving the actors will be drawn. Use case diagrams are made using UML notation which is part of the RUP model.

The form of interaction between the actor and the e-commerce web application is depicted in Fig. 1. The interaction between the actor and the e-commerce web application is associational, which means that the use case is carried out independently and is not a process flow. There are two actors who interact with the e-commerce web application, namely: the admin, the actor who is responsible for all the data in the e-commerce web application, and the customer is the actor who orders the culinary at sarapan pagi rumah kito. The use case diagram also describes the use cases which are the features of an e-commerce web application.

Table 1. User Pesona

Abdul Somad	
Profile	• Field workers • Work from one place to another depending on the project you ger • Live ini the mosque complex of puri mas • Age 47 years
Personality	• Energgetic • Likes challenges
Influences	TV and smartphones
Tech Ecpertise Level	Expert
Goals	Facilitate mobility to support work
Device & Platform	Operating system android
Domain Details	Don't want to use complicated tools
Do and Don't	Do • Availabilty of appplication that make to work easier • Do not want along learning process • Uncomplicated use of the device Don't Applications that use too much use strict security
Brand & Product Relationship	Xiaomi redmi note 11 pro

4.4 Prototyping

Prototyping is an important artifact provided by the UI/UX concept to complement the design of the RUP model. By using prototyping, users get an overview related to the e-commerce web application that will be created. In addition, with prototyping, users can simulate e-commerce web applications before they are made.

From a developer perspective, prototyping is very helpful in developing e-commerce web applications. Developers do not need to require large resources to show an overview of the e-commerce web application that will be created to users. Developers can draw directly using pencil and paper or use the Figma application. The advantage of using an application like Figma is that it can generate program code that can be used to create an e-commerce web application interface.

Figure 3 shows the prototyping of an e-commerce web application that will be created. This prototyping will be very similar to an e-commerce web application that will be made in terms of appearance or characteristics.
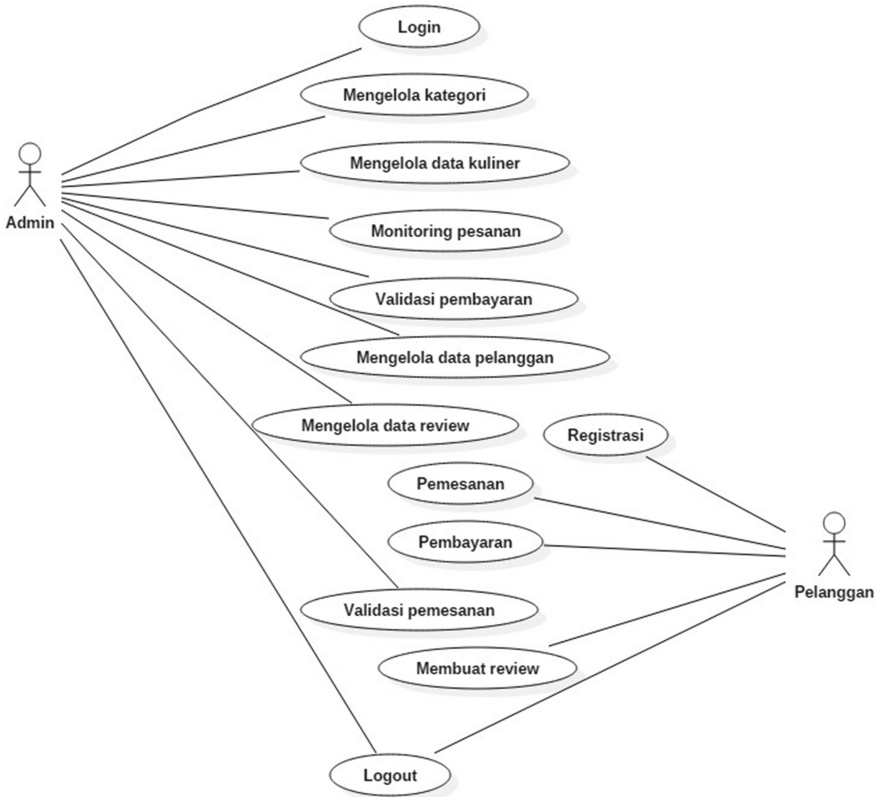
Fig. 2. Use Case Diagram E-Commerce Web Application

4.5 Interface E-Commerce Web Application

The home page of the e-commerce web application that first appears using a smartphone is shown in Fig. 4. On this home page there is a navbar that contains navigation to the pages contained in the e-commerce web application. Culinary information available at sarapan pagi rumah kito. Customers can order these dishes by clicking on the basket in the culinary image. In addition to displaying culinary delights, at the bottom of the page there are customer opinions regarding the culinary offerings at sarapan pagi rumah kito.

4.6 Discussion

There are two ways to evaluate the e-commerce web application, first by testing the e-commerce web application interface page form. Testing is done by using the black box method. The purpose of the test is to find out the output produced by the e-commerce web application is in line with expectations. One test of the e-commerce web application interface page is shown in Table 2. From the test results, the output day of the e-commerce web application is in accordance with user expectations.

Fig. 3. Prototyping E-Commerce Web Application

The second test is carried out based on usability factors of e-commerce web applications, namely: the level of success, convenience, efficiency, and satisfaction. Measurements were made by distributing questionnaires to 10 customers for sarapan pagi rumah kito.

The success rate of using e-commerce web applications reaches more than 90 on average based on the results from Table 3. These results indicate that e-commerce web applications are easy to use. In this measurement, the customer immediately tried the e-commerce application, after that he filled out the questionnaire given by the researcher.

After measuring the success of using e-commerce web applications, the next step is to measure the level of use. This measurement is carried out by giving various tasks to users of e-commerce web applications. Based on the measurement results, it is obtained that 60% of users are able to use e-commerce web applications, while there are 40% of users who still have difficulty using this application. Users who are still difficult to use are caused by not being used to using e-commerce web applications.

E-commerce web application efficiency as measured by how fast an application or features used. In this study, units of seconds are used to measure the user's speed in
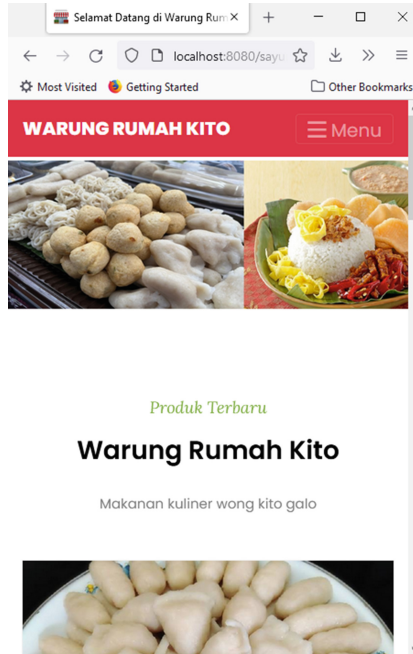
Fig. 4. Homepage E-Commerce Web Application

Table 2. Functionality testing adds culinary data

No	Item Test	Expected results	Actual results
1	Admin does not enter category data, culinary names, prices, stocks, descriptions, and images in the add culinary data form.	The system displays an error message:	The system displays an error message:
2	Admin enters all data according to the specifications of the form added culinary data.	The system displays a message that culinary data has been saved.	The system displays a message that culinary data has been saved..

doing the task. Measurements are made to measure the user's time in doing tasks using a stop watch on a smartphone.

The final measurement of an e-commerce web application is the level of satisfaction of all customers. From the measurements, it can be seen that customers are satisfied using this application.

Table 3. The success rate of using e-commerce web applications

No	Customer	Level of success (Scale 1–100)
1	1	100
2	2	100
3	3	100
4	4	100
5	5	90
6	6	100
7	7	100
8	8	100
9	9	90
10	10	90

Table 4. Ease of using e-commerce web applications

No	Tasks	Workmanship (Scale 1–10)
1	1	8
2	2	8
3	3	5,5
4	4	7
5	5	6
6	6	9
7	7	8
8	8	6,5
9	9	8
10	10	8
11	11	9
12	12	7,5
13	13	6
14	14	5
15	15	7

Table 5. Efficiency of using e-commerce web applications

No	Tasks	Time (Scale 1–5) s
1	1	3
2	2	3
3	3	5
4	4	2
5	5	3
6	6	2
7	7	2
8	8	3
9	9	3
10	10	2

Table 6. Customer satisfaction

No	Customer	Satisfaction Level (Scale 1–5)
1	1	5
2	2	5
3	3	5
4	4	5
5	5	4
6	6	5
7	7	5
8	8	5
9	9	4
10	10	4

5 Conclusion

The conclusions obtained from this research are as follows:

1. The RUP software development model has the advantages of being product-oriented. The resulting software has ease of use when used by its users. The UI/UX model has the advantages of user-oriented software development. By implementing the UI/UX model in the RUP software development model, the resulting software is of high quality, easy, and convenient for users to use.
2. The implementation of UI/UX is carried out at the stage of analysis and design of the RUP model. The analysis stage is implemented in user analysis to obtain software

requirements, while the design is implemented in software structure and software prototyping. This form of implementation further clarifies the stages of the RUP model.

3. E-commerce web applications created by implementing UI/UX on the RUP model produce web applications that are simple, easy, user-friendly, and have powerful software functionality. These results can be seen from the measurement results of e-commerce web applications based on usability factors.

4. Based on the test results, the e-commerce web application built by implementing UI/UX on the RUP model has complete functionality and a good level of acceptance from users. All user requirements are well implemented. When using this e-commerce web application the user does not experience any difficulties without burdening the user's huge resources.

6   Recommendation

The e-commerce web application created has a good level of acceptance by users. In general, this e-commerce web application helps the process of sales transactions that are in sarapan pagi rumah kito between sellers and buyers. Because the focus of this research is only on how to analyze users and design, of course there are still many shortcomings in the product. The features possessed by e-commerce web applications are still limited. For further research, it is hoped that it will focus more on how to complete the features in e-commerce web applications.

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