

Interaction Design

App Design Summaries

Summary 1:

☰ App Description

App Description

App Idea

The PG&E Energy Reducer will be a web application for PG&E customers that will allow them to visualize their heat and electric consumption through easily readable and understandable graphical representations. The app will also show trends and recurring energy spikes and will give the customer advice to help reduce their energy consumption as well as their energy costs.

App Users

PG&E customers without smart home products or other applications that monitor energy consumption (i.e. smart thermostats, energy monitors) aged at 18+.

App Workflow

To use our app a PG&E customer will ****sign in to their account***** where they will be met with a number of charts showing consumption for both gas and electric by day, month, and year. Areas of high consumption will be identified and highlighted by the app, which will be accompanied with advice to reduce consumption in said areas. The users will use the information provided by the app to reduce their energy consumption.

App Data Types

JSON files of customer usage data from PG&E database
Auth credentials

Summary 2:

☰ App Description 2

App Description 2

App Idea

The PG&E Energy Reducer will be a web application for PG&E customers that will allow them to visualize their heat and electric consumption through easily readable and understandable graphical representations. The app will also show trends and recurring energy spikes and will give the customer advice to help reduce their energy consumption as well as their energy costs.

App Users

PG&E customers without smart home products or other applications that monitor energy consumption (i.e. smart thermostats, energy monitors) aged at 18+. These customers are not expected to be technically savvy, so the application will be tailored to the average non-technical customer.

App Workflow

To use our app an approved PG&E customer will be met with a single page with a few charts showing consumption for both gas and electric selectable by day, month, and year. Areas of high consumption will be identified and highlighted by the app, which will be accompanied with advice to reduce consumption in said areas. The users will use the information provided by the app to reduce their energy consumption.

App Data Types

- JSON files of customer usage data from PG&E database
- Auth credentials and interaction

App Views

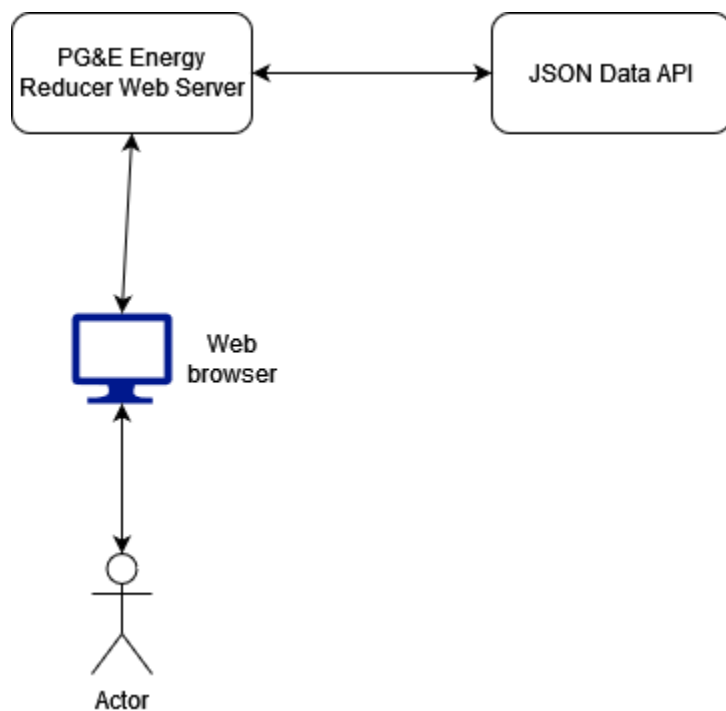
- Single page with different graphs/sections that refresh within the page
 - Select time range, energy type
- Emotional translation of data i.e. carbon output in kg, miles driven (from PG&E), Wren
 - API calls

Implementation Challenges

An anticipated challenge is the difficulty in plotting consistent and readable graphs. Inconsistent range and missing data are challenges that we will need to come up with a solution for so that our graphs are still useful and readable.

- Possible limited range of data depending on how PG&E keeps their database

System Overview



A simplified explanation of how our system works is displayed above. A user loads the site from their web browser, which queries the web server. Any data that is needed is returned via a JSON API.

Stakeholders and Users

Stakeholders

Primary:

Residential/Business owners using PG&E

The primary stakeholders in this project are residential or business owners that are consuming energy through Pacific Gas and Electric. Users that do not already have access to energy consumption data through other smart devices are expected to be the majority of these stakeholders. However, there will be users who already have access to the data but want to use this application for better understanding their energy consumption.

Engineering stakeholders:

Sachin Fernandes (Scientist)

Patrick Seidel

Nate Allsop

Zayne Pepin
Wes Alberg
Jack Hayes
Jack Snowden
Peter LaMantia
Soham Sheth

Secondary:

Investors
Diverse Suppliers
Community
 Emergency Responders
 Environmental Organizations
 Economic Organizations
 Climate Resilience Organizations
Employees
 Current
 Prospective
 Retirees
Labor unions

Users:

Residential/Business owners using PG&E

Personas

Primary User 1:

Name: Nilufer
Occupation: Interior Designer
Age: 24 years
Location: California, USA

Nilufer is an Interior Designer working with a multinational company. She has been a customer of PG&E for a long time for almost the last 6 years. She always used to wonder why her electricity bill used to vary. After using the application she got to know the unnecessary use she had while consuming electricity and heat. But, the app helped to analyze where she can save the heat and energy during which day and time of the week and now she is saving a lot of money which she is using for her further investments (again a suggestion provided by the app)

Primary User 2:

Name: David
Occupation: ML engineer
Age: 30 years

Location: New York, USA

David is a machine learning engineer in California. Since 2019 he is working from home and he has seen a rise in his monthly bills. He knew there would be an increase in monthly bills but after he started using the app he came to know that he can actually save 30 %of heat and electricity that he used to waste. He started analyzing and saving heat, energy and electricity.

Secondary User 1 :

Name: John

Occupation: Scientist

Age: 34 years

Location: Houghton, Michigan

John is a scientist who has been working with PG&E. He has gone through many complaints from the PG&E customers regarding sudden rise in electricity bills. So John came up with a solution of sharing data to the individual with the help of an application. He saw the idea actually worked and people have started recognizing where they use unnecessary energy and that was the reason for sudden rise in electricity bills.

Secondary User 2 :

Name: Kelly

Occupation: Scientist

Age: 28 years

Location: California, USA

Kelly is a scientist working with PG&E company. She came up with an awesome idea from the environment point of view and attaching the energy consumption directly to the customer's emotion. She suggested the idea that while sharing the customer data in graphical form or distribution you can send some message like you could have saved some amount of money and from that money you could have done the following list of things. She had an amazing idea of gamifying the app which would keep people connected more to the application.

Environment Descriptions

The PG&E Energy Reducer will be designed for 'in browser' desktop use, but will be scalable for usability on mobile browsers.

Notes

Notes from the interviews with the scientist and among ourselves.

Interview Prep

☰ Scientist Interview Prep Notes 1

Team 3 Pre-Interview Notes

Scientist/Client Names:

Sachin Fernandes

Meeting Date and Time:

1/18/2023, 4pm EST (1pm PST)

Meeting Location:

<https://michigantech.zoom.us/j/83861060135>

Team interview roles:

Team Leader: Patrick Seidel

Note takers: Zayne Pepin

Interview questions:

1. Team member introductions
 - 1.1. Name
 - 1.2. Year
2. Ask Sachin about himself
 - 2.1. His background in the industry
3. Overarching goals for project
 - 3.1. Gather specifications & requirements (What will the application do?)
 - 3.1.1. Simple, easy to understand and use. Straightforward graphs and visuals.
 - 3.1.2. Basic recommendations
 - 3.1.3. Display consumption relative to an 'ideal' home -> need to qualify what this is
4. Who is the app going to serve?
 - 4.1. Stakeholders
 - 4.2. User roles and use cases

5. How will we be utilizing the provided libraries (broadly)?
 - 5.1. C3Js
 - 5.2. Service workers
 - 5.3. Web frameworks
 - 5.4. Authentication
 - 5.5. Interfacing 3rd party APIs
 - 5.6. How to access the PG&E API
6. Ask about the situation with the backend database, do we just query or is there more development to be done
7. Ask about what information the API has and what data we'll need
 - 7.1. Any documentation available?

<https://github.com/manatarms>

 Scientist Interview Prep Notes 2

Team 3 Pre-Interview #2 Notes

Scientist/Client Names:

Sachin Fernandes

Meeting Date and Time:

1/25/2023, 4pm EST (1pm PST)

Meeting Location:

<https://michigantech.zoom.us/j/89849313534>

Team interview roles:

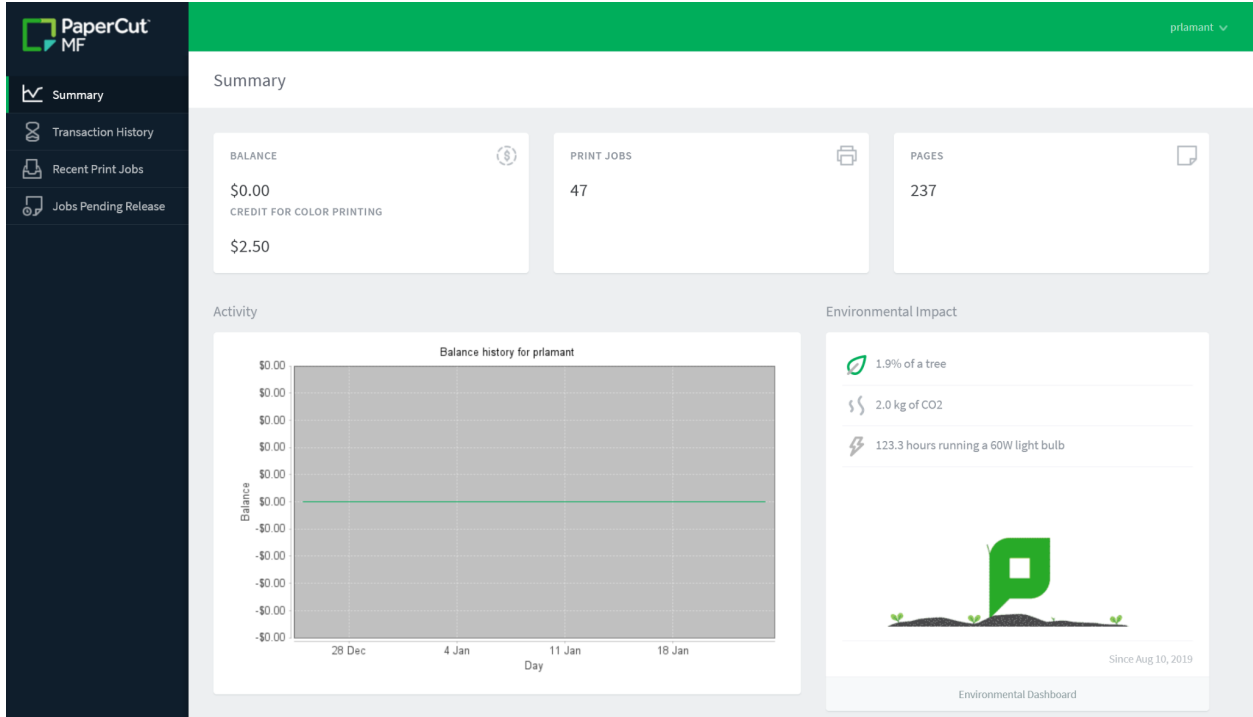
Team Leader: Patrick Seidel

Note takers: Zayne Pepin

Interview questions:

1. Discuss App Description

- a. Make any necessary changes for App Description 2
2. Identify stakeholders
 - a. Primary, secondary, tertiary
3. Major Workflow (step by step user interaction)
 - a. Multiple workflows?
 - b. Dependence on type of user
4. Data Types
 - a. Sample data?
5. Views (pages)
 - a. Widgets?
 - b. What data visualizations are you looking for?
 - c. How should anomalies be reported to the user?
 - i. Pop Ups on graphs?
 - ii. Separate page?
 - iii. Current vs previous year metrics
 - iv. Gamification?
 - v. Carbon use total similar to papercut



d. Are we plotting on many graphs? Or are we plotting all data on one graph with the ability to show/hide specific datasets?

6. Anticipated challenges

7. Ask to see/explain API and the API calls we will be making and their return types

a. Any documentation

b. API keys / authentication

8. How would you like us to implement authentication?

9. Are we responsible for setting up any hosting services/deployment?

a. If so, any recommendations?

10. Are there any roadblocks you anticipate we may have?

Interview Notes

Scientist Interview Notes 1

First Meeting with Sachin

Meeting Date:

1/18/2023, 4pm EST (1pm PST) via Zoom

Interview questions:

1. Ask Sachin about himself

Took CS4760 previously. Works at Cloudflare with their API.

2. Overarching goals for project

People can access their own data for thermal and electric consumption. The scope of this is within those. Most people go about their days and lives consuming energy (leaving fans on, heat, etc.) without surfacing the data. Sachin's idea is to surface and determine things such as days of excessive energy usage which will allow for users to not only understand their energy consumption but also to reduce it. This is also important for users as companies can sometimes charge more money based on the time or day that energy is being consumed. This project will be a stepping stone towards helping people understand their energy consumption overall.

3. Who is the app going to serve?

This app should be able to serve the public and in turn should be kept as general/simple as possible. Everyday users should be able to utilize this application without difficulty and it should be easy to understand. Therefore the UI should give simple suggestions towards energy reduction.

Stakeholders will include homeowners and the API shall give them suggestions and comparisons relative to an "ideal home." The ideal home is an idea Sachin would like to work towards determining.

The app is primarily targeted at users that are not as energy/conservation minded.

4. How will we be utilizing the provided libraries (broadly)?

Sachin wants us to utilize libraries that make sense to us, the provided libraries are suggestions that are useful and well documented relative to our project and its goals.

C3Js is an abstraction of a lower level drawing language. It will allow for less cumbersome graphical representations.

5. Ask about the situation with the backend database, do we just query or is there more development to be done

Our job will mostly be front end development, but there will be little backend work for us to handle.

Sachin will write the backend including data that we will be using.

6. Ask about what information the API has and what data we'll need

Data availability is based on monthly time ranges. PG&E charges and aggregates data monthly.

We will be able to query from buckets including day, month, and year energy consumption data.

JSON format.

Sachin's GitHub:

<https://github.com/manatarms>

Scientist/Client Names:

Sachin Fernandes

Meeting Date and Time:

1/25/2023, 4pm EST (1pm PST)

Meeting Location:

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Team interview roles:

Team Leader: Patrick Seidel

Note takers: Zayne Pepin

Interview questions:

1. Discuss App Description

Need to determine how to provide feedback to users. How to pick out patterns from the data. Therefore this section should be more “open ended” or generalized as we do not know exactly how the app will function in this way.

Users should be generalized to everyone who wants to gain more insight into energy consumption rather than focusing on those who don't already have smart devices etc. Though it is more useful to those who do not already have smart homes or similar devices.

2. Identify stakeholders

a. Primary, secondary, tertiary

Primary - People using PG&E. Engineering stakeholders.

Secondary - PG&E's consolidators.

Tertiary - The engine that does the aggregation of data and expands the usage to more people.

3. Major Workflow (step by step user interaction)

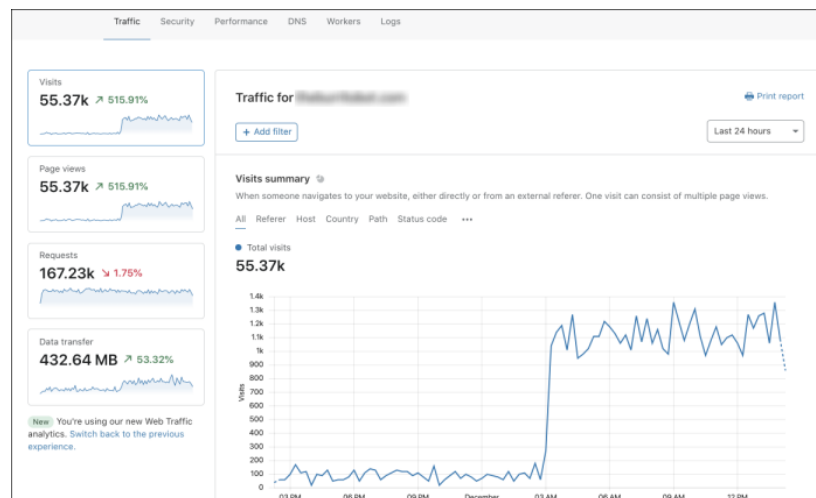
Depending on where we decide to host the application, one of the things we could do is put it in front of an auth provider so a user doesn't need to sign into their account. Sachin's account is what we will be talking to so we can abstract the user authorization. The interesting piece we want to focus on is the representation of data rather than the functionality for a user to sign in to the application.

4. Data Types

From a data visualization perspective we're just looking at time series structured JSON. Every data point has a time value which we use to plot the data. We need some credentials that we will send in our API request but they cannot be the credentials we use to access authorization as we cannot put our secret credentials in the actual code.

5. Views (pages)

Cloudflare analytics example:



We should keep everything within one page similar to the above example.

Stretch goals:

Overlaying graphs for comparing data. (may run into issues with how long data about a person can be held)

<https://www.wren.co> may have an API that can drive emotional feedback.

Gamifying the application.

6. Anticipated challenges

Plotting graphs is harder than it seems.

Inconsistent time ranges can be difficult to deal with.

How to handle days with missing data.

How to handle edge cases like NULL's or 0's.

7. Ask to see/explain API and the API calls we will be making and their return types

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  "endDate": "2023-02-08",
  "reads": [
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        "type": "ACTUAL"
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  ]
}
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    }
  }
}
```

Nominal Use Scenarios

At least 2 scenarios describing the nominal use of the application, drawing on your personas (See lecture notes and below)

Nilufer would like to observe their electric consumption from last week. Nilufer opens the PG&E Energy Reducer App, signs in to her account, selects 'Week' in the drop down menu above the 'Electric Consumption' graph, and observes her electric consumption habits from the last week. While observing her electric bill, Nilufer notices that there are many areas where she is wasting electricity, and is more conscious about her consumption over the following weeks.

John is a scientist who has been working with PG&E. He has gone through many complaints from the PG&E customers regarding sudden rise in electricity bills. So John came up with a solution of sharing data to the individual with the help of an application. He saw the idea actually worked and people have started recognizing where they use unnecessary energy and that was the reason for sudden rise in electricity bills.

David doesn't understand why his gas bill was so high from last month. David opens the PG&E Energy Reducer App, signs in to his account, selects 'Month', and checks the graph for abnormalities to understand why his gas bill was unusually expensive.

Kelly is a scientist working with PG&E company. She came up with an awesome idea from the environment point of view and attaching the energy consumption directly to the customer's emotion. She suggested the idea that while sharing the customer data in graphical form or distribution you can send some message like you could have saved some amount of money and from that money you could have done the following list of things. She had an amazing idea of gamifying the app which would keep people connected more to the application.

Error Scenario

Users could try to view data from a date or range where PG&E had not collected data, or data does not exist, this would result in an error.

There may be missing data for a given point in time. The application will need to be robust enough to handle this error.

Users attempt to access the application when PG&E servers are down or under maintenance.

Simplified Hierarchical Task Analysis

Upper level views:

- Main Page View
 - Gas usage graph
 - Electricity usage graph
 - Select date range
 - Display user tips
- Login/out view
 - Username
 - Password
 - Forgot Password
 - Redirect to PG&E
 - Create Account
 - Redirect to PG&E

Lower level views:

- API view
 - GET Requests
 - Authentication

Database schema

We do not currently have any backend database we need to configure or manage. However, we will be querying an API supplied by our scientist to supply data to our application. Thus far, we have a fairly limited description of how the API will function, but in general the API will:

- Require authentication to allow interaction
- Return data for specific time windows
- Return time-series data
- Be JSON-formatted