WolfPool Application

Arpita Shekhar
ashekha@ncsu.edu
Computer Science

Aishwarya Sundararajan
asundar2@ncsu.edu
Computer Science

Amulya Varote
avarote@ncsu.edu
Computer Science

Bhavik Patel
bcpatel@ncsu.edu
Computer Science

ABSTRACT

There are applications in the market which enable us to share rides with others. The applications like Uber and Lyft have features like UberPool and Lyft Line. But these services are not available at all the locations. The companies have not provided these features in all the places possibly due to the reasons like low population and good public transportation. The "WolfPool" application has been developed to solve these issues by studying the existing systems. The application finds people traveling in the same direction and provides an opportunity for them to share their rides. The application already has features like creating a plan or joining existing plans. After including features like cost estimation, adding a stop on the current route, and payment gateway, the application will be available for commercial use. To make use of the application effectively, the user must be able to update and delete the plans. We have decided to implement the cost estimation, adding a stop on the current route, and payment gateway features together with updating and deleting plans.

Index Terms - Uber, Lyft, UberPool, LyftLine, payment gateway, cost estimation, P/E ratio.

1. INTRODUCTION

Every semester students come to the USA to do their higher studies. Some of the top universities like NC State University are located in the outer parts of the town or city. Majority of the students admitted to the universities are international students. The international students face difficulties in adapting to the new culture and in figuring out the cheapest mode of transportation. The students depend on either public transportation (GoRaleigh and GoTriangle) or cab service for commuting. During weekends, there are very few university wolfline buses and the frequency of goRaleigh public buses is once in 45 minutes. If the students miss one bus then they have to wait for another 45 minutes to take the next bus.

Even if the frequency of the public bus increases, the travel time is more compared to cab services. The web application mainly helps people travelling at the same time and the same route to plan in advance and share the ride. This comparatively reduces the cost of transportation.

Based on the survey of the existing WolfPool applica-

tion, we have realized the importance of using the same application to estimate the cost of the trip and then divide among the people who shared the trip. We also observed the importance of integrating the application with a payment gateway like Venmo/Paypal. In order to supplement the existing features of the application, the addition of previously mentioned features would provide a single conducive platform for users to manage their travel plans and settle all their expenses.

2. CASE STUDY

Based on the previous case study of WolfPool application, we observed that the frequency of the public buses is low and it is time consuming mode of transportation. The team has come up with the figure 1 of routes taken by the cab and the public bus. They concluded that a lot of time is wasted in the journey and waiting for the bus.The case study also reflects how companies like Uber and Lyft have saved the carbon dioxide emissions by introducing UberPool. The previous case study is concluded by saying that, unfortunately lot of college towns and cities don't have these shared cab services and hence there is importance of an application like wolfPool.

The application has a very simple UI. The user has to signup and then signin to use the application. The user has to enter the date, time, source, destination and number of people and then join the plans. If there are no plans matching the requirements then the new plan is created. If there are existing plans then the user can join the plan. The mail containing the information will be sent to the users after the user joins any existing plans. Existence of a fare estimator and expense tracking would make it much easier for the user to plan the travel itenary.

The uber fare estimator estimates the trip fares by considering the estimated time and distance of the destination from the source, current demands for rides in the area, and surcharges, fees, and tolls. [4] Additionally, fares vary by location and vehicle option. The Lyft fare estimator levies two types of fares: Variable and Quoted. Variable charges include incremental charges based on estimated time and ride distance as measured using the GPS data from the driver's phone. If phone signal is lost, fare is calculated by using available data from the ride. On the other hand,

quoted fares (base fare) are subject to change based on abrupt change in destination, addition of multiple stops. Lyft does not guarantee that variable and quoted price would be the same. Other charges include Service Fee, Prime Time, Cancellation fee, Damage fee, Tolls, tips to the driver, etc. [5] Since our application extends the idea of UberPool and LyftPool, we have used their fare estimator in our application.

	Paypal	Google Wallet	Venmo	Square Cash	Apple Pay Cash
Compatibility	Android, iOS, Web	Android, iOS, Web	Android, iOS, Web	Android, iOS, Web	iOS
Payment methods	Credit, debit, bank transfer	Credit, debit, bank transfer	Credit, debit, bank transfer	Credit, debit card	Credit, debit card
Credit fee	2.9% + $0.30	2.9%	2.9%	3%	3%
Debit fee	2.9% + $0.30	Free	Free (25 cents for instant transfers)	Free	Free
Bank transfer fee	Free	Free	Free	N/A	N/A
Withdrawal speed	Up to 1-2 business days	Up to 1-3 business days	Up to 1 business day	Up to 1-2 business days	Up to 1-3 business days
Transfer limits	$10,000	$9,999	$3,000	$2,500	$3,000
Special features	PayPal.me shareable links	Integration with other Google services	Quick transfers to banks	No need to set up an account	Automatically available in iOS

Figure 1: Comparison of various apps with respect to certain features

From the above figure, it evident that PayPal is a pervasive payment gateway that is compatible with both Android and iOS applications and 12% of the US market uses Paypal for transactions. Google Wallet stands apart due to its integration with other Google Services like gmail, which allows users to request money by simply pressing the little dollar sign in the toolbar under a message. The best thing about Apple Pay cash is it's well integrated with iOS but this this could also be a downside as it's only compatible with iPhones with no desktop or Android interface. Venmo is a social-friendly payment application. The transactions made in Venmo can be made public as preferred by the user. But care should be taken to ensure to not accidentally make a private transaction public. Square Cash does not mandate account creation and avoids long waits or extra steps in the transferring process. However, one of the major downsides of using Square Cash is: it cannot be used with Bank accounts but just credit/debit cards.

Feature	Splitwise	SettleUp
Global reach	Yes	No
API Support	Compatible	Not compatible
multiple accounts loginable	No	Yes
Language support	Yes	Yes
Bill Reminder	Yes	Yes
Automatically splits bill	Yes	Yes
Payment integration	Yes	Yes

From the above assessment of comparison between splitwise and settleUp used for settling up bills between a group of friends, we infer that splitwise offers extensive documentation support for integration with our application. Hence, we choose splitwise over settleUp.

In WoolPool application, the person who creates the plan books the cab and also makes the payment. Rest of the people who have shared the cab pays their portion to the person who has paid for the complete trip. Hence the same application can be used for both of these tasks.

The people use mainly two applications, splitwise to do the expense tracking and the other applications like cashApp/venmo for the payment. By implementing the cost estimation per person and payment gateway in the same application, the users time is saved. The most important thing is, the application will have the complete flow from creating the plan to the payment.

The decided features will be implemented by integrating the web application with the splitwise application for expense tracking and paypal payment gateway for the payment. [3]The paypal is online payments system that supports online money transfers and serves as an electronic alternative to traditional paper methods like checks and money orders.

3. SURVEY RESULTS

We conducted the survey of the application by asking 30 people to better understand what kind of features the users expect in such an application. The day to day applications which the users use to ease their task have been analyzed by taking in to consideration the survey results given by these 30 people. The results of the survey are as follows.
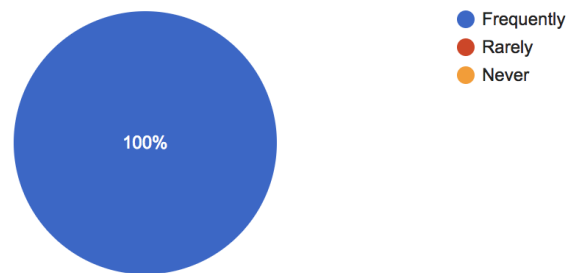
**Figure 2: How often do you use Splitwise to track the expense?**

Before the era of Splitwise, many people relied on the cumbersome media of notes and paper to keep track of their shared expenses with their friends. Post the Splitwise breakthrough, people turned to Splitwise to track expenses. To know how often people use this type of application, this particular question was asked. We can see in Figure , 100 percent of the people use Splitwise to track expenses. After analyzing this data, the idea is to integrate such an application with the existing wolfPool application so that the users can keep track of the transportation expenses in

one place.
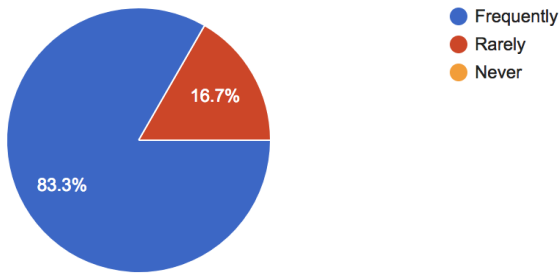
**Figure 3: How often do you use Uber/Lyft to know the estimated cost of your trip?**

People use Uber/Lyft fare estimator to know the cost of the trip before booking it. We asked people how often they use Uber/Lyft application just to see the estimated cost and then decide whether to travel or not. We can observe from the Figure , 83.3 percent people use these applications to get the estimated fare of the travel. The idea is to include such a feature which can provide the estimated fare in the same application.
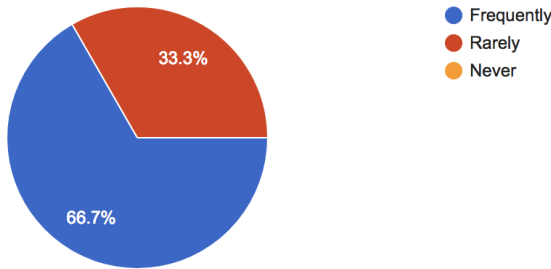
Figure 4: How often do you use applications like PayPal to transfer money for shared trips?

It has become so common now a days to transfer money online. PayPal is one of the applications which is really useful to transfer money to another entity. The above question was asked to maximize the target customers of the application through integration with payment gateways like Paypal. We understood from the Figure that 66.7 percent use PayPal for fund transfers. The idea is to integrate PayPal payment gateway with the application so users can use the same application to make payments to people with whom the trip has been shared.

We asked users to know if they would like all the above features in a single application. We can see from the Figure that 100 percent people prefer having all the features in the same application rather than separate applications. The main idea of this project is to integrate the existing applications with WolfPool to make it an independent
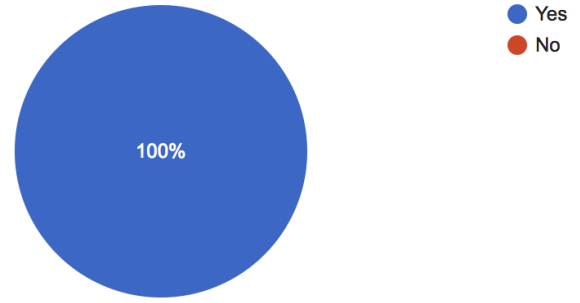
Figure 5: Would you prefer having all the above features in a single application related to shared trips like WolfPool?

application.
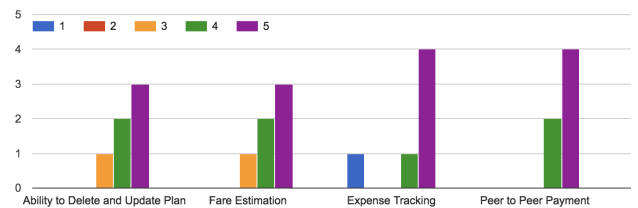
Figure 6: Please rate following features based on their usefulness. (5 being most useful and 1 being least useful)

In the end, we also asked users to rate the features out of 5. We can see from the Figure 6 that all the features mentioned in the survey questions have received 5. According to the feedback, some of the features people wish to have are SMS/Push notification and linking social media accounts of people.

4. IMPLEMENTATION

1. **Update or Delete Plan:** This is a very basic but quite useful feature, for the application like wolfpool. In our everyday life we come across many instances where we need to change our plans and reschedule or modify our commitments. On the same lines, once an user creates a plan of a cab ride, there may be different reasons for which they may need to update the plan or delete the plan altogether. For this we have provided feature of updating or deleting existing plan to user. User may delete the existing plan or they can remove themselves from the plan. In addition to this, user can change any one or all attributes of a plan. User can update date and time of the trip, Source and Destination of the trip and also user can update number of people who will accompany them.

2. **Email Notifications:** We have updated the previous email notification service, Mailjet that was configured with the application. The main reason for changing the

implementation was approximately 15 minutes delay in receiving the account verification email. The application now uses Node.js module called Nodemailer which supports the usage of multiple transport services for email delivery. We have used gmail as our transport service. The email delivery now is almost instantaneous. Nodemailer lays emphasis on security of email transmission with zero code dependencies.

3. **Uber and Lyft APIs:** Uber's Price Estimates endpoint returns an estimated price range for each product offered at a given location. The price estimate is provided as a formatted string with the full price range and the localized currency symbol. The response also includes low and high estimates and the ISO currency code for situations requiring currency conversions. The price range is categorized based on the type of Uber service(UberX, Uber Black etc.). [9] When surge is active, its surge_multiplier will be greater than 1, but the price estimation also considers this factor. The API also provides Server token or OAuth 2.0 for user access token which can be used for authorization of a particular user or resource. Typically, the ride request estimate function that is available in the Uber API is used for this purpose. The request estimate has POST parameters like product_id, start_latitude, start_longitude, start_place_id, end_longitude, end_place_id, seat_count for upfront rates as well as surge pricing. It is important to note that trip estimates are not allowed when users are currently on uber trips. Such a case is handled by returning a 403 Http Status code.

In addition to the Uber's API we have also used Lyft's price estimation. If the destination parameters are not supplied, the cost endpoint will simply return the Prime Time pricing at the specified location. It also provides a sandbox environment endpoint to test our application before deploying it to production. The sandbox runs in production nodes itself which makes the transition from development to production environment easier.

4. **Splitwise API and Paypal payment gateway:** Splitwise has create_group, create_expense, update_expense, delete_expense and get_expense api's which will be integrated with the application to manage expense among people sharing rides. The Paypal's API authorization framework is OAuth 2.0. Request and response payloads are in JSON format. Paypal's sandbox allows us to create test accounts - business and personal. The REST API uses webhooks for event notifications which provides support for instant payment notifications or payment data transfers. We plan to use the express website payment option which is most likely to be auto approved by PayPal when we register our application. Authorizations are guaranteed for up to three days. After the three-day honor period authorization expires, the payment needs to be re-authorized.

5. **Merging plans on the same route:** Plans that have nearby source and destinations could be merged. This will be implemented by measuring the difference in the distance between nearby destinations, using the Google Maps API. Merging such plans could potentially solve the problem of indefinite waiting, wherein users who enroll for a plan with sources and destinations slightly different from existing plans do not find many enrolling for the same plan and hence do not get a chance to carpool. This can be implemented using simple algorithms for tracking distance between destinations of plans to destinations of every other plan while at the same time keeping track of the maximum available vacancy for each plan. A min heap of capacity three could be maintained for efficient retrieval of two to three plans that have closest destinations to each other.

5. EVALUATION

A single key performance indicator is not a good enough metric to evaluate our application. Multiple application integrations to wolfPool necessitate multiple objectives which require additional metrics to measure.

We introduce two metrics to observe the increase in user base from before integrating WolfPool with PayPal, Splitwise, ride fare estimation feature to after applying these integrations. One is "WolfPool Engagement Score" and the other is "Performance Score". The two main parameters that have been used in evaluating these scores are "number of visits to WolfPool page" and the "number of plan enrollments". Naturally, the latter parameter is assigned a greater weight of 5 as compared to the former with weight 3 as the ultimate goal is to get users to enroll in plans to the maximum possible extent.

Old Engagement Score=3*(number-of-visits to WolfPool phase 1)+5*(number of successful plan enrollments with WolfPool phase 1)

New Engagement Score=3*(number-of-visits to WolfPool phase 2)+5*(number of successful plan enrollments with augmented WolfPool phase 2)

WolfPool Engagement Score=New Engagement Score-Old Engagement Score

If the WolfPool Engagement Score is a large positive value, then these integrations are invaluable to WolfPool.

Performance Score=(Number of registrations in WolfPool phase 2)-(Number of registrations in WolfPool phase 1)

The performance score considers the application performance for a fixed duration(15 days) for both phase 1 and phase 2 to conclude the positive or negative shift in user base. A large positive value of performance score indicates that these integrations are invaluable to WolfPool. A large Engagement and a Performance score indicate that the applied integrations have had a significant impact on increasing the customer base of WolfPool. A small Performance Score and a large Engagement score indicate that the already existing registered users of the application are continuing to use WolfPool but people who are not already registered with WolfPool possibly see no application in using WolfPool. This could indicate including some more features that target such sections of people. A large Performance Score and a small Engagement score indicate that many people are willing to register for the application but refrain from frequently enrolling in various plans. This indicates that the effect of integrating these new features

did not have a significant impact on the application. This could also indicate that such users usually enroll in plans for which they aren't able to find other users.

One of the other key performance measure in a software industry is people and how they respond to the suite of services offered to them. Customer feedback through the application will guarantee that we pay close attention to customer retention and continue to improve and include features that are most in demand according to the current trends. Feedback can be taken through 5 star - rating of overall user experience.

6. TIME LINE

Timeline	Task	Description
3/29/2018	Report 2a Submission	Gathering requirements, surveying, and determining feasibility
1/4/2018	Study API (PayPal, SplitWise,Uber,Lyft)	Identify useful modules of API and analyze integration with existing app
2/4/2018	UI Design	Plan and Decide User Interface and divide tasks among teammates
15/4/2018	Working Prototype	Have a fully functioning prototype of the application
17/4/2018	10 minute presentation	Showcase coolness quotient of the project
27/4/2018	Acceptance Test/ Evaluation	Draft the testing report
28/4/2018	Documentation and Readme File	Report of the project including the README file on GitHub
1/5/2018	Report 2b Submission	Develop detailed project report

Figure 7: Time line for the project implementation

7. CONCLUSION

WolfPool at the moment is operating for NC State students. Feedback about the application and the impact of application is profound amidst NC State students. After integrating WolfPool with splitwise expense tracker, payment via Paypal, and providing an option to merge plans on the same route, the application can be made universal as all the basic features required to globalize such an application would be available. It is a matter of cleverly devising an architecture for replication of databases using robust distributed systems algorithms that could potentially make this an excellent standalone application by itself. Furthermore, this application could be a much appreciated add-on feature to Uber/Lyft. A large percentage of people in the world would prefer to save their travel expenses and would opt for carpooling via plans. Adding this feature to Uber/Lyft could potentially increase the frequency of customer rides and customer base of Uber/Lyft. This could have a direct impact on the revenues and P/E ratio of Uber/Lyft in the long run.

8. FUTURE SCOPE

1. It would be great if WolfPool users had the option to subscribe for push notifications from the app when the criteria for the plan are completely met. For example, users may want to take a ride only if the maximum amount of people (let's say 3) have opted for the plan. The users needn't login to the application to check if more users are opting for their plan. This feature automatically updates users via the app after their set criteria are met.

2. Wolfpool offers a platform for strangers to mingle with each other. But users may feel secure if they are paired up with friends opting for the same plan. So, the app could be integrated with Facebook to access users' list of friends and provide priority to pair them up with friends over strangers opting for the same plan.

3. More the merrier: Any traditional carpooling application like uberPool provides an option for users to refer more people to sign up for the app and provides discounts for gratuity. Similarly, existing users of the application could be provided a unique referral link with which they can earn discounts by getting more people to sign up for Wolfpool.

4. Lyft has recently been testing a subscription-based model wherein people pay a monthly price, eg:199 dollars for 30 rides where each ride is worth less than 15 dollars [8]. Such subscription-based models could eventually increase the profit margin of WolfPool and could a feature implemented in WolfPool.

9. REFERENCES

[1] https://github.com/arpitashekhar/WolfPool /blob/master/reports/ WolfPool_March_Final_Report_Group_F.pdf
[2] https://www.splitwise.com/about
[3] https://en.wikipedia.org/wiki/PayPal
[4] https://help.uber.com/h/d2d43bbc-f4bb-4882-b8bb-4bd8acf03a9d
[5] https://s3.amazonaws.com/api.lyft.com/ static/terms.html
[6] https://www.digitaltrends.com/mobile/paypal-vs-google-wallet-vs-venmo-vs-square-cash/
[7] https://www.quora.com/What-is-the-best-bill-splitting-app-for-friends
[8] http://money.cnn.com/2018/03/16/technology/lyft-subscription-plan/index.html