

Usability Analysis of Online Travel Agent Applications Using System Usability Scale and Electroencephalography

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ABSTRACT

In the digital era, technology has transformed the travel and tourism industry, with Online Travel Agents (OTAs) like Traveloka, Tiket.com, and Agoda offering convenient trip planning through digital platforms. Despite their popularity, issues such as navigation difficulties and unclear information still affect user satisfaction. This study aims to evaluate the usability of OTA applications using the System Usability Scale (SUS) based on the ISO 9241-11 standard and Electroencephalography (EEG) to analyze user physiological responses. The test involved 10 respondents and 4 task scenarios. The results showed that Traveloka achieved a SUS score of 85, with 95% effectiveness and 0.023 goals per second efficiency. Tiket.com scored 79 with 92.5% effectiveness and 0.026 goals per second efficiency, while Agoda scored 70 with 87.5% effectiveness and 0.016 goals per second efficiency. EEG data revealed that Traveloka and Tiket.com had the highest average alpha wave values, indicating respondents felt nervous or anxious, whereas Agoda showed higher beta wave values, suggesting respondents were calm and aware without full concentration. This study highlights that the usability of OTA applications is influenced by user experience, which can be measured subjectively through SUS and more deeply using EEG data to understand physiological responses when interacting with the application.



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I INTRODUCTION

In the digital era, technology has brought significant changes to the travel and tourism industry, with the emergence of Online Travel Agents (OTAs) such as Traveloka, Tiket.com, and Agoda, which provide convenience for planning trips through digital platforms. According to Statista data (2023), 84.62% of Indonesians use Traveloka as the most popular online travel booking platform, followed by Tiket.com at 64.43%, Agoda at 40.79%, and several other platforms [1]. Based on a Populix survey (2022) involving 1,000 respondents, 64% of OTA application users in Indonesia are aged 18-25 years, while the remaining 36% are users aged 25 years or older [2]. This data shows that the 18-25 age group dominates the use of Online Travel Agent (OTA) platforms in Indonesia. Despite its popularity, negative reviews are still often found regarding the user experience on the three applications, as noted in Google Play

Store reviews, including difficulties logging in, technical errors, discrepancies in price information, the absence of a direct order cancellation button, and a less responsive interface, which can be confusing. These constraints suggest that, although the application offers various useful features, there are still aspects of usability that require improvement to enhance user satisfaction and experience.

The various constraints that exist in each application indicate that the success of the application is not only determined by its technical functions, but also by its level of usability [3]. Human-Computer Interaction (HCI) focuses on the design of computer technology and the interaction between humans and computers, including the applications and systems used [4]. Usability in Human Computer Interaction can be evaluated based on the ISO 9241-11:2018 standard, which states that the usability of a system is determined by the effectiveness, efficiency, and satisfaction of users in achieving specific goals. Effectiveness refers to the

extent to which users can accurately and completely achieve their goals when using a system or product. Efficiency refers to how quickly and easily users can complete tasks without wasting time or other resources. Satisfaction focuses on users' feelings about the ease of use, convenience, and whether the system meets their expectations and needs [5].

Usability testing is an evaluation method to measure the extent to which a product or system can be used effectively, efficiently, and satisfactorily by users [6]. In evaluating usability subjectively, the System Usability Scale (SUS) is used to measure ease of use, comfort, and user experience when using technology-based systems or applications [7]. The SUS method provides a usability score to evaluate the overall user perception of ease of use, clarity of display, and comfort in accessing Online Travel Agent (OTA) services. The measurement results obtained using the SUS method provide a clear picture of the system's usability level [8]. There are three elements in the SUS rating, namely Adjective Ratings, Grade Scale, and Acceptability Ranges. Adjective Ratings is an assessment category that uses adjectives to describe the SUS scores obtained from users. The grade scale is used to describe the quality of a system being studied in a letter form. Acceptability Ranges are utilized to evaluate how acceptable the system is for users [9]. In addition to the subjective approach, this study also employs an objective approach by utilizing Performance Measurement to assess the effectiveness and efficiency aspects of usability testing, collecting quantitative data related to respondent performance when completing specific tasks with the system or product [10].

In addition to performance measurement, this study employs an objective approach by utilizing Electroencephalography (EEG), a method for recording electrical brain activity on the scalp surface during simulation [11]. EEG is used to understand the level of focus, stress, and cognitive load experienced by users when operating the application [12]. EEG is considered a reliable indicator of spontaneous brain activity. This activity directly and in real-time describes a person's emotional condition. Therefore, EEG results tend to be difficult to fake in terms of emotion, thereby minimizing the potential for bias. This makes EEG a handy tool for understanding the user's state when viewed from their brain signals [13]. With EEG, objective data is obtained that cannot be measured through subjective observation alone, providing a deeper understanding of the user's experience.

TABLE I
BRAINWAVES FREQUENCY

No	Waveform	Frequency Range	Emotion
1	Gamma	30 Hz s/d 100+ Hz	Concentrating
2	Beta	12 Hz s/d 30 Hz	Thinking
3	Alpha	7,5 Hz s/d 12 Hz	Calm
4	Theta	4 Hz s/d 7,5 Hz	Sleepy
5	Delta	1 Hz s/d 4 Hz	Deep sleep

In general, there are five waveforms with corresponding frequency ranges and emotions, as shown in Table I [14]. According to Lai, Lai, and Chiang (2015) cited in [14] stated that an increase in the number of beta signals indicates that someone is thinking, feeling nervous, or anxious, while an increase in the number of alpha signals indicates that someone is in a calm and conscious state, but with a level of concentration that does not require full attention. According to Haeinn Lee and Seo (2010), as cited in [14], an increase in the number of theta signals indicates that an individual is in a comfortable state.

One of the software programs used to monitor brain activity in real-time is Mind Monitor. The data generated by the Mind Monitor application contains information about the absolute band power of all EEG channels in Bel (B) per second [15]. This software is connected to EEG devices such as the Muse Headband via Bluetooth [16]. The Muse Headband is a headband-like device equipped with four silver-coated electrodes located in the anterior frontal and temporal parietal brain areas. These active electrodes (channels) consist of TP9 (left ear), TP10 (right ear), AF7 (left forehead), and AF8 (right forehead), whose positions can be seen in Figure 1 (areas marked in light green) [17].

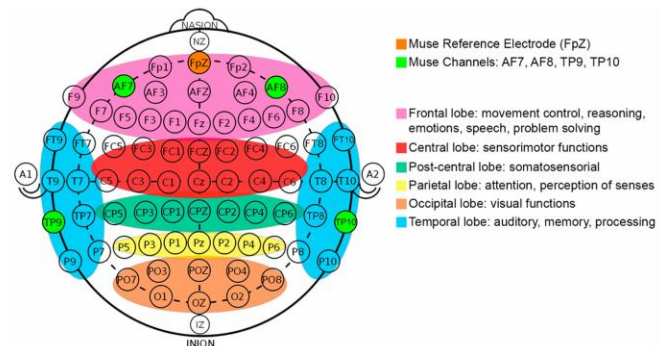


Figure 1. Muse Headband Electrode Positions

According to Hendriyati (2019) in [18], one of the reasons underlying the development of OTA is the broad and limitless market. Along with the development of this market, the need for a more efficient and effective OTA platform is increasing. This study aims to analyze the usability of the Online Travel Agent (OTA) application using the System Usability Scale (SUS), based on the ISO 9241-11 standard, and to identify the user's physiological responses using Electroencephalography (EEG). The results obtained are expected to serve as a helpful reference in the development and improvement of Online Travel Agent (OTA) applications, as well as in making the application more efficient and effective in meeting user travel needs.

II. METHOD

The following steps will be taken to address the problem.

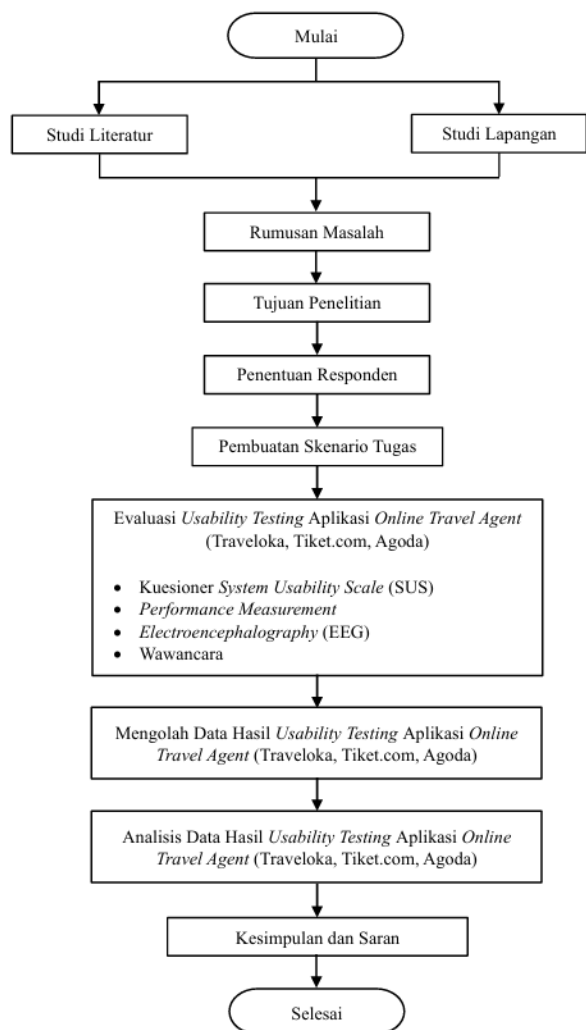


Figure 2. Flowchart

A. Population and Sample

The population in this study consists of active users of the Online Travel Agent application, aged 18-25 years, who have experience using the Traveloka, Tiket.com, and Agoda applications for booking accommodations in the last 6 months, and are not easily nervous or anxious. In addition, as a selection step, a pre-research questionnaire will be used to ensure that respondents meet the criteria of age, frequency of application use, and their tendency towards anxiety, which are essential parts of the data analysis for this study.

TABLE II
PRE-RESEARCH QUESTIONNAIRE

No	Questions
1	Do you use OTA applications (Traveloka, Tiket.com, and agoda)?
2	How often do you use it in the last 6 months?
3	Are you willing to be a respondent in this study?
4	Can the data from your observations as a respondent be used for further explanation?
5	Are you someone who gets nervous or anxious easily?
6	How often do you feel restless or anxious when you have difficulty using the application? (scale 1-7) 1: Never at all 2: Almost never 3: Occasionally 4: Sometimes 5: Often 6: Very often 7: Always

Referring to Nielsen, which states that five respondents can represent 85% of usability problems, and increasing the number to more than five, such as 10, to enhance the reliability of the results [19]. Faulkner added that 10 respondents can find 95% of usability problems [20]. Therefore, the OTA application usability testing uses 10 respondents.

B. Experiment and Collecting Data

On the day of testing, testing begins by installing the EEG Muse S Headband on the respondent's head and then connecting it to the Mind Monitor application. According to [14], before starting, respondents will be given 20 seconds to feel calm and comfortable so that the EEG recording results are more accurate. After that, respondents were explained the task scenarios that needed to be run for each application. The task scenarios are presented in Table VI. The task scenario execution for each application was conducted in the same manner, starting with the Traveloka application, followed by completing the SUS questionnaire, and then taking a 4 minute break. The same process was also applied to the Tiket.com and Agoda applications.

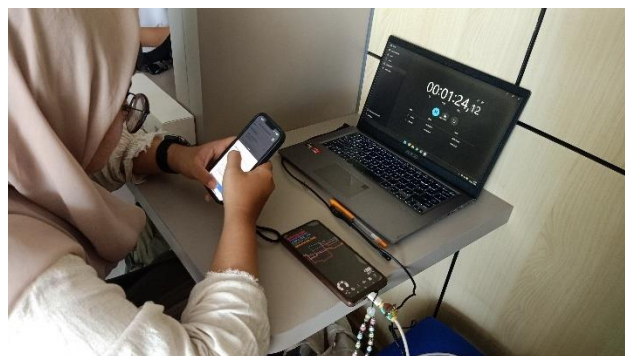


Figure 3. Experiment Process

C. System Usability Scale (SUS)

TABLE III
SUS QUESTIONNAIRE

No	Statement Items	1	2	3	4	5
1	I think I will use this app again	O	O	O	O	O
2	I found the app complicated to use	O	O	O	O	O
3	I found the app easy to use	O	O	O	O	O
4	I needed help from another person or a technician to use the app	O	O	O	O	O
5	I felt the features of the app worked as they should	O	O	O	O	O
6	I felt there were many inconsistencies in the app	O	O	O	O	O
7	I felt other people would figure out how to use the app quickly	O	O	O	O	O
8	I found the app confusing	O	O	O	O	O
9	I felt there were no barriers to using the app	O	O	O	O	O
10	I need to get used to it first before using the app	O	O	O	O	O
* 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree						

The System Usability Scale (SUS) is used to evaluate the satisfaction aspect of usability testing. It consists of 10 statements answered using a Likert scale with five choices, ranging from “strongly disagree” to “strongly agree”. The questionnaire was given directly in the form of printed sheets after respondents finished using each application (Traveloka, Tiket.com, and Agoda). The level of usability of the application can be determined based on the final SUS score [21].

D. Performance Measurement

Performance Measurement is used to measure the effectiveness and efficiency aspects of usability testing by collecting quantitative data related to respondent performance when completing specific tasks with a system or product. The effectiveness aspect is calculated based on the level of success and failure of respondents in completing task scenarios [22]. The average results of the percentage of respondents' success in completing tasks are interpreted based on the 1991 Ministry of Home Affairs Research and Development Reference Standards [23], as shown in the following table.

TABLE IV
STANDARD MEASURE OF EFFECTIVENESS

No	Effectiveness Ratio	Achievement Level
1	< 40%	Very Ineffective
2	40% - 59,99%	Ineffective
3	60% - 79,99 %	Quite Effective
4	≥ 80%	Very Effective

The efficiency aspect is used to measure the time needed by respondents to complete a task successfully in seconds [22], with the following equation:

$$\text{Time Based Efficiency} = \frac{\sum_{j=1}^R \sum_{i=1}^N \frac{n_{ij}}{t_{ij}}}{NR} \quad (1)$$

Where:

R is the number of participants

n_{ij} is the result of task i by participant j , later n_{ij} will be worth 1 if successful or 0 if failed

The time required by participant j in task scenario i

The average time taken by respondents to complete a task scenario is analyzed using the time range in the time behavior indicator [23], as shown in the table below.

TABLE V
TIME INTERVAL ON TIME BEHAVIOR INDICATOR

No	Length of Time	Qualification
1	60 – 300 Second	Very fast
2	360 – 600 Second	Fast
3	660 – 900 Second	Slow

Data collection techniques are used to measure the effectiveness and efficiency of respondents by providing selected task scenarios based on user complaints regarding hotel reservations on the Google Play Store. The following is a list of task scenarios that will be tested on respondents.

TABLE VI
TASK SCENARIO

No	Task
1	Log in to the application using a registered personal account
2	Search for hotels in Surabaya for one person on June 1-2, 2025, using the search box with the following criteria: a 4-star hotel, a swimming pool, and a budget of 1 million (including tax).
3	Select a hotel that meets the criteria within the price range of 1 million (including tax) and proceed to the booking page. After that, proceed with the payment process until you select the available payment method.
4	Find the “Cancel Order” button and cancel the order that is already in the payment stage.

E. Electroencephalography (EEG)

Electroencephalography is used to understand the level of focus, stress, and cognitive load experienced by users when operating the application [12]. The data collected is in the form of absolute values of beta, alpha, and theta wave power bands. According to [24], several provisions must be adhered to by participants before the test is carried out, including stopping taking any medication, including sedatives; washing hair the night before the test is carried out; not using oil or hair spray on the day of the test; and avoiding food and drinks containing caffeine, at least 8 hours before the test.

III. RESULT AND DISCUSSION

A. System Usability Scale (SUS)

1. Traveloka

TABLE VII
TRAVELOKA APPLICATION SUS QUESTIONNAIRE RESULT SCORE

Statement Items	Age	Respondent Result Score									
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Statement 1	21	3	4	4	4	3	4	4	4	4	4
Statement 2	25	3	3	3	3	3	4	3	3	4	3
Statement 3	21	3	4	3	3	3	4	4	4	4	4
Statement 4	22	3	4	3	3	4	4	4	4	3	4
Statement 5	24	3	4	1	2	4	3	3	2	3	4
Statement 6	24	3	3	2	2	4	4	3	4	4	4
Statement 7	21	3	4	3	3	4	4	4	4	4	4
Statement 8	21	3	3	2	2	4	3	4	2	4	4
Statement 9	21	3	4	2	2	4	3	4	2	4	4
Statement 10	23	4	3	3	3	3	3	4	3	4	4
Average SUS score		85									

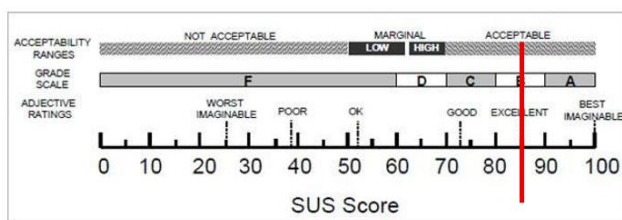


Figure 4. SUS Score Traveloka

Based on the calculations, it can be seen that the Average SUS Score on the Traveloka application is 85. The SUS score of the Traveloka application falls within the acceptability ranges category, specifically rated as acceptable with a grade scale of B and adjective ratings in the excellent category. Based on this assessment, the Traveloka application is straightforward to use and well-received by its users.

2. Tiket.com

TABLE VIII
TIKET.COM APPLICATION SUS QUESTIONNAIRE RESULT SCORE

Statement Items	Age	Respondent Result Score									
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Statement 1	21	4	3	4	4	3	3	3	2	3	3
Statement 2	25	4	3	4	4	2	4	3	2	3	3
Statement 3	21	4	3	4	4	2	3	3	2	3	3
Statement 4	22	4	3	4	4	2	4	3	4	3	3
Statement 5	24	4	3	4	4	2	4	4	3	4	4
Statement 6	24	4	3	4	4	2	4	3	3	3	2
Statement 7	21	4	3	4	4	2	3	3	2	2	2
Statement 8	21	4	2	4	4	2	4	4	3	2	3

Statement Items	Age	Respondent Result Score									
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Statement 9	21	4	2	4	4	2	3	3	0	2	3
Statement 10	23	4	1	4	4	2	4	4	3	2	2
Average SUS score		79									

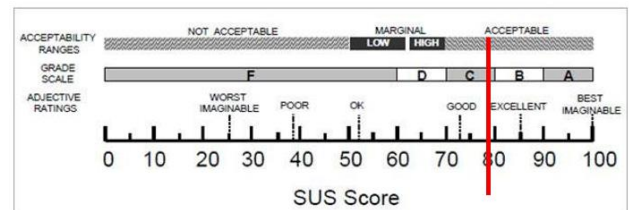


Figure 5. SUS Score Tiket.com

Based on the calculations, it can be seen that the Average SUS Score on the Tiket.com application is 79. The SUS score of the Tiket.com application falls within the acceptability ranges category, specifically in the acceptable range with a grade scale of C, and the adjective ratings are categorized as good. Based on this assessment, the Tiket.com application is easy to use and well-received by its users.

3. Agoda

TABLE IX
AGODA APPLICATION SUS QUESTIONNAIRE RESULT SCORE

Statement Items	Age	Respondent Result Score									
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Statement 1	21	4	3	2	4	4	3	3	2	4	3
Statement 2	25	3	3	3	3	4	2	3	3	3	3
Statement 3	21	3	2	2	3	4	2	3	3	2	3
Statement 4	22	3	1	3	3	4	2	2	2	3	3
Statement 5	24	4	3	3	4	3	3	4	3	4	3
Statement 6	24	3	3	3	3	4	3	3	3	3	3
Statement 7	21	2	2	3	3	4	2	2	2	3	2
Statement 8	21	3	3	3	2	4	2	3	2	2	2
Statement 9	21	3	2	1	3	4	2	3	2	2	2
Statement 10	23	3	2	3	3	4	2	3	2	2	2
Average SUS score		70									

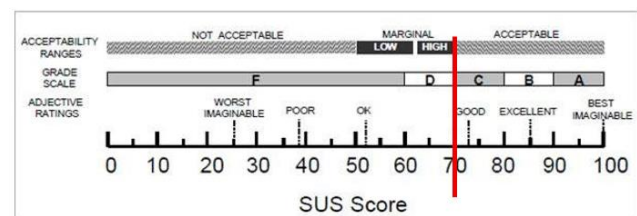


Figure 6. SUS Score Agoda

Based on the calculations, it can be seen that the Average SUS Score on the Agoda application is 70. The SUS score of the Agoda application falls into the acceptability ranges

category, specifically marginal high, with a grade scale of D, and the adjective ratings are categorized as okay. Based on this assessment, the Agoda application has quite good usability and is accepted by users.

B. Performance Measurement (Effectiveness)

Effectiveness is measured based on the level of success or failure of respondents in completing the task, with a value of “1” for success and “0” for failure. Respondents are considered to have failed if they did not complete the task, selected the incorrect menu, or requested assistance from the researcher [25].

1. Traveloka

TABLE X
TRAVELOKA APPLICATION EFFECTIVENESS VALUE CALCULATION RESULTS

Respondent	Task Scenario				Effectiveness Value (%)	Achievement Level
	T 1	T 2	T 3	T 4		
R1	1	1	1	1	100	Very Effective
R2	1	1	1	1	100	Very Effective
R3	1	0	1	1	75	Quite Effective
R4	1	1	1	1	100	Very Effective
R5	1	1	1	1	100	Very Effective
R6	1	1	1	1	100	Very Effective
R7	1	1	1	1	100	Very Effective
R8	1	1	1	0	75	Quite Effective
R9	1	1	1	1	100	Very Effective
R10	1	1	1	1	100	Very Effective
Average Effectiveness Value					95%	

The average effectiveness value of the Traveloka application, as reported by 10 respondents, was 95%, which falls within the very effective category according to the 1991 Ministry of Home Affairs Research and Development Reference Standards [23]. However, two tasks (numbers 2 and 4) could not be completed by two respondents.

2. Tiket.com

TABLE XI
TIKET.COM APPLICATION EFFECTIVENESS VALUE CALCULATION RESULTS

Respondent	Task Scenario				Effectiveness Value (%)	Achievement Level
	T 1	T 2	T 3	T 4		
R1	1	1	1	1	100	Very Effective
R2	0	1	1	1	75	Quite Effective

Respondent	Task Scenario				Effectiveness Value (%)	Achievement Level
	T 1	T 2	T 3	T 4		
R3	1	1	1	1	100	Very Effective
R4	1	1	1	1	100	Very Effective
R5	1	0	1	1	75	Quite Effective
R6	1	1	1	1	100	Very Effective
R7	1	1	1	1	100	Very Effective
R8	1	1	1	1	100	Very Effective
R9	1	1	0	1	75	Quite Effective
R10	1	1	1	1	100	Very Effective
Average Effectiveness Value					92,5%	

The average effectiveness value of the Tiket.com application, as reported by 10 respondents, was 92.5%, which falls within the very effective category according to the 1991 Ministry of Home Affairs Research and Development Reference Standards [23]. However, three tasks (numbers 1, 2, and 3) could not be completed by three respondents.

3. Agoda

TABLE XII
AGODA APPLICATION EFFECTIVENESS VALUE CALCULATION RESULTS

Respondent	Task Scenario				Effectiveness Value (%)	Achievement Level
	T 1	T 2	T 3	T 4		
R1	1	1	1	1	100	Very Effective
R2	1	1	1	0	75	Quite Effective
R3	1	1	1	0	75	Quite Effective
R4	1	1	1	1	100	Very Effective
R5	1	1	1	1	100	Very Effective
R6	1	1	1	0	75	Quite Effective
R7	1	1	1	1	100	Very Effective
R8	1	1	1	0	75	Quite Effective
R9	1	1	1	1	100	Very Effective
R10	1	1	1	0	75	Quite Effective
Average Effectiveness Value					87,5%	

The average effectiveness value of the Agoda application, as reported by 10 respondents, was 87.5%, which falls within the very effective category according to the 1991 Ministry of

Home Affairs Research and Development Reference Standards [23]. However, task number 4 could not be completed by five respondents.

C. Performance Measurement (Efficiency)

The efficiency aspect is calculated based on the time it takes respondents to complete the task scenario, measured in seconds.

1. Traveloka

TABLE XIII

TRAVELOKA APPLICATION EFFICIENCY VALUE CALCULATION RESULTS

Resp onde nt	n_{ij}				t_{ij}				n_{ij} / t_{ij}	n_{ij} / t_{ij}	n_{ij} / t_{ij}	n_{ij} / t_{ij}
	T 1	T 2	T 3	T 4	T 1	T 2	T 3	T 4	T1	T2	T3	T4
R1	1	1	1	1	2 1	8 5	9 8	3 5	0, 04 8	0, 01 2	0, 01 0	0, 02 9
R2	1	1	1	1	2 9	6 8	7 4	3 7	0, 03 4	0, 01 5	0, 01 4	0, 02 7
R3	1	0	1	1	2 7	9 3	9 5	3 1	0, 03 7	0, 00 0	0, 01 1	0, 03 2
R4	1	1	1	1	3 1	9 2	9 4	2 4	0, 03 2	0, 01 1	0, 01 1	0, 04 2
R5	1	1	1	1	4 1	7 5	8 3	3 9	0, 02 4	0, 01 3	0, 01 2	0, 02 6
R6	1	1	1	1	2 9	6 5	8 9	2 4	0, 03 4	0, 01 5	0, 01 1	0, 04 2
R7	1	1	1	1	2 4	6 9	8 7	2 1	0, 04 2	0, 01 4	0, 01 1	0, 04 8
R8	1	1	1	0	2 1	6 9	8 8	2 4	0, 04 8	0, 01 4	0, 01 1	0, 00 0
R9	1	1	1	1	2 5	8 2	9 4	2 2	0, 04 0	0, 01 2	0, 01 1	0, 04 5
R10	1	1	1	1	4 3	5 7	6 9	4 1	0, 02 3	0, 01 8	0, 01 4	0, 02 4
Time Based Efficiency									0,023 goal/second			

The time-based efficiency value for 10 respondents with four tasks on the Traveloka application is 0.023 goals per second, which means that each respondent completes the task at a rate of 2.3% per second, taking around 43.57 seconds to reach 100%. This value falls into the very fast category, as indicated by the time behavior indicator in Table V.

2. Tiket.com

TABLE XIV

TIKET.COM APPLICATION EFFICIENCY VALUE CALCULATION RESULTS

Resp onde nt	n_{ij}				t_{ij}				n_{ij} / t_{ij}	n_{ij} / t_{ij}	n_{ij} / t_{ij}	n_{ij} / t_{ij}
	T 1	T 2	T 3	T 4	T 1	T 2	T 3	T 4	T 1	T 2	T 3	T 4
R1	1	1	1	1	4 4	7 5	8 1	2 3	0, 02 3	0, 01 3	0, 01 2	0, 04 3
R2	0	1	1	1	5 6	8 3	8 6	1 5	0, 00 0	0, 01 2	0, 01 2	0, 06 7
R3	1	1	1	1	2 8	8 0	1 3	2 1	0, 03 6	0, 01 3	0, 01 0	0, 04 8
R4	1	1	1	1	5 2	7 2	8 6	1 0	0, 01 9	0, 01 4	0, 01 2	0, 10 0
R5	1	0	1	1	5 1	0 2	1 7	1 5	0, 02 0	0, 00 0	0, 00 9	0, 06 7
R6	1	1	1	1	4 5	8 6	9 1	1 3	0, 02 2	0, 01 2	0, 01 1	0, 07 7
R7	1	1	1	1	3 8	8 1	9 4	1 9	0, 02 6	0, 01 2	0, 01 1	0, 05 3
R8	1	1	1	1	4 3	7 2	8 3	3 1	0, 02 3	0, 01 4	0, 01 2	0, 03 2
R9	1	1	0	1	2 6	8 8	1 3	1 8	0, 03 8	0, 01 1	0, 00 0	0, 05 6
R10	1	1	1	1	3 2	7 3	8 6	2 1	0, 03 1	0, 01 4	0, 01 2	0, 04 8
Time Based Efficiency									0,026 goal/second			

The time-based efficiency value for 10 respondents with four tasks on the Tiket.com application is 0.026 goals per second, which means that each respondent completes the task at a rate of 2.6% per second, taking around 38.46 seconds to reach 100%. This value falls into the very fast category, as indicated by the time behavior indicator in Table V.

3. Agoda

TABLE XV
AGODA APPLICATION EFFICIENCY VALUE CALCULATION RESULTS

Respondent	n_{ij}				t_{ij}				$\frac{n_{ij}}{t_{ij}}$	$\frac{n_{ij}}{t_{ij}}$	$\frac{n_{ij}}{t_{ij}}$	$\frac{n_{ij}}{t_{ij}}$
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
R1	1	1	1	1	35	77	89	82	0,029	0,013	0,011	0,012
R2	1	1	1	0	42	65	93	88	0,024	0,015	0,011	0,000
R3	1	1	1	0	40	72	98	65	0,025	0,014	0,011	0,000
R4	1	1	1	1	38	82	87	47	0,026	0,012	0,011	0,021
R5	1	1	1	1	44	81	83	34	0,023	0,012	0,011	0,029
R6	1	1	1	0	29	77	98	48	0,034	0,013	0,011	0,000
R7	1	1	1	1	39	82	95	45	0,026	0,012	0,011	0,022
R8	1	1	1	0	31	72	85	61	0,032	0,014	0,012	0,000
R9	1	1	1	1	35	79	11	35	0,029	0,013	0,009	0,029
R10	1	1	1	0	35	81	94	65	0,029	0,012	0,011	0,000
Time Based Efficiency									0,016 goal/second			

The time-based efficiency value for 10 respondents with four tasks on the Agoda application is 0.016goals persecond, which means that each respondent completes the task at a rate of 1.6% per second, taking approximately 63.66 seconds to reach 100%. This value falls into the very fast category, as indicated by the time behavior indicator in Table V.

D. Electroencephalography (EEG)

The data displayed is in the form of absolute band power figures that have been averaged in Bels (B) and the results describe the overall cognitive condition of the user when using each application.

1. Traveloka

TABLE XVI
TRAVELOKA APP ELECTROENCEPHALOGRAPHY VALUES

Respondent	Electroencephalography Signal Data (Bels)		
	Theta	Alpha	Beta
R1	0,49362	0,50634	0,48705
R2	0,51123	0,52865	0,48856
R3	0,49904	0,51271	0,51716
R4	0,48599	0,50598	0,50137
R5	0,50532	0,51850	0,51243
R6	0,49811	0,51149	0,48635
R7	0,49765	0,50134	0,49981
R8	0,49754	0,50400	0,48615
R9	0,49823	0,51223	0,49063
R10	0,50563	0,52550	0,49298
Average of Each Signal	0,49924	0,51267	0,49625

The highest electroencephalography value of the Traveloka application is in the alpha signal, at 0.51267 B, followed by the theta signal at 0.49924 B and the beta signal at 0.49625 B. The most significant average signal on the Traveloka application is the alpha signal, which indicates that respondents are in a calm and conscious state, with concentration that does not require full attention, as stated by Lai, Lai, and Chiang (2015) in [14].

2. Tiket.com

TABLE XVII
TIKET.COM APP ELECTROENCEPHALOGRAPHY VALUES

Respondent	Electroencephalography Signal Data (Bels)		
	Theta	Alpha	Beta
R1	0,49678	0,50883	0,48240
R2	0,49836	0,50046	0,48706
R3	0,48762	0,51620	0,50316
R4	0,50044	0,51773	0,50121
R5	0,48500	0,49662	0,50635
R6	0,49316	0,51172	0,50190
R7	0,50481	0,51222	0,50398
R8	0,49800	0,50964	0,49742
R9	0,49016	0,51677	0,50027
R10	0,49480	0,52348	0,51732
Average of Each Signal	0,49491	0,51137	0,50011

The highest electroencephalography value of the Tiket.com application is in the alpha signal, at 0.51137 B, followed by the beta signal at 0.50011 B, and the theta signal

at 0.49491 B. The average most significant signal on the Tiket.com application is the alpha signal, which indicates that the respondents are in a calm and conscious state, with concentration that does not require full attention, as stated by Lai, Lai, and Chiang (2015) in [14].

3. Agoda

TABLE XVIII
AGODA APP ELECTROENCEPHALOGRAPHY VALUES

Respondent	Electroencephalography Signal Data (Bels)		
	Theta	Alpha	Beta
R1	0,49858	0,49750	0,50510
R2	0,49881	0,50899	0,50766
R3	0,49243	0,50665	0,49901
R4	0,49908	0,50457	0,50852
R5	0,49766	0,52736	0,50150
R6	0,49385	0,50779	0,51642
R7	0,49695	0,50730	0,51522
R8	0,48580	0,49737	0,51280
R9	0,50573	0,50113	0,50944
R10	0,49652	0,50488	0,50455
Average of Each Signal	0,49654	0,50635	0,50802

The highest electroencephalography value of the Agoda application is in the beta signal at 0.50802 B, followed by the alpha signal at 0.50635 B, and the theta signal at 0.49654 B. The most significant average signal on the Agoda application is the beta signal, which indicates that respondents are thinking, feeling nervous, or anxious when using the application, as stated by Lai, Lai, and Chiang (2015) in [14].

IV. CONCLUSION

Based on the test results, the Traveloka app achieved an effectiveness score of 95%, an efficiency of 0.023 goals per second, and a satisfaction score of 85, placing it in the acceptable category with a grade scale of B and adjective ratings of excellent. The Tiket.com app achieved an effectiveness score of 92.5%, an efficiency of 0.026 goals per second, and a satisfaction score of 79, placing it in the acceptable category with a grade scale of C and adjective ratings of good. Meanwhile, the Agoda app achieved an effectiveness score of 87.5%, an efficiency of 0.016 goals per second, and a satisfaction score of 70, placing it in the marginal high category with a grade scale of D and adjective ratings of okay. Therefore, it can be concluded that the Traveloka app has the best usability, followed by the Tiket.com app, and the Agoda app ranks last.

Based on EEG data calculations, the Traveloka and Tiket.com apps showed the highest average absolute power band values in the alpha signal, with values of 0.51267 B and 0.51137 B, respectively. This indicates that respondents were

calm and aware without requiring full concentration. The Agoda app showed the highest average absolute power band value in the beta signal, 0.50802 B, indicating that respondents were in a state of thinking, feeling nervous or anxious. Therefore, it can be concluded that respondents tend to feel calm and aware without the need for full concentration when using the Traveloka and Tiket.com apps. In contrast, when using the Agoda app, respondents tended to feel nervous or anxious and thought more.

Based on the analysis, the Traveloka and Tiket.com apps produced higher SUS scores than the Agoda app, which aligns with the EEG results dominated by the alpha signal, showing that respondents were calm, aware, and did not require full concentration. In contrast, the Agoda app produced lower SUS scores, which aligns with the EEG results dominated by the beta signal, indicating that respondents were nervous, anxious, and thinking more. Overall, the test results show that the usability of Online Travel Agent apps is heavily influenced by the user experience, which is not only reflected through subjective assessments using the SUS questionnaire but can also be further analyzed using EEG data to understand the physiological responses of users. Easier-to-use apps, such as Traveloka, not only enhance user satisfaction but also minimize feelings of nervousness, anxiety, and excessive thinking, which can affect the effectiveness and efficiency of app usage.

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