

Original Research Paper

Modeling User Experience in Delivery Applications Using the Design Thinking Method and System Usability Scale

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Abstract: Technological developments bring comfort and ease to users in accessing applications. Companies need to design systems that are centered on human needs to create technology that is competitive in the market, especially in the field of expeditions. The problem that arises in the sea cargo expedition company is that master data recording is still done manually, which has an impact on reducing data accuracy. Apart from that, the process of recording shipping transactions and status changes is not updated in real time. Things like this are the reason Sea Cargo Expedition hopes to design a goods delivery application that is centered on user needs. This research aims to design a prototype and test the level of user satisfaction with the goods delivery application. Based on the background of this problem, the research focuses on implementing the design thinking method to develop a goods delivery application because it is able to collect user needs directly. Design thinking is divided into five stages, namely, empathize (understanding the problem), define (analyzing the problem), ideate (creating a wireframe), prototype (designing an application design), and test (trial using System Usability Testing (SUS)). This research produces a prototype goods delivery application based on the user's user experience assessment so that it can provide good functionality.

Keywords: Design Thinking, User Interface, User Experience, System Usability Testing

Introduction

The development of internet technology has taken the industry one step further in its application in modern life (Humayun, 2021; Andry *et al.*, 2022). User Interface (UI) and User Experience (UX) are one of the technological developments that can utilize digital means to increase user comfort and convenience in using applications (Ali *et al.*, 2022; Khan *et al.*, 2023). Improvement and evaluation in terms of appearance and features are needed to solve problems that focus on end-user needs. To create technology that is competitive in the market, the industry needs to design systems that are human (user) centered, aka human-centric. Increasingly tight business competition means that every company is required to design applications that suit business needs (Andry *et al.*, 2019). One of the companies that needs to design applications in the field of goods delivery services.

Sea cargo expedition companies provide services via sea transportation modes in large quantities. As time progresses, it cannot be denied that companies are starting to look at the world of information technology in their business development efforts. However, the company realizes that the use of technology has not yet reached an effective and efficient point. The problem that arises is that master data recording is still done manually using paper which tends to have an impact on reducing data accuracy. Apart from that, the process of recording shipping transactions and status changes is not updated in real time. Things like this are the reason why companies hope to design a goods delivery application that can help manage business processes. By designing applications, companies can create a better user experience in terms of UI/UX (Sharma and Tiwari, 2021). The application design process uses the Design Thinking method because it aims to provide a UI and UX appearance that focuses more on the user's needs in using the application. Previous research

titled "Employing DDR to Design and Develop a Flipped Classroom and Project Learning Module to Applying Design Thinking in Design and Technology" states that design thinking application is becoming a demand in industrial and commercial areas (Padzil *et al.*, 2021). Therefore, it is necessary to consider designing applications that focus on the complex problems of user needs.

Based on the background of these problems, implementing the design thinking method is necessary because it can connect business needs and application development that were not previously thought of (innovative). The analysis begins with understanding user problems by conducting interviews and distributing questionnaires (empathy) (Martins *et al.*, 2020). The second stage analyzes the problem and user needs (define). The third stage, producing design solutions (ideate). The fourth stage, designing the application design based on the mockup that was created in the previous stage (prototype). The fifth stage, obtain responses and feedback by conducting trials using the System Usability testing (SUS) technique (test). The results of the application testing are analyzed to obtain success scores and the satisfaction level of the application. The results are a prototype of a goods delivery application based on user experience or user-centered so that it can provide good functionality. This research is limited to developing applications based on user requests and conducting usability evaluations for the system. The practical recommendation obtained is that application design focuses on user experience and provides concrete solutions to the main problems of shipping goods. Therefore, the potential impact that can arise from findings in developing goods delivery applications is operational efficiency from the delivery side, improving customer service, and speeding up the flow of goods from producers to consumers.

Materials and Methods

Research Gap

This section explains the comparison results of previous research with current research in Table 1.

Design Thinking

Design thinking generates value for users and market opportunities, not just based on appearance and function alone (Magistretti *et al.*, 2021). In the process, design thinking uses a human-centered approach aimed at better understanding the problems or needs of users (Hehn *et al.*, 2020). This method focuses on understanding the specific characteristics of existing users to make the design process appropriate to user needs. The design thinking process is divided into five, namely (1) Empathy, (2) Define, (3) Ideate, (4) Prototype and (5) Test.

Usability Testing

Usability is a quality attribute that measures how easy it is to interact with the product or system operated by the user (Lewis and Sauro, 2021). Usability testing conducts a series of user trials. There are four aspects of usability testing (Asyari and Muriyatmoko, 2020; Sukmasetya *et al.*, 2020). Learnability explains the ease with which users can interact and learn the system to complete tasks the first time they use the system. Efficiency explains the system's ability to help user's complete tasks in a short and simple time. Satisfaction explains the level of user satisfaction with the system using the SUS method. Effectiveness is whether users can complete the goals according to what they need.

Table 1: Research gap analysis

Previous research title	Description	Current research
"A practical guide to design thinking", by Grasaas <i>et al.</i> (2019)	Discusses the concept of design thinking, which is creating new solutions using the help of tools	Applying the design thinking concept that has been formulated in previous research in developing delivery applications
"Enlightening the dynamic capabilities of design thinking in fostering digital transformation", by (Magistretti <i>et al.</i> , 2021)	Explains how design thinking capabilities help find opportunities provided by digital technology in carrying out transformation	Carrying out case studies on companies by looking for problems experienced by users directly to implement the right system
"On Integrating design thinking for a human-centered requirements engineering", by Hehn <i>et al.</i> (2020)	Explains the possibilities and approaches to integrating design thinking in requirements engineering. The approach used is gathering needs based on user experience, finding goals and measuring success	Applying three design thinking requirements gathering approaches derived from previous research
"Usability and user experience: design and evaluation", by (Lewis and Sauro, 2021)	Explains the stages of the design thinking process, namely empathy, synthesis, ideation, prototyping, iterative test and redesign	Applying the five stages of the design thinking process in application development
"User experiences and Usability evaluation of COVID-19 application", By Nagro (2023)	Evaluate the usability of the application from the user's perspective using the help of SUS and (UMUX)	Usability evaluation is applied to goods delivery applications using SUS analysis

System Usability Scale (SUS)

The System Usability Scale (SUS) measures application usability based on user views (Ratnawati *et al.*, 2020). The SUS questionnaire uses a five-point Likert scale (Holden, 2020). Respondents were asked to rate "strongly right", "not right", "neutral", "right" and "strongly right" (Nagro, 2023). Table 2 shows the questions asked to users.

Table 2 shows a list of questionnaire questions distributed to users of the goods delivery application. The results of calculating the questionnaire scores are then grouped based on the determination of acceptability, grade scale, and adjective rating in Fig. 1.

Collect Data

This section explains the data collection techniques used in research using several techniques (Lin *et al.*, 2021; Andry *et al.*, 2023).

Document study. This research uses information documents from companies, namely in the form of vision and mission documents, objectives, and current organizational structure.

Table 2: SUS question lists

No.	Question
1	Will users use goods delivery applications to help with daily business?
2	Is this delivery application complicated to use?
3	Is this goods delivery application easy to use in business operations?
4	Does using this goods delivery application require the help of other people/techniques?
5	Do the features of the goods delivery application function as they should?
6	Does this delivery app have a lot of inconsistencies?
7	Can users find out how to use the application quickly?
8	Does this delivery application confuse users?
9	Are there any obstacles in using these goods delivery application?
10	Do users need to get used to it first before using this goods delivery application?

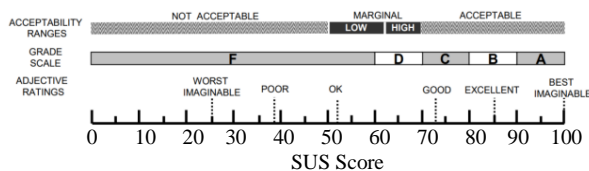


Fig. 1: Adjective ratings, acceptability ranges, and grade scale in SUS (Grasaas *et al.*, 2019)



Fig. 2: Research stages (Pondaag *et al.*, 2023)

Interview. To get an overview of current conditions, interviews were conducted at the company. Interviews are conducted to determine user needs. Interview results as supporting material for system implementation.

Observation. Carried out for one month. The results of the observations carried out obtained data and information, namely a brief history of the company, business process flow, internal and external business conditions, as well as internal and external technological conditions.

Research Subject

The subjects in this research were users of goods delivery applications. Users are asked to fill out a questionnaire related to satisfaction in using the application. Apart from that, interviews were also conducted with several users to obtain an overview of the company's business processes (Patricio *et al.*, 2020).

Research Stages

This section explains the research stages that need to be passed in Fig. 2.

Figure 2 shows the research stages. The following describes the flow of the research process carried out (Pande and Bharathi, 2020; Herfandi *et al.*, 2022):

1. Literature study: Collect reference materials related to problems faced by companies. This theory is obtained through internet media, reading sources, such as books that are related to and support the research process
2. Data collection: Researchers will conduct field research to determine user needs and conduct interviews to find information related to business processes in goods delivery companies. Observations and interviews were carried out to directly observe activities in the company
3. Explore problems (empathize): Define user problems by interviewing company stakeholders. Apart from that, data is extracted regarding problems and needs, who the target users of the application
4. Problem analysis (define): The second stage is analyzing and understanding the problems that have been collected in the empathy stage
5. Solution design (ideate): The third stage is to produce a design solution
6. Create design (prototype): Design an application design based on the mockup that was created in the previous stage
7. User feedback (test): Obtain responses and feedback by conducting trials to find out whether the application has resolved existing problems. The results of the application testing are analyzed to obtain success scores and the level of user satisfaction. At this stage, testing was carried out using questionnaires with the SUS method

Results

Explore Problem (Empathize)

The empathy stage focuses on directly understanding the problems. This stage collects information and distributes questionnaires (Nasution and Nusa, 2021). Sea cargo expedition needs a system that helps employees record shipping transactions. In addition, the system created can reduce errors in recording and reporting data. In current conditions, user characteristics within the company are divided into six, namely:

1. Shipper, the party who sends the goods
2. Freight forwarder is a company that provides shipping services
3. Carrier, the carrier of goods provided by the delivery/forward service
4. Notify party, the party that provides information regarding the status and location of the goods being sent
5. Consignee, owner of the goods, or recipient of the goods
6. Admin manages master data and access

This stage forms an empathy map which is divided into four quadrants in Table 3.

Table 3: Empathy map

Says	Thinks
<ul style="list-style-type: none"> • "I need an easy-to-use system to manage shipping" • "Is there a feature to track packages easily" • "I want an app that allows me to monitor delivery status in real-time" 	"I hope this app can help me save time in arranging deliveries" "Is this app safe to use?" I want my shipping data protected" "Is it feature-packed? I wish I could find everything I need in one place"
Does <ul style="list-style-type: none"> • Enter shipping details into the system • Track delivery status regularly • Confirm receipt of goods when they arrive at their destination 	Feels Frustrating if the shipping management the process is complicated and time-consuming Confident when you can easily track delivery status Happy and relieved when the goods sent arrive on time and in good condition

Table 4: Problem lists

Problem	Description
Difficulties in data management	Managing delivery information such as customer details, delivery information and delivery status can be complicated and difficult to organize
Unclear delivery status	Customers and managers may have difficulty knowing where their goods are in the shipping process
Human error	The risk of human error increases, such as entering shipping details incorrectly or sending a package to the wrong address
Delay in delivery	The risk of delivery delays can increase due to a lack of proper monitoring and coordination
Difficulty in tracking	Difficult to track delivery history, create audits, and analyze delivery performance
Lack of integration	The shipping process becomes less efficient because it needs to rely on various separate systems for inventory management, order management, and more
Inability to adapt to customer needs	Difficult to meet unique customer needs or to adapt delivery processes according to changes in market demand

Table 3 shows an empathy map that describes the results of user interviews related to wants and needs in the system.

Problem Analysis (Define)

After describing the characteristics and needs of users through an empathy map, the next stage is to define the problems experienced by users. The description of the problem is shown in Table 4.

Next, identification of the content needed by potential application users is carried out. These information needs include:

1. Get information about data that describes objects surrounding business processes, such as trucking locations, container types, services, shipping lines, drivers, car types, and much more
2. There is information that includes price data, such as selling price, transportation costs, and others
3. There is information on booking transactions, billing fees, invoices, and much more
4. There is report information on each transaction per month, recording of travel documents, and bill recaps
5. Facilitates data repair, user data settings, and data status

The features of the system being developed include:

1. Authentication features (login, add user, reset password). When the user opens the application, there will be a login feature by entering the name and password. Previously, this application had a super admin role that managed user accounts and had different access according to its designation
2. File/master data feature. After the user inputs the name and password, the user can access the dashboard with the file/master data feature. This feature includes container type, service type, shipping company, warehouse, import shipper, import consignee and many more
3. Price list feature. Users can access the export, cost, and import sub-modules. The price list module from the export sub-module consists of selling price export, incentive from an agent, heavyweight surcharge, seeking selling rate, and quotation to the agent. The price list module is a sub-module cost that consists of feeder rate, price agent, price trucking, warehouse, and operations. The price list module, the import sub-module, consists of mechanic charges, do charges (standard) and do charges (special)
4. Transaction feature. Users can access features consisting of stuffing plans, job orders, pick-up requests, and arrival notices
5. Finance features. Users can access features consisting of invoices to the shipper, credit notes, finance process, refund vouchers, proof of cash disbursement, and discount voucher
6. Report feature. Users can access features consisting of job sheet book, shipper report, sales report, job sheet recap, warehouse rebate, job approval listing, refund list not yet paid off, job listing not yet invoiced, report per department, booking report via third party, report profit/agent and sales commission report
7. Utility features. Users can access features consisting of file search, invoice and credit note agenda, data status, and the start of the year process

Solution Design (Ideate)

At the application interface design stage, first, create a simple design by outlining the outline of the system. The solution design at this stage is still in the form of a framework for arranging the elements on the page. Figure 3 shows an example of the design of a delivery application.

Figure 3 shows filling in trucking company data, where there are several inputs that must be made.

Create Design (Prototyping)

After passing the ideation stage, the next step is to implement it into the delivery application design process. Figure 4 shows the prototype. Figure 4 shows a prototype from a trucking company. Users can add data, such as ref. No, name, contact person, account number, address, and remarks. In this case, the user can add data, edit, or delete by clicking the new, edit, and delete buttons and can also save, print, and exit. Browse is used to search for data, which can be done with Prev and next.

User Feedback (Test)

The testing method used in this research is the System Usability Scale (SUS). The SUS consists of 10 questions with answers in the form of a linear score from 1-5.

The wireframe shows a window titled "Trucking Company" with a close button in the top right corner. The form is organized into several sections. On the left, there are four input fields for "Ref No.", "Name", "Contact Person", and "Account #". Below these is a larger text area for "Address", and at the bottom is another text area for "Remarks". On the right side, there is a vertical column of buttons: "New", "Edit", "Delete", "Browse", "Prev", "Next", "Save", "Print", and "Exit".

Fig. 3: Wireframe trucking company

The prototype shows the same form as the wireframe but with sample data entered. The "Ref. No." field contains "T-001", "Name" contains "TEST", "Contact person" contains "MR. TEST", and "Account #" is empty. The "Address" and "Remarks" fields are empty. The buttons on the right are "New", "Edit", "Delete", "Browse", "Prev", "Next", "SAVE", "Print", and "EXIT". The window title is "TRUCKING COMPANY" and the browser tab is "f_truco".

Fig. 4: Prototype trucking company

Table 5: SUS score calculation

Question	Respondent														
Will users use goods delivery applications to help with daily business?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Is this delivery application complicated to use?	2	5	5	5	4	4	4	5	4	4	3	3	5	5	3
Is the delivery of this good application easy to use in business operations?	3	2	3	3	1	1	2	1	4	1	3	2	2	3	1
Does using these goods delivery application require the help of other people/techniques?	4	5	5	5	5	4	5	5	5	5	4	3	5	4	5
Do the features of the goods delivery application function as they should?	2	2	1	1	2	1	2	5	3	2	1	3	2	2	4
Does this delivery app have a lot of inconsistencies?	3	5	5	5	5	5	5	5	4	5	5	3	5	4	4
Can users find out how to use the application quickly?	4	5	1	2	1	2	2	1	3	2	5	4	2	3	2
Does this delivery application confuse users?	3	5	5	4	5	4	5	5	4	5	4	3	4	4	4
Are there any obstacles in using these goods delivery application?	4	2	1	1	2	1	1	2	1	3	3	3	4	5	5
Do users need to get used to it first before using these goods delivery application?	3	5	5	5	5	5	5	5	4	4	4	4	3	2	4
Total	4	2	1	3	3	3	1	3	1	2	5	5	5	3	5
Final score	32	38	32	34	33	30	32	37	33	33	37	33	37	35	37
SUS score average	80	95	80	85	82.5	75	80	92.5	82.5	82.5	92.5	82.5	92.5	87.5	92.5

Table 5 shows the calculation results of the SUS score. The results of the score calculation obtained an average final score of 85.5, which was included in grade B, with an adjective rating in the excellent category and in the acceptable category.

Discussion

Improvement and evaluation in terms of appearance and application features are needed to solve problems that focus on end-user needs. However, before evaluating, it is necessary to design the application according to user needs. One of the companies that needs to design applications in the field of goods delivery services. The initial stage begins with directly understanding the problems faced by users, which requires a system that helps employees record delivery transactions. In current conditions, user characteristics within the company are divided into six, namely shipper, freight forwarder, carrier, notify party, consignee, and admin.

After analyzing user problems, you can identify the content that potential application users need. The features that need to be developed are authentication, master data, price lists, transactions, finance, reports, and utilities. Next, create a simple design by pouring out the outline of the system or what is usually called a wireframe. The 4th stage, implementing the wireframe into prototype form. The final stage focuses on testing to measure the level of usability from the user's perspective. In this study, the results of the score calculation obtained an average final score of 85.5, which was included in grade B, with adjective rating in the excellent category and in the acceptable category. Thus, the goods delivery application can handle user problems and needs, related to data accuracy and speed.

Applying the design thinking method to goods delivery applications can provide several benefits and uses. Design thinking prioritizes a deep understanding of users. By understanding customer needs, challenges, and preferences in the delivery process, applications can be designed to better suit the user experience. Design thinking involves creating prototypes that can be tested by

users iteratively, factors that influence individuals and organizations, the stages comprising a standard design thinking process along with its fundamental principles and tools, and the resulting outcomes for both individuals and organizations involved in a design thinking project (Rösch *et al.*, 2023). This allows app developers to get immediate feedback and make changes over time so that apps can be more precise and efficient.

Conclusion

Implementation of design thinking is needed to measure the feasibility of UI/UX in goods delivery management applications. The first stage starts with understanding the problems faced by users (empathy), namely master data recording is still done manually, and the process of recording shipping transactions and status changes is not updated in real-time. Shipping companies need a system that helps employees record shipping transactions. In addition, the system created can reduce errors in recording and reporting data. The next stage is defined, which formulates the information needs and features of the goods delivery application. These features include authentication, files, price lists, transactions, finance, reports, and utilities. The results are expressed in the design solutions at the ideate and prototype stages. The prototype represents success in achieving a true understanding between the product and the user. The final stage is obtaining feedback from users (test). Testing uses the SUS method. The results of the score calculation obtained an average final score of 85.5, which was included in grade B, with an adjective rating in the excellent category and in the acceptable category. Thus, the goods delivery application can handle user problems and needs, related to data accuracy and speed. This research has implications that aim to build innovation to change the shipping expedition business, namely by digitizing the use of applications.

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Author's Contributions

Kevin Christianto: Establishing research planed, designed, interpretation of results, and preparation of manuscript.

Aziza Chakir: Formulating problems, data collections, and data analysis for research.

Johanes Fernandes Andry and Fransiskus Adikara: Interpretation of result and help to prepare the manuscript.

Lydia Liliana and Jennifer Felicia: Develop user requirements, modeling, and tested.

Ethics

This article is original and unpublished. Corresponding authors confirm that all other authors have read and agree that the manuscript does not involve ethical issues.

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