User centered design of an Iphone application for women business travelers

Rajalakshmi Neelam Jagadish
Abstract

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This thesis walks through the user centric design of an iphone application specific to a hotel service for women business travelers. It aims at providing the luxury of performing tasks such as remote hotel check-in/check-out, ordering food/transport/room services, emergency help, complaining services, order history and safety measures. This thesis covers the initial design and developmental iterations of the application. Android Version with added features of the same application will be the future enhancements.

I would like to thank my reviewer Mr. Lars Oestreicher, Uppsala University and supervisor Mrs. Tahira Sultan, MicroUsability for their exceptional guidance throughout my thesis. Finally, I am so grateful to my parents, as this Masters wouldn’t have been possible without their never ending support and love.
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1. INTRODUCTION

My major thesis interest was to design a web application or a mobile application based on user centered design. I approached my supervisor with this intention. After discussing few of the ideas and thesis topics, I was able to decide on a topic. The bottom line of the project is to provide hands on instant facility for women business travelers during their travel and their stay at hotel, as they are very cautious about it. Amidst their busy schedule these women business travelers prefer comfortable and safe stay. The number of women joining the global workforce has been steadily rising. A noticeable concern that has drawn the attention of hotel industries in this decade is the differing needs of women business travelers during their stay. So this is one marked change that is well worth looking at. In recent routine, hotel organisations to access their services, involve Smartphone technologies as one of their branding communication amongst their female/male customers [1]. This is done as a high level strategy to provide the best customer experience in all possible ways to their clients.

As a result of the above mentioned cause this master thesis describes the necessity as the user centered approach of designing and developing an iphone application for women business travelers specific to a hotel. It is a combination of both hotel services and possible safety awareness for women business traveler. This project is completely done in collaboration with MicroUsability private limited, Singapore. Due to time constraints this thesis covers only the initial research, stakeholder interviews and design iterations.

2. BACKGROUND

Women business travelers around the world are increasing by 20% in the last decade [2]. As per the study [3] conducted by Amadeus (a global travel group) in January –August 2012, the numbers of female business travelers across the Asia-Pacific region is expected to upswing distinctly down the line in the forthcoming decades. By 2030, this number surveyed out of 1500 business travelers is predicted to gradually increase by 400%, majorly influenced by the growth of women business travelers from China and India. The same survey [4] provides a statistical information of business women from most contributed countries like Singapore, India, China, Korea, Japan, Australia and Indonesia cruising international business roughly around 4.5 million
trip. The reason for the evolvement in numbers is stated to be the industrial equality between the corporate and management sectors.

![International business departures by women, 2011 – 2030](image)

Figure 1: Amadeus- Jan 2012 -Survey

By the end of 2013, the ratio of men to women business traveler is estimated to be edging close to the unvarying 50:50 mark [5]. Hospitality organisations known about facts are still into the research and analysis of how to satisfy the women business traveller during their business trips [2]. Women business travelers do think that it would be a surprise, if the hotel industry recognizes them as a significant consideration in their marketing. Apparently women are very much concerned about everything during their abroad stay. What are their specific types of needs? How do these needs differ from that of the men? How has the hotel industry addressed these needs of women?

Based on the survey conducted by the *Hospitality research from Cornell University* [1], women business travelers (WBT) are of many different profiles. Women business travelers might vary in personas. These distinct types of personas might differ either in any of their frequent travel experience in a year/demographic details/remuneration. But the needs can be common for all these WBT personas or at least a large sample of the lot. Data from multiple research analysis reveals that the emotional needs of women business travelers are higher during their abroad travel [1]. These needs mostly evolve around safety, security and privacy [1] . Although amenities are also their primary priority, women business travelers expect a safe and comfortable
trip [6]. Women want assurance that their hotel cares about their safety according to the study [5] of 13,000 women from Fortune 1,000 companies. While male travelers are satisfied with basics about fire exits and in-room safes, women want comprehensive support regarding personal safety from intruders or assaults. So far, being aware of the uncanny rise in the men to women business traveler edging 50:50 ratio [5], five star International hotels started treating their woman business traveler customers with an extra intricate attention. In fact, the hotel and tourism sectors have already demonstrated recognition of this significant demographic [1] via explicit services geared specifically towards female business travelers ranging from the following

- At UK – Hyatt, they service tour guides hosting the women business travelers.
- Four Seasons – Houston, Texas; Women only floors.
- Women chauffeurs/driver for transport services
- Women only housekeeping service.
- Dubai / Abudabi -Unique pink-roofed cab services that host female-only drivers
- Special surveys to find out the specific amenities (like Hair dryers) interested.
- Maiden Voyage -A network system for providing info on women business travelers
- Specific measures hotels have taken include well-lit hallways, covered parking and deadbolts on doors.

[Note: These are practiced from 1990’s till date]

Hotel industries accentuate and primarily prioritize these services for women business traveler but it is also left open for male business travelers if they prefer. In spite of their increase in number and the advancements in technology; a safe stay with preferred hotel services in their busy schedule is still a question mark. Creating an Iphone application for such a desperate need makes this project more interesting. It isn’t enough if it was only told, that this project is interesting and its reason is desperate. It has to be proven by User research studies with at least qualitative results.
2.1. SMARTPHONE IN HOTEL INDUSTRY?

Gone are those days, were the customers have to wait hours together in a long –queue to book their rooms. As every century passes by, one or the other advancements are made to any industry, based on the evolution of technology and trends. In other words, rather than adapting to the current trend it is about winning the customer satisfaction. Customer experience management plays an important marketing role, especially in the hospitality industry. Best practices are introduced to increase the revenue of the hotel industries. It is proven that, the revenue yield of services provided from the hotel desk in the traditional work timings are comparably very less than the revenue yield of full time services such as websites and smartphone involvement [7]. Smartphone integration in the hotel industry over the past 5 years has become a one –time investment methodology to escalate revenue with limited labour.

Most of the business travellers use smartphones for easy access of internet usage while they travel. Figure 2, demonstrates the percentage of leisure and business travelers using smartphone applications in the Asia pacific region as per an Amadeus survey [6].40% of business travelers and 25% of leisure travelers user their smartphones for their travel related stuff and bookings. Usage of smartphones during travel is especially high by the Business travelers from China and India. Also, the right side of figure illustrates the expected percentage of increase in smartphone usage by the travelers in the year 2030.

![Figure 2 –Estimated Smartphone Usage of travelers in 2012 & 2030](image-url)
As already known, creation of a smartphone application creates a technical buzz while choosing between the platforms and Operating systems. But as off now, Microusability’s current focus are on the Iphone applications. Amongst the Smartphone market, Apple IOS application store has about 1,200,000+ [8] applications as on June 2, 2014 leading the Android market. The fact that the application store has more number of applications can provide much of a branding to the hotel. Also, it has a clean and neat user interface design.

2.2. PURPOSE OF THE THESIS
To design an iphone application for woman business travelers based on user centered design process. This step by step process will include

i) Initial Research ( Stakeholders & User Interviews)
ii) Content Invention ( Persona Behavioural Model & User Scenarios)
iii) Content Organisation (Card sorting )
iv) Rapid prototyping ( Lo-fi & Hi-fi)
v) Usability testing

2.3. COMPETITIVE BENCHMARKING STUDY
Competitive benchmark study is done to find if there are any, existing products of the same type or if the product has competitors in the same market. Performing this study at the early stages of the research will help designers to make their application specific for a particular purpose. It is also useful in not developing an application which is already in the market. This study plays the most vital role because, an IOS application gets rejected in the Apple application store, if there are more number of similar applications.

To justify the statement of purpose [9] of this application, a simple search study of already existing similar kind of Iphone hotel applications for women business travelers was carried out on the internet/Apple application store and other known sources. Analysis of those results revealed that there are many existing iphone applications that provide
Guest Service IOS apps specific to a Hotel.

Clustered under the travel category in Apple app store, these apps constitute hotel guest services such as hotel room booking system; check-in; check-out; food booking system via app; wake up calls; concierge contact; housekeeping; spa and massage; transport facilities; amenities; luggage assistance; profile settings hotel information; etc...Hotel managements also aid mobile payment for their self serviced app. The access to these applications is only open for the privileged customers of respective hotels.

IOS apps for Hotel bookings.

Hotels are listed in the app from around 200 countries in the world for hotel room booking purposes with easy payment options. Rooms can be searched on price, deals or reviews. Rare services like cancellation of the booked room are also inclusive. An automated message with clear Itinerary is sent to user’s email id soon after booking. Bookings are saved in the mobile device for guest users. Specials deals and packages for all types of their regular users are introduced and used as a marketing trait to increase booking actions via the application.
IOS Emergency Apps

These free of cost apps categorized under lifestyle are designed for tracking user’s GPS location; SOS location based on GPS; Reporting on harassment, Receive notifications if friends and family members are in the close proximal distance; hazards and non safe places; The automatic emergency number updates while travelling abroad; Single tap instant messages and emails during emergency situations. Often the target audiences of these applications are women and especially female college students.

2.4. STATEMENT OF PURPOSE OF THE APPLICATION

As a result of competitive benchmark study and further discussions with supervisor the scope of this application was derived. This application is mainly aimed to provide a combination of two modules for women business travellers.

1.) First Module - Instant hotel services specific to a hotel such as check-in / check-out, food, transport, spa, gym, housekeeping ordering services, bills, offers, etc.
2.) Second Module – Emergency services such as Automatic Emergency calling numbers (of nearby fire station, police station, Ambulance service), Hotspots, Alerts (accidents, Natural destruction /camouflages) based on the location of the user.

Note: Room reservation service is not included in the scope; because there are many number of IOS applications for this purpose such as Expedia, Hotels.com & Booking.com.
2.5. USABILITY

Technology can become a disaster when it is not provided comprehensively or when the communication between the servers drops. For example, if a customer orders fresh towels upon arrival at the hotel via the app and to their disappointment, has been retaliated with a number of error messages from the app. When this happens, an unsatisfactory service trail of the hotel management will be filed from their customers. Surprising a customer with bad service is never a good trait that should be followed as it might decrease the credibility and reputation of hotel management. Uncertainties in the self-service applications tend to exhaust users. Also, there are chances for the user to get highly frustrated, if there are multiple steps needed to complete a simple task. The most challenging part of this thesis is that the whole application has to be developed with Usability and security. Such communication failure [10] over mobile applications has to be eradicated by designing a clean user interface with perfect navigation and user experience. A combination of usability and security has to be embedded into this application as all the process progresses over mobile communication. Upon all these conditions, the product has to be easy to use. Apple provides “Human Interface guideline” and “Developer guideline” to help designers and developers build a simple yet usable IOS application for its users. An application that doesn’t follow these guidelines is also rejected in the apple stores during Beta testing. The user experience of the application can be achieved by making it simple and user oriented [11].

3. USER CENTERED METHODOLOGY

When an application is designed, it is important that it’s designed for its primary users. Otherwise the application will never be appreciated and used. The sole purpose of developing an application is to satisfy its users. How to satisfy the user? Every user has an expectation on how they want the application to be/ how it should function? For e.g.: I prefer a gaming application that has more animations and colours rather than it being monochromatic. Thinking from the user’s perspective and gathering direct information from the user will help in designing the “user
desirable product”. To be very clear, in this methodology users are involved in every phase of the project to obtain their requirements, feedback, desires, wish list, limitations, etc.

User centered design is a process and design philosophy focussed on placing input from user research as the focal point for design decisions[12]. The major advantage of user centered approach is the decreased development cost that will produce increased revenue. It also decreases the effort spent of customer services, manual development and training costs. Figure 6 presents the various steps carried out in an UCD approach of mobile designing.

![Figure 6: User Centered Design (UCD) process (From Ergomen)](image)

This thesis is structured into four phases of User centered design approach right from the interviews to usability testing. It is explained further in the following sections. PHASE I – Initial Research includes all possible interviews from the management sector (Stakeholder interviews) and users (Business women travelers in general). PHASE II- User Identification is where the deliverables from phase-I are deciphered into personas, behaviour model, Scenarios and User flow. PHASE III- Content Invention is basically a card sorting exercise conducted with the profile users. PHASE IV – Rapid prototyping elaborates the creation of lo-fi wireframes, based on user inputs and research data. Following wireframes, process of visual
designing is explained. **PHASE V – Usability Testing** deals with analysis of usability testing results conducted with prototypes and visually designed wireframes.

### 4. PHASE I – INITIAL RESEARCH

The first phase of this project deals with the identification of all initial research data concerned with the development of this mobile application. The main purpose of the research is to bring out the insight into targeting only women business travellers. This process was basically performed to discover the changing known facts about women business traveller over the decade. The research motive was achieved through three paces, namely the *stakeholder interviews, user interviews* via direct one-to-one interviews and *surveys*. The different interesting findings are categorised and emphasized according to the prevailed facts. As a result, these research data and analysis are made useful for architecting the whole project plan.

#### 4.1. RESEARCH QUESTIONS

Real time research in a huge area can be very vast and strenuous. Research has to be bridled. Hence, listing out the research questions are a process of focussing research towards a central point. They are clear, focussed, specific questions that can provide the required research direction and results eliminating rest of the junk information. Research questions were framed in such a way that all the required details about women business traveller are derived from the stakeholder’s and user’s perspective. The following are the set of research questions

- Is there any increase in the number of women business travelers? How do you know that there is an increase?
- How are women’s needs different from those of men? Is it from any of the Emotional needs / psychological needs or behavioural needs or just the basic needs? Is women business traveller very cautious about their stay unlike men?
- How does the Hotel address these needs? What are the different methods that hotels follow to satisfy women’s need (if any)? Do they provide special woman only services etc...
4.2. STAKEHOLDER INTERVIEWS

Stakeholders are people with powered position in an organisation. As far as the hotel industry is concerned, the stakeholder can be the employees, owners, chairperson, etc... The purpose of interview with the stakeholder is to know the effort that the hotel industries are investing to attract and market their hotel services among the women business travellers. Also, it provides the demands, expectations and preferences of women business traveller during their stay in the hotel. All of the five start and seven star hotels chosen for basic research were based in India with multiple branches around Asia Pacific. Out of the lot, only two hotels had mobile application as an access point for their hotel services. Hotel management recommended their Front office managers and training managers as the target stakeholders who can provide all reliable details when interviewed. Check Table 1 for the stakeholder profiles.

<table>
<thead>
<tr>
<th>Company</th>
<th>Business class hotels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of experience</td>
<td>7-15 years</td>
</tr>
<tr>
<td>Age</td>
<td>33-51</td>
</tr>
<tr>
<td>Gender distribution</td>
<td>8 Males and 3 females</td>
</tr>
<tr>
<td>Specialization</td>
<td>Front office managers and Training managers</td>
</tr>
<tr>
<td>Total Sample</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 1: Stakeholder profile

Methods

Stakeholder’s interview involved both qualitative and quantitative research. Few of the data needed both numbers and oral thinking. Hence to justify the nature of the research, mixed method [13] [14] research was chosen for the initial research. A mixed research method is a combination of qualitative and quantitative research. According to Leech and Onwuegbuzie (2006) benefits of the mixed method research are, “Its logical and intuitive appeal, providing a bridge between the qualitative and quantitative
paradigms.” The methods for the stakeholder interviews are used from both qualitative and quantitative research. Quantitative methods (Paper Questionnaire) were chosen to collect the statistical and numerical data. Adding more justice to the quantitative data, cognitive thoughts and personal opinions about the women business traveller trends were gathered via qualitative research method (interview).

**Questionnaire**

The stakeholders answered the questionnaire, which had certain set of questions categorized under particular field of hotel industry subjecting women business travellers. These set of questions are categorised under fields such as clients, Offers/Packages, Check in and checkout, room and amenities, Services, Complaints, Mobile Application. The resultant data are represented by using pie charts and bar graphs.

**Interviews**

Soon after responding to the questionnaire, stakeholders were interviewed at their office with a small set of questions unlike the previous questionnaire leading to an informal discussion (*Talk aloud method [15]*) about the activities of their customers. Due to the hotel management confidentiality issues, the data was not audio/video taped. All important points were taken down as notes at the session. The discussion was mostly ranging from behaviour and demands of women business travelers to their services provided to them. The information obtained from the interviews is presented in *Coding framework qualitative method [16]*. In coding framework the verbal phrases from the interview session are interpreted into text (code) that relate to a topic or issue. *Table 2* illustrates Coding framework method.

<table>
<thead>
<tr>
<th><strong>Q&amp;A’s</strong></th>
<th><strong>Correlated Codes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What type of phone do you wish to use?</strong>&lt;br&gt; I wish to use smartphones like Samsung Galaxy, Iphone 5c, and HTC one.</td>
<td><strong>Smart phone preference</strong></td>
</tr>
<tr>
<td><strong>How much do you spend for a smartphone?</strong>&lt;br&gt; I would like to pay via PAYPAL if its below $600 ,otherwise i choose EMI’s</td>
<td><strong>Budget /Expense</strong></td>
</tr>
</tbody>
</table>

*Table 2: Sample coding framework*
4.3. RESULTS

The data from the mixed method research were analysed and concluded. The findings from stakeholders opinions are discussed in such a way that the quantitative data are highlighted with the qualitative data as mentioned earlier. These findings are solely based on the stakeholder’s perspective. A comparative difference of both men and women’s need will be discussed in the next phase User identification.

Finding 1 | Increase in numbers-Statistical proof for the increasing number of women business travellers over the decade than men was confirmed from the quantitative paper questionnaire (Fig 8). 8 out of 11 stakeholders were very sure about valiant increase in number from their hotel industry experience. This makes this result different because the recent research in 2010[3] reveals that the women business traveller were only 20% a decade ago.

![Figure 8: Increase in WBT over a decade- Stakeholder prediction](image)

Points gathered via the talk aloud method during Q&A’s for the same are categorised and coded under “Increase in number over the decade”. The exact points shared by the shareholders during the discussion are listed down.

**CODE – INCREASE IN NUMBER OVER THE DECADE**

- Women business traveller have definitely increased by 30% since 2000 when I started my career.
- Women are definitely high in number, gone are the days where only men stay at hotels for a business trip.
- Women have reached the equal importance beneficiary in the hotel industry only because of their increase in numbers.
Finding 2 | Safety & Security- As per the Stakeholders feedback, women business traveller needs are different than that of men’s from the data obtained (Fig 9: L.H.S). Women are always very concerned about their safety and security. That’s how women’s needs differ from men. The findings revealed that, women while choosing a hotel mainly consider safety/security factors (Fig 9: R.H.S).

Qualitative research obtained explains on why they seek safety and security services from hotels.

CODE – SAFETY & SECURITY

- They feel very secured when the services are provided from the hotel
- Factors like Language, New to place make them stay under the hood of safety and security
- Care is taken that the single women feels secure than feeling comfortable.
- Women request for doors with pin-hole mirror view and an intercom service for safety
- WBT are provided with rooms in single women floor for safety.

Finding 3 | Differing needs: All amenities and services are almost preferred by the women business traveller. Fig. 10: L.H.S. Preferred services and R.H.S. Amenities preferred are shown. Among the Services Wi-fi, transport guidance and money exchange are highly preferred.
Special requests were discussed from the qualitative data analysis. Following points recorded during the session are listed as follows.

**CODE – DEMANDS / EXPECTATIONS**

- Women are particular about clean bathrooms.
- Wi Fi is a must for these modern women.
- Strict on time services are preferred as they are very organized and planned.

**Finding 4 | Mobile Application**- The idea of mobile application for women business traveller was interesting to the stakeholders as they thought that they might bring in some difference in their profit and standard quotas set for women business traveller. 9 out of 11 stakeholders voted yes for the hotel mobile application. The *Fig 11 Mobile App Necessity* shows the quantitative data.
Other random points from stakeholders on the development of mobile application for hotels guest services

**CODE – MOBILE APPLICATIONS**

- Information Technology is ruling the world, why not in the hotel industry?
- It's not that easy to develop such an app which has to satisfy women.
- Security issues are the red alarm.
- It will work out if payment options are excluded.

5. PHASE II – USER IDENTIFICATION

5.1. COMPARATIVE STUDY  Initial research on finding the users commenced with the survey distribution. The survey was distributed over a random set of twenty-three female users and 26 male users of varying age groups. An online survey using QUALTRICS 2012 was conducted to obtain a comparative result and to highlight the differences between men’s & women’s needs during their travel. The users were questioned about their personal, demographic, mobile phone usage, travel experience data etc... The survey link was distributed over internet to all the users. The survey for men business travelers had similar questions as in the survey of women business travelers with a few extra questions. Both male and female participants were also interviewed following their survey response.

![Figure 12: Different users interviewed]
5.2. RESULT & ANALYSIS

Phase- I describes the findings that were obtained based on the stakeholders feedback. In this phase the findings highlights the difference in the needs of men and women. The results are discussed in the following findings.

Finding 1 | Safety factors

Upon comparing the results for the survey question “What are the factors for being more cautious during travel?” from both men and women, it was found that almost 95% of the women who took the survey selected the choice “Safety” than men as in Fig 13: Factors for being cautious. “Foreign environment or new to place” was chosen by women to be second highest factor for being more cautious during stay.

![Figure 13: Factors for being more cautious during travel](image)

Finding 2 | Differing needs

From Fig 14 the services which had higher priorities as chosen by women travelers during the stay were mostly transport, money exchange, food restaurants, spa, gym, Wi-Fi. Whereas a man’s highest priorities were Wi-Fi, gym and transport. Amenities & other facilities that womanly were mainly interested are travel guidance, instant help services, toiletries, clean bathroom, ventilation, free phone services. Men preferred free internet, free phone services, Fan/AC in whole list of amenities. Women were specific that all these facilities are mentioned in the itinerary.
Finding 3 | Men & Women Mobile application usage

Women use mobile applications as equally as men that are either used for hotel services /travel/tourist’s spots around. To be specific, they also used other applications like Foursquare, Trip advisor, Google Maps etc to find information on their current geographical location.

Points gathered on differing needs from male Business traveler.

These points are completely based on the responses provided by the male participants, when they were interviewed on how they think that their requirements are different from that of women business travelers. The following are the important generalized discussions gathered from the interviews and discussion with the male participants. "Privacy and security” of a woman is far
more essential than that of a men’s, as in men don’t bother much about the safety under any kind of circumstances. For example women take extra maps. They are gender distinctive and will no way the needs can be equal. Some of the men were not sure about the exact difference of needs but they guessed that women would need double the safety since they are physically fragile by nature than men in some situations. This might make them vulnerable than men in terms of safety (especially in terms of physical strength). They prefer more secure environments considering their rooms, floors, distance of the hotel from the work places, etc. But it’s not the same with men. Men are mostly okay with any kind of rooms and it’s not a problem at all in most cases. Differing needs in the sense it would be only when there are certain requirements specific to women. There are some natural issues specific to women. Safety can be the only differing or extra need that women prefer than men. Traveler need being different is plan of travel – Men would travel even if there are no constructive plans. Whereas, women might go forward to travel only after a proper plan if it is for business. They plan and organize a lot.

5.3. PERSONAS AND SCENARIOS
Personas are sampling representation for a large population of user’s behaviour, thoughts and goals. As the quote “Know the user”[17] says, it is important to start the designing phase by having the target users in mind. It totally depends on how we create the persona as there is no perfect methodology to it. The personas for this project are derived from the real users along with an extensive data collected from qualitative Guerrilla research [18].Guerrilla research was chosen over the traditional research to compensate the cost and time constraints.

IN-DEPTH-INTERVIEWS
Fifteen users were short listed based on their mobile phone usage and travel experience to attend the in-depth interviews. In the in-depth-interviews users were questioned on their usual routine on how they book rooms in hotels when they travel, time consumed for the process, special needs, bad experiences, etc...

After thorough analysis of the information obtained from the survey and in-depth interviews the different types of personas and scenarios were built. Additional information
gathered from the qualitative research was also used in the persona development. Three types of persona was built based on the following important characteristics such as whether the users are aware of smart phone & mobile application usage and user travels at least twice a year.

5.3.1. PRIMARY PERSONA

This persona addresses the most important target audience for this mobile application. She is a business traveler who takes more than three business trip a year, with expert level mobile usage.

<table>
<thead>
<tr>
<th>Name: Ridhvi Patel</th>
<th>Age: 34</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment: Self-employed Chef</td>
<td>Mobile: Iphone, Samsung S3 and Blackberry</td>
</tr>
<tr>
<td>Education: Bachelor’s in Commerce</td>
<td>Marital Status: Married</td>
</tr>
</tbody>
</table>

Behavior Model and goals: Ridhvi spends most of her time in client meetings, searching data on the internet and cooking. She uses mobile phone for calls, texts, checking mails, chat, Skype call and social media. She is addicted to mobile phones. Updates most recent technology and tries them no matter how bad it is. She always hunts for mobile applications on photography, news and travel applications. Ridhvi only uses applications that are highly intuitive and fast. She has been a critic for a food recipe mobile application.

Scenario: You hear from the hotel website, that there is an application available to access guest services in hotel you booked? If you want to book the services/use it by yourself for your stay, how will you do it? Please list down every step of the process.

Ridhvi downloads the application straight away by herself. First she looks out for the description of the hotel and its location. Location is very important, as it should be near the work place. Takes a brief look into the application. Ridhvi likes to select an offer package with better description about it, rather than to select each and every service. Looks out for special packages like single women’s room on women only floors or rooms with royal security with sample photographs of it. She looks out for the transport, money exchange, food order via hotel app itself. As she has used a number of applications, she expects a better understandable user interface. Ridhvi doesn’t like to spend too much of time on going through a lot of steps. She
prefers offers or discount or points for the amount of money spent. Also, looks for redemption of the points if she revisits the same hotel. If everything is decided, she reads the terms and conditions and proceeds to the order. She prefers not to pay via mobile application as she feels it is not secure enough. She would like to receive an email on her orders. But she also prefers a separate bar code to it, so that it cannot be unauthorized. In some unfortunate cases, she cancels the services that she reserved. She says that it is not possible in any of the application that she used to easily cancel the reservation. She spends only 15-20 minutes for the whole process.

5.3.2. SECONDARY PERSONA

Secondary persona was created in such a way that our application can also be extended to them. She is a business traveler who travels once or twice in a year with novice mobile experience.

<table>
<thead>
<tr>
<th>Name: Sarah Woh</th>
<th>Age: 26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment: Researcher</td>
<td>Mobile: Samsung galaxy S2</td>
</tr>
<tr>
<td>Education: Master’s in Genome-Technology</td>
<td>Marital Status: Single</td>
</tr>
</tbody>
</table>

**Behavior Model & Goals:** She spends most of her time at research lab, reading articles and performing experiments. Uses smart phone mostly for call, text messages and for checking her mails. Rarely uses social media on phone and laptop. She doesn’t use any form of hotel apps. She either seeks help from her friends / colleagues / hotel receptionists. She never downloads mobile application unnecessarily. She might learn to use a mobile application if it is very easy to understand and use.

**Scenario:** You hear from the hotel website, that there is an application available to access guest services in hotel you booked? If you want to book the services/use it by yourself for your stay, how will you do it? Please list down every step of the process.

She searches for the application reviews and learns how to use the mobile/web application from the friend or via the same application itself if it is possible. She would like to glance through the application thoroughly until the bill payment without logging into it. Because, she doesn’t want
to register to something that she is yet to know. She always looks for the authenticity and 
description of the hotel everything on the first page. If satisfied, she likes to continue looking for 
best services preferred. She would find out service timings, types (for e.g.: room dining service, 
etc) and taxes. Makes final decisions on the services and proceed to billing. She prefers the 
application to provide billing data with all terms and services required. Probably spends 30 
minutes including the time taken to understand and not more than that.

5.3.3. NEGATIVE PERSONA

It was created to represent the people who are not considered for designing this mobile 
application. She doesn’t travel and a novice in online usage.

<table>
<thead>
<tr>
<th>Name: Belinda Elizabeth</th>
<th>Age: 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment: Associate Accountant</td>
<td>Mobile: HTC</td>
</tr>
<tr>
<td>Education: Bachelor’s in CA</td>
<td>Marital Status: Single</td>
</tr>
</tbody>
</table>

Behavior Model & Goals:

Is totally busy with her regular routine life such as working, spending time with her family and 
finds no time for internet. Rarely uses internet and social media. She uses mobile phone only for 
calls and text messages. She never travels for business trips as she is responsible only for 
accounts in the office. She is not a big fan of smartphone.

6. PHASE III-CONTENT INVENTION

Tasks in content invention are done to define every content and features in the 
application. It assists in determining what content to add, edit and remove. The different steps in 
content inventory might vary depending on each project and its requirements. But, basically it 
includes constructing user flows. Framing labels and hierarchy (names for each menu and 
submenu in relation to its content) leading to create a comprehensive Information architecture. 
As a result of which will be a structured and organized content for any kind of application. It also
helps in enhancing the intuitiveness and findability for the users of the system. User flows and Card sorting were the two methods of content inventory done for this project.

6.1. USER FLOWS

The user flow is the path a user follows through a interface to accomplish a goal or complete a task. User flows are sketched even before the prototyping phase, to make sure that the whole application is designed in context with the user’s expectation. It is also a process of not getting derailed during the designing phase. The navigation in the whole system is explained in parts for better understanding. When the user’s narrative description is sketched into a flow of tasks the possibility of things that might go wrong during execution can be identified.

6.1.1. GUEST SERVICE MODULE - USER FLOW

After thorough analysis of the data gathered from Initial stakeholder and user interviews, User flows were constructed. Initially multiple rough sketches of the user flows were discussed and improvised repeatedly so as to suit the requirements. It finally got settled on the following set of pictures as described modules. As mentioned earlier in the scope of the application, the application has two modules.

Fig 16 demonstrates the user flow for guest service module, were the actions are indicated with user –iphone icon and the process is represented in dashed lines. In the guest service module, user has to login/register to the particular hotel branch application in order to enter into the application. This entry point avoids unnecessary signups for the hotel other than their customers. In order to access the guest services of the particular hotel, user will check-in 24-hours prior with their booking reference number. Soon after they check-in, the user can access any type of guest service and order them. The ordered receipt will be saved automatically in the receipts section of the application. The process of guest service ordering is limited to three steps (review, select and order) as shown in fig-16.

Payment is not included in this application as the users and also stakeholders preferred not to have it in this version. Similar to check-in, check out can be done via the application itself. During check-out, the pending bills will be displayed to the user. In this way, the user will be made aware of the bill that has to be paid in the hotel concierge.
The guest service and receipts section definitely needs a check-in action from the user. The highly prioritised pre-requisites like food, transport, spa, housekeeping services by the women business traveler are decided as some of the mandatory menu items that has to be guest services. The remaining contents of guest services and its sub-menu items are structured in the next section i.e. Card sorting.

![User flow for Guest service Model](image)

**Figure 16: User flow for Guest service Model**

### 6.1.2. EMERGENCY MODULE USER FLOW

The emergency module contains of the safety measures. It was known that there can be multiple numbers of safety measures that can be imbibed into the applications. But, to not exaggerate the complexity of the application these safety measure were limited yet very useful. It has three types of possible security facilities. This emergency module will completely work based on the GPS. It automatically updates the emergency numbers for fire station, police station and ambulance in all countries. Users can just click and make a call during emergency. Secondly, to make the user aware of their current location and the tourists/ most famous spots around her
Hotspots are included. Users are also made available with the manual search in Hotspots. It automatically lists the number of tourist place around the user’s close vicinity of about 2.5km based on their current location. Lastly, the application will alert the user regarding the happenings around the close vicinity, for e.g. accidents, vandalisms, police stations, Doctors, natural camouflages if any like earthquake, storm, tornado, etc...All these happenings will be mapped onto the Maps section in Alerts. This is done, so as to bring awareness for the user’s safety. Fig 17 presents the user flow of emergency module. Emergency module is open to the users even without check-in. Login / register is just enough to access the emergency module. The functional requirements & contents in each of these are discussed in the Card sorting and prototyping parts of the document.

![User flow for Emergency Module](image)

### 6.2. CARD SORTING

The aim of this exercise is to find out the general content required for this hotel app based on user’s conceptualization and categorization. As a result of user’s categorization, the information architecture for this mobile hotel was built. This technique is used to get ideas for restructuring sites to increase intuitiveness, discovery and findability. Just like arranging the deck of playing cards into their corresponding four suits clubs, diamonds, spades and hearts; Study participants are presented with a series of titles or descriptions of content and features and then
asked to organize them into groups and name those groupings. These tests are often conducted online and can be moderated or unmoderated.

6.2.1. METHODOLOGY

In a remote open card sorting activity [19], participants were presented with a list of 52 randomly arranged items. Participants were asked to sort these lists into groups according to how they feel the items should be organized and by their relation. Items that participant feel do not belong in any group are identified as well. Participants were then asked to provide appropriate category titles for the groups they made.

6.2.2. WEBSORT-CARD SORTING TOOL

An online card sorting tool known as WEBSORT was used in this card sorting exercise. Participants were provided with the unmoderated card sorting tool link to participate in the card sorting method. Different types of labels were displayed to the user on the side panel of card sorting tool once the user accesses the link by entering the name. Each participant was instructed on how to do the arrangement of labels and naming them under one category. Also, participants were given an option to comment on the irrelevant / unsorted label. Each session took around 10-25 minutes.

6.2.3. PARTICIPANT PROFILE

The following seventeen participants were selected and categorized as per the persona, based on their frequent travelling experience, Smartphone usage and online experience for conducting this hotel app online card sorting session.

<table>
<thead>
<tr>
<th>No. of participants</th>
<th>Persona 1</th>
<th>Persona 2</th>
<th>Persona 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td>28-44</td>
<td>25-39</td>
<td>21-35</td>
</tr>
</tbody>
</table>

Table 3: Card sorting Participant profile

6.1.4. CARD SORTING DELIVERABLES

After every card sort performed by the users, the web sort tool creates an automated data set. The main advantage of these web sort tools are that, throughout the process of participants sorting the cards, the tool automatically creates a number of matrix datas, tree diagrams based on
the relationships or common found pattern. Among these mixtures of data matrices the item-by-item matrix is initially considered for the data analysis.

This matrix provides a quick idea on how the user has related each item from the card set. The **Fig-18 Item-by-item matrix** is the arrangement of same set of cards in both rows and columns. For example in the figure; the first row item R2 is same as the first column item CB, i.e. “Report on services”. **Fig-18** is just a part of the complete result. The numbers as in percentage represents the number of times participants, grouped each card with every other card in the card list. The highest number in dark blue background demonstrates how these items are strongly related or grouped more often by the participants and has the highest possibility to be a set of items under the same category. The highest number also indicates the most common pattern formed from the set of results obtained. For instance, consider the items from rows R4 – R8 exactly correlates 100% with the items of columns CC – CG in **fig 18**. This percentage is likely to only help in finding the set of items that can be under a group. It doesn’t determine the category / group title of these items. The contents of the group can be figured from the analysis of item x item matrix.

Besides the items in a group, it is equally important to identify its corresponding group title or category or labels. **Item-by-Category matrix** is one of those exercises which will help in finding the category names labelled by the participant for a set of items. **Figure 19** illustrates the arrangement of Items.
in the rows and categories in the column. Similar to item by item matrix, the percentage indicates
the number of times participants grouped items across a particular category. In fig 19, the items
from the rows R9 to R14 shows a possible agreement with the category “Call emergency”. The
category name might differ from participant to participant and finding those is the critical
challenge in the analysis of card sorting results. But being said that it might vary, the category
names might not be the exact one that will be used in IA. These are initial set of names found for
a basic understanding of the participant’s expectation. The participant’s expectation in other
words can be described as on how the participant wishes to recognize, certain set of elements
while they use an application. Categories are found as similar / most used patterns but not as the
finalised title. These categories at least display a link or correlation with the contents in it. Some
of the categories obtained from the card sorting results are listed below.

- Emergency (5), Emergency calls (3), Emergency contacts (1), Call (2), Call contact (1),
  Call emergency (1), Contacts (1), In case of emergency calls (1).
- Food (9), Food apps (1), Food services (1), Foods (1), Foods &bars (1).
- Hotel info (4), Hotel details (2), Hotel (2), Hotel facilities (1),
- Report (5), Complaint box (2), Emergency (2), Hotspot and reporting (1), Complaints (1)
- Transport(5), Things to take care of(2), Travel(2s), Transport apps(1), Transport details(1)
  , Travel details (1), vehicle info(1), Tourist info(1).
- Order/Orders (5), Orders &bills (1).

Note: The numbers near categories indicated the number of times participants used the same
category.

If we take a quick glance at the categories listed out, it’s visible that participants have
labelled a category in different ways referring to the same meaning. It’s really confusing as of
how to reduce it to a single category. For example consider the first example; here the category
emergency is described in different ways like emergency calls, emergency contacts, call, call
contact, In case of emergency calls, etc... But the context is absolutely same. Amidst all those
multi dimensions to a single category, it is vital to track down the theme beneath these categories
to know the general representation of it. If the difference is figured out, then the context can be
found. Same category might be labelled differently in terms of same meaning (synonyms),
abbreviations, short forms, phrase or similar set of words. Consider report from the above list;
here report is also depicted as complaint box. This explains the differing synonym factor. In this way, the categories for its corresponding items are channelled out.

**Fig 20: Dendrograms, or tree diagrams**, are formed from card sorting results. It displays a relationship between the items in all groups in the form of branches and clusters. Identifying the clusters is critically tough. In these branching, the higher the distance; higher is the difference. The shorter the distance; shorter is the difference and more similarity. It shows the different strategies and groups that the participants prefer. It provides limelight to different IA. More or less acts as a complimentary evidence for both item by item matrix and item by category matrix.

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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar</td>
<td>Cocktails</td>
<td>Coffee</td>
<td>Evening snacks</td>
<td>Dinner</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restaurants</td>
<td>Restaurants</td>
<td>Ice cream</td>
<td>Ice cream</td>
<td>Ice cream</td>
<td>Ice cream</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast</td>
<td>Cross analysis of items vs items</td>
<td>Cross analysis of categories vs</td>
<td>Cross analysis</td>
<td>Cross analysis</td>
<td>Cross analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entertainment</td>
<td>Emergency</td>
<td>Order/orders</td>
<td>Vehicle drop</td>
<td>Cost per mile</td>
<td>Mile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After thorough analysis of the card sorting results such as patterns, tree graphs, Cross analysis of categories (vs) items, cross analysis of items (vs) items various categories and their corresponding group were identified. This also influenced the Information Architecture (IA) of this application. The list of categories and its contents named by the participants are arranged as follows in a random order. The numbers next to the category indicates the number of participants named the same. Upon analysis, the most common categories and their related group/labels were identified as follows in different categories such as entertainment, check in, check out, unsorted, emergency, Order/orders, food, hotel info. Groups and their corresponding items are listed in the following table;
PHASE IV- RAPID PROTOTYPING

It is more or less similar to that school fun where, children are asked to sketch a picture from a single line theme. All the imagination and relevant conceptualization are done in accordance with the single line theme that was given to them. Each field describes this in every different way such as story boarding in gaming and industry; scripting in arts field; protocols in bio field; Goal of prototyping is convincing the client and the designer with basic sketches about an idea. All the feedback obtained is described in the sketches visually which also details out each and every design standard and development specification required for the functioning of the system. All the behaviours and the interactions are clearly stated out in these set of prototypes. **Figure 21: Rapid prototyping** best describes the process of rapid prototyping. All the feedback from the users is captured to generate an idea. This idea then is sketched as a storyboard or a flow of tasks. Later these flows are discussed and evaluated with users, stakeholders, designers and developers. The entire yes, no and edits regarding the initial sketches are captured. These
captured ideas are then iterated in the initial sketch. This validation is a cycle of repetitive iterative approach. The major advantage of rapid prototyping and its review with the user is that, it helps in making minute tweaks or complete changes in the system without disturbing the whole system during the initial phase. Rapid prototyping is useful for the designers, as they can experiment different approaches without any risk. Prototypes vary from Lo-fi prototypes (initial paper sketching / black & white mock-ups) to Functional prototypes (visually designed with all functionalities). For this hotel app application, Lo-fi prototypes and Hi-fi non-functional prototypes were designed. It is briefly elaborated in the following sections.

7.1. LO-FI PROTOTYPING

In the process of rapid prototyping, lo-fi prototyping is often the first step that is carried out. For this application, it all started off with a usability expert (my supervisor) and a designer (me) discussing the feedback obtained from the users and also brainstorming the concepts. The brainstormed ideas were all sketched out on a paper, which is also known as paper-prototyping. *Fig 22: Paper prototype* illustrates a part of the sketches that was done in the course of paper prototyping for this application. These set of 40-50 prototypes are the rough-draft sketches of the lo-fi prototype which will be designed in lo-fi prototyping software. It is just done as a time saving procedure, in order to avoid too many errors while creating the lo-fi prototypes in prototyping software. These basic sketches are also iterated based on the differing ideas and concepts. The basic sketches include an outline for the layout, content arrangement, different methods, different priorities, functionalities, gestures required etc. It replicates the aesthetics of the final product if not the functional requirements completely. These pencil sketches were introduced to designers and usability experts for further optimization. The final sets of tweaked sketches were used as a reference for preparing the actual lo-fi prototyping.
I used BALSAMIQ for creating the prototypes. It was only planned to design for Iphone 4S and earlier versions. But later in October 2013, IOS 7 was introduced in the market. IOS7 interface was completely changed to flat design. There were few things that designers had to update their knowledge on IOS7, which are deeply discussed in the Hi-Fi designing section. Here in Lo-fi, the discussion is mostly about the content and IA (Information Architecture) except for the difference in the screen size. **Fig 23: Iphone 4S Vs Iphone 5 screen size** presents the difference in the actually screen sizes. Iphone 4/4S has the screen size of 960 x 640 in height by width. In Iphone 5/5c/5S, the height of the screen size is increased as 1136 x640. It was aimed to provide quite a lot of space in the centre of the screen and also for a sharp screen. Otherwise, the dimension; icon sizes of the Navigation and Tab bar remains the same as previous versions. The standards and design rules were followed from *IOS Human Interface Guidelines: Designing for IOS 6 & IOS 7* [9].
The **Lo-Fi Wireframes** as explained earlier, took several rounds of iterations and discussions. The major changes that took place in each version are elaborated in the following set of figures. This is a vital part where the differing designer’s perspective and the user’s perspective are met and produced on a screen. Which is probably why lo-fi wireframing is purposely time consuming and iterative.

**Login and register**

As every other hospitality application, the starter page of the application has the hotel branding, logo and copyrights details. In the initial versions for login (check L.H.S of Fig 24: *login/register version 1 Vs version 2*), it just had the input fields for the login and a button for registration. So in this initial version, upon clicking the registration button it will take the user to the hotel website. It was like completing the registration in the hotel website and then user themselves has to sign in to the application again. This three step process seemed to be complicated and confusing. So when discussed with the users, they preferred the registration in the application itself. In the second version of the login wireframes (check R.H.S of Fig 24: *login/register version 1 Vs version 2*) login and registration were placed in the same page. Which makes it easier for the user switch between the login and signup process.
**Functional Requirements:**

As the first step for the user, it was aimed to keep the input fields as minimalistic as possible. Providing a long page of input fields to fill in will definitely make the users bored and tired in the very first page of the application. So login started off with two input text fields for the username and password. It ended up with the check box to save password; a link for creating a new password; a login button. Signup had 5 input text fields for the demographic details, finishing it off with the declaration; a link for terms & conditions; Signup button. It was stressed by the user to provide a link for the terms and conditions.

**Check-in and check-out.**

Check-in and check-out were one among those pages were security issues were considered vital. QR codes (Quick Response code) & NFC’s (Near field Communication) were included in the initial sketches as part of the secure check-in process (L.H.S. *Fig 25: Check-in V1 vs V2*). In order to embed the QR codes in Check-in, either there has to be an in-built QR code reader in the application or the user has to use another application to read the QR codes, which basically navigates to the Room details in hotel website. NFC’s are the Near field communicator which are expensive and complicated for mobile applications. Hence QR codes and NFC’s were opted off for check-in process. In later versions, it was improvised to a simple and secure format as in the R.H.S of the *Fig 25: Check-in V1 vs V2*, were only the reference number is required to check-in to access the guest services.

**Functional Requirements:**

Only a single text/number input field was included for the user to enter the reference number so as to avoid the user entering their details repeatedly every time after registration. It was decided to keep almost all data to be read only and just display the details such as the room details, availability of check-in and checkout info, general instructions soon after user’s check-in. Appropriate feedback messages are displayed to users as a response to their previous actions and their actions are reconfirmed as in *Fig 25 Check-out* has a checkout button. If there are any pending bills, the user will be taken to the bending bills (receipts) during checkout.
Guest services

From the card sorting results, guest services were kept consistent in all versions of the lo-fi wireframe. It basically has all the basic services that the hotel provides such as the check-in, check-out, food, transport, bar, house keeping services, Spa, offers, etc., as in the Fig 26: Lo-Fi Guest service page. The functional requirements of this page was contained only to gestures like tap.
Food

The design of the food page commenced with the categorisation of food based on the different meal timings (breakfast, lunch and dinner) which is illustrated in R.H.S of Fig 27: *Food services Lo-fi*. Later after the referring the discussions from the stakeholders, it was studied that the hotels may have more than one restaurant and bar. Being known that, if there is still a designed page based on the meals it would be difficult for user to sort and select from the long list. So the later versions brought a list view of the restaurants. Users can visit the preferred restaurant and select food based on the meal timings. Order can be edited and cancelled any moment during the ordering process only. Application provides the privilege of delivering order services based on the users selected time. This review, select and order format is kept consistent with almost all services in the applications such as bars, transport, Spa, Offers with their respective content. Once ordered, the orders will be saved in receipts.

**Functional requirements:** To make this food selection simple and as easy as possible the clickable list view UI element (which just lists down set of items) was used for displaying the number of restaurants, food (with pictures) etc. The sorting options for better categorisation and
selection were provided based on meal timings (Breakfast, lunch, dinner, All) with right and left arrows. As it is a three part process were the users reviews the restaurants, selects food and places the order; a progress bar was included to update the user on their current position and remaining steps. A back button and a close button is provided on the navigation bar to traverse back to any of the step in food order. Some of the action buttons like live counters, automatic count on the pace order button, place order, select time and confirm are included which are the same in functionality as their name suggests. The appropriate confirmation and info message box are also used as a part of UI.

Orders

The orders initially were planned to be designed with its status of delivery. Check left hand side of Fig 28: Orders V1 vs V2 were the checked icon (tick mark) refers to the delivered symbol. The list of orders was arranged in two tabs (past and current), in which the delivered orders are placed in past and yet to be delivered orders are placed in the current tab. But after discussions and brainstorming, users preferred that the orders stay in receipts as long as the payments are made in the reception and the users were not much bothered about the delivery status of the order. So, the status of the orders were removed and just the unpayed orders were kept in the receipts section. Soon after the order is made, the orders will be automatically sent to the user’s email.

Figure 28: Orders V1 (vs) V2
Functional Requirements

These orders including check in and check out are listed down in the clickable list view UI. All read only details of the order including the date and time are displayed in the orders. This same page is displayed, if the user checks out without paying the bills at the reception.

Emergency

It was challenging to think about a set of emergency services that can be incorporated into an application. Every choice ended up complex and expensive. When thought about the most essential and easy choice, few options were captured. Again these choices are also complex but it stood up to the design standards and expectations. All of the emergency services are based on the user’s location via GPS. The emergency module has to stand out separately from the guest services, so that its accessible anytime at any point of the application. Hence, all the emergency services were planned to be on the tab bar or as a drop down menu in the nav bar.

As a part of being in an environment, it is known from the research that the women are extra cautious about their surroundings. To make the users aware of their current environment, tourist spots or famous things near (close proximal distance of about 2.5km) the user’s location.
are listed down in the **Hotspots** section of the application. Hotspots were initially just list of places listed and upon clicking user can access the map view.

**Functional Requirements**

As in **Fig 29: Hotspots lo-fi** the hotspots around user’s current location are displayed in a clickable list view UI element. Also, user can manually search for any places with search bar. As soon as the user clicks on particular spot, the map view is displayed. The map provides the directions to the spot with general Iphone 5 Map UI kit.

**Emergency calling numbers**

Every country has their own emergency calling numbers for fire, ambulance and police station. They either have individual numbers for emergency services (for e.g.: In India the calling numbers for Fire -101, Ambulance-102 and Police-100) or one emergency number like 121 or 911. In this application, these numbers are included in the emergency section, so that when the user clicks on call fire/ambulance/police buttons as in **fig 30: Emergency numbers lo fi**, calls are directed to the particular emergency number.

![Figure 30: Emergency calling numbers](image-url)
These emergency numbers will change automatically based on the country the users are currently in. Along with this emergency numbers, another button called the call friends is also included. Once the user clicks the call friends, user will be navigated to the contacts of their Iphone.

**Functional Requirements:** It needed only four action buttons although the emergency numbers are updated in the backend database. It is accompanied with confirmation message from the users to avoid making calls by mistake or unknowingly.

**Alerts:** The idea of alerts, started off with users selecting a set of events happening around them like accidents/ vandalism/ natural calamities etc. by providing their minutes /hours of stay at a particular place (basically check-in). Upon selecting the events, users will receive live notifications, if it happens around their vicinity. So this above mentioned process when brainstormed seemed to be spoiling the idea of the term “alerts”. Because the user has to perform multiple steps like entering the minutes / hours they will stay, select events, etc. It lowers the overall user experience. Alerts are just notifications or warning messages and not making the user to do all actions manually. So in the later versions of alerts, the whole design was completely changed into a map view. In which, if there are any incidents (accidents / natural calamities, vandalism, strikes, etc) happening in the close vicinity, it will be visually pinned onto the map on the particular address. Also a message notification will be displayed on the screen to the user. In this way, women business travellers can stay safer knowing about their happenings in the surroundings. **Fig 31: Alerts** demonstrates the comparison between the earlier and the current version of alerts.

**Functional requirements:** Although it deals with lot of backend work, the map view was supported by IOS Map UI kit. Manual search and distance are disabled as it just displays the content. Gestures that are used in the page are zoom and single tap to pop open up the address of the events.

**Note:** Usability testing-I was performed with these set of lo-fi wire frames after all the iterations. Usability testing-I and its results are discussed [here](#).
7.2. Hi-Fi PROTOTYPING

This is the phase were the product is visually brought alive, more like a blueprint. There is no need for a designer to explain it to the client or users, as the product is produced visually. It reduces the burden of the user and the client to imagine about the product as in the lo-fi wireframes. The hi-fi designing is a process of enhancing the lo-fi wireframes with perfect display resolutions, colourful UI elements that are apt, different font families for the text, typography, gradients, textures, scaling, brightness and contrast capturing the essence of the finished product. A perfect attention to every pixel takes place in hi-fi design. Again, IOS defines a set of UI elements, resolution (ppi), font, different design standards, etc in the Human Interface guideline (HIG) for the designers.

The IOS HIG also insists on following the set of design norms as per instructed to avoid unnecessary elimination during the beta testing of application in App stores. The hi-fi designing is usually done in tools such as Adobe Photoshop, Illustrator, Etc... I designed it in Adobe Photoshop as I’m familiar with it. But for the icons, I used Adobe Illustrator as it works better for vector based icons.
Retina Resolution

The smartphone display resolutions are defined in pixels. These pixels are commonly used, as it existed as the easily understandable unit for designing. For example, iPhone 3GS offers the resolution of 960x640 (height by width) resolution, with 163 pixels per inch. As far as smartphone is concerned it keeps evolving. The evolvements happen in every hardware and software element. So did the evolution of resolution with pixels. The Retina Display is the resolution named by Apple 2010, for its high resolution screen display in iPhone 4. It provides high quality image than any other resolution. Any display can be a retina display when it offers a pixel density above 163 pixels per inch. The company Apple claims that its resolution is the maximum amount of details that a human eye can perceive. Retina Display is designed to smooth the jagged edges of pixels to provide a higher-quality image than previously available on mobile devices [20]. This effective technology is especially prevalent or noticeable in texts. Here’s how the magic works in retina display. The pixels per inch are increased to an exact doubling of 326 ppi compared to its earlier version of 163 ppi. The higher the number of pixels per inch, the sharper screen appears. It means that these extra pixels are shrunk at an inch to provide lot of details to form the high image quality/sharpness. The difference in the sharpness of the image is displayed in fig 32. The Retina display for Iphone 5+ is 1136x640 with pixel density of 326 ppi.

How is this retina display achieved in Adobe Photoshop designing?

In order to achieve retina display all the UI elements should be exported with two images. First is the 1x image and the other is the 2x (retina image with 326ppi). The retina image should
be exactly two times larger than the normal 1x image in every dimension. For eg: If the user friendly touch sensitive icon on an Iphone screen is 44x88 , then the 2x(retina image) should be 88x176 px. While exporting, the retina images are tagged with last name”@2x” along with their original name as in fig 33: Retina image scaling. 1x images are also named in the same manner. The common way of building this 2x and 1x images is using Slicing or scaling in Photoshop design. Scaling method works better and easy, in which the 2x image is first designed with double the times its dimensions. To obtain the 1x image, 2x images are scaled down by 50% of its size; for example, if the image 100x100 it’s scaled down to 50x50.

Why is it so important to differentiate between these 1x (non-retina) and 2x (retina) images in Iphone retina display?

The Iphone models range from Iphone 3 (low pixel density image quality) to Iphone 4+ (Retina display). 1x images that are lower in image quality will be used in Iphone models that were released before Iphone 4+ models. The 2x images are used in the Iphone 4+ models which have retina display. It is important to upload both 1x and 2x images during the development, as earlier versions of Iphone (IOS) doesn’t automatically downscale the images from 2x to 1x.

**Gestures**

The gestures are now a vital input part in interaction design for smart phones with touch screens. These gestures are equally emphasized and looked up as an element of the User Interface (UI). Since the era of touch screens, gestures have redefined the term “Interaction design” on touch screen devices. It allows the users to perform a specific task on the device, in a very simple; efficient; dynamic and easy way. Most of the time, designers are only keen on the visual content and information architecture. But as a user experience designer the gestures are
considered primary. It can be a single-step replacement for a multiple step process. For example: In regular mobile phones, if the messages in the inbox are to be deleted; the user has to select on multiple steps. Whereas, in smartphones, it’s a single left or right swipe gesture. It’s up to the designer’s creativity to decide on the gestures, as long as it suites the apt purpose and requirement. Some examples of IOS applications that almost completely work on gestures are Fruit Ninja, Temple run, 2048, Pair, etc... Fortunately, IOS7 has introduced few more interesting gestures to complete tasks faster. This application contains the basic standard gestures which are compatible with Iphone 5 and its previous versions, as it is not a gesture oriented application. **Fig 34: IOS Gestures used** presents the list of gestures utilized in this application. Tap is to select an item; Scroll is to traverse between the data on the same page; Spread is to zoom in and zoom out on the screen; Drag flick is to swipe left or right for deleting or to move.

![Figure 34: IOS Gestures used.](image)

**Flat User Interface design**

The flat user interface is a new terminology wide spread in website and mobile interface development. These flat user interfaces are simple, modern, attractive interfaces without gradients, textures, shadows. It stands against the *Skeumorphism* [21]. It’s getting familiar for its approach of only providing important and essential information to its users. IOS7 offered its complete flat UI design in the fall of 2013; which takes the textures, bezels and gradients out of the UI and replaces them with simple and clear design elements. **Figure 35: IOS6 Vs IOS7 UI Design demonstrates the clear difference.** In a designer’s perspective, flat design replaces functionality over style. The most common design change is the removal of bars and raised buttons from the UI. The bars are gone, and the buttons have been replaced with text or arrows.
The colours are used to draw eyes to something important, not to make things look pretty. The images are used when the app calls for it and they often have a transparent appearance.

IOS7 HIG provides standard *Flat UI Font* family mostly like, *Helvetica Neue Light, Ultra light* which are crisp or sharp in densities. These font sizes and family are defined by default in HIG for the navigation and tab bar. Flat UI otherwise for it looks are easy to handle complexity. From a developer’s perspective, the UI elements of flat design are easy to read as they are only vector elements. It honours the minimalism factor all in all in the user interface.

![Figure 35: IOS 6 Vs IOS 7 UI Design](image)

**No Skeumorphism**

*Figure 36* best describes that Flat UI is against Skeumorphism. *The Skeumorphism is a look like design or imitation of a real world objects as digital design.* For example: Applications like the passport has a leather texture and the threaded border as its background to represent the passport purse material. In the figure, IOS6 has its background as the imitation of paper bill with paper texture and the zigzag border. IOS7 completely avoids these styling factors and only provides the information and functionalities. None of the UI elements from the IOS 7 design has shadow and
gradient attributes highlighting the edges. Bars are replaced by transparent images in IOS7. Some of the evident difference in UI elements of IOS7 and IOS6 are listed in Appendix-B.

The Lo-fi wireframes, discussed in the rapid prototyping section were developed into hi-fi designs. Few of the visually designed hi-fi screenshots are discussed in the following section based on the type of guest service. Fig37: Geo Fencing demonstrates on how the application prompts the user about their current location after their login itself. Geo fencing [22] is a location-based service that sends messages to smartphone users who enter a defined geographic area.

Geofencing plays an important role in updating the emergency numbers of each country; only if the countries
are known, application can auto update the respective global numbers. If this is not automatic, the location or the country should be changed by the user manually in iPhone settings which would have been a huge flaw in user experience.

**Login & signup**

As discussed in the Lo-fi wire framing, login and signup with the terms and conditions were visually designed as in the **Fig 38: Hi-Fi login & signup**. From the results of Usability test-I, it was learnt that users do not prefer login and signup as the starter page. As it is a hospitality application, the users preferred to take a look into the application (one or two pages). Having the login & signup as the starter page was kind of like a hindrance for the users to at least know the application. It is possible that the users could leave the application because of this process. So as a solution, the login and signup process was removed from the Starter page, left with only the branding and copyrights details. The application was kept open, so that the users can view the alerts screen, settings screen which has the description of hotel, contact details etc. But, if they access any of the functionalities on the tab bar it will take them to login/signup.

![Figure 38: Hi fi Login & Signup](image-url)
Check-in and Checkout

Check in hi fi designing has time zone along with date on it. The user can only login via their reference number and not with any other personal details. This is done for complete security purpose. Once the user has checked in, the instructions and the room number info are provided as in the Fig 39: Hi-Fi check-in & check-out. The difference between IOS6 and IOS7 designing of the same check in page is displayed in the figure. During this period user can click on check-in to see the room details or the receipts in the receipts section. Check out is similar to that of check in; but check out are made available only a day before their checkout.

Food Services

The structure that is designed for food services are kept consistent throughout all other guest services like bar, transport, spa, offers, etc...The first screen of food service is a list of restaurants in the hotel. Once the restaurant is selected, the page as in fig 40: Hi fi IOS7 food service appears which is followed by the order screen if the orders are placed. From fig 40, it can be noticed that IOS6 has gradients. IOS 7 designs are differed by their gradients and bars as in fig 40: Hi fi IOS7 food services
Emergency Module

The hi-fi designing of emergency module was iterated and evolved a lot from the lo-fi. The unique emergency numbers of all countries are uploaded in the application so that the application automatically updates these numbers by itself using Geo-Fencing [22]. Other than few fuzz in logic of the call friends feature, the idea of emergency calling was accepted well in usability testing-I. As per the feedback from Usability testing-I, “call friends” feature from emergency calling went highly debatable on how the users can select friends from a list of 100 contacts while flying in a different country. It was discussed and brought to a solution that, the user can select three friends either from the country that they are travelling or any place as per their wish. This can be configured in a settings page that is only available for “call friends” feature. In fig 41: Hi-Fi Emergency when the user clicks “friends”, the application will immediately prompt the user to configure (adding three mobile numbers) the settings. These settings will result in the application prompting the user to call either of the three in a list box when “friends” is tapped.
Alerts Map and Hotspots

The alert displays the user’s current location with a pulsing animation. Police stations, hospitals and clinics are also displayed on alerts. Hotspots list all tourist spots near the user.
Note: The Usability testing-II was performed with these set of hi-fi frames. Usability testing-I and its results are discussed here.

8. PHASE V- USABILITY TESTING

The usability testing is a technique used in user-centered interaction design to evaluate a product by testing it on users [22]. The usability testing focuses on measuring the usability (ease of use and efficiency of task completion) of a product’s capacity to meet its intended purpose. The results from the usability testing are useful for the designers and developers to identify problems before coding. In usability testing, users will be given with a set of tasks to complete. The details of the user completing the tasks are recorded, observed and noted down. In this way, the completion rate, task failure, user satisfaction is determined from usability testing. The results are either qualitative or quantitative. In certain cases it involves both qualitative and quantitative results. Usability testing is done with large and small sample for all devices, websites, mobile, mobile applications, etc...This type of testing can be performed with lo-fi wireframes, hi-fi wireframes at any part of the development as long as there are users and materials to test. A perfect usability testing can be performed with 5-6 users as per Nielson Norman Group.

8.1. USABILITY TESTING-I:

The main purpose of usability testing-I is to test the lo-fi wireframes of the hotel mobile app via remote usability testing. This usability testing plays a vital role in knowing the following.

● To record, task completion of guest services.

● To observe how the users approach emergency module and complete the tasks.

● Update the information architecture based on user comments.

8.1.1. PROJECT METHODOLOGY

The moderated remote usability testing was done with real time users who have enough business travel experience and mobile application usage. The moderated remote usability testing
was chosen, as the test participant and the organiser / facilitator of this testing are from different physical locations. The test participants were from Singapore, Sweden and India. It’s called moderated because instructions and links are provided to the user by the person called “moderator/facilitator” at the other end of the test participant. The moderator records the whole conversation and helps the test participant if there is any clarification. The major advantage of remote usability testing is that it’s cheap and non-expensive. Also, it is easy to collaborate with the users over different geographical location. In this remote usability testing session, the users were given with a set of tasks along with the instructions to perform it. The feedbacks from user are helpful to update the lo-fi wireframe. This remote usability testing took place for around 45-55 minutes online, including technical check, testing instructions, set of tasks and post questionnaire. The total number testing participants are 7 + 3 backup test participants. **Table 4: Participant profile for Usability testing-I** describes the different personas chosen for testing including backup participants.

<table>
<thead>
<tr>
<th></th>
<th>Persona-I</th>
<th>Persona-II</th>
<th>Persona-III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of user</strong></td>
<td>Expert</td>
<td>Medium</td>
<td>Novice</td>
</tr>
<tr>
<td><strong>Travel Experience</strong></td>
<td>&gt;4 times a year</td>
<td>&gt;2 times a year</td>
<td>No travelling experience</td>
</tr>
<tr>
<td><strong>Mobile Usage</strong></td>
<td>Maximum</td>
<td>Minimum for mail, call and text</td>
<td>Minimum usage like gaming, etc...</td>
</tr>
<tr>
<td><strong>No. of participants</strong></td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

*Table 4: Participant profile for Usability testing-I*

**8.1.2. TEST MODERATION & FACILITY**

This moderated remote usability testing was done via Skype. One moderator was in charge of the remote usability testing. The moderator was also responsible for asking questions to the user and interrogate on their actions. Further user’s behavioural reactions were recorded using Skype video recording software. Other observations such as extra points that user wishes to quote will be undertaken by the moderator itself. The usability testing was initiated with the consent confirmation for video and audio recording for about 5 minutes which includes the time for the user to read the content and agreeing with it. For the next 10 minutes, set of instructions were explained to the test participant by the moderator. These set of instructions had information on what is to be done, questioning on doubts, etc... After which the task scenarios were shared
with the user one after the other for 20-25 minutes. Finally, a post questionnaire and a talk aloud session was carried out with the users on the experience and comments for 10 minutes.

8.1.3. TASK SCENARIOS

List of 9 task scenarios were provided to the test participants. The participant will then have to review on the screen captures/tasks of the hotel mobile application and provide feedback for it. Following are the nine task scenarios.

TASK-1 (Login/register): Imagine that you downloaded this hotel application for the first time and you wish to login via the following set of images. Have a look at the screen carefully to register first and login.

 Screens displayed: Login and register screen; Registration confirmation screen.

Steps for completion:

- Click on Register; fill in the details;
- Click on Login; Enter login credentials to login.

TASK-2 (Find hotel profile): Choose suitable to know more about the hotel and its branches.

 Screen displayed: Guest services page & Settings page

Steps for completion:

- Click on settings icon on the Navigation bar.
- Select Hotel profile.

TASK-3 (Check-in): Assuming that you have booked a room already, with the reference number “A1234THM” please check in to the application to access the guest services.

 Screen displayed: Guest services, Check in page, Room details.

Steps for completion:

- Select check-in from guest services.
- Enter reference number; Click ok.
- Review room details; Click ok.
TASK-4 (Food order): Select Cheese pizza from the rain forest restaurant for your dinner at 9:30 pm and place the order.

*Screen displayed:* Guest services page; Restaurant list; Food list; Order.

*Steps for completion:*

- Select food; Select rain forest restaurant;
- Select cheese pizza; Enter time; confirm order.
- Click ok to save order.

TASK-5 (Find receipts): Find the order receipt for the same cheese pizza that you ordered and review the details.

*Screen displayed:* Same food order page; Receipts page

*Steps for completion:*

- Select receipts from the tab bar.

TASK-6 (Order Transport): Book a half hour Toyota Etios cab ride prior to the business meeting that is scheduled for tomorrow morning 9:30am.

*Screen displayed:* Guest services page; Taxi list; Taxi order.

*Steps for completion:*

- Select taxi from guest service;
- Select Toyota Etios from the taxi list;
- Enter pickup details; Select time; Confirm order

TASK-7 (Emergency): On the way from meeting, you happened to see a girl abused by a bunch of guys. You wanted to call police nearby? How would you do via your application?

*Screens displayed:* Same Taxi order page; Emergency.

*Steps for completion:*

- Select emergency from tab bar.
- Select Call police

**TASK-8 (Hotspots around):** As it’s your last day, you should be ready to find details on the nearest shopping malls and tourists place around you. Where can you find that information in this application?

*Screen displayed:* Guest services page.

**Steps for completion:**
- Select hotspots from tab bar;
- Search; or select respective tourist spot from the list.

**TASK-9 (Checkout):** Hope you had a best stay. Please check-out of this application.

*Screen displayed:* Guest services page.

**Steps for completion:**
- Select guest service
- Click checkout button

### 8.1.4. USABILITY TESTING RESULTS

The usability test results from 9 users were analysed thoroughly including all the general requests and comments provided by the test participants. The qualitative issues that were obtained from the results are categorised under important sub sections of user interface designing such as Taxonomy/Terminology, Hierarchy, Navigation, and Interface. The quantitative data is used for the measurement of overall usability success rate and task success. The above mentioned issues are discussed in the following section.

**TAXONOMY /TERMINOLOGY**

The data is scattered throughout set of pages in this application. Every set of data is arranged in its relevant group. Content arrangement is done in Information architecture. These groups should be identified by user with a group name rather than the chunk of data. This naming is done completely depending on the relevant data present in the group. For eg: A basket that has orange, apple, grapes, pears will be known as fruit basket. This logical labelling tradition
is called Taxonomy. The taxonomy is a vital part of the Information architecture. As per the results obtained from usability testing-I using the lo-fi wireframes, test participants had lot of issues with the taxonomy and terminology.

- It was specified that the name or the term was not understandable as it seemed either difficult/strange/irrelevant. Those words are concierge, Archives, around me, Alert, fire fighters, complaint type, transport, call friends, dropdown. Test participants felt that these words are too vague and it doesn’t provide a detailed relation or guidance of what the user can get from it. Replacement of the words with familiar words was requested by the test participants.

- The users provided requests and suggestions for the previously listed names that have to be changed. In the same order they should be changed from Concierge→ Menu, Archives→Orders/Receipts, Around me→Tourists place/hotspots, Alerts→Message/Order confirmation, Fire fighters→Fire station/fire services, Complaint type→complaint about, Transport→Book a taxi, call friends→call from contacts, dropdown→destination.

- Polite Sentences like “Thank you for the order! Welcome back again!”, “Have a pleasant meal” are missing. These are few of the many small details that might make the user use the application.

**INFORMATION ARCHITECTURE**

The arranging and organization of data in their respective relevant groups are done in Information architecture. It helps in finding information in short search period. The structure of the product is represented in an easy understandable way. During this usability testing, test participants mentioned that some of the functionalities are misplaced and they would prefer it in a better relevant place. The following are the menus or functionalities that need change in their current position.

- Almost all test participants preferred a simple 2-3 step signup process integrated in the application itself.

- Highlight Emergency services with extra emphasis as it is very important amongst the other services.
Differentiate the profile information separately from the hotel information separately in the settings menu.

A categorized list (like hotels, theatres, etc.) can make this around me much better. A toggle button with the list and map view can be included, so that the user can switch between the views.

A common request was to provide suitable titles for date and time during check-in with time zone.

Display the terms and conditions in the same page as the signup process.

Mostly all users want the List menu (because that’s more familiar and easy to traverse between data).

**NAVIGATION**

The navigation design is the design of methods of finding one’s way around the information structure [23]. Navigation is how a user gets around on an application – and if it’s lacking in effective navigation, it is not going to work, the way it need it to. In this usability testing, test participants struggled in finding the way to move onto the next steps. Those issues are listed down in the following points.

- **Alignment:** The users requested the change in alignment of guest services as: Check-in, transport, rooms, restaurants, bar, gym, spa, and check-out.

- **Buttons:** Most of the participants had difficulty in finding the icon “=” on the navigation bar. They tried to search for the option “about the hotel” in the concierge. They also insisted on having “about the hotel” separately, so that it would be easy for them to do it. The button “=” was not understandable and appealing. So, finding hotel profile was difficult. Basically the buttons such as next, confirm, back etc... Were used on the navigation bar as guidance to the next step. But, test participants felt that next button / confirm / cancel button on navigation bar of certain pages were not appealing and so they had difficulties in moving on to the next step and couldn’t complete the task.

- **Progress bar:** The number of steps in check-in is not visible for the user. Test participants suggested a progress bar would help them understand the whole process and its steps.
INTERFACE

The interface design concerns the controls, mechanisms, and processes that users require to perform their tasks on systems and so meet their goals. For example, an interface designer determines whether to use a menu rather than a set of tabs, whether to use a drop-down list rather than set of radio buttons, and the process, or steps, for setting up a new email account using a wizard. This inevitably means that interaction design is about creating affordances—including defining what controls do and how to communicate what they do to users—that is, designing affordances. Some of the information regarding Interaction design is listed as points. These points are direct feedback obtained from the test participants.

- In the food listing page, users requested to include the zoomed in view of the food. Include the missing information such as size of the serving (small, medium, and big.), timings of lunch, dinner, and breakfast about when they are served would also help. Also it was recommended to follow the same List view UI throughout the application.
- In general for all the ordering services like food, taxi, spa and gym the orders that are made should be visible while ordering.
- Information on where to collect the keys, room info, floor no, corridor info are missing.
- Icons are not understandable. For example • “other” icon and the “menu” icon looks identical this may confuse the user. Either of it should be changed.
- Check in and check out details should be available to download as a PDF version.
- Application cannot seem intent and vast. A video or guiding can be incorporated as a tour to know how this app will be useful to user with all its services.

GENERAL REQUESTS

From the genuine consolidated feedback from users, it was implied that the user was asked to manually do many tasks at once. In this age of minimalistic design and where the user is at the centre of every app, that seemed a little off for the users. It had a lot to do with input fields and decide on the navigation. Also, it was highlighted that certain services are restricted to current day; if that’s modified then the app will be even more useful. It can be more engaging
rather than just info seeking. For example, user rating the tourist spots reviews on hotels, sharing the hotel reviews to friends. Directions inside the hotel can also be added here. Do not place the sign-up process as the first step, as most of the users like to take a look at the application

**OVERALL & TASK SUCCESS RATES**

The previous set of results was qualitative data obtained from the users. The task success and overall success are calculated from the quantitative data. The overall success is measured by the percent of participants who completed each task successfully. Consider the data shown in *Table 5. Overall success*. This is totally based on actual data from the usability testing of lo-fi wireframes. It is crossed tabulated with Tasks and user as in the table. This table describes the set of results which are success (S) when a user completes the task; failure (F) when the user did not complete the task; success with difficulty (SD) when the user has partially completed a task. These resulting parameters indicate assumed values based on their task completion. They are either 0’s (indicating task failure) or 1’s (indicating task success) and 0.5’s (indicating success with difficulty). The overall success rate [25] is calculated based on the formula *Overall Success Rate* = \((S\times C + SD\times C)/(S+SD+F)\). Therefore, based on lo-fi wireframes usability testing results, the calculated overall success rate is 73%.

<table>
<thead>
<tr>
<th>Users/Task</th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
<th>U4</th>
<th>U5</th>
<th>U6</th>
<th>U7</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (Login/register)</td>
<td>S</td>
<td>F</td>
<td>F</td>
<td>SD</td>
<td>S</td>
<td>S</td>
<td>SD</td>
</tr>
<tr>
<td>T2 (Find hotel profile)</td>
<td>S</td>
<td>SD</td>
<td>SD</td>
<td>S</td>
<td>F</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td>T3 (Check-in)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>T4 (Food order)</td>
<td>S</td>
<td>SD</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>F</td>
<td>S</td>
</tr>
<tr>
<td>T5 (Find receipts)</td>
<td>SD</td>
<td>SD</td>
<td>SD</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>T6 (Order Transport)</td>
<td>S</td>
<td>S</td>
<td>F</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>SD</td>
</tr>
<tr>
<td>T7 (Emergency)</td>
<td>S</td>
<td>S</td>
<td>F</td>
<td>F</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>T8 (Hotspots around)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>SD</td>
<td>SD</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>T9 (Checkout)</td>
<td>S</td>
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<td>S</td>
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<td>SD</td>
<td>S</td>
</tr>
</tbody>
</table>

*Table 5: Overall success-Usability Testing I*
Task successes are calculated when there are more than one user and one task. The row wise average from table 5 provides the task success rates. It is measured by calculating the percentage of tasks each participant completed successfully. The radar diagram in fig 43: Radar diagram for Task success, it can be noticed that the Task 1. Login/signup has 57% has its task success rate. It means that 57% of the participants were successful in completing Task. Similarly all other tasks success rates are calculated task wise. Users were very successful in check-in (100%), Food order/Transport order/Hotspots around (92%). Some of the tasks success were moderate with Find receipts (78%), Checkout (78.5). Other three tasks that were not successful and had some difficulty in them are Login/signup (57%)/ Find hotel profile (57%) and Emergency (57%). This was helpful in finding were the users had difficulty in completing the task such as emergency, login/register and finding hotel info.

8.2. USABILITY TESTING-II

The purpose of usability testing –II was to test the hi-fi designs that were created after feedback results from lo-fi testing. Also to test the user experience of the application, on how the user is able to understand the navigation and the abstract of the application with graphic design.

8.2.1. METHODOLOGY & TEST MODERATION

An unmoderated usability testing via the usability testing tool called IntuitionHQ was carried out. IntuitionHQ is a special free tool testing screenshots or images with click heat maps. It is useful in testing designs quickly and easily. It also IntuitionHQ provides user feedback to clients simply and visually with click heat maps. The click heat maps, records a participant’s click in a significant point on a screen represented in colours. It is often used for easy result analysis. Most heat maps are characterised with red being the most often clicked area down to blue or green being the least clicked (and absence of colour being not clicked at all). These heat maps are often used to examine the usability and navigation of the product. Because, the click heat maps provides information on the areas were the testers have most clicked. Also, the rarely clicked points and
leaving points (as in, they quit completing the task) are also visualized. When this is identified, this void in the navigation design can be filled in and iterated for the better. On the other hand, users might click on blank areas of the page or they might accidentally click in those areas. That might be a clue to use that area better with design. The deliverables of the usability testing tool are visual click heat maps, number of clicks and the average task completion seconds for each task. A total of 6 participants from usability testing-I were chosen for the usability testing. The participant profile was equally recruited with 2 participants for each persona (personas are same as in Table 4). Usability testing was conducted on the internet by distributing the testing link generated by IntuitionHQ tool was among these six participants.

8.2.2. TASK SCENARIOS

As the participant profile was already known from previous Usability testing-I, just the tool was used to record the demographic details of participants; which were almost similar to the pre-test questionnaire. Although there was good feedback for some of the tasks like food order, hotspots, transport, check-in, etc.; they were again retested in this testing as they had minor and major tweaks in them. The participants were asked to perform a total of 7 tasks with simple subtasks in 25 minutes. All proper instructions were provided before the test and on the link as it was a non-moderated usability testing. In the post questionnaire users were asked to provide user rating for the applications. The following are the tasks scenarios that the user performed.

TASK-1 (Check-in): Assuming that you have booked a room already, with the reference number “A1234THM” please check in to the application to access the guest services.

Screen displayed: Guest services, Check in page, Room details.

Steps for completion:

- Select check-in from guest services.
- Enter reference number; Click ok.
- Review room details; Click ok.

TASK-2(Find hotel profile): Choose suitable to know more about the hotel and its branches.

Screen displayed: Guest services page.
Steps for completion:

- Click on settings icon on the Navigation bar.
- Select Hotel profile.

**TASK-3 (Food order):** Select 1 set of “Coffee and Croissant” from the Italian cuisine restaurant for your dinner at 9:30 pm and place the order.

*Screen displayed:* Guest service page; Restaurant list; Food list; Order.

Steps for completion:

- Select food ; Select rain forest restaurant;
- Select cheese pizza; Enter time; confirm order.
- Click ok to save order.

**TASK-4 (Find receipts):** Find the order receipt for the same cheese pizza that you ordered and review the details.

*Screen displayed:* Same food order page; Receipts page

Steps for completion:

- Select receipts from the tab bar.

**TASK-5 (Order Transport):** Book a half hour Toyota Etios cab ride prior to the business meeting that is scheduled for tomorrow morning 9:30am.

*Screen displayed:* Guest services page; Taxi list; Taxi order.

Steps for completion:

- Select taxi from guest service;
- Select Toyota Etios from the taxi list;
- Enter pickup details ; Select time ; Confirm order
TASK-6 (Emergency): You would like to visit a tourist place “Zingria’s Bridge” but you don’t know where it is? What would you do?

i) Assuming that on return, you lost your passport and you want to call the nearby police station? What would you do?

ii) Where can you spot the near police station location on the app?

Screens displayed: Same Taxi order page; Hotspots; Emergency and Alerts.

Steps for completion:

- Select hotspots from tab bar; Search; or select respective tourist spot from the list
- Select emergency from tab bar. Select Call police.
- Select alerts from emergency; Check on maps.

TASK-7 (Checkout): Hope you had a best stay. Please check-out of this application.

Screen displayed: Guest services page.

Steps for completion:

- Select guest service
- Click checkout button

8.2.3 RESULTS & ANALYSIS

The test results was analysed with the data obtained from the usability testing tool such as the heat maps, average seconds of each task completion, user rating, task success, etc. As in Table 6: Overall success- Usability test II, all tasks were quite successful with good feedback except for receipts and hotel info. The task success rates of these tasks are 67% and 58% respectively. Moreover, the average task completion seconds analysis revealed that receipts and hotel info task took the maximum time of 22.32sec and 34.6 sec respectively. When compared to other task completion hotel info was considered hard and time consuming. Hotel info’s task success rate was more or less the same in previous usability testing. In order to study what was really distracting the users during the hotel info task, the heat maps of the tests were keenly analysed. Check Fig 44 for the heat maps of hotel info. In fig 44 only two users clicked on the
area “Settings” to complete the task. Some of the users clicked on guest services. The rest of the users accidentally or unknowingly or knowingly clicked on spaces which were totally not related to task completion. The users, who clicked on the guest services, expected the hotel info to be in the guest services. Hence there was at least a hint to find why there was failure in hotel info task success. Similarly on analysing the receipts heat maps users quit their task by clicking it on guest services or any other space.

On conclusion, the overall task success of the usability testing was calculated as 86.75% which is comparably higher than the previous Usability testing with lo-fi wireframes. Overall user experience was rated 3.8/5 and the visual designing of the application was rated 3.5/5.

### Table 6: Overall success – Usability testing II

<table>
<thead>
<tr>
<th>Users/Task</th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
<th>U4</th>
<th>U5</th>
<th>U6</th>
<th>Secs</th>
<th>Task success</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (Check in)</td>
<td>S</td>
<td>S</td>
<td>SD</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>10.4</td>
<td>92%</td>
</tr>
<tr>
<td>T2 (Find hotel info)</td>
<td>S</td>
<td>S</td>
<td>SD</td>
<td>SD</td>
<td>SD</td>
<td>F</td>
<td>34.66</td>
<td>58%</td>
</tr>
<tr>
<td>T3 (Food order)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>SD</td>
<td>SD</td>
<td>14.32</td>
<td>83%</td>
</tr>
<tr>
<td>T4 (Find Receipt)</td>
<td>S</td>
<td>S</td>
<td>SD</td>
<td>SD</td>
<td>S</td>
<td>F</td>
<td>22.32</td>
<td>67%</td>
</tr>
<tr>
<td>T5 (Book a Taxi)</td>
<td>S</td>
<td>S</td>
<td>SD</td>
<td>SD</td>
<td>S</td>
<td>S</td>
<td>16.7</td>
<td>83%</td>
</tr>
<tr>
<td>T6 (Emergency)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>SD</td>
<td>SD</td>
<td>16.4</td>
<td>83%</td>
</tr>
<tr>
<td>T7 (Checkout)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>8.3</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Fig 44: Hotel info heat map

**9. IMPLEMENTATION**

Apart from coding, the complex part of the application is its real time dynamic data. To make it simple, a developer website for the application was built. All the data needed for every guest services are updated in this developer site. This developer site is a simple CMS (Central management system) framework based website. The person responsible for administration can
live update all data on this website. The Hotelapp has a Yii framework developer site as in the Fig 45. The dashboard of the Hotelapp website has individual tabs for every guest service in the hotel app right from the registered user’s info to the ordered receipts in the system. These guest services can be managed, edited and updated individually every update that has been made. For example, the food list in the restaurant can be updated with picture, a short description, timings available, size, etc... These data that are in the developer’s site are accessible in the IOS application via Web services function available in the IOS SDK.

The emergency module required backup data like the unique global emergency numbers (Including fire, ambulance and police) of 133 countries. Also for alerts and emergency services geocoding was used in the application. The geo coding prompts the user about the current location during their travel period. The geocoding was done with the compilation of International country codes of 205 countries. These emergency number list and country code list with country names were created into a JSON file to act as a backend supporting data in the application.

9.1. TEST FLIGHT APP
The TEST FLIGHT APP is a platform that allows developers and the team to beta test an IOS application for its testers spread wide around the world. It allows installation of the beta application on different IOS devices via a free common platform. The test flight platform provides information on beta testing, crash reports and analytics. Fortune 500 companies, investors, top publishers, independents, students, etc… from experts to beginners all rely on Test flight.
In Test Flight, the tester’s device (Any IOS device) is registered with the UDID of the IOS device. UDID or Unique Device Identifier is a unique 40-hex character serial number that identifies a tester’s IOS device. For example, I have an Iphone 5 mobile phone and I want to test this application on my mobile phone. Now, with my UDID the developer registers my device on the testing platform. Soon after registration, the developer sends out a provisional profile of the application, which basically is the beta version of the application to the user via an email invite. Testers (as in me), can download this provisional profile (Fig 46) via test flight app for iphone users and install them on my device. Meanwhile, Test Flight on the developer side will observe if there are any installation problems or crash reports of the application in the particular device. Check Fig: 47 to understand the working of test flight app.

The hotel app icon and its build version are displayed on top left part. The activities of the testers are recorded on the right side with their name and real timings. The profiles of the testers and their installation status are listed in the central portion. The feedback and crash
reports displayed in the bottom left part of the test flight simulator. The provisional profiles hotelapp were distributed amongst 12 testers of different Iphone devices. Installations of the application were successful in all the tester’s device and no crash report were recorded.

10. IMPACT OF THE SOLUTION

With this hotel application trending, the hotel managements can get a chance to be in pace with the technological devices used by their customers. Hotel applications can acts as a better guide for their customers with all those information in the app. It facilitates effective and efficient communication with guest directly on their handsets. The benefits of customized mobile application in hotel industry can bring in improved customer experience. These mobile applications can be used as a marketing strategy to increase their number of women business traveller customers. These applications can obtain better revenue out of low investment and imbibing technological resources. Also, the benefits of hotel apps and its impact of the solution for the travelers themselves is the renowned improved life style. For example, traveler do not necessarily have to sit at one place, but can wander and roam around within or out of their property with their handsets while managing day-t-day routine simultaneously during the check-in period. It reduces the amount of energy and time invested during the stay. It provides hands on application with instant services such as check-in/check out and the rest of ordering services. Extra special services such as emergency and alerts module are one of the factors that might attract women travelers as their needs have been taken into consideration.

10.1. DELIMITATIONS

The applications of these types are always iterated in terms of design and development especially, when it involves real time data. Also, the whole process took lot of time than expected because of the release of IOS7 update. As there are multiple steps that has to be done, due to time limitations the number of focus group discussions /user interviews / usability testing rounds were reduced. It is developed only as an iphone application. The changing content in the application is the major disadvantage in the application. If the server is slow/fails, or if the administrator forgets to update the real time data; there are chances that the whole process can become a mess and users might worry about the non-updated services. All time attention is needed for these of real time data. In the current version of the application emergency modules are just introduced, it can be simplified and improvised for smooth functionality. Finally, room
booking is not a part of this application. It’s just that the application doesn’t focus on room booking/reservation and that is seen as a great de-limitation by the users as they are used to it being a part of the application.

11. FUTURE WORK

The primary Usability tests were indubitably instrumental in enhancing the information architecture and flow of the current hotel app version. Despite addressing usability issues mentioned by the users, the application still has lot of room for further optimization. Some of the high end functionalities that has to be worked in the future versions are

i) **Alerts** – Notifications on maps or alert messages of any natural calamities, accidents happening around the user’s close proximal distance (say 2.5-3km).

ii) **Orders** – Facilitation of cancelling orders via the app after food order. Also inclusion of live Status (under, process, cancelled and delivered) updates for orders.

iii) **Hotel Management** - Addition of any other extra guest services /emergency services other than that exists in the current application version.

iv) **Marketing** - Integration of Facebook login/register plug-in will bring in a wide marketing promotion to the application.

v) **Smart phone Apps** - Development of Hotelapp android application for the highest type of app users besides IOS applications.

vi) **Apple App Store beta testing** – Soon after the branding establishments, Hotelapp will be uploaded for the Apple app store’s beta testing.

12. CONCLUSION

The safety for women business travellers itself is a vast humungous topic, that it can be presented as a whole thesis. But the hotelapp is an amalgamation of both hotel guest services and emergency safety services for women business travellers. It ended up as being a GPS location based application. Software is never a finished product in its very first cycle of development. As mentioned earlier, this version of the Hotelapp was built completely in accordance with the initial requirement gathering from the stakeholders and user interviews. As a next step forward, the app will constitute all features mentioned in the future work. Soon after brand establishments, the app will be uploaded for Apple app store beta testing following availability in
the iTunes Store. The implementation of an Iphone application was not as easy as I thought. Commencing off as a naive user experience designer and as a self learner, this thesis was a tremendous exponential learning curve right from capturing ideas to understanding ppi’s & retina resolution for Iphone.

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APPENDIX A
[User Identification survey]

1. PERSONAL

- Name
- E-mail address
- Phone number (With area code)
- Currently living in?
- Age group
- Designation
- Marital status

2. TRAVEL PROFILE

- Travel mostly for
  a) Business b) Leisure

- Number of business trips per year?
  <2 b) >2 c) >4

- Who accompanies you during your travel? (Select multiple choices, if you have)
  a) On my own b) Colleagues c) Partner/Family d) Other (Please specify)

- How do you plan your stay? (Select multiple choices, if you have)
  a) Hotel online services b) Call directly to the reception c) Agents d) Mobile Applications

- What is the reason for you to be more cautious during your travel?
  a) Safety b) new place & language c) All of the above.
3. MOBILE PHONE USAGE

- Which type mobile phone do you use?
  a) Smart phone  b) Ordinary

- Which type of Smart phone do you use? (Select multiple choices, if you have)
  a) IOS (Iphone) b) Android (Samsung, Sony xperia, Google Nexus) c) Windows (Nokia lumia, HTC)

- If yes, which of the following travel applications do you prefer to use? (Select multiple choices, if you have)
  a) Trip advisor b) Trip it c)Hotels.com d) Respective hotel application
APPENDIX-B

Evident differences in the UI elements of IOS6 and IOS7 are listed below.

i) Nav bar

![Nav bar comparison]

ii) Tool Bar

![Tool Bar comparison]

iii) Alert view

![Alert view comparison]
iv) **Picker**

![Picker Image](image)

v) **Switch/Toggle button**

![Switch/Toggle Image](image)

vi) **App store icons**

- Settings Icon 58x58
- Spotlight Icon 80x80
- App Icon 120x120