**Secured Card: Using Frontend to Increase Business and Improve User Satisfaction**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this
assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## Abstract

Capital One needed a user-friendly Secured Card sign-up page for new clients. Over the past summer, my team and I helped build and streamline this feature for Capital One. Our primary goal was to accurately measure and reduce customer dropout rates on the sign up page, leading to a greater percentage of customers signing up. Other goals included enhancing the developer experience by refactoring and updating old code, as well as adding features that clarified what Capital One offers, thus reducing customer support line calls.

In order to achieve these goals, my team contributed primarily towards the and created new AWS services for sending confirmation and update emails to new and old Secured Card customers. With our contributions, the Secured Card sign up page now has enhanced customer data tracking to inform future design decisions as well as assist in future AB testing.

## 1. Introduction

*You can't revise a blank page.*
—Leonard Wolf

Starting one's financial journey is an important step. The average American debt balance is $96,371 [1]. Developing and improving one's credit score is a way to minimize extra expenses and gain substantial benefit from the money lenders. Beginning the credit journey is challenging for many individuals. To improve one's credit score, one generally needs to borrow money. But borrowing money requires having a good credit score.

Capital One decided to start its secured line card, Secured Card, which allows clients to use their own locked money as collateral for their line of credit. In order to allow customers to easily sign up online, the flow of the website needs to be streamlined. Eliminating confusion, reducing wait times, and collecting data for the site to know where sticking points are is vital. Some of these features involve some back-end work, but the majority rely on front-end developers, as their code directly interacts with consumers.

## 2. Related Works

The current literature as well as web-driven technological trends indicate that the frontend experience for customer experience is crucial. Exponential drop-off rates occur after fractions of a second of load times. Any confusion that users have regarding UI leads to greater customer dissatisfaction and increased load on customer support lines (Rita, Oliviera, Farisa 2018) [3]. While many developers view frontend as somewhat trivial, the research clearly shows that frontend development has a significant impact on customer satisfaction.

## 3. Process Design

Editing and implementing a large codebase like the one Capital One has requires an understanding of the current architecture, communication with stakeholders to find out what changes need to be made, and several technical challenges.

### 3.1 Review of System Architecture

Capital One's Secured Card team divided up the front-end javascript and html, back-end java and api's, and cloud databases into separate services that can call and interact with one another. The front end was already designed in React Javascript and the edits we made revolved around thematic design principles as stated in the official documentation. Design and "perceived playfulness" plays a large part in customer satisfaction and purchase rates online [2]. Customers prefer "rounded corners" and "a consistent color scheme" to name a few design choices. Capital One's front-end framework, *Gravitus*, handled most of that already. One of the main objectives of our team was to switch from the outdated web framework to the newest CSS styling sheet within Capital One. Writing scripts that measure user retention alongside the increased perceived flow of the site should result in an increased customer satisfaction as well as increased retention. Having customers understand and be happy what they sign up for also relieves the customer support lines as well. Environment variables, api keys, and any form of auto filling information needed to be secured and separate from the frontend to prevent bad actors from potentially stealing data and exploiting security vulnerabilities.

The architecture was originally outdated to principles and techniques used in 2016. The css style guide was outdated and the React components used a class-based approach instead of the more modern function-based approach.

### 3.2 Web Page Requirements

Our team was set to update the aforementioned antiquated component instantiation methods and css style sheet. We also were required to streamline the site by adding features such as autofill, warning boxes, data and flow monitoring, and an automated email sender that communicated with the backend.

### 3.3 Key Components

Learning React, a basic amount of AWS architecture, and Agile methodology were crucial in designing and implementing these changes in the ten weeks we had together. On the technical side, AWS Lambda, PostGres Databases, Golang, and internal services in order to deal with user authentication and security were needed. In terms of communication and teamwork, daily standups as well as frameworks to discuss ideas such as sprint planning days and review sessions played important roles in getting our team to work together effectively.

### 3.4 Challenges

Learning the internal tooling at Capital One proved to be the hardest part for our team. Most of us had worked with AWS before, and most of us were familiar with basic user authentication. However, it took weeks for our team to be given the correct AWS authentication as well as a long time to learn how to verify users on the front end through the Capital One "Chamber of Secrets" internal API. Communication started on the rocky side, as well, but we quickly learned to better assess and explain where we were stuck along the way.

## 4. Results

By the end of the internship, our team had finished our primary objectives. The site now had more advanced and better working data tracking, and the flow had improved. Old and outdated javascript had been

swapped with new and supported versions of React. A deliverable that is now in production is the email service and AWS Lambda that we created in order to update customers on their deposit status.

After this summer, the sign-up page code is updated and better organized, and we alleviated customer support lines to a degree by creating avenues for automatic email confirmation so customers can rest assured their transactions have gone through.

## 5. Conclusion

Credit and credit cards specifically make up a significant source of revenue for Capital One. Their starter, or "secured," card allows users to begin their credit journey by opening a line of credit with their own money.

The work done with the site this summer will allow new users to more easily sign up, while also securing longevity and ease of use for developers working with the codebase in the future.

## 6. Future Work

Capital One is rapidly expanding its ownership and reputation in the credit card market with its new *Venture Card* series. Creating pipelines and paths for secured card users to upgrade could drastically reduce customer acquisition costs and benefit the business as a whole while alleviating the consumer's stress of switching card companies.

Connecting the api's and databases meaningfully between their *Venture Card* and *Secured Card* departments will be critical for this mission. Machine learning for prediction of which customers are likely to upgrade, modern web design to cut on load times and customer confusion, and updated API's in modern coding languages could all play a part in this transition, and are natural follow-ups to the work my team did this summer.

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