City of Melbourne: To Improve Parking Availability for Melbourne Commuters

FIT5120 Onboarding Presentation

TP30

Problem Framing

Question

How might we provide drivers with real-time parking information to reduce search times and ease congestion?

Issues

- Wasting time, fuel, energy circling for parking
- Lack of real-time and predictive parking data
- Rising car ownership and CBD congestion
- Missed policy goals on emissions & traffic

Strategy

- Live + predictive parking data
- Congestion drivers viz
- Eco-smart commuting choices

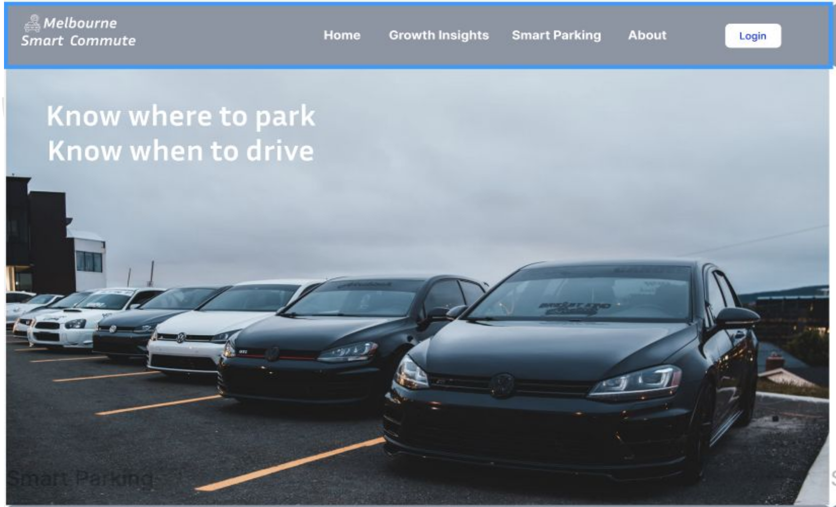
Impact

- **Time, stress, and emissions reduction**
- **Trip planning improvement**
- **Smart city goals**

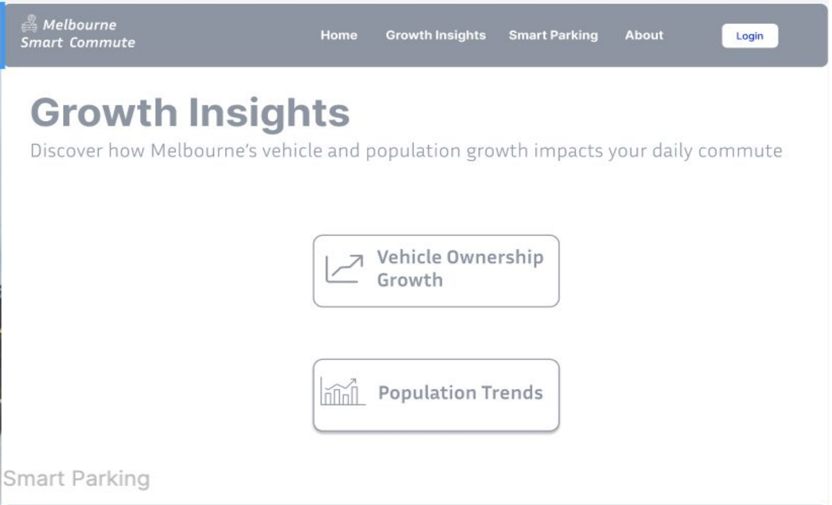
Epics Walkthrough & Benefits

Epic	What We Deliver	Why It Matters
1. Data Insights (Must Have)	📊 Dashboard (US 1.1) 📍 Population growth viz (US 1.2)	Builds user awareness of systemic causes behind traffic issues; shifts mindset
2. Real-Time Parking (Must Have)	🗺️ Live availability map (US 2.1) 📅 Predictive & historical trends (US 2.2–2.3)	Minimises time lost, stress, and emissions by guiding smart parking
3. Eco-Friendly Actions (Should Have)	🌿 CO2 calculator (US 3.1) ♻️ “Greenest” parking filter (US 3.2)	Encourages low-carbon choices with minimal disruption

High level prototype

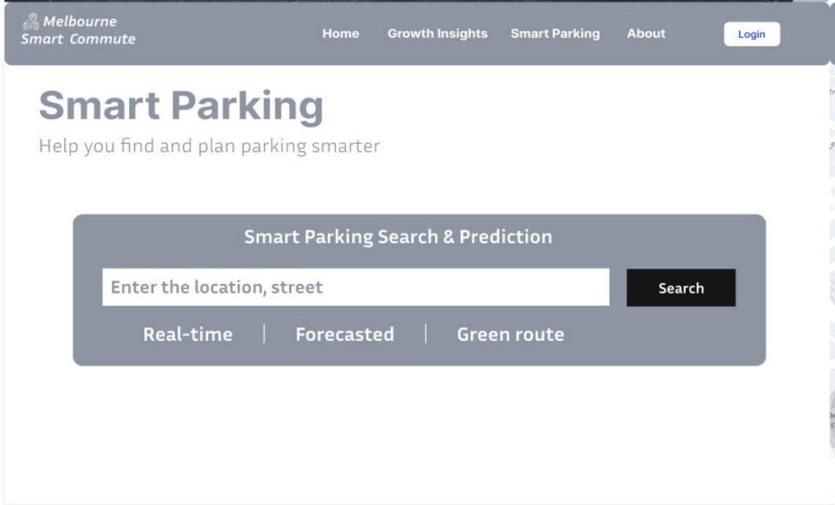


Know where to park
Know when to drive



Growth Insights

Discover how Melbourne's vehicle and population growth impacts your daily commute

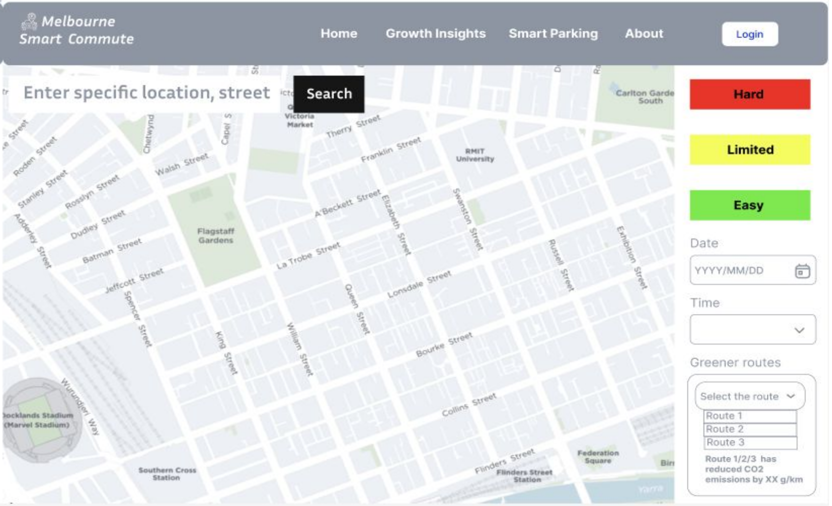


Smart Parking

Help you find and plan parking smarter

Smart Parking Search & Prediction

Enter the location, street



Enter specific location, street

Date

YYYY/MM/DD

Time

Greener routes

Select the route

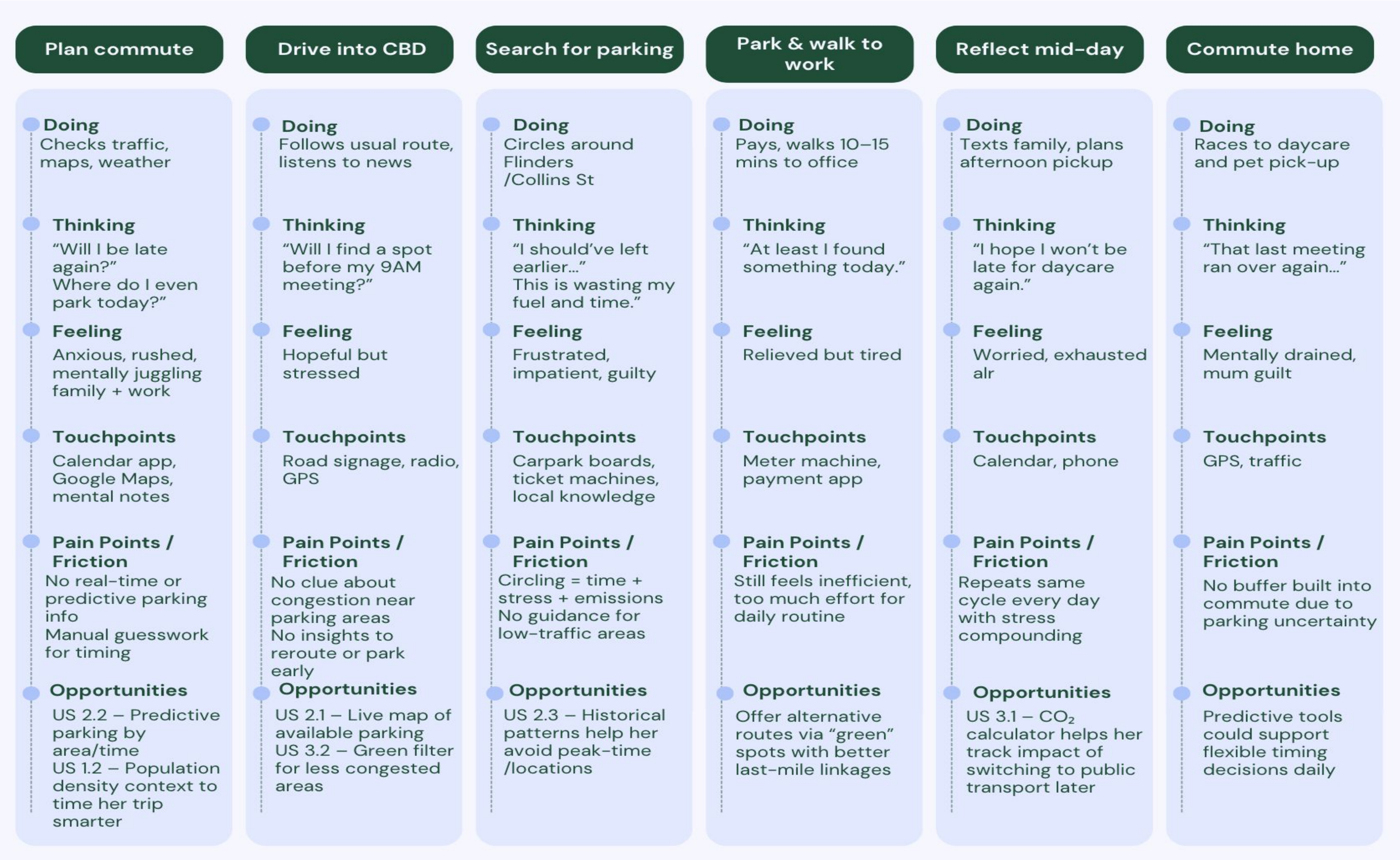
Route 1

Route 2

Route 3

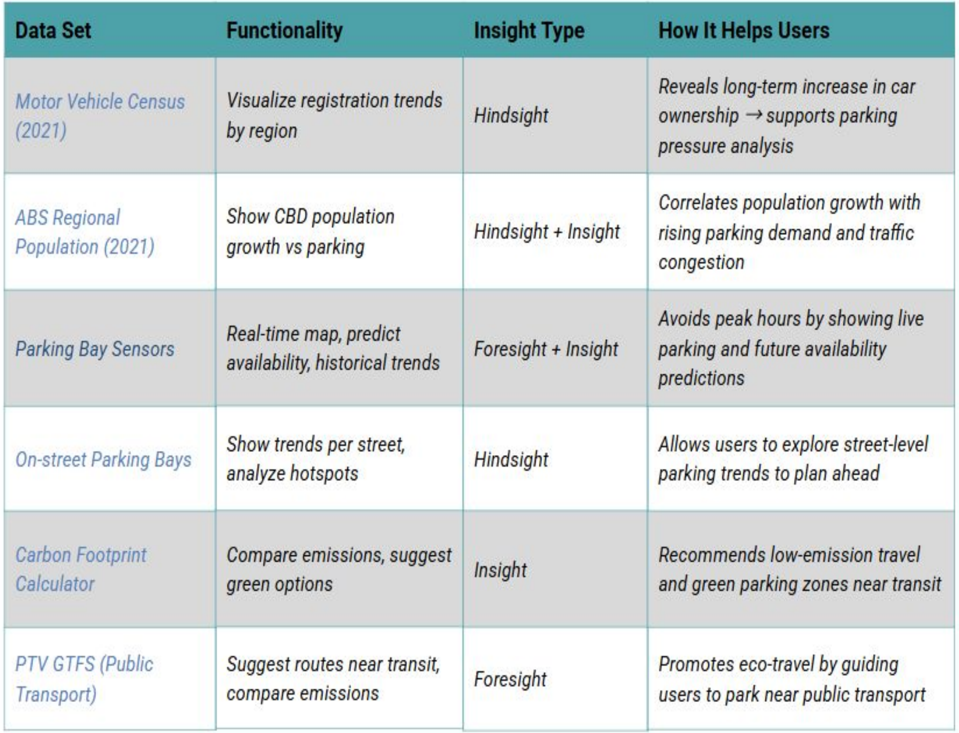
Route 1/2/3 has reduced CO2 emissions by XX g/km

Customer journey map

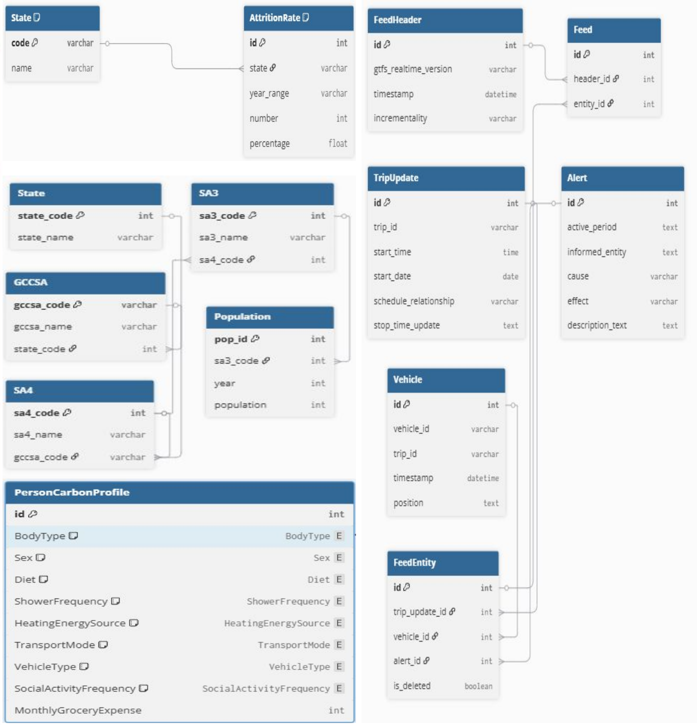


	Plan commute	Drive into CBD	Search for parking	Park & walk to work	Reflect mid-day	Commute home
Doing	Checks traffic, maps, weather	Follows usual route, listens to news	Circles around Flinders /Collins St	Pays, walks 10–15 mins to office	Texts family, plans afternoon pickup	Races to daycare and pet pick-up
Thinking	"Will I be late again?" Where do I even park today?"	"Will I find a spot before my 9AM meeting?"	"I should've left earlier…" This is wasting my fuel and time."	"At least I found something today."	"I hope I won't be late for daycare again."	"That last meeting ran over again…"
Feeling	Anxious, rushed, mentally juggling family + work	Hopeful but stressed	Frustrated, impatient, guilty	Relieved but tired	Worried, exhausted alr	Mentally drained, mum guilt
Touchpoints	Calendar app, Google Maps, mental notes	Road signage, radio, GPS	Carpark boards, ticket machines, local knowledge	Meter machine, payment app	Calendar, phone	GPS, traffic
Pain Points / Friction	No real-time or predictive parking info Manual guesswork for timing	No clue about congestion near parking areas No insights to reroute or park early	Circling = time + stress + emissions No guidance for low-traffic areas	Still feels inefficient, too much effort for daily routine	Repeats same cycle every day with stress compounding	No buffer built into commute due to parking uncertainty
Opportunities	US 2.2 – Predictive parking by area/time US 1.2 – Population density context to time her trip smarter	US 2.1 – Live map of available parking US 3.2 – Green filter for less congested areas	US 2.3 – Historical patterns help her avoid peak-time /locations	Offer alternative routes via "green" spots with better last-mile linkages	US 3.1 – CO_2 calculator helps her track impact of switching to public transport later	Predictive tools could support flexible timing decisions daily

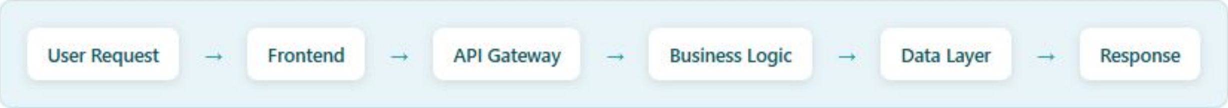
Open Data



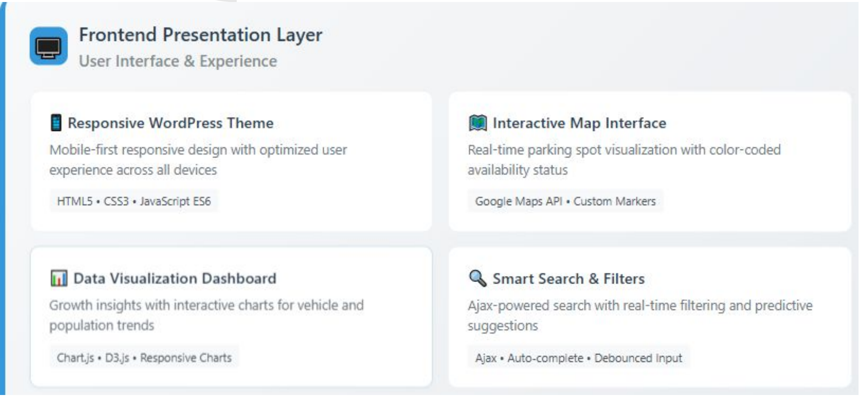
Data Set	Functionality	Insight Type	How It Helps Users
Motor Vehicle Census (2021)	*Visualize registration trends by region*	*Hindsight*	*Reveals long-term increase in car ownership → supports parking pressure analysis*
ABS Regional Population (2021)	*Show CBD population growth vs parking*	*Hindsight + Insight*	*Correlates population growth with rising parking demand and traffic congestion*
Parking Bay Sensors	*Real-time map, predict availability, historical trends*	*Foresight + Insight*	*Avoids peak hours by showing live parking and future availability predictions*
On-street Parking Bays	*Show trends per street, analyze hotspots*	*Hindsight*	*Allows users to explore street-level parking trends to plan ahead*
Carbon Footprint Calculator	*Compare emissions, suggest green options*	*Insight*	*Recommends low-emission travel and green parking zones near transit*
PTV GTFS (Public Transport)	*Suggest routes near transit, compare emissions*	*Foresight*	*Promotes eco-travel by guiding users to park near public transport*



System Architecture



User Request → Frontend → API Gateway → Business Logic → Data Layer → Response



Frontend Presentation Layer

User Interface & Experience

Responsive WordPress Theme

Mobile-first responsive design with optimized user experience across all devices

HTML5 • CSS3 • JavaScript ES6

Interactive Map Interface

Real-time parking spot visualization with color-coded availability status

Google Maps API • Custom Markers

Data Visualization Dashboard

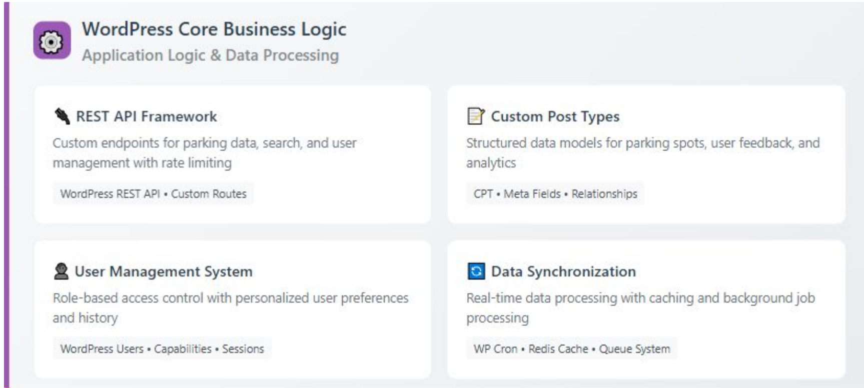
Growth insights with interactive charts for vehicle and population trends

Chart.js • D3.js • Responsive Charts

Smart Search & Filters

Ajax-powered search with real-time filtering and predictive suggestions

Ajax • Auto-complete • Debounced Input



WordPress Core Business Logic

Application Logic & Data Processing

REST API Framework

Custom endpoints for parking data, search, and user management with rate limiting

WordPress REST API • Custom Routes

Custom Post Types

Structured data models for parking spots, user feedback, and analytics

CPT • Meta Fields • Relationships

User Management System

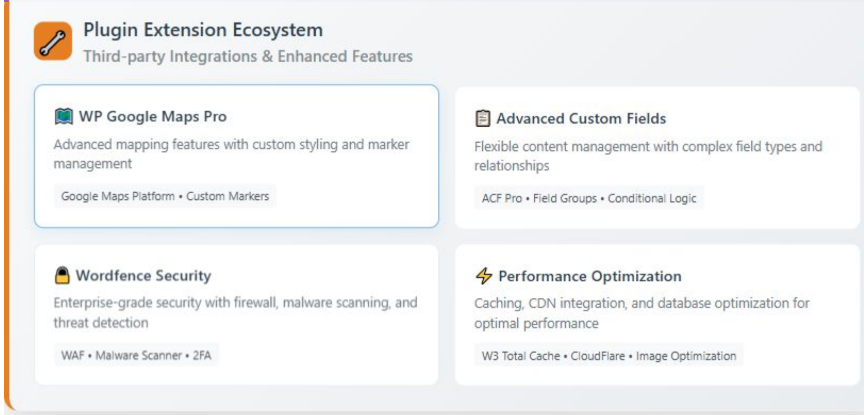
Role-based access control with personalized user preferences and history

WordPress Users • Capabilities • Sessions

Data Synchronization

Real-time data processing with caching and background job processing

WP Cron • Redis Cache • Queue System



Plugin Extension Ecosystem

Third-party Integrations & Enhanced Features

WP Google Maps Pro

Advanced mapping features with custom styling and marker management

Google Maps Platform • Custom Markers

Advanced Custom Fields

Flexible content management with complex field types and relationships

ACF Pro • Field Groups • Conditional Logic

Wordfence Security

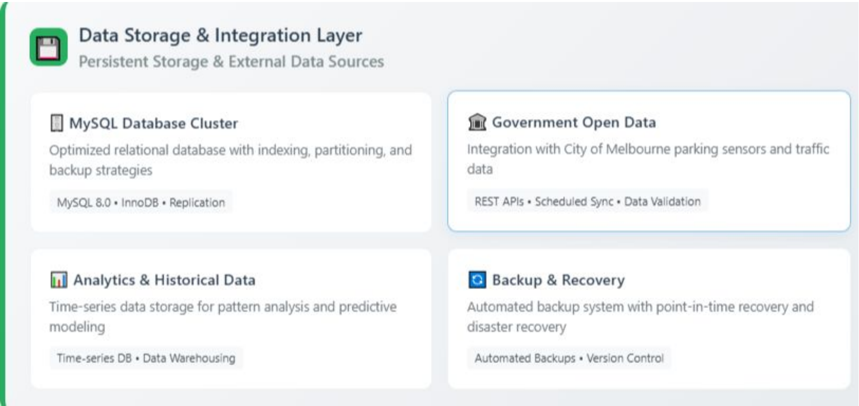
Enterprise-grade security with firewall, malware scanning, and threat detection

WAF • Malware Scanner • 2FA

Performance Optimization

Caching, CDN integration, and database optimization for optimal performance

W3 Total Cache • CloudFlare • Image Optimization



Data Storage & Integration Layer

Persistent Storage & External Data Sources

MySQL Database Cluster

Optimized relational database with indexing, partitioning, and backup strategies

MySQL 8.0 • InnoDB • Replication

Government Open Data

Integration with City of Melbourne parking sensors and traffic data

REST APIs • Scheduled Sync • Data Validation

Analytics & Historical Data

Time-series data storage for pattern analysis and predictive modeling

Time-series DB • Data Warehousing

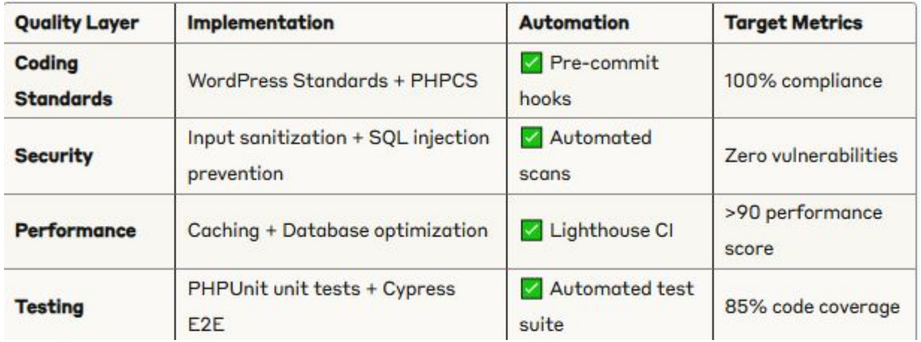
Backup & Recovery

Automated backup system with point-in-time recovery and disaster recovery

Automated Backups • Version Control

Code Quality

Code Quality Integration Framework

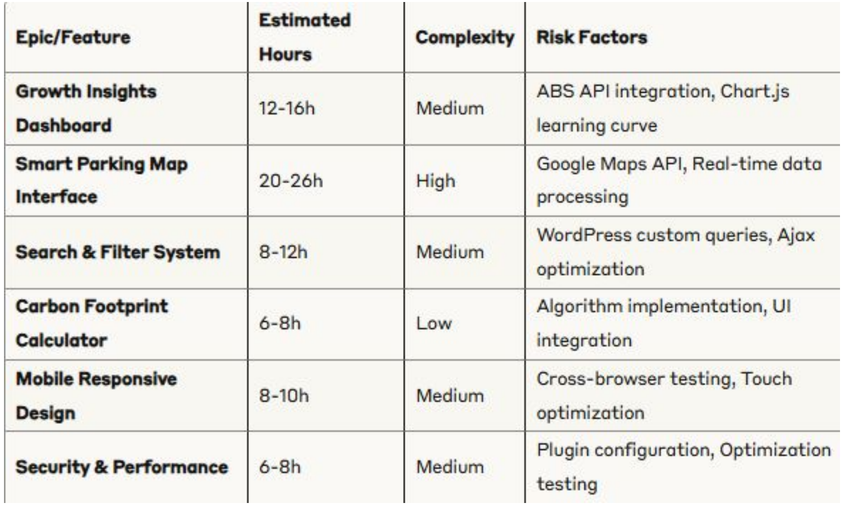


Quality Layer	Implementation	Automation	Target Metrics
Coding Standards	WordPress Standards + PHPCS	✅ Pre-commit hooks	100% compliance
Security	Input sanitization + SQL injection prevention	✅ Automated scans	Zero vulnerabilities
Performance	Caching + Database optimization	✅ Lighthouse CI	>90 performance score
Testing	PHPUnit unit tests + Cypress E2E	✅ Automated test suite	85% code coverage

Quality Gates: Code Review (2-person) → Automated Tests → Security Scan → Performance Check → Deploy

Project Management & Tracking
LeanKit Board : FIT5120 2025S2 TP30

Feature Development Time Estimation

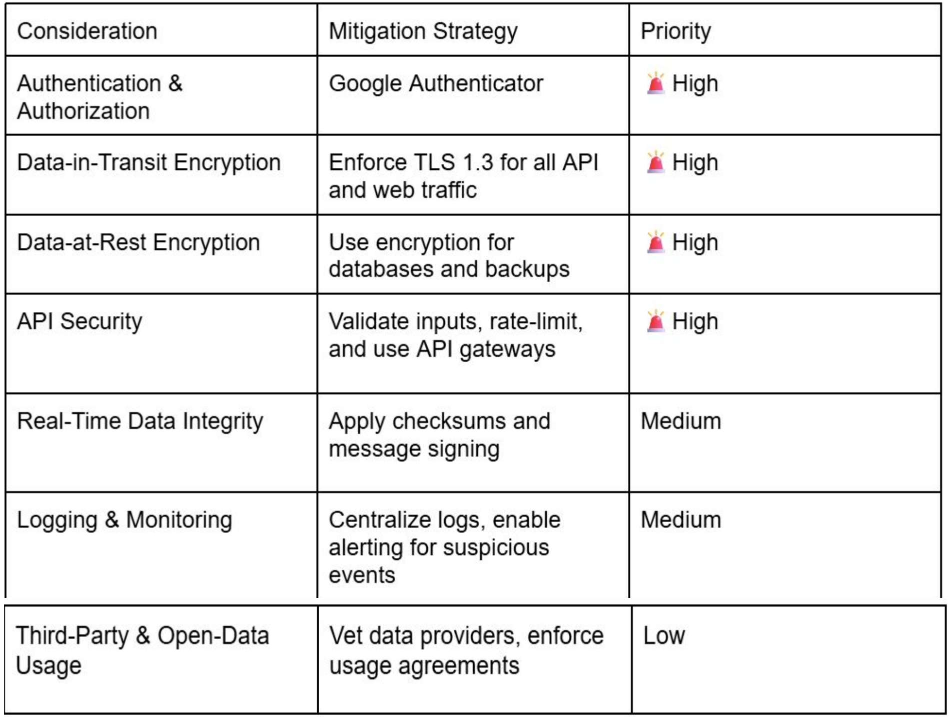


Epic/Feature	Estimated Hours	Complexity	Risk Factors
Growth Insights Dashboard	12-16h	Medium	ABS API integration, Chart.js learning curve
Smart Parking Map Interface	20-26h	High	Google Maps API, Real-time data processing
Search & Filter System	8-12h	Medium	WordPress custom queries, Ajax optimization
Carbon Footprint Calculator	6-8h	Low	Algorithm implementation, UI integration
Mobile Responsive Design	8-10h	Medium	Cross-browser testing, Touch optimization
Security & Performance	6-8h	Medium	Plugin configuration, Optimization testing

Total: 60-80 hours | Buffer: 20% | Final Estimate: 72-96 hours

Security Plan

Security Considerations



Consideration	Mitigation Strategy	Priority
Authentication & Authorization	Google Authenticator	🚨 High
Data-in-Transit Encryption	Enforce TLS 1.3 for all API and web traffic	🚨 High
Data-at-Rest Encryption	Use encryption for databases and backups	🚨 High
API Security	Validate inputs, rate-limit, and use API gateways	🚨 High
Real-Time Data Integrity	Apply checksums and message signing	Medium
Logging & Monitoring	Centralize logs, enable alerting for suspicious events	Medium
Third-Party & Open-Data Usage	Vet data providers, enforce usage agreements	Low

Security Inspection & Quality Assurance

Static Application Security Testing	**Tools:** SonarQube, Veracode **Frequency:** Every commit via CI/CD pipeline **Description:** Automated reports flagging insecure code patterns
Secure Code Reviews	**Description:** Peer review checklist **Process:** Each feature branch is reviewed by two developers from different disciplines
Dependency & Container Scanning	**Tools:** Dependabot, Clair **Description:** Alerts on vulnerable libraries and container images

Innovation

Innovation 1: Urban Dynamic Pressure Index Visualization System	Innovation 2: Behavior - Bound Parking Prediction	Innovation 3: Green Parking Points Ecosystem
Core Concept: Merge EPIC 1.0 (congestion data) and EPIC 2.0 (real - time parking gaps, historical trends).	Core Concept: Leverage EPIC 2.0’s AI plus user schedules. Predict parking spots matching personal trips	Core Concept: Link EPIC 3.0’s eco - tools to rewards. Earn points for green acts (like transit - linked parking, off - peak trips), redeem for free parking, priority, or user’s eco behavior reports.
User Impact: Visually show “congestion + parking” pressure via color - coded zones. Help avoid tough areas and adjust time.	User Impact: Solve prediction mismatches, ensure timely parking for time - critical tasks, ease stress	User Impact: Turn eco-behaviors idea into action, save costs, make sustainable development.