

Spring 2023 - Quiz App GPT Chatbot

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Project Overview

Initial Problem:

Students needing additional support in understanding concepts and receiving relevant information for the course while using QuizApp.

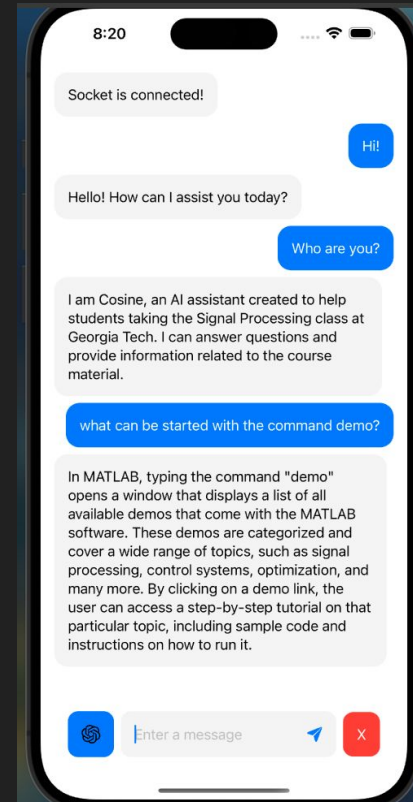
Project Overview

Semester Goals:

- Create an extension of the current QuizApp to add a chatbot that helps students understand concepts through a NLP model like GPT.
- Allow students to easily access questions and get course-relevant answers from the model along with leveraging the model's power to help explain the concepts easily

NLP GPT model used for the chatbot

- We are using the GPT 3.5 API provided by openAI, which is a very powerful conversational model.
- It has the ability to take an initial input, which makes it convenient to specify what types of output we'd like.



NLP GPT model used for the chatbot

- In addition to answering questions relevant to course material, the chatbot can take additional information in the input such as course logistics and answer them as well.

Who is teaching this class?

The Signal Processing class at Georgia Tech is taught by Professor James McClellan. He is well-known in the field of signal processing and has made significant contributions to the development of digital signal processing theory and its applications. The course textbook, "Signal Processing First," was also written by Professor McClellan in collaboration with Ronald Schafer and Mark Yoder.

NLP GPT model used for the Chatbot

- By specifying the course textbook the chatbot can limit the scope of answers to that of the textbook.
- Similarly, it can be extremely helpful in helping students practice their concepts, and not just understand them.

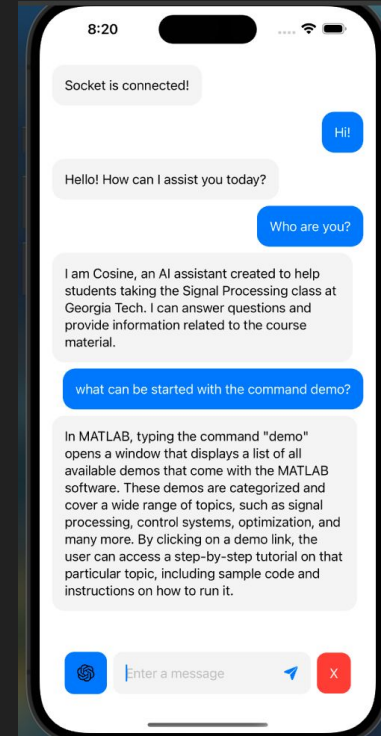
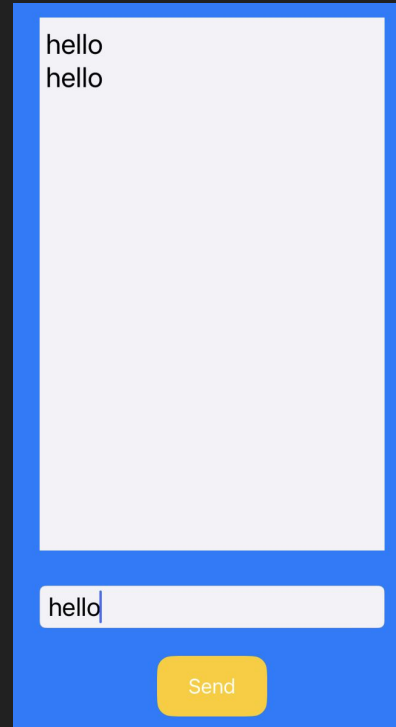
Give 2 random questions from the 2nd and 3rd chapter

Sure! Here are two random questions, one from Chapter 2 and another from Chapter 3 of the "Signal Processing First" textbook:

1. Chapter 2: What is the difference between a continuous-time signal and a discrete-time signal?
2. Chapter 3: How can we determine the frequency resolution of an N-point DFT?

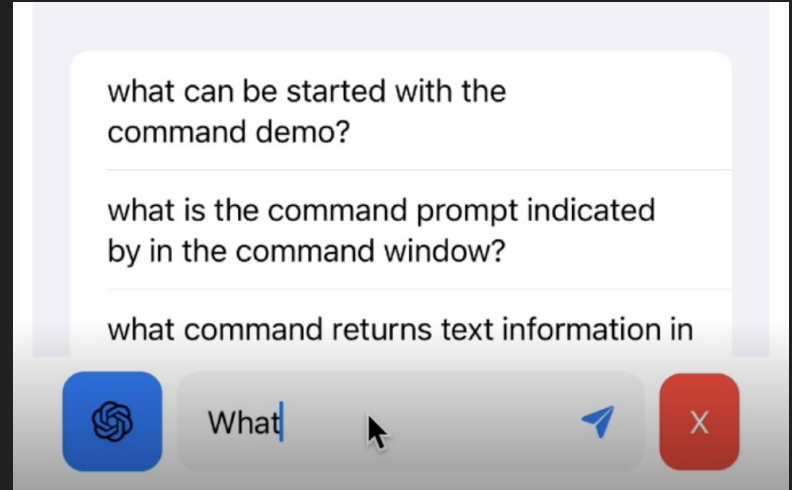
Front End Design and Implementation

- Chat Interface
 - Interactive and simplistic design
 - Full emphasis on ease of use
 - A simulation of texting messaging application
 - Several modes: GPT active & Profesor override



Front End Design

- Autocomplete textfield
 - Use saved question as a reference for the autocomplete
 - Making it easier to ask frequently asked question
- Future plans
 - Complete integration within the quizApp
 - Real-time update on autocomplete



Database used for the project

- Currently storing data locally within the server.
- Local file dynamically updated based on received queries.
- Fields:
 - query: The received query
 - frequency: Times this query was received
 - users: List of all users who submitted this query
 - time_stamps: List of times that query was received
 - response: Cached answer if computed already
- Currently have four hand-implemented API endpoints for interacting with data via Swift.

```
{  
  "query": "what are fir filters?",  
  "frequency": 1,  
  "users": [  
    "mock"  
  ],  
  "time_stamps": [  
    1681588255954  
  ],  
  "response": null  
},
```

Autocomplete functionality

- Averages around 0.03s to compute!
- Filters + Primary Sort Order
 1. Prefix Matches
 2. Pattern Matches
 3. Any Word Matches
- Auxiliary Weighing Function
 - Strategically weighs together length, frequency, and similarity to produce a likelihood.
 - Used to further sort suggestions within the primary sort categories.

Input: cosine signal addition-

```
{
  query: 'what can an additive combination of cosine signals produce?',
  likelihood: 1.204,
  frequency: 8,
  matches: [ 'cosine', 'signal' ]
},
{
  query: 'how many cosine signals of the same frequency could be combined by phasor addition?',
  likelihood: 1.022,
  frequency: 4,
  matches: [ 'cosine', 'signal', 'addition' ]
},
{
  query: 'what are cosine signals or sine signals equivalent to?',
  likelihood: 0.832,
  frequency: 5,
  matches: [ 'cosine', 'signal' ]
},
```

Features to be added in the Future

- Integration with the current Quiz App
- Data sent to the professor about how the students are doing
- Introduce a different format of quizzes where students answer questions to the GPT model instead of MCQ questions
- Allow professor to add syllabus, question information, and any other relevant course information to help the model keep the latest information in hand.
- If we ever need more than one server, perhaps migrate data to Firebase.
- Use a more advanced GPT model

Demo

Questions

Thank you