CLOUD COMPUTING

Project Report

MyMacroChef

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Abstract- *The Idea is to implement a smart meal planning and delivery system based on user's dietary preferences like calorie intake and food type. User will be able to set-up meal options from a wide variety of dishes for the next week/month based on his desired BMI. For effective implementation of the programme, user will be prompted with meal suggestions that had been proved beneficial to other users in the past.*

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1. Introduction

It’s way past dinner time and you’re getting hungrier by the minute and cooking seems like just one more chore you’d rather avoid. You wake up the next day feeling gloomy from all the junk food you ate last night and start contemplating life decisions. With all the deadlines, responsibilities and personal commitments life throws at us, healthy eating isn’t always the number one priority. Accessible and affordable healthy food programmes can be a great solution to this problem and we are trying to address it.

2. Methodology

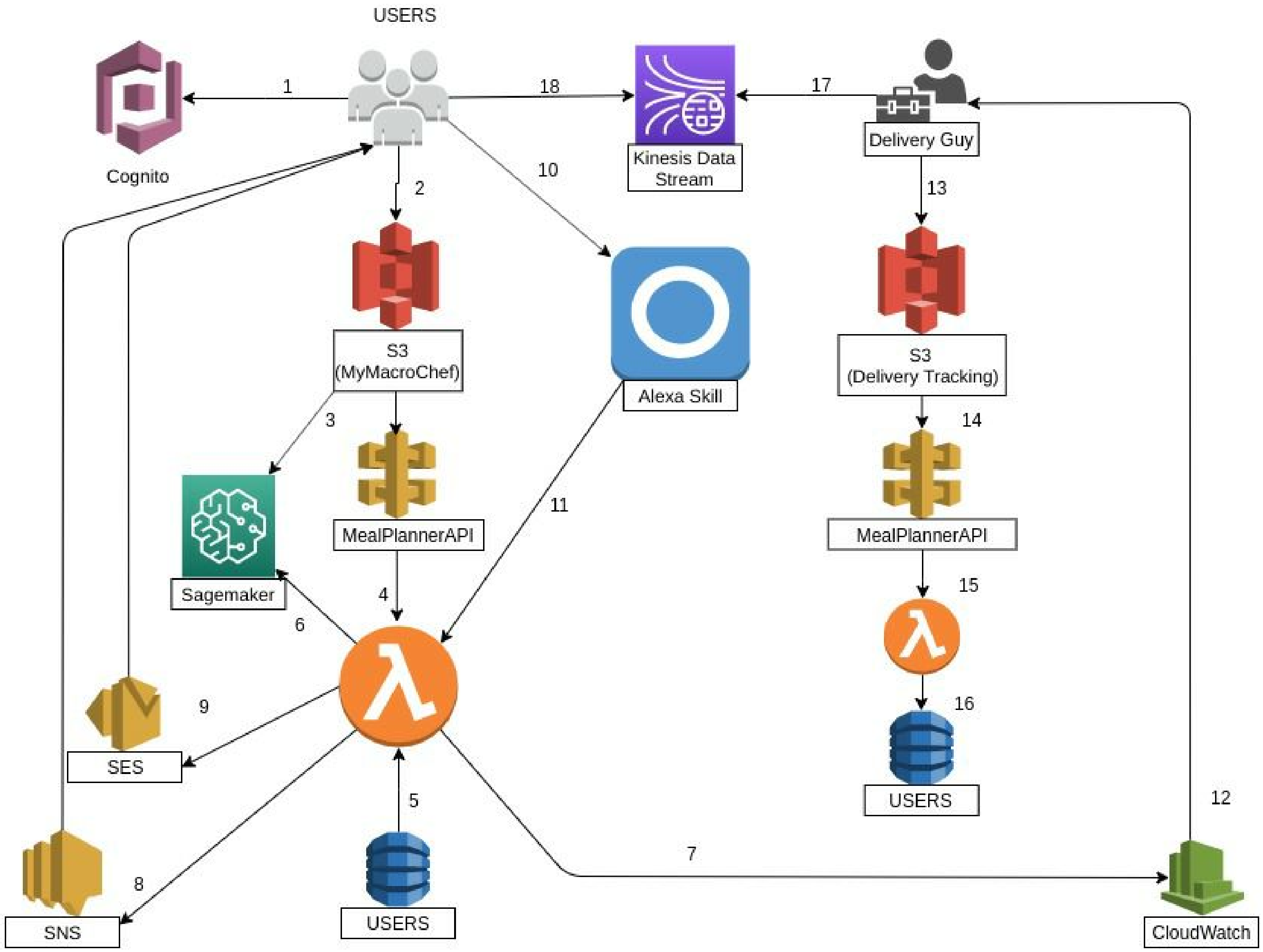
The user can get into the system using Sign In/Sign Up page after email authentication Using AWS Cognito. When the user is first signing up, he will land on his Profile page which is a Form that requires them to enter their personal information like Name, Weight, Height, Age and the type of food the user prefers to eat. We recommend what calories he should be consuming by displaying the computed BMI vs optimal BMI dynamically.

Once the user has setup their profile, system will redirect them to preferences page. The pre-populated meals are the recommended high-rated meals from thousands of users that have similar user parameters like Weight, Height, Calorie Intake, Age, Activities to the new users. The recommendations were generated by predicting cluster of the new user in K-Means Clustering Algorithm deployed on sagemaker endpoint. If the user doesn’t like the suggested recommendation in the first list, he could always get new recommendations by requesting again. Lambda function takes care of the dietary restrictions and food allergies of the new user, so he could get customized choices for meals that will best suit him.

Processing all the above information, the system will now prompt the user to enter the delivery time for each/multiple meals throughout the week. For ease of use, we have provided Day-Week-Month-View inside a calendar with interactive drag-n-drop feature. User can put multiple delivery locations for particular type of meals (For eg: Lunch at Work and Dinner at Home). Once this one-time-setup is done, user can track his delivery live. The location of the Delivery Guy is shared with the system through Kinesis Data Stream which provides real-time location of his delivery on the embedded google maps component on the web-page itself. SNS and SES were enabled to notify users for payments and delivery information. Cloudwatch events trigger the delivery guy to begin his trip at the requested time to the saved address of the user automatically.

If you want to change the meal for a day, or the delivery time/address or just cancel the meal, you can ask Alexa to do it for you.

2.1 Architecture



2.2 Components

- **SageMaker (Recommend Meals)**

Amazon SageMaker is a fully-managed service that enables data scientists and developers to quickly and easily build, train, and deploy machine learning models at any scale. With **1000** users and 300,000 ratings, Sagemaker **K-Means** Clustering model is being trained to form 35 different clusters. Each cluster corresponds to user that have similar type of details like weight, height, calorie intake, age, sex and activities. The trained model was then **deployed** to sagemaker endpoint. When a new user fill out and saves the form, sagemaker endpoint is being triggered. Prediction is being made for the new user according to his personal details and is being assigned to a **cluster**. We use the cluster information to pick out top-rated meals from the previous users in the cluster that share the same preferences as the new user.

- **Kinesis Data Stream (Delivery Tracking)**

  You can use Amazon Kinesis Data Streams to collect and process large streams of data records in real time. We used kinesis to stream the **coordinates** of the delivery guy in order to allow the user to track his delivery. The data is then fetched by lambda and S3 to display current location.

- **Alexa Skill (User Interaction)**

  The Alexa Skills Kit lets you teach Alexa *new skills*. Customers can access these new abilities by asking Alexa questions or making requests. You can build skills that provide users with many different types of abilities. The **intents** include: Change Delivery time, Change Delivery location, Change Meal for any day and Cancel Meal. The alexa was interfaces directly to update in DynamoDB when particular intent is fulfilled.

- **Cognito (User Authentication)**

  We used Cognito to securely manage and synchronize app data for users across all their mobile devices. New users can **register** to this services using Sign Up page on the web-page with email verification. The system was made secure using **access-tokens** from cognito interface and implementing it in API headers.

- **S3 (Front end and Data Storage)**

  We used S3 to store and retrieve any amount of data, at any time, from anywhere on the web. These resources include html, css, js, csv, json and Sagemaker models. The project is statically hosted on S3 with two endpoints - one for **webpage** and one for **sagemaker** model.

- **DynamoDB (User Details)**

  We created databases in DynamoDB which stored **user's** details(profile, login info, address and time of delivery, payment info, meal preferences, etc.).

- **API Gateway (RESTFul APIs)**

  An API gateway is programming that sits in front of an application programming interface (**API**) and acts as a single point of entry for a defined group of microservices. We created a number of resources(calendar, profile, preferences, etc.) which had **GET** and **POST** methods to request or send data with ‘Access-Token’ headers.

- **Lambda (serve Requests)**

  AWS Lambda is a serverless compute service that runs your code in response to events and automatically manages the underlying compute resources for you. We created a number of lambda functions which were triggered on GET or POST methods.

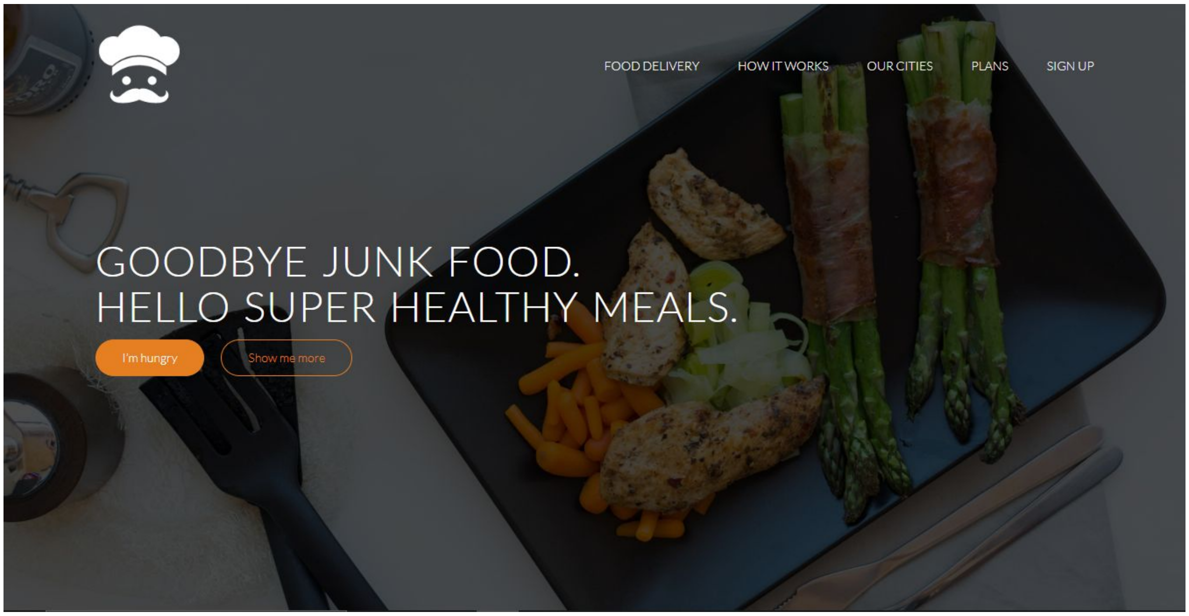
- **SES and SNS (Notification)**

  SNS and SES can be used to fan out notifications to end users using mobile push, SMS, and email. We used SES and SNS to notify user about his order, successful sign up, etc. via email and sms respectively

- **Cloudwatch (Trigger User Meals to Drivers)**

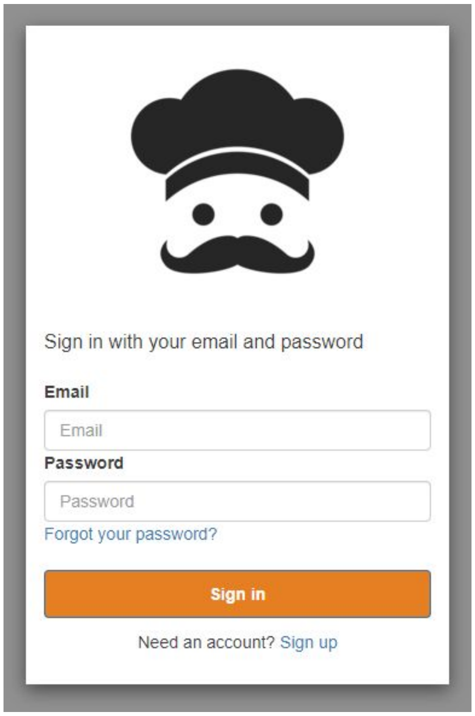
  CloudWatch collects monitoring and operational data in the form of logs, metrics, and events, providing you with a unified view of AWS resources, applications, and services that run on AWS and on-premise servers. We used CloudWatch to monitor the logs of lambda functions. Cloudwatch would also trigger event to **start the trip** before 30 minutes from the delivery time to the saved address automatically.

3. Project Workflow



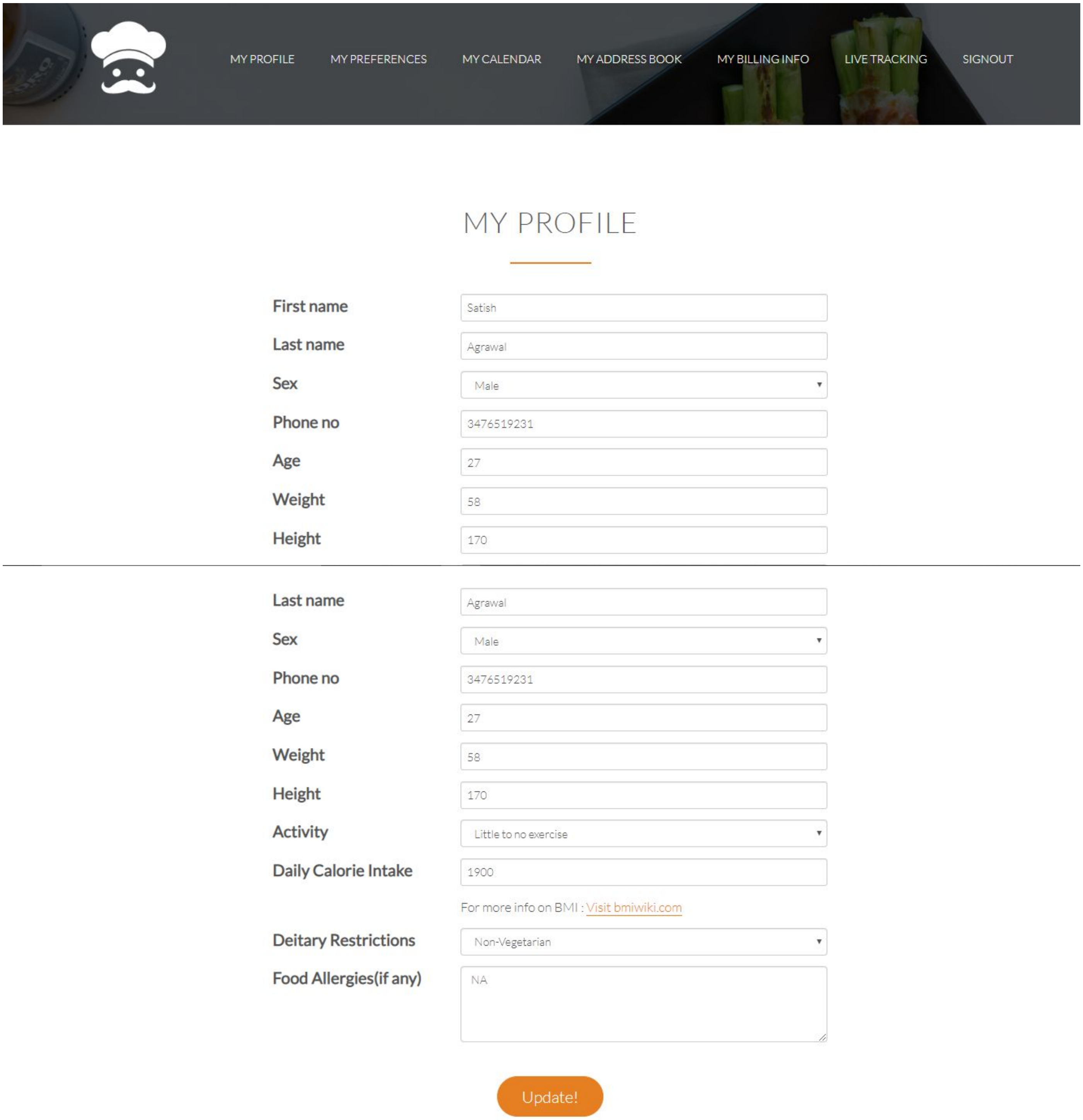
Landing page

3.1 Cognito


Sign in with your email and password

New User Registration/Sign In

3.2 Profile



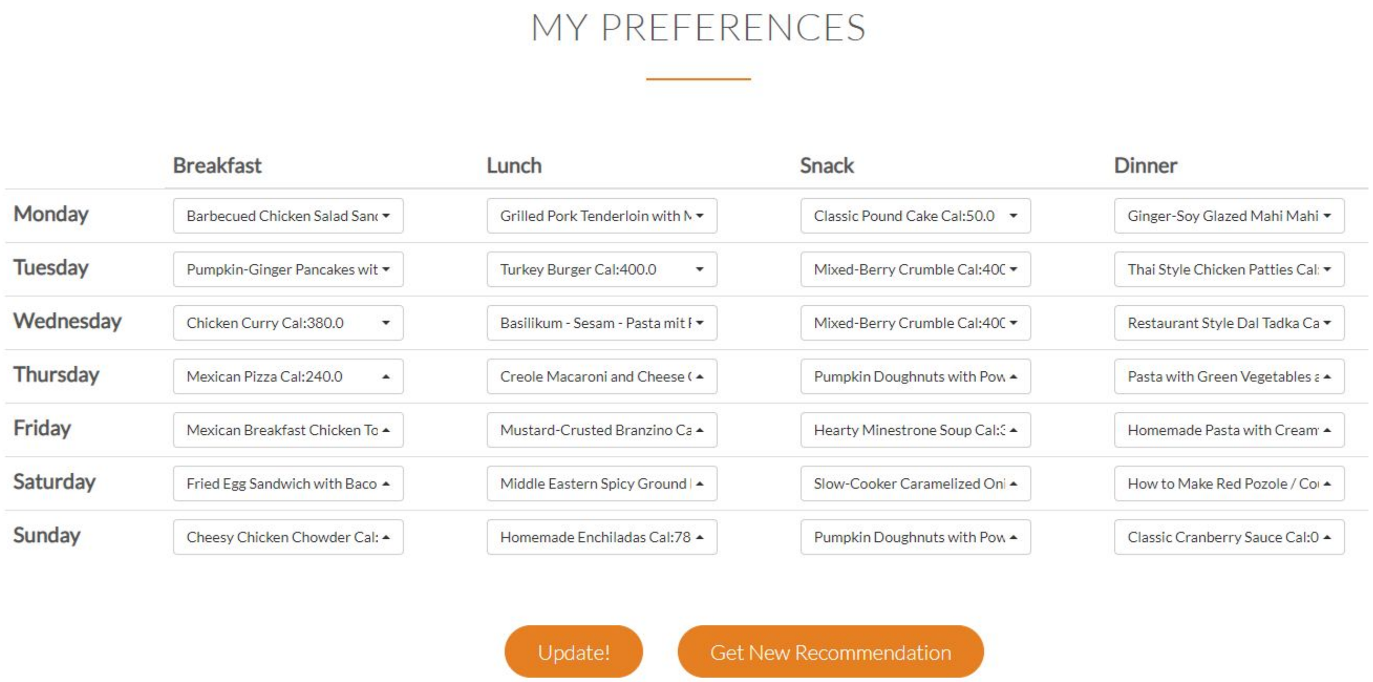
MY PROFILE

First name	Satish
Last name	Agrawal
Sex	Male ▾
Phone no	3476519231
Age	27
Weight	58
Height	170

Last name	Agrawal
Sex	Male ▾
Phone no	3476519231
Age	27
Weight	58
Height	170
Activity	Little to no exercise ▾
Daily Calorie Intake	1900
	For more info on BMI : Visit bmiwiki.com
Deitary Restrictions	Non-Vegetarian ▾
Food Allergies(if any)	NA

Fill the New User Details Form

3.3 My Preferences

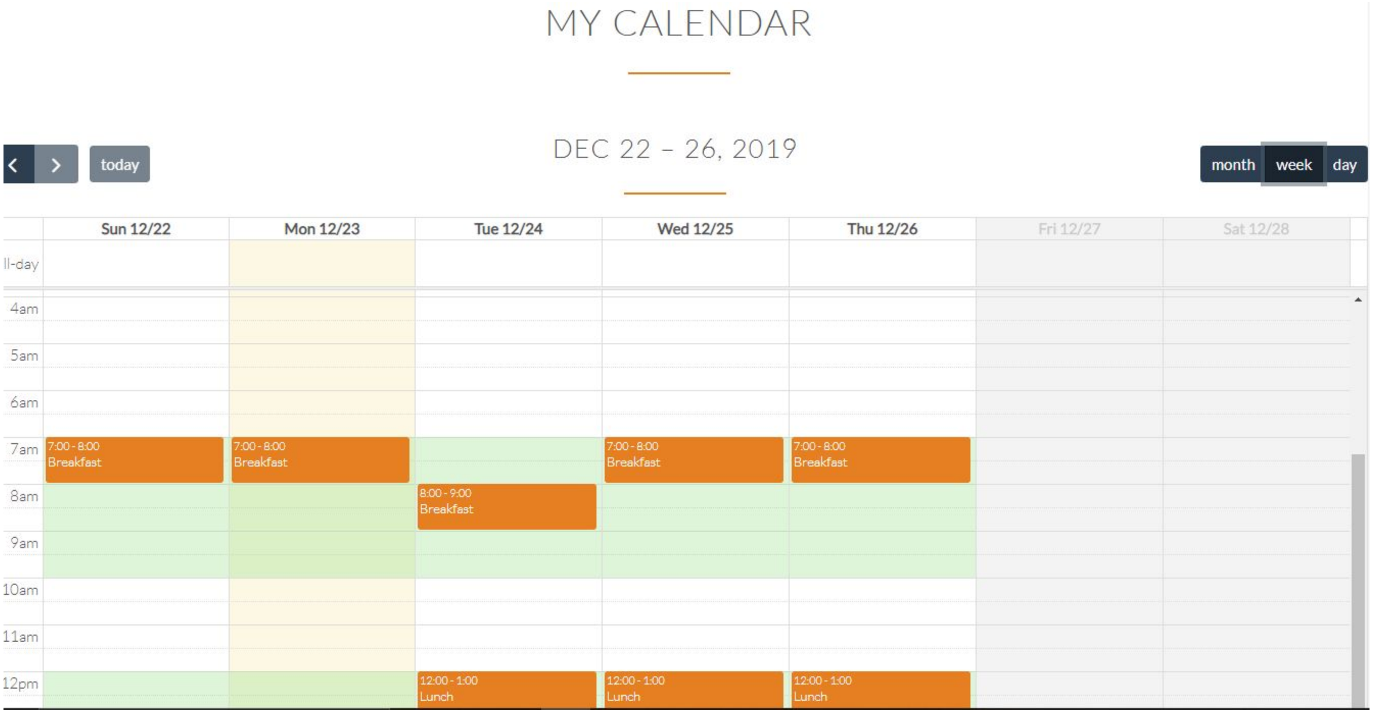


MY PREFERENCES

	Breakfast	Lunch	Snack	Dinner
Monday	Barbecued Chicken Salad Sanc	Grilled Pork Tenderloin with N	Classic Pound Cake Cal:50.0	Ginger-Soy Glazed Mahi Mahi
Tuesday	Pumpkin-Ginger Pancakes wit	Turkey Burger Cal:400.0	Mixed-Berry Crumble Cal:40C	Thai Style Chicken Patties Cal:
Wednesday	Chicken Curry Cal:380.0	Basilikum - Sesam - Pasta mit I	Mixed-Berry Crumble Cal:40C	Restaurant Style Dal Tadka Ca
Thursday	Mexican Pizza Cal:240.0	Creole Macaroni and Cheese (	Pumpkin Doughnuts with Pow	Pasta with Green Vegetables a
Friday	Mexican Breakfast Chicken To	Mustard-Crusted Branzino Ca	Hearty Minestrone Soup Cal:3	Homemade Pasta with Cream
Saturday	Fried Egg Sandwich with Baco	Middle Eastern Spicy Ground I	Slow-Cooker Caramelized Oni	How to Make Red Pozole / Co
Sunday	Cheesy Chicken Chowder Cal:	Homemade Enchiladas Cal:78	Pumpkin Doughnuts with Pow	Classic Cranberry Sauce Cal:0

Get suggested Meal Recommendations and choose from 20000 other meals

3.4 My Calendar



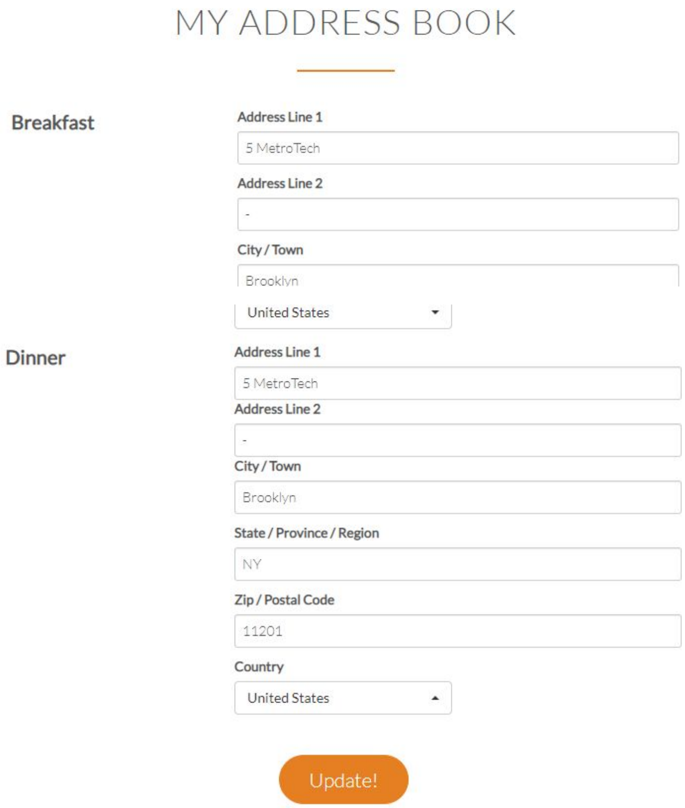
MY CALENDAR

DEC 22 – 26, 2019

	Sun 12/22	Mon 12/23	Tue 12/24	Wed 12/25	Thu 12/26	Fri 12/27	Sat 12/28
ll-day							
4am							
5am							
6am							
7am	7:00 - 8:00 Breakfast	7:00 - 8:00 Breakfast		7:00 - 8:00 Breakfast	7:00 - 8:00 Breakfast		
8am			8:00 - 9:00 Breakfast				
9am							
10am							
11am							
12pm			12:00 - 1:00 Lunch	12:00 - 1:00 Lunch	12:00 - 1:00 Lunch		

Drag-Drop to change delivery time for each meal together

3.5 My Address Book



MY ADDRESS BOOK

Breakfast

Address Line 1: 5 MetroTech

Address Line 2: -

City / Town: Brooklyn

United States

Dinner

Address Line 1: 5 MetroTech

Address Line 2: -

City / Town: Brooklyn

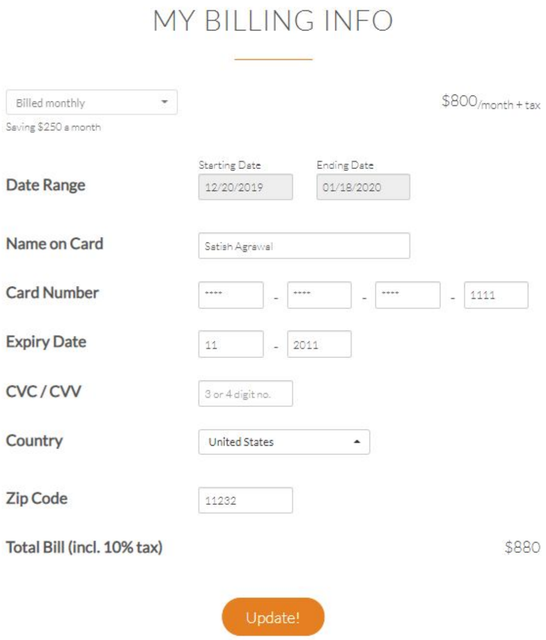
State / Province / Region: NY

Zip / Postal Code: 11201

Country: United States

Enter delivery location for each Meal Type

3.6 My Billing Info



MY BILLING INFO

Billed monthly

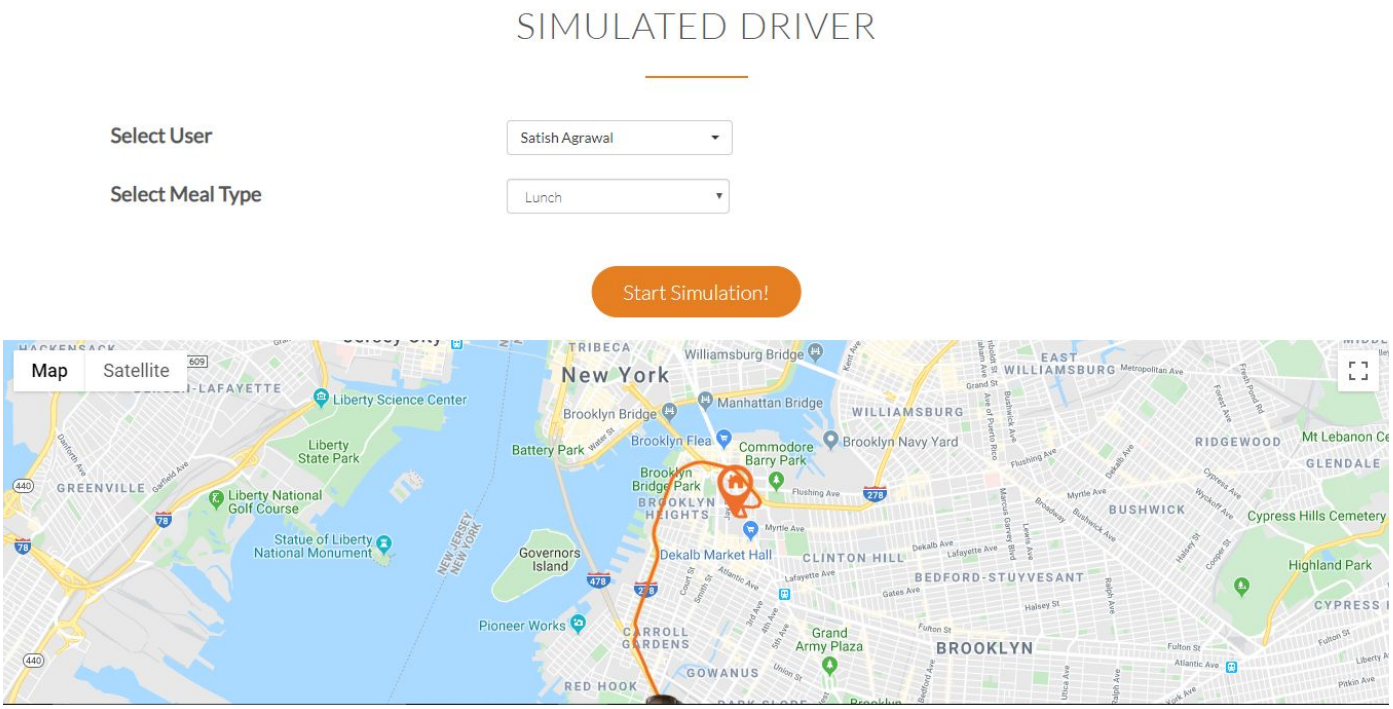
Saving $250 a month

$800/month + tax

Date Range	Starting Date 12/20/2019	Ending Date 01/18/2020
Name on Card	Satish Agrawal	
Card Number	**** - **** - **** - 1111	
Expiry Date	11 - 2011	
CVC / CVV	3 or 4 digit no.	
Country	United States	
Zip Code	11232	
Total Bill (incl. 10% tax)		$880

Enter Payment Details

3.7 Live Tracking

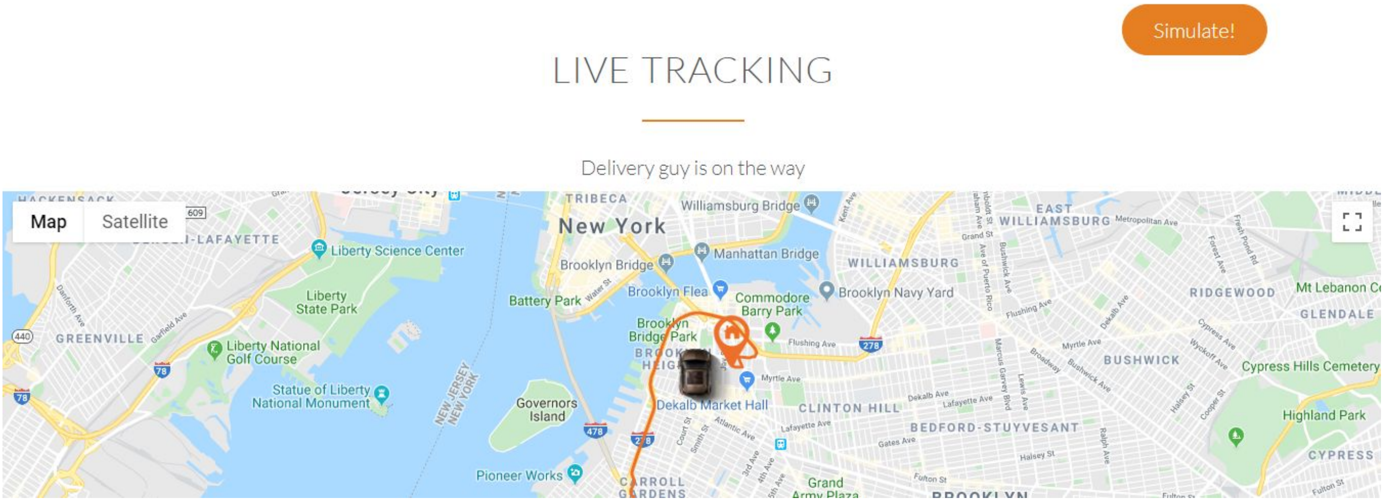


SIMULATED DRIVER

Select User: Satish Agrawal

Select Meal Type: Lunch

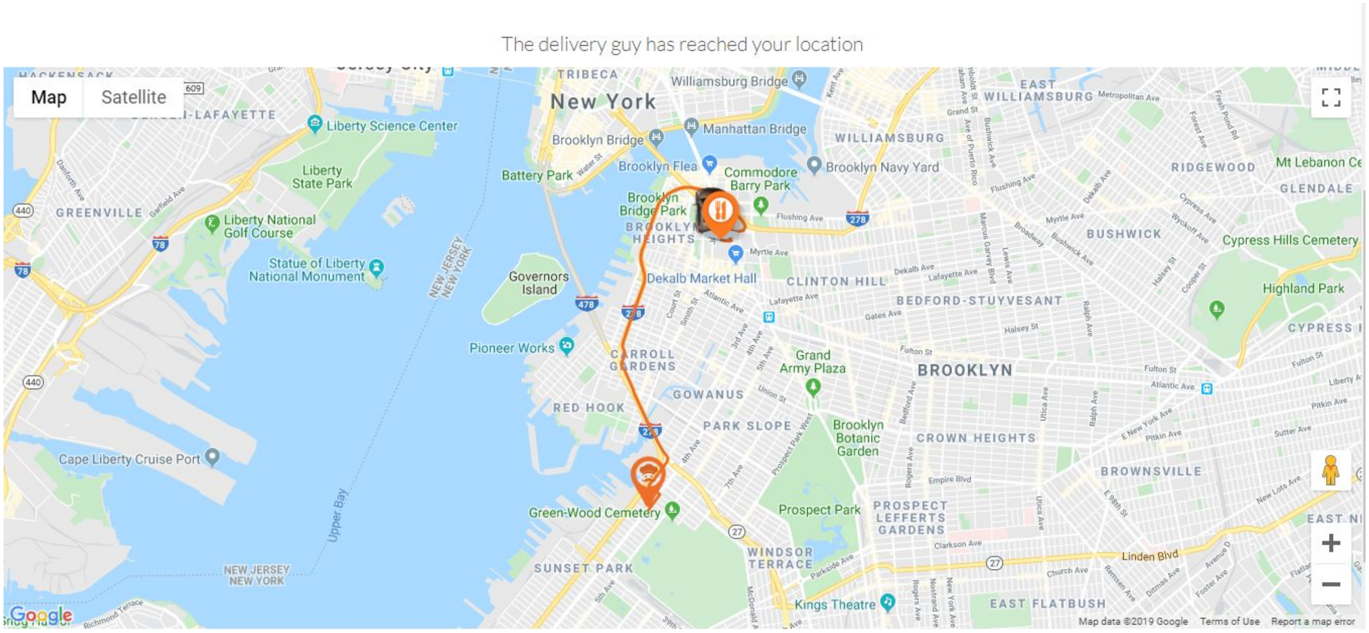
Clouwatch triggers this automatically but for demo we trigger it with Start Simulation button
(This will pop-up Delivery Guy's webpage)
(Go back to the original webpage to track the delivery)



LIVE TRACKING

Delivery guy is on the way

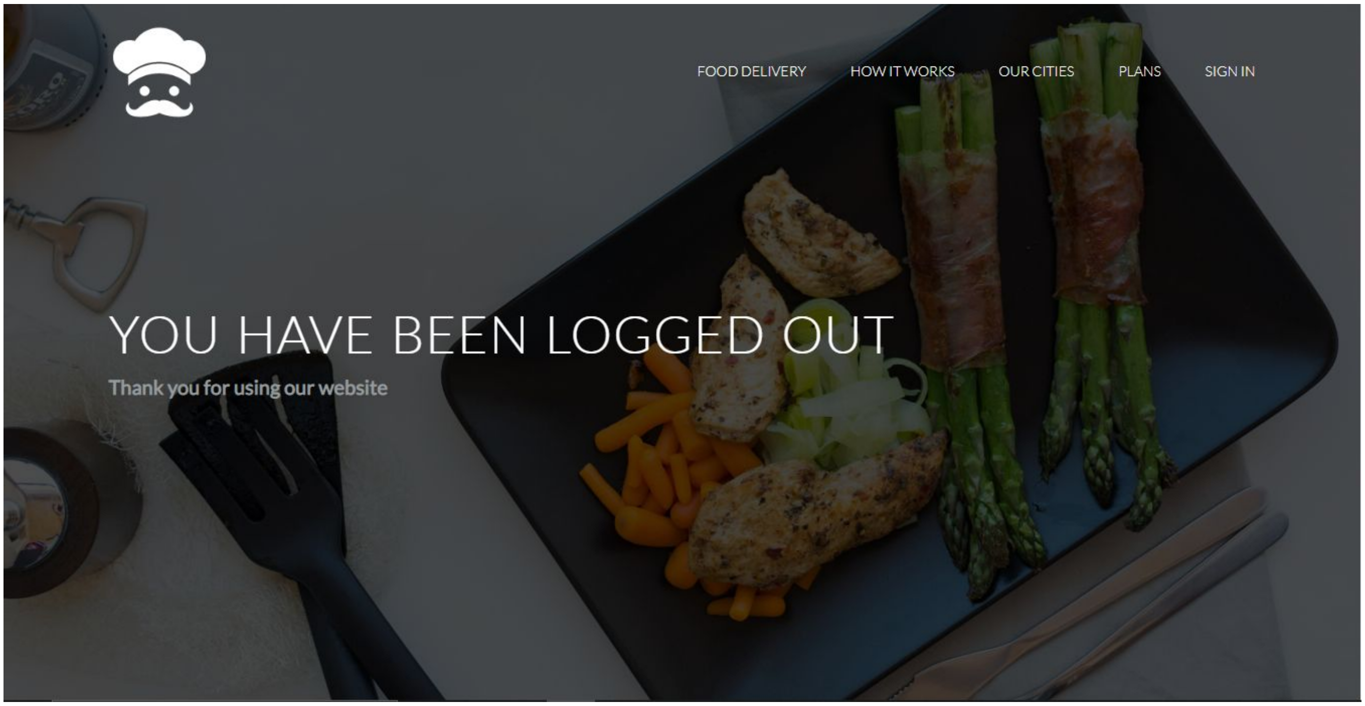
User can locate his delivery guy location in real time



The delivery guy has reached your location

User gets notified by email and text when the delivery guy reaches his address

3.7 Signout



YOU HAVE BEEN LOGGED OUT

Thank you for using our website

4. Future Work

- Meal selection currently supports only one week. Extend it to support entire subscription length.
- Go to macro level instead of just calories
- Enable alexa to get macros of requested meal
- Integrate NLP to support individual recipe manipulation for more customized user experience.
- Eventually, integrate robotics to enable food preparation using the detailed recipe and micro-level breakdown of each ingredient.

5. Conclusion

We have successfully built a fully-scalable, full-fledged Meal Recommendation and Delivery system that helps a user to maintain a healthy lifestyle. The one-time setup, easy tracking and Alexa-powered functionalities allows user to handle every aspect of food-ordering experience in a smooth and systematic way.