

User Interface Design and Implementation
Midterm Report (March 2017)

Increase the ease of navigation for information-heavy websites

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Project Statement

Background

Bank card application is known to be a bothersome process. The emergence of online application services has greatly reduced waiting time and physical paperwork. However, due to the large amount of information present in the website, and the cluttered user interface, the online bank card application is not as convenient as it intended to be.

Take the website interface for local bank DBS card application (Fig 1) for example, the viewer is assumed to have plenty of domain knowledge in order to understand the terminologies presented. For viewer who is unfamiliar with terms such as “debit”, “credit” or “annual fee”, it may be a headache to navigate and apply for a suitable card efficiently.

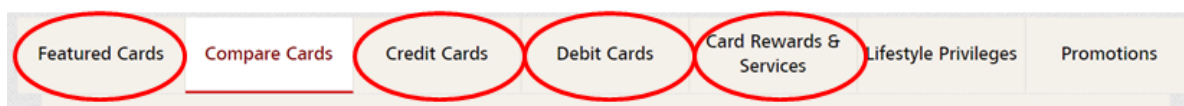


Fig 1: Bank Card Application Options for DBS

Problem

Customers who lack domain knowledge often find it confusing to get the services/products they want, because it is **overloaded** with information, **cluttered**, and **not properly organized**.

For example, many customers are having difficulties finding the bank card that suits them best. This is because there are too many terminologies that are unknown to new users, such as credit, debit, or brand-specific terms such as ‘Frank card’, ‘Everyday card’, etc.

Objective

To design a **guided** and **streamlined** application scheme, targeted at **information-heavy** websites for users to select products/services followed by submit the application, to maximize the **learnability**, **ease of navigation** and **satisfaction** of the users.

Target user issues

Target User	Characteristics	
	Before (Existing Issues)	After (Objectives)
Computer Literate	<ol style="list-style-type: none">1. Lack of domain knowledge and experience2. Confused about terminologies	<ol style="list-style-type: none">1. Complete user guidance and recommendation system2. help user to understand terminologies and pick the suitable product or service.
Expert Users	<ol style="list-style-type: none">1. Hindered by poor navigation	<ol style="list-style-type: none">1. Streamlined process and clear navigation2. Directly find specific product or service

For the first type of users (Computer Literate), they only have a rough idea about the product and lack domain knowledge. They might feel confused about the various complicated terminologies for bank card applications. Therefore, we could provide well-designed user guidance and recommendation systems, that can help direct those users to find their suitable products or services.

For the second type of users (Expert Users), they are professional in this domain and seek for a specific product. However, their search process may be hindered by the poor navigation system. We can provide a refined streamlined process and clear navigation system to filter out useless information, and make the search process easy and direct.

Preliminary literature review

Relevant research papers

Our team utilizes ACM Digital Library to find good quality research papers on User Interface. After crawling through the array of research papers, we have found a few promising research that will be beneficial to our project. In this section, the two most useful ones will be elaborated upon.

The first research paper presents query aspects of support exploratory search³. When a user wants to find out more about credit card details, they will use Google to search and compare what the different banks have to offer. Current word-based search engines are useful in homepage finding, however, when it comes to deep exploratory search task like topic learning, it is not very useful. The researchers aim to overcome this limitation by capturing the search journeys of other users with semantically related searches, and use them as roadmaps to guide users in their topic learning.

So far, we have learnt from the paper two things -- how search results are diversified, and how they created a new interface to facilitate the exploratory search.



Fig 2: A query chains of "Acid Rain"

From the above diagram, we can see each chain reflects a particular aspect of Acid Rain, for instance, how water pollution is a result of acid rain and how acid rain is related to global warming.

acid rain	<p>3. Acid Rain There are many forms of acid rain that are seen around the world. In parts of the world where there is wet weather, there is acid rain, acid snow, and acid fog. library.thinkquest.org/CR0215471/acid_rain.htm</p>	<p>4. Acid Rain Natural Rain: "Normal" rainfall is slightly acidic because of the presence of dissolved carbonic acid. Carbonic acid is the same as that found in soda pop. www.elmhurst.edu/~chem/vchembook/190acidrain.html</p>	<p>5. Acid rain, from USGS Water Science for Schools Acid rain information, from USGS Water Science for Schools ga.water.usgs.gov/eda/acidrain.html</p>
causes of acid rain	<p>1. What is Acid Rain and What Causes It? A discussion of the causes and effects of acid rain, and possible policy solutions. www.policyalmanac.org/environment/archive/acid_rain.shtml</p>	<p>2. Acid Rain Students Site: What causes acid rain? Sources of Acid Rain Acid rain is caused by a chemical reaction that begins when compounds like sulfur dioxide and nitrogen oxides are released into the air. www.epa.gov/acidrain/education/site_students/whatcauses.html</p>	<p>3. Acid Rain - Causes The Environment: A Global Challenge is the most comprehensive resource on the environment available online. With 400 articles discussing everything from environmental economics to ... library.thinkquest.org/26026/Environmental_Problems-acid_rain_-_causes.html</p>
effects of acid rain	<p>1. Effects of Acid Rain Acid Rain US EPA Acid rain negatively affects surface waters and aquatic animals, forests, automotive coatings, materials, visibility, and human health. www.epa.gov/acidrain/effects/</p>	<p>2. Effects of Acid Rain - Forests Acid Rain US EPA Acid rain causes slower growth, injury, or death of forests and has been implicated in forest and soil degradation in many areas of the eastern United States www.epa.gov/acidrain/effects/forests.html</p>	<p>3. Acid Rain Effects This website explores the causes and solutions to the acid rain problem. www.geocities.com/narily/acidrain.html</p>
acid rain and global warming	<p>1. Acid rai limits global warmig - 03 August 2004 - New Scientist Sulphur pollutio may have a unexpected beeffit - reducg emissios of the global warmig gas methae from atural wetlads www.ewscietist.com/article/d6231</p>	<p>2. Forests: Global Warmig & Acid Rai EcoKids is a web site maintained by Earth Day Canada. ... Forests help remove large amouts of CO 2 from the air. The Earth's atmosphere is made of water vapour ... www.ecokids.ca/pub/eco_ifo/topics/forests/global_warmig.cfm</p>	<p>3. NYTimes: Acid Rai Global Warmig Climate Chage o Flickr - Photo ... NYTimes: Acid Rai Global Warmig Climate Chage . This is a visualizatio of the frequency of the phrases 'acid rai', 'global warmig' ad 'climate chage' i New York Times ... www.flickr.com/photos/bjgret/3260987915/set-7711c7a113711c6a0b7/</p>

Fig 3: Tabular Aspect Interface

The tabular aspect interface presents a list of the useful query of "Acid Rain". Each row presents an aspect of acid rain, and each column presents the rank of the pages based on their coverage of the keywords. This is extremely useful as it saves the user time and energy, since reformulating their search queries is time-consuming. On top of that, most of the useful information is consolidated succinctly under one page.

Of course, we are not building a search engine. The concept of query chains can help us generate a highly diverse path for our UI, thereby creating a more satisfying user experience. Tabular aspect is one design option that we will explore in the coming weeks, because our UI might have to be changed according to user feedback accordingly.

The second research paper is on Usability of Navigation Tools for Browsing Genetic Sequences². There are huge amounts of data to deal with when facing DNA sequences, and software used in displaying DNA sequences are crucial for bioinformatics research. The current tools do not provide explicit feedback or information to the user, as to whether they are heading in the right direction. This causes the user to 'get lost' in the huge pool of sequences.

This research paper provided us with various options of implementing the navigational feature in a software and also examples in conducting a heuristic evaluation of user interface controls. One way of designing navigational feature is to compare the existing tools used for navigating in a page. The next two figure

illustrates the consideration of the researchers and an example of a prototype aimed at empowering users in panning across the DNA sequences.

Design	Configuration	Occurrences	Problems	Warnings
Scroll bar	Horizontal	14	1	1
Connected view	Overview displayed above detail	8	1	4
Buttons	Two or four buttons, horizontal	4	2	3
Hand tool	Drag view in either direction	2	4	2
Circular map	Small circular overview	2	4	3
No panning		1	-	-

Fig 4: Comparison Table for existing Tools

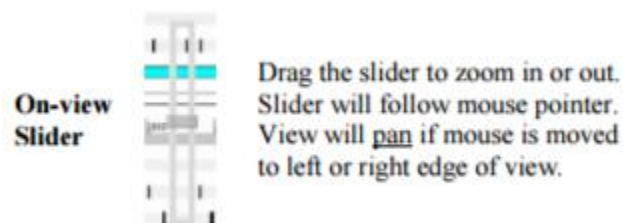


Fig 5: On-View Slider created by researchers to facilitate 2 Degree of Freedom Navigation in a page

For user-testing side, the paper provided a useful graph to evaluate the effectiveness of the newly implemented UI. We intend to use this for our user testing to evaluate our UI.

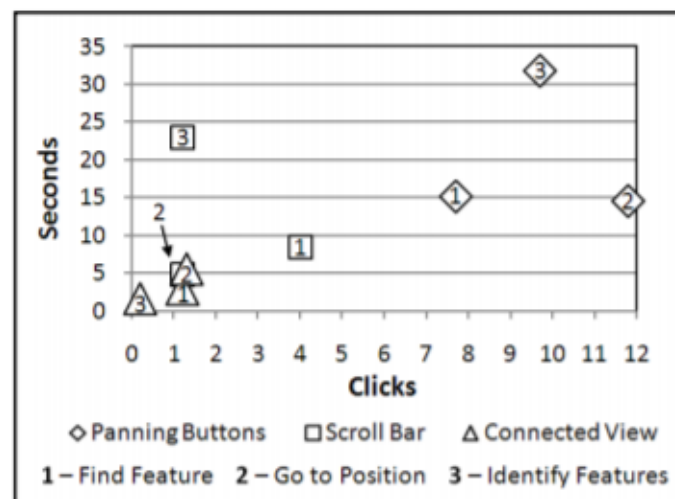


Fig 6: Average Number of Seconds and Clicks for Panning Tasks

In the coming weeks, we will be reading deeply into other related research papers such as using AI in creating an Intelligent User Interface¹.

Websites with helpful navigation solutions

Besides reading research papers, our team have found and consolidated websites with UI features we can use for our UI design. Below is the table.

Name	Strengths/Solutions we want	URL
SUTD website	Classifies information into undergraduate/phd/prof etc	http://www.sutd.edu.sg/
ICA	<ol style="list-style-type: none"> 1. The categories of users are immediately displayed on the home page, with the most common functions listed. 2. The frequently accessed e-Services are displayed on the right. 	https://www.ica.gov.sg/
Phone topup (e.g. SingTel / M1)	<ol style="list-style-type: none"> 1. Step by step instructions 2. Not showing unnecessary info 3. Use of images and icons 4. Consistent color scheme 	https://hi.singtel.com/gotoTopUp.do
Electronic Product Service	<ol style="list-style-type: none"> 1. Sorted by product, then further categorised by problem 2. Use of image and icons 	Apple https://support.apple.com/en-sg Toshiba http://www.therepairhospital.com/toshiba-laptop-repair.htm
NTUC Insurance claim	<ol style="list-style-type: none"> 1. Clearly numbered steps 2. Expandable instruction items 3. Big icons and instructions with ample white space breather 	http://www.income.com.sg/claims
Job Search	Questionnaire dropdown provides guidance and reduces memory load	https://www.jobscan.sg/

Preliminary re-design samples

Application Flow Design

Traditional Flow

The traditional bank website separates the card information and application pages. Shown below are the lists of bank cards with basic information. However, there is no link attached to the list if the customer wishes to apply for the card directly.

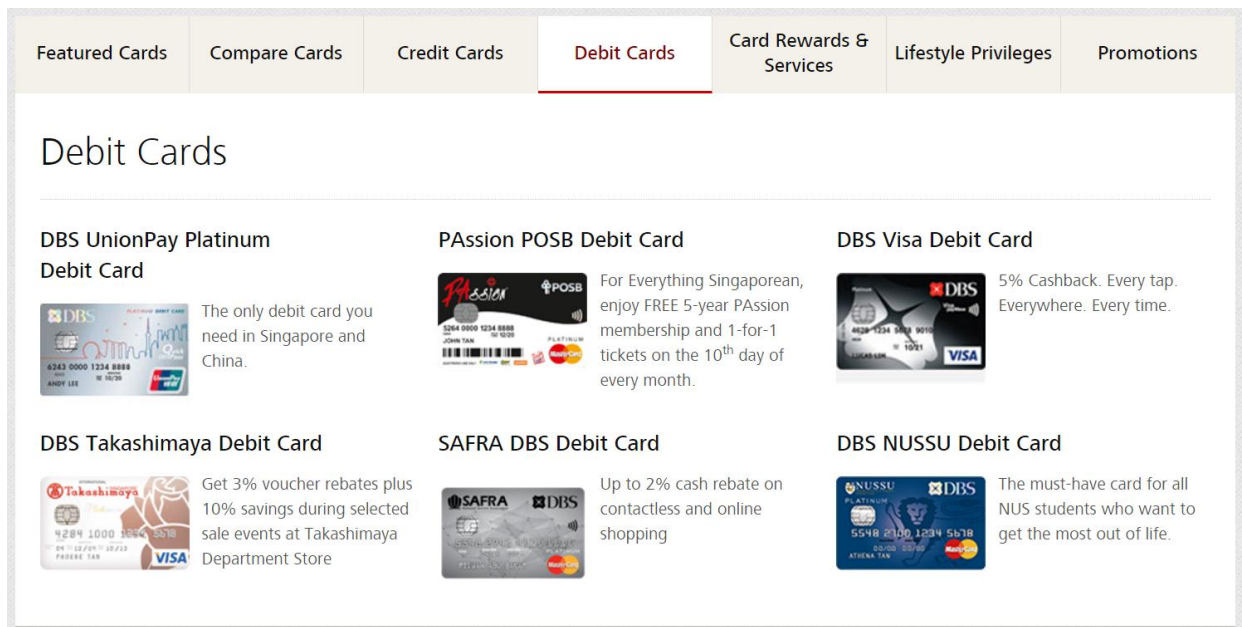


Fig 7: Bank card information page

Instead, the card application link is located at a different location in the web page. After the customer clicks “Apply”, an empty application form is then loaded. We note that there is no information pre-filled for the applicant.

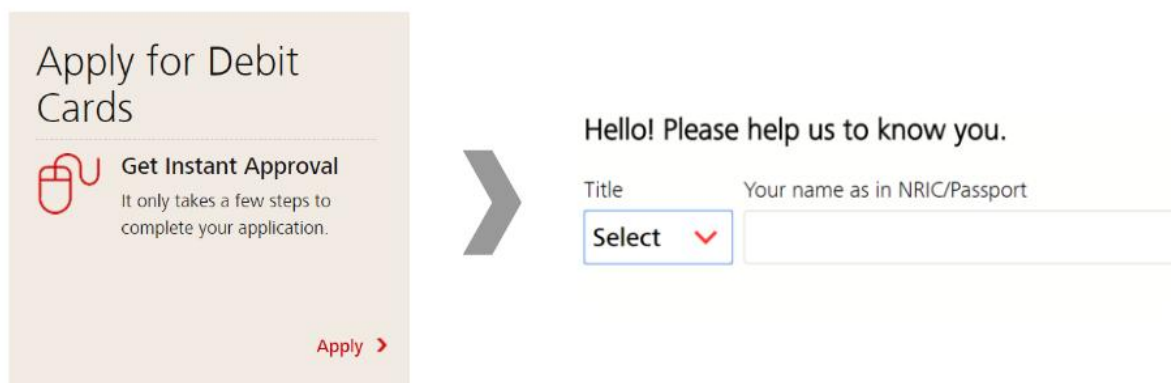


Fig 8: Bank card application process

Re-Ordered and Streamlined Flow

To improve the user experience and streamline the process from card selection to card application, we have devised the following re-ordered flow.

This flow is re-ordered from the traditional flow, because we moved part of the card description information into the information filtering part, the first part when a customer enters the bank card website. This information will not only be used for card recommendation results but be saved and reused to partially populate card application content.

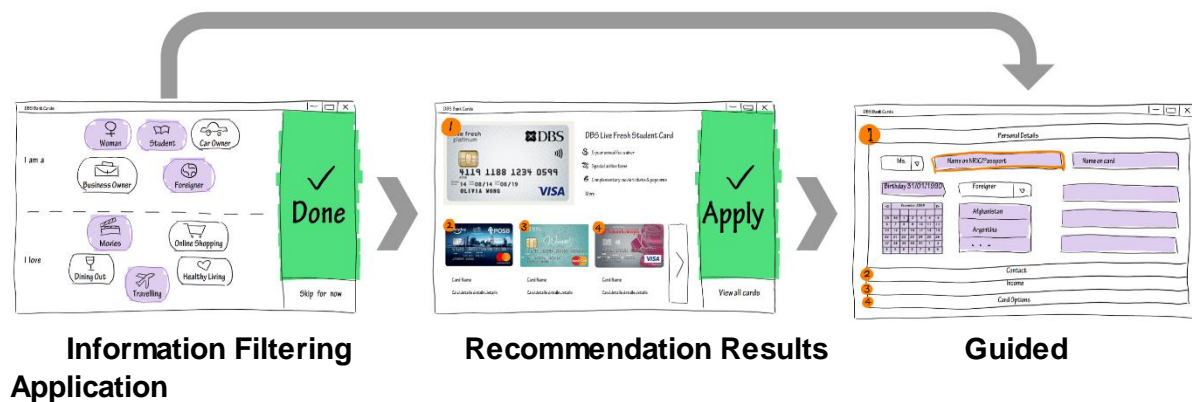


Fig 9: The new bank card application flow

Interface Mockups

1. Information Filtering

The first page of the bank card website will display an intuitive questionnaire that collects the customer's identity and preference information. A skipping button is provided as well for customers who just wish to look around.

DBS Bank Cards

I am a

- Woman
- Student
- Car Owner
- Business Owner
- Foreigner

I love

- Movies
- Online Shopping
- Dining Out
- Travelling
- Healthy Living

Done

Skip for now

Fig 10: Visitor's preference questionnaire

2. Recommendation Results

Based on information collected from the previous questionnaire, the list of bank cards will be filtered and sorted to reflect cards that are most suitable for the customer's needs and preferences.

Similar to the skipping function we implemented in the filtering questionnaire page, we added a "View all cards" option for customers who prefer to take a look at all the available choices.



Fig 11: Prioritized card recommendation page

3. Guided Application

Once a card has been selected, the customer is led to the application page. Some required fields in the application form has been auto-filled based on the questionnaire responses indicated previously. The customer may verify and edit the auto-filled information at any time.

The application form acts as a guided form in two aspects:

1. The required fields that are still blank are highlighted in a different colour from the completed fields, so that the applicant can directly assess how many more fields has to be filled in;
2. The next required field is emphasised visually through the use of highlight border, and this highlighted border guide will progressively move along to the next field after the current one has been filled. This way, we take the applicant through the process step-by-step, to complete it under clear guidance.

DBS Bank Cards

1

Personal Details

Ms. ▾

Name on NRIC/Passport

Name on card

Birthday 31/01/1990

Foreigner ▾

Afghanistan

Argentina

...

2

3

4

Contact

Income

Card Options

29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9

Fig 12: The partially pre-filled and guided application form

Planning

Time Schedule

Gantt Chart

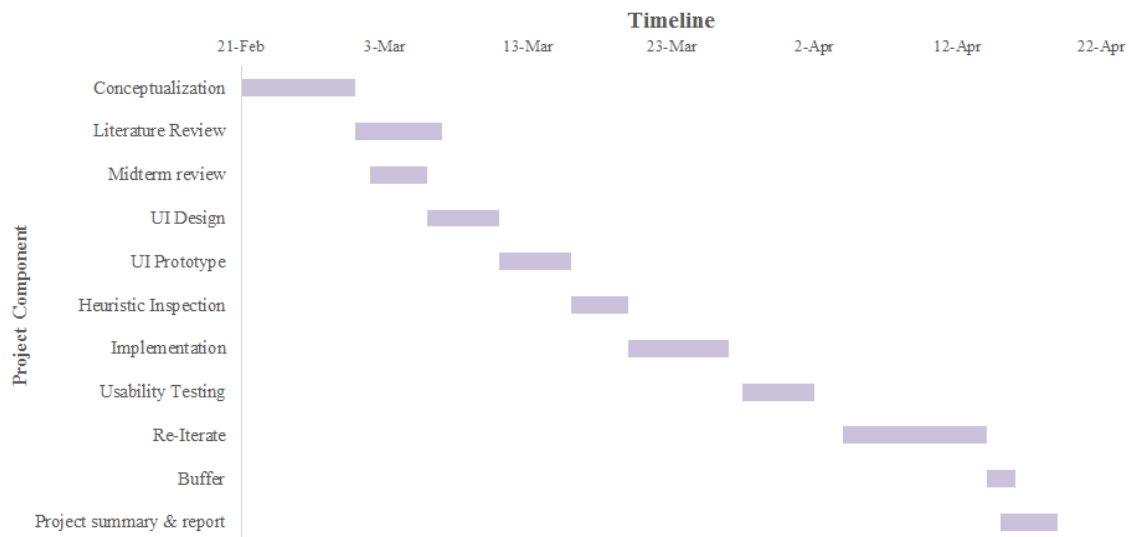


Fig 13: Gantt Chart timeline with re-iteration period and buffer

Our timeline is based on re-iterative design, where we will set aside a period of at least 10 days with some buffer, to make adjustments to any major problems that we have identified through usability testing.

Re-iterative Design Cycle

We hope to perform at least 1 cycle of re-iterative design within the limited time period.

The first step is to design the UI, mainly in terms of functions, structure, layout and user journey. Afterwards, we will move onto prototyping and use heuristic inspection to check for existing or potential usability bugs. We can then move on to implementing our first design, and gather usability feedback for the re-iteration cycle.

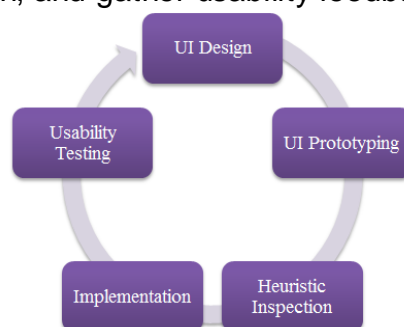


Fig 14: Our Iterative Design Cycle

Work Allocation & Coordination

Member	Roles		Additional Tasks
	Individual	Combined	
Jun Hao	Literature Reviewer Design Solutions Integrator	Problem & Solution Framing	Examine existing precedents of good/bad UI, extract strengths and weaknesses.
Valerie	Planner & Proofreading Usability Evaluation Methods	UI Design UI Heuristic Inspection	Ensure we stay on track, keep to our problem and our intended solution/objectives.
Xiongyi	Programmer Usability Goals Inspector	Usability Testing	Analyze results of user testing for re-iterative design.
Yujia	QC- Quality Control Project Manager (Timer & Coordinator) Programmer	Programming	Ensure deadlines are adhered to and everyone is on the same page.
Zhexian	Prototyper Prototype Designer		Do initial mockups.

Implementation Tools

1. Mockup - Pen and paper, stylus, GUIToolkit
2. Prototyping - Invision / FluidUI
3. Implementation - Web development (HTML, CSS, JavaScript, Python)

Usability Evaluation- Goal Assessment

Heuristic Inspection Method

We will attempt the various application processes for ourselves to set a “benchmark” by taking the following steps:

1. Track click distances
2. Record time taken to complete various tasks
3. Detail navigation experience- problems faced, areas of redundancy or confusion etc.

Afterwards, we will compare with our improved design to see if there is significant improvement in the areas above, and also check for any other potential usability bugs.

Questionnaire

We will also provide questionnaires for the users with regards to the existing designs, and also the improved design. For each aspect, we will compute the relative improvement score.

Relative Improvement Score= Score (Improved Design) – Score (Existing Design)

This way, by gathering the relative improvement scores for each aspect from different users, we will know what areas of (significant) improvements we have achieved, and which areas still need further improvements or redesigning

Usability Evaluation- User Testing Method

Observation Technique	Evaluation Method	Test Objective	Test Metrics
Contextual interviews: watch how user navigates in their natural environment, silent observation at the side	First-click Testing	1. Examines what a test participant would click on first on the interface in order to complete their intended task 2. Observe how users navigate in their natural work/home setting 3. Measures: 1) Information visibility 2) Ease of navigation etc	Measurable Outcomes: Successful Task Completion Critical Errors Non-critical Errors Error-free Rate Time on Task Subjective measures: Likes, Dislikes and Recommendation
	Scenarios	1. Check if user is able to complete the tasks under different COMMON scenarios	

⁵ see reference

Usability Evaluation- User Testing Metrics

	Priority Level	Criteria	Measurement Aspect	Measurement Technique
Usability Goals	1	Learnability	Time to learn task (number of retries required to achieve zero error rate)	Direct Observation
	2	Error Rate	Number of errors	Direct Observation
	3	Efficiency	Time to complete task	Direct Observation
	4	Memorability	Percentage of procedure remembered by users	Questionnaire
	5	Satisfaction	Opinion rating	Questionnaire
UX goals	1	Satisfying	Opinion rating- intuitive, ease of navigation, (low) level of frustration	Questionnaire
			Observe facial expression: frustrated, peaceful, happy etc	Webcam
	2	Enjoying	Pleasurable experience, level of fun etc	Questionnaire
	3	Motivating	Time of self-exploration	Direct Observation
	4	Aesthetic	Opinion rating- layout, colours & fonts, etc	Questionnaire

Target User Impact

The revised web page should organize information properly, with clear categorization and navigation systems, as well as user guides. It should achieve following features:

1. Users could easily select the correct category from multiple choices.
2. Users could find sufficient explanations for the words or terms they are confused about within the same web page.
3. Users are able to reverse their actions conveniently.
4. Users could toggle between the overview and detail sections of the product.

Through the above features, we aim to achieve two main impacts to users' life:

1. Among various types of products, the user guides or recommendation system could lead users to the one which is most suitable for them.
2. Users can search for specific services or products easily.

Doing the abovementioned could reduce the frustration when users are faced with massive information, which they are unfamiliar with. They do not have to worry about the lack of background knowledge or experience in certain area. Through multiple MCQ or user guides, website could provide recommended product/service to users based on their unique requirements. Furthermore, if users want to find a specific product/service from various options, our categorization and filtering system will simplify the searching process.

Further Applications of Solution

Possible Application Areas

Our refined UI design could be applied to all of the products/service application system with complicated categories, coupled with abundant information- such as VISA, job application, bank card and insurance selection, etc. It could be implemented for both online and offline platforms. It may also become an industry standard to filter out redundant information for target customers.

Websites with similar navigation problems

Website name	Problems/Weaknesses	URL
VISA Application	<ol style="list-style-type: none">1. Too much information2. Not targeted enough	US VISA application: https://singapore.usembassy.gov/visas.html

Great Eastern Insurance claims	<ol style="list-style-type: none"> 1. Small and cramped instructions 2. Lots of hyperlinks to open instructions in separate pages/software 3. Lots of clicks 	https://www.greateasternlife.com/sg/en/personal-insurance/get-help/make-a-claim.html
Course selection	<ol style="list-style-type: none"> 1. Inconsistent information 2. Confusing tables 	https://timetable.nctu.edu.tw/
Job search and application portal	<ol style="list-style-type: none"> 1. Not personalized 2. Not suitable for applicant who just want to look around 3. Font size too small 	https://www.indeed.com.sg/

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- [2] Rutherford, Abell, Churcher, McKinnon (2010). Usability of Navigation Tool for Browsing Genetic Sequences. *AUIC '10 Proceedings of the Eleventh Australasian Conference on User Interface , Volume 106 Pages 33-41*. Retrieved from <http://dl.acm.org/citation.cfm?id=1862287>
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- [4] Screenshots were taken from <https://www.dbs.com.sg/personal/cards/>
- [5] Planning a Usability Test. *Usability.gov*. Retrieved from: <https://www.usability.gov/how-to-and-tools/methods/planning-usability-testing.html>