Mirchandani Technologies

The Recycle Bridging The Physical And Digital Worlds Of Recycling Via IoT

Timeline:
June 2022 – April 2023

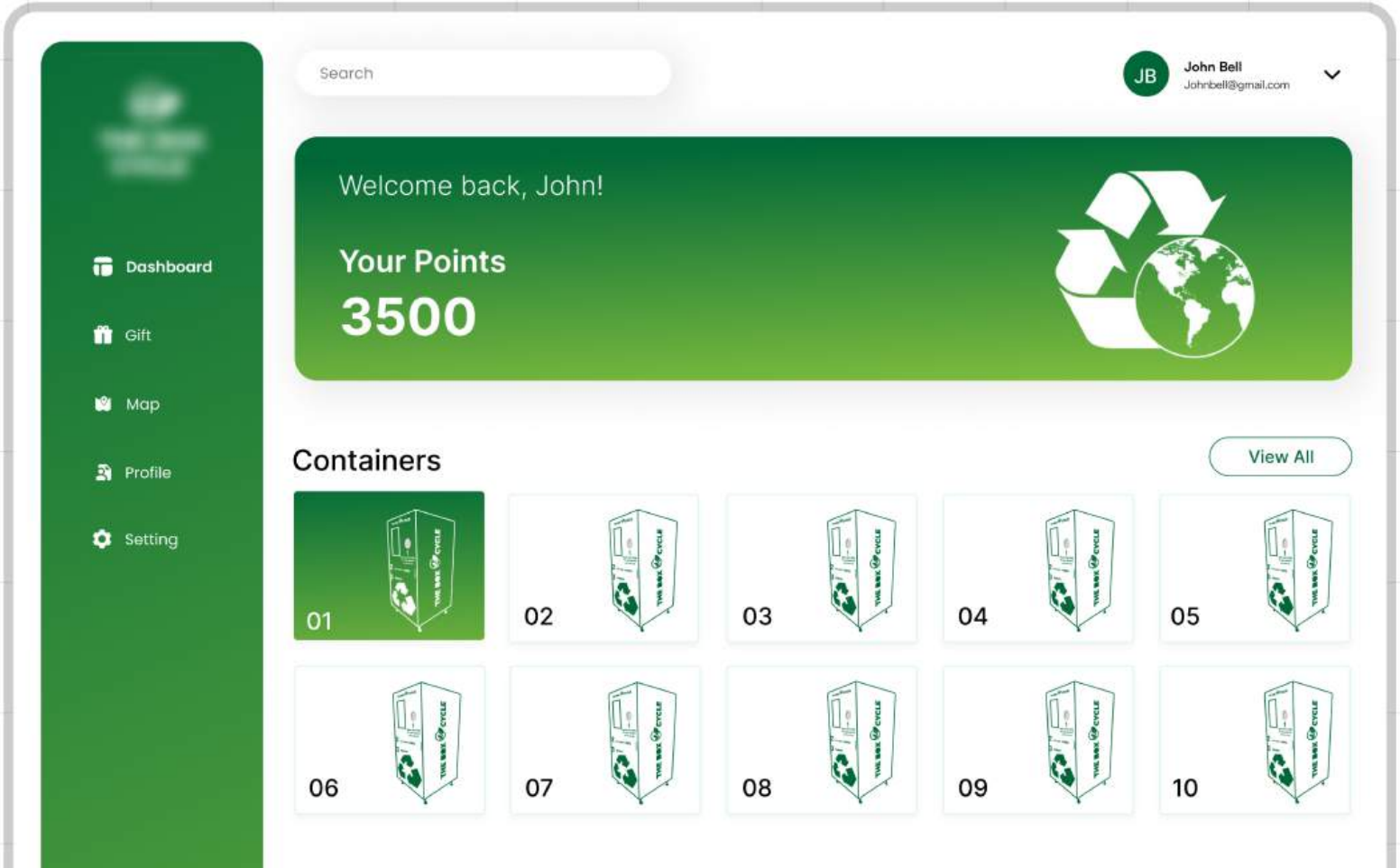
Domain:
IoT, CleanTech,
Mobile App Development

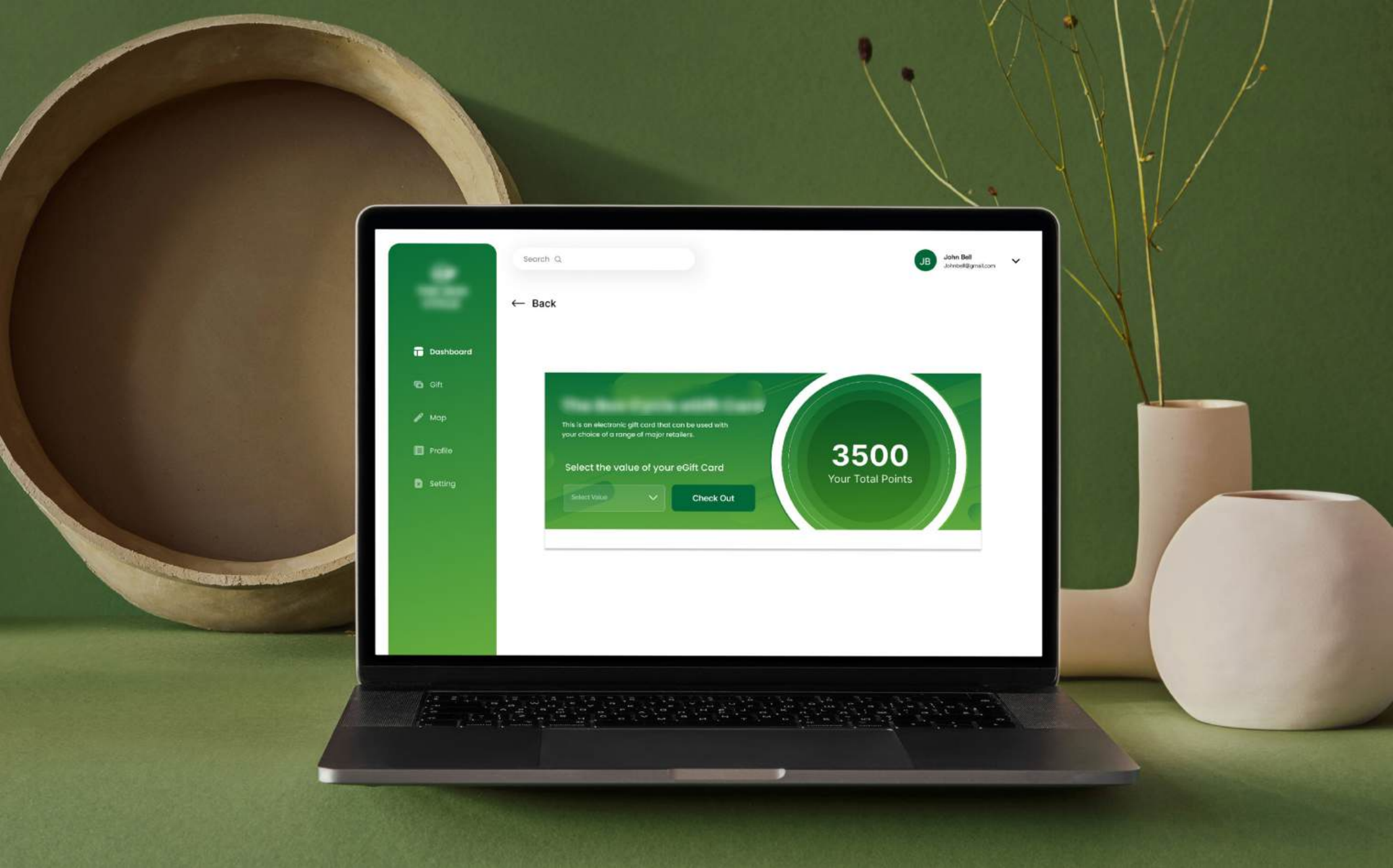
Tech Stack: **React Native, Node.Js, AWS, WebSockets (Socket.IO), PostgreSQL, Serial Port API, Tango Card Integration**

IoT-Powered App Supporting **Recycling And Sustainable Living**

This platform aims to reduce landfill waste by incentivizing recycling through a "Scan, Recycle, Reward" model. However, their existing infrastructure struggled to bridge the gap between the user's mobile device and the physical recycling machines.

Mirchandani Technologies was tasked with re-engineering the ecosystem to create a seamless, real-time interaction where a mobile app could unlock a physical machine, track deposited items (bottles/cans) instantly, and disburse digital rewards.




Search
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Johnbell@gmail.com
Back
Dashboard
Gift
Map
Profile
Setting
This is an electronic gift card that can be used with your choice of a range of major retailers.
Select the value of your eGift Card
Select Value
Check Out
3500
Your Total Points

The Challenge

When Mirchandani Technologies took over the project, It faced significant technical hurdles that prevented the product from scaling:

- Hardware-Software Disconnect: The existing communication between the mobile app and the physical recycling machine was unreliable. The machines often failed to open upon scanning, or failed to report accurate bottle counts back to the server.
- Latency Issues: Traditional API calls were too slow for the "instant gratification" needed in a user-facing kiosk environment.
- Legacy Code Debt: The existing codebase relied on outdated dependencies, causing crashes on newer iOS/Android versions and blocking App Store approval.
- Complex Authentication: Security loopholes existed in the login flow, and social logins (Facebook/Apple) were failing compliance checks.

The Solution: Technical Architecture

To solve the latency and hardware communication issues, we moved away from a purely REST-based architecture for the machine interaction and implemented a hybrid Event-

A. The IoT Communication Bridge (The "Magic")

The core innovation was the implementation of WebSockets (Socket.IO) combined with Native Serial Port Communication.

The Problem: How do you make a phone unlock a steel gate in real-time?

The Fix-

User Side: The user scans a QR code on the machine using the React Native app.
The Signal: Instead of a slow HTTP request, the app emits a socket event to the AWS Node.js server.
The Machine: The machine (running an Android-based controller) listens on the same socket channel. It receives the "Open Command."
The Hardware: The Android controller utilizes the Serial Port API to send a Hex String command to the machine's PLC (Programmable Logic Controller), physically unlatching the gate.

B. Accurate Data Tracking & Rewards

We integrated the Tango Card API for rewards and built a custom Credit Module.

Bottle Counting-

As users insert bottles, the machine sends byte data via the serial port to the controller. We developed a translation layer to convert these Hex bytes into integer counts, which are pushed to the backend via sockets in real-time.

Credit Logic-

A robust backend algorithm validates the session (ensuring the user's email matches the scanner) and instantly updates the user's credit score in PostgreSQL.

Key Results

Real-Time Performance

Reduced the latency between "QR Scan" and "Gate Open" to under 200ms using WebSockets.

Hardware Reliability

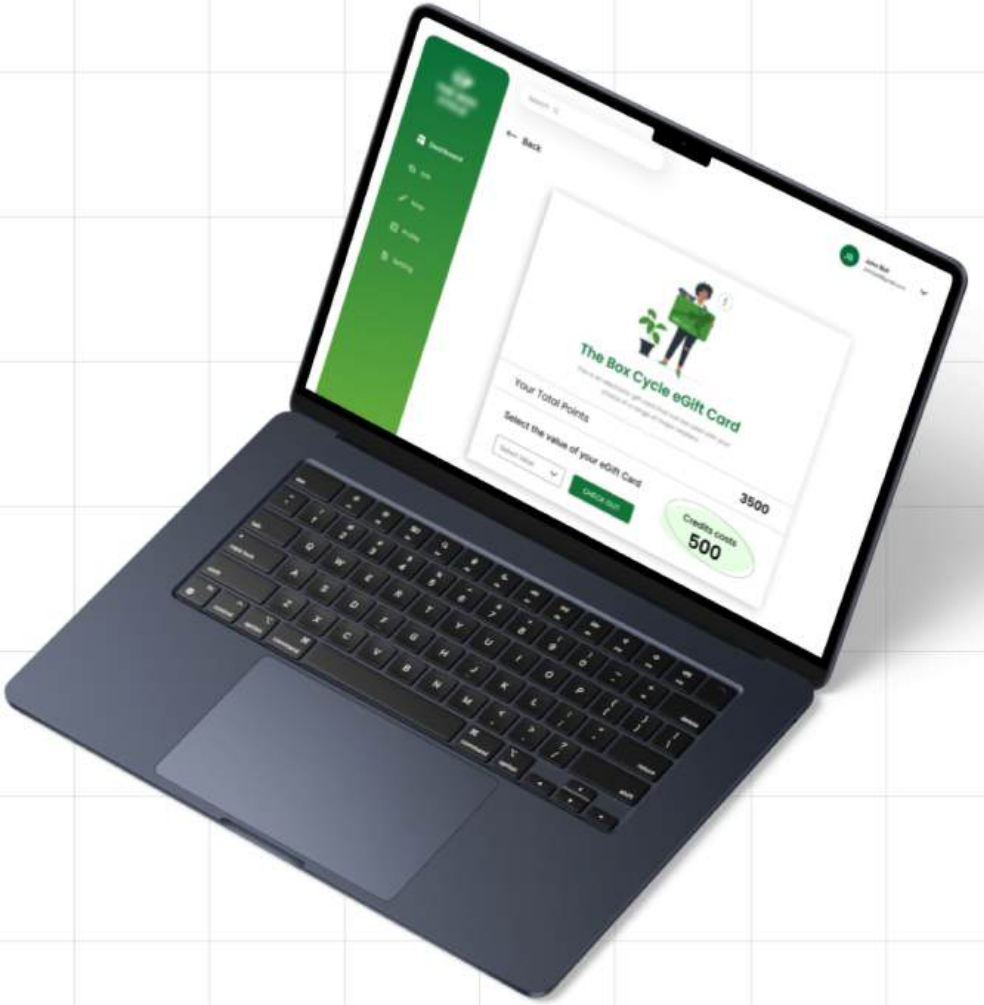
Achieved 99.9% accuracy in bottle counting by stabilizing the serial port communication

User Engagement

The introduction of the gamified credit system and instant Tango Card rewards led to a measurable increase in daily active users.

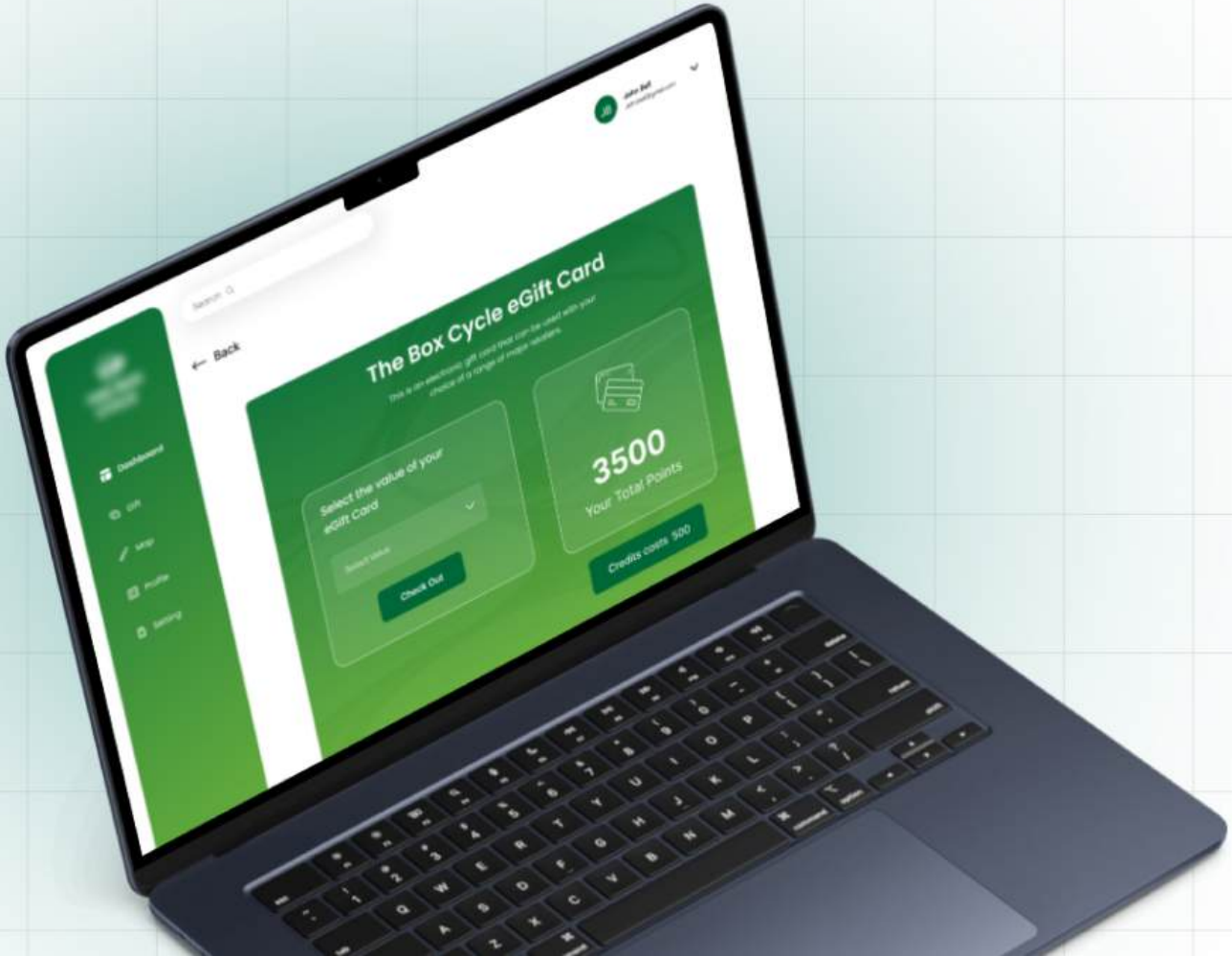
Store Approval

Successfully published both iOS and Android apps after resolving complex policy and native crash issues.



Client Testimonial:

"Working with Mirchandani Technologies has been a game-changer... The new app has significantly improved user engagement and streamlined our recycling process."



Future Roadmap

Advanced Gamification

Introducing leaderboards, badges, and "recycling streaks.

Machine Expansion

Integration with different types of recycling hardware using the established Serial/Socket protocol.

AI Analytics

Using the data collected to predict bin fullness and optimize pickup routes.

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