**Project**

Building a parking management software application to streamline parking operations at multiple locations.

Important Features

* Mobile app providing Real-time Availability to see available parking spots in real-time.
* Reservation System allowing drivers to reserve parking spots in advance.
* Payment Integration to make online payment.
* Data Analytics for Parking managers to access valuable data on parking patterns, occupancy rates, and revenue generation.
* SaaS capabilities to set up software for any parking locations.

Key Result Areas & Responsibilities

* Conduct interviews, workshops, and surveys with key stakeholders to lead the project discovery.
* Document requirements, prioritize features, and build a roadmap for product releases to define project vision.
* Create business process diagrams to visualize workflows, structures, and relationships.
* Ensure requirements are clear, valuable, achievable, and testable using the INVEST (Independent, Negotiable, Valuable, Estimable, Small, Testable) criteria.
* Design basic wireframes to communicate business needs to designers and developers.
* Support in the requirement estimation and planning for initial MVP releases and expecting near future to turn into cloud based software with IOT’S.

PROJECT

ON

“**PARKING MANAGEMENT SYSTEM”**

“EasyParking Web & Mobile Application”

V\_1.0

Created By – ITP Feb BA Batch Prachi sharma

Date – 22nd  June, 2024

Submitted to: Swapnil Sir.

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**Requirements Definition**

Parking management has long been a critical challenge for urban areas, commercial centers, and large facilities. Traditional methods of managing parking spaces often lead to inefficiencies, customer frustration, and revenue losses due to manual processes and lack of real-time data. As cities and businesses grow, the need for a more efficient, scalable, and user-friendly solution becomes imperative.

#### Current Challenges

1. **Congestion and Space Utilization:** Manual monitoring of parking spaces often results in poor space utilization and congestion, as drivers spend significant time searching for available spots.
2. **Revenue Leakage:** Inaccurate tracking and manual billing processes can lead to significant revenue leakage and fraud.
3. **Operational Inefficiencies:** Staff must manage routine tasks such as ticketing, payments, and space monitoring, which can be time-consuming and prone to human error.
4. **Customer Dissatisfaction:** Long wait times, difficulty in finding parking spaces, and cumbersome payment processes contribute to a poor user experience.
5. **Limited Data Insights:** Traditional systems lack the capability to collect and analyze data, limiting the ability to make informed decisions for improving operations.

**Executive Summary**

The development and implementation of an automated cloud-based parking management software application. The purpose of this project is to streamline parking operations across multiple locations, enhancing efficiency, security, and user experience through advanced technology.

Building an automated cloud-based parking management software application to streamline parking operations at multiple locations.

**Objectives**

* Identify the existing challenges in the current business process
* Explore the various business modules and map them with the opportunities to automate the current business process
* Build the web based interface for the parking manager to create, set up and display the parking locations and parking slots
* Build the mobile interface for the customer who can find the available parking space and book it in advance
* Provide actionable insights of the business performance to the business owner
* Identify the opportunities for the future tech enablement to make overall business process highly efficient

**Expected Outcome**

* User friendly web interface allowing the business owner to set up parking areas, assign parking managers and schedules
* Mobile application for the customers to register and utilize the services so that available parking slots can be seen, booked and paid upon the completion of usage
* Business Dashboards and Reports to understand the key performance indicators of the business and all important information about the performance of the business
* **Operational Efficiency:** Automates routine tasks like billing and access control, freeing up staff for more critical functions.
* **Scalability:** A cloud-based architecture ensures the system can easily scale to accommodate additional locations and increased demand.
* **Data Analytics:** Generates valuable insights through data collection and analysis, aiding in strategic decision-making and operational improvements.

**Key Stakeholders**

|  |  |
| --- | --- |
| **Roles** | **Interests** |
| Business Owner | Provide all necessary business information and details on various business processes |
|  | Provide sign off on all important documentation (BRDs, Release Summary etc.) |
| Parking Manager | Provide hands on details on the parking operations |
|  | Share the problem areas in the parking operations |
|  | Perform the testing and give sign off on various stages |
| Product Manager (POC) | Lead the Product Vision and Product Roadmap |
|  | Provide sign off on all requirement artifacts (BRD, Epic, User Stories, Wireframes & Diagrams) |
|  | Provide sign off on release scope, sprint scope and estimations |
|  | Provide sign off on the UAT |

**Project Scope**

The EasyParking is a web and mobile based business application solving the complex operational challenges in the parking management business so that the parking owners and managers can manage and control their parking locations, virtually coordinate with the customers over available and occupied parking slots. Manage the entire business flow from booking to payments. On the other hand, provide ease to the customers in finding the available parking slots, book in advance and make online payment upon usage.

**Constraints**

* The solution will be developed for one parking location to perform the pilot
* The customers who have registered in the EasyParking application will only be able to make the use of the booking feature
* The parking operations cannot be managed without the appointment of parking owner and parking manager in the application
* Other than the authenticated users no one can use the application

**RATIONALS**

The primary rationale for developing a parking management software is to significantly enhance the efficiency of parking operations. Traditional parking management methods are often labor-intensive, error-prone, and inefficient, leading to suboptimal use of resources and increased operational costs. By automating routine tasks such as space monitoring, billing, and access control, the system will streamline operations, reduce manual labor, and minimize human error.

**Enhanced Customer Experience**

Providing a superior customer experience is crucial in today’s competitive environment. Long wait times, difficulty in finding parking spaces, and cumbersome payment processes can lead to customer dissatisfaction and lost business. The proposed system will offer real-time information on parking availability, easy online reservations, and convenient digital payment options, making the parking process smooth and hassle-free for users. This enhanced customer experience can lead to increased customer satisfaction and loyalty.

**Revenue Optimization**

Manual billing processes and inaccurate tracking can lead to revenue leakage and fraud, significantly impacting the profitability of parking operations. The automated billing feature of the proposed system ensures accurate and timely payments, reducing the risk of revenue leakage. Additionally, real-time occupancy tracking and data analytics can help optimize pricing strategies and maximize revenue.

**Scalability and Flexibility**

As cities and businesses grow, the demand for efficient parking solutions increases. A cloud-based architecture provides the necessary scalability and flexibility to accommodate this growth. The system can easily be expanded to new locations and adapt to changing demands without significant additional costs or disruptions. This scalability ensures the solution remains viable and effective as the organization grows.

**Data-Driven Decision Making**

Access to accurate and comprehensive data is essential for making informed decisions. The proposed system will collect and analyze data from various sources, providing valuable insights into parking usage patterns, peak times, and customer behavior. These insights can help administrators make strategic decisions to improve operations, optimize space utilization, and enhance customer satisfaction.

**Security and Compliance**

With increasing concerns about data security and privacy, it is crucial to have robust security measures in place. The cloud-based system will incorporate advanced security protocols to protect user data and ensure compliance with relevant regulations. This not only safeguards the organization against potential breaches but also builds trust with customers who are increasingly concerned about their data privacy.

**Environmental Benefits**

Efficient parking management can also have positive environmental impacts. By reducing the time drivers spend searching for parking spaces, the system can help decrease traffic congestion and lower carbon emissions. Additionally, features such as online reservations and automated billing reduce the need for physical tickets and receipts, contributing to a reduction in paper waste.

**Competitive Advantage**

Adopting advanced technology solutions such as a cloud-based parking management system can provide a significant competitive advantage. It demonstrates a commitment to innovation and customer satisfaction, differentiating the organization from competitors who may still rely on outdated, manual processes. This technological edge can attract more customers and position the organization as a leader in efficient and modern parking solutions.

**High level**

**Context Diagram**

|  |  |
| --- | --- |
| SUPER **ADMIN**  **ADMIN**  **SUB-ADMIN**  **BUSINESS USERS**  **EASY PARK MANAGEMENT SYSTEMS -APLLICATION**  **Reg-users**  Non Reg-users  **Non Reg-users**   |  | | --- | |  | |
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| **Web Admin panel** | |
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### **Business Requirements Document (BRD)**

* **Project Overview:** The goal is to develop an automated cloud-based parking management software to streamline operations at multiple locations. This system will enhance efficiency, security, and user experience through real-time occupancy tracking, online reservations, automated billing, and data analytics.
* **Purpose of the Document:** To outline the business requirements for the parking management software, ensuring all stakeholders have a clear understanding of the project's objectives, scope, and deliverables.
* **Project Objectives:**
  + Improve operational efficiency.
  + Enhance customer experience.
  + Optimize revenue.
  + Ensure scalability and flexibility.
  + Support data-driven decision-making.
  + Maintain security and compliance.

#### Business Goals and Objectives

* **Efficiency Improvement:** Automate routine tasks, reduce manual labor, and minimize human error.
* **Customer Experience:** Provide real-time parking information, easy reservations, and digital payments.
* **Revenue Optimization:** Implement accurate billing and reduce revenue leakage.
* **Scalability:** Ensure the system can grow with demand and additional locations.
* **Data Insights:** Collect and analyze data for operational improvements and strategic decisions.
* **Security:** Protect user data and ensure compliance with regulations.

**Scope**

* **In Scope:**
  + Development of web based infrastructure.
  + Creation of web and mobile applications.
  + Implementation of digital payment systems.
  + Development of data analytics and reporting tools.
  + Deployment of security measures.
  + User training and support.
* **Out of Scope:**
  + Physical infrastructure modifications (e.g., construction of parking facilities).
  + Marketing and promotional activities.

#### Stakeholders

* **Primary Stakeholders:**
  + Project Sponsor
  + Project Manager
  + Development Team
  + Operations Team
  + Customer Service Team
* **Secondary Stakeholders:**
  + End-users (drivers, customers)
  + Parking facility managers
  + Finance and Accounting Team
  + Compliance and Legal Team

#### Functional Requirements

* **User Management:**
  + User registration, login, and profile management.
  + Role-based access control.
* **Parking Space Management:**
  + Real-time occupancy tracking.
  + Space allocation.
* **Reservations and Booking:**
  + Online reservations.
  + Reservation management.
* **Payment and Billing:**
  + Digital payments.
  + Automated billing.
  + Invoice generation.
* **User Interface:**
  + Web and mobile applications.
  + Admin dashboard.
* **Notifications and Alerts:**
  + User notifications.
  + System alerts.
* **Data Analytics and Reporting:**
  + Usage analytics.
  + Financial reporting.
  + Operational reports.

#### Non-Functional Requirements

* **Performance:**
  + Scalability and fast response times.
* **Reliability:**
  + High availability and fault tolerance.
* **Usability:**
  + User-friendly interface and accessibility.
* **Security:**
  + Data protection and access control.
* **Maintainability:**
  + Modular architecture and comprehensive documentation.
* **Compliance:**
  + Adherence to regulatory requirements and industry standards.

#### Technical Requirements

* **Technology Stack:**
  + Web (React, Angular) and mobile (ios and android ) frameworks.
  + Database (PostgreSQL, MySQL, MongoDB).
* **Integration:**
  + Payment gateways (Stripe, PayPal).
  + Third-party services (reservation platforms, CRM).

#### Assumptions and Constraints

* **Assumptions:**
  + Adequate budget and resources will be available.
  + Stakeholders will provide timely feedback.
* **Constraints:**
  + Regulatory and compliance requirements.
  + Integration challenges with existing systems.

#### Risk Management

* **Potential Risks:**
  + Delays in hardware delivery.
  + Data security breaches.
* **Mitigation Strategies:**
  + Establish strong vendor relationships.
  + Conduct thorough testing.
  + Implement robust security measures.

#### 

#### Implementation Plan

**Timeline:**

* + Phase 1: Planning and Requirements Gathering (Month 1-2)
  + Phase 2: Design and Prototyping (Month 3-4)
  + Phase 3: Development and Testing (Month 5-8)
  + Phase 4: Pilot Deployment (Month 9-10)
  + Phase 5: Full Deployment (Month 11-12)
  + Phase 6: Ongoing Maintenance and Support (Post-Deployment)

**Milestones**

* + Requirements Approval
  + Design Approval
  + Prototype Completion
  + Full Deployment
  + Post-Deployment Review

#### Appendices

**Glossary of terms:**

**Admin Dashboard  
Automated Billing  
Cloud Computing  
Customer Experience  
Data Analytics  
Digital Payments  
End-users  
IoT (Internet of Things)  
Occupancy Tracking  
Online Reservations  
Operational Efficiency  
Revenue Leakage  
Role-based Access Control  
Scalability**

This glossary aims to clarify terms and concepts relevant to the development and deployment of the cloud-based parking management software, ensuring a common understanding among all stakeholders.

### **Functional Requirements Document (FRD)**

#### Introduction

* **Purpose:** The Functional Requirements Document (FRD) defines the specific functionalities and behaviors that the web based parking management software must exhibit to meet the business requirements outlined in the BRD.
* **Scope:** This document details the functional requirements that will drive the design, development, testing, and implementation phases of the project.

#### User Management

* **Requirement 1.1:** User Registration and Login
  + Users can create accounts, log in, and manage their profiles securely.
  + Registration requires email verification and password setup.
* **Requirement 1.2:** Role-based Access Control
  + Roles include Administrator, Operator, and End-user.
  + Administrators have full system access, Operators manage parking operations, and End-users reserve parking spaces.

#### Parking Space Management

* **Requirement 2.1:** Real-time Occupancy Tracking
  + IoT sensors monitor and update the availability of parking spaces in real-time.
  + Display real-time occupancy status on web and mobile interfaces.
* **Requirement 2.2:** Reservation Management
  + Users can view available parking spaces, select desired slots, and make reservations.
  + Reservations are confirmed with a notification sent to the user's registered email or mobile number.

#### Reservations and Booking

* **Requirement 3.1:** Online Reservations
  + Users can browse available parking slots by location, date, and time.
  + Select and reserve parking slots with instant confirmation and payment options.
* **Requirement 3.2:** Reservation Modification and Cancellation
  + Allow users to modify or cancel reservations within a specified time frame.
  + Automatically adjust availability and notify affected users.

#### Payment and Billing

* **Requirement 4.1:** Digital Payments
  + Integration with major payment gateways (e.g., Stripe, PayPal) for secure online transactions.
  + Support for credit/debit cards, digital wallets, and other electronic payment methods.
* **Requirement 4.2:** Automated Billing
  + Calculate parking fees based on reservation duration and rates.
  + Generate digital invoices and receipts for user records.

#### User Interface

* **Requirement 6.1:** Web Application
  + Responsive web interface accessible via desktop and mobile browsers.
  + Intuitive navigation and user-friendly design for seamless interaction.
* **Requirement 6.2:** Mobile Application
  + Native or hybrid mobile app for iOS and Android devices.
  + Provide features such as real-time parking availability and reservation management.
* **Requirement 6.3:** Admin Dashboard
  + Comprehensive dashboard for administrators to monitor system performance, user activity, and revenue metrics.
  + Tools for managing reservations, generating reports, and configuring system settings.

**Notifications and Alerts**

* **Requirement 7.1:** User Notifications
  + Automated notifications for reservation confirmations, reminders, and updates.
  + Alerts for payment status and parking availability changes.
* **Requirement 7.2:** System Alerts
  + Notifications to administrators for critical system events (e.g., sensor failures, security breaches).
  + Alerts for maintenance schedules and system updates.

#### Data Analytics and Reporting

* **Requirement 8.1:** Usage Analytics
  + Collect and analyze data on parking space utilization, peak hours, and revenue trends.
  + Visualize data through charts and graphs for easy interpretation.
* **Requirement 8.2:** Reporting
  + Generate standard and customized reports on parking revenue, occupancy rates, and user demographics.
  + Export reports in various formats (PDF, CSV) for further analysis.

#### Security and Compliance

* **Requirement 9.1:** Data Security
  + Implement encryption protocols to secure sensitive user information (e.g., payment details, personal data).
  + Comply with data protection regulations (e.g., GDPR, CCPA) for handling user data.
* **Requirement 9.2:** Regulatory Compliance
  + Ensure adherence to local, national, and industry-specific regulations related to parking management and electronic payments.

**Reference Documents**

**Project Proposal**

* + Provides an overview of the project goals, scope, and objectives.

**Business Requirements Document (BRD)**

* + Outlines the detailed business requirements for the parking management software.

**Technical Requirements Document (TRD)**

* + Specifies the technical requirements, including technology stack, integration details, and hardware specifications.

**System Architecture Diagrams**

* + Illustrates the high-level architecture of the cloud-based parking management system, including components and their interactions.

**User Interface (UI) Wireframes**

* + Visual representations of the user interface design for web and mobile applications, showing layout and navigation.

**Data Flow Diagrams (DFDs)**

* + Describes the flow of data within the system, including inputs, processes, and outputs.

**Security and Privacy Policies**

* + Documents outlining security measures, data protection protocols, and compliance with privacy regulations.

This BRD aims to provide a clear and comprehensive understanding of the business requirements for the development and deployment of the web based parking management software, ensuring alignment among all stakeholders and guiding the project through successful completion.

**HIGH LEVEL DIAGRAM**



**Main Key Performance Indicators**

several KPIs can be derived from the dataset to measure and monitor the system's performance, user engagement, operational efficiency, and financial health. Here are some key KPIs:

#### ****Occupancy and Utilization KPIs****

* **Occupancy Rate:**
  + **Formula:** (Occupied Parking Spaces / Total Parking Spaces) \* 100
  + **Description:** Measures the percentage of parking spaces that are occupied at any given time.
* **Peak Occupancy Time:**
  + **Formula:** Time of the day with the highest occupancy rate.
  + **Description:** Identifies the busiest times, helping to manage demand and optimize space allocation.
* **Average Utilization Rate:**
  + **Formula:** Average of occupancy rates over a specified period.
  + **Description:** Indicates overall space usage efficiency over time.

#### ****Financial KPIs****

* **Revenue per Parking Space:**
  + **Formula:** Total Revenue / Total Parking Spaces
  + **Description:** Assesses the average income generated per parking space.
* **Revenue per User:**
  + **Formula:** Total Revenue / Number of Users
  + **Description:** Measures the average revenue generated per user.
* **Payment Compliance Rate:**
  + **Formula:** (Number of Successful Payments / Total Number of Transactions) \* 100
  + **Description:** Tracks the percentage of transactions completed successfully without errors or defaults.

#### ****Customer Experience KPIs****

* **Reservation Success Rate:**
  + **Formula:** (Number of Successful Reservations / Total Number of Reservation Attempts) \* 100
  + **Description:** Measures the efficiency of the reservation system.
* **Customer Satisfaction Score (CSAT):**
  + **Formula:** (Sum of Customer Satisfaction Ratings / Number of Responses) \* 100
  + **Description:** Collects feedback on customer satisfaction with the service.
* **Average Reservation Time:**
  + **Formula:** Total Time Spent on Reservations / Number of Reservations
  + **Description:** Measures how long it takes, on average, to complete a reservation.

**Operational Efficiency KPIs**

* **Turnaround Time per Parking Space:**
  + **Formula:** Total Time for Parking Space to be Reoccupied / Number of Vacant Instances
  + **Description:** Measures the time taken for a parking space to be reoccupied after it becomes vacant.
* **System Uptime:**
  + **Formula:** (Total Operational Time / Total Time) \* 100
  + **Description:** Measures the availability and reliability of the system.
* **Incident Response Time:**
  + **Formula:** Total Time Taken to Resolve Incidents / Number of Incidents
  + **Description:** Tracks the efficiency of the support team in handling issues and incidents.

**User Engagement KPIs**

* **Active Users:**
  + **Formula:** Number of Users Who Made Reservations or Payments within a Specific Period
  + **Description:** Measures the number of engaged users using the system regularly.
* **Retention Rate:**
  + **Formula:** ((Number of Returning Users / Total Number of Users) \* 100) over a specific period.
  + **Description:** Measures how many users return to use the system again, indicating user loyalty.
* **User Churn Rate:**
  + **Formula:** (Number of Users Lost / Total Number of Users) \* 100
  + **Description:** Measures the percentage of users who stop using the system.

**Conclusion**

The project will follow a structured approach outlined in the Business Requirements Document (BRD) and Functional Requirements Document (FRD), ensuring clear alignment with business goals and stakeholder expectations. Key functional and non-functional requirements have been identified, covering user management, parking space management, reservations, payments, access control, user interface design, notifications, data analytics, security, and compliance.

Potential risks and mitigation strategies have been considered, along with a comprehensive implementation plan to guide the project from conception to full deployment. This includes phases for planning, design, development, testing, pilot deployment, and post-deployment support, ensuring a smooth transition and continuous improvement.

Ultimately, this project is poised to deliver a robust, scalable, and secure parking management system that not only meets current demands but is also able to adaptable to future growth and technological advancements. The successful deployment of this system will set a new standard in parking management, providing significant benefits to operators, users, and stakeholders alike.