CS4242 Human Computer Interaction

Heuristic Evaluation for Train Schedule Application

Group Project

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1 INTRODUCTION

This report describes the heuristic evaluation process and findings for Sri Lanka Train Schedule application. It begins with summary information describing the product and its target population, and then continues with an overview of the heuristic evaluation technique in general, the specific goals of this project, and the heuristics used in our walk-through of the application. Following is a summary of the major problems identified by the heuristic evaluation and a more detailed exploration of the findings related to these specific problems prioritized according to their severity and impact on the user experience. The report concludes with a list of resources related to heuristic evaluation and a detailed list of the actual heuristics used in the evaluation.

2 PRODUCT DESCRIPTION

Sri Lanka Train Schedule is developed under the initiative of delivering government e-services which are connected to Lanka Gate through smart phone mobile interface. From this application a user can get Train Schedule and Ticket Price information from Sri Lanka Railways. This application is developed for ICTA Sri Lanka by Bhashitha Nandun Gamage. This app is getting highly trend among Sri Lankan Smartphone users, more than 100,000 downloads have been happened until now. This application can be downloaded free from the Google play store link given below.

Download link: https://play.google.com/store/apps/details?id=lk.icta.mobile.apps.railway

For this project, we used a set of nine heuristics to discover usability problems in the train schedule application interface. This evaluation focused on the core functionality of the train schedule app interface: get the train schedule and ticket price. The goal of this project was to identify major usability flaws in the Sri Lanka Train Schedule application using established heuristic evaluation techniques.

3 HEURISTIC EVALUATION TECHNIQUE

Heuristic evaluation is a form of usability inspection where usability specialists judge whether each element of a user interface follows a list of established usability heuristics. The heuristic evaluation usability method was used to produce the findings summarized in this report. According to renowned usability expert Jakob Nielsen, a "heuristic evaluation involve shaving a small set of evaluators examine the interface and judge its compliance with recognized usability principles (the 'heuristics')" (How to conduct a heuristic evaluation). Commonly referred to as a "discount" usability technique (Nielsen, 1993, p. 160), this method allows evaluators to discover possible usability problems in a product or application in a single afternoon. Later, more expensive and extensive user testing can investigate the usability problems identified through heuristic evaluation. When conducting a heuristic evaluation, evaluators compare a pre-defined set of specific usability principles with a product or web site interface while attempting to accomplish actual system tasks. Evaluators may either work individually, combining findings later, or they may perform the evaluation at the same time with each individual focusing on several different heuristics.

Many of the most commonly available lists of heuristics are specifically oriented toward the evaluation of web sites. As a mobile application, Sri Lanka Train Schedule application has a different interface and navigation style than a traditional web site. To best accommodate these needs, we combined a set of ten heuristics suggested by Jakob Nielsen (1993) and a set of nine design principles suggested by Saul Greenberg, a professor of Human-Computer Interaction at the University of Calgary(Design Principles and Usability Heuristics). The nine heuristics used to evaluate the Sri Lanka Train Schedule application are listed in full detail below.

1. Use Aesthetic and Minimalist Design
    - Less is more – less information/less complex structure is easier to understand.
    - Extraneous information risks confusing the novice user and slows down the expert user.
    - Text size, font, and spacing allow the user to read the font.
    - Color is used to highlight current area of work or group functionally related items.
    - Screen layout uses gestalt rules for human perception to increase users' understanding of relationships between the dialogue elements.
2. Effective Menu/Command Structure
    - Frequently used commands are easily accessible.
    - Related commands are grouped together.
    - Experienced users have shortcuts to perform frequent operations quickly.
3. Use Simple and Natural Language
    - Simplify and shorten text as much as possible.
    - Use words, phrases, and concepts that are familiar to the user, rather than system-oriented terms.

- Use words based on the task that the user is trying to accomplish.

4. Minimize User's Memory Load
    - Utilize recognition rather than recall.
    - Make available tools/options visible to user (no scrolling required).
    - Include appropriate labels so that users can easily locate desired buttons/menu options.
    - Provide hover text over labeled/unlabelled buttons.
    - Use a small number of pervasive rules or generic commands that apply throughout the user interface.
5. Be Consistent
    - Vocabulary/labeling should be consistent within tasks.
    - The same function/label should do the same thing everywhere throughout the application.
    - Same information should be presented in the same location and formatted in the same way on all screens and dialog boxes.
6. Provide Feedback
    - Inform the user about what the system is doing.
    - Show progress achieved toward goal, particularly if operation takes more than 10 seconds to complete.
    - Notify user when a task is completed.
7. Provide Clearly Marked Exits
    - Allow user to cancel a system function or leave and unwanted state easily.
    - Include cancel buttons in dialog boxes.
    - Support generic undo and redo commands throughout the system.
8. Deal with Errors in a Positive Manner
    - Error messages indicate specific problem in plain language.
    - Error messages suggest a solution to help user solve the problem.
9. Provide Help
    - Easy to search for solutions to specific problems.
    - Help content is written in a task-oriented fashion.
    - Each help section is as self-contained as possible.

In order to usefully group the findings resulting from this heuristic evaluation process, we clustered specific instances of heuristic violations into eleven problem areas. To further understand the impact of each of these problems, we estimated both its severity in terms of usability principles and the ease with which the problem might be solved. Problem severity ratings were impacted by the frequency with which the problem occurred, the ease with which the user could overcome the problem, and the persistence of the problem—whether it could be solved once or would bother the user every time a task was attempted. This resulted in a dual rating for each problem found, which was used to prioritize the problem areas for presentation in this report. The tables below define the severity and ease of fix rating systems applied. Severity ranks are based on those defined by Jakob Nielsen (Severity ratings for usability problems).

Severity Rankings	
Rating	Definition
0	Violates a heuristic but doesn't seem to be a usability problem
1	Superficial usability problem: may be easily overcome by user or occurs extremely infrequently. Does not need to be fixed for next release unless extra time is available.
2	Minor usability problem: may occur more frequently or be more difficult to overcome. Fixing this should be given low priority for next release.
3	Major usability problem: occurs frequently and persistently or users may be unable or unaware of how to fix the problem. Important to fix, so should be given high priority.
4	Usability catastrophe: Seriously impairs use of product and cannot be overcome by users. Imperative to fix this before product can be released.

Ease of Fixing Rankings	
Rating	Definition
0	Problem would be extremely easy to fix. Could be completed by one team member before next release.
1	Problem would be easy to fix. Involves specific interface elements and solution is clear.
2	Problem would require some effort to fix. Involves multiple aspects of the interface or would require team of developers to implement changes before next release or solution is not clear.
3	Usability problem would be difficult to fix. Requires concentrated development effort to finish before next release, involves multiple aspects of interface. Solution may not be immediately obvious or may be disputed.

4 SUMMARY OF FINDINGS

After completing the heuristic evaluation of the Sri Lanka Train Schedule application, we identified **12** problem areas that violate traditional usability principles. These problems have been prioritized below, with the most severe and easiest to fix problems listed first, it illustrates that Sri Lanka Train Schedule has the considerable number of usability problems in the area of consistency.

#	**Problem**	**Severity Ranking**	**Ease of Fixing Ranking**	**Heuristic Number**	**Broad Heuristic**
1	Inconsistencies when the internet disconnects	3	1	6,8	Provide Feedback, Deal with Errors in a Positive Manner
2	Sometimes, application is not responsive for unknown reasons	1	2	6	Provide Feedback
3	Status message is more technical terms rather than natural language	2	1	3	Use Simple and Natural Language
4	Time format is restricted only to 24hour clock	0	1	3	Use Simple and Natural Language
5	Undo commands basically unsupported.	3	2	7	Provide Clearly Marked Exits
6	Zone classification is not in a conventional way	1	2	2,5	Effective Menu/Command Structure, Be Consistent
7	Application does not promptly highlight the mistaken input fields	3	2	8,9	Deal with Errors in a Positive Manner, Provide Help
8	Application is not responsive for past date queries	2	2	6,8	Provide Feedback, Deal with Errors in a Positive Manner
9	There are buttons and tabs with drill down features	3	2	1,4,5	Use Aesthetic and Minimalist Design,

	but they are not clearly visible as button				Minimize User's Memory Load, Be Consistent
10	Star button in the title bar makes a ambiguous meaning	1	1	4,5	Minimize User's Memory Load, Be Consistent
11	Error/warning messages are not highlighted	3	2	2,5,8	Effective Menu/Command Structure, Be Consistent, Deal with Errors in a Positive Manner
12	Helpdesk information is not user friendly	3	2	9	Provide Help

5 SPECIFIC PROBLEM AREAS

5.1 Inconsistencies when the internet disconnects

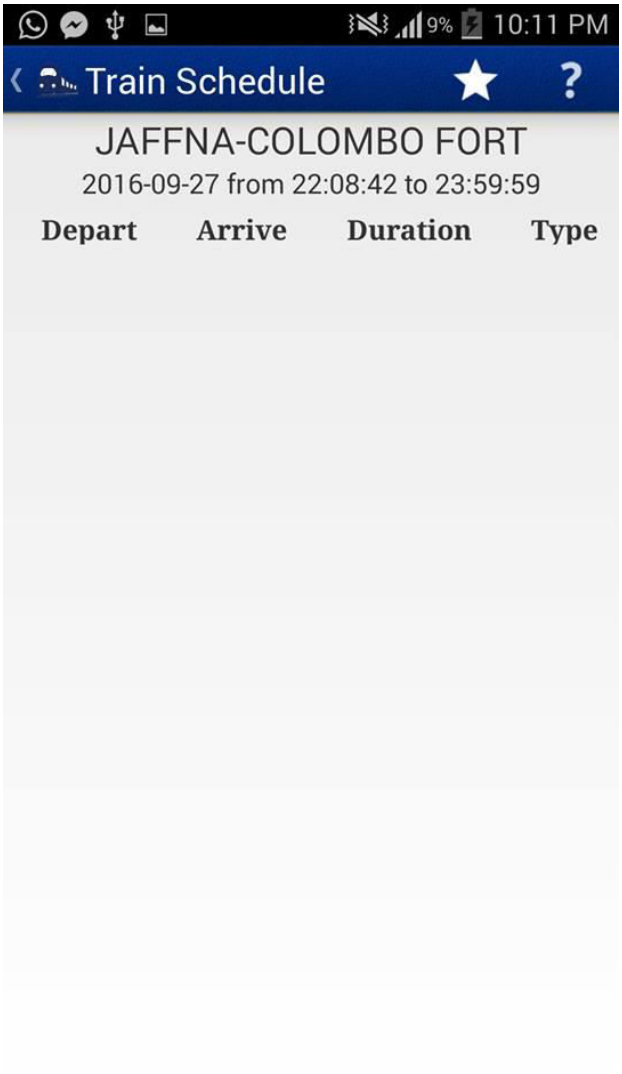
#	**Problem**	**Severity Ranking**	**Ease of Fixing Ranking**	**Heuristic Number**	**Broad Heuristic**
1	Inconsistencies when the internet disconnects	3	1	6,8	Provide Feedback, Deal with Errors in a Positive Manner

Problem

While user input stations and do search function within the application interface, evaluators noticed inconsistencies when internet disconnects. If the internet disconnects when user search train schedule application doesn't inform the user but rather shows an empty search results. If the internet connection disconnects while using the application, it doesn't notify the user about that but rather it pretends to work as normal. These problems violate heuristic number 6 which states that the system should always keep users informed about what is going on, through appropriate feedback within reasonable time and 8 states that error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution. This problem area is ranked as a major usability problem because it relates to the main functionality of the system. Internet connection is important for this application. If user doesn't know about internet failure, he/she may simply become confused about what happens.

Evidence

This problem affects the main function of the system. In here when user input the values to the fields in the "Timetable" tab and press the search button, but suddenly device internet disconnected then there is no any error or warning messages notify about the internet connection to the users. Here is the screenshot of the problem red squared line clearly shows that there is no internet connection and application doesn't show any warning messages.



Recommendation

The obvious and simple solution to this problem is to check the internet connection and shows any warning or error messages which clearly shows about the problem like "There is no internet connection" or "Check your internet connection".

5.2 Sometimes, application is not responsive for unknown reasons

#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
2	Sometimes, application is not responsive for unknown reasons	1	2	6	Provide Feedback

Problem

Even if all other factors such as internet connections and correct input fields (stations) are working, sometimes user won't be able to get the search results. User may wonder if internet connection is not working but even with his connectivity to the internet he/she can experience this issue. This problem violates Visibility of system status heuristic from Jacob Niellsen's heuristics. Users' experience this problem occurs extremely infrequently so this was ranked as superficial usability problem.

Evidence

If users do search functions and all other factors are working properly, users may get empty fields.

Recommendation

Solution for this problem may be some difficulties to solve. Developers also want to know the place of code which has the problem. Use some more testing to find the exact situation of the problem and change the functionality of the system and also give some error messages or warning messages to users about the system like "System doesn't respond as you expect retry again, Thank you".

5.3 Status message is more technical terms rather than natural language

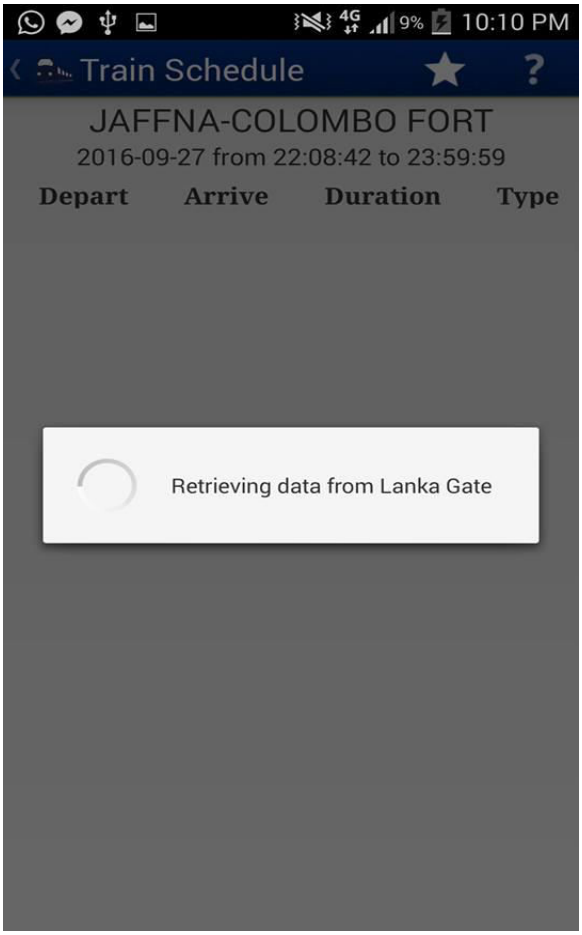
#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
3	Status message is more technical terms rather than natural language	2	1	3	Use Simple and Natural Language

Problem

The application shows the status messages of the operations using some more technical terms rather than using simple or natural language. This may gives inconvenient feel for users. This problem violates the heuristic match between systems and the real world or use Simple and Natural Language which states that the system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. This problem ranked as minor usability problem because most of the users don't care about some status messages after the first use.

Evidence

Here is the example of this problem category. "Retrieving data from Lanka Gate" is something related technical words and developers don't mention anything about Lanka Gate.



Recommendation

The obvious and easy solution is to use simple and natural language terms to indicate the status messages like "Getting Information, Please wait..." This is also handle users in a good manner and feels comfortable.

5.4 Time format is restricted only to 24hour clock

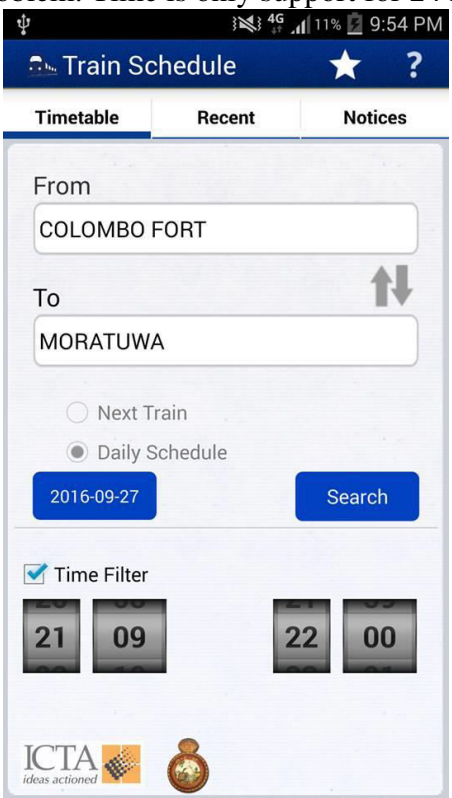
#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
4	Time format is restricted only to 24hour clock	0	1	3	Use Simple and Natural Language

Problem

In the "Timetable" tap of the application has the feature for time input field to search train schedule based on time. But developers only allow the users to select the time in 24 hour clock format. Some users may feel comfortable to input time in 12 hour clock format and some other users like to use 24 hour clock format. The users who mostly familiar with 12 hour clock format may feel uncomfortable to use this 24 hour clock format. This problem violates a heuristic but doesn't seem to be a usability problem.

Evidence

Here is the evidence for this problem. Time is only support for 24 hour clock format.



Recommendation

The easy solution is to allow users to change the time format as it is convenient for them. So add the functionality to support the application for 24 hour clock as well as 12 hour clock.

5.5 Undo commands basically unsupported.

#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
5	Undo commands basically unsupported.	3	2	7	Provide Clearly Marked Exits

Problem
When someone mistakenly presses back button in any state will terminate the application.

Recommendation
It is better to popup a dialog box which confirm whether a user really want to exit the application or not.

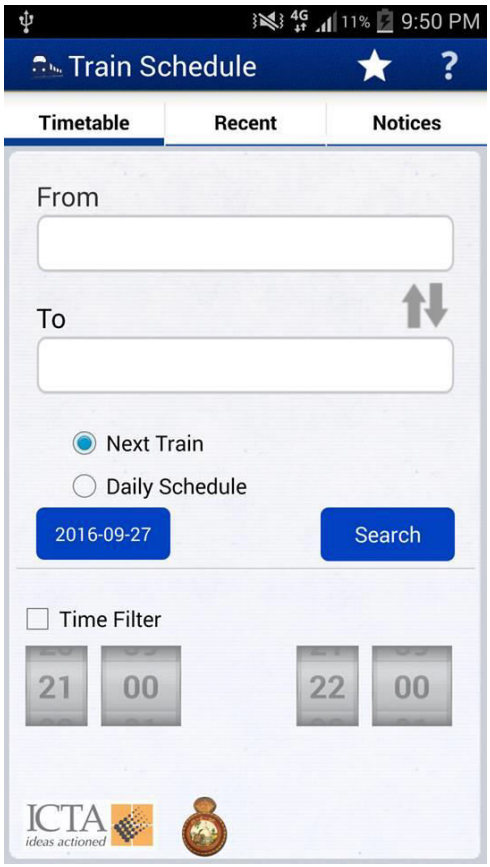
5.6 Zone classification is not in a conventional way

#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
6	Zone classification is not in a conventional way	1	2	2,5	Effective Menu/Command Structure, Be Consistent

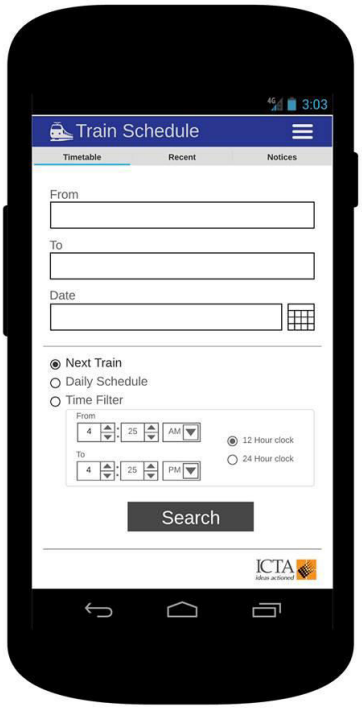
Problem

Input fields are not well structured. Time selection is also a member of the radio button group. But it is separated in different zone. Other than that calendar is also located parallel to search button. Search button is located in the middle.

Evidence



Recommendation



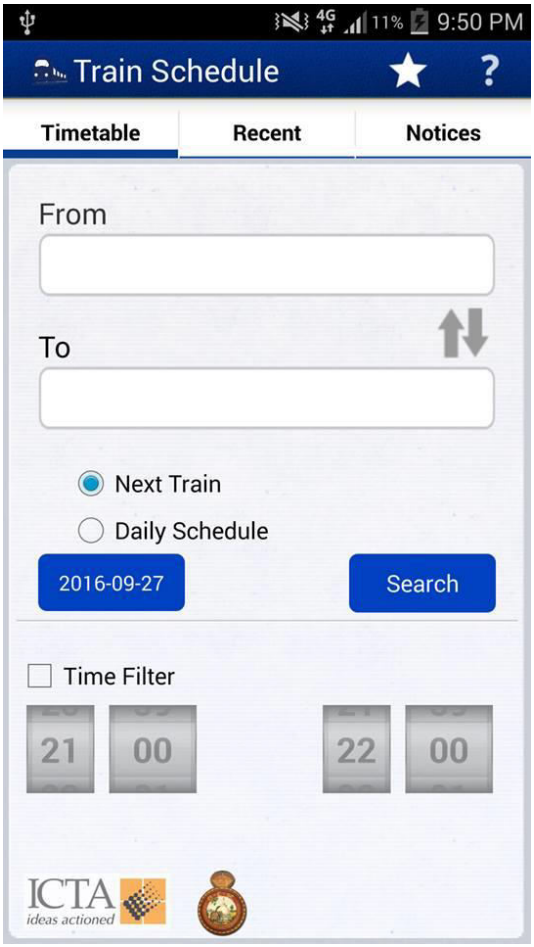
5.7 There are buttons but they are not clearly visible as button

#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
7	There are buttons but they are not clearly visible as button	3	2	1,4,5	Use Aesthetic and Minimalist Design, Minimize User's Memory Load, Be Consistent

Problem

There is a button to toggle the stations between from and to. It doesn't look like a button but rather looks like a picture embedded in the background.

Evidence



Recommendation

- Use a button to toggle between from field and to field.

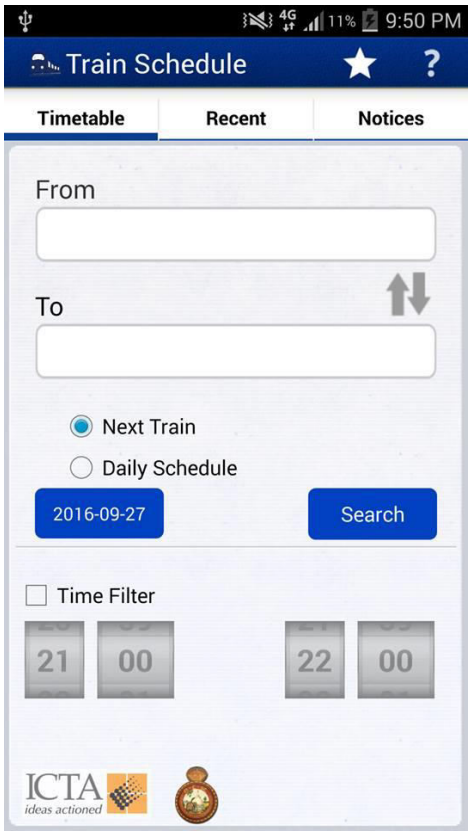
5.8 Star button in the title bar makes a ambiguous meaning

#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
8	Star button in the title bar makes a ambiguous meaning	1	1	4,5	Minimize User's Memory Load, Be Consistent

Problem

The star button in the title bar of the application tends to make a feel of favorite stations but it rather leads to the play store application page.

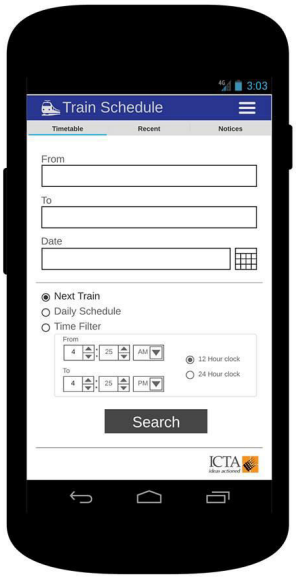
Evidence



Recommendation

Developers use this icon for asking users to rate the application in Google play. Better idea for this is remove all icons in the title bar and create a menu drop down list in the title bar. Within that drop down list clearly give these options for users. They can use these options within the menu drop down.

- Rate Train schedule
- Help



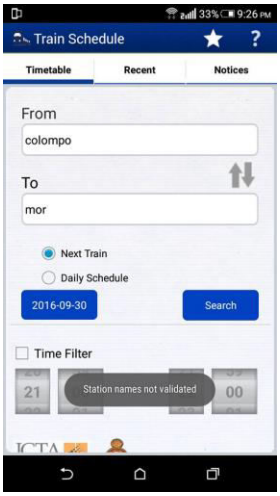
5.9 Application does not promptly highlight the mistaken input fields

#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
9	Application does not promptly highlight the mistaken input fields	3	2	8,9	Deal with Errors in a Positive Manner, Provide Help

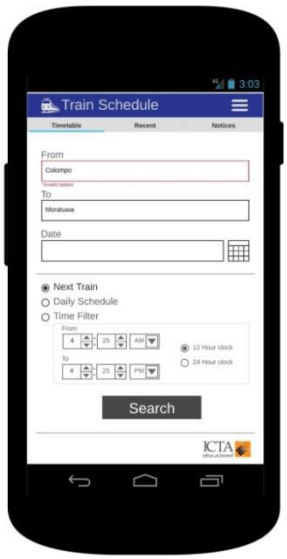
Problem

When someone search with wrong station name, it only shows a popup message which says some fields don't have relevant data. It is not clearly indicate which field mentioned by the application.

Evidence



Recommendation
It is better to clear the incorrect field and make that field visible to user.

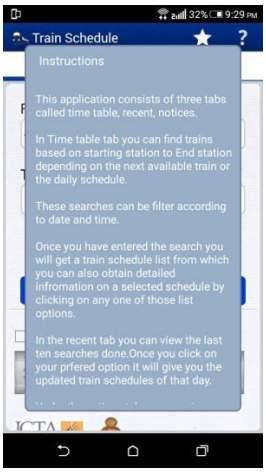


5.10 Helpdesk information is not user friendly

#	Problem	Severity Ranking	Ease of Fixing Ranking	Heuristic Number	Broad Heuristic
10	Helpdesk information is not user friendly	3	2	9	Provide Help

Problem
Application has a help option but it's not elaborating clearly.

Evidence



Recommendation
Step by step guidelines Bullet points or guidance at the first use is preferable.

6 USER EVALUATION

6.1 System Usability Scale (SUS)

The System Usability Scale (SUS) has proved to be a valuable evaluation tool, being robust and reliable. It correlates well with other subjective measures of usability SUS has been made freely available for use in usability assessment, and has been used for a variety of research projects and industrial evaluations. SUS was developed as part of the usability engineering program in integrated office systems development at Digital Equipment Co Ltd., Reading, United Kingdom. SUS allows us to evaluate a wide variety of products and services, including hardware, software, mobile devices, websites and applications.

The SUS includes 10 questions which we will ask the system users to complete. Users answer each question by ranking from 1 to 5. 1 means they strongly disagree, 5 means they strongly agree, and 2 and 3 are somewhere in the middle.

Here are the 10 template questions:

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

The SUS is generally used after the respondent has had an opportunity to use the system being evaluated, but before any debriefing or discussion takes place. Respondents should be asked to record their immediate response to each item, rather than thinking about items for a long time.

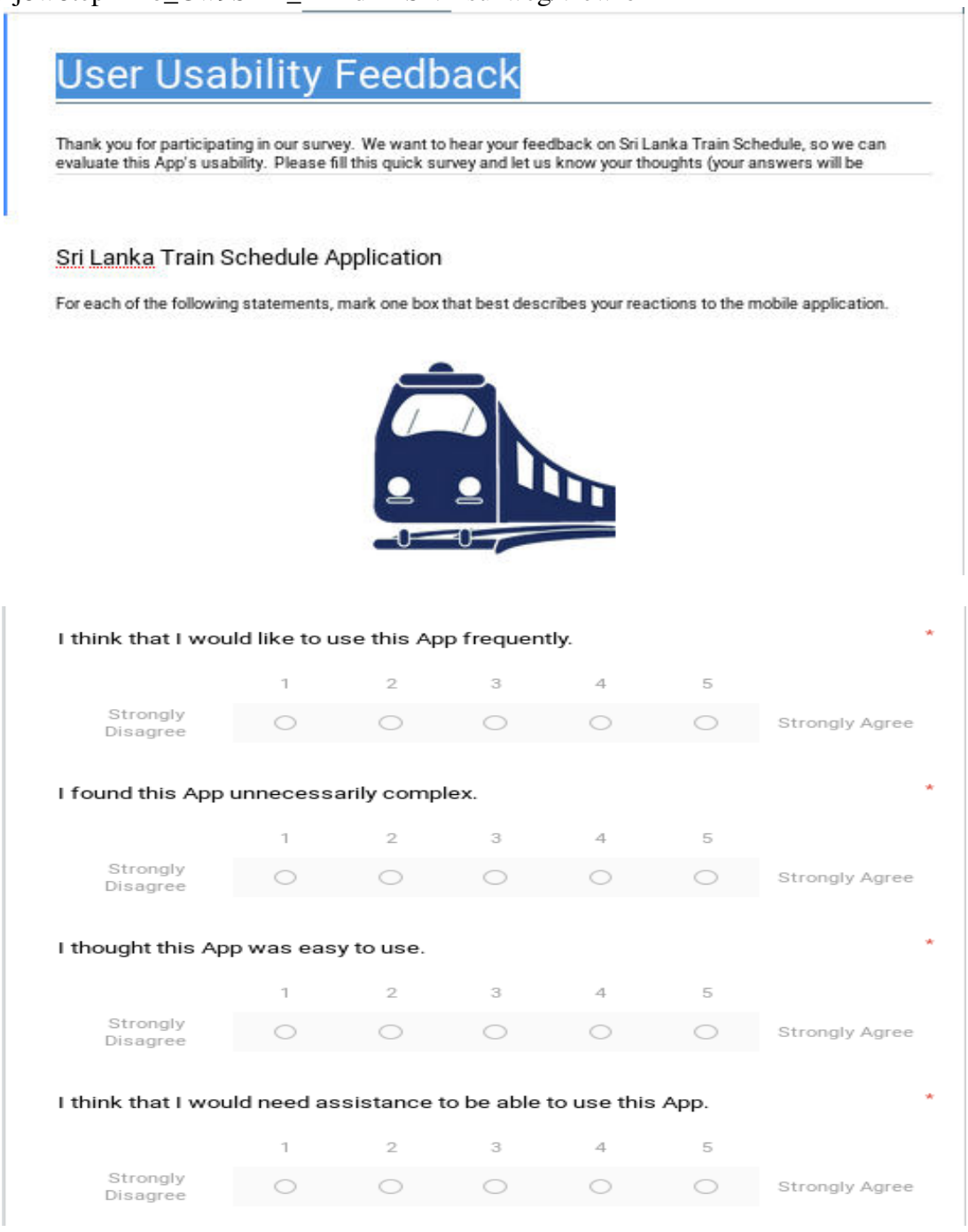
SUS yields a single number representing a composite measure of the overall usability of the system being studied. Note that scores for individual items are not meaningful on their own. Here are the sequential steps to score the SUS for a particular system.

- For odd items: subtract one from the user response.
- For even-numbered items: subtract the user responses from 5
- This scales all values from 0 to 4 (with four being the most positive response).
- Add up the converted responses for each user and multiply that total by 2.5. This converts the range of possible values from 0 to 100 instead of from 0 to 40.

6.2 User survey

We conducted a user survey for analyze the usability of current train schedule application. We follow the same SUS ten question and its five response model. The screenshot of our Google form survey given below:

https://docs.google.com/forms/d/e/1FAIpQLSdxMHVFs-rM6sazj8w8teprxHo_Cw9S1M_R1BdXESNMsuzwcg/viewform



User Usability Feedback

Thank you for participating in our survey. We want to hear your feedback on Sri Lanka Train Schedule, so we can evaluate this App's usability. Please fill this quick survey and let us know your thoughts (your answers will be

Sri Lanka Train Schedule Application

For each of the following statements, mark one box that best describes your reactions to the mobile application.

I think that I would like to use this App frequently. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I found this App unnecessarily complex. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I thought this App was easy to use. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I think that I would need assistance to be able to use this App. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I think that I would like to use this App frequently. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I found this App unnecessarily complex. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I thought this App was easy to use. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I think that I would need assistance to be able to use this App. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I found the various functions in this App were well integrated. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I thought there was too much inconsistency in this App. *

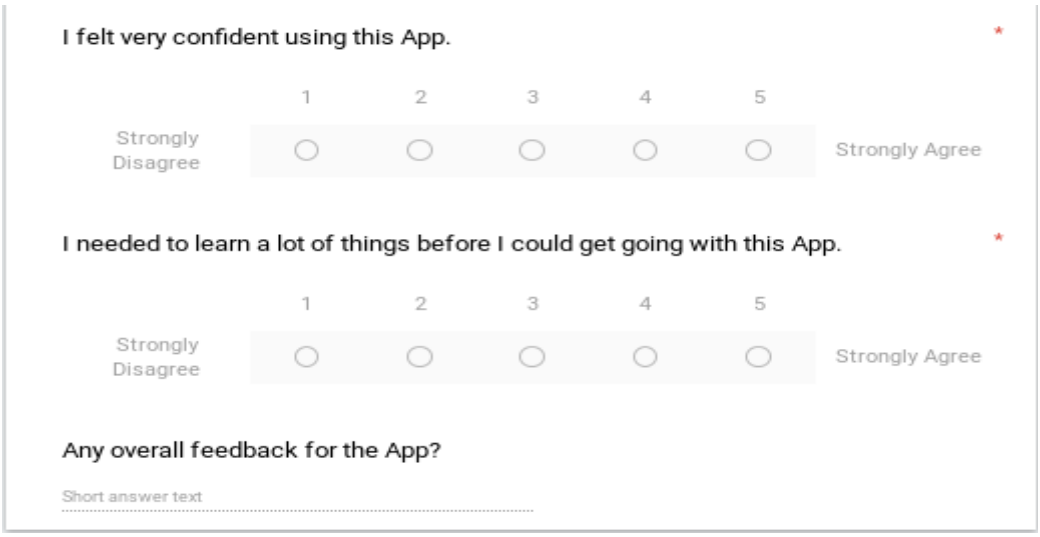
	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I would imagine that most people would learn to use this App very quickly. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I found this App very cumbersome/awkward to use. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree



6.3 User survey responses

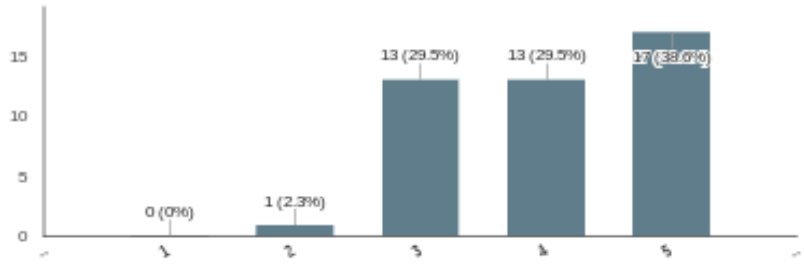
Here are the responses we got for our survey, most of the users already using this application for a while and it really easy for them to respond quickly. As show in the screenshot we get 44 responses, mostly from our batch mates and roommates.

44 responses

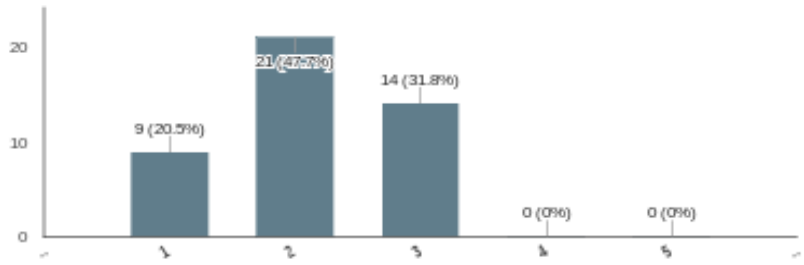
SUMMARY | INDIVIDUAL

Accepting responses

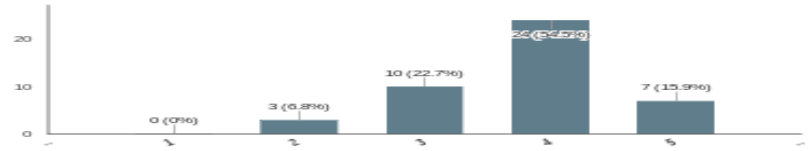
I think that I would like to use this App frequently. (44 responses)



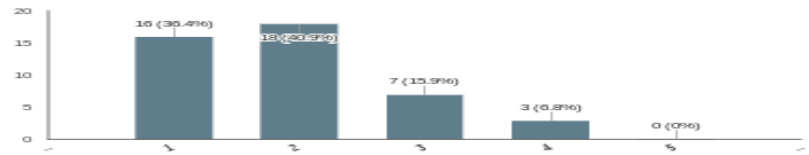
I found this App unnecessarily complex. (44 responses)



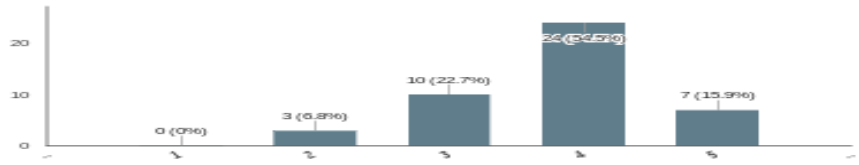
I thought this App was easy to use. (44 responses)



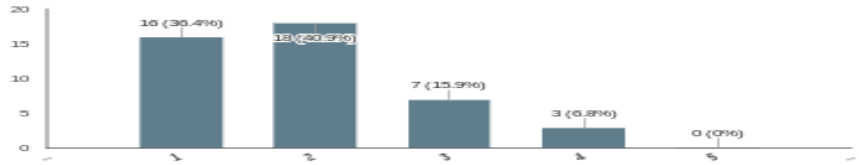
I think that I would need assistance to be able to use this App. (44 responses)



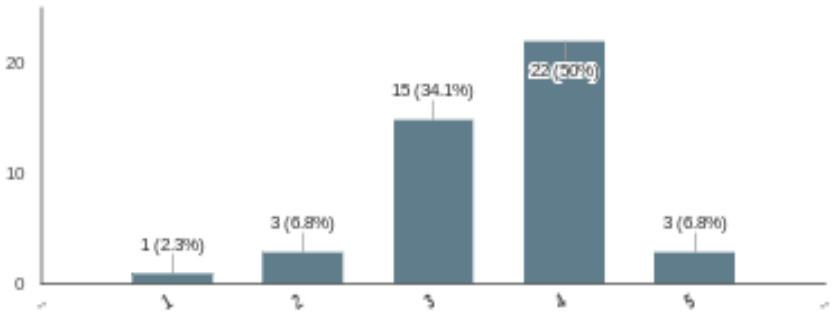
I thought this App was easy to use. (44 responses)



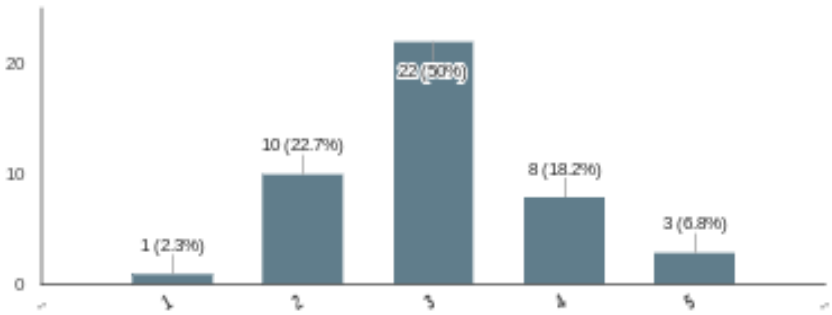
I think that I would need assistance to be able to use this App. (44 responses)



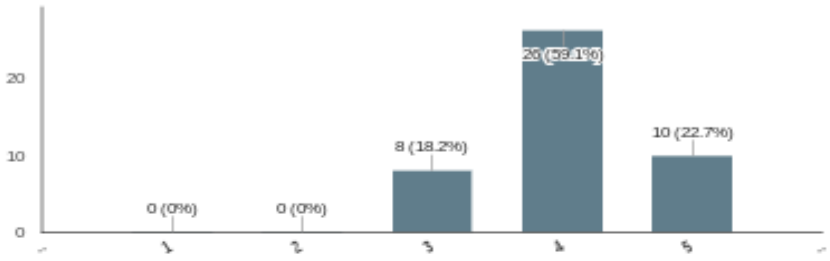
I found the various functions in this App were well integrated. (44 responses)



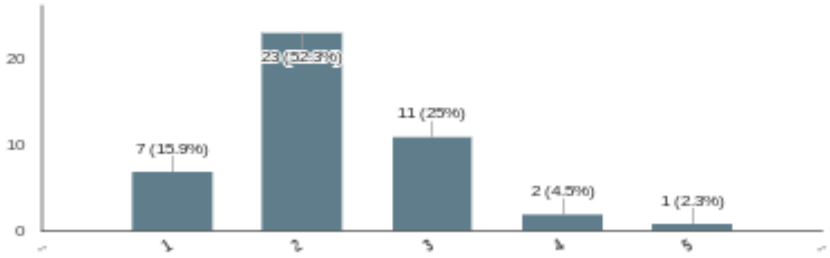
I thought there was too much inconsistency in this App. (44 responses)

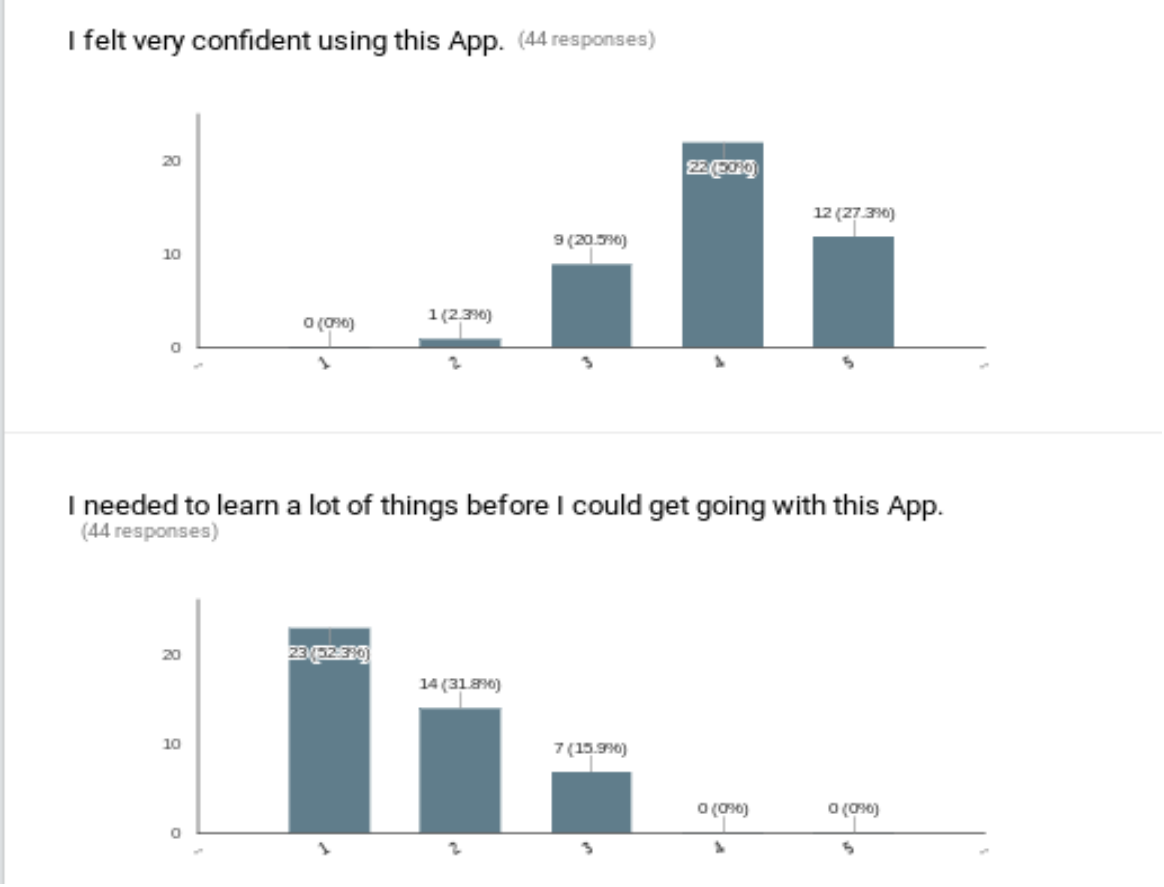


I would imagine that most people would learn to use this App very quickly.
(44 responses)

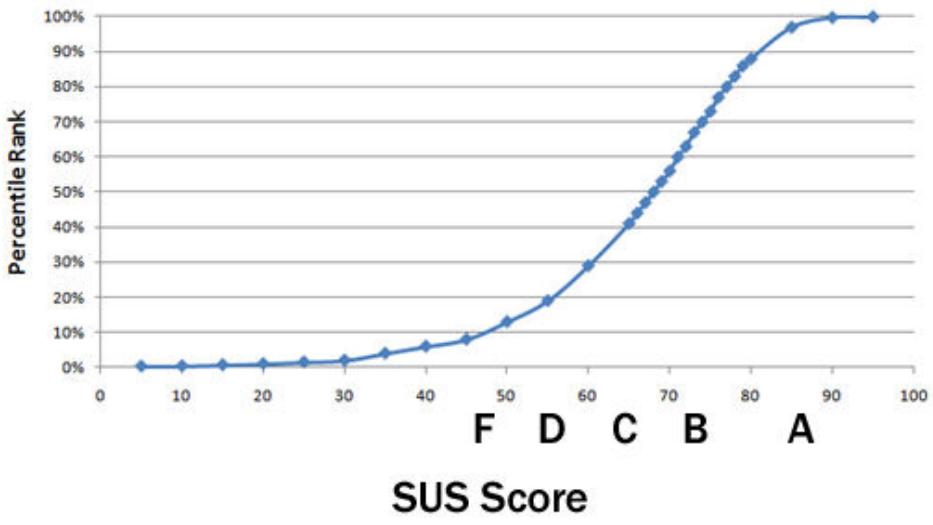


I found this App very cumbersome/awkward to use. (44 responses)





Based on these responses we calculated the SUS score, we get 71.136 as the average score for total response. The graph below shows how the percentile ranks associate with SUS scores and letter grades.



Thus, our result is fallen under grade of B. Our scoring SUS was done by Google spreadsheet, which is given below:
https://docs.google.com/spreadsheets/d/1pXbUhe8ccktQNDn2DL9Er1uB3fSpu3XNysZXj-4mvlQ/edit?usp=sharing

7 CONCLUSION

While Sri Lanka Train Schedule application is generally considered easy to use, a detailed heuristic evaluation based on nine general usability principles revealed a number of specific usability problems. These specific usability problems were clustered into 12 general problem areas and ranked according to severity and the ease with which they could be fixed.
The most severe problem areas were addressed in more detail in this report, providing information about the general problem, some specific examples, and a high-level recommendation for solving the problem.

The seven most severe and easiest to fix problems are:

1. Inconsistencies between menus and buttons
2. Some language does not correspond with user terminology
3. There are buttons that the user may not realize are buttons
4. Not all buttons have tooltips
5. Some inconsistencies with Windows operating standards
6. Undo commands basically unsupported
7. Modal interface causes inconsistency in available features

By investigating these problem areas in more depth and implementing user-centered solutions, Sri Lanka Train Schedule application designer will be able to make an already well-designed product even easier to use.

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