

FINAL PROJECT PORTFOLIO FOR GOBART

TEAM : DESIGNERS' SQUAD



GoBART Mobile App

Travel Smart

Get your BART Tickets in your phone !!

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PART I: TECHNICAL DOCUMENT FOR GOBART

I. INTRODUCTION

Our project GoBART aims to create the User Interface for an application that lets the user check the schedule and purchase digital tickets to ride the Bay Area Rapid Transit (BART). BART is a public transportation metro system which connects San Francisco Bay Area in California with cities in Alameda, Contra Costa, and San Mateo counties. BART tickets can be bought by automatic ticket vending machines that accept coins and bills and generates a physical ticket which can be scanned at the fare gate. However, BART commuters encounter several issues like Ticket Vending Machine (TVM) unreliability, complexities to purchase tickets from TVM, difficulty to find information about train delays or train transfer, uncooperative BART agents, waiting in long queues during rush hours and unavailability of BART schedules. Since there is no concept of digital tickets, the most critical issue is the need to carry a physical card or a ticket along the journey which could be lost or forgotten.

The primary goal of our application GoBART is to generate a digital BART ticket that is saved directly to a BART rider's smartphone or shared via email to make his travel easy. As we are slowly moving towards digital wallet, it is important to embrace the idea of digital tickets. In our system, users can get a Quick Response (QR) code once they make their payment. These mobile QR codes can be scanned at a hypothetical automated fare gate that scans mobile QR tickets to enter the BART station for commute.

II. ANALYSIS OF EXISTING SYSTEM

A. BART

As a first step, we researched and analyzed the existing system and the current problems faced by the BART riders. During this research, we observed the main issues faced by the BART riders in 2016 BART Customer Satisfaction Survey Study as shown in Fig.1. In this survey, the BART officials have generated the satisfaction graph and have prioritized the feedbacks based upon several attributes. The main challenges faced by BART riders according to this survey are TVM unreliability due to aging and equipment breakdown, challenges faced during the purchase of BART Tickets, difficulty to find information about train delays or train transfer, uncooperative BART agents, long wait in queues during rush hours, unavailability of BART schedules or Map and unresponsive BART.gov websites.

We examined in detail at the reasons that caused these problems. One of the main issues listed before is the purchase of tickets from TVM. It is caused by the complexity of purchasing tickets and a number of mental calculations involved to buy tickets for multiple days. We realized that the Graphical User Interface (GUI) of TVM is not interactive nor intuitive. The components of the machine are scattered over a wide area as it is a big machine and users have to get used to the flow of buying tickets. The users will already have to know which station they are getting down at. Unless the user knows all the locations and stations, it will be difficult to decide beforehand. For example, tourists who do not know Bay Area will find it difficult to locate the destination station using Google Maps. Though there is a poster plastered to the vending machine that displays BART fares and location, it does not draw the attraction of riders due to its small size. Thus, there is a lot of processes to do to receive a single BART ticket. To make matters worse, some vending machines only accept change. Once we identified this issue, we break down this sluggish procedure into an easy three step process. Step 1 is setting the FROM and TO location from the drop down menu, Step 2 is the selection of the number of tickets or type of trip, Step 3 is the payment of tickets using Apple pay or master or visa card.

There are certain instances when the amount of money left on the user's card is lesser than what is required to get out of the station. In cases like these, there are ticket vending machines inside the station for users to reload cash. But the hurdle is, no cards are allowed in most of the ticket vending machines. Some users who do not have cash will usually exit the station through the emergency exit and refill their card and go back in. This is tedious and a waste of time and this issue is resolved in our GoBART app through a single Auto-load button.

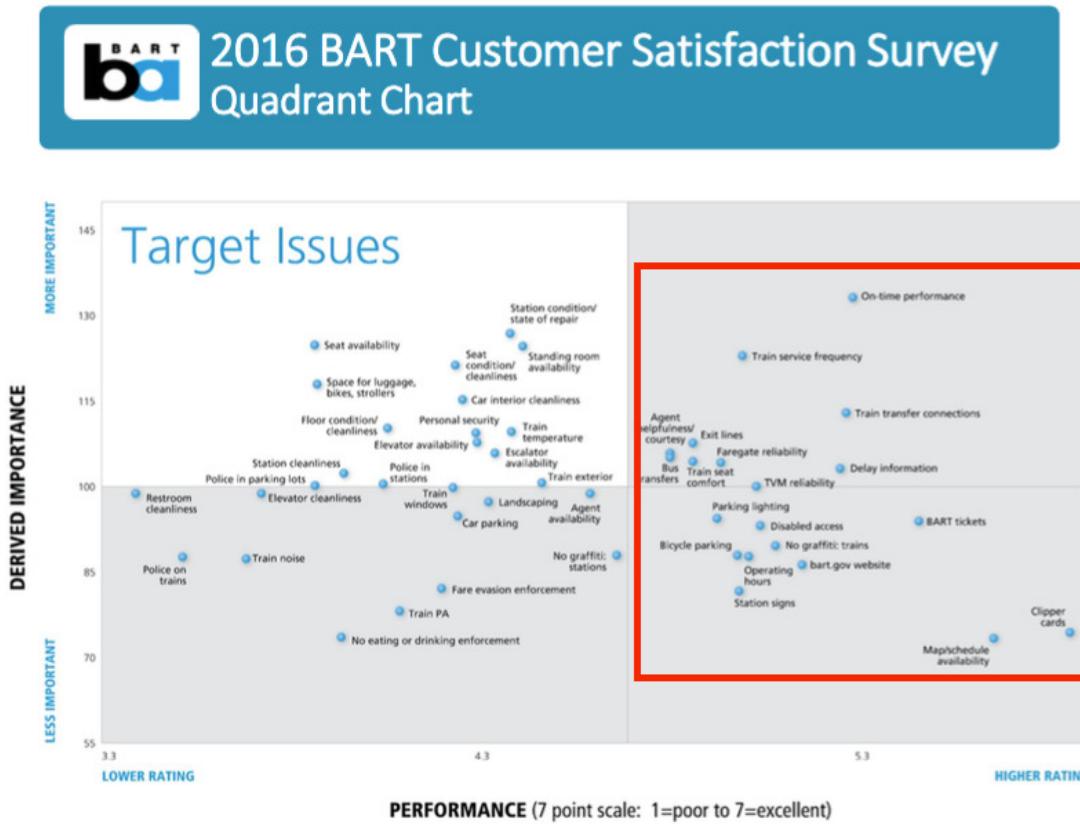


Fig.1. Customer Issues Found at 2016 BART Customer Survey Study [1].

B. CALTRAIN

We recognized that several problems encountered by BART are identical to the difficulties faced by Caltrain. Caltrain is a California commuter rail line on the San Francisco Peninsula and in the Santa Clara Valley [2]. Some of the major issues faced by Caltrain clipper card riders are listed below.

Currently, Caltrain has only two options to purchase tickets like in BART. Firstly, traveling with a clipper card. The customers must tag on and tag off clipper cards at boarding and destination stations. Secondly, travelling with a printed paper tickets purchased from TVM using cash or coins. Using a clipper card is comparatively easier than using the paper tickets as one just needs to touch the card to the Clipper card reader located at boarding station until the rider hears a long beep, sees a green light and a message displaying “OK”. Thus, the full amount of the ride will be deducted from your card. When the rider reaches the destination, the clipper card must be tagged off by scanning it at the destination card reader, until a double beep with green light is heard. Now card reader display shows the message of the amount refunded, as it takes only the cost of riding from boarded station to your destination rather than taking the amount of entire ride. But the problem is that one may forget to scan the clipper card at destination station which can lead

to deduction of the full amount of ride. This scenario is comparable to the problem faced at BART. However, we have not yet implemented a solution to overcome this obstacle in the GoBART application.

According to Don Norman, there are two categories of user errors: slips and mistakes. A good error-prevention strategy discussed by Don Norman in his book "*The Psychology of EveryDay Things*" is the removal of burden on user's memory. In this case, the error is not caused due to mistake in the design but due to forgetfulness of human. Therefore in the future efforts, we plan to create alerts or messages to remind the user to tag on or tag off from the station, thereby warning them before some errors are made.

Another challenge commonly faced by Caltrain clipper card users is the setting up of Autoload feature that ensures value on the card. This feature automatically loads money from user's visa or mastercard into a clipper card when the clipper card value reaches zero. However, in some cases, the rider may not frequently use a clipper card and they do not want to setup autoload. If no autoload option is chosen, the users with clipper card either have to go and find a TVM to load the money or have to provide their clipper card serial number (on the back of card), contact information and payment source (credit/debit) for this recurring order by logging into their account in the clipper card website. In such cases, it may take up to three to five days to load the cash into the clipper card. This restrains the users from using their newly loaded clipper cards immediately. Hence, the user has to again depend upon a TVM to purchase a paper ticket and issues for purchasing ticket as same as mentioned in section II. A. Moreover, a user need to log in to the clipper card website to load the money or know about the current value of clipper card. However, as discussed in section II. A, the websites could be unresponsive at times or TVM becomes unreliable. This problem is fixed in our application by adding an auto load toggle button that lets the user to easily enable or disable this feature. Furthermore, users can know about the current value of card through this feature.

Hence, we analyzed that a few problems faced by Caltrain and BART commuters are identical. Therefore, development of a mobile application based upon BART issues can also offer solutions to some of the Caltrain issues. Thus in the future, we can form a generic travel application that offers digital tickets for BART commuters as well as Caltrain commuters.

III. TECHNICAL REQUIREMENTS

GoBART application is currently designed for iPhones with latest OS versions. The detailed requirements can be found in Table 1. Though this application requires an internet connection to buy a ticket, it lets you view the purchased tickets offline.

TABLE I: GOBART TECHNICAL REQUIREMENTS

iOS version	9.2.0 - 10.3.1
Devices Support	iPhone 5/5s, iPhone 6/6 Plus, iPhone 7
Display orientation	Portrait

IV. DESIGN PHASES

A methodology based on a cyclic process of prototyping, testing, analysing, and refining a product or process. Based on the results of testing the most recent iteration of a design, changes are made. This process is intended to ultimately improve the quality and functionality of a design. The approach that we chose for our project was to Ideate, Design, Test, Refine, Evaluate and then cycle through these steps for various iterations as in Fig. 2. This helped us eliminate redundancy and achieve consistency.

In the early stages we brainstormed and came up with rough ideas for the interface and decided on the workflow as in Fig. 3. Then we fine tuned the interface and performed usability testing and some redesign to perfect the system, the details of which will be explained later on.

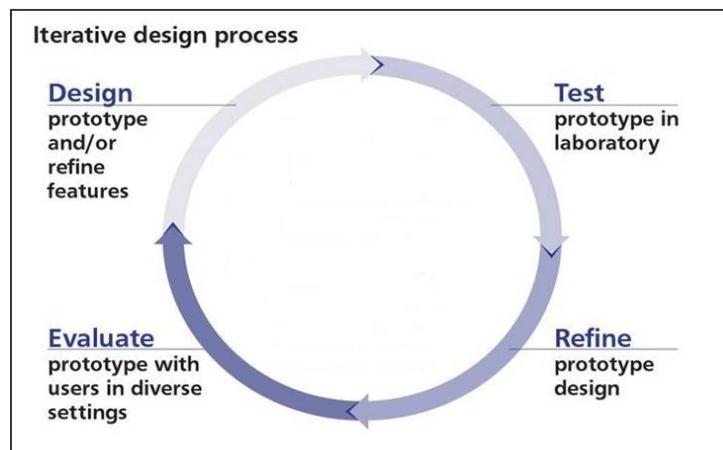


Fig. 2. Iterative design process.

V. IMPLEMENTATION

A. EXPERT VERSION vs EXPRESS VERSION WORKFLOW

The **expert version** is used by regular BART commuters. These commuters will have full knowledge about which stations to get on and off from. So, in this version the user can directly select the stations on the 'Buy Tickets' page to buy tickets. They also have the option to search stations using a map.

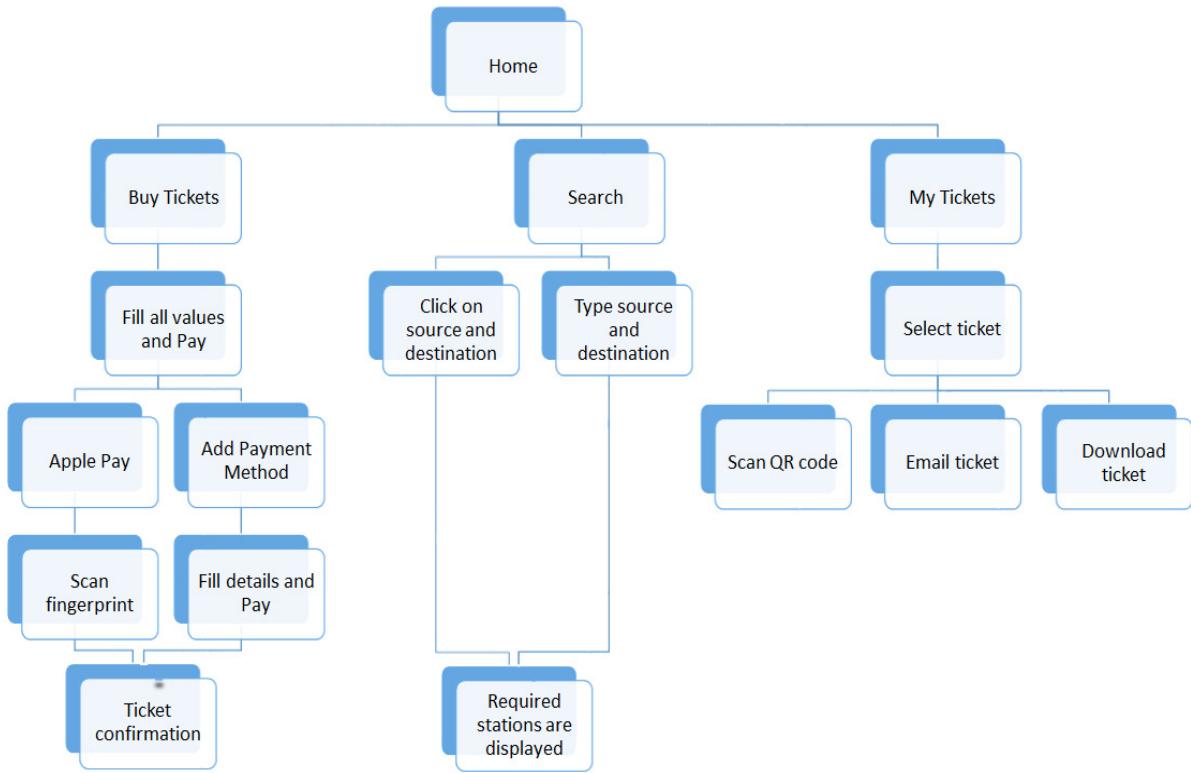


Fig. 3. Expert version workflow.

The **express version** is for tourists/first-time BART commuters. These commuters will not know about the stations. So, these users can select their source and destination by clicking on the map provided or by typing in the source and destination. The app will then directly show them the stations that they need to get on and off at. And then the user can click on buy tickets, which will lead them to a pre-filled ‘Buy Tickets’ page.

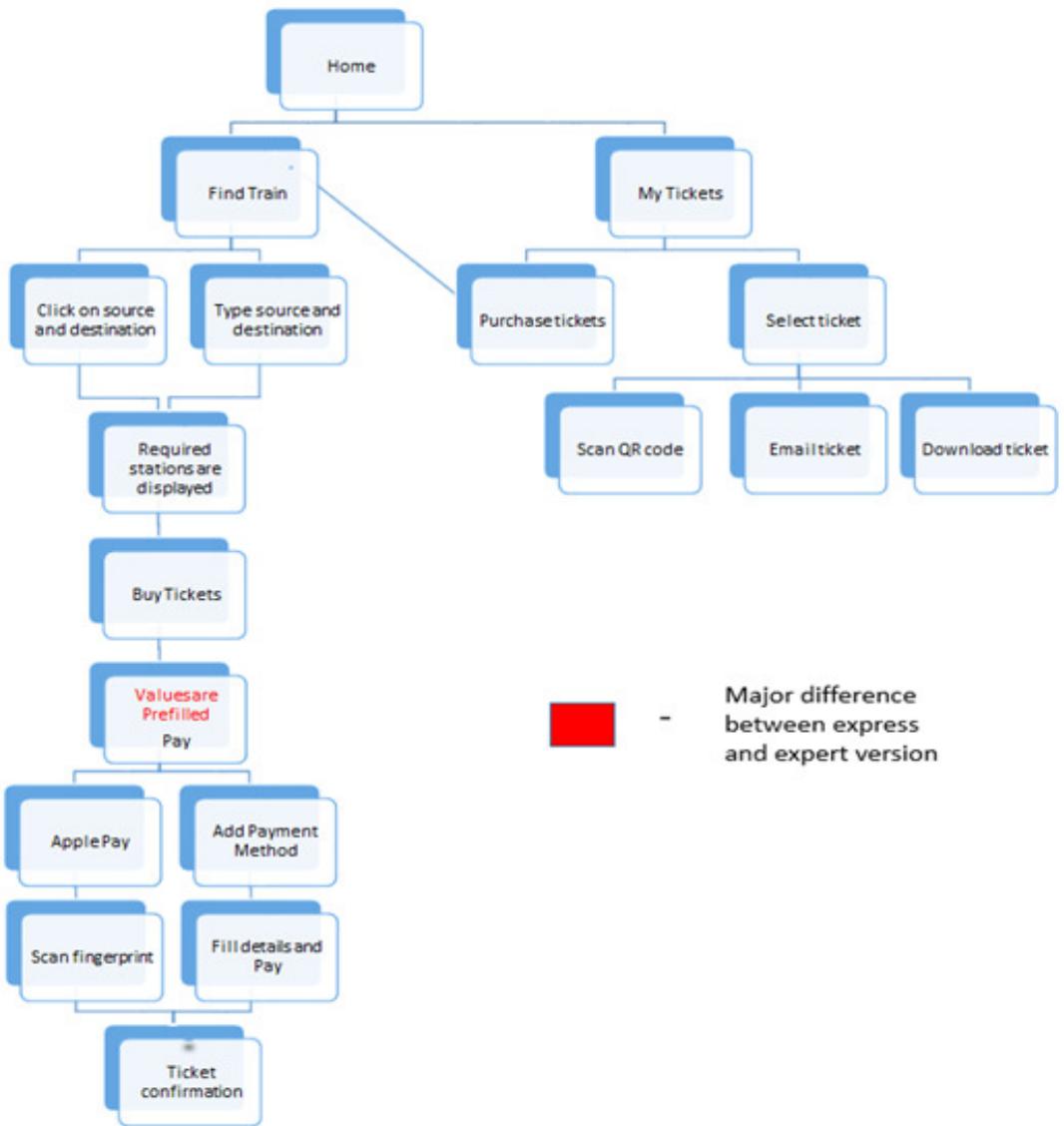


Fig. 4. Express version workflow.

B. PAYMENT WORKFLOW in EXPERT VERSION vs EXPRESS VERSION

Both expert version and express version supports two types of payments:

1. Apple Pay
2. Credit Card

The payment method of apple pay is identical in express and expert version.

The payment method of credit card is different. When the user uses the express version, the credit card information is saved locally on device. As long as the user uses the same device, he

can use “Pay by saved card” to pay for ticket without filling card details. Once the user uses another device, the user needs to manually fill card information. In expert version, after the user saves the credit card information once, he can apply “Pay by saved card” in the future on any device, since this information is saved. For security reasons, all payment by credit card requires CVV to be validated.

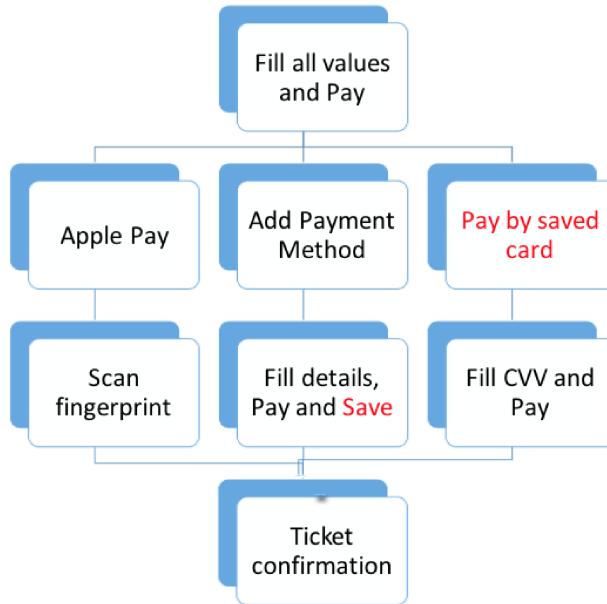


Fig. 5. Payment workflow

VI. MARKETING AND MONETIZING STRATEGY

We identified that having a great idea or an application with an excellent design is not sufficient to make an application successful. Identification of target market, marketing, and monetizing strategies are significant for the growth and success of a mobile application.

A. KNOW THE TARGET AUDIENCE

A great application should offer real value to a particular community of people. If the correct target user group is not identified during initial stages, then the application might have to be redesigned and remodeled during the later stages of the development phase which incur cost and time. Hence, the first step towards achieving a leading position in the market is knowing the target audience. The identification of the target audience at the initial stage can save time and resources during development and promotion phases.

In our application, once we fix the idea and research on regular BART commuter issues, we identified two kinds of the target user for the application. The first group is BART commuter group who frequently travel in BART and the second group is tourists who are the first time BART passengers or

temporary BART riders. The realization of holes of the existing system and current market helped us to plan and design the application around.

B. MARKETING STRATEGIES

There are numerous marketing strategies that let the application discoverable to the users and. If the application does not have excellent marketing strategies, then it could be ignored by users which lead to its decline. Thus having an app marketing strategy is crucial for the success of the app. Some of the strategies are listed below:

a) Developing an Online Presence

We can develop an online presence of our app through online networking services such as social media, comment marketing, blogs, forums etc. The following Fig. 6. and Fig. 7. shown below are examples of online marketing of GoBART application through social media.



Fig. 6. Twitter page of GoBART



Fig. 7. The facebook page of GoBART for marketing the app.

b) Within app marketing

Another kind of marketing strategy is within app marketing. There is a feature to share the QR code of purchased tickets to other people in your contacts. This scenario happens when the sender has to purchase the ticket on behalf of another user. This is a good marketing strategy that does not procure any external cost for marketing. To achieve this, we need to think about app marketing during the planning stage of the application and not after completing the development of the application. The Fig 8.is a screenshot of the share page of GoBART that supports within-app marketing.

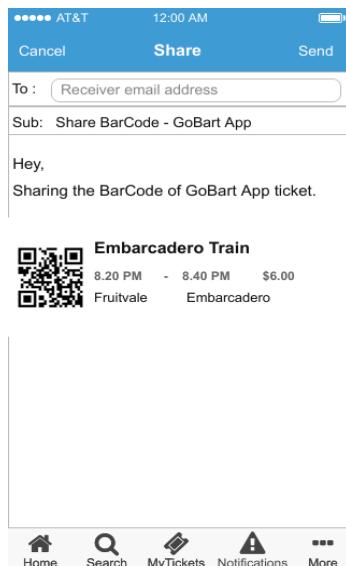


Fig. 8. Share page of GoBART

c) Impressive Advertisements

Marketing the application using an impressive short and efficient advertisement video or posters is our another approach. A video is a powerful tool that can convey the need for the particular mobile application. It helps to boost app visibility, enhance user recognition and engagement, and receive several downloads. The video should emphasize the benefits of our application and how will it simply the target user's life. Moreover, we can paste posters or keep fliers in BART stations. We can also place our application in Appstore for user visibility.

d) Market the user experience

During the marketing of user experience, we can let the customer know on how this particular application will simplify a BART rider's life. One way to achieve it is by testing the prototype with BART riders and collecting feedbacks from them. This lets you to identify the errors or pit-holes that were not discovered previously. Prioritize these feedbacks and continuously improve the design by redesign of the app. Once the app design is final ready to market, we can ask users by mail or direct communication to publish their experience in social media or request them to give review of the app in AppStore. Thus, this can be considered as a direct marketing approach. The Fig 9 shown below is an example of user experience we have received in our facebook page. Since it is in a social media page, the comments or reviews can obtain high visibility.

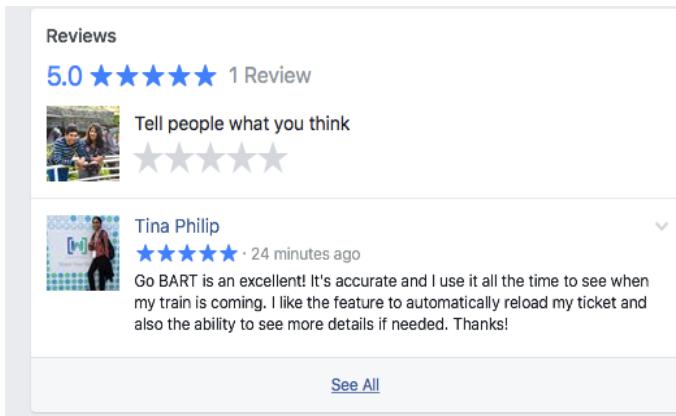


Fig. 9. Marketing user experience through social media

C. MONETIZING STRATEGIES

Monetizing strategies helps the application to earn revenue. Our main monetizing strategy is to provide users few months of free trial version and pay per download after the trial date. Free apps with in-app purchases for one-time items/functions is another marketing strategy suitable for our app.

VII. FUTURE WORK

In the future, we plan to implement an additional feature which accounts for the discounted BART tickets. The discounted tickets are the special color coded tickets like the green physical card given to senior citizens and the red colored cards for disabled people. These tickets would have special discounted rates applicable and should have some authorization mechanism associated to identify eligible person to prevent fraud.

We also plan to implement a travel guide through our interactive map feature that would recommend nearby tourist attractions to the user and add a feature that sends alerts or messages that remind all user to tag off from the station.

In the future efforts, we have also thoughts to transform this application which is currently targeted to BART riders either to a generic application that can be used for BART as well as Caltrain or creation of another application solely targeted for Caltrain users.

VIII. CONCLUSION

BART estimates ridership in fiscal year 2016 will average 430,000 trips on weekdays and 129 million trips annually. During peak commute hours, over 60,000 people ride through the Transbay Tube in each direction. As stated, buying ticket from vending machine is complex , and, recharging clipper card is not convenient. The application can address this problem to benefit a huge population. If the application saves 10 seconds on each trip, it will save around 1000 hours on one weekday.

The top ridership day in 2015 was June 19 for the Warriors Championship Parade and A's game - 548,076, more than 10 times the 43,000 on average in 2015. There are many people do not ride BART regularly, who need go to the obsolete BART vending machine to purchase ticket. BART directly serves SFO and OAK, the nation's 7th and 35th busiest airports. For those travelers, they need an efficient way to get ticket and go. Furthermore, there are many tourist, who are not familiar with the vending machine. The experience of dealing with the vending machine is not grateful, and, will influent the impress of the city.

The application will address the problems of the current ticketing system, and, integrate functions to provide convenience and assistance to users. The goal of our application is commute easier, live better.

PART II: STORY OF GOBART

I. OUR STORY

The idea for our app started when we discovered a problem that one of our team mates faced in her everyday life and the discussions on how this was a common problem of almost every one riding BART for their daily commute. There was no way yet, to travel in BART without actually carrying a physical ticket/clipper card. In this age when everyone is racing towards a digital wallet, this old method badly needed an upgrade. Talking to other BART riders in our class and outside, revealed that there actually was genuine interest in travelling ticketless (physical ticket). So the user testing actually involved understanding how the existing system worked and how better we could solve it with our app. So we had the problem that we wanted to solve. Now it was time to well, solve it. After much debate, we came up with a method which substitutes QR code to physical tickets. Now a QR code reader would be required to scan the ticket at the station, but this was an established system and also not an expensive one.

The next step was to come up with an easy to use interface for our app - GoBart. This was to be done with great care since even the greatest of ideas could be spoiled in execution, without the right UI. The initial designs were sketched in paper as this was the least expensive and most effective way to communicate our ideas and also a method to standardize the design. The collaboration of the designs required us to get together once in awhile but we found an alternative by taking pictures of the paper prototype on the phone and sharing them. This could be done instantly and whenever we wanted the opinion of other teammates. By this time, our design was somewhat done and we got the opportunity to show the paper prototype to our classmates and test the usability.

The Usability testing with the paper prototype was an actual eye opener. It showed us numerous pot holes in the app that we had never identified. Some users found it difficult to follow the workflow and needed a bit of explanation to complete the tasks. These feedbacks helped us while designing the app using Mockingbot.

II. DESIGN

As a team, we brainstormed possible ideas and design features. We had a list of features written down. Once this was done, the design phase commenced. The design phase was split into two parts that go in a linear fashion - Paper Prototype and Visual Design.

The paper prototype (also called the Low Fidelity prototyping) included a rough sketch of where the features would be located and the workflow of the prototype. The main purpose of this low fidelity prototype was to provide a sketch that had some, if not all, of the characteristics in the final product and provides a way to test broad concepts. This gave a general idea of how the crowded or plain the interface looked. Fig.10 below shows an image of the “Buy the Ticket” workflow during the paper

prototype phase. Once the paper prototype underwent testing, making changes were made and the visual design closely followed.

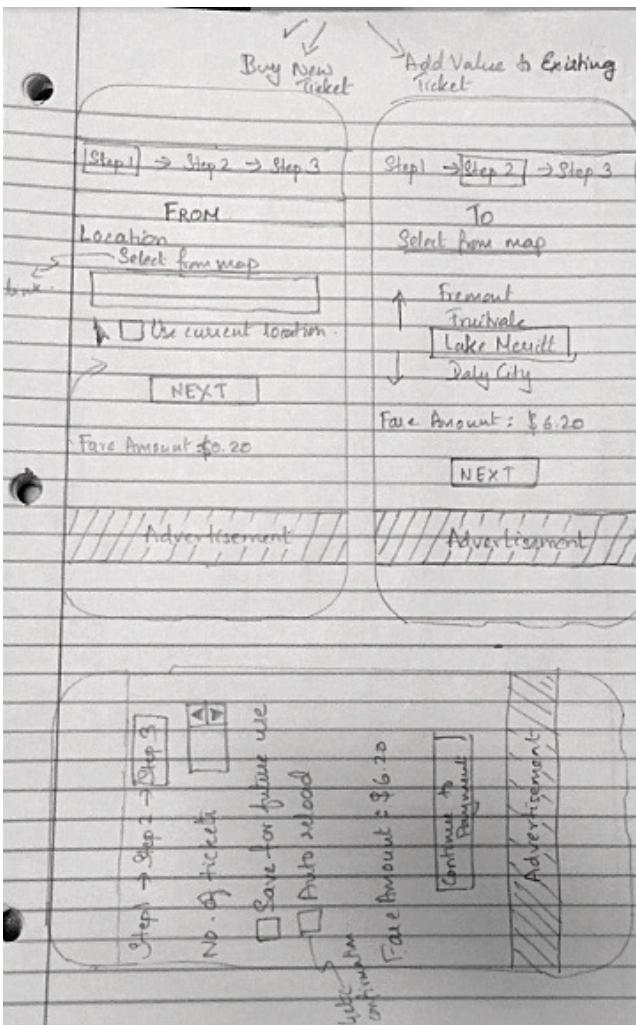


Fig.10. Paper prototype of the “Buy A ticket” page.

Visual design (also called High Fidelity Prototyping) is an interactive design of the final prototype. Though they would not contain most of the functionality, it will give a user the feel of the application and a way to access if users and developers were thinking along the same line. After going through multiple prototyping tools, we finally settled for “MockingBot”. The most important feature MockingBot provided was the collaboration feature. Secondly, the application contained many built in elements which we could drag and drop into the prototype. The most prominent tasks such as “Buy A Ticket”, “View Ticket” were given more importance than the other parts of the application. Fig. 11 below shows a screenshot of the MockingBot High Fidelity prototyping tool.

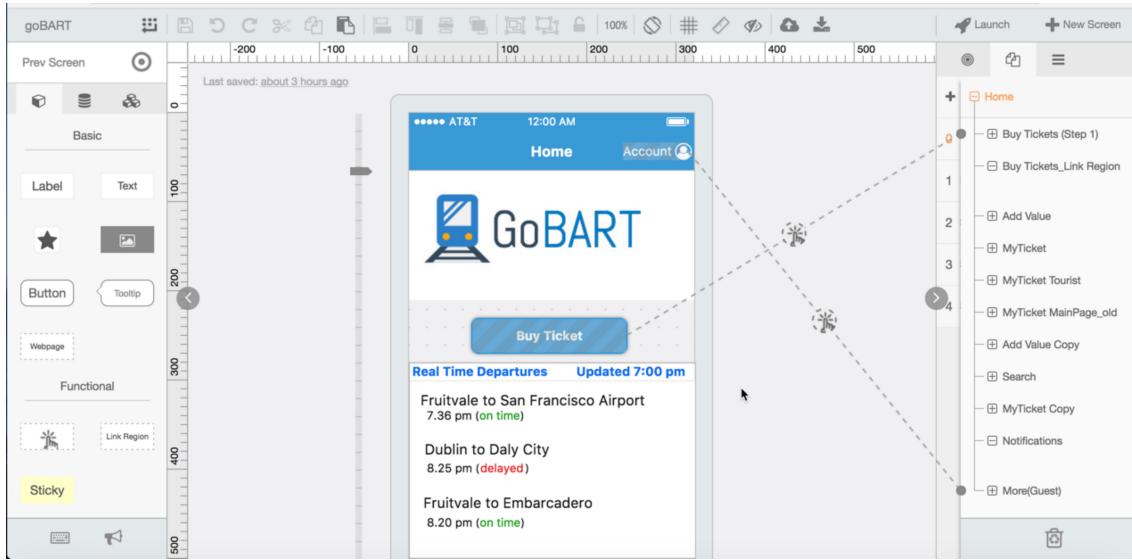


Fig. 11. MockingBot interface

While building the application, the types of users were taken into consideration. The two types of users that would be the most prominent users were the “Tourists/ One-Time User” and the “Everyday BART rider”. The use of GoBART for the both them are very different. While the tourist might not know the city that well and would prefer to enter the destination to find out the closest station, the Everyday rider would need a fast way to load his ticket and use it. Thus, the workflow for the two processes were quite different and so we made two versions - The Express Version and the Expert Version.

Once again, after going through multiple rounds of testing (as described in the section below), the prototype went through many iterations. A detailed analysis of the testing phase will be discussed in the next section. After the last iteration, the application was easy to navigate through and the functionalities it provided were easily accessible. This allowed any type of user to use the application in an efficient manner.

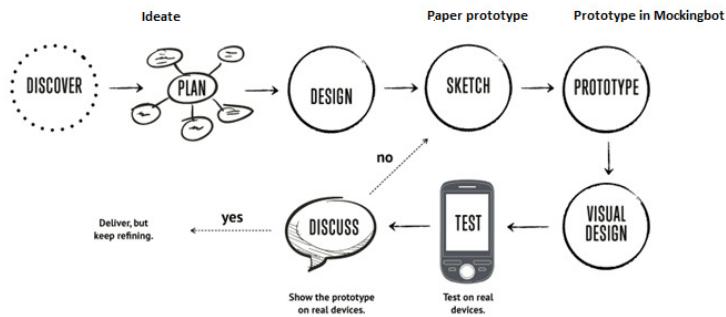


Fig. 12. The Design Phases.

III. TESTING EXPERIENCE

Our very first test was about how people generally felt about the idea of this application. For this, we spoke about this idea to friends and family. We got the opportunity to ask a couple of BART riders and got their opinion. In general, they liked the idea. But some of them never found it difficult to carry a card with them whereas some of them thought since we are going transitioning everywhere - plane tickets, credit cards, etc., it wouldn't be very difficult to adapt to this. And on the long run, it would be the best option. Some of them were skeptical about the use of smartphones and were doubtful about how elder riders or less tech savvy riders would use the application. But here for the case of the project, let's assume that this hypothetical situation where you have both options - Clipper card and QR code scanner. Our initial paper prototypes were tested by our friends and family. This gave us an idea of what we need in the application and what we needed to get rid off. It also gave us an idea of user's expected work flow. We made some changes on the workflow. Most prominent tasks, such as "Buying A Ticket", "Loading a Card", viewing current train timings were given a higher priority. These particular tasks could be done as soon as you open the application.

After the second round of testing, the feedback we got was that we needed a theme and the application looked flat. We decided on a blue and white theme for the entire application. All the elements were given a shadow so that they do not appear flat.

The third and the fourth round of iteration was tested by users who knew the BART ticket buying process whereas others who did not know the process to buy a ticket. What we noticed is how the two types of testers asked different questions. We changed the application to suit the different users. Other changes included weeding out unnecessary elements, adding new features such as "Maps", etc. An important change was the number of steps that was needed to buy a ticket. When the initial paper prototype included four steps. Towards the end of the fourth iteration, only the important elements remain and the number of steps needed to buy a ticket was reduced to two steps.

The application has undergone numerous testing phases and it is safe to say that it offers an easy and fast way to avoid the vending machine and buy a ticket faster.

IV. THOUGHTS BEHIND THE ITERATIONS:

After the first set of iterations in usability testing, we came together and discussed the problems encountered by users during testing. We discovered that a few issues were identical for most users. So we prioritized the issues and improved our prototype by solving the problems one by one according to the severity and brainstormed on design improvements. However, some issues were contradictory. The feature that posed an issue for one person were actually appreciated by another. Moreover, testers who were unfamiliar with iOS app took more time to realize some icons like share/biometric authentication as it was uncommon on their phone. Another thing that we noticed is there were some common instincts

for testers. They traveled wild and went beyond tasks by clicking on everything they liked. For example, one of the tasks we assigned users were to view the purchased ticket and not to share the ticket via email. But 50% tried it without asking.

In every usability test, each one of us played the role of the tester and the observer. As a tester, we learned to think aloud for each task. As an observer or narrator who facilitated the testing session, we realized that one need to be well prepared with a set of tasks in advance and needs to check with how ease the testers are carrying out the tasks. If the narrator is not prepared to give a clear explanation of the scenario or not prepared with tasks at hand, it can cause confusion to the tester. Being an observer, we never forget to note down the errors are made by each tester. Moreover, we watched the user response for each task, including their emotional behavior. Some users performed task easily and were excited about the consistency and easiness of the app. However, some users experienced problems that we didn't expect to have.

We have realized that both the tester and observer or narrator has obligation towards a successful usability testing. Some of the major problems found in each iteration and the respective solutions offered are shown in the below figures. Initially purchasing ticket task was confusing for the testers and we improved it by breaking it down to a two step process as shown in Fig. 13.

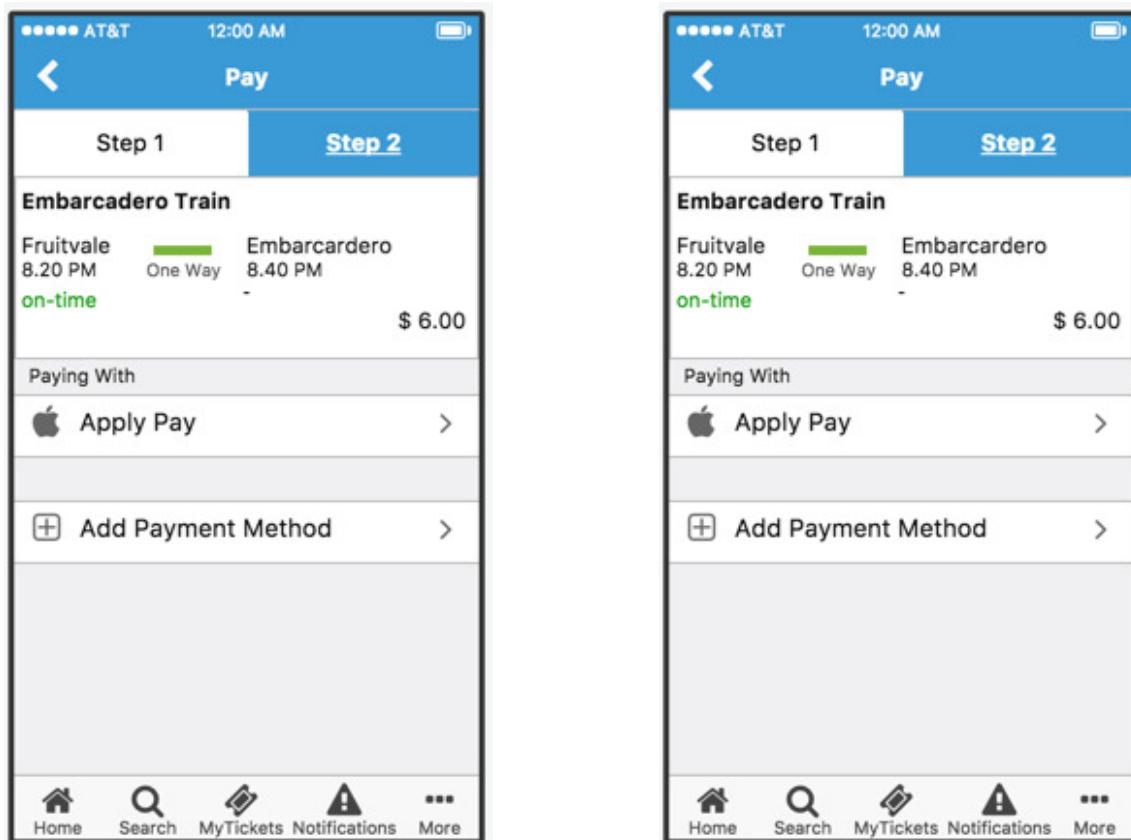


Fig. 13. (Left) Step 1 “Buy the Ticket”; (Right) Step 2 “Payment”

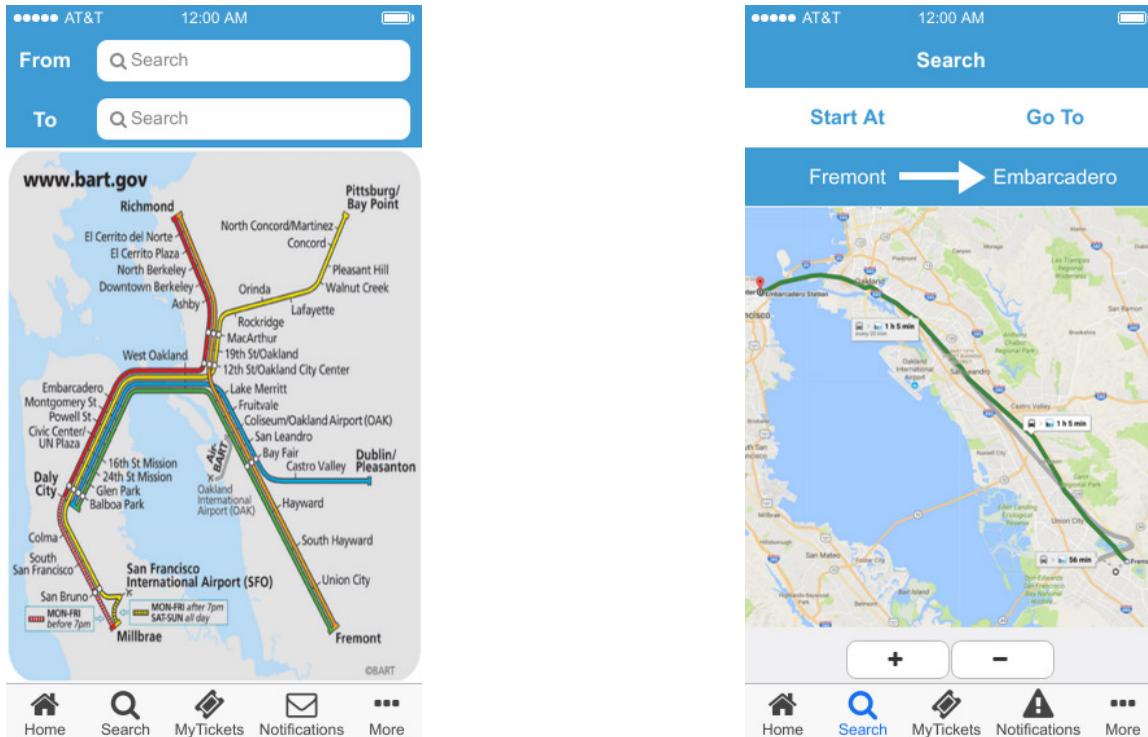


Fig.14. Initial static map (on left) and map after improvement (on right)

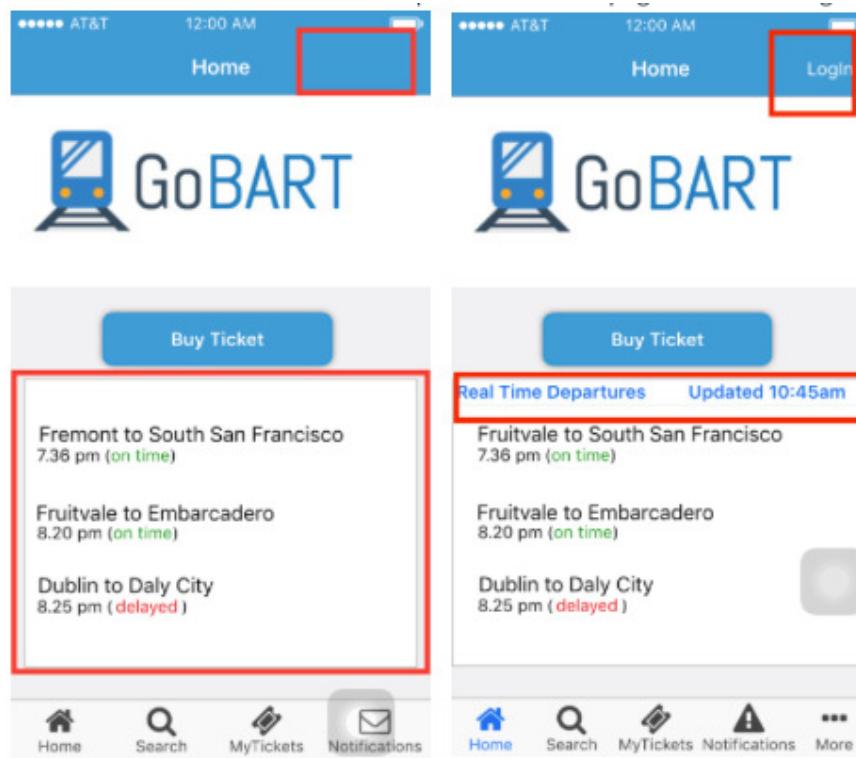


Fig. 15. Resolved the ambiguity of Real Time Departures and adding Login button for existing users.

V. LEARNING OUTCOMES

- (i) First and foremost, we learned that starting with a paper prototype is the best way to let our imagination run free. Being a group of developers with no prior designing experience, paper prototyping helped us to identify the user needs during the initial stage and built a prototype according to the user's requirements and preferences. We realized that it is a simple inexpensive technique to communicate as well as review our ideas and helped us to eliminate the redundant screens during the beginning stage of designing.
- (ii) Next, we understood the importance of finding a good tool for prototyping. Some had a steep learning curve, whereas others would not let us use all the features without upgrading and yet others had no collaboration features between Mac and Windows. Taking all these factors into consideration, we chose Mockingbot which was easy to learn and collaborate and also had many built-in widgets.
- (iii) Testing early and iteratively is important as the initial design is likely to be flawed with respect to the key requirements. Late discovery of design defects results in costly over-runs and to avoid this, iterative testing is useful. An iterative approach is superior to a linear or waterfall approach in that risks are mitigated earlier and changes in requirements are accommodated.
- (iv) The importance of high fidelity prototyping: High-fidelity prototyping gave us something realistic enough to try out our ideas with target users. It helped us discover which ideas are good and which are not and also find out if users can figure out how to use the product. Working on a high-fidelity prototype helped us think through the product to a much greater degree than the paper specs.
- (v) The importance of preserving consistency throughout the application is another learning outcome. Initially, we did not maintain consistency in the design elements and it caused ambiguity as well as difficulty in users. After achieving color consistency and design consistency in the application, we realized that this enhances the user experience across our application. Thus, users need not relearn the app on each use. Furthermore, we can make user's mental model identical to designer's mental model by maintaining consistency.
- (vi) We comprehended that usability testing and receiving user feedbacks is an effective way to understand the user experience. Usability testing helped us to evaluate our application and discover the problems or setbacks in the design early in the prototyping process. The testing session enabled us to think aloud for each task as a user and importance of noting down the emotional reactions of user-experience as an observer. Thus for an outstanding user experience or usability testing, a designer needs to be patient and ready for a constant improvement of the design by collecting continuous user feedback. Each iteration can let the designer analyze the problems that were unidentified during previous iterations.
- (vii) Project Management: One of the most important learning outcomes was how to manage the project. Each one of us held responsibilities in initiating, planning, executing, controlling, and closing the work

to achieve specific goals and meet specific success criteria. This also helped us to identify the strengths of each one of us, which might include not just designing the prototype but also writing, researching about a problem and presenting it in an effective manner.

(viii) The identification and analysis of different marketing and monetizing strategies made us understand that building a great app or idea is not enough to make our application successful. Once we are done with the development phase, we should instantly begin approaches to market and monetize the application. An app should be discoverable to the users by introducing its features no one else has. If the app does not have excellent marketing strategies, then the application can sit in the corner ignored by the users which lead to its decline. Moreover, having monetizing strategies such as in-app and subscription help us to collect revenue.

(ix) The project lets us gain hands-on experience not only in the development of hi-fi and lo-fi prototyping but also the application of Gestalt principles directly to the UX and UI design especially proximity, similarity, and figure-ground. This helps the user to process and assess the information with higher efficiency and accuracy.

(x) Most importantly, this experience gave us a whole different perspective of design. Each one of us gained an insight into the different ways to create an effective design.

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