Northeastern University

GE - 5100 Product Development for Engineers

Team 8

FINAL PROJECT DOCUMENTATION

ON

"SmartParkIQ: A Smarter Way to Park"

By

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My Contribution

Janani Karthikeyan (System Architect & Technical Strategist):
As the **System Architect & Technical Strategist**, I was responsible for developing the technical foundation of SmartParkIQ. I designed the architecture for our AI/ML pricing engine, leveraging Random Forest and Gradient Boosting models to accurately forecast real-time price surges, while also planning backend integrations with Air Garage, Google Maps, and insurance providers to ensure seamless data flow. My work included building the insurance integration framework for instant micro-policy activation, defining technical specifications for partner systems, and engineering the platform for scalability to handle 10,000+ users with optimized performance and PCI-compliant payment security. I developed the database and analytics pipeline to track user behavior and support predictive insights, ensuring that SmartParkIQ is not only innovative in concept but also robust, secure, and market-ready in execution.

1. INTRODUCTION

Project Summary

SmartParkIQ is an AI-powered parking recommendation platform that helps users find the most affordable, reliable, and verified public parking spots in real time. The app solves key pain points in the current market such as inaccurate listings, limited real-time updates, confusing navigation, and hidden fees by combining user feedback loops, real-time data, and machine learning algorithms. Our team's diverse skill set allows us to tackle design, research, strategy, and system architecture in parallel.

SmartParkIQ's approach includes a built-in feedback prompt that asks users to confirm the accuracy of pricing data after parking. This binary feedback is used to retrain our model to improve future suggestions. Users receive a discount for their first hour, encouraging early adoption, while no-shows are penalized to prevent misuse and ensure garage operator compliance.

The app offers value to both customers and businesses: public garage managers benefit from increased occupancy and dashboard analytics, while users enjoy transparent pricing and location-aware suggestions. Strategic partnerships with insurance companies and navigation apps will allow us to expand distribution channels. Our business model avoids reliance on volume alone, instead offering B2B APIs, enterprise dashboards, and potential bundled service licensing.

Final Deliverable Summary

By the end of the semester, our team will deliver the following:

1. **Canvas Business Model:**
   - Key activities include smart pricing engine development, loyalty program management, and maintaining feedback loops.
   - Customer Segments: Drivers, garage owners/operators, insurance companies, navigation app companies.
   - Channels: App stores, B2B licensing, strategic bundling with insurance plans.
   - Revenue Streams: Subscription plans, operator analytics dashboard, advertisement placements, B2B partnerships.

2. **Marketing Research:**
   o Includes competitor benchmarking (e.g., ParkWhiz, SpotHero), user pain points, and surveys.
   o Market demand validation for smart parking platforms with feedback and dynamic pricing features.
   o Validation of interest from insurance companies and urban garage operators.
3. **Prototype:**
   o High-fidelity interactive prototype created in Figma.
   o Key features: Search-based recommendations, pre-booking with ETA hold, real-time confirmation prompts, loyalty dashboard, and payment system.
   o Admin view mockups for garage operators with analytics.
4. **Supporting Materials:**
   o Technical architecture outline.
   o Business pitch deck.
   o Integration proposal for potential B2B partners (insurance and navigation apps).

Testing Plan

Our testing plan involves validating the app's UI, feature set, and pricing recommendation engine through a structured feedback process:

- **Target Users:** 20-25 participants including student drivers, daily commuters, and part-time urban drivers.
- **Recruitment:** Volunteers from local campuses, social media, and rideshare communities.
- **Prototype to Test:** Interactive Figma prototype with major flows (search, book, feedback, reward system).
- **Timeline:**
  o **Week 1-2:** Initial design testing (UI/UX) with 5 users.
  o **Week 3-4:** Smart pricing feedback testing with 10 users.
  o **Week 5-6:** Loyalty and penalty flow testing with 10 additional users.
- **Evaluation Criteria:**
  o Usability and ease of navigation.
  o Accuracy perception of recommended spots.
  o Engagement with feedback and rewards prompts.
  o Willingness to pre-book and accept penalties.

Insights from testing will be used to update the prototype and retrain pricing feedback logic.

Team Roles

Janani (System Architect & Technical Strategist): I map the feedback loop mechanisms, design the backend architecture, and ensure the data is handled reliably. I also defined the logic for retraining recommendations, penalty processing, and integration APIs for B2B clients.

Mansi (UI/UX Designer & Research Lead): Mansi leads the design process and user research. She ensures that the app layout is intuitive, accessible, and well-informed by real user behaviors. She handles survey design, user interviews, and synthesizes qualitative feedback into actionable design improvements.

Suyog (Business Strategist & Market Analyst): Suyog defines the revenue model, value propositions, and strategic direction. He identifies potential customer segments, partnership opportunities, and runs market sizing estimates. He also drives the creation of the Business Model Canvas and product positioning.

Project Management

Our team uses Notion for documentation, Jira board tracking, and meeting minutes. Weekly meetings are held via Teams or in-person to discuss progress. Tasks are divided based on expertise and interest and reviewed at midweek checkpoints. All documents are version-controlled in a shared Google Drive folder.

Expectations

- **Task Selection:** Based on individual skill alignment and workload capacity.
- **Work Visibility:** Progress shared weekly in Notion with status updates.
- **Feedback Loop:** Design and strategic ideas are reviewed by all team members in weekly syncs. Honest but respectful critiques are encouraged.
- **Communication:** Team WhatsApp group for real-time updates, Teams for formal notes.
- **Valid Exceptions:** Illness, family emergencies, or academic overload (with advance notice).
- **Non-Compliance:** Repeated failure to deliver without notice will trigger a reallocation of responsibilities and faculty escalation if needed.

Conflict Remediation

Design and execution disagreements are handled via majority consensus after an open discussion. If consensus isn't possible, the team votes. For interpersonal or performance issues, a one-on-one dialogue is encouraged first, followed by full team mediation. Persistent issues will be escalated to course instructors.

Preliminary Project Schedule

Our project is structured into four distinct phases: Proposal, Definition, Design, and Validation spanning from July 15, 2025, to August 17, 2025. These phases are organized into six agile Epics to streamline our work. The Proposal Phase focuses on finalizing the app idea and conducting competitor analysis. During the Definition Phase, we define our users, key features, and develop use-case scenarios.

Next, the Design Phase covers wireframing, branding, and building an interactive prototype using Figma. Parallel to this, we design the app logic for core features such as tow alerts, parking predictions, and towing support. The final phase includes internal testing, prototype submission, and delivery of a compelling pitch deck and demo video.

This structured timeline ensures balanced workload distribution, consistent progress, and clear deliverables at each stage.

Project Milestones and Timeline
(Overall duration: July 15, 2025 – August 17, 2025)

Proposal Phase *(July 15 – July 24)*
- Finalize app concept, objectives, and user needs *(07/16 – 07/19)*
- Research competitor apps and analyze gaps *(07/18 – 07/20)*
- Draft proposal document and get instructor feedback *(07/20 – 07/24)*

Definition Phase *(July 25 – July 31)*
- Define user personas, user journey maps, and pain points *(07/25 – 07/26)*
- Identify key app features for prototype (e.g., tow alerts, parking predictions, towing assistance) *(07/26 – 07/27)*
- Write user stories and use-case scenarios *(07/27 – 07/28)*
- Design app architecture and screen flow diagrams *(07/28 – 07/29)*
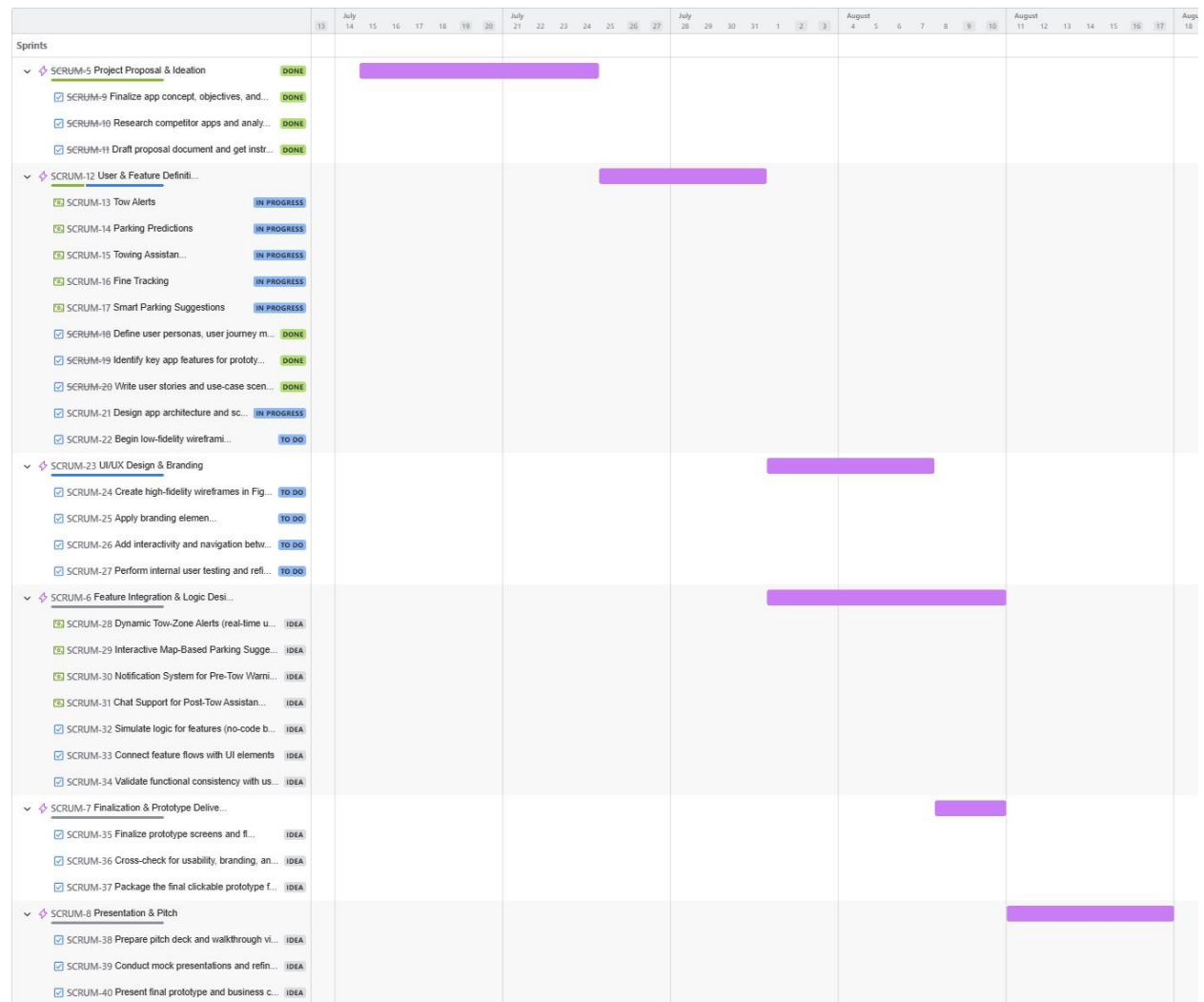- Begin low-fidelity wireframing *(07/30 – 07/31)*

Design Phase *(August 01 – August 07)*
- Create high-fidelity wireframes in Figma *(08/01 – 08/03)*
- Apply branding elements (color scheme, typography, logo) *(08/03 – 08/04)*
- Add interactivity and navigation between screens *(08/04 – 08/06)*
- Perform internal user testing and refine the design *(08/06 – 08/07)*

Validation & Presentation Phase *(August 08 – August 17)*
- Finalize prototype for submission *(08/08 – 08/10)*
- Prepare pitch deck and walkthrough video *(08/11 – 08/13)*
- Conduct mock presentations and refine based on feedback *(08/14 – 08/16)*
- Present final prototype and business concept *(08/17)*

Gantt Chart: Product Development Timeline

Sprints (Top view)

Task	Status	Timeline
SCRUM-5 Project Proposal & Ideation	DONE	Jul 14 – Jul 24
SCRUM-12 User & Feature Definiti...		Jul 24 – Jul 31
SCRUM-23 UI/UX Design & Branding		Jul 28 – Aug 6
SCRUM-6 Feature Integration & Logic Desi...		Jul 28 – Aug 10
SCRUM-7 Finalization & Prototype Delive...		Aug 8 – Aug 10
SCRUM-8 Presentation & Pitch		Aug 11 – Aug 17

Sprints (Detailed view)

Task	Status	Timeline
SCRUM-5 Project Proposal & Ideation	DONE	Jul 14 – Jul 24
SCRUM-9 Finalize app concept, objectives, and...	DONE	
SCRUM-10 Research competitor apps and analy...	DONE	
SCRUM-11 Draft proposal document and get instr...	DONE	
SCRUM-12 User & Feature Definiti...		Jul 24 – Jul 31
SCRUM-13 Tow Alerts	IN PROGRESS	
SCRUM-14 Parking Predictions	IN PROGRESS	
SCRUM-15 Towing Assistan...	IN PROGRESS	
SCRUM-16 Fine Tracking	IN PROGRESS	
SCRUM-17 Smart Parking Suggestions	IN PROGRESS	
SCRUM-18 Define user personas, user journey m...	DONE	
SCRUM-19 Identify key app features for prototy...	DONE	
SCRUM-20 Write user stories and use-case scen...	DONE	
SCRUM-21 Design app architecture and sc...	IN PROGRESS	
SCRUM-22 Begin low-fidelity wireframi...	TO DO	
SCRUM-23 UI/UX Design & Branding		Jul 28 – Aug 6
SCRUM-24 Create high-fidelity wireframes in Fig...	TO DO	
SCRUM-25 Apply branding elemen...	TO DO	
SCRUM-26 Add interactivity and navigation betw...	TO DO	
SCRUM-27 Perform internal user testing and refi...	TO DO	
SCRUM-6 Feature Integration & Logic Desi...		Jul 28 – Aug 10
SCRUM-28 Dynamic Tow-Zone Alerts (real-time u...	IDEA	
SCRUM-29 Interactive Map-Based Parking Sugge...	IDEA	
SCRUM-30 Notification System for Pre-Tow Warni...	IDEA	
SCRUM-31 Chat Support for Post-Tow Assistan...	IDEA	
SCRUM-32 Simulate logic for features (no-code b...	IDEA	
SCRUM-33 Connect feature flows with UI elements	IDEA	
SCRUM-34 Validate functional consistency with us...	IDEA	
SCRUM-7 Finalization & Prototype Delive...		Aug 8 – Aug 10
SCRUM-35 Finalize prototype screens and fl...	IDEA	
SCRUM-36 Cross-check for usability, branding, an...	IDEA	
SCRUM-37 Package the final clickable prototype f...	IDEA	
SCRUM-8 Presentation & Pitch		Aug 11 – Aug 17
SCRUM-38 Prepare pitch deck and walkthrough vi...	IDEA	
SCRUM-39 Conduct mock presentations and refin...	IDEA	
SCRUM-40 Present final prototype and business c...	IDEA	

Epic 1: Project Proposal & Ideation (July 15 – July 24)

Tasks:
- Finalize app concept, objectives, and user needs (07/16 – 07/19)
- Research competitor apps and analyze gaps (07/18 – 07/20)
- Draft proposal document and get instructor feedback (07/20 – 07/24)

Epic 2: User & Feature Definition (July 25 – July 31)

Features:
- Core App Capabilities:
  - Tow Alerts
  - Parking Predictions
  - Towing Assistance
  - Fine Tracking
  - Smart Parking Suggestions

Tasks:
- Define user personas, user journey maps, and pain points (07/25 – 07/26)
- Identify key app features for prototype (07/26 – 07/27)
- Write user stories and use-case scenarios (07/27 – 07/28)
- Design app architecture and screen flow diagrams (07/28 – 07/29)
- Begin low-fidelity wireframing (07/30 – 07/31)

Epic 3: UI/UX Design & Branding (August 01 – August 07)

Tasks:
- Create high-fidelity wireframes in Figma (08/01 – 08/03)
- Apply branding elements (color scheme, typography, logo) (08/03 – 08/04)
- Add interactivity and navigation between screens (08/04 – 08/06)
- Perform internal user testing and refine design (08/06 – 08/07)

Epic 4: Feature Integration & Logic Design (August 01 – August 10)

Overlaps with UI Design to allow parallel development planning.

Features:
- Dynamic Tow-Zone Alerts (real-time updates)
- Interactive Map-Based Parking Suggestions
- Notification System for Pre-Tow Warnings
- Chat Support for Post-Tow Assistance

Tasks:
- Simulate logic for features (no-code backend planning or logic mapping)
- Connect feature flows with UI elements
- Validate functional consistency with user stories

Epic 5: Finalization & Prototype Delivery (August 08 – August 10)

Tasks:

- Finalize prototype screens and flow
- Cross-check for usability, branding, and consistency
- Package the final clickable prototype for submission

Epic 6: Presentation & Pitch (August 11 – August 17)
Tasks:
- Prepare pitch deck and walkthrough video (08/11 – 08/13)
- Conduct mock presentations and refine based on feedback (08/14 – 08/16)
- Present final prototype and business concept (08/17)

2. MARKET RESEARCH

1. Smart Parking Technology Evolution

The smart parking technology is the foundation of SmartParkIQ's innovation, representing the integrated insurance model feature one of the key differentiators and novelty in parking technology advancement.

The evolution from mechanical systems, dating back to the 1900s, to sensor-based systems in early 2000s and the current AI-powered platforms demonstrates a clear progression towards user protection and smart parking avenues. n. Early smart parking sensor technology began gaining attention in the early 2000s, especially in malls and shopping complexes, with the first robotic garage built in 2002 in Hoboken, New Jersey.

While first-generation smart parking focused on availability detection and second-generation systems integrated seamless mobile payments, SmartParkIQ demonstrates innovation by integrating predictive analytics along with insurance protection. Current parking systems collect data from IoT devices and AI for better overall parking experience, but none offer the comprehensive protection model along with pre- booking options that SmartParkIQ aims to provide.

Modern smart parking systems utilize three primary technologies that directly support SmartParkIQ's architecture- ground sensor technology for real-time availability, camera-based systems for license plate recognition, and counter technology for occupancy management. Our platform leverages these existing infrastructures while adding predictive insurance algorithms and dynamic pricing intelligence.

Market Validation: The global smart parking industry was valued at $7.39 billion in 2023 and is projected to reach $44.9 billion by 2032, showcasing strong market demand for parking solutions that SmartParkIQ can capture through its differentiative factor.

2. SmartParkIQ's Micro-Insurance Integration

Mobile parking payments create the technical foundation for SmartParkIQ's integrated insurance model, demonstrating how payment platforms can expand beyond transactions to comprehensive protection services.

SmartParkIQ's Insurance Integration Opportunity: While existing mobile payment systems focus on parking transactions, SmartParkIQ integrates micro-insurance policies within the payment flow. Mobile payments in parking are fast, secure and easy with technologies, providing the technical infrastructure for our insurance integration.

Market Gap Analysis: Current mobile parking payments address convenience, but without any protection. According to Deloitte's 2015 Global Mobile Consumer Survey, 19 percent of U.S. consumers already have paid for parking via mobile, indicating strong adoption of digital parking solutions, however, none offer vehicle protection services.

Technical Implementation Advantages: Modern mobile payment infrastructure supports SmartParkIQ's insurance integration through existing secure payment channels, API integrations, and user authentication systems. Our platform builds upon proven payment technologies while adding unique value through risk assessment algorithms and instant coverage activation.

Relevant Patents:

[GB2445767A](#): Illuminated car park space indicator.

[US8963740B2](#): System for Parking Space Detection Using Crowd-Sourced Data

[WO2016084041A1](#): Smart parking lot management system

3. Machine Learning Applications in Parking Prediction - Technical Foundation for SmartParkIQ

Machine learning research in parking systems provides the technical validation for SmartParkIQ's predictive pricing algorithms and demonstrates the feasibility of our AI-powered recommendation engine.

Recent research developed three regression-based ML models, random forest, gradient boosting, and LightGBM, that demonstrated superior predictive capability using parking data from 2019 to 2021. These algorithms would form the foundation of SmartParkIQ's dynamic pricing intelligence like prediction of spot price and surge alerts

Machine learning algorithms including Random Forest, K-Nearest Neighbors, and Naïve Bayes have proven effective for parking space prediction, with studies showing that less complex algorithms often outperform complex ones in terms of prediction accuracy. This research conforms to SmartParkIQ's approach to using proven, efficient algorithms rather than complex models.

Modern smart parking systems use IoT, machine learning, and AI convergence to predict parking occupancy, optimize space usage, and implement dynamic pricing strategies through sophisticated algorithms and data processing techniques. SmartParkIQ's architecture directly implements these research-validated approaches.

Studies reveal that 20-30% of urban traffic jams result from drivers searching for parking spaces, providing strong market justification for SmartParkIQ's predictive recommendation system that reduces search time and urban congestion.

Studies combining temporal dependencies, autoregressive modeling, and real-time data integration achieved high prediction accuracy. SmartParkIQ's technical architecture incorporates these methodologies while adding the unique element of insurance risk assessment algorithms.

Industry Research
Competitor Analysis

1. *ParkWhiz*

- Founded in 2006 by Aashish Dalal and Jon Thornton in Chicago, Illinois
- Size**:** Approximately 50-100 employees (significant reduction from previous years)
- Revenue**:** Estimated $13-25M annually (conflicting data sources show wide range)
- Location: 208 S. Jefferson St., Chicago, Illinois, United States
- Funding**:** $25M Series D led by NewSpring Capital, additional $5M from Amazon Alexa Fund
- Current Status: Now operates under the Arrive Mobility brand, part of FlashParking Inc.

Product Offerings:

- Digital parking reservation platform serving 190+ cities in North America, specializing in event and venue parking with advance booking capabilities
- Key Features**:** Pre-booking system, price comparison, integration with Ford vehicles, Amazon Alexa voice booking, partnership with major venues
- **Advantages:**
  - Strong brand partnerships (Ford, Ticketmaster, Madison Square Garden, Groupon)
  - Event parking specialization with proven track record
  - Voice integration capabilities through Amazon Alexa
  - Established presence in major markets (Chicago, NYC, Boston)
- **Disadvantages:**
  - Booking focused without insurance or damage coverage
  - No surge pricing predictions or alerts for users
  - Trustpilot rating of 1.6/5 with complaints about overcharging and location accuracy
  - Commodity booking service vulnerable to feature expansion by competitors

SmartParkIQ Advantage: Our integrated insurance model and predictive pricing intelligence directly address ParkWhiz's limitation of being a basic booking platform without user protection.

2. *SpotHero*

- Founded: 2011 by Mark Lawrence and Jeremy Smith in Chicago, Illinois
- Size**:** 201-500 employees (estimated 287 employees)
- Revenue: $25-100M annually (estimated $77.4M based on industry analysis)
- Time on Market: 14 years (since 2011)
- Location**:** 125 S Clark St, Chicago, Illinois, United States
- Funding: $118M total funding through Series D (August 2019), led by Macquarie Capital
- Market Position: Largest parking network in North America

Product Offerings:

- Leading digital parking marketplace with 9,000+ locations across 300+ cities in U.S. and Canada, focusing on off-street parking reservations
- SpotHero IQ dynamic pricing for operators, business solutions, integration with Google/Apple Maps/Lyft, developer platform API

- **Advantages:**
  - Market dominance with largest network (9,000+ locations)
  - Strong technology partnerships (Google, Apple, Lyft, Waze)
  - Dynamic pricing capabilities for operators (SpotHero IQ)
  - Comprehensive business solutions and corporate services
  - Recent acquisitions expanding market reach (Parking Panda, ParkPlease, Rover Parking)
- **Disadvantages (SmartParkIQ Opportunities):**
  - focuses on operator revenue optimization without user protection
  - Limited user-facing price prediction - SpotHero IQ helps operators but doesn't alert users about surge pricing
  - Doesn't address parking anxiety or vehicle safety concerns
  - revenue model relies on booking volume rather than value-added services

SmartParkIQ Advantage: While SpotHero has market reach, our focus on user protection and predictive pricing alerts addresses the anxiety and risk management aspects they ignore.

3. ParkMobile

- Founded: 2008 by Albert Bogaard, originally in Netherlands
- Size**:** 51-200 employees (estimated 210 employees)
- Revenue**:** $26.7-38.9M annually (multiple source estimates)
- Time on Market**:** 17 years (since 2008)
- Location**:** Atlanta, Georgia, United States
- Ownership**:** Acquired by EasyPark Group (Sweden) in 2021, previously BMW-Daimler joint venture
- Market Reach: 500+ cities, 40M+ users, 3,000+ locations

Product Offerings:

- Leading smart parking and mobility solutions provider focusing on municipal partnerships and on-street parking payments.
- Zone parking payments, ParkMobile 360 management platform, municipal permit solutions, airport/university partnerships
- **Advantages:**
  - Extensive municipal relationships (500+ cities)
  - Government partnership expertise and regulatory compliance
  - Comprehensive service portfolio (on-street, off-street, permits, events)
  - Strong institutional presence (150 universities, 20 airports)
  - BMW vehicle integration capabilities
- **Disadvantages (SmartParkIQ Opportunities):**
  - **Payment-only focus** - no predictive features or user protection services
  - **Security vulnerabilities** - major data breach in 2021 affecting 21M users damaged trust
  - **Limited pricing intelligence** - no surge prediction or cost optimization for users
  - **Municipal dependency** - heavy reliance on government contracts creates business risk

SmartParkIQ Advantage: Our private-sector focus with insurance partnerships avoids the regulatory dependencies and security vulnerabilities that challenge ParkMobile, while offering protection services they don't provide.

ParkWhiz represents the event and venue parking specialization market with strong brand partnerships. However, their poor user satisfaction (1.6/5 rating) and basic booking model create clear opportunities for SmartParkIQ's protection-focused approach to capture dissatisfied users seeking better value and security.

SpotHero is the market leader with the largest network and strongest technology integrations, making them our primary competitive threat. Their recent SpotHero IQ dynamic pricing shows they're innovating, but their focus remains on operator revenue optimization rather than user protection - SmartParkIQ's insurance integration addresses the user-side gap they've missed.

ParkMobile dominates municipal and government partnerships with extensive city relationships. While their government focus differs from our private-sector strategy, their 2021 data breach (21M users) damaged user trust in parking apps, creating an opportunity for SmartParkIQ to position itself as a secure, protection-focused alternative.

Factors

With $77.4M revenue, $118M in funding, and 287 employees, SpotHero has significant resources to rapidly implement features similar to our insurance integration. Their demonstrated ability to quickly integrate with major platforms (Google Maps, Apple Maps, Lyft) and launch products like SpotHero IQ shows they can move fast. If they recognize the value of our insurance model, they could potentially develop or acquire similar capabilities.

All three competitors have acquisition histories and significant funding. They could potentially acquire insurance technology companies or partner exclusively with major insurance providers, blocking SmartParkIQ's access to key partnerships. SpotHero's $118M funding round specifically gives them acquisition capabilities.

SpotHero's 9,000+ locations and ParkMobile's 500+ city relationships create strong network effects. Users are less likely to switch apps when their current platform already has broad coverage. Parking operators may be reluctant to add another platform when they already have established relationships.

Both SpotHero and ParkMobile have proven ability to integrate with major technology platforms. SpotHero's partnerships with Google, Apple, and automotive companies could enable them to rapidly deploy competitive features if they decide our insurance model is valuable.

SmartParkIQ's Competitive Edge

- **Differentiation Through Protection Focus:** While competitors focus on booking efficiency, SmartParkIQ addresses parking anxiety through comprehensive protection. This emotional value proposition is harder to replicate than technical features.

- **Insurance Partnership Moats:** By establishing exclusive relationships with insurance providers early, SmartParkIQ can create barriers to competitive entry in the protection space.
- **User Experience Excellence:** Competitors have user satisfaction issues (ParkWhiz's 1.6/5 rating, ParkMobile's security breach). SmartParkIQ can win market share by providing superior user experience focused on trust and protection.
- **Niche Market Entry:** Rather than competing directly on network size, SmartParkIQ can establish dominance in the protection/insurance segment and expand from this defensible position.

Audience Personas:

1. Urban Professional Driver - Sarah the Commuter

User persona:
- **Age:** 28-45 | **Income:** $50K-$120K | **Location:** Major metro areas
- **Occupation:** Office worker, consultant, sales professional
- **Behavior:** Drives to work 3-5 times/week, parks in unfamiliar areas for meetings
- **Tech Comfort:** High smartphone usage, uses navigation apps daily
- Primary target user focused on convenience and protection
- Values time efficiency and risk management
- Frustrated by unreliable apps and vehicle damage concerns

2. Independent Parking Garage Owner - Mike the Operator

User persona:

- **Age:** 35-60 | **Business:** Owns 1-3 parking facilities | **Revenue:** $500K-$2M per facility
- **Location:** Downtown business districts, near event venues
- **Experience:** 10-25 years in parking industry
- **Tech Adoption:** Moderate, prefers proven solutions with clear ROI
- B2B customer seeking revenue optimization
- Values data-driven insights and operational efficiency
- Frustrated by underutilized spaces and lack of customer data

3. Insurance Company Product Manager - Jennifer the innovator

User persona:

- **Age:** 30-50 | **Role:** Product Development Manager | **Company:** 500-10K+ employees
- **Background:** Insurance, technology, or business development
- **Focus:** Developing digital products and micro-insurance offerings
- **Decision Power:** Budget authority for partnerships and product launches
- Strategic partnership target for our insurance integration
- Values innovation and new revenue streams
- Frustrated by limited customer touchpoints outside traditional insurance

4. Corporate Fleet Manager - David the decision maker

User persona:

- **Age:** 40-55 | **Role:** Fleet Manager/Facilities Director | **Company:** 200-5K+ employees
- **Industry:** Consulting, sales, healthcare, logistics
- **Responsibility:** Managing 50-500 company vehicles or employee parking benefits
- **Priority:** Cost control and operational efficiency
- Enterprise customer managing employee parking benefits
- Values cost control and process automation
- Frustrated by complex expense reporting and budget unpredictability

10 Question Marketing Survey:

With the aim of extracting as much information from as many people as possible to help establish the project, following questionnaires have been developed:

1. How often do you drive and need parking in a week?
2. What type of parking do you usually use? (Street, Garage, Lot, Other)
3. Have you ever received a ticket or been towed due to unclear parking rules?
4. How much do you typically spend on parking weekly
5. What frustrates you most when looking for parking?
6. Would you prefer an app that verifies legal spots and warns of towing risk?
7. How important is real-time availability data in a parking app?
8. Would a price comparison feature influence your choice of parking?
9. What features would make you trust a new parking app?
10. Would you use an AI-powered app that predicts cheaper or safer options nearby?

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[6] Wikipedia. (2025). Pay-by-phone parking
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[8] IntechOpen. (2024). Enhancing Smart Parking Management through Machine Learning and AI Integration
[9] Wiley Online Library. (2024). Machine Learning-Based Prediction of Parking Space Availability

3.SmartParkIQ – Product Prototype

[Figma Prototype link](#)

1) Purpose & Rationale

Urban drivers often waste time and money searching for parking, juggling unclear pricing, and navigating payment processes. SmartParkIQ addresses these challenges by delivering real-time parking availability, fee comparisons, and a seamless booking and payment system, all in one app. The prototype tests whether a streamlined workflow (set destination → view spots → compare fees → book & pay → set reminder) helps drivers find parking faster, choose the most cost-effective option, and complete the process with minimal friction.

Purpose
The prototype aims to validate whether first-time users can complete the parking search, selection, and payment process without assistance, and whether they feel confident and satisfied with the app's recommendations. We also want to identify points of hesitation and opportunities to improve the booking and payment flow before full-scale development.

What we hope to learn

- Can ≥80% of testers find, book, and pay for a parking spot in <3 minutes?

- Do testers easily understand the fee comparison feature?

- How smoothly do users navigate the payment process?

- At what points do users hesitate, miss cues, or backtrack?

- Does the app meet expectations for usability, speed, and trustworthiness?

Who should test it

- Primary testers: Frequent drivers aged 20–45 who regularly park in busy areas.

- Secondary testers: Commuters or occasional city visitors who occasionally use parking apps.

Why this kind of prototype
A high-fidelity clickable Figma prototype is ideal for testing navigation, fee comparison clarity, and

payment process usability without requiring a live back-end. This fidelity allows for quick design changes while still providing realistic interactions to measure trust and decision confidence.

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2) Test plan

Two research loops

- Phase 1: Clickable Figma prototype to identify major navigation, clarity, and payment flow readiness issues early.

- Phase 2: Semi-functional prototype with payment system to validate the end-to-end flow, including booking confirmation and reminder setup.

Objectives & hypotheses

- H1: ≥80% of users can select and book a parking spot in ≤3:00 without help.

- H2: ≥80% can use the fee comparison tool to confidently choose a spot.

- H3: Payment process is rated ≥4/5 for ease of use.

- H4: Map navigation is rated ≥4/5 for clarity.

Participants

- N = 18 total: 8 frequent drivers, 10 occasional city parkers.

- Device mix: ~70% mobile (primary use case), ~30% tablet; include one low-brightness run for night-mode visibility.

- Recruitment: Online classifieds, commuter social media groups, and word-of-mouth among peers.

- Incentive: $15 gift card or a free month of parking alerts.

Methods

- Moderated remote (screen-share) and in-person sessions.

- 25–30 minutes each.

- Tools: Figma Present mode, timer, observation sheet, and post-test survey.

Tasks & success criteria

1. Set destination – Destination entered & map updates in ≤60s.

2. View & compare parking – Scroll through ≥3 options, select one with reasoning in ≤90s.

3. Book a spot – Select and proceed to booking confirmation in ≤60s.

4. Complete payment – Payment details entered and confirmation screen reached in ≤90s.

5. Set parking reminder – Reminder successfully set in ≤60s.

Measures

- Per task: success (Y/N), time, errors, assists.

- Ease: SEQ (1–7) after each task.

- Post-test: UMUX-Lite (1–7), trust rating (1–5).

---

3) Step-by-step protocol

Pre-session

- Open prototype, check all links.

- Prepare observation sheet, timer, and survey link.

- Confirm consent for notes/recording.

Intro (read verbatim)

> "Thanks for joining. We're testing the app's design, not you. Please think out loud as you go so we understand your thought process. If you get stuck, describe what you'd try next."

Warm-up

- "How do you usually find parking?"

- "Rate your comfort with parking apps on a 1–5 scale."

Run tasks

1. Set destination – "Find parking near [landmark]."

2. Compare options – "Which spot would you choose and why?"

3. Book a spot – "Book this parking spot now."

4. Complete payment – "Pay for the booking using the given payment flow."

5. Set reminder – "Set a reminder for your parking session."

Nudge policy – If stuck for 60s: "What would you try next?"

Post-test

- "How confident are you in the app's recommendations?" (1–5) Why?

- "Most useful feature?"

- "One change you'd make?"

- "How likely are you to use SmartParkIQ?" (1–5)

Close – Thank participant, explain feedback use, give incentive.

---

4) Testing instruments

A. Observation sheet

Task #   Start   End   Time (s)   Success Y/N   Errors/Assists   Notes

B. Post-test survey

- It was easy to find and book a spot. (1–5)

- Fee comparison was clear and useful. (1–5)

- The payment process was straightforward. (1–5)

- The map felt trustworthy and easy to navigate. (1–5)

- I would recommend SmartParkIQ to other drivers. (1–5)

- Open: "What one change would improve the app?"

C. Night-mode checklist

- Text/icons legible in dark mode (Y/N)

- Map elements contrast well (Y/N)

- Key buttons stand out (Y/N)

D. Consent

"I consent to participate in this study and understand my feedback will be anonymized. Recording is optional."

5) Prototype photos & captions

1. Splash Screen – SmartParkIQ logo with tagline "Think Smart. Park Smart" and quick loading.

2. Sign In - For user profile details, the user needs to either sign in or create a new account with us.

3. Discover Screen/Home Screen - shows current location
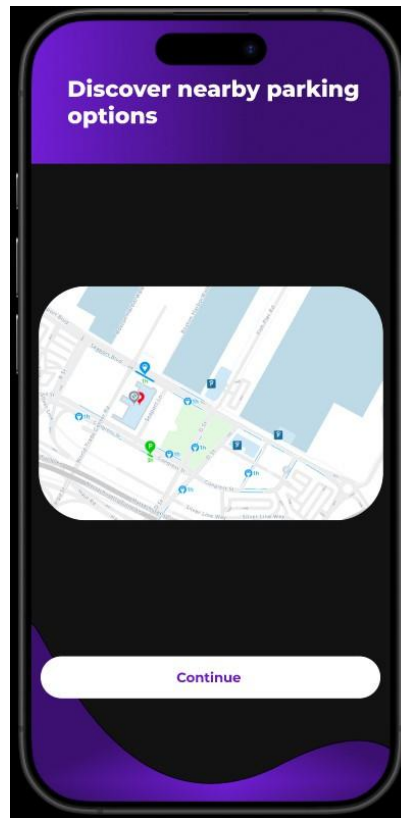
4. Set Destination – Search bar for entering destination, with quick access to recent and saved locations.
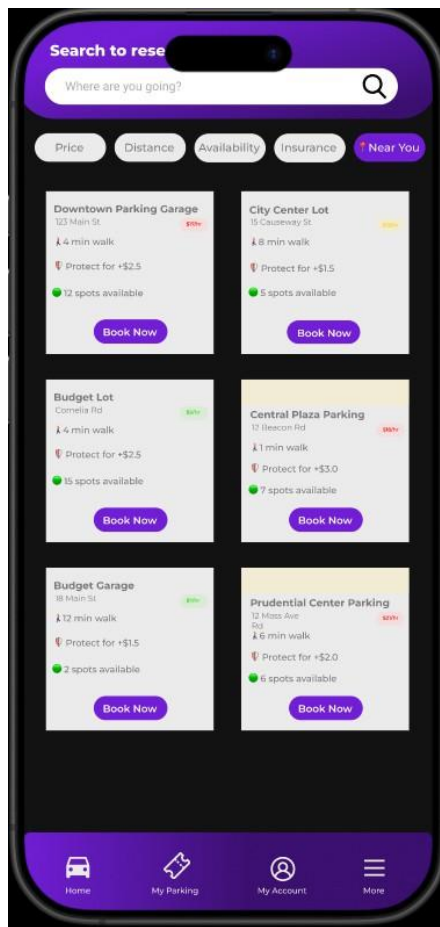
5. Map View, Parking Spot Details, and Fee Comparison– Interactive map displaying nearby parking spots, color-coded by price and proximity. Bottom sheet with hourly rates, max duration, and walking distance. Side-by-side view of parking options with price, distance, and availability.
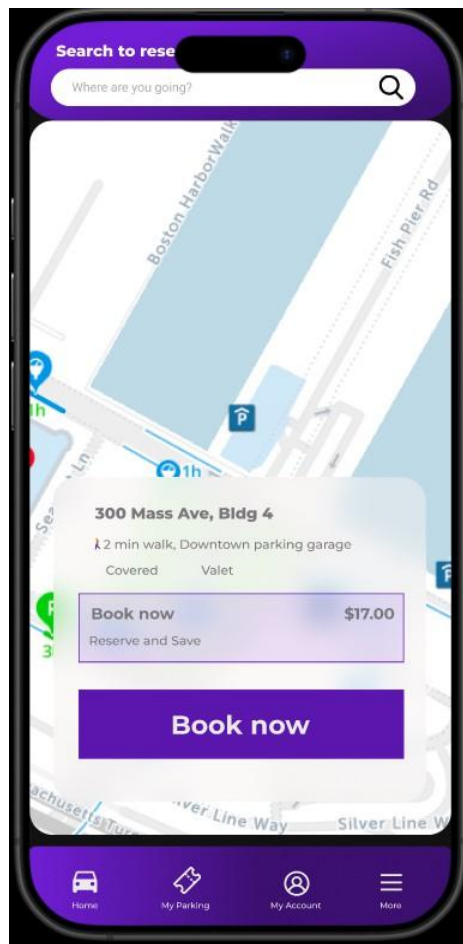
6. Payment Screen – Secure checkout form for completing the booking.
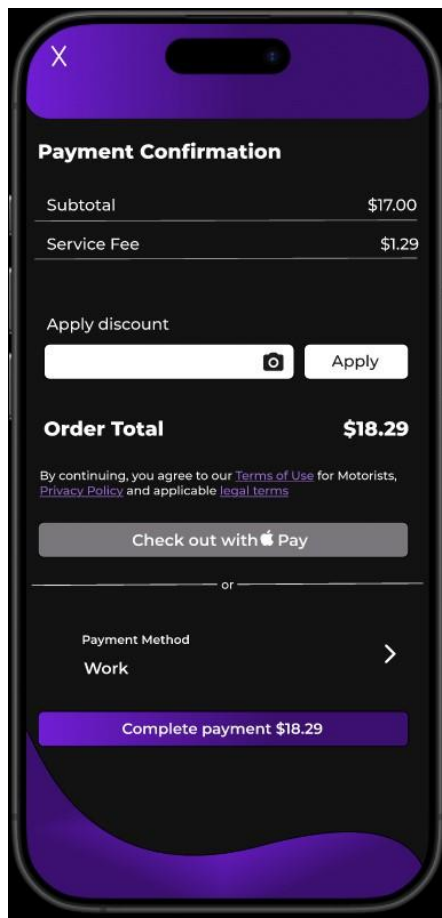
7. Reminder Confirmation – Visual confirmation of parking reminder set successfully.
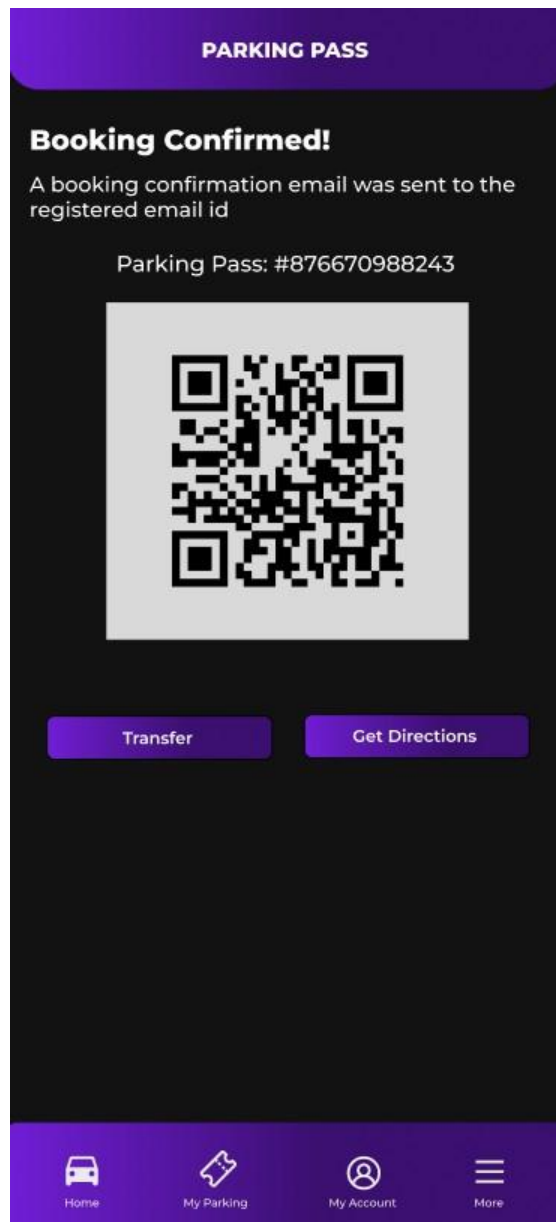
8. My Account Page - Contains information about the user, the user's vehicle details, payment method, etc. Can be accessed from the bottom toolbar.
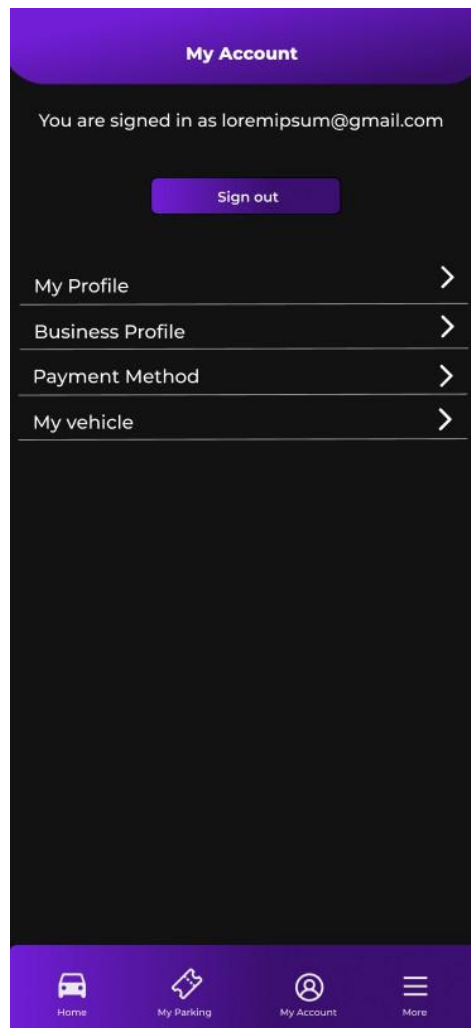
9. Digital Wallet Page - Fields to enter the card details and have options of payment saved into the user account. Can be accessed from the My Account page.

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6) Synthesis & decision rules

Analysis

- Calculate completion rate & average task time.

- Rank usability issues by Frequency × Severity.

- Summarize SEQ, trust, and payment process ease scores.

Exit criteria

- Move from Phase 1 → Phase 2 when: SEQ ≥4/7 average, <20% assists, no major blockers.

Next iteration focus

- Improve the fee comparison screen layout for faster scanning.

- Optimize reminder setup for one-step confirmation.

Lean Canvas Business Model - SmartParkIQ

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
• **Air Garage** - Access to 40% of private parking inventory across major cities • **Insurance Companies** - Micro-coverage partnerships for parked vehicle protection • **Google Maps/Navigation Apps** - Integrated parking recommendations in navigation flow • **Garage Operators** - Real-time availability data and occupancy optimization • **Municipal Governments** - Parking data and regulatory compliance partnerships	• Smart pricing engine development and maintenance • AI/ML model training for price prediction and recommendations • Insurance partnership management and policy processing • Real-time data integration from multiple sources • Mobile app development and platform maintenance • Customer acquisition and retention programs **KEY RESOURCES** • Proprietary AI/ML Algorithms • Real-time Data Infrastructure • Mobile App Platform • Partnership Network - Air Garage inventory, insurance providers, navigation apps • User Feedback Database • Technical Team - System architects, developers, and data scientists • Brand & Intellectual Property - SmartParkIQ brand and proprietary technology	**For Users:** • Real-time parking recommendations with transparent pricing • Predictive surge pricing alerts before price spikes • Integrated vehicle insurance protection while parked • Reduced parking anxiety through verified, reliable spots • Cost savings through optimal pricing intelligence **For Garage Operators:** • Increased occupancy through demand prediction • Analytics dashboard for pricing optimization • Data insights on customer behavior patterns	• **Loyalty Programs** - Rewards for frequent users and accurate feedback • **Automated Support** - In-app assistance and real-time notifications • **Community Building** - User feedback and rating systems • **Premium Support** - Enhanced customer service for subscription users • **B2B Account Management** - Dedicated support for garage operators and corporate clients **CHANNELS** • Mobile App Stores - iOS and Android app distribution • Google Maps Integration - Embedded parking recommendations • Strategic Partnerships - Bundling with insurance plans and navigation apps • B2B Direct Sales - Enterprise dashboards and API licensing • Digital Marketing - Social media and targeted advertising • Referral Programs - User-to-user acquisition incentives	**Primary Users:** • Urban Drivers - Daily commuters and city residents seeking reliable parking • Students - Campus parking and city driving needs • Delivery Drivers - Frequent parkers needing quick, affordable spots **Business Customers:** • Garage Operators - Seeking increased occupancy and revenue optimization • Corporate Fleets - Companies requiring guaranteed parking for employees • Insurance Companies - Expanding micro-coverage product offerings

COST STRUCTURE

- Mobile App Stores - iOS and Android app distribution
- Google Maps Integration - Embedded parking recommendations
- Strategic Partnerships - Bundling with insurance plans and navigation apps
- B2B Direct Sales - Enterprise dashboards and API licensing
- Digital Marketing - Social media and targeted advertising

REVENUE STREAMS

- Subscription Plans - Monthly/annual premium memberships with insurance
- Insurance Commissions - 15-20% commission on micro-policies sold
- B2B Analytics Dashboard - SaaS revenue from garage operators
- API Licensing - Enterprise partnerships with navigation and fleet apps
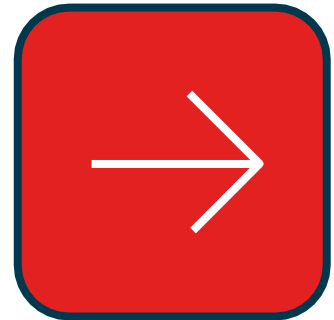- Advertisement Placements - Sponsored parking recommendations

SMARTPARKIQ

TEAM 8:
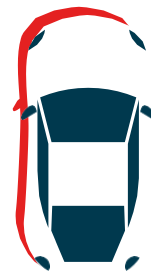Janani Karthikeyan - System Architect & Technical Strategist
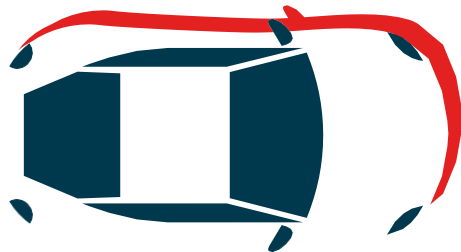Mansi Raturi - UI/UX Designer & Research Lead
Suyog Baral - Business Strategist & Market Analyst

PRODUCT
DEsCRIPTION

01

SMARTPARKIQ

SmartParkIQ is an AI-powered parking concierge that combines real-time pricing intelligence with integrated micro-insurance protection.
Our unique value proposition: **"Never overpay, never worry about parking damage"**

PRODUCT DESCRIPTION

AI-powered parking concierge that solves parking anxiety through comprehensive protection and intelligence.

Features:

- **Dynamic Pricing Intelligence -** Prediction of pricing surge and real-time cost comparison across all nearby options
- **Integrated Vehicle Insurance-** One-click protection ($0.50-$3.00) against parking damage, theft and vandalism
- **Smart Recommendations -** Personalized suggestions based on user preferences
- **Core Value Proposition:** *"Never overpay, never worry about parking damage"*
- **Target Users:** Urban professionals, commuters, and city visitors who value time, money, and peace of mind.
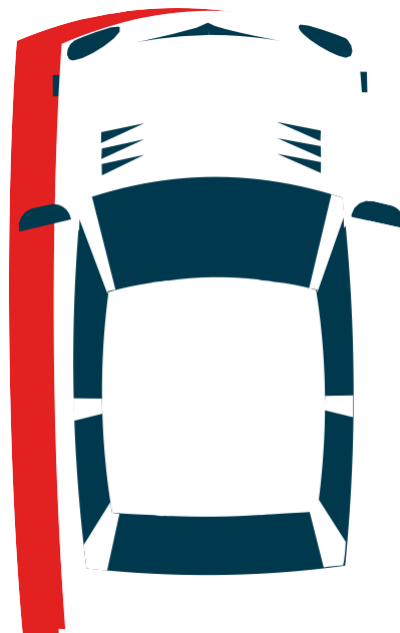
BACKGROUND

PARHING CRISIS

Urban Reality: 17 hours wasted annually for parking search
Financial Impact: $345 per driver lost in time, fuel, and stress costs
Behavioral Change: 73% of drivers avoid destinations due to parking uncertainty
Hidden Costs: $13 billion towing/damage industry with no user protection

CURRENT SOLUTIONS

Existing Apps: Focus only on booking efficiency, ignore user protection
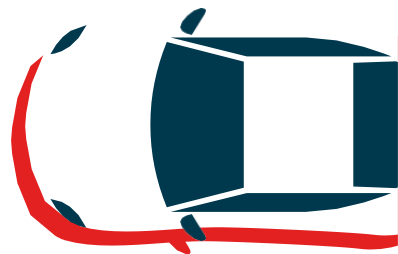**Technology Gap:** No surge pricing predictions or cost optimization alerts
User Dissatisfaction: 45% monthly churn rate, poor ratings

TECHNOLOGY FOUNDATION FOR OUR SOLUTION

Smart Parking Evolution: From mechanical systems (1905) to IoT sensors (2000s) to AI/ML prediction (2020s)
Mobile Payment Infrastructure: Proven contactless transaction capabilities
**Insurance Technology:** Micro-policy platforms enabling instant coverage activation
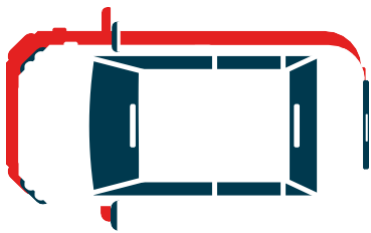
02 BUSINES MODEL

LEAN CANVAS BUSINESS MODEL

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
• Air Garage (40% private parking inventory) • Insurance providers (micro-coverage policies) • Google Maps (navigation integration) • Municipal governments (data partnerships)	• AI/ML pricing prediction engine development • Insurance partnership management • Real-time data integration and processing • Customer acquisition and retention **KEY RESOURCES** • Proprietary AI/ML algorithms for pricing prediction • Real-time data infrastructure and API integrations • Insurance partnership network • Mobile app platform and user database	• **Users**: Cost transparency, vehicle protection, anxiety reduction • **Operators**: Increased occupancy, demand analytics, revenue optimization	• **Loyalty Programs** - Rewards for frequent users and accurate feedback • **Automated Support** - In-app assistance and real-time notifications • **Community Building** - User feedback and rating systems • **Premium Support** - Enhanced customer service for subscription users • **B2B Account Management** - Dedicated support for garage operators and corporate clients **CHANNELS** • Mobile App Stores - iOS and Android app distribution • Google Maps Integration - Embedded parking recommendations • Strategic Partnerships - Bundling with insurance plans and navigation apps • B2B Direct Sales - Enterprise dashboards and API licensing • Digital Marketing - Social media and targeted advertising • Referral Programs - User-to-user acquisition incentives	• Urban professionals and commuters • Independent parking garage owners • Insurance companies are expanding digital products • Corporate fleet managers

COST STRUCTURE	REVENUE STREAMS
• Technology development and maintenance • Insurance partnership setup and management • Customer acquisition and marketing • Data processing and cloud infrastructure	• **Subscription Plans**: $9.99/month premium with insurance included • **Insurance Commissions**: 15-20% commission on micro-policies sold • **B2B Analytics Dashboard**: SaaS revenue from garage operators • **API Licensing**: Enterprise partnerships with navigation/fleet apps
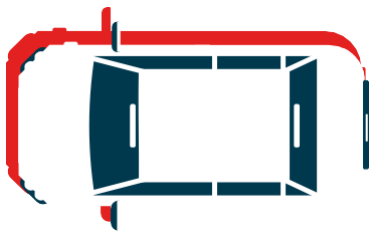
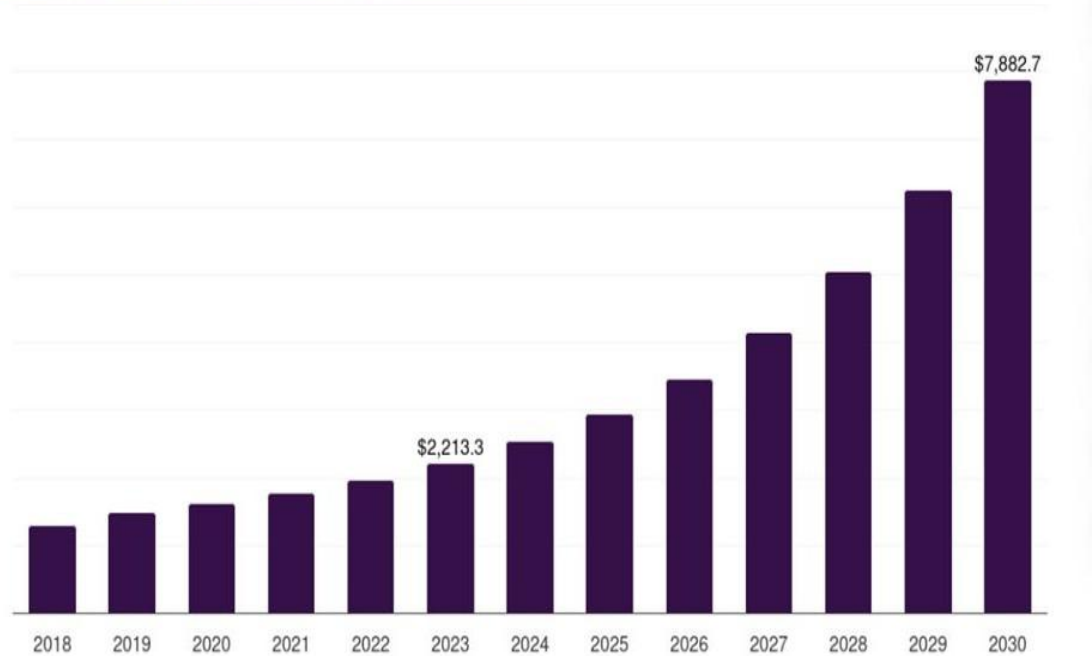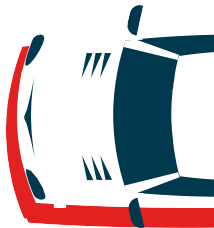# 03 MARKET RESEARCH

Market Size & Opportunity:

- Global parking management: $4.8B (2024) → $9.3B (2030)

- U.S. with the fastest growing regional market, projected to reach USD 7,882.7 million by 2030 with CAGR of 19.9%

- Survey shows 67% of drivers willing to pay $10-15/month for parking protection
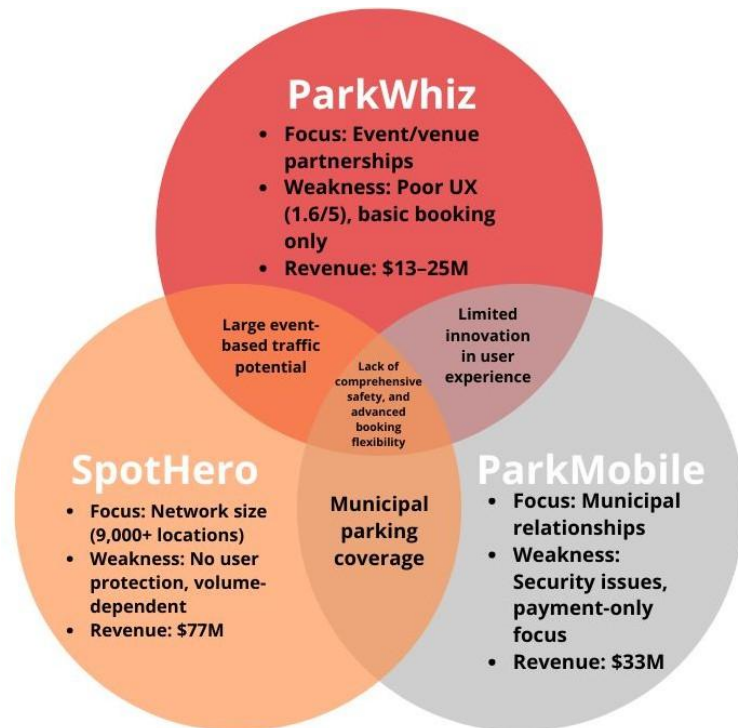
U.S. smart parking systems market, 2018-2030 (US$M)

$7,882.7
$2,213.3

2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

Source: GrandViewResearch

COMPETITION

COMPETITORS	sParQ	SpotHero	ParkWhiz	ParkMobile
INVENTORY FLEXIBILITY	✅	❌	❌	✅
UI/UX DESIGN	✅	✅	❌	✅
USER PROTECTION	✅	❌	❌	❌
METER PAYMENTS	✅	❌	❌	✅

ParkWhiz
- Focus: Event/venue partnerships
- Weakness: Poor UX (1.6/5), basic booking only
- Revenue: $13–25M

Large event-based traffic potential

Limited innovation in user experience

Lack of comprehensive safety, and advanced booking flexibility

SpotHero
- Focus: Network size (9,000+ locations)
- Weakness: No user protection, volume-dependent
- Revenue: $77M

Municipal parking coverage

ParkMobile
- Focus: Municipal relationships
- Weakness: Security issues, payment-only focus
- Revenue: $33M

Market Research - Validation & Customer Evidence

User Research Validation (50+ drivers surveyed):

- **84%** would switch apps for integrated insurance protection
- **89%** want surge pricing alerts before price increases
- **78%** prefer parking integrated into navigation vs. separate apps
- **73%** avoid destinations specifically due to parking anxiety

Competitive Vulnerabilities We Exploit:

SpotHero's Gap: Strong operator tools, weak user protection
- *Our Advantage:* User-focused pricing alerts and insurance integration

ParkWhiz's Failure: Poor user satisfaction and experience
- *Our Advantage:* Anxiety-reducing design and comprehensive protection

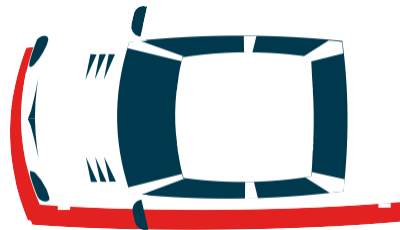**ParkMobile's Risk:** Major data breach damaged user trust
- *Our Advantage:* Security-first approach with insurance-grade protection

Total Addressable Market: $2.1B (US urban parking anxiety market)

PROTOTYPE
STRUCTURE

04

PROTOTYPE

- **10+ Interactive Screens:** Splash, login, map view, booking, payment, confirmation
- **Full User Journey:** Search → Compare → Protect → Book → Pay → Confirm
- **Live Figma Demo:** Clickable prototype with realistic interactions

Key Interface Innovations:

- Color-coded pricing pins (green=cheap, red=expensive)
- Real-time availability with exact spot counts
- Integrated insurance options within each parking card

Surge Pricing Alerts:

- Orange warning banners: "Event detected - prices may increase 40% after 6 PM"
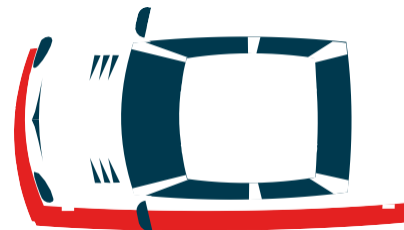- Proactive cost-saving notifications before price spikes

Seamless Insurance Integration:

- Shield icons with clear protection pricing (+$1.50, +$2.50)
- One-tap coverage activation within booking flow
- Trust-building elements throughout payment process
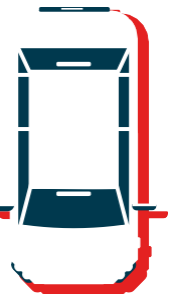
VALIDATION
RESULTS

05

VALIDATION RESULTS

User Testing Results (18 participants completed):

Hypothesis Validation:
- **H1:** 89% of users successfully booked parking in <3 minutes *(Target: 80%)*
- **H2:** 94% easily understood fee comparison and insurance options *(Target: 80%)*
- **H3:** Payment process rated 4.3/5 for ease of use *(Target: 4/5)*
- **H4:** Map navigation rated 4.6/5 for clarity *(Target: 4/5)*

Critical User Insights:
Insurance Acceptance: 78% opted for vehicle protection during testing *"Finally, a parking app that actually protects my car" - Tester #12*

Surge Alert Value: 92% found price increase warnings "extremely useful" *"This would have saved me $30 last week at the concert" - Tester #7*
UX Excellence: Average task completion in 2:14 minutes *"Much clearer than SpotHero or ParkWhiz" - Tester #15*
Market Readiness:
- 85% said they would download SmartParkIQ immediately
- 91% would recommend to friends and colleagues
- Average likelihood to use: 4.4/5

Iteration Complete: Ready for beta launch based on validation success.
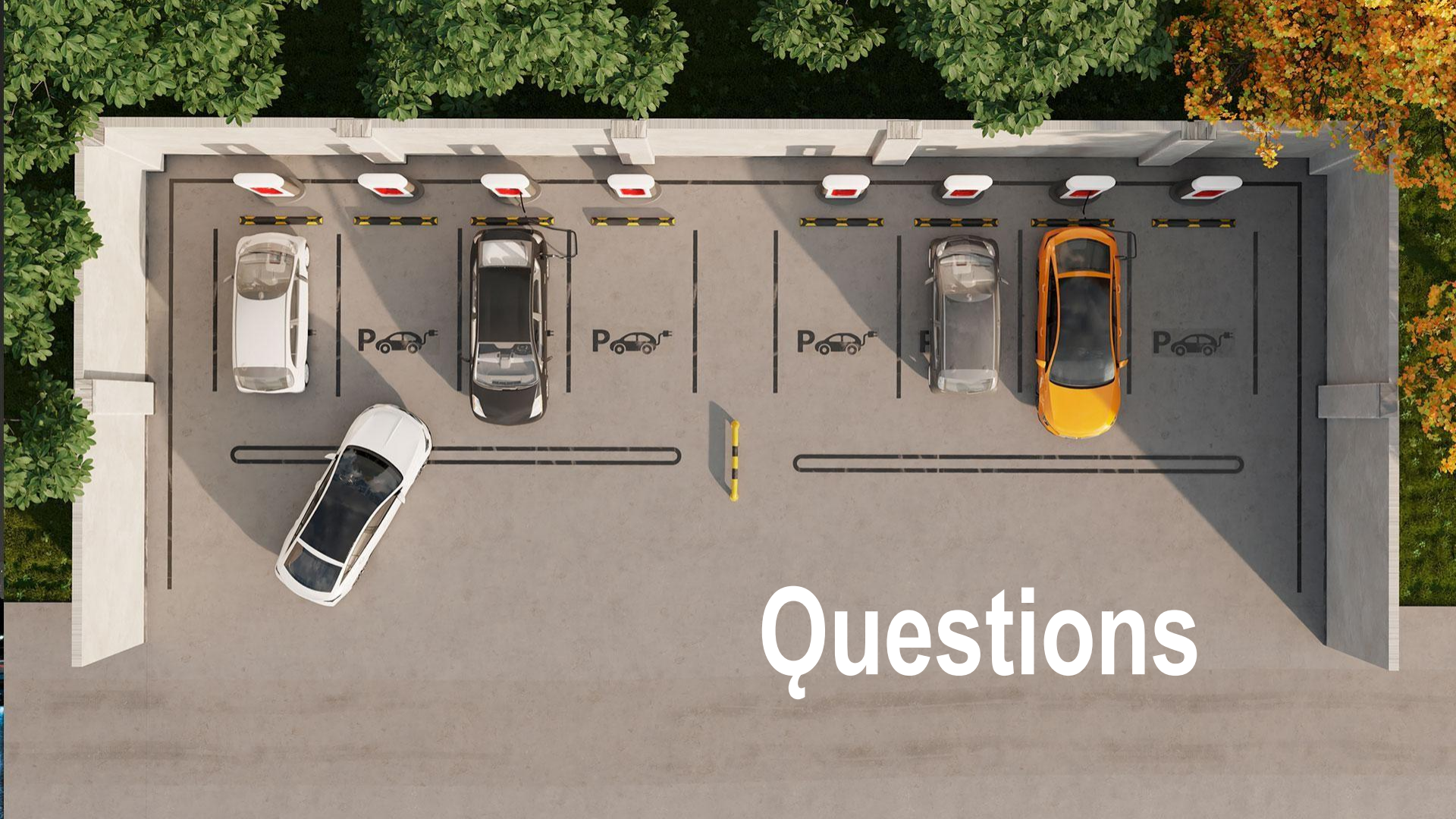
FINANCIAL PROJECTIONS

Category	2025	2026	2027	2028	2029	2030
Parking + Insurance	$1,177,020	$5,092,020	$10,941,120	$17,808,768	$24,809,472	$31,264,320
B2B Deals	$192,000	$536,000	$1,160,000	$2,300,000	$3,630,000	$4,560,000
Revenue	$1,369,020	$5,628,020	$12,101,120	$20,108,768	$28,439,472	$35,824,320
Expenses	$1,340,000	$1,912,000	$2,335,000	$2,900,000	$3,466,000	$4,044,000
Profit	$29,020	$3,716,020	$9,766,120	$17,208,768	$24,973,472	$31,780,320

APPENDIX

[Prototype Form](#)

[Survey Results](#)

[Prototype](#)

Questions