



RecyCognize

Recycle smart.

Recognize impact.



UNIVERSITI
MALAYA

Team Winion Minions
Great Malaysia AI Hackathon 2025



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The high price of not sorting beverage packagings

6.96%

of recyclables in Malaysia were **not recycled** in 2022

≈1mil

tonnes of **recyclables ended up in the landfills**

≈RM291mil value lost

assuming 1kg of recyclables hold 30 sens on average

Recyclables and their estimated value in 2022



Plastic
RM70 million
(10 sen / kg)



Tetrapak carton
RM3 million
(5 sen / kg)



Aluminum
RM25 million
(40 sen / kg)

Why are recyclables thrown away instead of generating economic benefits?

Low rate of separation-at-source

Separation-at-source is the process of segregating waste into categories **at the point where it is generated** by households, businesses, or institutions.

The underlying reasons of low source separation rate:

Consumers lack motivation, as there are **limited incentives** to practice separation-at-source.

Even environmentally conscious consumers face challenges, as **recycling bins are not widely available** in households and premises.

Contamination of recyclables

Even when recyclables are separated by material and collected, contamination (e.g., a greasy Tetra Pak) can spoil the entire batch, making it unrecyclable and sending it to landfills.

Consumer journey of recycling frustration

Key Takeaway: Even motivated consumers often fail to recycle due to a **lack of infrastructure and incentives**, leading to recyclable materials ending up in general waste.



⚠ Pain Point 1: Lack of Incentive (Cost & Small Benefit)

She thinks: "Recycling takes extra effort and what do I really get out of it?"

41% of consumers say recycling is too time-consuming, and many don't see a clear incentive.

Source: FMCG Gurus Survey, via Packaging News (2022)

⚠ Steps with pain points

⚠ Pain Point 2: Lack of Infrastructure

Anna walks around her office block and finds only one set of bins.

In Malaysia, consumers report that recycling bins are not widely available, especially outside homes.

Source: Ipsos Malaysia, "Perception vs Reality: Zero Single-Use Plastic" (2019)



⚠ Pain Point 3: Limited Bin Compartments

The recycling station she finds only has:
-General Waste -Paper -Cans
But she's holding a plastic bottle and there's no compartment for it.

Source: APU University's recycle bin located outside the elevator area



End Result: Throw in General Bin

Anna sighs, thinks it's not worth the hassle, and tosses both the can and plastic bottle into general waste.

This recyclable packaging is now contaminated or landfilled, reducing recovery rates and costing Malaysia millions annually.

Source: The Star (2023) – "The high price of not recycling"



Our solution: AI-powered Smart Reverse Vending Machine (RVM) Ecosystem

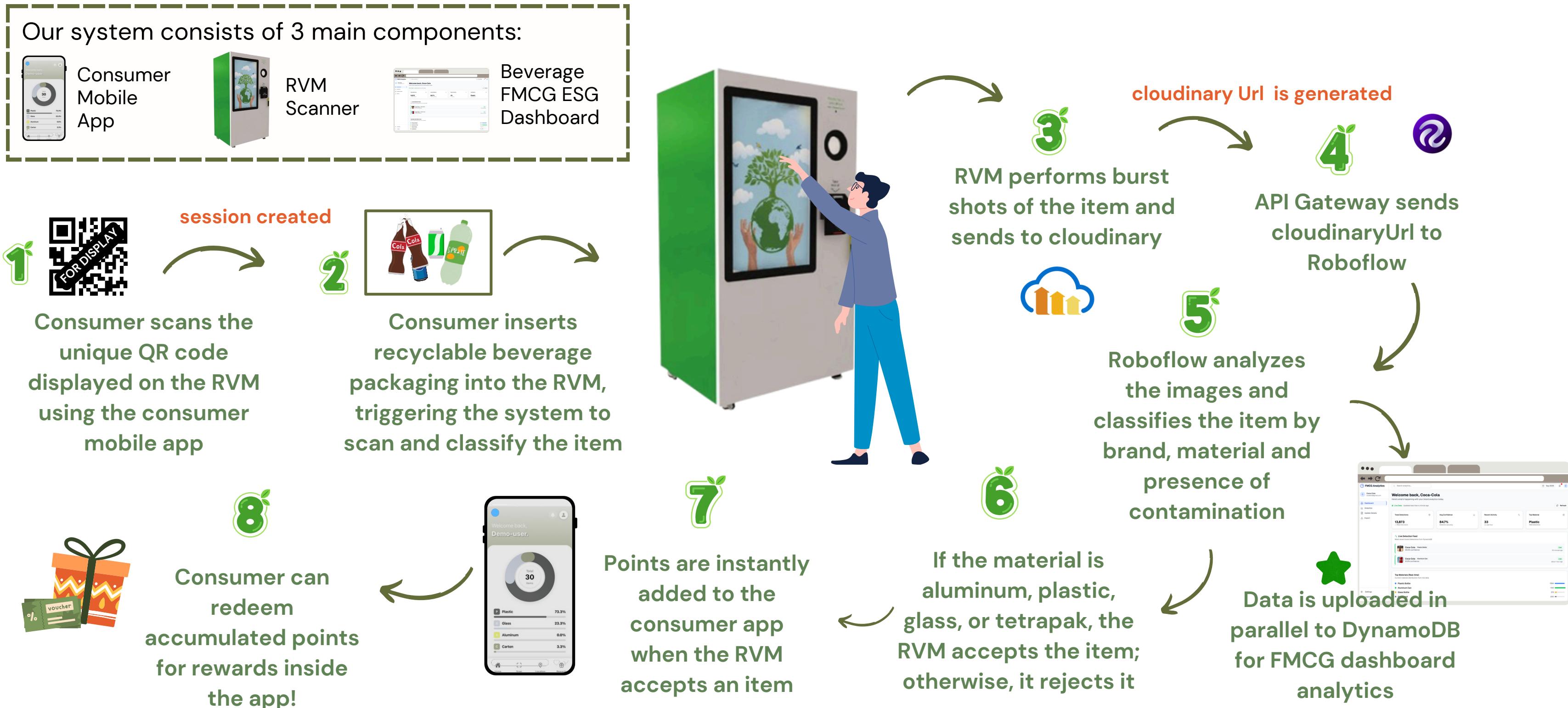
Powered by AI and AWS, our RVM focuses specifically on **beverage packaging** (plastic, aluminium, glass and tetrapak). Our RVM can **recognize emptied beverage packaging** by material, brand, and contamination.

Consumers are rewarded for recycling beverage packaging, with incentives provided by Fast Moving Consumer Goods (FMCG) companies. Meanwhile, recycling data is shared with these companies to support ESG reporting.



This forms a complete loop, where consumers are motivated to recycle, companies gain verified sustainability data for ESG reporting, and valuable beverage packaging materials are recycled. A **win-win cycle for people, business, and the planet.**

Deep dive into the user journey and system flow



The Consumer App

Recycognize's Consumer App transforms every recycling action into measurable impact by rewarding proper disposal and guiding consumer to nearest RVM, making recycling easier, rewarding, and trackable.

Strategic objective	Boost consumer recycling participation		
Rationale	Introducing Consumer App	Key enablers	Success story
<p>35.38%</p> <p>Recycling rate in Malaysia's 2023, far below what is needed for sustainable waste management.</p>	<p>Providing instant QR-based check-in and real-time guidance to the nearest RVM.</p> <p>Effortless Redemption</p> <p>Personal Impact Tracing</p> <p>Integrated Navigation</p> <p>Seamless Check-In</p> <p>Transparent Rewards</p> <p>Smart RVM Locator</p>	<p>Beverage FMCG brands sponsor rewards, such as vouchers or discounts, to incentivize users to recycle, while promoting their commitment to sustainability</p>	<p>RecycleMich (Austria)</p> <p>An Austrian app that lets users scan packaging barcodes to access local recycling info and earn rewards like shopping vouchers, engaging over 26,000 users. Reached finals of the 2024 Sustainability Awards in Amsterdam</p>
<p>Economic incentives are lacking</p> <p>67.39%</p> <p>Support monetary incentives for recycling</p> <p>53.66%</p> <p>Support receiving rebates for recycling</p>	<p>Empowers users to recycle with rewards & transparency</p> <p>Instant check-in & guidance make recycling impactful</p> <p>SWCorp, 2023; Malaysian Journal of Society and Space, 2020; Recycleme.eco, 2024</p> <p>Team Winion Minions Great Malaysia AI Hackathon 2025</p>		

The RVM (Reverse Vending Machine) Software

Recycognize Reversed Vending Machine software that sorts plastic, aluminum, glass, tetra pak and recognize brands at the source, ensure high-quality recyclables, reduce contamination, and DRS ready solution.

Strategic objective

Boost Malaysia's recycling rate and waste value recovery by enabling automated waste sorting.

Rationale

58.8%

Malaysians cite lack of convenient infrastructure as the main barrier to recycling

~24%

low rate of key plastics are recycled nationally due to low quality of recyclables

67%

consumers prefer brands that are sustainable boosts FMCG to practice environmental responsibility for ESG

Introducing RVM Software

AI-Powered Recognition

- Multi-label detection:
Brand +Material
+Contamination in a single scan
- Real-time decision:
accept/reject item <1min

Seamless Consumer Experience

- QR check-in instantly links RVM and user profile.
- Instant reward points in consumer app when the item is accepted.

Parallel Data Streaming

- Every scan is uploaded in real time to DynamoDB



Key enablers



Beverage FMCG

Collect and track brand-specific packaging waste



Retailers hosting RVM

Host RVMs with our software in malls and convenience store



Advertising & Media Agencies

Post advertisements on RVM Screen

Success story



In Norway & Germany, 92–97% return rates with nationwide RVM-enabled DRS.



- Impact: Beverage container litter reduced by >70%.
- Relevance: Even reaching 70% (not 97%) would mean +15,000 tonnes recycled and RM157m of value recovered annually.

The Beverage FMCG ESG Dashboard

Strategic objective

Provide Beverage FMCG companies with reliable Environmental, Social, and Governance (ESG) reporting data, securing their buy-in to fund consumer recycling incentives.

Rationale

Bursa Malaysia is requiring listed companies to provide ESG reports.

- By 2025 Large cap PLCs (\geq RM2B market cap) must start climate-related reporting.
- By 2027 All PLCs must comply.

80% of Malaysia's top 100 PLCs are now engaging in ESG reporting.

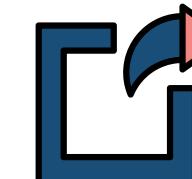
74% of public companies plan to invest in new sustainability reporting technology and tools over year 2025.

Introducing Beverage FMCG Dashboard



A dashboard that provides beverage FMCG companies required data to generate ESG reports, which include:

- Carbon footprint and emissions
- Sustainability scores
- Material composition and percentage of recyclability
- Governance & reporting
- Performance over time



Export Features

- PDF ESG Metrics Export (executive summary + KPIs + compliance status)
- CSV Raw Data (granular RVM detection logs)

Key enablers



Beverage FMCG Partnerships
Collaboration to fund rewards

Success story



Polytag partners with brands to reward consumers for recycling while providing brands with valuable data insights that support EPR compliance.

Technology behind the solution

AI Interface

Roboflow API

Hosted model for brand & material classification



roboflow

Backend

Serverless

- **AWS Lambda** → Business logic
- **Amazon API Gateway** → Exposes REST endpoints
- **IAM** → Secure Lambda & DynamoDB access



Data Storage

Amazon DynamoDB

Fully managed NoSQL database that delivers fast, scalable, and serverless data storage



amazon
DynamoDB

Technology behind the solution

Identity & Auth

Amazon Cognito

User login, JWT tokens



Amazon Cognito

Frontend

Consumer App

- React Native/ Expo
- Features: Scan QR, earn points, view history, claim rewards

FMCG Dashboard

- Next.js + Tailwind CSS
- Features: Analytics, charts (Recharts), CSV export, EMG report



Supporting Service

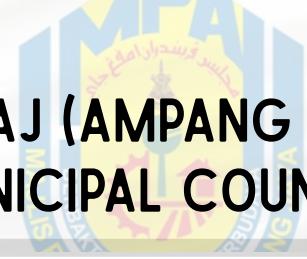
Cloudinary

Recharts



<Recharts />

Competitor Analysis

	 KLEAN (KLEAN THE WORLD)	 RVMPLUS (RVMPLUS.COM)	 COCA-COLA x AEON "RECYCLE ME!" (HIROYUKI-IND.COM.MY)	 CARLSBOT (CARLSBERG MALAYSIA)	 MPAJ (AMPANG JAYA MUNICIPAL COUNCIL)
PET bottles	Yes	Yes	Yes	No	Yes
Aluminium cans	Yes	Yes	No	No	Yes
Glass bottles	No	No	No	Yes	No
Cartons (Tetra Pak)	No	No	No	No	Yes
Brand specific	No	No	Yes	Yes	No
Rewards / incentives	Points / redemption model (Grab)	Points / redemption model	PET buy-back: RM0.10 per 10 bottles + points (campaign)	Community/CSR-led (The Star)	Instant reward with TnG credits
Where seen in MY	Retail, petrol marts, malls; national brand pilots (Grab, F&N) (Petron)	Klang Valley installs; corporate/community sites (operator website) (rvmplus.com)	AEON malls multi-site campaign (2023/2024) (Mini Me Insights)	Sabah (multiple sites; 2022→2024 rollout) (Carlsberg Malaysia)	Menara MPAJ (MPAJ)

- Key differentiators
- Unlike others with limited scope, we **handle plastic, aluminum, glass, and tetrapak** beverage packaging.
 - Our system can **detect brands**, making it Extended Producer Responsibility (EPR)-ready.
 - We implement **contamination checks** to ensure only clean recyclables are processed.
 - A **first-of-its-kind model** where FMCG beverage brands fund consumer rewards while benefiting from ESG reporting data generated by the RVM.

Business Model Canvas

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Key Partners

- RVM manufacturers and integrators
- Beverage FMCG brands and retailers
- Recycling processors and Material Recovery Facilities (MRF)
- Local authorities
- EPR operators and deposit-return scheme operators
- Cloud & AI services (AWS)

Customer Segments

- Beverage FMCG brands
- Malls and convenience stores
- Advertising Agencies on RVM screens
- Consumers

Key Resources

- Roboflow & labelled training data
- Cloud infra (AWS) and analytics stack.
- Business development and partnerships team

Value Propositions

Closed-loop SaaS ecosystem combining

- AI material, brand and contamination detection
- Beverage FMCG ESG dashboard
- Consumer incentive mobile app

creating a self-reinforcing cycle of accurate recycling, compliance reporting, and user engagement without heavy RVM CAPEX

Customer Relationship

- B2B enterprise contracts (licensing + SLAs)
- Integration support
- Analytics insights workshops
- Co-branding for consumer engagement campaigns

Channels

- Direct sales to FMCG companies
- Partnerships with sustainability/retail associations
- AWS Marketplace listing (SaaS distribution)
- FMCG sponsorship via pilot projects

Key Activities

- Develop & maintain AI model (brand detection, material classification, contamination detection)
- Build & operate FMCG Dashboard (analytics, IFRS S1/S2 exportable annexes, user management)
- Provide consumer app + QR/session linking to drives engagement
- Integration & on-boarding (RVM device onboarding, data pipelines, QA)
- Customer success, verification workflows (link recycler receipts to recoveries)

Cost Structure

- Development & model training (Roboflow datasets, labeling, tuning)
- Cloud infra (AWS GPU inference, DynamoDB, storage, Lambda, backups)
- Customer success & integration services
- Labour cost
- Sales & marketing (B2B enterprise outreach)
- Compliance methodology maintenance (updating emission factors, IFRS/ISSB mapping)
- Lightweight on-prem agent code / RVM SDK integration (but no direct RVM CAPEX)

Revenue Stream

- SaaS licensing fee (per-site / per-company, monthly or annual)
- API usage-based billing (if FMCGs integrate directly into their systems)
- ESG analytics premium add-ons (custom reports, benchmarks)
- Advertising Revenue: Brands pay to run ads on RVM display screens
- Retail Partnerships: Commission or revenue-sharing when RVMs drive store traffic or sales
- White-label consumer app for brand campaigns (Coca-Cola loyalty tie-ins)



Impact We Bring

Environmental Impact

Improves quality of recyclables



Reduce carbon emissions

Annual mass collected =
(Throughput × Item weight × 365)

Avoided CO₂e = Mass × ΔEF
(Virgin - Recycled)

a RVM can save up to ~20 tCO₂e annually depending on material

DRS Ready

FMCG
legally responsible for the packaging (EPR) → Fund for recycling → circular accountability

Consumer

A deposit (e.g. RM0.10/pc)
makes not recycling = losing money

The global experience (Reloop) shows high return rates over 90%

Reduce landfill waste

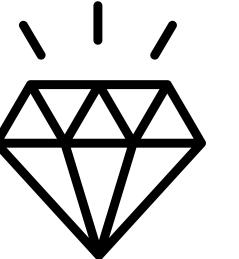
Annual mass collected =
Throughput × Item weight × 365

Landfill volume saved = Mass ÷
Bulk density (kg/m³) (or Mass ×
Volume per tonne factor from
EPA/industry tables)

save ~34 and 320m³ of landfill space per year

Economic Impact

Value Recyclables Captured



With RVM/DRS: If return rate rises
from ~16% → 70% (Lithuania), then:

Extra value captured=(New
rate-Baseline rate)×Lost recyclable
value=(70%-16%)×RM291m

RM157m recyclables recovered
annually

ESG Reporting Cost Savings



Companies spend RM100k–300k
per year on ESG auditing.

an RVM-linked SaaS model could
cut this by 50–70%

Cost Saving Waste Management



Landfill tipping fee in Malaysia ≈
RM35–50/tonne (average).

Landfill cost savings=Extra tonnes
diverted×Tipping fee
(RM/tonne)=80000x35 (low case)

=
RM3–4 million/year saved

Increased job creation



Job creation in logistics, recycling,
and machine servicing

Social Impact

Increased recycling rate

- Convenience & Accessibility
- Incentives & Rewards
- Transparency & Trust

Builds FMCG trust with stakeholder

67% of Malaysians prefer sustainable brands

- FMCG gets credible ESG
- FMCG improve brand trust

Community Engagement

- Publicly placed RVMs create visible symbols of sustainability.
- Local councils can brand RVMs as community recycling hub

Impact (Metrics Calculation)

Variable	Value	Unit	Description
N	1500000000	containers/year	Total containers placed on market per year
w	0.0185	kg/container	Average weight per container (18.5 g)
r0	0.31	-	Baseline recycling rate (31.5%)
r1	0.7	-	Projected recycling rate after DRS + RVM (70%)
s	1.3	tCO2e/tonne	CO2e savings per tonne recycled
d	0.1	RM/container	Deposit per container
	Results	Unit	Calculation
Total tonnes placed on market	27750	tonnes/year	$N * w /1000$
Baseline tonnes recycled	8602.5	tonnes/year	$N * w * r0 /1000$
Projected tonnes recycled (after DRS+RVM)	19425	tonnes/year	$N * w * r1 /1000$
Extra tonnes recycled	10822.5	tonnes/year	$N * w (r1 - r0) /1000$
Extra CO2 saved	14069.25	tCO2e/year	$(N * w (r1 - r0) /1000) * s$
Annual deposit payout (if using DRS)	105000000	RM/year	$N * r1 * d$



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DEMO

Recycognize Recycle smart. Recognize impact.

Link to our demo video:

https://drive.google.com/file/d/1loKb53vEAVDNdQbKgRnyPawzEmDJpABJ/view?usp=share_link

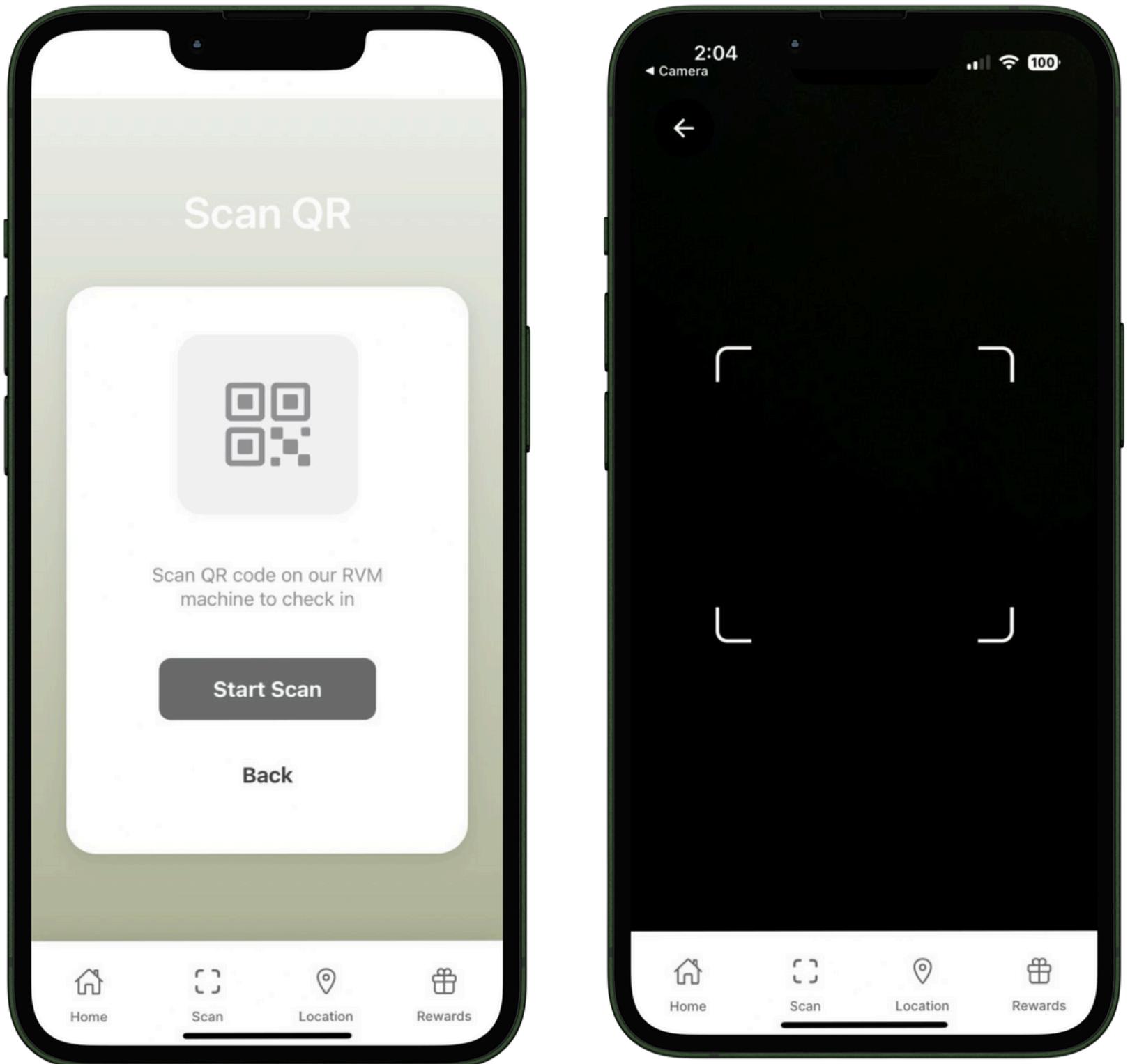
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DEMO - Consumer App (Home Page)

On the Home page, users can instantly view their total number of items recycled, along with a detailed breakdown by material type (e.g., plastic, aluminum, glass, tetra pak). For each category, a short eco-friendly tip is displayed at below to encourage better recycling habits and promote sustainable behavior.

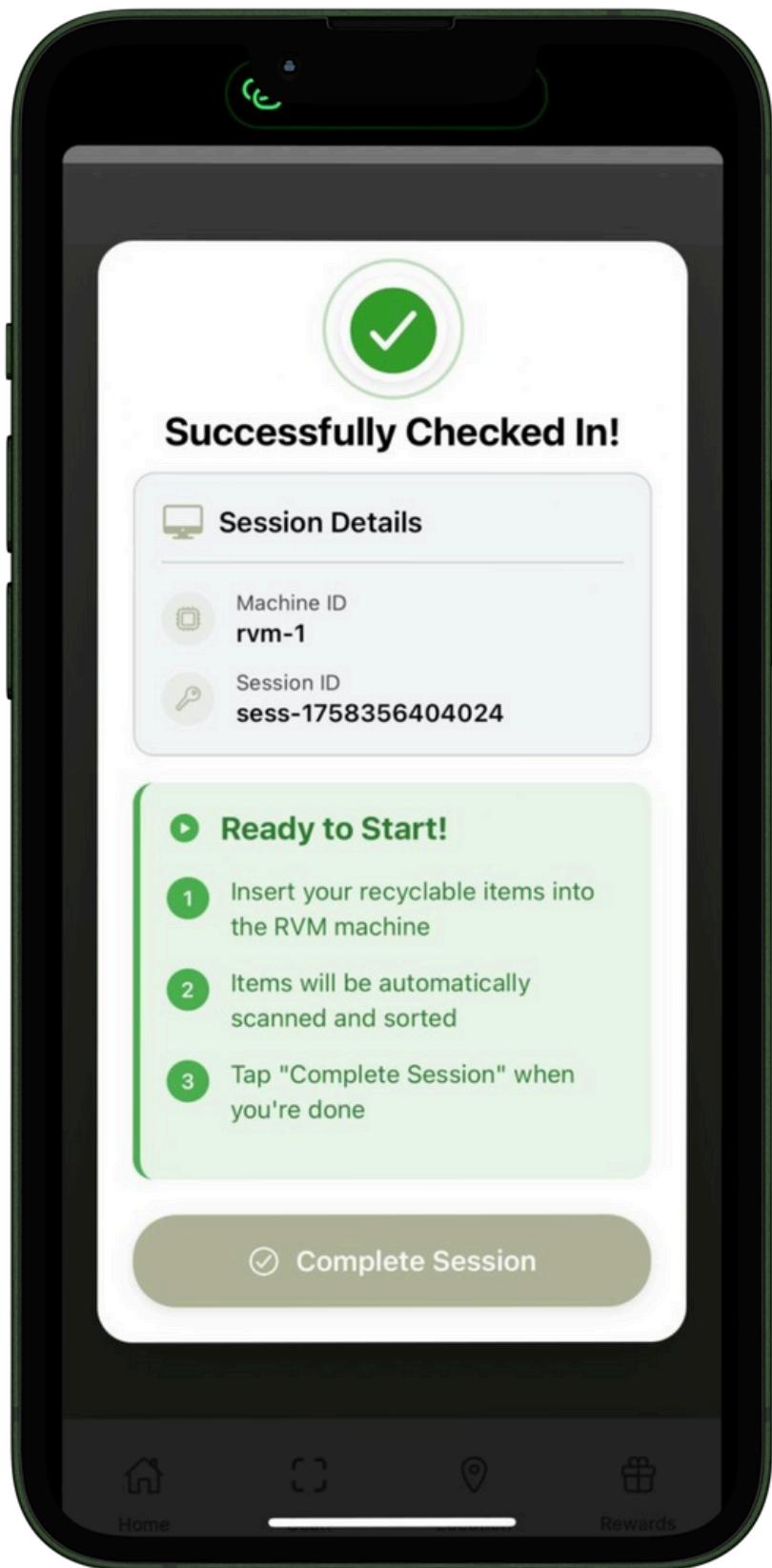


DEMO - Consumer App (Scan Page)



The **Scan page** enables users to initiate a recycling session by scanning the QR code displayed on the RVM machine. This seamless check-in process securely links the user with the machine, ensuring that all recycled items are tracked and reward points are accurately credited in real time.

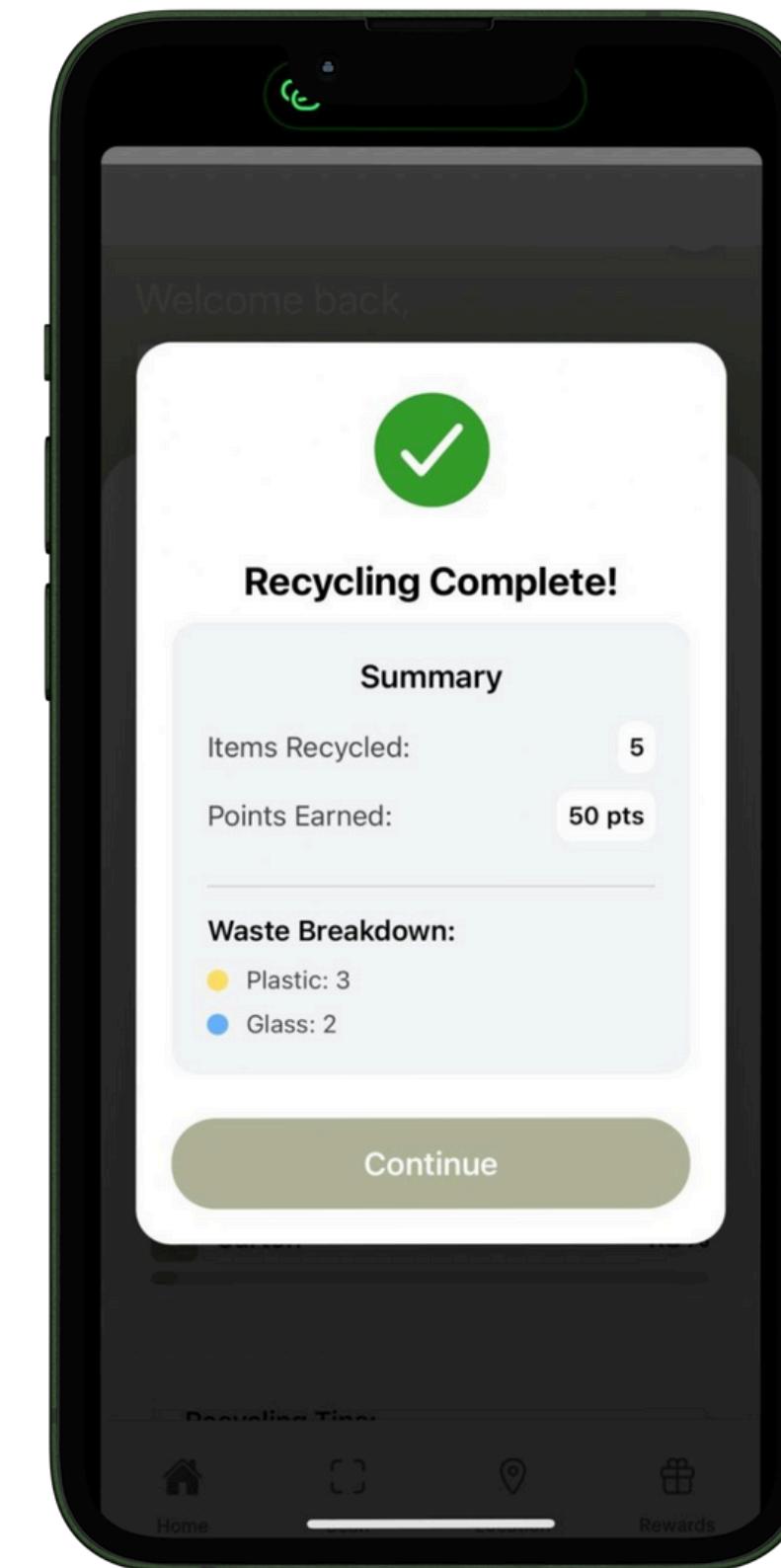
DEMO - Consumer App (Pop-up Guide)



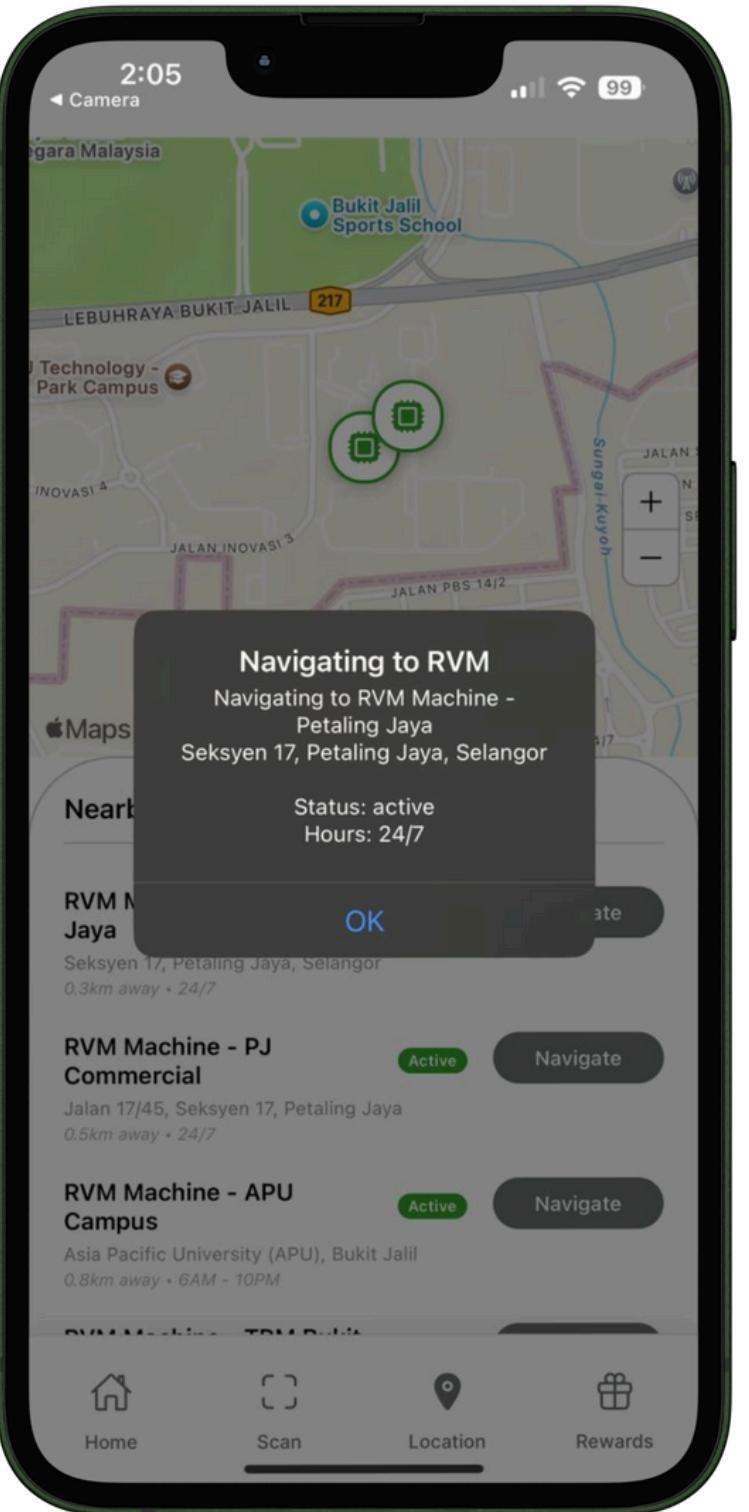
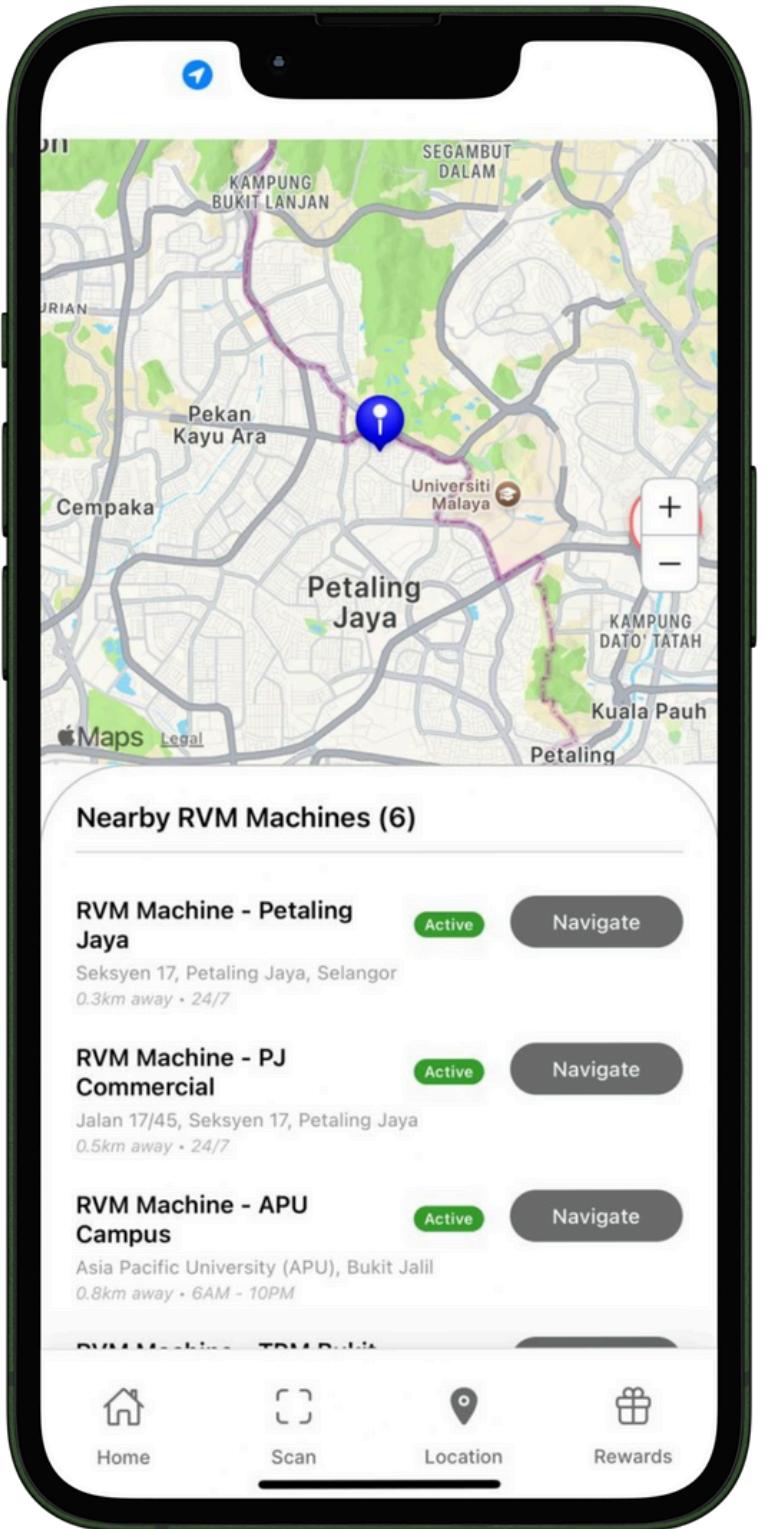
Once the consumer successfully checks in, an interactive pop-up guide provides clear instructions on how to place items into the RVM. After depositing their items, users can simply tap the “Complete Session” button to finalize the process and instantly record their recycled item.

DEMO - Consumer App (Summary Pop-up)

After completing a session, a **summary pop-up** is displayed, providing the consumer with a clear breakdown of the items recycled during that session. The summary highlights both the total count and the material types, giving users instant visibility into their impact and reinforcing positive recycling behavior.



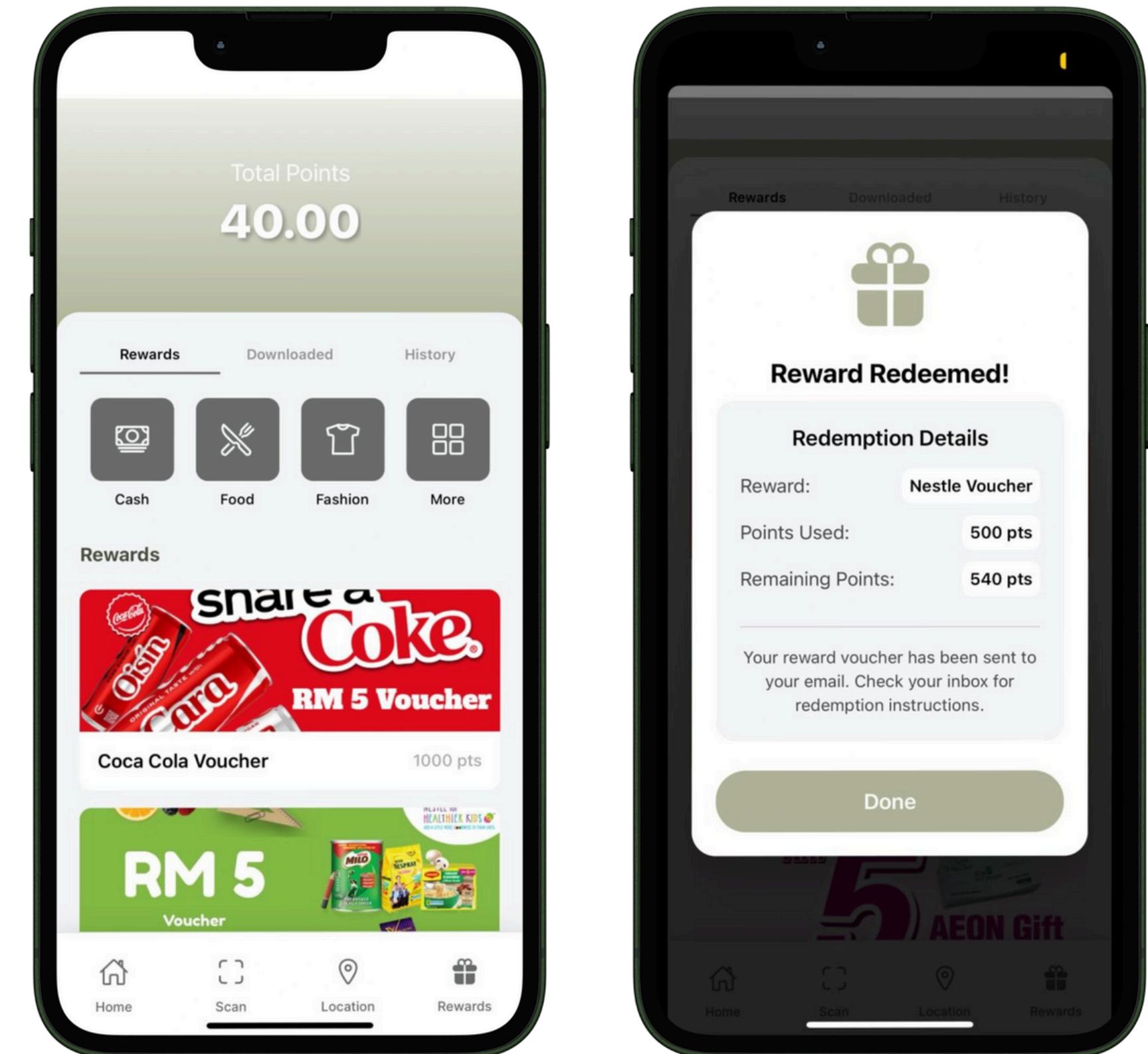
DEMO - Consumer App (Location Page)



The Location page enables consumers to easily discover the nearest RVM machines through an interactive map interface. Users can view available RVMs in their vicinity and receive real-time navigation guidance to reach their chosen location, making recycling both convenient and accessible.

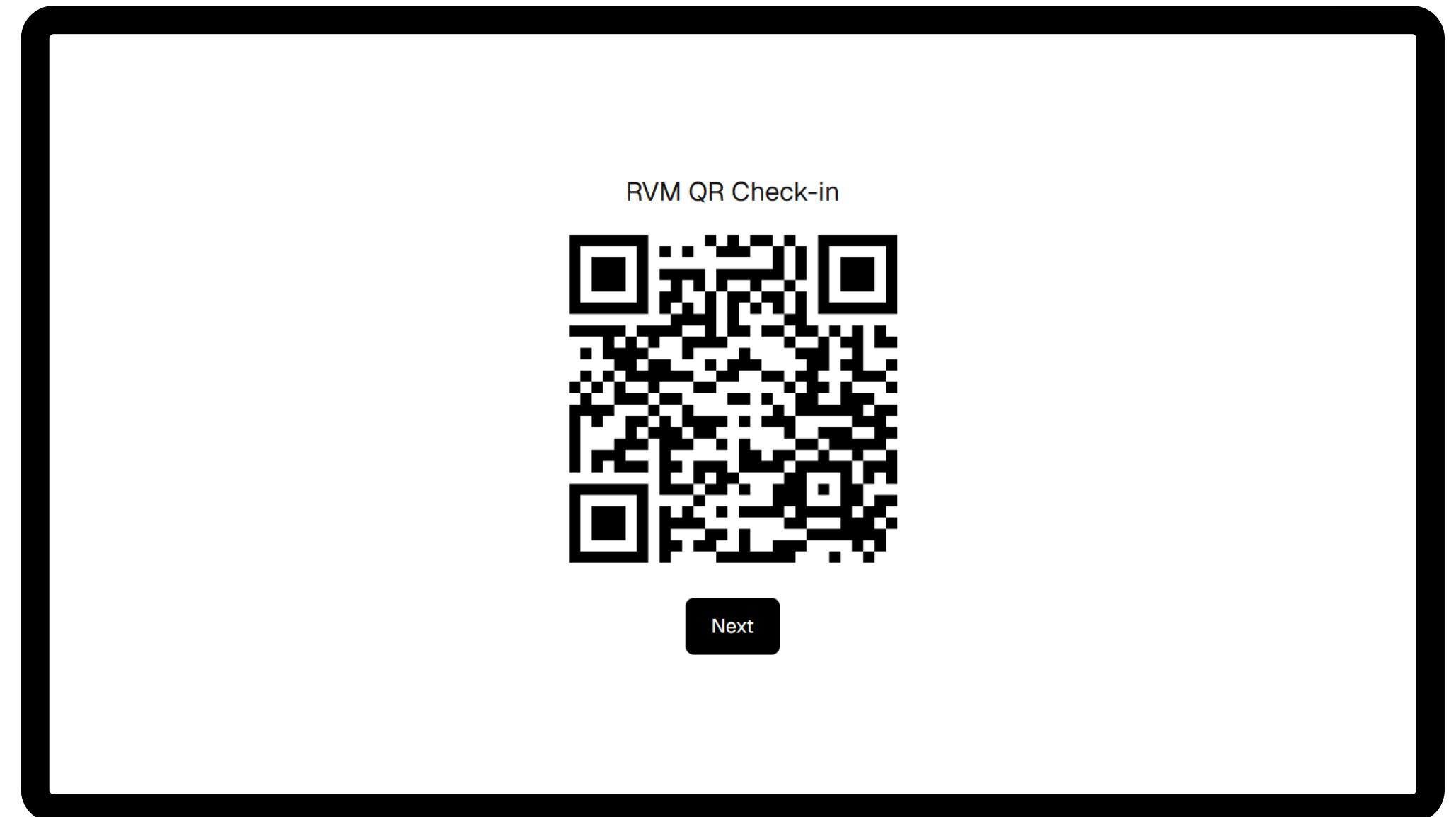
DEMO - Consumer App (Rewards Page)

The **Rewards page** allows consumers to seamlessly redeem rewards using their accumulated points. Users can explore a curated catalog of offers, track their available balance, and instantly claim rewards, all within the app, providing a tangible incentive for consistent recycling behavior.



DEMO - RVM Screen

The RVM screen displays a QR code, which consumers scan with the mobile app to authenticate.

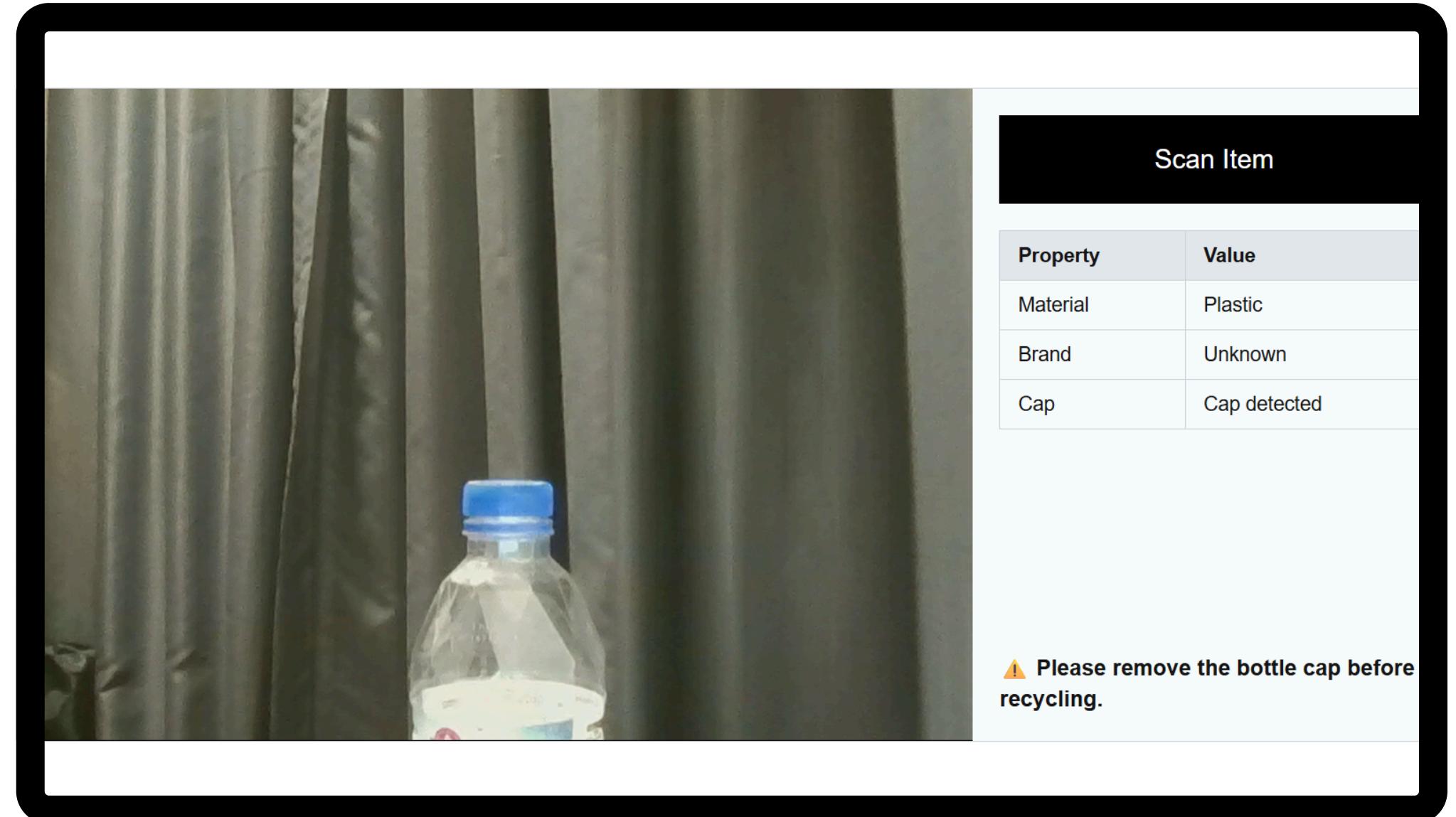


DEMO - RVM Screen

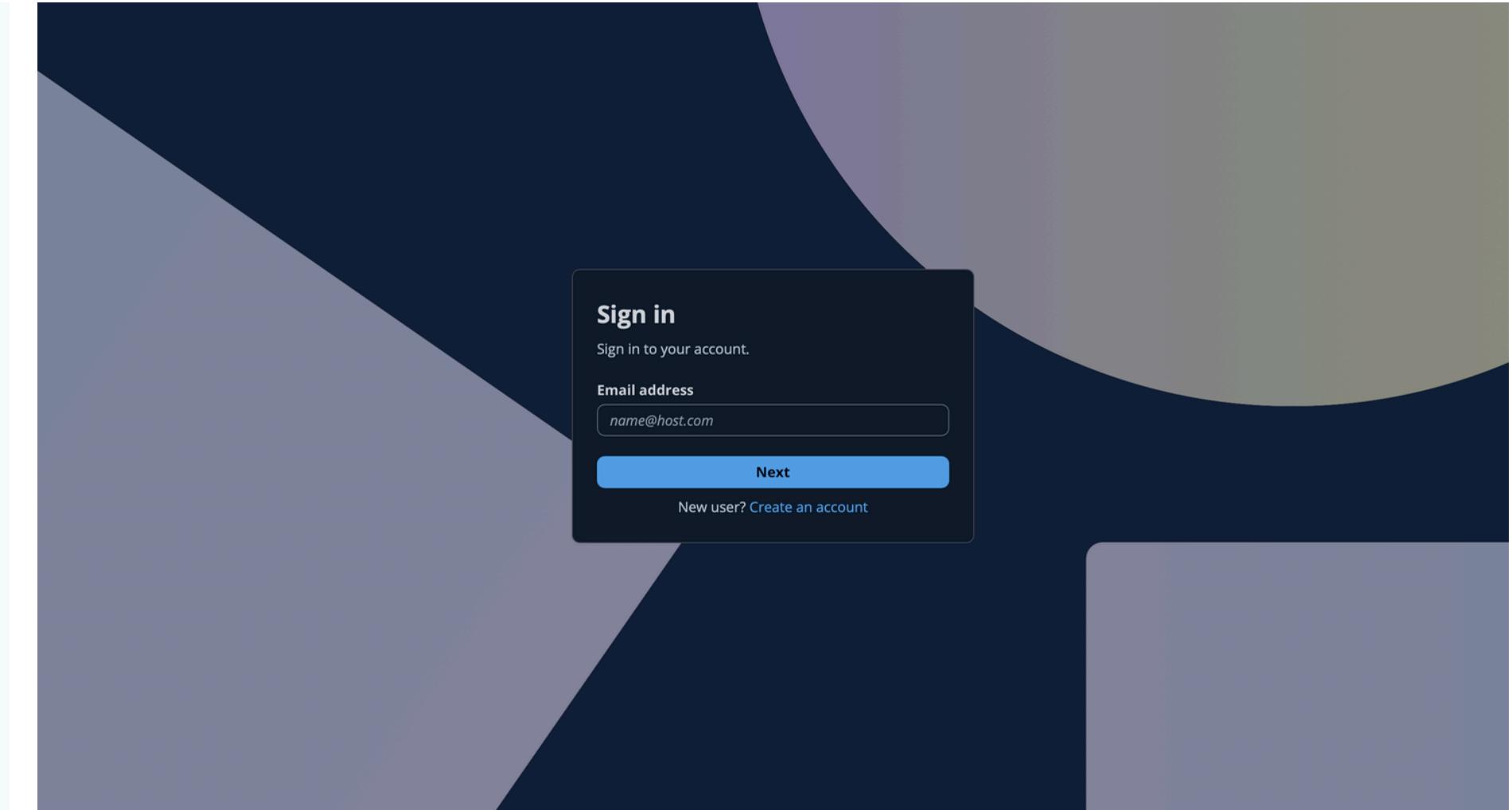
When an item is deposited, the RVM scanner captures burst images and sends them to Roboflow's multi-label classification model.

The model predicts material, brand, and contamination. Results are shown on the RVM screen.

Users are informed whether the item is accepted or rejected.



DEMO - FMCG Dashboard



User can choose to Sign In or Sign Up using **AWS Cognito**

DEMO - FMCG Dashboard (Dashboard Page)

View total detections, average confidence, and top detected materials with a live feed of recent activity.

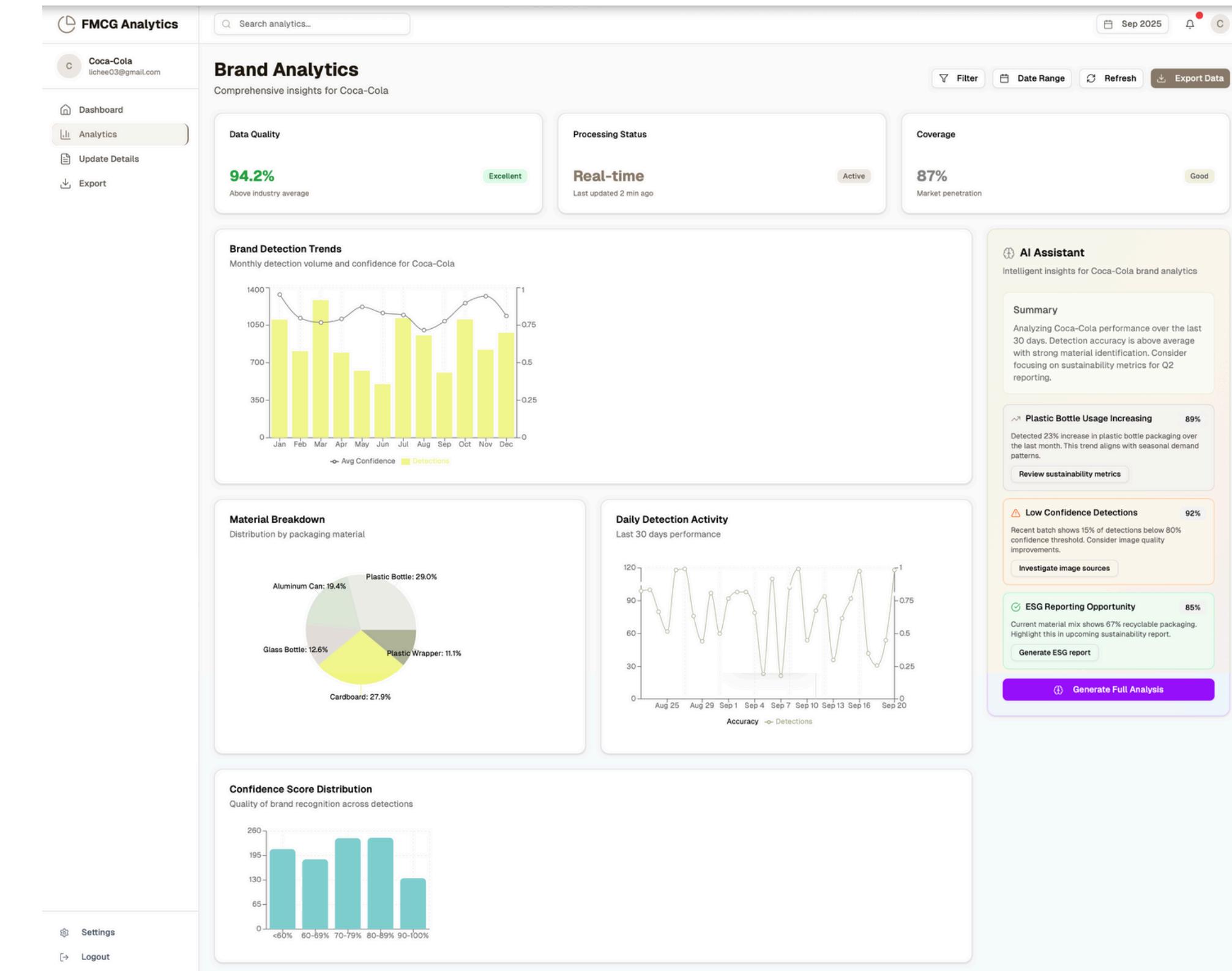
The screenshot shows the FMCG Analytics dashboard for the user 'Coca-Cola' (lichee03@gmail.com). The dashboard is organized into several sections:

- Welcome back, Coca-Cola**: A summary message with a note about live data being updated less than a minute ago.
- Live Data**: Key metrics: Total Detections (13,873), Avg Confidence (84.7%), Recent Activity (33), and Top Material (Plastic).
- Live Detection Feed**: A list of recent detections from DynamoDB, showing two items: 'Coca-Cola Plastic Bottle' at 94.0% confidence (Live, 30 minutes ago) and 'Coca-Cola Aluminum Can' at 91.0% confidence (Live, about 1 hour ago).
- Top Materials (Real-time)**: A chart showing current material distribution. The top four materials are Plastic Bottle (1084), Aluminum Can (1184), Glass Bottle (219), and Cardboard (200).
- Historical Overview**: Metrics for historical items (2), avg confidence (93.5%), materials (2), and recent detections (0).
- Recent Brand Detections**: A section showing the latest items detected for Coca-Cola, including a Plastic Bottle (95.0% confidence, 15/01/2024) and an Aluminum Can (92.0% confidence, 15/01/2024).

At the bottom, there are links for Settings and Logout.

DEMO - FMCG Dashboard (Analytics Page)

Explore interactive charts showing brand trends, material breakdowns, daily activity, and confidence score distributions.



DEMO - FMCG Dashboard (Update Details Page)

Edit Company Registration

Update your company details and registration information

Company Identity

Company Name *	Cola.co	Company ID / Tax ID	123
Brand Names *	Cola	Packaging Type *	Bottle
Contact Person *	Lc	Recyclability *	Yes
Account Admin Name *	Lc	SKU	Cola
Account Admin Email *	lichee03@gmail.com	Barcode	12345
RVM Partner IDs *	RVM001	Unit Weight (g) *	4
Default Currency	MY	+ Add Product	
Material Mapping Preference *	Plastic	+ Add Product	

Operational Metadata

Default Region	Malaysia
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[+ Add RVM Partner ID](#)

[Cancel](#) [Save Changes](#)

Register or update company information to enable tailored analytics and reporting.

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DEMO - FMCG Dashboard (Export Page)

Export ESG insights as a professional PDF (executive summary, KPIs, compliance) or download raw detection data as CSV.

The screenshot shows the FMCG Analytics dashboard for Coca-Cola. On the left, a sidebar includes links for Dashboard, Analytics, Update Details, and Export (which is highlighted). The main area features a 'Data Export' section for generating ESG reports. It displays two main sections: 'CSV Data Export' (with 2 available records and 94.2% data quality) and 'ESG Metrics Export' (with a sustainability score of 60/100 and 50.0% recyclable percentage). Below these are 'Current ESG Metrics' including Recyclable Materials (50.0%), Sustainability Score (60/100), Carbon Footprint (60.0), Material Efficiency (89.0%), and Waste Reduction (19.5%). The bottom section shows the 'Export History' with three completed exports: a CSV file from Jan 15, 2025 (1250 records), an ESG Metrics Export from Jan 10, 2025 (980 records), and another CSV file from Jan 05, 2025 (2100 records).

Data Export
Export analytics data and generate ESG reports for Coca-Cola

CSV Data Export
Export raw analytics data for external analysis

Available Records: 2 Data Quality: 94.2%

Includes:

- Brand detection results
- Material classification
- Confidence scores
- Timestamps and metadata

ESG Metrics Export
Generate comprehensive sustainability reports

Sustainability Score: 60/100 Recyclable %: 50.0%

Report Includes:

- Environmental impact metrics
- Material sustainability analysis
- Compliance status
- Improvement recommendations

Current ESG Metrics
Real-time sustainability performance indicators

Metric	Value
Recyclable Materials	50.0%
Sustainability Score	60/100
Carbon Footprint	60.0
Material Efficiency	89.0%
Waste Reduction	19.5%

Export History
Recent data exports and reports

Type	Records	Date	Status
CSV	1250 records	2025-01-15	completed
ESG Metrics Export	980 records	2025-01-10	completed
CSV	2100 records	2025-01-05	completed



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Thank you!

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