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User Experience Evaluation Using Integration of Remote Usability Testing and Usability Evaluation Questionnaire Method

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Abstract — Sinovi (Innovation Center Innovation System) is a website developed to manage the collection of innovation and HAKI owned by the ITTP academic community. Based on the results of initial observations made by interviewing the Center for Innovation and HAKI, although it has been done twice socialization of website use, there are still complaints and obstacles experienced by users. Based on these problems, the researchers conducted research on evaluating the user experience (UX) of the Sinovi website. This study aims to determine the system's performance based on user experience. The UX evaluation process uses methods moderated remote usability testing and user experience questionnaire (UEQ). The study's results using moderated usability testing showed a significant difference in completion rate between the two groups of users, with each group having values of 0.9560 and 0.8235. While the results of time-based efficiency tests showed that the average time-based efficiency between group A and group B has similarities with the values obtained, respectively are 0.1652 and 0.1259. The test results using UEQ show that the Sinovi website has managed to get a positive evaluation. Several categories were successfully obtained, including the "Attractiveness" category with a score of 1.967, the "Perspicuity" category with a score of 1.850, the "Efficiency" category with a score of 2.042, the "Dependability" category with a score of 1.825, and the "Stimulation" category with a score of 1.742. The overall user experience evaluation results show that Sinovi's website is already at a good user experience level but needs to improve to reduce the number of problems.

Keywords: user experience, user experience evaluation, usability testing, user experience questionnaire, moderated remote usability testing.

I. INTRODUCTION

The integration of methods in usability measurement is widely used to provide a comprehensive assessment of the software user experience [1]. In addition, the evaluation results can explore possible problems experienced by users. However, during a pandemic, we need a usability measurement method to make it easier for users and observers when there is a social distancing policy. The evaluation method used is remote

usability testing. Remote usability testing is very appropriate to use during a pandemic situation like now because the test can do it anywhere and anytime without meeting in person. Remote usability testing is divided into 2, namely moderated remote usability testing and unmoderated remote usability testing. Moderated remote usability testing is a test that involves remote encounters between researchers and respondents in a virtual room. During the testing session, the researcher will give instructions, observe user interaction in real-time, and continue with follow-up questions. Moderated remote usability testing method, separating users and researchers in space and time, shows similarities with conventional methods, so it is considered more efficient in time and problem identification [2]–[5]. Another method used in this research is the User Experience Questionnaire (UEQ). Following its objectives, the UEQ method is a method that allows evaluation to run quickly based on the user experience of each interactive product [6], [7]. In addition, the UEQ method has also provided Data Analysis Tools in excel format that can simplify the measurement of the user experience questionnaire (UEQ). This research contributes to combining observation and questionnaire methods in evaluating the usability of an application. The observation method is represented by paying attention to the user's behavior when using the application with the URUT method. At the same time, the UEQ questionnaire method was carried out to complete the findings during observation. Several feedback techniques are available to measure user experiences, such as Usability Metric for user experience (UMUX) or System Usability Scale (SUS) [8]–[11]. However, some of these questionnaire methods have weaknesses. For example, UMUX and SUS with an insufficient number of question items are Quick and Dirty tests because they are good enough to solve the current problems. However, they may not be enough to facilitate possible changes in the future. User Experience Questionnaire (UEQ) is a facts processing device associated with the consumer reveal that is straightforward to implement, reliable, and valid, which may be used to supplement facts from different top first-class assessment methods [6], [7].

This study evaluated the user experience when using the Innovation Center Information System (Sinovi) website. Sinovi is an information system in the unit of Center for

Innovation and Intellectual Property Rights of Institut Teknologi Telkom Purwokerto (ITTP), Indonesia. The unit handles the management of innovations and Intellectual Property Rights owned by the ITTP academic community, such as copyright filings, incubation of business innovations, and others. However, the current COVID19 pandemic has made the service process impossible to do manually [1]. To overcome this, the Innovation Center and Intellectual Property Rights at ITTP's work unit seeks to develop a system using the Innovation Center Information System (Sinovi) website. Sinovi is a website created to manage a collection of innovations and Intellectual Property Rights owned by the ITTP academic community.

More than four thousand active user migrations and the system launch process have been carried out by the Innovation and Intellectual Property Rights Center unit on Sinovi. The existence of the Sinovi website is a new thing for the ITTP academic community, so users are not used to using the system. Carrol M. Barnum stated that users don't want to waste time learning to use a product. So a product should be designed with the user in mind [12]. The book also reveals what everyone will experience when using a website. The fact is that not everyone has the experience to use a website. This is directly proportional to the conditions in ITTP at the time of the implementation of the Sinovi website. Based on the results of initial observations, the researcher interviewed one of the heads of the staff. Even though she had held socialization twice about "how to use the Sinovi website," there are still complaints of constraints experienced by users, such as difficulty finding innovation plus buttons, difficulty finding copyright added buttons, and inability to add copyright submissions. In addition, there are still some changes that need to be done and adjusted to the specified flow. Based on this, the user experience evaluation on the Sinovi website is also essential to know the system's performance based on user experience and find out other possible problems from users who are not known.

II. RESEARCH METHODS

This research was carried out through several stages, as shown in Figure 1.

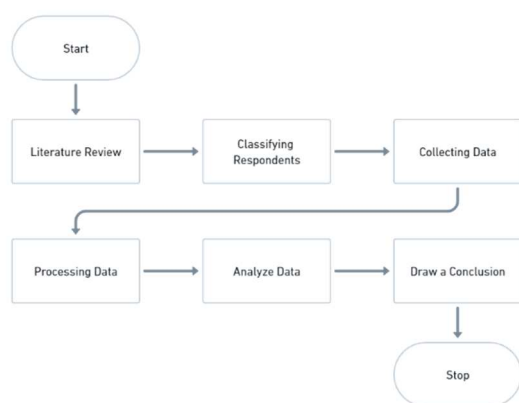


Fig. 1. Research Flowchart

A. Literature Review

In this phase, a literature review reviews previous research related to the Sinovi website, User Experience, Moderated Remote Usability Testing, and UEQ. The literature study was

undertaken to strengthen the issues raised and reference for conducting research.

B. Classifying Respondents

Respondents in this study were users of the Sinovi website. The Sinovi website is intended for the entire ITTP academic community, including lecturers, employees, and students. The number of respondents in this study was 30 respondents [13]. The selection of respondents was carried out using a simple random sampling technique. This method allows the choice of respondents at random, where every member in a population has the same opportunity to be sampled. Technically, respondents will be given a schedule and a link to perform moderated usability testing. Then after conducting moderated usability testing, respondents will fill out a UEQ questionnaire.

C. Collecting Data

Collecting data in this study was carried out qualitatively and quantitatively. The data collection method used for qualitative data is the Moderated Remote Usability Testing method. At the same time, the quantitative data is obtained through the UEQ questionnaire method.

At the qualitative data collection stage, the researcher conducted online meetings with respondents to test the usability of the Sinovi website. The researcher as moderator will supervise by providing several test scenarios. After the researcher completes the test scenario, it will provide specific follow-up questions for discussion. Table I shows a list of questions asked for discussion with the respondents, and Table II shows the test scenario.

TABLE I. LIST OF QUESTIONS TO DISCUSS

No	Question
1	What do you think about the Sinovi website?
2	How do you feel when you use the Sinovi website?
3	Are there any problems when you use the Sinovi website? If there are problems, what are those problems?
4	In your opinion, what needs to improve the Sinovi website?
5	Is there anything that needs to be added or removed from this website?

TABLE II. TEST SCENARIO OF SINOVI WEBSITE

No	Test Scenario
T1	Log in to the system.
T2	Adding innovation to the idea level.
T3	View the details of innovation at the idea level.
T4	Transforming innovation data at the idea level.
T5	Delete innovation data at the idea level.
T6	Adding innovation at the prototype level.
T7	Added prototype documentation.
T8	Delete innovation data at the prototype level.
T9	Added a copyright application.
T10	Added creator.
T11	Complete copyright file.
T12	Upload proof of payment.
T13	Download the certificate.
T14	Log out of the system.

Usability testing using moderated remote usability testing will consider the success rate (time success) and the time required to complete the task (time on task). This data will be

used to calculate the effectiveness (completion rate) of time-based efficiency as complementary research data used as a basis for further research.

The researcher will distribute the UEQ questionnaire to the respondents at the qualitative data collection stage after completing moderated remote usability testing. UX measurement using UEQ is divided into six scales (aspects) with 26 indicators of followers [7], [14]. UEQ consists of pairs of indicators that are mutually contradictory in meaning and can represent products with 7 (seven) scales.

D. Processing Data

At this stage, the researchers observed users through video recordings during the evaluation. Based on the video, researchers will observe performance metrics on the level of success (task success) and the time required to complete the task (time on task). To calculate the effectiveness and efficiency of the Sinovi website will use task success and time on task observation data.

Value of effectiveness and efficiency will calculate the success rate of respondents. A binary value of '1' is given if the respondent completes the task. While if the respondent fails to complete the task, it will give a binary value of '0'. Task completion time is the time in seconds or minutes calculated starting from the task's completion until the respondent's last click. Effectiveness is calculated by measuring the level of success (completion rate). Effectiveness is represented by using the following equation [1]:

$$\bar{E} = \frac{\sum_{j=1}^R \sum_{i=1}^N n_{ij}}{NR} \times 100\% \quad (1)$$

Where \bar{E} is the completion rate, R is the total respondents, N is the number of tasks, n_{ij} is that tasks can be completed. If it's done, worth '1' else worth '0'.

Time-based efficiency is how efficiently the tasks tested on the respondent is based on the time it takes the respondent to complete the task. Formula (2) is the formula used to calculate time efficiency :

$$\bar{P}_t = \frac{\sum_{j=1}^R \sum_{i=1}^N \frac{n_{ij}}{t_{ij}}}{NR} \quad (2)$$

Where \bar{P}_t is time-based efficiency, R is the number of respondents, N is the number of tasks, n_{ij} is the task that can be completed. If it is finished, then worth '1', else if it fails, then worth '0', t_{ij} is the time it takes the respondent to complete the task.

In addition, when observing video recordings, researchers also observed feedback and suggestions given by participants. This data will be used to reference for recommendations for improving the Sinovi website. Then the results of the UEQ questionnaire will be processed using the Data Analysis Tools obtained at <https://www.ueq-online.org/>.

E. Analyze Data

Data analysis is done by comparing the two groups of respondents. The first group is respondents who have experience using the Sinovi website, and the second group is respondents who have never used the Sinovi website. After

performing the data calculation process, the next step is to analyze the data obtained. Analysis was carried out on the calculation results of the completion rate, time-based efficiency, and the UEQ benchmark diagram to help interpret the evaluation results. Based on the UEQ benchmark, the evaluation results will determine the scale obtained from each UEQ aspect: Excellent, Good, Above Average, Before Average, or Bad [14].

F. Draw a Conclusion

After the evaluation stage is completed, conclusions are obtained to answer the problems. That has been described in the introduction section. Researchers will also add suggestions for the unit that handles the Sinovi website and further research.

III. RESULT AND DISCUSSION

A. Analysis of Moderated Remote Usability Testing

In the usability analysis, the researcher observed the results of task success and time on task achieved by the respondents. The data obtained based on these observations, then grouped into two parts. Group A is for users who have used the Sinovi website, and group B is for users who have never used the Sinovi website. After grouping the data, then the calculations are carried out.

In this study, the researcher calculated the effectiveness by measuring the level of success of the tasks carried out by the respondents. Calculation of the completion rate of each respondent uses the formula (1). Figure 2 and Figure 3 show the completion rate graph of the Sinovi website.

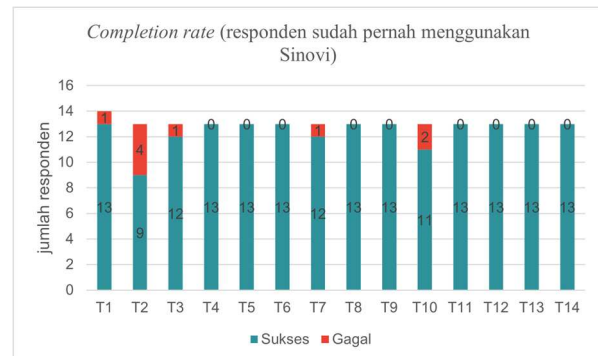


Fig. 2. Graph of Work Completion Rate Respondents Group A

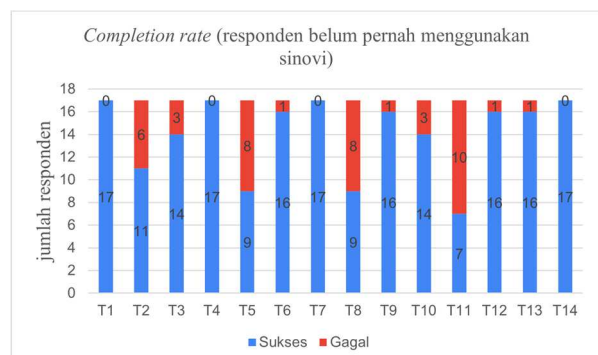


Fig.3. Graph of Work Completion Rate Respondents Group A

Formula (1) is used to get the completion rate calculation. Based on these calculations, the completion rate values were

obtained from each group of respondents. The completion rate for respondents who have never used Sinovi (Group A) is 96%, while the completion rate for respondents who have never used Sinovi (Group B) is 82%.

Time efficiency is the value of time used by respondents in completing tasks. The time efficiency value is calculated based on the time on task in seconds and the successful completion of several given tasks. The calculation of the efficiency value of each respondent uses the formula (2). Formula (2) calculates the number of success rates (task success) divided by the time required to complete the task (time on task). Figure 4 and Figure 5 shows graphs of the time efficiency values of the two groups of respondents.

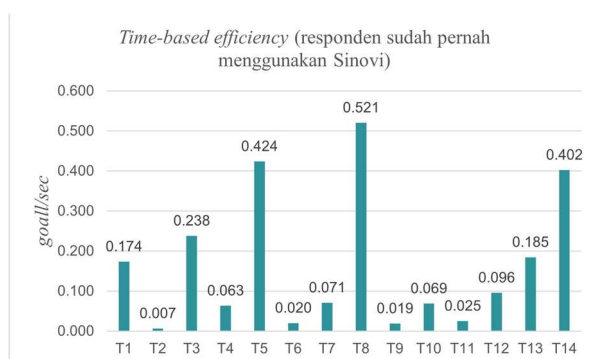


Fig. 4. Time-based Efficiency Graph of Respondents in Group A

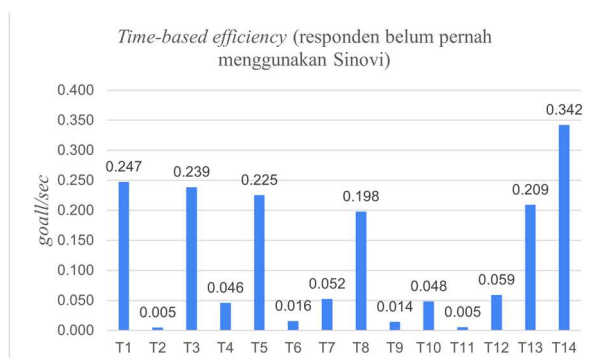


Fig. 5. Time-based Efficiency Graph of Respondents in Group B

Time efficiency measurement aims to determine how efficient the time needed by participants to complete the given task is. This study's calculation of time efficiency uses the equation (2). In this study, the value of time efficiency produces units of tasks per second. The higher the value of time efficiency, the more efficient the time needed to complete the task. Based on calculations using the formula (2), the time efficiency value for respondents who have used Sinovi is 0.17 goals/sec. In contrast, for respondents who have never used Sinovi, the time efficiency value is 0.12 goals/sec.

Based on the observation of video recordings and feedback expressed by respondents during the test, researchers obtained some inputs and suggestions from respondents for improving the Sinovi website. The problems and recommendations for improvement are described in Table III.

TABLE III. PROBLEMS AND IMPROVEMENT RECOMMENDATION OF SINOVI WEBSITE

Task	Goal	Problem	Improvement Recommendation
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T2	Adding innovation to the idea level.	Respondents have difficulty finding the add idea button.	Move the position of the adding idea button to the top right and put the word "Add" as information next to the icon.
T2	Adding innovation to the idea level.	Respondents did not see the team names field, so they did not fill the names in the field. In addition, Respondents thought that entering the team names to add only the members.	Changed its position and added tooltips to minimize mistakes.
T2	Adding innovation to the idea level.	Respondents do not know the type of file extension that must be attached.	Add description or extension information of the file to be uploaded under the upload attachment field.
T3	View the idea detail page.	Respondents do not think that the title is clickable. The respondents did not expect that the search for detail buttons would be in the action buttons.	It would be better if the title colouring could be more emphasized and add detailed actions inside the action grouping.
T5	Delete an idea.	Respondents don't see the delete button at the top of the idea details. Respondents were confused because there was an action to delete the team and the delete button above.	It would be better if given the difference between removing a team and removing ideas, for example, by adding tooltips.
T6	Adding innovation at the prototype level.	Respondents do not understand foreign words (English) contained in the submission form, such as "unique value proposition".	Added information using tooltips or information below the field regarding the explanation of the related word.
T6	Adding innovation at the prototype level	Respondents were confused because when they filled in the idea field, they did not enter and were immediately blank.	It is clarified again that the idea field is a combo box, and the current copywriting is corrected to minimize confusion for users.
T8	Delete a Prototype.	Respondents don't see the delete button at the top of the idea details. Apart from that, Respondents were confused because there was an action to delete the team and the delete button above.	It would be better if given the difference between removing a team and removing ideas, for example, by adding tooltips.
T10	Added a new creator to the existing copyright.	Respondents did not expect that adding a creator, could be added to the creator tab. So users tend to choose editing actions to add creators to existing copyrights.	Added the "add creator" feature to the copyright editing action (such as when you first add a copyright application).
T11	Completing the existing	Respondents tidak mengetahui informasi berkas	Ditambahkan penjelasan atau informasi ekstensi file

	copyright file.	yang harus diunggah.	di bawah field upload lampiran.
T11	Completing the existing copyright file.	Respondents were confused because there was no information when they uploaded the wrong copyright file.	Added error information when uploading / completing files failed.
T16	Log out of the system.	Respondents did not expect the logout button to be on the left side because it is usually located at the top of the navbar (on the right)	Changed the location of the logout button to be in the navbar (at the top right).

B. UEQ Analysis

Measuring user experience using UEQ is done after the respondent has completed a given set of test scenarios. Points refer to the list of UEQ questionnaires that are available online. After the answers to the questions are collected, the next step is to calculate the UEQ score using the tools provided.

TABLE IV. UEQ QUESTIONNAIRE RESULTS

	Mean	Variance
Attractiveness	1.967	0.68
Perspiciuity	1.850	0.80
Efficiency	2.042	0.49
Dependability	1.825	0.60
Stimulation	1.742	1.11
Novelty	1.375	1.03

Based on Table IV, we can see that all of the UEQ scores on the Sinovi website received positive evaluation results (ranging from 0.8 to a maximum score of 3 based on the explanation in the analysis tools). The "Attractiveness" category has a score of 1.967. This result indicates that the respondents liked the appearance of the Sinovi website. The "Perspiciuity" category got a score of 1.850. This result indicates that respondents found the Sinovi website easy to recognize. The "Efficiency" category got a score of 2.042 points. The "Efficiency" category has the highest score compared to other categories. This score shows that respondents can complete their tasks quickly and not require unnecessary effort. The "Dependability" category received a score of 1.825 points. This score means that the components on the Sinovi website point to the right place and makes the user feel in control of the interaction. The "Stimulation" category received a score of 1.742 points, which is in the positive evaluation area. Users feeling motivated to use the Sinovi website can interpret this score. The "Novelty" category received a score of 1.375. Although it is still in the positive evaluation zone, the "Novelty" category has the lowest score. This score shows that the Sinovi website still needs to improve its creativity. Figure 6 shows the UEQ benchmark from the Sinovi website.

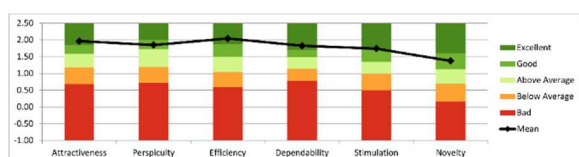


Fig. 6. UEQ Benchmark

In Figure 6, we can see that the attractiveness, efficiency, dependability, and stimulation categories received an "Excellent" rating if we compare it with the dataset owned by UEQ. This means that on the attractiveness scale, the Sinovi website is in the 10% range with other products that have the best ratings. Then, it received a "Good" rating for the perspicuity and novelty categories. In both categories, the Sinovi website is below 10% of other products with a better rating and above 50% of other products with poor ratings.

C. Pearson Validity Test

The validity test was carried out to measure the validity of the questionnaire used [8]. One of the validity tests that can be used is using the Pearson validity test. This test connects each questionnaire item score with the total score obtained. Test Validity of the UEQ items changed each negative question on the questionnaire to a positive question. So the answers to negative questions also need to be adjusted. After that, the scores and total scores obtained were tested using SPSS software tools. The test results using SPSS tools are presented in Table V.

TABLE V. PEARSON VALIDITY TEST RESULTS

Question Items	r _{count}	r _{table}	Keterangan
Q1	0.827	0.361	Valid
Q2	0.684	0.361	Valid
Q3	0.722	0.361	Valid
Q4	0.778	0.361	Valid
Q5	0.734	0.361	Valid
Q6	0.630	0.361	Valid
Q7	0.831	0.361	Valid
Q8	0.694	0.361	Valid
Q9	0.628	0.361	Valid
Q10	0.589	0.361	Valid
Q11	0.750	0.361	Valid
Q12	0.750	0.361	Valid
Q13	0.618	0.361	Valid
Q14	0.780	0.361	Valid
Q15	0.447	0.361	Valid
Q16	0.833	0.361	Valid
Q17	0.624	0.361	Valid
Q18	0.791	0.361	Valid
Q19	0.525	0.361	Valid
Q20	0.674	0.361	Valid
Q21	0.788	0.361	Valid
Q22	0.611	0.361	Valid
Q23	0.747	0.361	Valid
Q24	0.833	0.361	Valid
Q25	0.814	0.361	Valid
Q26	0.785	0.361	Valid

Decision-making to determine whether the questionnaire item is valid or not is determined based on the r_{count} and r_{table} values [10]. If the value of $r_{count} > r_{table}$, the questionnaire item is declared valid. If the value of $r_{count} < r_{table}$, the questionnaire item is declared invalid. In a test with 30 respondents, the results obtained a significance value of 5% for r_{table} at 0.361 [11]. Based on these provisions, the validation test results listed in Table V are declared valid for each item of the questionnaire.

D. Cronbach Alpha Reliability Test

Reliability testing is conducted to assess whether the questionnaire can be trusted as a measuring tool. If the Cronbach Alpha value is more than 0.60, the questionnaire

item is declared valid. If the Cronbach Alpha value is less than 0.60, the questionnaire item is declared invalid [8], [12].

In this study, researchers obtained the results from reliability testing with a Cronbach Alpha value of 0.958 points. It means that the questionnaire can be declared reliable because it has a value of more than 0.60 points. The reliability testing results in this study can be seen in Table VI.

TABLE VI. CRONBACH ALPHA RELIABILITY TEST RESULTS

References Value	Cronbach Alpha Value	N of Items	Conclusion
0.6	0.958	26	Reliable

IV. CONCLUSION

Research on evaluating user experience on the Sinovi website that has been carried out by researchers using the Moderated Remote Usability Testing and User Experience Questionnaire (UEQ) method has succeeded in getting a conclusion.

Based on the results of the completion rate test using the Independent Sample T-Test, it was shown that there was a significant difference between group A and group B. Group A had an average completion rate of 0.9560 (96%), while group B had an average completion rate of 0.8235 (82%).

Based on the time-based efficiency test results using the Independent Sample T-Test, the average time-based efficiency between group A and group B has similarities. Group A got a score of 0.1652 (17%), while group B got 0.1259 (13%). Apart from that, based on user feedback, the developer's team must fix several problems in the user interface of the Sinovi website.

The UEQ measurement on the Sinovi website shows that the "Attractiveness" category scores 1.967, the "Perspicuity" category scores 1.850, the "Efficiency" category scores 2.042, the "Dependability" category scores 1.825, the "Stimulation" category scores 1.742, and the "Novelty" category got a score of 1.375. The six categories are in the range of 0.8 to a maximum score of 3. Based on that, we can conclude that the Sinovi website has positive evaluation results.

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