INVOCA

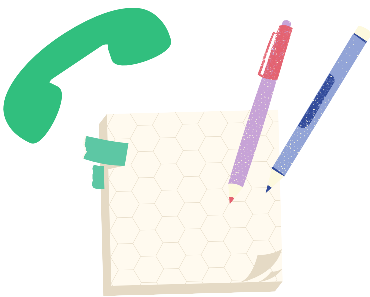
CALL SUMMARIZATION

Company: *Invoca*

Mentors: David Ron, Lauren Hedberg, Jasen Hall, Rachel Pham, Yinon Rousso

Team Name: #Koki's Kookies

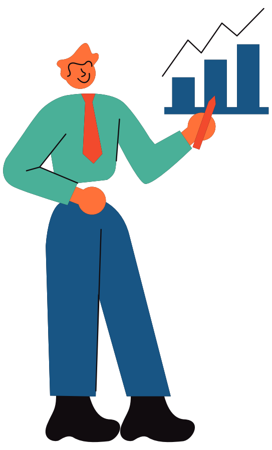
Team Members: Koki Narimoto (Lead), Adarsh Garg, Sydney Lim, Bryan Xu (Scribe), Shaurye Mahajan, Zion Wang



Introduction

What is the problem?

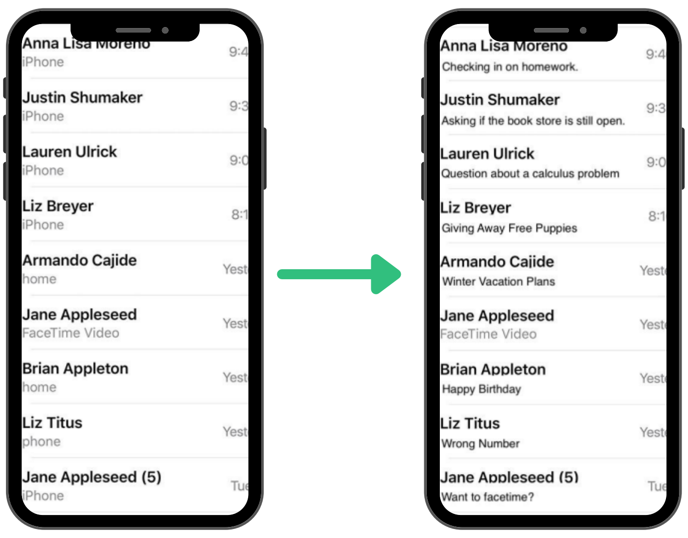
As a salesperson making hundreds of phone calls on a weekly basis, critical information gets lost. Whether this is from lack of notes or incorrect translation between conversations to text, there exists a critical need for call summarization within the field of sales folks.



What is our objective?

Remembering information from a sales call is extremely important. Regardless of how experienced a salesperson is, there will always be some information that is lost during the phone call. Thus, we need a way to refer back to our calls and recover this lost information. By using state-of-the-art speech-to-text and summarization technology, we want to give YOU the upper hand in securing sales!

Call Summarization



```
Anna Lisa Moreno          9:4
iPhone
Justin Shumaker           9:3
iPhone
Lauren Ulrick             9:0
iPhone
Liz Breyer                8:1
iPhone
Armando Cajide            Yest
home
Jane Appleseed            Yest
FaceTime Video
Brian Appleton            Yest
home
Liz Titus                 Yest
phone
Jane Appleseed (5)        Tue
iPhone
```

```
Anna Lisa Moreno                          9:4
Checking in on homework.
Justin Shumaker                           9:3
Asking if the book store is still open.
Lauren Ulrick                             9:0
Question about a calculus problem
Liz Breyer                                8:1
Giving Away Free Puppies
Armando Cajide                            Yest
Winter Vacation Plans
Jane Appleseed                            Yest
FaceTime Video
Brian Appleton                            Yest
Happy Birthday
Liz Titus                                 Yest
Wrong Number
Jane Appleseed (5)                        Tue
Want to facetime?
```

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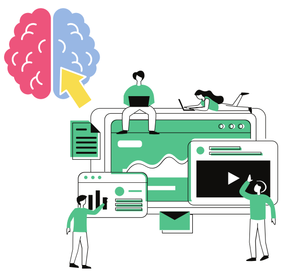
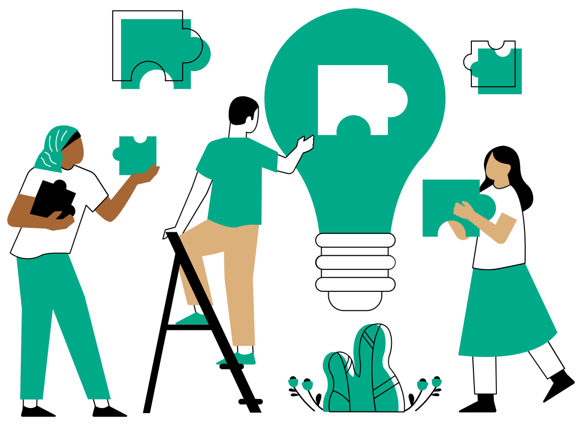
How will we implement our solution?

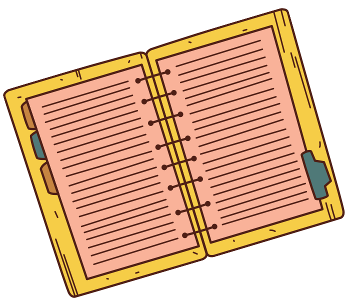
- Incorporate IBM Watson's cloud-based speech-to-text APIs to transcribe a conversation to text
- Incorporate natural language processing and machine learning techniques (i.e. sentiment analysis) to create an accurate summarization of the transcription
- Research/utilize API's to make summarizations easily readable and create visualizations to give users more options

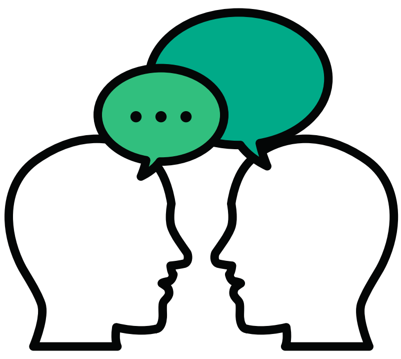


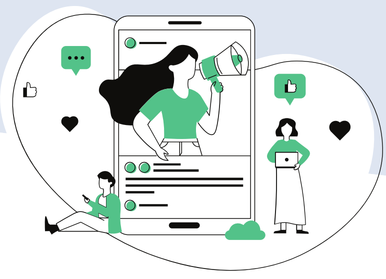
How is the problem addressed today?

To this day, there are very few solutions to this issue despite there being an apparent demand for such a product: especially within the sales force. The main reasoning for there being a lack of existing solutions is that spoken language adds several degrees of complexity to the problem. Some reasonings for the complexity include the addition of filler words, accents, style, and background noise in conversations. Thus, the following presents some related solutions; however, none are identical to this product.

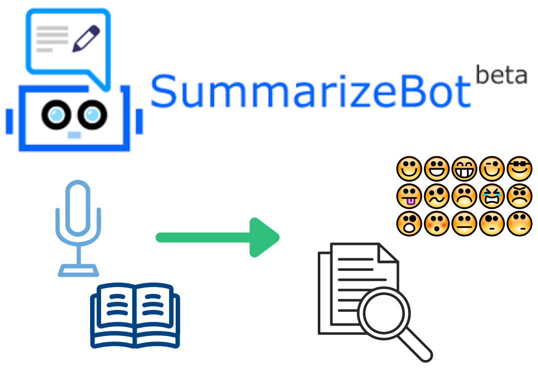








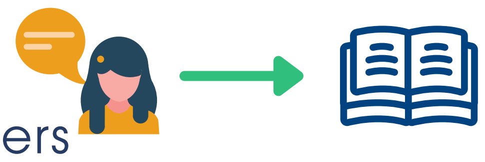
- ## Summarizebot
  - SummarizeBot allows for real-time summarization and sentiment or intent analysis of audio and text data
  - Pros:
    - Real-time audio processing and summarization
    - Keyword extraction
    - Variable summary size
    - Supports multiple languages including
      - English, Chinese, Russian, Japanese



  - Costs:
    - Free tier (14 days only):
      - 5000 included requests
      - Up to 5 API calls per minute
      - 3 MB max file size
    - Standard tier ($179/month)
      - 120,000 included requests
      - Up to 20 API calls per minute
      - 10 MB max file size
  - Custom Tier
      - Unlimited requests
      - Custom API Calls limit

- ## Cognistx
  - Cognistx is for companies to allow them to look for specific things that the consumer is saying. It can also format that speech into text form to allow them to have easy access to the information. Can also do call summarization and understand the overall call sentiment.
  - Pros:
    - Able to pick out specific answers and convert them to text
    - Can fully summarize and find basic emotions of the call
    - Intended for customer service
  - Cons:
    - Only a prototype

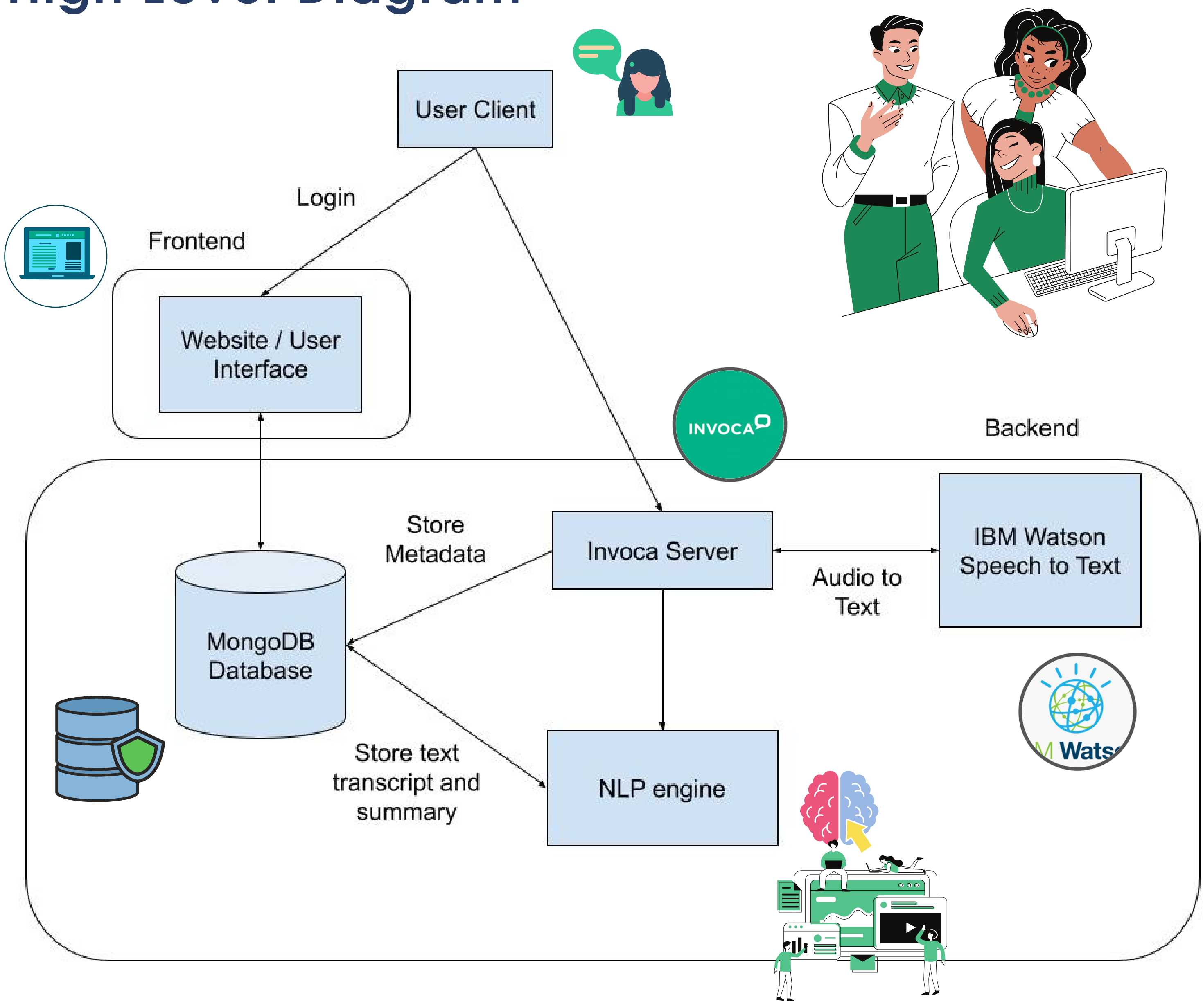
COGNISTX™



- **Abridge**
  - Abridge is a service that transcribes medical appointments. It easily gives summarizations of doctor's visits and returns a format that makes it easy to share with patients
  - Pros:
    - Free app for patients
    - Fast transcriptions and summarization
    - Highlights and emboldens keywords to make summarizations easier to read
  - Cons:
    - Only limited to the medical field

System Architecture Overview:

High Level Diagram



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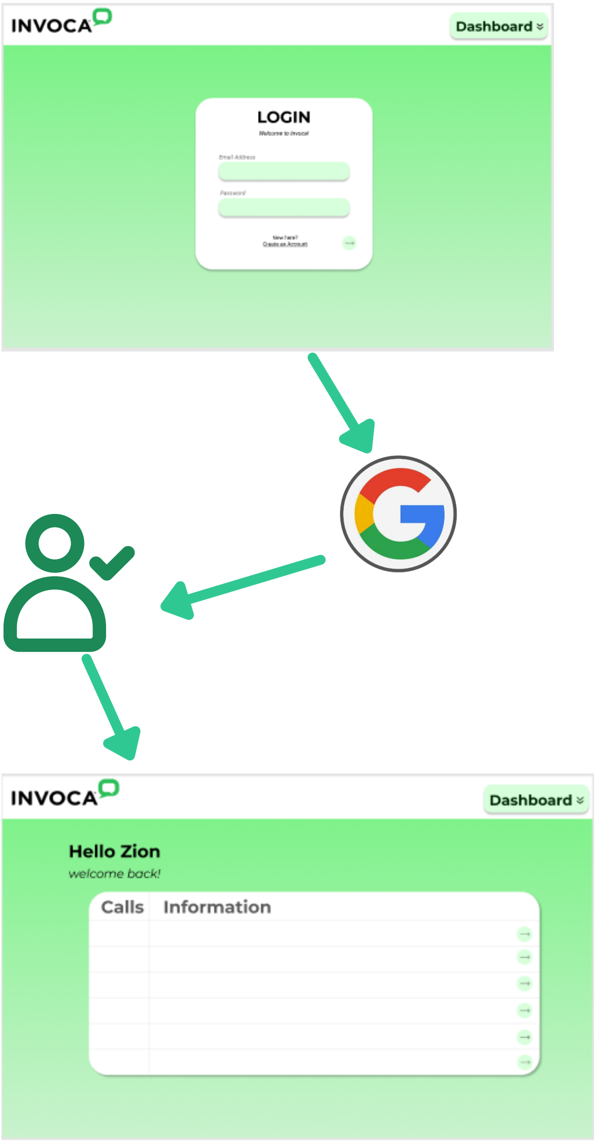
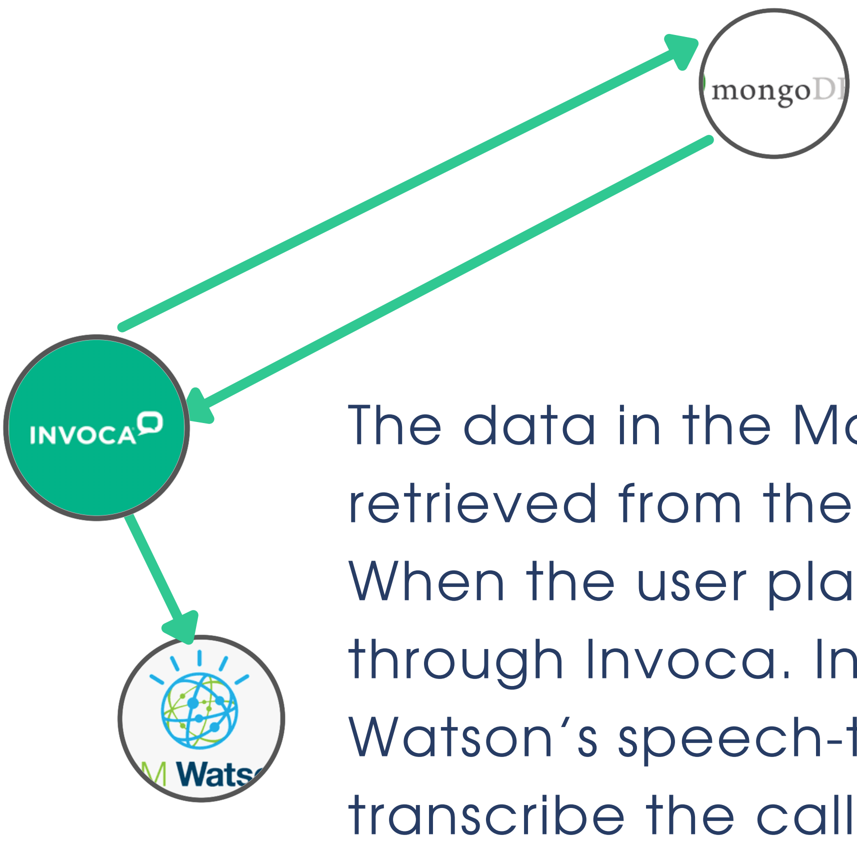
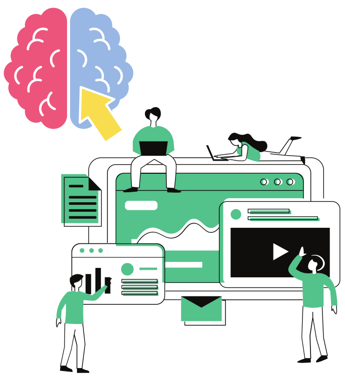
User Interaction & Design

The user accesses the front end through the website and user interface. They login with their credentials using their Google accounts which will be authenticated with OAuth. The user arrives at their dashboard, which contains a table of their call logs and summaries. This call data is retrieved from the MongoDB database





The data in the MongoDB database is retrieved from the Invoca servers. When the user places a call, it is routed through Invoca. Invoca uses IBM Watson's speech-to-text API to transcribe the call. We receive the transcribed call from Invoca's servers. First, we store the metadata directly in our database. This includes information such as the call time, call length, and customer's phone number. The full transcription of the call is sent to our NLP engine, where we will create a concise summary of the call as well as determine the customer's sentiment. Both the full text of the call and the summarization are stored back in our database.



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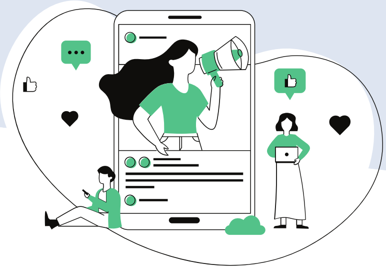
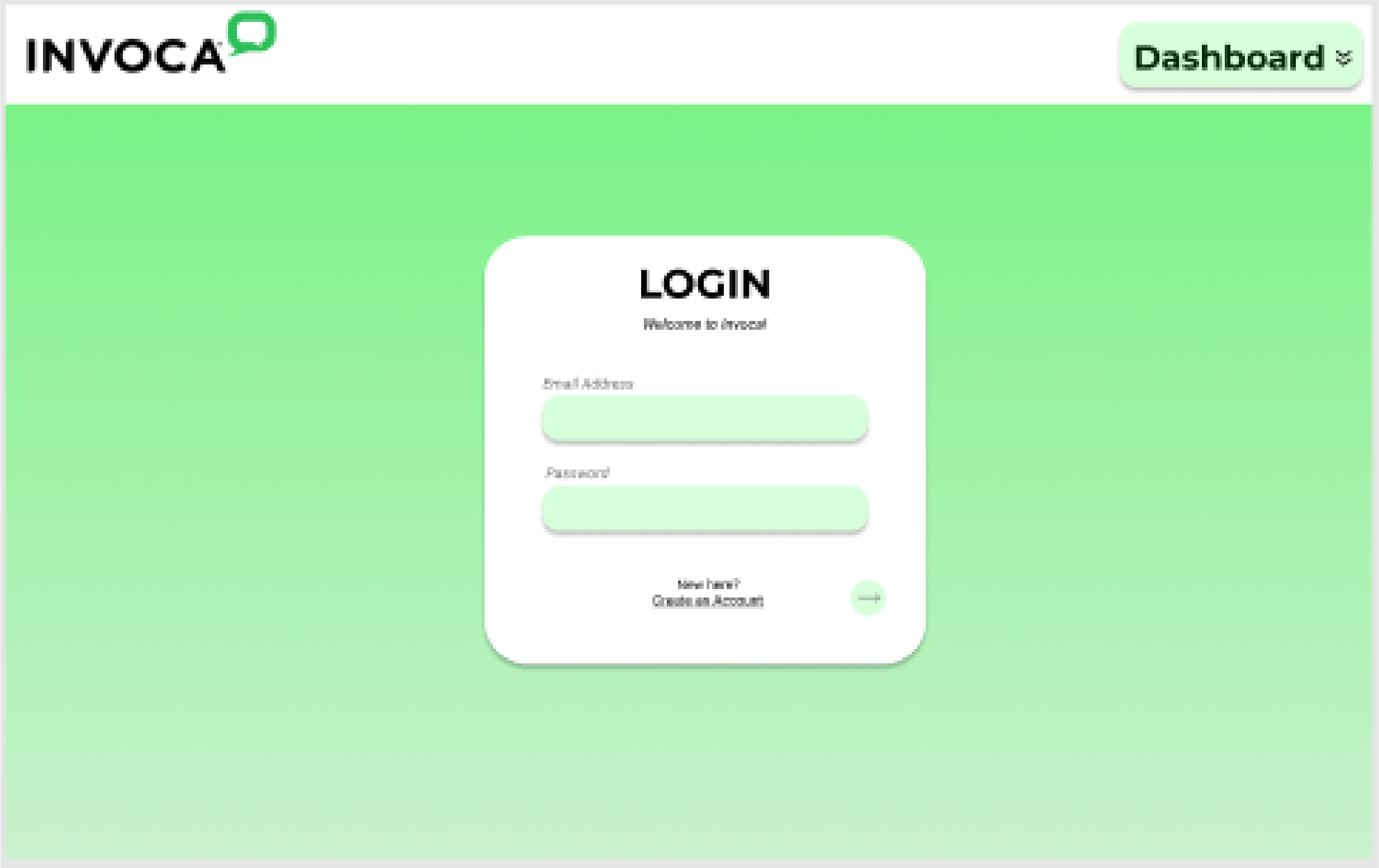
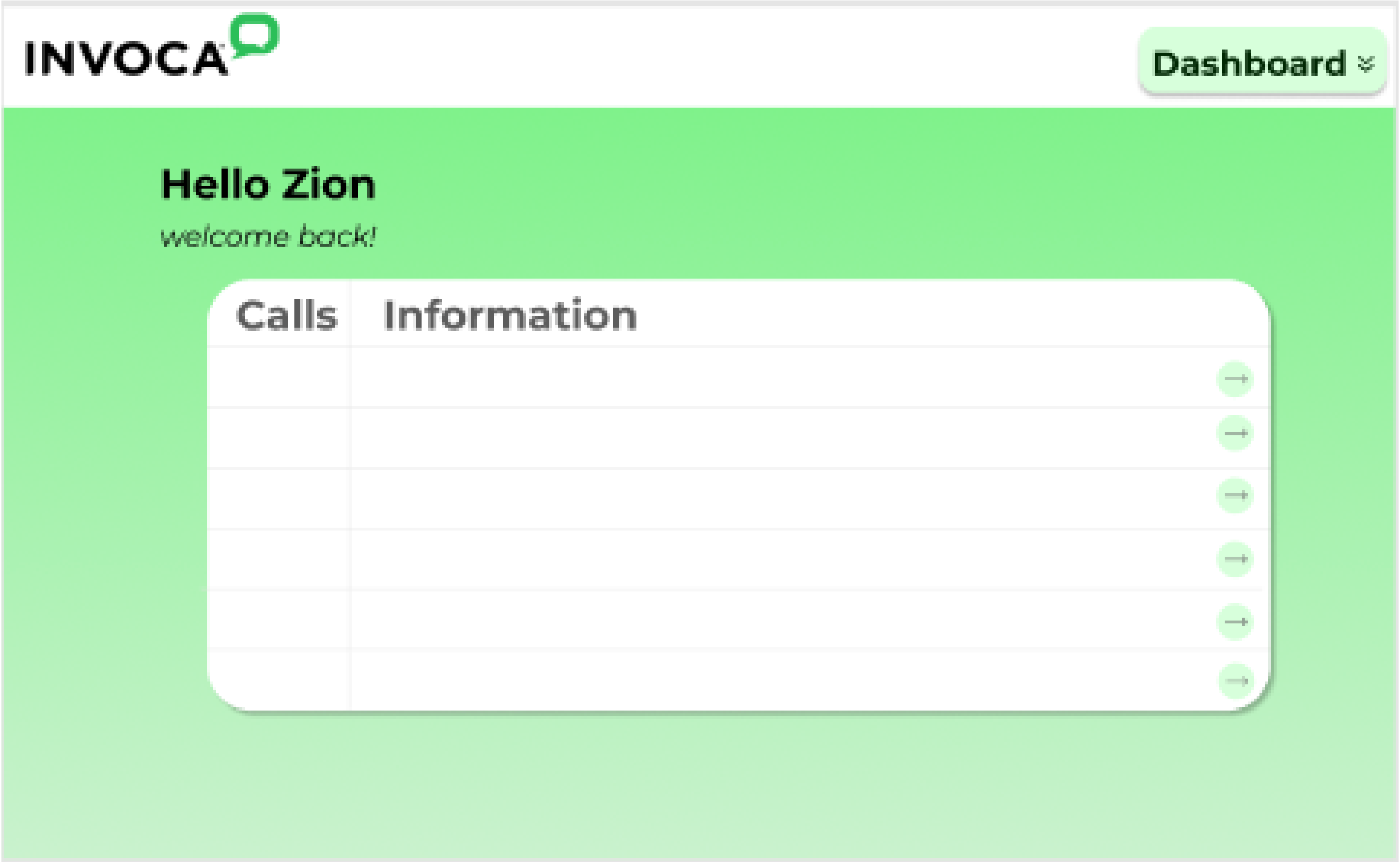


Log In



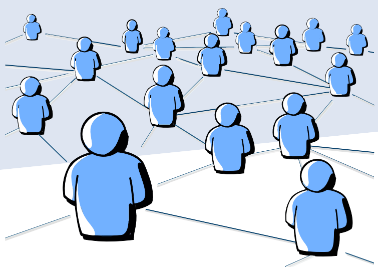
Dashboard



Thttps://www.figma.com/file/ARbWTHFeA41dbLWZoqnhlX/invoca-project?node-id=0%3A1

Our UI is meant to emulate the UI of previous Invoca projects so that long-time customers can feel a sense of familiarity with this new project. We are planning to add more pages as we continue the project but for now, we want a very simple UI to display the more complex backend we are working on.

INVOCA



User Stories:

- (1) As a user, when I open/close the app, call summarizations are left intact.
    - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/1
    - Scenario1:
        - The user closes the app after making a phone call
        - Phone call logs will still remain intact and none will be deleted upon closing the web app
    - Scenario 2:
        - User opens app after not interacting with phone number for a while
        - All previous call logs should remain intact and able to be viewed
- (2) As a user, when I look at the call summarizations, call summarizations should be neat and not obscure phone numbers/contact names
    - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/2
    - Scenario 1:
        - Call summary fits neatly in cell and names are clear
    - Scenario 2:
        - Call summary does NOT fit neatly; thus, must be truncated by creating an optimal call summary such that the most information is retained
- (3) As a user, I can swipe through my call history and click on any call summary to see the entire transcription of the particular call as well as additional information, which could include the length, sentiment, etc.
    - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/3
    - Scenario 1:
        - Call transcript is clicked in the table, and a full modal is displayed with the entire call transcript
    - Scenario 2:
        - Call transcript is truncated for being too long in table
        - User can click on table entry and pull up the full call transcript, which is expandable and interactive
- (4) As a user, I can see a suggested name if the phone number is not in my contacts.
    - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/4
    - Scenario 1:
        - If a phone number has been called before, put down previously used name for this call
    - Scenario 2:
        - If a phone number has not been called, use machine learning algorithms to predict name recommendations based on words said in conversation
- (5) As a user, I can view my profile, information, and call logs by using the navigation bar on the top/side.
    - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/5
    - Scenario 1:
        - Pulling up the web app allows the browser to correctly render the navbar, which is interactive and working
    - Scenario 2:
        - Changing pages still allows for the navbar to be displayed and interactive; the navbar should remain constant

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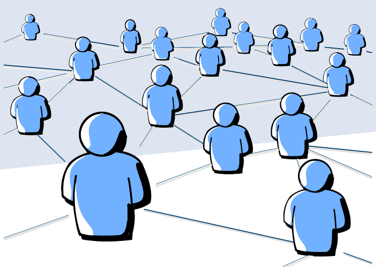
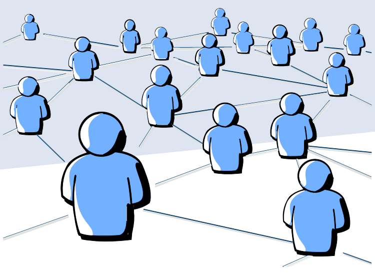
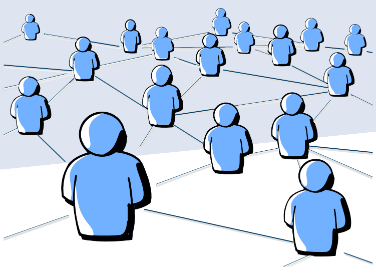


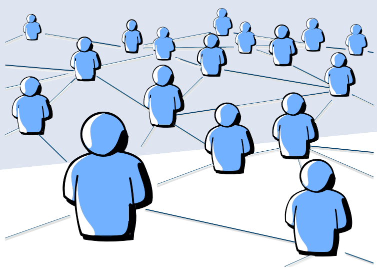
- (6) As a user, I can delete conversations that I no longer deem necessary.
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/1
  - Scenario 1:
    - When the call log table is filled with lots of calls, the user can delete any call logs that aren't as important when analyzing these call logs
  - Scenario 2:
    - When the call log table contains an unwanted call, the user has an easy time removing the call from the database
    - The call should NOT appear again upon deletion
- (7) As a user, I can upload a csv file of my call logs so that it is easier to view call summaries
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/9
  - Scenario 1:
    - A user has call logs already recorded and wants to be able to upload them easily
    - This function allows them to upload concisely
  - Scenario 2:
    - A programmer wants to input lots of data into the database for testing, this allows them to do so efficiently
- (8) As a user, I can login/register to ensure the user is permitted to access the database/resources
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/11
  - The login register will assign a unique user id to the user such that the call logs retrieved will only be that of the user logged in
  - Scenario 1:
    - A user registering will assign a new user id such that the calls that user makes will be stored in the database and displayed on the website
  - Scenario 2:
    - A user logging in will retrieving the call logs that are associated with that user id by pulling/filtering. By doing so, users will only have access to their call logs and nothing else
- (9) As a user, I can log out of my account if I am not using it and do not want anyone else to get access to my call log information.
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/11
  - Scenario 1:
    - Log out button renders upon logging in, is clickable and functions correctly
  - Scenario 2:
    - Log out button does NOT appear when not logged in, and private information is also not rendered until user is logged in
- (10) As a user, I can update the call log if the produced call log was missing some information from the notes the user took during the call
  - Github Issue https://github.com/cs189-invoca-capstone/cs189_invoca/issues/1
  - Scenario 1:
    - Since call recording and speech-to-text may lead to inevitable errors in translation, there is an edit option which allows users to edit the call log that was stored onto the website/database



  - Scenario 2:
    - If the call log did not capture important information that was not spoken during the call but you wanted to store onto the website, you can do so via this edit feature
- (11) As a user, I can see the average sentiment of my calls
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/13
  - For each call, I can see what the sentiment of that call is based on the discussion I had with the person on the other end and sentiment analysis of the conversation
  - Scenario 1:
    - The user had a generally positive conversation and would see a positive sentiment for that call log.
  - Scenario 2:
    - The user had a generally negative conversation and would see a negative sentiment for that call log.
  - Scenario 3:
    - The user had an unenthusiastic conversation and would see a neutral sentiment for that call log.
- (12) As a user, I am assigned a phone number at registration that I can use to receive call summarization
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/14
  - Scenario 1:
    - A user can access the profile page to generate a phone number if not generated
  - Scenario 2:
    - Once the number has been generated, the number is saved to the database and is displayed on the profile every time the user accesses the page
- (13) As a user, I can filter through the call logs via the search bar
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/26
  - This would provide a query that filters the database by the desired search word
  - Scenario 1:
    - I use the search option and once I filter, it brings a list of phone calls that relate to that search
  - Scenario 2:
    - I use the search option and once I filter, it brings forward no call logs related to that search
- (14) As a user, I can receive calls with the Invoca assigned phone number such that the call information retrieved from the call will be updated on the call log data table
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/14
  - Will continuously poll the API endpoint such that call logs will be updated in real-time
  - Scenario 1:
    - As soon as a user gets off the call with a client, will be able to see that call log placed into the web app in real-time
  - Scenario 2:
    - If a user gets off of an important phone call, but forgot some key information, can retrieve that call log info very quickly and will not have to wait a long period of time



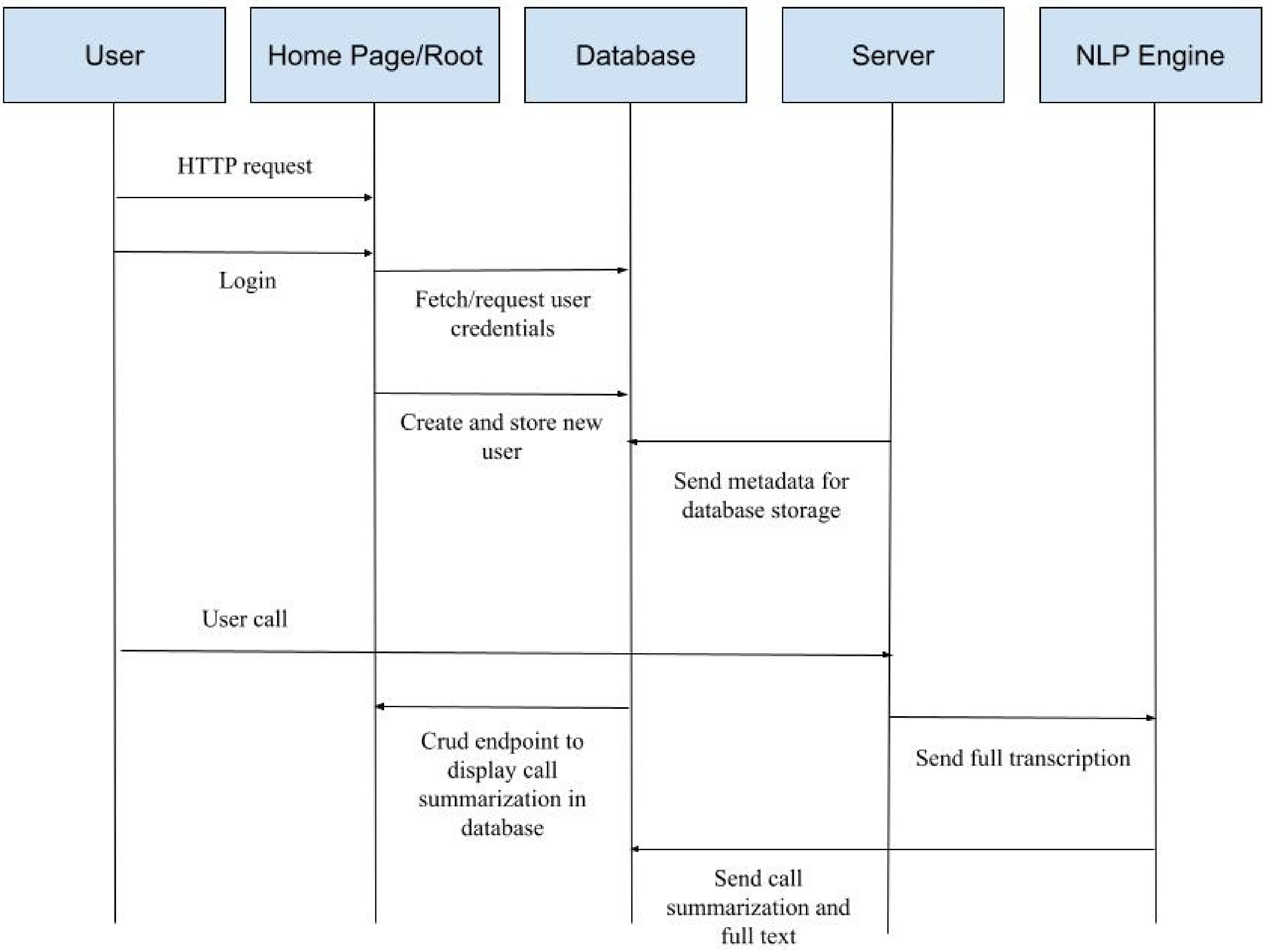
- (15) As a user, I can sort my calls based on a given field
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/27
  - Depending on what the user has chosen (choices being date, call time, sentiment), the call log list will be sorted based on that parameter.
  - Scenario 1:
    - I chose the sort by date option, it brings up a list of phone calls sorted chronologically starting with the most recent call
  - Scenario 2:
    - I chose the sort by sentiment option, it brings up a list of phone calls sorted by the calculated sentiment starting with the highest sentiment
- (16) As a user, I can scroll through my calls on different pages
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/28
  - This would use pagination to split up a user's calls into different scrollable pages so the webpage is not cluttered
  - Scenario 1:
    - I want to see a recent call, I stay on the first call log page.
  - Scenario 2:
    - I want to see an earlier call, I scroll through the call log pages until I find the one I am looking for.
- (17) As a user, I can view and update my profile as I see fit
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/29
  - Scenario 1:
    - I already have an account and I am logged in therefore I am easily able to view my profile each aspect of my profile editable
  - Scenario 2:
    - I have not yet logged in and therefore there is no way for me to view the profile page
- (18) As a user, once I log in all of my data will be automatically pulled and displayed nicely
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/30
  - Scenario 1:
    - A user not logged in will not have the ability to view the profile or the tables of calls
  - Scenario 2:
    - Once logged in the dashboard will change and all the different pages will appear
- (19) As a user, I can see the call summarization of the call that was made to quickly assess the call and take away key components/information from the call
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/31
  - Scenario 1:
    - If most of the calls that you made takes 10 min, reading through each call (speech-to-text) to its entirety will take way too much time. By having a summarization, can just take away key information
  - Scenario 2:
    - For a manager looking through the calls his/her employees made, the call summarization will allow the manager to quickly assess how the employee is doing in the calls

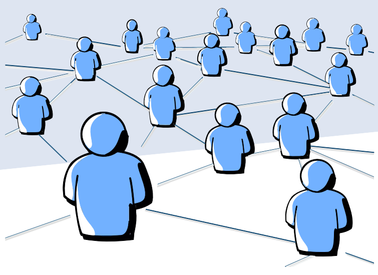


- (20) As a user, I can provide feedback to the machine learning algorithm such that if there is a certain word that is deemed unnecessary but the algorithm keeps suggesting the word, the user can let the algorithm know that word is unnecessary
  - Github Issue: https://github.com/cs189-invoca-capstone/cs189_invoca/issues/32
  - Scenario 1:
    - If a summarization includes a certain product's name, but if all of that users' calls are regarding the same product, then the name of the product is unnecessary
  - Scenario 2:
    - Since the summarization and how individuals summarize calls are different, this feedback system would allow the user to modify their call logs and summarizations to closely resemble their personal behavior

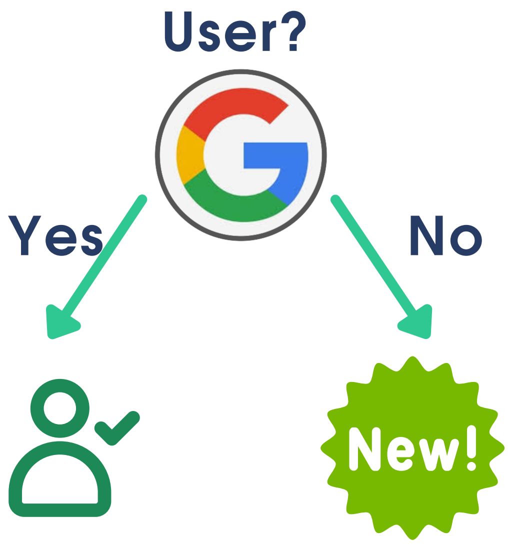
System Models

Contexts, sequences, behavioral/UML, state


User
Home Page/Root
Database
Server
NLP Engine
HTTP request
Login
Fetch/request user credentials
Create and store new user
Send metadata for database storage
User call
Crud endpoint to display call summarization in database
Send full transcription
Send call summarization and full text



The user sends an HTTP request to access the website and user interface. They login with their credentials using their Google accounts which will be authenticated with OAuth. The credentials are sent to our database to see if they are an existing user or not. If not, they are prompted to create an account. Once logged in, the user arrives at their dashboard, which contains a table of their call logs and summaries.



The data in the MongoDB database is retrieved from the Invoca servers. First, we store the metadata of the calls directly in our database from the servers. This includes information such as the call time, call length, and customer's phone number.

The full transcription of the call is sent to our NLP engine, where we will create a concise summary of the call as well as determine the customer's sentiment. Both the full text of the call and the summarization are stored back in our database. All of the call data, including the summarization, the full transcript, and the metadata, is then retrieved from the database and displayed onto the user's dashboard.

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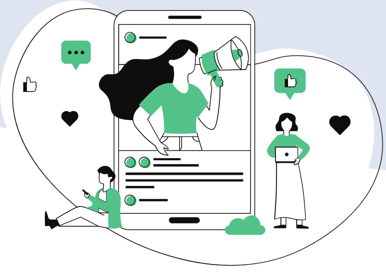

Appendices

- Frontend:
  - React JS
- Backend:
  - Node JS
  - Express JS
- Testing / Deployment
  - Heroku
  - Github
- Database:
  - MongoDB
  - Mongoose
- API
  - IBM Watson's cloud-based speech-to-text APIs
  - Invoca's native API for call routing