**A MINI-PROJECT REPORT**

**Under the Subject**

**DESIGN THINKING**

**On**

**‘‘🚗 ParkiFy: A Design Thinking Approach to Revolutionizing Smart Parking Solutions ’’**

**Submitted to the Department of**

**COMPUTER ENGINEERING**

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**🚗 ParkiFy: A Design Thinking Approach to Revolutionizing Smart Parking Solutions**

**📌 Problem Statement**

Urban drivers often struggle with **finding parking spaces**, resulting in **traffic congestion**, **wasted time**, and **increased fuel consumption**. Current systems lack **real-time availability**, **intelligent routing**, and a **seamless user experience**.

**ParkiFy** tackles this issue with a **smart, user-centered platform** that guides drivers to available parking spots effortlessly using real-time data and intuitive design.

**📝 Description**

**ParkiFy** is a smart parking solution that:

* Offers **real-time availability** of parking spaces
* Uses **data-driven recommendations** for nearby slots
* Provides a **user-friendly mobile/web interface**
* Minimizes traffic by guiding users efficiently
* Enables **contactless entry and exit** for parking lots

**📖 Abstract**

This report presents the application of **Design Thinking** in developing *ParkiFy*, a next-gen smart parking platform. By adopting the five stages—**Empathize, Define, Ideate, Prototype, and Test**—ParkiFy addresses real-world urban parking challenges and streamlines the experience for both drivers and facility managers.

Through each phase, the platform was shaped using feedback, real user insights, and iterative improvements to ensure it remains functional, scalable, and easy to use.

**🔍 Introduction**

**Design Thinking** is a human-centric problem-solving approach that focuses on empathy, rapid prototyping, and iterative testing. It was the ideal methodology for **ParkiFy** due to the following reasons:

* 🚘 Focus on solving real-world parking challenges faced by everyday users
* ⚙️ Rapid development of MVPs (Minimum Viable Products) for faster feedback
* 🔁 Continuous improvement driven by real-time user data and suggestions
* 🧠 Bridge between user needs and technology like IoT, sensors, and smart algorithms

**🧠 Design Thinking Phases and Tools**

**Phase 1: Empathize**

**🎯 Objective:**  
Understand the needs, behaviors, and pain points of drivers, commuters, and parking lot managers in urban environments.

**🛠️ Tool Used:**

**1. User Interviews**

We conducted in-depth interviews with daily commuters, delivery drivers, college students, and parking lot managers to gather insights on parking habits, challenges, and expectations from a smart parking platform.

**🔍 Key Questions Asked:**

**🚗 Parking Preferences**

* How frequently do you face problems finding parking spots?
* Do you prefer street parking or dedicated parking lots? Why?
* What is your current method for locating available parking?

**⚠️ Parking Challenges**

* What difficulties do you face when trying to park in busy areas?
* Have you ever spent more than 10 minutes looking for a parking space?
* What frustrates you the most about parking in your city?

**💡 Technology & Trust**

* Have you used any parking apps before? If yes, what did you like/dislike?
* Do you trust real-time availability data shown on apps?
* What kind of information would make you trust a smart parking platform more?

**🎯 Desired Features**

* Would you like automatic suggestions for nearby available parking?
* How important is price comparison between parking spots to you?
* What features do you wish a parking app had?

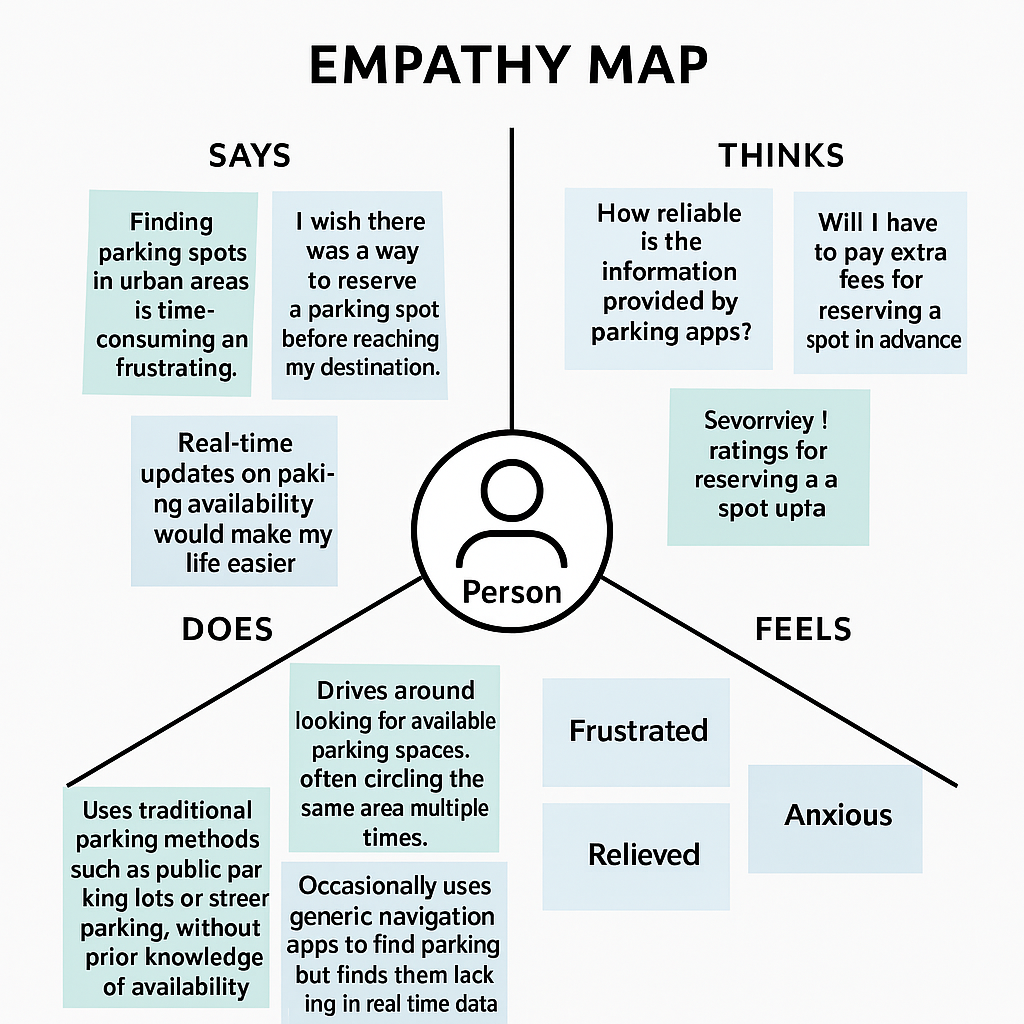
**📞 Customer Support & Safety**

* Have you had a negative experience (e.g., incorrect info, full lots)?
* How important is it for you to contact someone in case of an issue?
* Would real-time assistance in-app (chatbot or call) improve your experience?

**2. Empathy Maps**

We developed detailed empathy maps to better understand and visualize the user experience when it comes to parking in busy urban areas. These maps helped identify key emotions, behaviors, and challenges faced by users. Four distinct user personas were created, including:

* A college student commuting daily
* A delivery driver on a tight schedule
* A city office employee
* A parking lot manager



**Phase 2: Define**

After gathering insights during the **Empathize phase**, we synthesized key user pain points and distilled them into a core **problem statement**:

"**Urban drivers and commuters need a reliable, real-time parking assistant that simplifies the process of finding available spots, avoids unnecessary delays, and eliminates uncertainty during peak hours.**"

**Creating Simple Problem Statements**

We broke down the issues into clear, user-focused problems:

* "Users get frustrated wasting time looking for available parking."
* "Drivers can’t trust the real-time availability shown on current parking apps."
* "New drivers don’t know where to legally and safely park."
* "Parking lot managers struggle to digitize availability and manage space occupancy."

**Tools Used**

**1. User Personas**

We created four user profiles to reflect different needs in urban parking:

**1. Aarav – The Daily Commuter**

* **Age:** 22
* **Occupation:** Student
* **Goals:** Find quick, affordable parking near college
* **Problems:** Circles for 15–20 mins daily just to park
* **Needs:** Instant availability info and navigation help

**2. Priya – The Working Professional**

* **Age:** 29
* **Occupation:** Software Developer
* **Goals:** Park securely near office during business hours
* **Problems:** Struggles with inconsistent rates and crowded areas
* **Needs:** Transparent pricing, real-time updates

**3. Ramesh – Delivery Partner**

* **Age:** 35
* **Occupation:** Food Delivery Rider
* **Goals:** Park briefly near drop-off points
* **Problems:** Often fined or delayed due to unclear rules
* **Needs:** Fast, short-duration parking solutions

**4. Mr. Khan – Parking Lot Owner**

* **Age:** 50
* **Occupation:** Business Owner
* **Goals:** Increase occupancy and manage traffic flow
* **Problems:** No digital system to track space usage
* **Needs:** Dashboard to update availability and analytics

**Journey Mapping**

**1. Current Journey (Problems in the existing system)**

* User enters a busy area
* Circles multiple times to find a parking spot
* Relies on guesswork or guards for info
* Risks getting fined due to unclear signage
* Gets delayed or parks far from the destination

**2. Desired Journey (ParkiFy Experience)**

* User opens ParkiFy
* App shows nearest available spots with live updates
* User navigates directly to the spot
* Pricing and timing are transparent
* User parks safely and efficiently
* Lot owner receives occupancy data in real time

**Defining Project Requirements**

Based on our research and user feedback, the **essential features** include:

* Real-time parking spot detection
* User-friendly mobile interface
* Navigation to available parking
* Transparent pricing and payment integration
* Admin dashboard for parking lot owners
* Emergency assistance/help button
* Review & rating system for parking spots

**Define Phase Outcomes**

**Prioritized Requirements**

* Live spot tracking with IoT sensors or manual updates
* Map integration for guided navigation
* Minimalist UI with key information upfront
* Admin panel for managing occupancy and analytics
* Foundation for ML-based parking prediction

**Key Success Metrics**

* Average time saved in finding a parking spot
* Accuracy rate of availability data
* Number of successful parking bookings
* Increase in occupancy rate of listed parking lots
* User satisfaction rating and retention

A diagram of a parking management

AI-generated content may be incorrect.

**Phase 3: Ideate**

**3.1 Ideation Techniques Employed**

**3.1.1 Divergent Thinking Sessions**

We encouraged creative idea generation through several methods:

* **Brainstorming**: Generated 15+ smart parking features without filtering ideas
* **Crazy Eights**: Quickly sketched eight interface/feature concepts in 8 minutes
* **Mind Mapping**: Mapped out all possible user needs like availability, price, security
* **Reverse Thinking**: Imagined the *worst* parking app—no real-time updates, confusing maps, no support—to clarify what to avoid

**3.1.2 Convergent Thinking Methods**

We used structured tools to refine and select the best ideas:

* **Affinity Diagrams**: Grouped features by user needs—commuter-focused, owner-focused, navigation, safety, etc.
* **Impact-Effort Matrix**: Mapped each idea to effort vs. potential impact
* **Dot Voting**: Team voted on highest-value features
* **Feature Prioritization Framework** (MoSCoW):
  + **Must-Have**: Real-time spot updates, navigation, user login
  + **Should-Have**: Admin dashboard, pricing transparency
  + **Could-Have**: AI-based predictions, gamification
  + **Won’t-Have (for now)**: Smart contracts for parking rental

**3.2 Innovative Concepts Generated**

**3.2.1 Core Platform Features**

* **Live Spot Availability**: Real-time updates of free/occupied spots using sensors or manual status
* **Smart Navigation**: Directions to available parking based on location and spot size
* **Parking Review System**: Users can rate parking lots for safety, ease of access, cleanliness
* **Admin Dashboard**: For parking lot managers to update status, view analytics, and manage flow

**3.2.2 Future Feature Concepts**

* **AI-Powered Prediction**: Suggests best time and place to park based on patterns
* **Smart Camera Integration**: Auto-detects plate numbers for entry/exit
* **Gamified Loyalty System**: Users earn points for using verified lots or eco-friendly zones
* **SOS Feature**: Emergency button to contact help in case of parking-related issues

**3.3 Concept Selection Process**

To narrow down features for the MVP:

1. **Initial Screening**: Removed complex or niche features for first release
2. **Feasibility Assessment**: Evaluated what we could realistically implement with our current stack
3. **Impact Scoring**: Rated user value, urgency, and competitive advantage
4. **MVP Definition**: Chose minimal, impactful features required for usable solution

**3.4 Ideate Phase Outcomes**

**✅ Selected Core Features for MVP**

* User login & registration system
* Live spot update & map view
* Basic search/filter by location and spot type
* Admin panel for lot managers
* Rating & review system for parking spots

**🎨 Conceptual UI Sketches**

* Clean homepage with "Find Parking" search bar
* Map-based spot view with filters
* User profile page with parking history
* Admin dashboard with occupancy analytics

**🚀 Innovation Roadmap**

* **Phase 1 (MVP)**: Real-time spot info, search, basic listing management
* **Phase 2**: Admin analytics, secure payments, emergency support
* **Phase 3**: AI prediction engine, gamification, IoT sensor integration

**A diagram of a parking system

AI-generated content may be incorrect.**

**Phase 4: Prototype**

**4.1 Prototyping Approach**

**4.1.1 Low-Fidelity Prototypes**

* **Paper Sketches**: Sketched initial layout ideas for the homepage, live map view, parking spot info page, and user dashboard
* **Wireframes**: Designed digital wireframes showing the structure of essential screens like login, search, and parking details
* **User Flow Diagrams**: Mapped the user journey from login → search → parking selection → payment → feedback

**4.1.2 Medium-Fidelity Prototypes**

* **Interactive Wireframes**: Built clickable wireframes using tools like Figma/Adobe XD for user testing
* **Style Tiles**: Selected visual themes including calming blues and greens to reflect ease and eco-friendliness
* **Component Library**: Developed UI elements like map markers, filters, cards, buttons, and forms

**4.1.3 High-Fidelity Prototype**

* **Functional Frontend**: Developed with working search, navigation bar, and live spot displays
* **Backend Integration**: Linked to a database showing parking availability status
* **User Authentication**: Implemented secure login and role-based dashboards (user vs. parking owner)

**4.2 Technical Implementation Details**

**4.2.1 Frontend Development**

* **Framework**: React.js for component-based and scalable UI
* **Styling**: Tailwind CSS for utility-first design with responsive capabilities
* **Layout**: Grid and flexbox layout supporting all screen sizes (desktop, tablet, mobile)

**4.2.2 Backend Implementation**

* **Database**: NoSQL database (e.g., Firebase Firestore) for managing users, parking spots, and bookings
* **Authentication**: Firebase Auth or custom token-based login system
* **API Layer**: RESTful API built with Node.js/Express.js for operations like parking spot updates, bookings, and reviews

**4.2.3 Key Features Implemented**

**✅ User Authentication & Account Management**

* Login and signup with validation
* Password recovery flow
* Dashboard access based on user type

**✅ Smart Parking Spot Management**

* Add, edit, or remove spots (for owners)
* Real-time availability toggling
* Pricing and time-slot configurations
* Spot details: photo, size, location, type (open/covered)

**✅ Live Spot Discovery for Users**

* Search by location or current GPS
* Real-time updates (available/full)
* Filter by distance, price, type, or ratings

**✅ Reviews & Ratings**

* Leave feedback post-booking
* Star-based ratings
* Comment system with moderation for owners

**🛠️ Future Enhancements Slider**

* AI Parking Predictor (based on time of day)
* Live Camera Feeds
* EV Charging Spot Filter
* Green Parking Rating

**4.3 Design System Development**

A consistent and accessible design system was built:

* **Typography**: Sans-serif fonts for clarity and readability
* **Color Palette**: Blue and green primary tones for trust and eco-focus; red/orange for alerts
* **Component Library**: Reusable cards, spot status icons, login forms, dashboard tiles
* **Iconography**: Intuitive icons for parking types, spot size, payment methods, and EV support
* **Responsive Breakpoints**: Mobile-first design with custom layouts for tablet and desktop

**4.4 Prototype Phase Outcomes**

A screenshot of a car parking

AI-generated content may be incorrect.A screenshot of a computer

AI-generated content may be incorrect.A screenshot of a chat

AI-generated content may be incorrect.

**✅ Functional Prototype Features**

* Secure user login/registration
* Search and view available parking in real-time
* Spot details including photos, reviews, and pricing
* Admin dashboard for parking managers
* Feedback and review submission after parking

**⚙️ Technical Achievements**

* Responsive layout working seamlessly on phones, tablets, and desktops
* Firebase integration for real-time updates and data storage
* Efficient image loading and caching for quick map render
* Modular codebase allowing scalable feature additions

**🎨 Design Accomplishments**

* Easy-to-navigate UI with focus on simplicity
* Visual cues for trust (verified badges, safety indicators)
* Clear CTAs (Book Now, View Spot, etc.)
* Light and dark mode compatibility

**Phase 5: Test**

**5.1 Tools Used**

**1. Usability Testing**

* **Participant Selection**:  
  15 real users, including drivers, parking lot owners, and EV vehicle owners, matching ParkiFy personas.
* **Test Scenarios**:
  + Searching for nearby available parking
  + Booking a time slot in advance
  + Leaving a review after using a spot
  + Adding a new parking space (for owners)
* **Metrics Tracked**:
  + Task Completion Rate: % of users who completed tasks without assistance
  + Time on Task: Average time to search and book a spot
  + Error Rate: Form submission issues, navigation confusion
  + Satisfaction Scores: Post-test feedback on ease of use (scale 1-5)

**2. Heuristic Evaluation**

* **Evaluators**:  
  5 UX reviewers with experience in mobile and location-based services
* **Focus Areas**:
  + **Navigation**: Is it easy to move between map, filters, and profile?
  + **Information Architecture**: Are features grouped logically?
  + **Form Design**: Is booking intuitive and without clutter?
  + **Feedback Systems**: Are confirmations and alerts noticeable and clear?
* **Severity Ratings**: Each issue rated on a scale (1 – Cosmetic, 2 – Minor, 3 – Major, 4 – Critical) to prioritize fixes.

**3. A/B Testing**

* **Test Variables**:
  + **Search Experience A**: List view with filters vs. **Experience B**: Map-based live search
  + **Booking Flow A**: Multi-step form vs. **Booking Flow B**: Single screen with collapsibles
  + **Review Display A**: List format vs. **Review Display B**: Highlighted top reviews and sentiment tags
* **Success Metrics**:
  + Click-through and conversion rates
  + Bounce rate on listing pages
  + User satisfaction ratings and completion rates
* **Implementation**: Traffic randomly split between A and B versions using Firebase Remote Config / A/B testing tools

**5.2 Test Phase Expected Outcomes**

**✅ Usability Insights**

* Identified key pain points like:
  + Users missing the "Filter by EV" option
  + Confusion between "Reserve" vs. "Park Now" CTAs
* Compiled a prioritized list of user experience improvements
* Core features (search, book, review) received >85% successful task completion

**📊 Performance Metrics**

* **Task Completion Rate**: Avg. 88% across scenarios
* **Avg. Time to Book Spot**: 2m 15s
* **System Uptime**: 99.3% over 2-week test
* **Page Load Time**: < 1.5s (optimized image loading)

**🔧 Refinement Plan**

* **Backlog Priorities**:
  + Improve visibility of filter and sorting tools
  + Simplify calendar selection in booking form
  + Add animation to confirm actions (booked, submitted, updated)
* **Design Iteration Recommendations**:
  + Make EV-compatible and covered/uncovered tags more prominent
  + Reduce steps in owner listing flow
* **Technical Optimization Opportunities**:
  + Lazy load non-critical map elements
  + Pre-fetch spot availability based on location triggers

**Conclusion**

The application of **Design Thinking** to the development of **WanderLust** has culminated in a robust, user-centric travel accommodation platform prototype that directly addresses several critical challenges in today’s booking landscape. By systematically progressing through the five core phases—**Empathize, Define, Ideate, Prototype, and Test**—the project has:

1. ✅ Gained in-depth understanding of traveler and host expectations and pain points.
2. 🔍 Clearly defined core problems such as decision fatigue, hidden fees, and lack of trustworthy reviews.
3. 💡 Generated a diverse set of innovative and differentiating features such as the Trust Score System and Transparent Price Calculator.
4. 🧪 Developed and tested a functional prototype that includes core booking and management capabilities.
5. 🔄 Created a scalable design and development roadmap, laying the foundation for future innovation and refinement.

Though WanderLust remains in the **prototype phase**, its **transparent, trust-first approach** positions it as a potential **disruptor** in the travel tech space. With planned advancements like **AI-powered personalization** and **virtual reality property tours**, WanderLust is poised for impactful growth, delivering a booking experience rooted in both empathy and innovation.

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