

Future-Proofing Physical Retail with AI and IoT

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VENDEE

The Vendee AI retail dashboard provides a comprehensive overview of store performance and competitive pricing. Key metrics include:

- Live Occupancy:** 26 / 40
- Trending - Last hour:** Quaker Oats So Simple (10 interactions)
- Underperforming - Last hour:** Adidas Supercourt White (1 interaction)
- Price Match:** Sneak Energy Bottle Green (Our Price: £20.00, Amazon: £17.99, -11%)

Products:

Name	Interactions	Price	Price Matched?	Competitor Prices
Nestle Nesquik Cereal	14,313	£2.00	✓ 0%	Asda: £2.00, ASDA: £2.00, Sainsbury's: N/A
Kellogg's Coco Pops	13,100	£1.55	✓ +25%	Asda: £2.00, ASDA: £1.50
Bulk Powders Protein	13,708	£13.18	✗ -10%	Asda: £11.99
Sneak Energy Bottle Green	13,689	£20.00	✗ -11%	Asda: £17.99
Quaker Oats So Simple	14,089	£1.80	✓ +72%	Asda: £3.40
Nestle Shreddies	14,013	£2.40	✓ 0%	Asda: £2.40
Adidas Supercourt White	13,652	£54.00	✓ +2%	Asda: £56.00
Nestle Golden Nuggets	13,743	£2.10	N/A	Asda: N/A

Trending - Today:

Name	Interactions
Quaker Oats So Simple	65
Nestle Nesquik Cereal	62
Nestle Golden Nuggets	61
Adidas Supercourt White	57
Sneak Energy Bottle Green	53

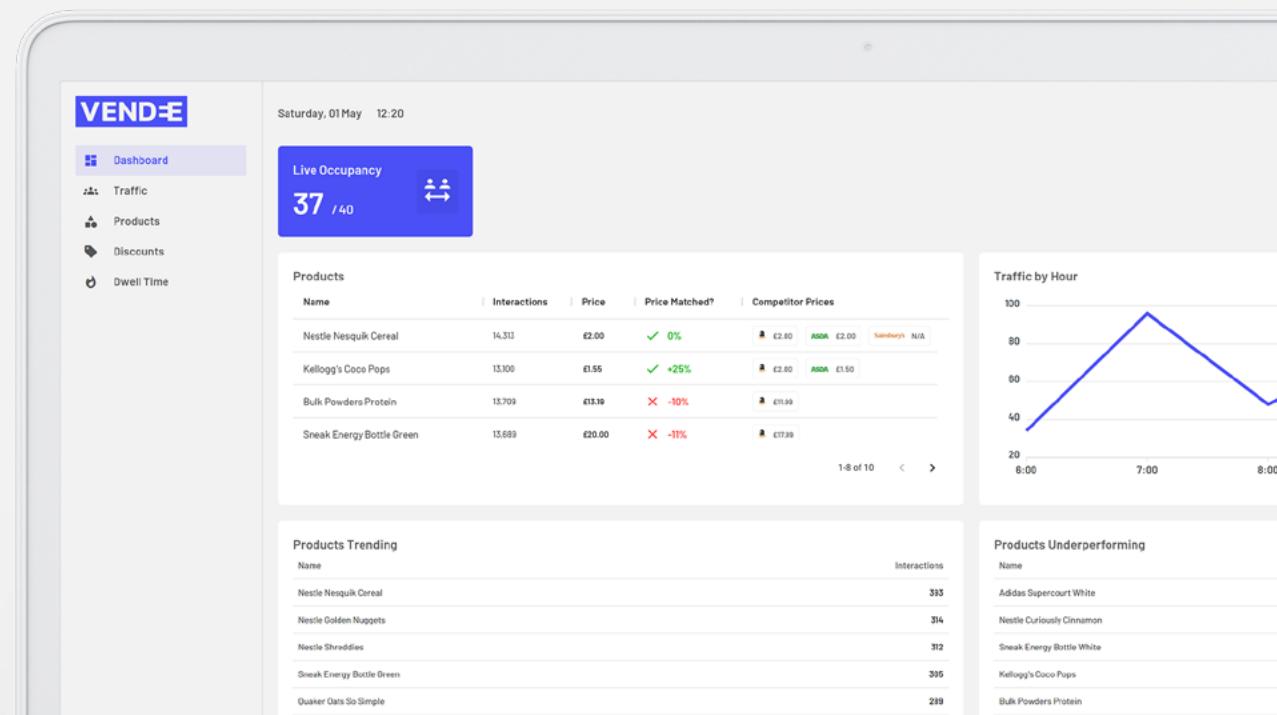
Underperforming - Today:

Name	Interactions
Adidas Supercourt White	57
Nestle Golden Nuggets	56

INTRODUCTION

VENDEE

- Research
- Methodology
- Design
- Implementation + Testing
- VENDEE Demo
- Evaluation
- Conclusion



Current Retail Landscape

32.4%

US E-Commerce Grown in 2020

E-COMMERCE



63%

UK Retail E-Commerce Sales in 2020 from Smartphones

M-COMMERCE



4/10

Consumers Switched to Online for Products They Would Have Bought Offline

COVID-19



The Role of Physical Retail



SHOWROOMING

When consumers inspect products offline, before making the purchase online.

EXPERIENCE

This product research is still valuable to retailers, providing customers with the chance to discover their products.

HOW TO MEASURE STORE PERFORMANCE?

Sales and profits are no longer suitable, as value is still being created through the pre-transaction stage of the customer experience. New metrics are needed:

Customer Behaviour

Product Engagement

Dwell Time

Omnichannel Retailing

A strategy that focusses on providing a seamless shopping experience, satisfying customers who increasingly want everything.

However, there are problems for retailers:

- | Data Integration
- | Lack of Technology



Technologies

Capturing and utilising data in the physical space is essential for omnichannel retailers.

Machine Learning Model

Facial Recognition

Object Detection

ARTIFICIAL INTELLIGENCE



Cameras

Digital Screens

BLE Beacons

INTERNET OF THINGS



Product



AIM

To develop a system that enables retailers to fully integrate omnichannel strategies by capturing and utilising data in the physical retail space.

	<ul style="list-style-type: none">Automatically capture customer behaviour and engagement in real-time.Utilise data across the store.A dashboard to provide retailers (managers) with an overview of store performance.	MUST	✓
	<ul style="list-style-type: none">Branding to make it more marketable to potential retailers.Enable personalised content to be sent to customers.Offer dynamic pricing on products.	SHOULD	✓
	<ul style="list-style-type: none">Perform automatic checkout when customers leave the store.Track when products in-store are out of stock.	COULD	✓
	<ul style="list-style-type: none">A companion smartphone app to enhance customer experience in-store.	WON'T	✗

Agile

A modern, iterative approach to project management and software development.

PRODUCT BACKLOG



USER STORIES



USER PERSONAS



UNIT TESTING



Product Specification

Produced to define the product requirements and design, including hardware and functions.

User Personas

Persona 1

Emma
Store Manager
Halifax, UK

Bio

Emma operates a small grocer in London. Her shop has seen declining sales over the past year; with the COVID-19 pandemic, this has been compounded by the fact that her loyal customers have been lost to the giant, online retailers who could continue to operate during the pandemic.

Needs

- Win back her customers in the post-pandemic economy.
- Cut costs in-store through requiring less staff.
- Offer competitive prices, so her loyal customers don't feel forced to shop online.

Frustrations

- Following strict government regulations on social contact.
- People using her store's resources without reciprocating with a purchase.

Tech

IT	Software	Mobile Apps	Online Shopping
■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■ ■

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User Stories

As a store manager, I want my shop to be busier so that I have the correct amount of staff available.

As a customer, I want to be able to pick up my products quickly and more conveniently.

As a replenishment assistant, I want to be able to restock shelves so that I can ensure I am offering a competitive price.

As a store manager, I want to be able to see what products are underperforming so that I can reposition them around the store to increase sales.

As a customer, I want to receive loyalty discounts so that I can be rewarded for shopping in-store.

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Wireframes

1 Dashboard

2 Traffic

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Hardware

Several hardware devices will be used to capture in-store data and utilise it:

- Video cameras used to capture customer behaviour and engagement in real-time
- Beacons to broadcast personalised content to nearby customers
- Digital screens to dynamically update product prices

These devices need to communicate and synchronise with the back-end. This is enabled with a Raspberry Pi, a single-board computer with 40-general-purpose input/output pins(GPIOS) suitable for interfacing with the devices. Node.js is an appropriate technology for interacting with the Raspberry Pi and the devices connected to it through the GPIO pins. As it is mostly used for server-side coding, it is well suited for this application.

A store management app is essential for store managers to generate valuable insights from the data captured, and allowing them to see store traffic, manage products, and personalise the customer experience. The app will be developed using React Native, which is a cross-platform mobile application framework, a framework for creating desktop apps. MongoDB will be used for the database, as it works well with

Raspberry Pi 4 **LCD Module**
Camera Module **BLE Beacon**

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Technologies

The product will benefit from ML to automate the process of identifying and observing customers in-store and the products they engage with. TensorFlow(TF) is an open-source machine learning library developed by Google, designed to use them in various production environments. For this product, TF can enable video cameras to detect customers and recognise the individual products they interact with. For the back-end, there will be a choice between several databases, to access the video feed and run it through the TF model, and to save and output the data. Node.js is an appropriate technology for interacting with the Raspberry Pi and the devices connected to it through the GPIO pins. As it is mostly used for server-side coding, it is well suited for this application.

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TensorFlow **Node.js** **Express**
React Native **MongoDB**

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Functional Specification

Vendē's functionality can be broken down into the following sections, starting with each page of the app:

Customers

- List all customers, with sort and filter functions.
- List all customers in-store.
- A header that shows the current date and time, updating each second.

Dashboard

- Display the main component from the other pages to provide an overview of the most critical data.
- Discounts can be attached to all products, or an individual product.
- Top panels should include the live occupancy component.

Traffic

- Display graphs for store traffic per hour and per week.
- Graphs should be interactive - hovering over them will reveal more data.
- Graphs should be relevant for the current day, allowing users to select the date/time for specific data.
- Top panels should show the live occupancy component and the day's traffic - this should include percent change from the previous day.

Products

- List all products, with sort and filter functions.
- Display stock level of each product as a gauge.
- Dynamic pricing as a column, with each of the competitor prices being listed and the percentage difference between the current price and the lowest competitor price.

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Branding

Modern and sleek brand assets to help the product distinguish the product from its competitors.

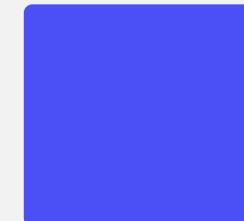
Logo



Icon



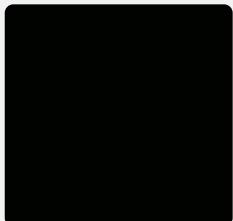
Colours



#4a4ff6



#f2f2f2



#010300

Initial Setup



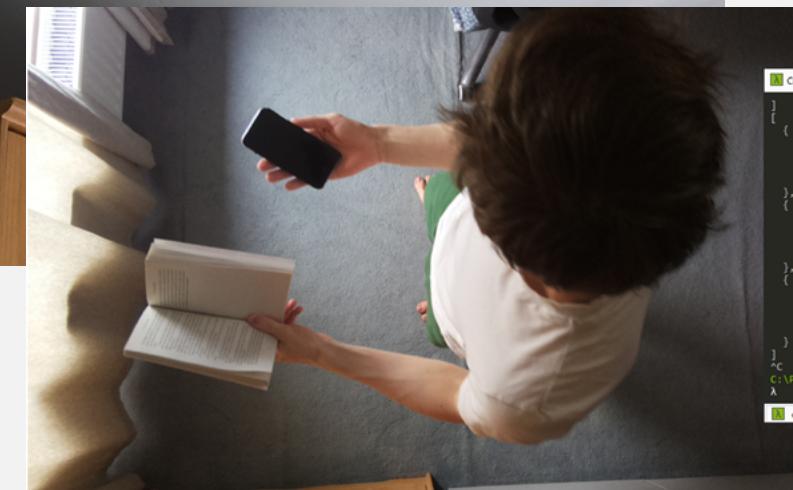
HARDWARE

- | Test Pi + Camera
- | Access Pi from Local Machine
- | Get Camera Feed



MACHINE LEARNING

- | Integrate Pre-Trained Model
- | Start Detecting Objects



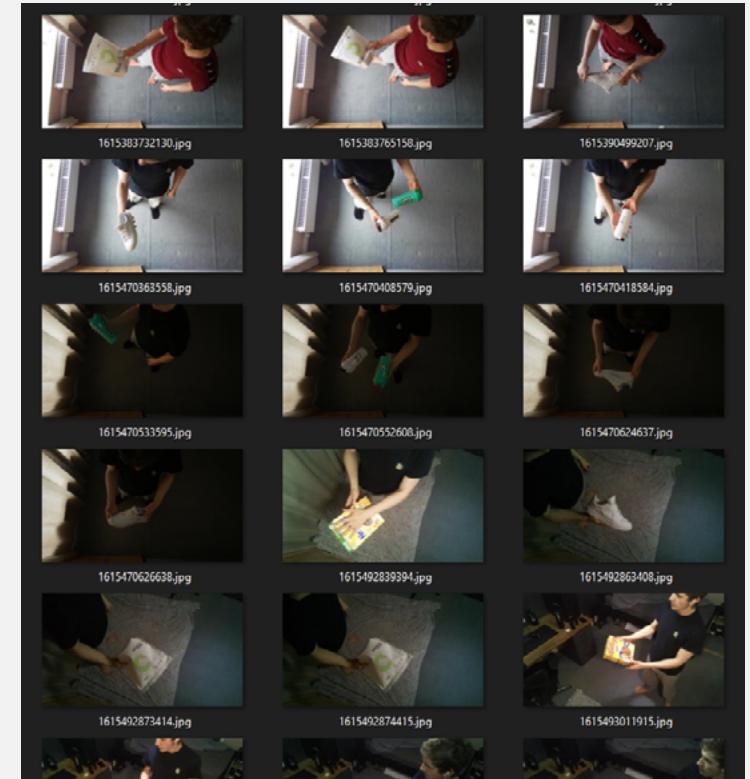
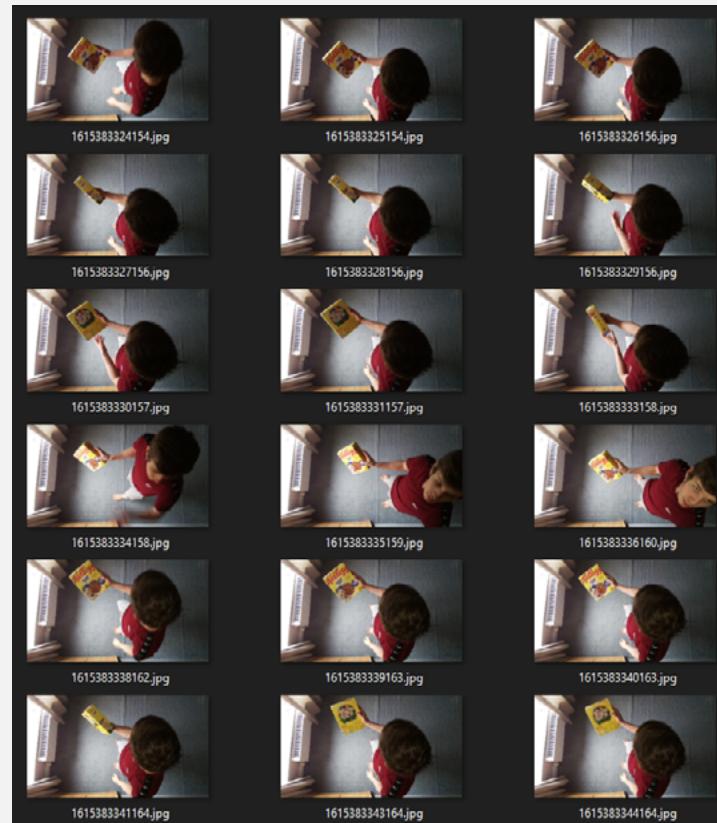
```
Cmder
}
{
  score: 0.8401,
  classid: 1,
  class: 'person',
  bbox: [ 0, 0.2129, 0.9232, 0.8057 ]
},
{
  score: 0.6777,
  classid: 77,
  class: 'cell_phone',
  bbox: [ 0.2042, 0.2448, 0.3733, 0.3554 ]
},
{
  score: 0.5669,
  classid: 84,
  class: 'book',
  bbox: [ 0.0647, 0.1126, 0.7681, 0.2916 ]
}
C
C:\Projects\vendee\detect (main -> origin)
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Custom Machine Learning Model



PREPARING DATASET

Various datasets were produced to train a robust model, capable of detecting people and retail items.

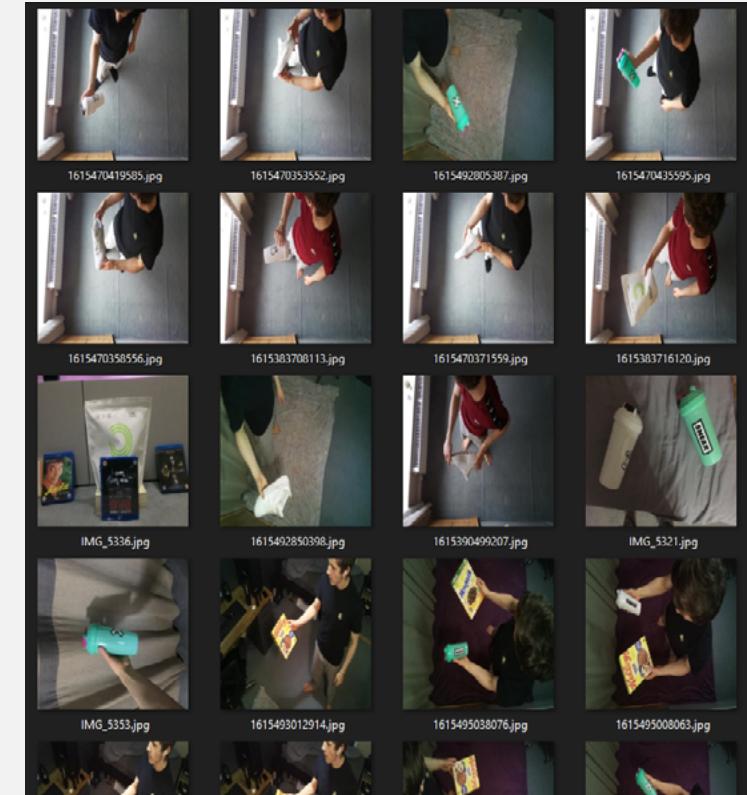


Custom Machine Learning Model



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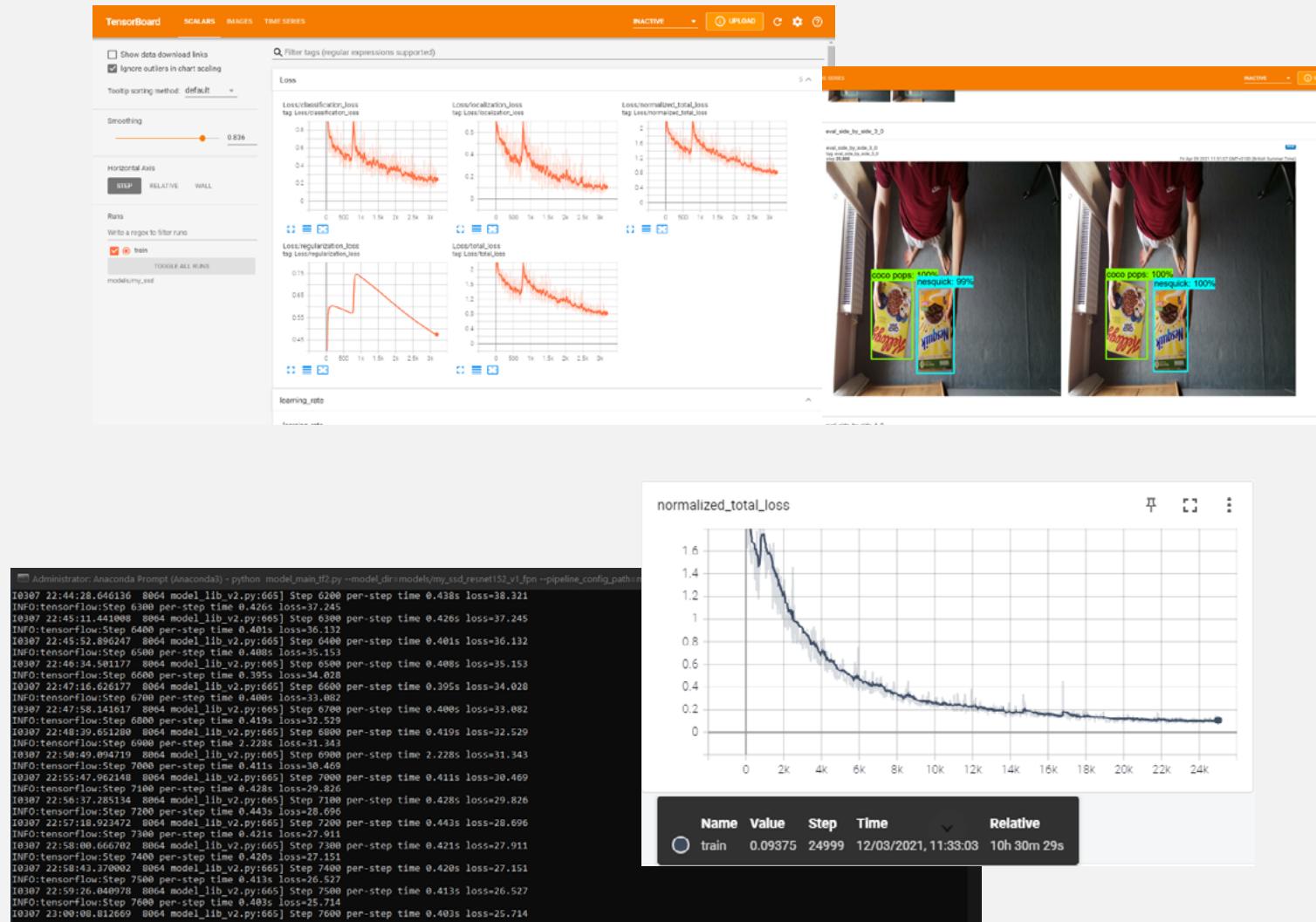
Final Dataset

Custom Machine Learning Model



TRAINING

The dataset is used to train the model to accurately predict the retail products.



Technologies In-Store

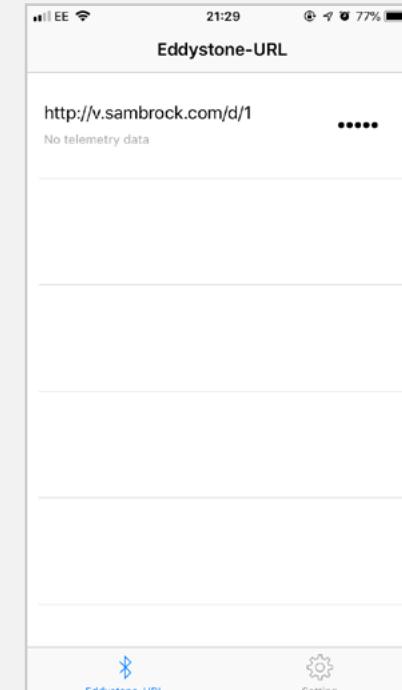
\$ _____

DYNAMIC PRICING

- | LCD Screens Displaying Price
- | Competitive Price Matching

DISCOUNTS

- | Bluetooth Beacons
- | Eddystone-URL



IMPLEMENTATION + TESTING

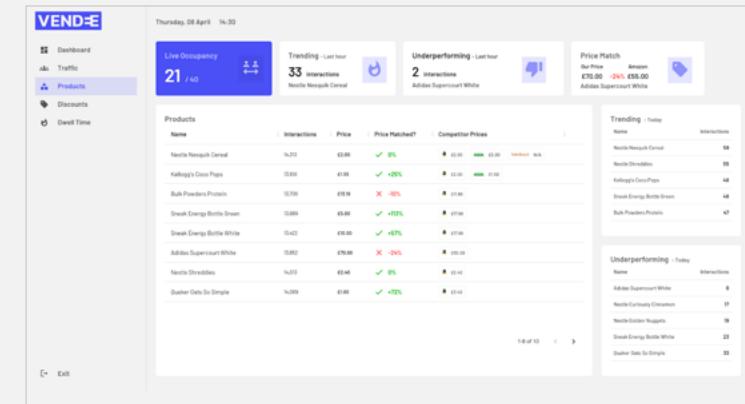
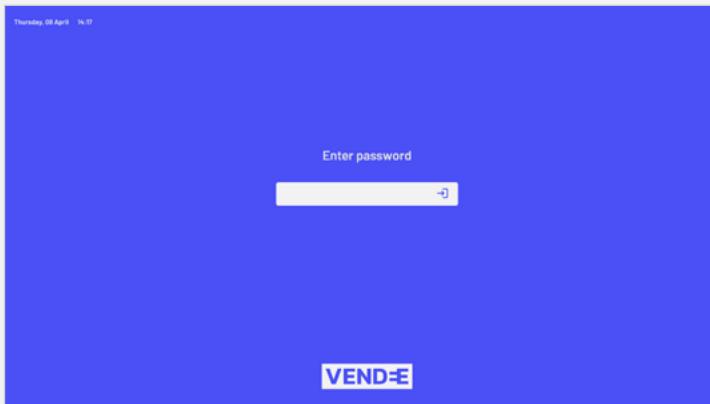
Web App



FRONT-END

React

Jest

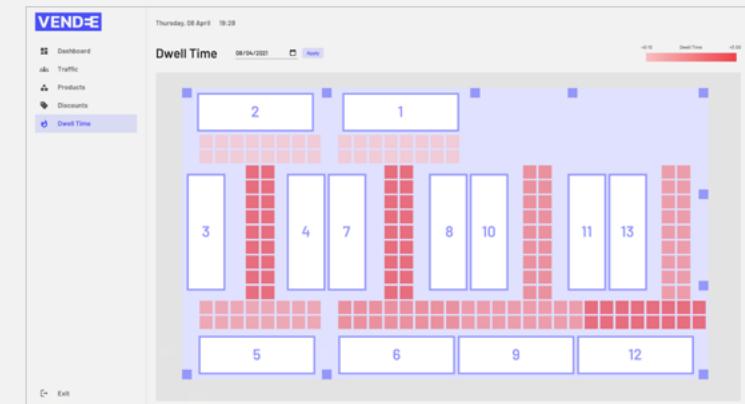
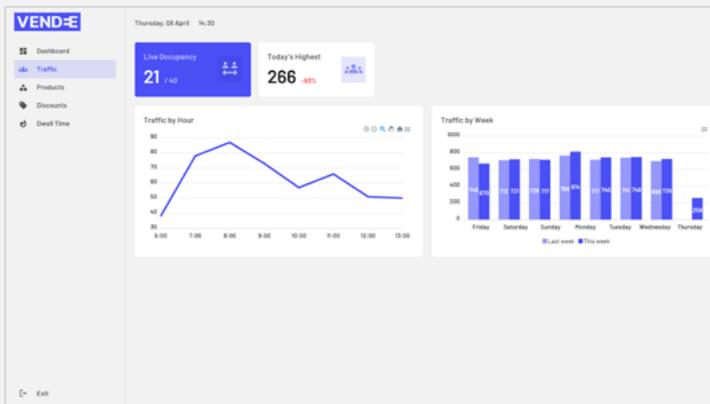


BACK-END

Node.js

Express

MongoDB





VENDĒ Demo

Future Developments

Vendee has many opportunities for future development.

Companion App	
Customer Facial Recognition	
Progressive Web App	
More Products in Dataset	
Custom Hardware	
Access Levels	

Learning and Self Development



DEVELOPED CORE SKILLS

- | Front-End Dev
- | Back-End Dev

ACQUIRED NEW SKILLS

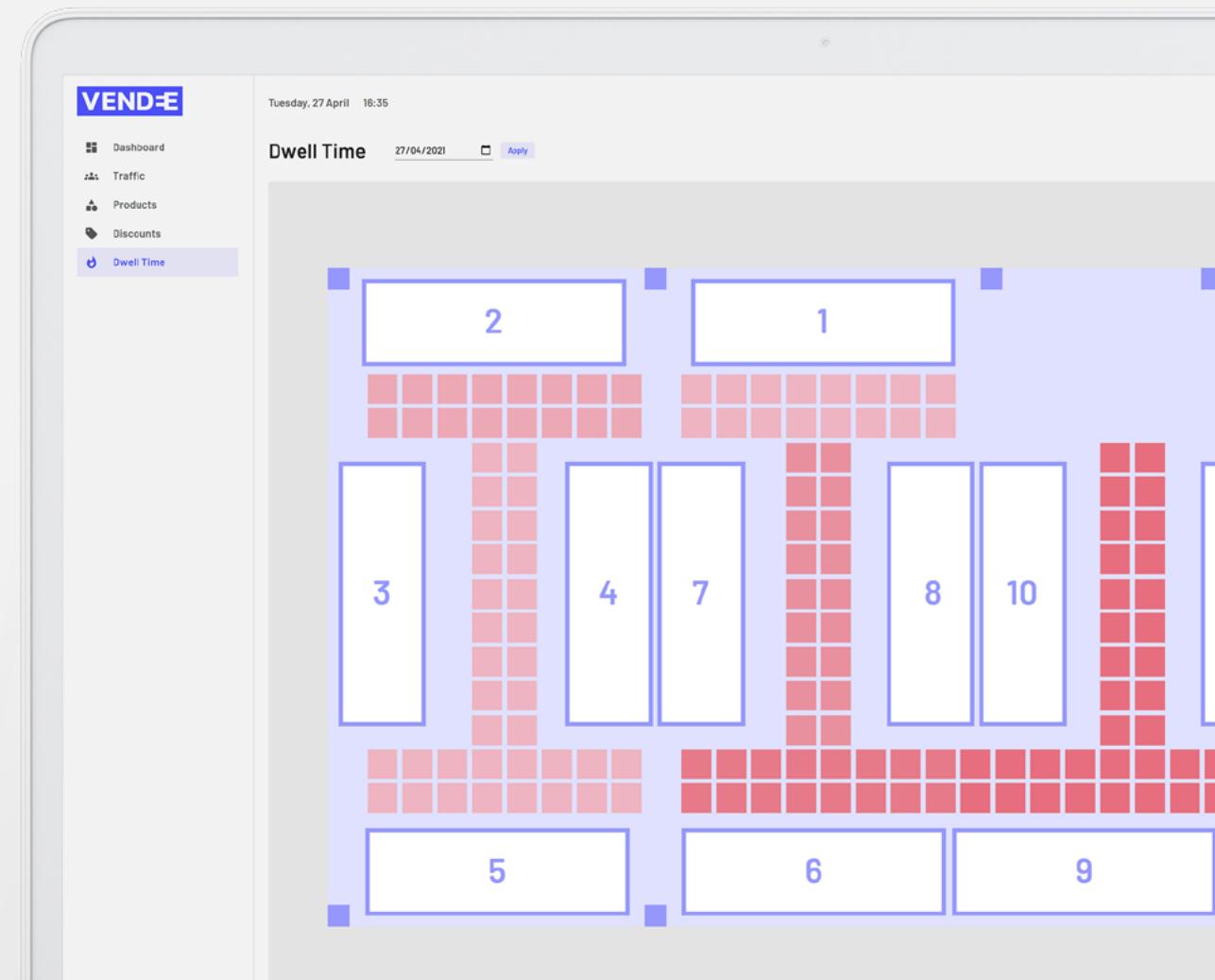
- | AI + Machine Learning
- | Internet of Things

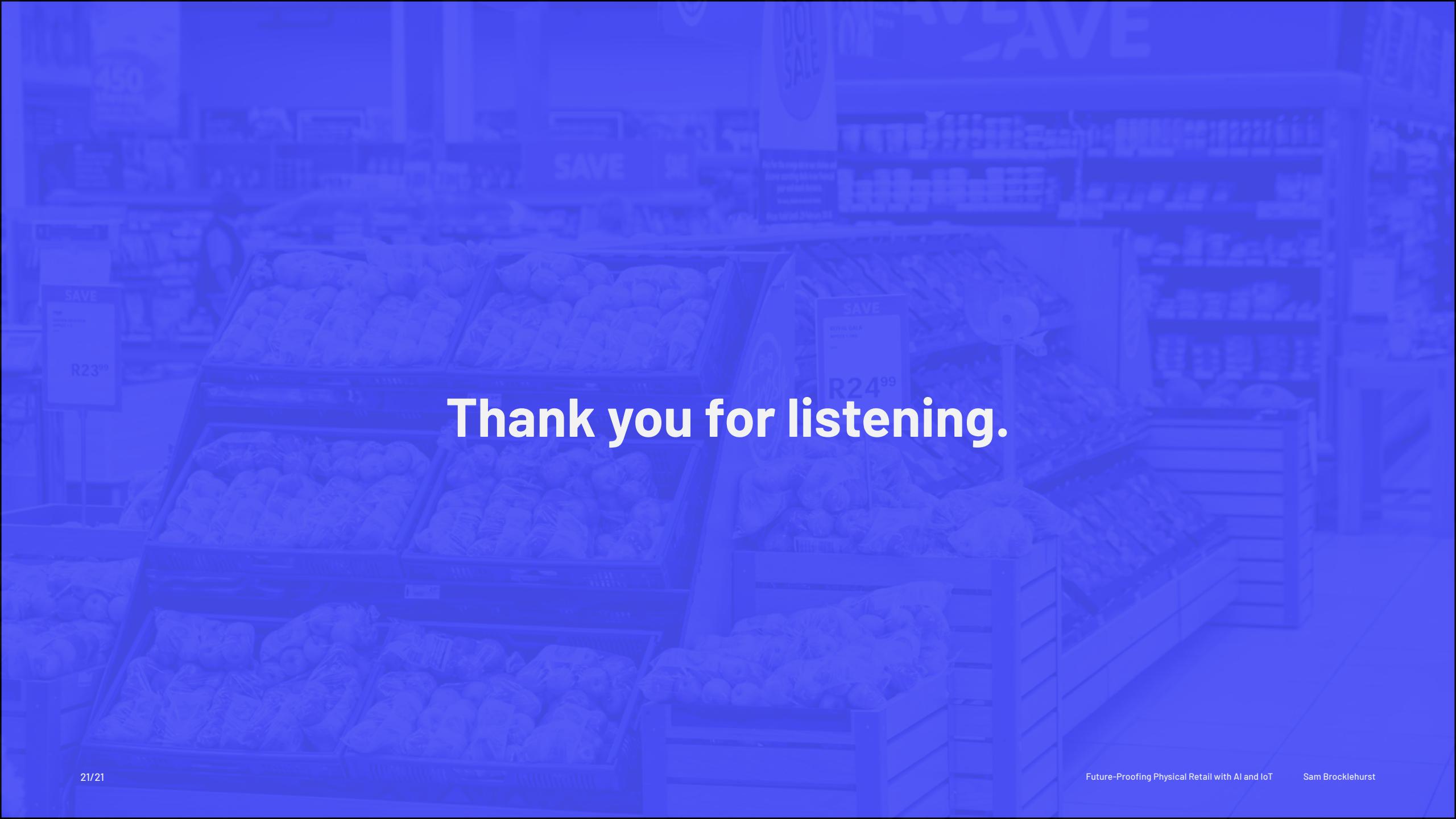
IMPROVED EMPLOYABILITY

- | Experience with Agile
- | Unit Testing
- | Writing Better Code

Future-Proofing Physical Retail with AI and IoT

- Post-Pandemic Retail Landscape ✓
- Omnichannel Strategy ✓
- AI + IoT ✓
- Viable Solution ✓





Thank you for listening.