Innovative Design of Ecommerce Mobile Application Using Kansei Engineering and System Usability Scale

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Abstract. Information technology is currently growing at a rapid speed in order to provide users with convenience, one of which is the ease of accessing the internet via mobile phones. The emergence of social media programs such as virtual buddy applications has contributed to the rapid increase in internet users, particularly via mobile phones. Social media, in addition to being a virtual friendship application, also functions as a promotional medium, one of which is the promotion of online shopping applications, hence boosting the number of online purchasing transactions in Indonesia. An online shopping platform was chosen to market university's products, allowing customers to shop easier and may increase the growth rapidly. As a result, Kansei Engineering is used in this study to develop applications that tap into users' emotional demands. In addition, to establish the optimum design for the user, the prototype was tested for performance and usability using a System Usability Scale (SUS) questionnaire. According to the study's findings, the application will be created with the following feelings in mind: appealing, attractive, organised, practical, innovative, quick, effective, accessible, interactive, and unique. According to usability studies, the "friendly concept" application generated better levels of satisfaction than the other design concepts.

1 Introduction

Information technology is currently advancing at a rapid pace in order to bring convenience to its users, one of which is the ease with which they may use the internet. A mobile phone can now be used to access the internet at any time and from any location. According to the Association of Indonesian Internet Service Providers, in 2019-2020, 73.7% of Indonesian people, or around 196.7 million Indonesians are active internet users who access the internet via mobile displays [1], [2]. Since 2018, the percentage of Indonesians who use the internet has climbed to 68.4%. The emergence of social media programs like virtual friendship applications is responsible for the rapid increase in internet users, particularly via mobile phones. Moreover, 87.4% of Indonesian internet users actively use social media apps. Apart from being a virtual buddy application, social media may also be

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used to promote media, such as online commerce applications. As a result, online purchasing transactions grew to 56.8% of Indonesians in 2019-2020, and are likely to rise further in the next years [2]. Raw food items, such as basics, vegetables, fruit, and other cooking seasonings, are among the products supplied through online shopping applications that are becoming increasingly diverse. As many as 2.7% of Indonesians or around 7.2 million people, have purchased raw food through online shopping apps [3]. The pandemic is driving raw food buyers away from traditional markets and supermarkets and toward internet shopping applications. As a result, different platforms for online raw food shopping, both through websites and mobile applications, have been developed.

Hydroponic and aquaponic operations at Telkom Surabaya Institute of Technology (ITTelkom Surabaya) are also expanding and entering the product harvesting stage, hence a platform to sell these goods is required. In order to sell ITTelkom Surabaya's products, an online shopping platform particularly a mobile application, was chosen so that consumers could purchase at any time and from any location. Moreover, ITTelkom Surabaya could grow its market in this area [1].

In a recent development, ITTelkom Surabaya's goods was offered directly via offline store, so consumers should call and visit the store. This offline store method causes buyers to complain that it is difficult to purchase things. To meet these requirements, the ecommerce application should be designed in such a way that users can quickly access and conduct transactions.

The answer to this challenge is to develop an ecommerce app that combines the user's emotional interests. User feelings and emotions can influence user experience by grabbing attention, providing users with delight and satisfaction, and being more focused on customer desires [4], [5]. This methodology can be implemented using the Kansei Engineering process [6]. This method has been utilised in application design research to create food packaging [7], educational applications and e-learning [8]–[11], e-commerce applications [12], [13], and food sharing app [2]. Kansei Engineering has been shown to meet the demands and emotions of users when utilizing the product. However, this strategy could be supplemented with a usability test to assess the product's capacity to meet the needs of the user [14].

The other studies integrate the Kansei Engineering technique with other methods to provide a more complete description of user requirements and validate the product's udability, such as integration with the KANO model [15], QFD model [16], Fuzzy linguistics [2], [17], and usability test method [2], [18]–[21]. As a result, the system usability scale (SUS) was applied to finish the product development process. This method has been proven to test the usability of a product, particularly in interface design [22].

According to the findings of these recent decade, the Kansei Engineering approach has never been utilised to design ecommerce application interfaces that are also linked and integrated with the usability approach. As a result, the goal of this study is to create an ecommerce application interface using the Kansei Engineering approach to elicit user emotions towards the proposed design, followed by a system usability scale to measure the user's needs and satisfaction with the design.

2 Methods

The semi-quantitative research methodologies are depicted in Figure 1, which can be separated into many stages. The topic, problem formulation, objective and limitations, literature review, and research gap analysis were all defined at the start. The kansei engineering process then began with the gathering and determination of kansei words, continued with element design, statistical analysis, and completed with various alternative

designs. Finally, a performance meter and the system usability scale (SUS) approach were utilized to build and test the prototype.

Fig. 1. Research Flow.

The kansei engineering method is processed by collecting kansei words from 200 respondents, validating the kansei words, collecting comparison products, distributing semantic differential questionnaires to 200 respondents, running statistical tests, determining and conducting principal component analysis, and performing partial least squares. The final part of the research involved prototyping, validation, and usability testing after the final element design was completed. The test will be based on performance statistics and a system usability scale questionnaire.

3 Results and Discussion

3.1 Kansei Words Results

The first step in determining the kansei word is to distribute a questionnaire asking respondents what they expect from the user interface design of a meal sharing app. The results are then compared to Nagamachi & Lokman (2011) 's kansei term. Following the acquisition of ten kansei words, semantic distinctions were made to determine whether the kansei words were required in the development of an application, with 1 indicating strong disagreement and 5 indicating strong agreement that the word was used to produce the application. Finally, the assessment results were statistically tested to provide the ten kansei terms requested by respondents with sufficient, valid, and reliable data, as shown in the table below. The Slovin adequacy test requires at least 136 respondents, but the study uses 206 respondents to guarantee that the data is adequate. The validity and reliability test was performed in line with the standard advice developed, which indicated that data is valid and trustworthy when r count is more than r table [23]. The data validity test found that the r table was 0.137, and that all test values (r counts) exceeded the r table, indicating that the data was valid. Finally, the reliability test demonstrated that all test results (r count) were greater than the r table, indicating that the data was valid.

Table 1. Kansei Words

Negative Words	**1**	**2**	**3**	**4**	**5**	**Positive Words**
Not appealing						Appealing
Unattractive						Attractive
Unorganized						Organized
Not practical						Practical
Not Innovative						Innovative
Slow						Quick
Ineffective						Effective

Negative Words	1	2	3	4	5	Positive Words
Inaccessible						Accessible
Not interactive						Interactive
General						Unique

3.2 Product Benchmarking

These 10 Kansei words will be analysed with a benchmarking product and a differential semantic questionnaire on a Likert scale, with the lowest value representing a negative Kansei word and the highest value representing a positive Kansei word. The product benchmark was determined as a result of a five-expert review discussion in the ecommerce industry, which has a few parameters that must be followed [24], [25]. Similar products, such as e-commerce applications, with over 500,000 downloads, and with distinct application color themes, are among the benchmarking product criteria used in this study. Then there's Segari, SayurBox, and Titipku, which are all comparison applications. Differential semantic questionnaires were distributed to 206 respondents in order to calculate the average value of each kansei for the three comparison benchmarking goods shown in the table below. The slovin adequacy test determined that 206 were sufficient, as were validity and reliability tests (r table: 0.123), indicating that the data is valid and reliable.

Table 2. Average Kansei Value on Product Benchmarking

Kansei Words	Segari	Sayurbox	Titipku
Appealing	3.97	3.97	3.93
Attractive	4.18	4.09	4.05
Organized	4.21	4.11	4.12
Practical	4.02	4.03	4.02
Innovative	4.07	4.06	4.05
Quick	4.19	4.06	4.08
Effective	3.93	3.97	3.90
Accesable	4.29	4.18	4.12
Interactive	4.31	4.31	4.22
unique	4.01	4.01	4.07

3.3 Principal Component Analysis

The major purpose of utilising a dimension reduction function such as Principal component analysis is to uncover the most significant words that have the greatest influence on the user's emotions while using the application [26]. [27] defines factor analysis as a statistical tool for studying the relationship between variables. This factor analysis approach was carried out with the statistical software IBM SPSS Statistics v.20. Principal Component Analysis (PCA) is a factor analysis extraction method that is great for variable reduction and concludes with varimax rotation for more precise results [12]. The picture below Fig.3 illustrates the total variance outcomes of the main component analysis technique. This

extraction process, as indicated in the table below, creates three components from twelve Kansei words to guide the creation of the application's user interface design.

Table 3. Result of Principal Component Analysis

Efficient Concept	Friendly Concept
Organized	Effective
Quick	Appealing
Attractive	Interactive
Accessable	Unique
Innovative	Practical

3.4 Design Element and Partial Least Square

The design of the mobile application's user interface is guided by Google Material Design, the design of the comparative products stated above, and numerous journals [2], [10], [11], [18]. The table below displays the conclusions of the design element categories examined by design professionals. The researchers next utilise PLS to determine which design aspects correspond to the kansei word selected by the respondent. Based on the partial least square results, the final interface design, which includes design elements for each design concept, is generated, as shown in the table below.

Table 4. Result of Partial Least Square

Category	Sub-Category	Concept 1: "efficient Concept"		Concept 2: "friendly Concept"	
		Range average	0.0075	Range average	0.0039
		Range	Desain Elemen	Range	Desain Elemen
Top app bar color	**Top app bar color**	0.0084199	Green #EBF5EA	0.005	White #FFFFFF
Body	**Body background color**	0	NS	0	White #FFFFFF
Body	**Body font style**	0.008	Modern style	0.005	Familiar style
Body	**Body font main color**	0.005	NS	0.001	NS
Theme	**Theme color**	0.008	Snow & Light green	0.005	Theme color - green
Menu navigation	**Menu navigation - icon style**	0.008	Round	0.002	NS
Loading page	**Loading page - type**	0.011	Without text	0.002	NS
Main page	**Main page - type**	0.008	Accounts, baskets, and categories	0.005	account, category, basket, order
Main page	**Main page - Buy location**	0.011	NS	0.003	NS
Main page	**Main page - delivery time**	0.005	NS	0.004	Yes

Category	Sub-Category	Concept 1: "efficient Concept"		Concept 2: "friendly Concept"	
		Range average	0.0075	Range average	0.0039
		Range	Desain Elemen	Range	Desain Elemen
Setting	**Setting - delete account**	0.011	NS	0.003	NS
Setting	**Setting - menu profile**	0.008	List orders, assist, handle return addresses, collaborate with others, and repay me	0.005	Wallet, address, account, blog, privacy policy, terms and conditions, help, and inbox are all available via the profile menu.
Setting	**Setting - coin features**	0.008	Referral, coin reward	0.005	voucher, point, referral
Setting	**Setting - Photo profile**	0.006	NS	0.006	Yes
Setting	**Setting - account**	0.008	Phone number, google, facebook	0.005	Phone number, google
Po up	**Pop up connection style**	0.006	NS	0.006	Text

3.5 Prototyping and System Usability Scale (SUS) Test

Prototyping is based on the results of design elements that were processed with partial least squares in the previous stage. "ITTS Mart" is the logo utilized, which is based on the name of its offline branding. This seeks to increase user awareness of the relevance of physical stores and to broaden their branding [28]. As indicated in figure 2, the design was carried out in Figma based on the results of the preceding phase. The efficient concept interface, as shown in the figure 2 has a green top bar and a modern font style. Friendly concept, on the other hand, has a white top bar and a familiar font style. Since the majority of the products sold are hydroponic and aquatic products, the fundamental colors of green and white reflect simplicity and freshness was selected. This color alignment adhered to the interface design recommendation that the color should represent the product or the goal of the application [29].

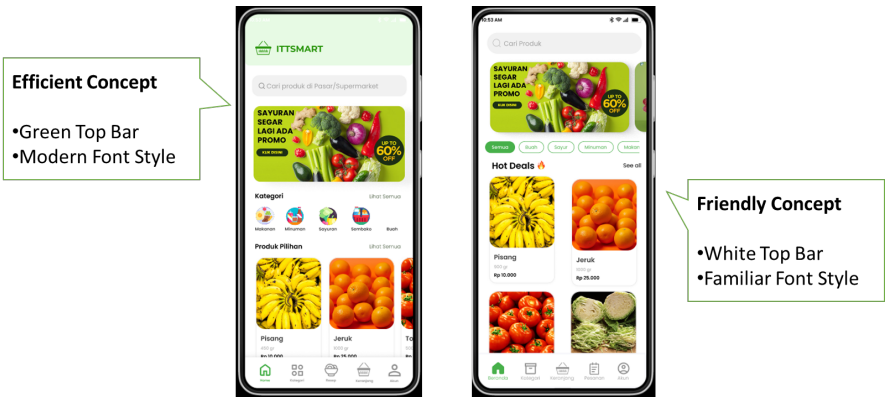

Figure 2. Prototype Design

The prototype is tested on users as the final stage of designing an ecommerce application. Two application concepts were tested using a scenario to ensure proper application operation. These scenarios are the buyers set to buy the product and then the buyer set to complete the payment process. This scenarios are fundamental process of the operation so that it is crucial to test these scenarios [1], [14]. At this point, the assessment indicators are carried out depending on the level of user satisfaction utilizing the SUS questionnaire [30]. The researcher included 200 respondents in this phase of testing. According to Nielsen (2000), usability testing necessitates a minimum of three respondents for each category.

As shown in the figure 3, the product with the friendly concept gets the highest user's satisfaction. Displaying "familiar font style" makes the user more familiar with the application design. According to Jakob's law, customers choose items that perform in the same way as all other products they are familiar with, and this is true for the majority of food-related applications in Indonesia [32].

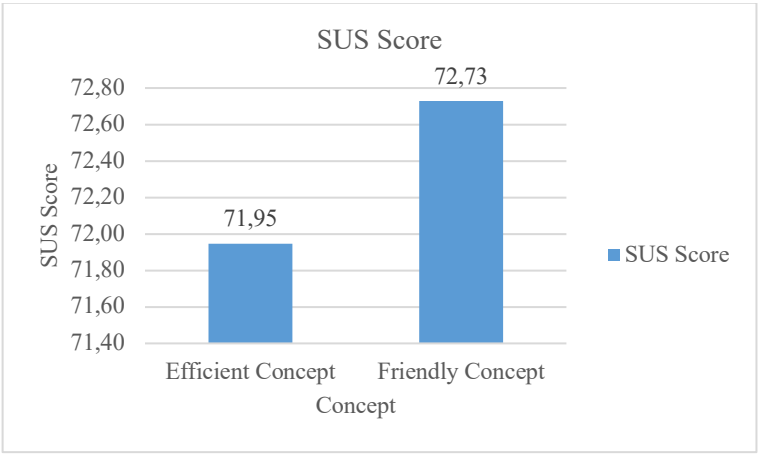

Figure 3. Result of SUS Score

Therefore, based on the result of the testing stage, it can be shown that the proposed design should be developed for e-commerce application is using friendly concept. This concept will lead to catch the user's feelings based on the result of design using Kansei Engineering approach. This SUS score also indicates that the design can be in level of

acceptable to be implemented [22]. The development of a mobile application can be done in accordance with the design elements for a friendly concept, so that the application is accepted by users with a satisfaction level of more than 72%.

4 Conclusion

According to the research, appealing, attractive, organized, practical, innovative, quick, effective, accessible, interactive, and unique are some of the kansei words utilized in the design of the e-commerce application. As a result of this research, a "friendly concept" for an alternative design to capture the user's emotions on an e-commerce application can be presented. The results of performance and usability testing reveal that the "friendly concept" has a more familiar design for users, which improves their experience.

As a recommended future study, this research can be expanded by incorporating more respondents in order to cover a broader spectrum of demands. Furthermore, the testing stage can be improved by testing the system with a genuine back-end system so that users can delve deeper.

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