



CIS 4010 Senior Design Team 35 Business Analysis
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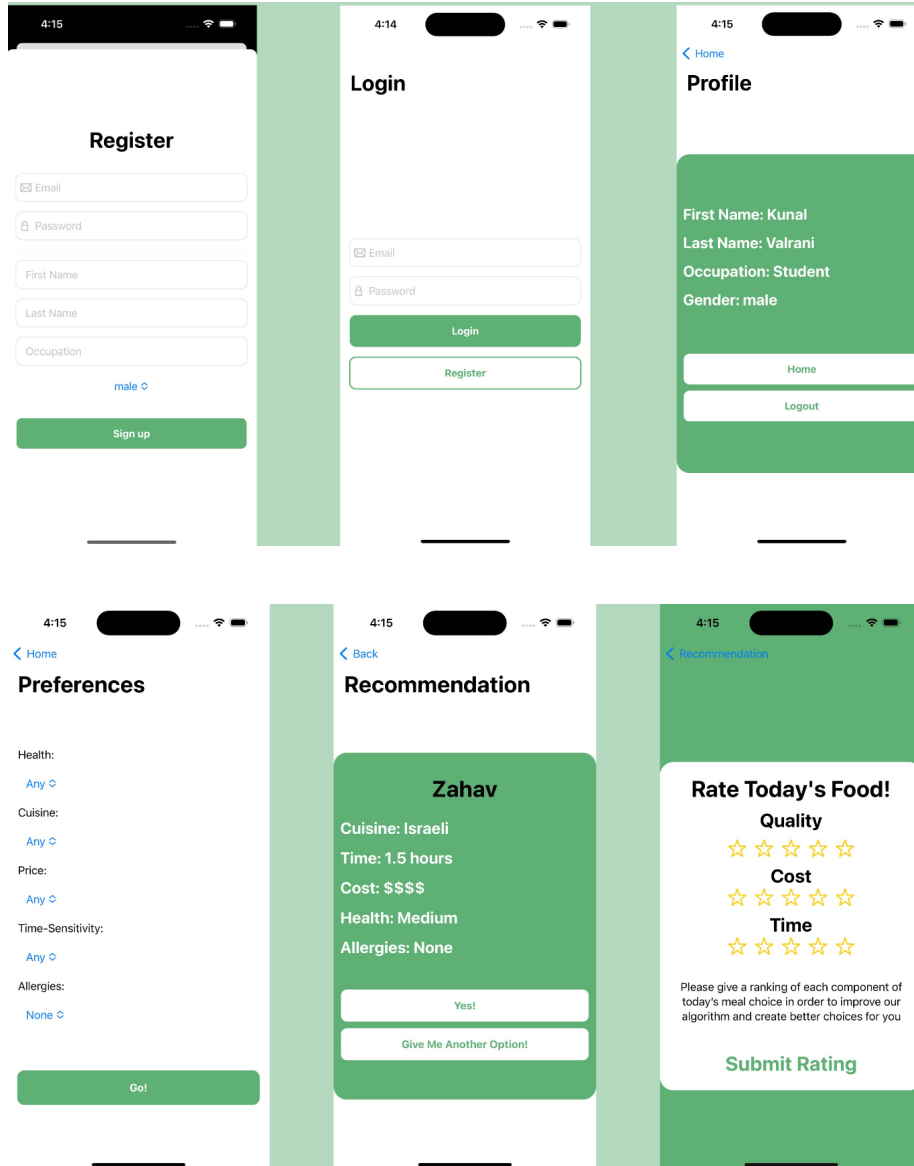
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Executive Summary

Today, busy college students and young adults in early stages of the workforce are finding it increasingly difficult to attain a suitable dietary balance throughout the week. These college students and young adults struggle to implement a diverse and healthy diet with their ‘on-the-go’ lifestyles, and thus either resort to eating the same foods, thereby forgoing a varied diet, or simply not eating enough food. This concept led to the fundamental vision of Mooncake; namely, how can we optimize where and how people can eat and enjoy their food?

Mooncake, as it stands today, is an iPhone app that uses machine learning to generate recommendations for where to eat in an instant. Created for college students and young adults, Mooncake helps these audiences pick diverse dietary options despite limited schedules. This forward-thinking allows students to select a milieu of options to eat. During our market research stage (*See more in market research section*), we learned that ease-of-use was our users’ top priority, so Mooncake is a minimalist app that focuses on navigation with the least amount of clicks possible. When registering, users create a profile featuring their age, occupation, and gender that will be fed into our machine learning model. Whenever users are interested in a meal, they input preferences relating to cuisine, time, and price. Our machine learning implementation will provide relevant recommendations to the user. Using feedback from user selections and reviews, the model will continuously improve for future recommendations specifically pertaining to the user in question (*See more in engineering innovation section*).

While Mooncake's mission, at its core, solely revolves around providing easier access to dining options around our users, there are a multitude of factors to account for in realizing this vision. Firstly, we valued rapid growth - how could we achieve Day 1 Scalability, and enable Mooncake as an interface to eventually help millions of young adults? Wherever our platform was to be launched, we noted that our eventual market size was massive, encompassing all college students and those in early stages of the workforce. Another competency we wanted to account for is retention. Once we had users on our platform, how would we incentivize them to continue to use Mooncake? Mooncake's core solution to this lies in the efficacy of our machine learning implementation. The higher the value of our recommendations to users, the more likely they are to use Mooncake, so directing our resources and time towards an extremely thorough implementation of our machine learning implementation was extremely important.



Value Propositions

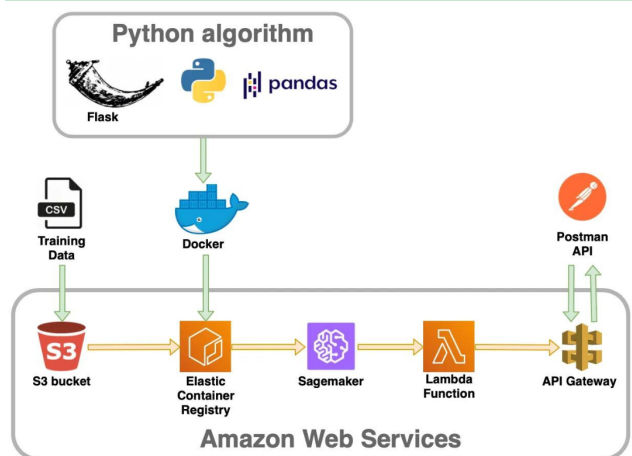
As discussed, the core **problem** is that college students and recent graduates struggle to pick diverse dietary options in their limited schedules. When designing and planning Mooncake, the idea was to create an ‘all-in-one’ food organizer that allows users to form meal plan needs according to their lifestyle needs. However, after surveying our target market, it was recognized that the problem was on a daily basis as most of these individuals do not plan their meals days in advance. Thus, our **solution** is Mooncake: an iOS app that provides instant recommendations for restaurants based on a selection of user preferences. Using a machine learning model, Mooncake utilizes user feedback to create recommendations on where an individual should eat.

Our **core value proposition** lies in the efficacy of our ML Model. Customized for each individual unlike on other platforms, Mooncakes recommendations will differ depending on a user's likes and tastes. In creating an appropriate Model to provide recommendations, we focused heavily on creating an expansive database of restaurants the Model can pick from, and on the underlying algorithms that define how recommendations will change as users provide feedback about Mooncakes recommendations. The unique database of restaurants Mooncake recommends from will likely lead to individuals being introduced to new restaurants and cuisines across the city they are located in. Another value proposition is our minimalistic user interface, allowing users to receive their recommendations with the least amount of clicks. Fundamentally, for our target audience, there is not enough time most weeks to pay attention to lifestyle needs, particularly eating habits. Most students have a rough idea about how many times they plan on cooking, eating out, ordering in etc. However, given the lack of time, they do not explore options beyond the fast casual and the well known restaurants in the city. We want to change that. We have built a recommendation system within our app that will help enhance one's eating experiences.

Engineering Innovation

Mooncake was designed and prototyped using Figma so we could get feedback from our target market before building the app. The app features a frontend built using Swift UI due to its previewing abilities and ease of use. As Mooncake expands, we will transition to React and utilize CSS to address individuals that do not have iOS products. The backend for Mooncake was structured to account for "Day 1 Scalability". In order to do this it was built on an Amazon RDS database using a PostGreSQL protocol and EC2 was used to run our server on Node JS. The relational database was used for numerous rapid lookups and aggregates, but we also have Amazon S3 storage buckets to complement this database and store larger items such as images.

The main proprietary element of our product is the ML model which was written in Python using Flask and Pandas. To host our ML model, we set up a combination of SageMaker, Lambda Functions and S3 Buckets. Our data set for this is stored in an S3 bucket, and we are using an EC2 instance and the SageMaker to run the model, which will eventually be exposed with an API on Amazon Lambda.



Market Research

When Mooncake was created, there was extensive market research conducted in order to validate that there was a need for the product. We began by determining that our primary market was college student, so Mooncake’s TAM (Total Addressable Market) is 19M people as this is the current estimate of college students in the US. Our SAM (Serviceable Addressable Market) is slightly smaller as we made an estimate that approximately 25% of students are on a school-required meal plan. This estimate was based on Penn’s numbers including undergrad and graduate students. Looking deeper into this, Mooncake’s SOM (Serviceable Obtainable Market) is 18,000 people because Mooncake is launching at Penn where there are ~24k students and ~25% on a required meal plan. We also conducted research through Penn Library and IBIS World to determine that the CAGR of the food services industry is expected to be 3.5% from 2023-2028, so there is a lot of opportunity for strong growth in the future. There are also strong tailwinds coming from the resurgence in eating out post-COVID.

Once the market was established, we reached out to our potential customers to conduct a Google survey about their food preferences and experiences on campus. From this we learned about potential competitors such as Shawna Mac or Gill Grilling which cook for different organizations on campus. However, we determined that these companies were not competitors as they did not provide recommendations, rather they just provided food. From the over 200 people that responded to the survey, the average satisfaction was 2.4/5, which is a very poor rating for such an important element in one’s life. Over 50% of respondents also believed they were going to the same restaurants too frequently and wanted variety in their diets. Following up to this question, 100% of this subgroup wanted recommendations based on their preferences. This survey demonstrated a strong need for Mooncake on Penn’s campus.

Post-surveying we launched the Beta testing which included sending out a form to individuals to record where they ate their meals over the past month. This allowed us to build a preliminary dataset for which Mooncake’s ML model was trained on. It included over 150 restaurants with

over 2,000 data points relating to time, cost, cuisines, and reviews. These data points were used to train the preliminary ML model and gave the app users new restaurant recommendations that they enjoyed.

Stakeholders

Users

Customers are often seen as the reason for a business existing; however, in the case of Mooncake, customers also are stakeholders. The quality of recommendations and ease of use of the app impacts this group as it will determine how long is spent on the app and how often it is used. If recommendations are poor, the users will no longer be interested in using the app and providing reviews, so the feedback to the ML model will begin to dry up. Thus, we view our users as a core stakeholder not only contributing toward our business, but also contributing toward the efficacy of our machine learning model.

Restaurants

Restaurants are important stakeholders as they provide the base for the expansion of Mooncake. The more restaurants that are on Mooncake, the better the model for recommendations of users. Mooncake allows for restaurants to generate additional revenue, potentially expanding locations or increasing dining options. Thus, we view restaurants as critical partners toward the growth of Mooncakes business.

Investors, Communities, and Government

These stakeholders are often the same for many startups and are not unique to Mooncake. Investors are interested in the success of Mooncake due to its financial implications on their investment as they seek to grow their returns. Communities are stakeholders in Mooncake because as Mooncake grows, it could potentially draw more interest into specific areas which could lead to future developments. Governments (city, state, and national) are stakeholders in Mooncake for the reason of taxes and regulation. The government will want to generate profit in the form of taxes off of successful businesses but it is also important for the government to regulate large corporations in order to foster opportunities for startups and prevent monopolies/price discrimination.

Competition

Direct Competitors: Yelp, Tripadvisor

The direct competitors to Mooncake are food review and recommendation sites such as Yelp and Tripadvisor. These companies allow users to see restaurants nearby that are rated by other users on their site. These competitors do not provide recommendations but rather rank the restaurants so a user can make their own informed decision. Mooncake differentiates itself from these competitors by utilizing its low-click UI and its unique ML recommendation model. The model will adjust based on the specific users preferences and reviews rather solely the reviews of others

These websites just rank restaurants by reviews (general, not specific to the user), but they do not factor in elements that Mooncake includes such as time and cost.

Indirect Competitors: Google, UberEats

Similar to our direct competitors, Google and UberEats also compete with Mooncake as they provide rankings of restaurants. However, these competitors' main task is not to rank restaurants, so they are not directly competing with Mooncake, but would rather be used as a compliment to Mooncake. Furthermore, these competitors provide recommendations based on location (Google) and time (UberEats) but do not integrate all preferences to provide a single recommendation like Mooncake.

Integration opportunities

Some of our competitors are prominent in the food space (such as Yelp), so despite competing with them, we think there are opportunities to integrate Yelp reviews into the Mooncake app. Furthermore, Mooncake will have much more data points with reviews as it is a simple three click process rather than having to type out a whole comment. Companies such as Yelp and Tripadvisor would be further able to utilize these data points on their platform potentially allowing for another revenue stream.

Revenue and Cost Models

When deciding upon appropriate revenue streams, two models were considered. Firstly, the *Freemium Model* would allow Mooncakes users the chance to utilize the benefits of our app free of charge, which we considered very important for a main component of our target audience - college students - who frequently run on tight budgets. This model would also allow for the optionality to purchase extended features on Mooncake, while free users would have these features withheld. Through further research into revenue streams of similar types of apps, we noted that monetizing through the Freemium model would be critical for rapid customer acquisition, as studies have shown that marketing a 'free app' leads to a far higher level of initial installs than a paid-for app. Moreover, we noted that subscription revenues on the App Store and Google Play Store have recently been increasing at a very rapid rate (\$13 billion in 2020, an increase from \$9.7 billion in the year before.) When considering adopting a Freemium Model for Mooncake, we noted that it would be very important in this scenario to conduct a thorough analysis on features that users would actually pay for. Thus, an extension of our market research was to speak to potential customers and gather information on extended features that they would consider paying for.

The second revenue model we considered was *Pay To Download*, where we would price Mooncake at \$0.99 on the App Store. This model would provide Mooncake with a more clear cut monetization strategy, and would limit the complicated nature of any revenue modeling. Moreover, a Pay to Download model would likely attract a more committed user base, as we

found that studies showed that users willing to pay upfront for an app were more likely to buy into its vision and continue using it, thus potentially improving our retention. Finally, we also discovered that Pay To Download apps still have a higher revenue per user than Freemium apps, though the current growth of Freemium app revenues are telling.

After much theorizing, Mooncake elected to opt for the Freemium Model. Reasons for this, as explained above, were to reach a larger initial audience (as users are far more likely to download an app free of charge), cut down on costs by focusing our marketing and design efforts on our customers with the largest lifetime value, and adopt a more complicated monetization strategy that we would try to maximize with careful market research, discovering the specific needs of our target audience.

Thus, a basic approach to our revenue model can be defined by the table below. We used market equivalents in deducing an appropriate growth rate, also taking into account our TAM, SAM, and SOM. A Mooncake ‘base’ user will have access to our recommendation platform in entirety, and possess the ability to receive on-the-go food options with full access to our Machine Learning model. A Mooncake ‘subscribed’ user will have access to our recommendation platform in entirety, the ability to add ‘friends’ on Mooncake to discover where other users are eating, direct messaging ability on the platform, and the ability to link with a group on Mooncake to curate meal experiences for groups instead of individuals.

	FY2023	FY2024	FY2025	FY2026	FY2027
<i>Mooncake Total Users</i>	29000	67667	157890	368410	859623
<i>Mooncake Free Users</i>	23200	54134	126312	294728	687698
<i>Mooncake Subscribers</i>	5800	13533	31578	73682	171925
<i>Mooncake Revenue</i>	\$68,904	\$160,772	\$375,147	\$875,342	\$2,042,469

In estimating our costs, we looked at statements from similar SaaS firms available online in producing what we thought are fair predictors of Mooncake costs over the next 5 years.

Cost Category	FY2023	FY2024	FY2025	FY2026	FY2027
Infrastructure and hosting costs	\$1,200	\$2,600	\$8,400	\$21,900	\$52,300
Development costs	\$20,000	\$20,000	\$40,000	\$40,000	\$80,000
Marketing and sales costs	\$4,500	\$11,500	\$18,500	\$40,000	\$80,000
Support and customer service costs	\$500	\$2,000	\$5,000	\$10,000	\$20,000
Overhead costs	\$5,000	\$10,000	\$15,000	\$20,000	\$25,000
Variable costs	\$10,000	\$15,000	\$20,000	\$25,000	\$30,000
Total Costs	\$41,200	\$61,100	\$106,900	\$156,900	\$287,300

As shown in the table, the cost to run Mooncake increases and adapts as our customer base expands. Conceptually, while most firms decrease their development costs over time, we decided

it would be appropriate to continue to invest in Mooncakes development over a 5 year period to begin - and retain - our status as the best food recommendation app for users.

Future Opportunities

Mooncake has the scope to rapidly expand, due to our backend implementation that has prioritized scalability. We see future opportunities in the following domains.

Mooncake across the country: Mooncake currently only operates in Philadelphia. We have the scope and opportunity to expand our areas of operation to every major city in the United States and beyond.

Mooncake Planning: Mooncake currently offers users the chance to select meals ‘on the go.’ We envision a MoonPlanner, where users may click a button and receive meal plan options for the rest of their week.

Mooncake Social: Mooncake is currently an individualized platform. We envision a social aspect of Mooncake, where communities can share their eating choices, and make reservations and food plans on the Mooncake app itself.

Mooncake Tracking: Mooncake may have the scope eventually to track users budgetary expenses and caloric intake through the week, giving our users a better picture of their dietary lifestyle.