

Usability Improvements for Touch-Screen Mobile Flight Booking Application: A Case Study

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Abstract— Smart phones have introduced great easiness in our daily life by mobile applications. Nowadays, it is possible to complete tasks on-the-go, without the need of computer. One of the facilities provided is the mechanism to buy flight tickets via mobile phones. However, in the development phase, often poor consideration of end-users' usability requirements leads to underutilization of such facility, thus decreasing potential profit of companies. The purpose of this work is to investigate usability problems for mobile flight booking applications on touch-screen phones and suggest solutions. Main expectations of users are presented from HCI (Human Computer Interaction) perspective and discussed through a case study. Questionnaire and interview methods were used for collecting data. Paper prototype has also been utilized to verify users' expectations of mobile flight booking more accurately. Results reveal that the users are very much concerned with the easiness and the lucidness of functions. Usability is a highly considerable subject for users to prefer a mobile flight booking application over booking tickets via online/ or agencies.

Keywords—Flight; Mobile; Touch-Screen; Usability; User

I. INTRODUCTION

Internet transformed many aspects of our life, such as how we shop for goods and services. According to the 2010 Nielsen report on Global Online Shopping [1], vacations are high priority for planned online purchases. Airline ticket reservation represented 32%, Hotel/Tours reservation 26%, and Event tickets 20% of global online sales in number of sales. However, online shopping is changing over time. Consumers of today use their mobile devices for shopping on-the-go with the ease of advanced mobile browsing and 3G/4G/Wi-Fi technologies [19]. Another survey of Nielsen [2] supports business correlation between mobile gadgets and online shopping trends. According to the report conducted in the first quarter of 2012, the vast majority (around 79%) of US smartphone and tablet owners have used their mobile devices for shopping-related activities. Oracle's survey [3] also highlights that consumers rely on their devices for more and more commerce-related activities, in addition to social and communicative activities. Results of those surveys show that airline and travel companies, -being the owners of the third most likely sold service in online shopping- should attract the users by expanding their flight service channels into growing mobile shopping trend.

This growth of mobile usage offers many ways to airlines and travel companies to reach their target customer as they race to provide reliable, always-on access to a new buying experience. However, customer experience with such applications significantly affects user's preference [4] to buy tickets and services via mobile over web interface and user's return rate; posing a huge challenge and opportunity for these service providers. There are numerous applications in application market that offer flight search and flight booking; however low usability of those applications indicates that designs were mostly done without much consideration of user's context and preferences.

There are many studies on usability issues. Web-page usability and user experience were discussed and sets of guidelines were introduced in [5], [6], [7], [8]. Although mobile application field is new, PDA and mobile application design challenges [15] were mentioned in some recent studies. Two closely-related studies [9], [10] to this work discussed usability concerns for mobile flight booking applications. However, those studies are conducted on stylus-aided PDAs and classic mobile phones; very few research works focus on specifically on touch-screen mobile application usability. Furthermore, none of those combined usability guidelines with flight booking applications on touch-screen devices. The purpose of this work is to discover and describe usability challenges found particularly in touch-screen mobile flight booking applications and suggest solutions to eliminate such problems.

II. RELATED WORKS AND MOTIVATION

Usability is defined as "*the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in particular environments*", where user experience definition is "*a person's perceptions and responses that result from the use or anticipated use of a product, system or service*" [11]. Although there are commonalities between user experience and usability, the literature argues that usability is a measurable term whereas user experience is immeasurable due to its relative and complex nature [7]. Usability can be thought within the terms of easiness and effectiveness, yet user experience.

As it is commonly practiced by developers, functionality does not arise as standalone factor in bringing out good software or application. Jordan [12] interprets Maslow's Hierarchy of Needs in the context of consumer needs and identifies "functionality" at base level, followed by

“usability” and “pleasure” at the top. Jordan also mentions that “usability” and “aesthetics” are major factors contributing pleasure of using products [4]. Linghammar further investigated the correlation between usability and aesthetics and concluded that visual beauty (qualities that gives pleasure to the sense) affects perceived usability [13]. Moreover, design aesthetics significantly helps to achieve customer loyalty through improving perceived usefulness, ease of use and enjoyment [14].

Considerable number of works investigated usability. Nielsen suggests 5 components to determine usability of a web page: “Learnability”, “Memorability”, “Efficiency of use”, “Errors” (as in reliability in use) and “User Satisfaction” [16]. However, the works are scarce when it comes to investigation of mobile user interface patterns and usability. In terms of variables affecting the design, web-page usability is relatively straightforward. But, in the context of mobile application development, usability yields more complex considerations. Dynamic user environment, unstable network connection, processor performance, memory size, screen size and attention interruptions have emerged as some of the usability challenges comparing to desktop PC applications [6], [17], [18].

Horizontal scrolling, handling dialogs when software keyboard is shown and hidden, mechanisms for entering text, interacting with applications without using stylus, creating a design that supports branding, are aesthetics, and utilizing screen space and user interaction during waiting for long-lasting operations are identified as six problem-areas regarding mobile application’s usability [9]. Usability concerns that are specific to travel web-sites are generally discussed from information presentation and offered functions [8]. Later on, Burmistrov interpreted the findings of travel usability guidelines from the perspective of mobile flight booking and brought general guidelines; using classical mobile phone [10]. However, there has been no research work performed for mobile flight booking usability challenges specific for small-sized touch-screen devices. Filling this void is the main motivation of our initiative.

III. METHODOLOGY

The study was carried out with a qualitative research approach, which is suitable for usability analysis. This is because, mobile usability’s concerns of easiness, efficiency, user satisfaction and embracement of the application can be best investigated by studying user’s actions and reactions towards the application in their own context and collecting their opinions through their own way of expressions. The study is also supported with questionnaires to increase accuracy of the analysis. It was conducted as a case study, analyzing usability facts over Turkish Airline’s commercial mobile flight booking application: “FlyTurkish”. Apple iPod 2G was used as test medium.

20 interviewees who were in the range of ages 18-40 were randomly chosen without any special criteria. However, they represented multiple countries which added diversity of the study. Male participants composed half of the interviewees which make an even distribution between genders. Interviewees consisted of advanced and novice

users, as well as smartphone owners and non-smartphone owners. Participants used to fly at least once per year.

Data were gathered with combination of both short survey questionnaires and unstructured interviews with participants to assist us of their understanding and perspectives towards online shopping and mobile flight booking. The questionnaire was designed to assess user’s understanding and involvement of online shopping, extract their shopping patterns and collect opinions in measurable way. Questionnaire had multiple choice questions of “Yes/No/Maybe”, Likert scale questions which participants had to choose either one of “Strongly agree/ Agree/Neutral/Disagree/Strongly disagree” and one open ended question. Likert scale answers were turned into numeric scores like, “Strongly disagree=1”, “Disagree=2”, “Neutral=3”, “Agree=4”, “Strongly Agree=5”. Frequencies and percentages were used for descriptive analysis.

The study was conducted in 2 steps and 2 interview sessions. 1st interviewees were asked to complete a round-trip flight booking task with destination, origin, date of travel and number of passengers as their preference. Since the existing commercial application does not allow test purchases, interviewees were unable to proceed to the last page of purchase which is e-ticket information, instead they completed the given task till the last stage of ticket purchase, which is confirming payment details. Interviewees were observed in natural manner during their execution of task.

The questionnaires were distributed to the interviewees after completing the given task. Answers of interviewees were also noted down during the interview. After interviewing the participants, notes and questionnaire results were analyzed in parallel. Related literature scan was conducted for reference and research findings related to flight travel, usability concerns of mobile applications and user satisfaction criteria were utilized as guidelines. Other market applications that offer mobile flight booking service were also explored for benchmarking.

From preliminary research findings, problem areas were detected and solutions were extracted for benchmarking analysis. 2nd interview was conducted to obtain user’s reaction towards the prototype that was built to eliminate problems that had been found in the first interview. Since prototype was built using a mock-up tool, user’s reaction to it as working application had to be collected through a simulation. To simulate a working application, prototypes were cropped as pictures and transferred to the touch screen device. Same interviewees were asked to execute some tasks in the problem areas and their reactions were been observed.

Lastly, interviewees were asked of their opinions of the new design. No questionnaire was distributed for the second interview. Total time spent in gathering data for each interviewee took around 45 minutes for the first interview and 20 minutes for the second, on an average.

IV. RESULTS FROM PRACTICAL INVESTIGATION

A. Questionnaires and Interview

Questionnaires were targeted to collect users’ perception towards online shopping in general and narrowed down to

their travel patterns, such as flight booking mediums to travel frequency. Participants' view of mobile flight booking over a case scenario and the assessment of their experience with the case application, "FlyTurkish" are performed.

B. Results of Collected Data

a) *Internet shopping and online flight booking.* The results had a parallel outcome to Nielsen's report in user's Internet shopping activities, showing 60% of the activities are related to travel, 70% of the participants bought flight tickets online, 65% booked their flight via airline website and airline websites were rated as the easiest way of buying ticket by 50%, followed by face-to-face interaction based airline office and travel agents. Mobile ticketing/GPRS/WAP were considered as the second "least preferable way of buying flight tickets" with 25%, after Airline call centers, 35%. Majority of interviewees with 75% also stated that they look for "price" primarily when buying flight tickets.

b) *Smart phone ownership and usage.* Majority of the participants (80%) owned a smartphone in one of the following platforms: iPhone OS 35%, Android 30%, Blackberry 10% and Windows Mobile 5%. Although 87% of the interviewees have been using their smart phones less than 2 years of period, more than half of them (56%), regarded themselves "Advanced" users. When users were asked of the applications they use mostly, "Facebook", which was rated the highest by 40%. More than half of the smartphone users (63%) had familiarity of mobile flight booking, as they at least searched or booked a flight using a mobile application such as Kayak, SkyScanner, AirAsia etc.

Users were given the following scenario: "You urgently need to book a flight ticket but you are outside. You have Internet available on your phone. Would you use your phone to book your flight or go home to book your ticket using PC/Notebook. Why?" Majority of the interviewees (around 65%) preferred booking flight tickets via PC or notebook in even urgent and exceptional cases, answering "No". The reasons of such preference fell under two categories: "convenience" and "security", first being the primary reason.

c) *Assesment of FlyTurkish application.* In general, participants expressed their opinions on the neutral or positive side for the look, ease of learning, performance and help of the application. 25% of the participants found the visual of the application good, while %35 rated as satisfactory. 70% of the users said that the application can be used without training or someone's help and 50% found it easy to learn, followed by 35% as neutral. Only 5% of the users rated the applications speed and performance "bad". 60% of respondents agreed that error messages were helpful to show what they did wrong and 75% considered application's suggestions and prompts to use towards the right usage "satisfactory/okay".

However, respondents criticized the application. The study has shown that 45% of respondents strongly did not find the calendar as visually satisfactory to select dates. Also 50% of the respondents did not get enough information of which step of the booking is being processed and how long the purchasing will take, with the mean 2.3. Half of the users

did not find the application enjoyable to use and stated that application does not work the way that they want it to work.

Statistics also show dependence between input area size and easiness to type-in information to those input fields. It has been found a positive correlation between input area size and convenience to type required information in forms: as input area is found insufficient in size to type in, convenience of entering required information in forms also decreases. Among those participants surveyed, 60% encountered difficulty in entering information into input fields, while only 10% of all had no difficulty. These data illustrate that input area size and how it shapes are important to provide user easiness in form filling.

Another remark about the results is that there is a negative correlation between the time required for finding the information that is important to user and required font size to highlight needed information. When font size is not big enough to spot needed information, the time required for finding the important information increases. For example, in the case of flight details page, users were asked to rank information that is most important for them. With no exception, departure date/time, arrival date time, departure airport and arrival airport were selected as most important information that users seek for. 55% of users found that font size is not big enough for them to spot the important information (mean=1.8). 35% percent of the users had difficulty in finding the information quickly, where the mean value was (2.85 < Neutral (=3)). Correlation was investigated further in the second interview with recommended design prototype, and it returned supporting answers from users, such as how highlighting the information with different styles (bold, increased font size and differentiated color) enhances the noticeability of important information. 75% of users also found the information not well-organized; for example flight information details and payment details (mean value of 2.25). Moreover, 80% of users disagreed that icons are clear to give the right information.

Easiness of finding how to proceed to the next page shows more significant association with user's level of familiarity (Novice or Advanced), comparing to the type of smartphone that they use. Novice users spent more time in figuring out what to do after each phase of flight booking, while advanced users knew how to proceed after each step. However different functions of the application were discovered by trial and error regardless of user's level of familiarity, as it is stated by 40% of the respondents.

Half of the respondents opined that the steps of buying the ticket are straightforward and they easily understood what they were required to enter input fields. 40% of the respondents rated the application as not frustrating to use (mean value=2.65 < Neutral). Nevertheless, while the mean value of 3.1 has shown that users found the application satisfactorily easy to use, 75% of the users still do not prefer to use the experimental application to buy flight ticket.

V. FINDINGS ON PROBLEM AREAS AND SOLUTIONS

This section presents the main usability problems discovered during the analysis of the interviews and the questionnaires. Solutions are also suggested.

A. Wrong choice of icons

As a picture is worth a thousand words, usage of visual aids improves the time to completion of tasks and helps better understanding of presented information. Regardless of the screen type (touch-screen or classic screens) icons are often used in place of information in order to save space in small screens of mobile information. So, the right choice of icon is a key to convey the right information. User interview revealed the difficulty of understanding among interviewees about what the icon stands for. When the definition under mobile ticket menu icon (Fig. 1) has been covered and user has been asked of what his/her understanding of it is, none of the users interviewed managed to make the right guess.

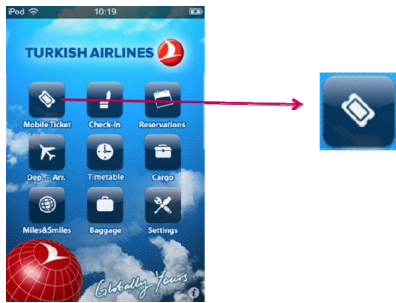


Figure 1. Mobile Ticket icon did not light up its meaning.

Solution. Clear, easy to understand and simple icon choice should be adopted to enhance user's perception. Some airline companies try to achieve uniformity by using the same icons between web and mobile applications; however a consideration should be given to their use in small screen resolutions. Icons that are clear to comprehend in big screens may not be clear after resizing to fit in small mobile screens.

B. Placement of icons

Placement of icons is more important in mobile devices than web-pages, as user's perception of icon's usage is closely related to its placement on the screen. Half of the interviewees thought the calendar icon in Figure 2 was to open calendar and tapped on it to select the date of flight.

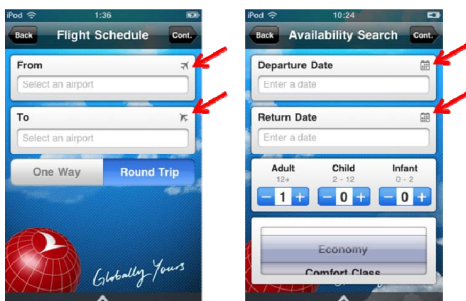


Figure 2. Misleading flight and calendar icons.

Solution. To understand the root of such confusion, icon's placement has been changed from top right corner to the top left corner next to the "Departure Date" and "Return Date". When same user was asked to choose the date, none of them attempted to tap on the icon. User's perception of

linked icon and presentational icon are formed by the distance of icon from the text at the same level, and right-side placement. Interviewees perceived icon at the right as a link to information whereas the icon on the left and next to text as complementary visual for text. Therefore icons should be placed accordingly.

C. Redundancy of steps in completing tasks

11 of 20 users found flight ticket booking process time consuming. Another problem arose when 3G connection was lost for a moment at the beginning of flight planning. User had to go back to the first menu and start over the planning. User was impatient and reluctant to complete the given task.

Existing FlyTurkish application collects flight planning information in three steps for domestic flights and two steps for international flights. User has to choose origin and departure and proceed to the next page that date of departure and if round-trip return date is selected. Third page collects cabin type preference and the number of passengers. Lastly, at the fourth page, flight search results are returned. Inefficiency of collecting information resulted in dissatisfaction of users to prefer mobile application to book flight ticket over web-page.

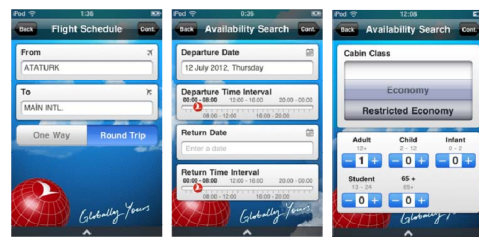


Figure 3. Existing interface where required data are collected in 3 steps.

Solution. Previous works [6], [17], [18] investigated the factors affecting mobile phone users. These studies found that mobile user profile is very different from web user profile in terms of unexpected user environment, unstable network connection and environmental distractions that interrupt process of completing a mobile task. Hence, mobile flight booking steps should be reduced to minimum and organized with minimal attention requirements. Figure 3 shows the old interfaces. In Figure 4, steps of flight planning steps has been compacted to one page, through analysis of other market applications for flight booking and HCI guidelines. An increment in user satisfaction was noted in second interview, which proves the efficiency of the solution.

D. Naming of menus and sections

Flight booking menu has been named as "Mobile Ticket" which was described as confusing by some users, especially for novice users. For example, some users thought "Mobile ticket" as referring to movie ticket purchasing. Another user expected it for buying concert tickets.

Solution. Naming should be direct and clear to the purpose of the menu and the possible tasks could be carried with it. User's expectation of interactive application has also a determining factor on naming. Instead of "Flight

planning”, “Plan your flight”, instead of merely “destination”, “Where do you want to go?” perceived by interviewees as if a real-smart system was talking to them.



Figure 4. After optimization of steps of collecting data (for round trip)

E. Uneasiness of single handed use

As a nature of mobility, people use their mobile phone on-the-go, mostly with scattered attention and controlling via single hand. This situation leads reconsideration of design to help single handed use. All of the interviewees except two were right handed users. When users were asked to complete certain tasks with single hand, existing design revealed that single hand usage has not been in the design consideration during the application design. Users had difficulty due to placement of information and input fields. Changing the number of adult passengers was relatively difficult due to its placement “at the left”, where interviewee used “right thumb” to navigate through the screen.

Solution. If the feature opts to get inputs from user and needs selection, prefer right side arrangement. Figure 5 shows the sample interfaces (existing and proposed).

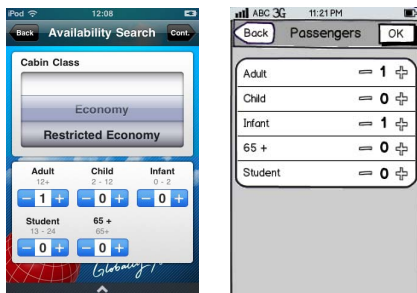


Figure 5. Comparison of passenger selection for one handed use. 1. Existing selection (left), 2. Proposed selection (right)

F. Small and disorganized input fields

Users had at least one to several attempts to enter information in input fields complaining its small size. Some users also found it exhausting to browse through passenger information form, due to its disorganized horizontal and vertical input fields.

Solution. In case of information collection, a consistent vertical form style should be adopted, in which user can

easily expect the next entry at one level below. Figure 6 shows the comparison of exiting and suggested passenger information form.

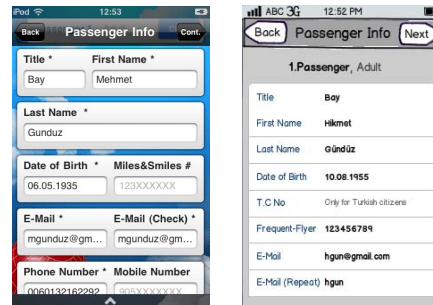


Figure 6. Comparison of passenger information form. 1. Existing form (left) 2. Proposed form (right)

G. Small selection fields

The most common problem that has been observed during interviewee’s completion of flight booking was erroneous tapping due to small input or selection fields. Users had tendency to give up easily by no response to their action. Users also expressed that they would not try to use the application for a second time if they do not feel comfortable using it at their first trial.

Solution. Interface should be designed to minimize user mistakes. In consideration to touch screens, it should be achieved by enlarging selection fields that is suitable to user’s finger-tip tapping.

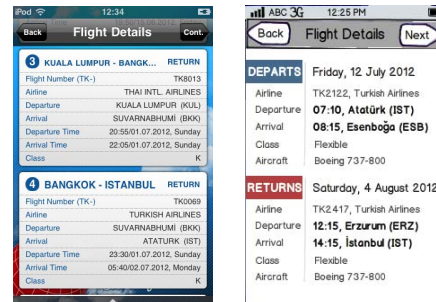


Figure 7. Comparison of flight details presentation. 1. Existing (left), 2. Proposed (right)

H. Crowded and disorganized information presentation

Last problem discovered through the interview is about information presentation of the design. User’s difficulty has been observed in flight details section, which is one of the 3 sections that the most information has been displayed. Some users took quite long time on revising flight details while some said the information is scattered and not comfortable to spot. Text size is also found to be small by users.

Solution. It is important to highlight most sought information since mobile users do not have time to review all the information (Figure 7, for example). Text size should also be increased, considering the distance from user’s eye while on the move. Adjustable text size function should be introduced as comfort factor.

VI. DISCUSSION, LIMITATIONS, AND FUTURE WORKS

Main findings in this study revealed that user's expectance is a complex matter which is not bounded only by usability. Moreover, components of usability that are "Learnability", "Rememberability", "Efficiency of use", "Reliability in use" and "User Satisfaction" arise as strongly interrelated attributes. As understood, user's perception towards the application and the satisfaction after use of that application may show different results. Most of the users answered either neutral or positively to the first question in the questionnaire of "*Application is easy to use*". However, during the interview session, majority mistyped when entering information, tapped on the wrong sections, took time to find the information they needed and how to proceed. Similarly, many of the users stated that they explored the features by trial and error. Narrowing down the questions to particular details of the application revealed the application's "*not actually usable*" functions. This variance between users' answers in questionnaire and interview suggested that study brings more reliable results when it includes more user observations and direct face-to-face interviews.

Another issue is regarding user's preference to use desktop-web flight booking over the mobile application. Although users found the application's features attractive, those qualities seemed to be insufficient to prompt them to buy their flight tickets via mobile, even in urgent cases.

Some of the users also questioned the advantage of buying the flight ticket via their mobile. When the functions are identically same with the web, mobile users tend to prefer flight booking via web. Users expect more personalized functions and more interactive services from their mobile flight booking application.

There are a few limitations of this study. This study can be considered as a particular study in a particular context, in terms of the profile of the participants and the context that it had studied of. This study may not be suitable to extract a particular cultural pattern for mobile flight booking use. It is excluded of the improvement of the application's "functions". Functions for disabled people, speech search, speech-to-text facilities, geo-locations services, personalized flight booking assistance have been omitted from his study due to its large complexity that will not fall under single study. Suggested usability improvements have been based on certain assumptions: for right-handed use and reading/writing in left-to-right direction. Study also did not investigate the aspect of colors in the design, since perception of colors vary from culture to culture, from context to context. Usability problems and guidelines to eliminate such problems were given over a general picture. All of these could be considered as our future works.

VII. CONCLUSION

This paper has presented main challenging issues with regard to usability of mobile flight booking for touch-screen devices. We verified previous research findings of usability of web-page and mobile applications and devised touch-screen specific suggestions. The results should be useful if

generalized and used by the mobile applications designers regardless of what kind of application is to be developed.

ACKNOWLEDGMENT

This work was supported by NDC Lab, KICT, IIUM.

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