Work Breakdown Structure Template for Smart Parking Management System

Prepared by: **Date:**

1.0 Project Ideation
- 1.1 Define project scope and objectives
- 1.2 Identity stakeholders
  - 1.2.1 Market Analysis
  - 1.2.2 Survey
- 1.3 Identity KRIs
- 1.4 Develop initial project timeline

2.0 System Design
- 2.1 Define system requirements
  - 2.1.1 Identify and document functional requirements
  - 2.1.2 Identify and document non-functional requirements
  - 2.1.3 Validate requirements with stakeholders
- 2.2 Design database schema
  - 2.2.1 Identify required data entities and relationships
  - 2.2.2 Design an Entity-Relationship Diagram (ERD)
  - 2.2.3 Choose the database technology
- 2.3 Create system architecture diagram
- 2.4 API Design
- 2.5 Security and Authentication Mechanisms
  - 2.5.1 Implement user authentication
  - 2.5.2 Apply data encryption
  - 2.5.3 Establish disaster recovery and backup strategies
- 2.6 AI Model Development for Optimal Parking
  - 2.6.1 Define AI use cases
  - 2.6.2 Collect and clean historical parking data
- 2.7 Integrate with Payment Gateway
  - 2.7.1 Research and select a payment gateway provider.

3.0 Mobile Application Development
- 5.1 UI/UX Design
- 5.2 Frontend development
- 5.3 Backend development

4.0 Infrastructure Implementation
- 4.1 Network Infrastructure Setup
- 4.2 IoT Sensors calibrationImplement
  - 4.2.1 Adjusting Sensor on specific condition
  - 4.2.2 AI Integration with IoT Sensors
- 4.3 Apply cloud-based Backend

Work Breakdown Structure Dictionary

WBS Item Number	1.1
WBS Item Name	Define project scope and objective
Description Specify the scope, goals/objectives, and deliverables of the project.	

WBS Item Number	1.2
WBS Item Name	Identify stakeholder
Description Determine the key stakeholders and their responsibilities in the project.	

WBS Item Number	1.2.1
WBS Item Name	Market Analysis
Description Conduct a market research to analysis user needs and behaviors in the target market.	

WBS Item Number	1.2.2
WBS Item Name	Survey
Description Distribute an online google form survey on websites, social media, etc. To gather data from the general public and potential users.	

WBS Item Number	1.3
WBS Item Name	Identity KRIs
Description Identify the level of potential and key risks of the system.	

WBS Item Number	1.4
WBS Item Name	Develop initial project timeline
Description Develop the project timeline and the person who is in charge of each task.	

WBS Item Number	2.1
WBS Item Name	Define system requirements
Description	

Collect and document clear systems requirements based on input from stakeholders, market analysis, and what is technically feasible. This includes defining the functional requirements and the non-functional requirements, such as system performance, security, and usability.

WBS Item Number	2.1.1
WBS Item Name	Identify and document functional requirements
Description Define core features that the system will require.	

WBS Item Number	2.1.2
WBS Item Name	Identify and document non-functional requirements
Description Specify system performance expectations and measure for security. Include the scalability of the system and any data processing constraints.	

WBS Item Number	2.1.3
WBS Item Name	Validate requirements with stakeholders
Description Conduct review sessions to confirm all requirements are feasible and aligned with the project objectives.	

WBS Item Number	2.2
WBS Item Name	Design database scheme
Description Develop the logical and physical database structure including the ER diagram and database scheme.	

WBS Item Number	2.2.1
WBS Item Name	Identify required data entities and relationships
Description Define the different entities and their relationships so that tables for different areas of the system such as user management and payment transactions can be created.	

WBS Item Number	2.2.2
WBS Item Name	Design an Entity-Relationship Diagram (ERD)
Description Visually represent data relationships to ensure a scalable and logical database structure.	

WBS Item Number	2.2.3
WBS Item Name	Choose the database technology
Description Decide between relational and NoSQLbased on scalability needs.	

WBS Item Number	2.3
WBS Item Name	Create system architecture diagram
Description Design a high-level system architecture diagram that outlines the components of the system including IoT devices. Ensure the architecture supports security, scalability and integration.	

WBS Item Number	2.4
WBS Item Name	API Design
Description Design API to facilitate communication between the mobile application, IoT devices, cloud infrastructure and mobile applications.	

WBS Item Number	2.5
WBS Item Name	Security and Authentication Mechanisms
Description Design and implement security protocols including encryption and authentication. There should be authorization mechanisms to protect data and make sure secure access to the system.	

WBS Item Number	2.5.1
WBS Item Name	Implement user authentication
Description Secure login and session management	

WBS Item Number	2.5.2
WBS Item Name	Apply data encryption
Description Encrypt sensitive data.	

WBS Item Number	2.5.3
WBS Item Name	Establish disaster recovery and backup strategies
Description Verify that data recovery mechanisms for system failures.	

WBS Item Number	2.6
WBS Item Name	AI Model Development for optimal parking
Description Develop and deploy an AI-based optimization model to predict parking availability and recommend the best spots.	

WBS Item Number	2.6.1
WBS Item Name	Define AI use cases
Description Define clear AI use cases that the system will solve or facilitate. Such as predictive parking and dynamic pricing.	

WBS Item Number	2.6.2
WBS Item Name	Collect and clean historical parking data
Description Prepare datasets for training the machine learning modules.	

WBS Item Number	2.7
WBS Item Name	Integration with payment gateway
Description Implement a cashless payment system for users to pay for parking seamlessly.	

WBS Item Number	2.7.1

WBS Item Name	Research and select a payment gateway provider
Description Evaluate the many payment gateway providers and choose one that would be the most ideal for the system and users.	

WBS Item Number	3.1
WBS Item Name	UI/UX design
Description Develop an initial conceptual model, mockups, interactive prototypes using Figma.	

WBS Item Number	3.2
WBS Item Name	Frontend development
Description HTML CSS Javascript	

WBS Item Number	3.3
WBS Item Name	Backend development
Description	

WBS Item Number	4.1
WBS Item Name	Network Infrastructure Setup
Description: Apply network protocols to connect IoT devices and systems to ensure stable communication and enhance security.	

WBS Item Number	4.2
WBS Item Name	IoT Sensors calibrationImplement

Description: Make sure the reliability of the sensor and avoid the abnormal or Incompatible saturation.

WBS Item Number	4.2.1
WBS Item Name	Adjusting Sensors for Specific Conditions
Description: Enhance sensor functionality in different environments like snow, extreme cold or high temperature conditions and ensuring the accurate detection.	

WBS Item Number	4.2.2
WBS Item Name	AI Integration with IoT Sensors
Description: Enable AI models can accurately analyze the sensor data then make real-time decision-making and provide predicted results .	

WBS Item Number	4.3
WBS Item Name	Apply cloud-based Backend
Description: Research and Implement appropriate cloud storage and data management solutions.	

WBS Item Number	4.3.1
WBS Item Name	Implement Database and cloud infrastructure setup
Description: Apply the designed database architecture and schema and apply real-time synchronization	

WBS Item Number	4.4
WBS Item Name	API Integration(Based on design)
Description: Based on the designed API infrastructure, develop and deploy APIs to connect the IoTsensors with the mobile application and cloud-based backend.	

WBS Item Number	4.5
WBS Item Name	Purchase and Deploy IoTSensors
Description Research on Market Price and performance to indicate fit vendors, install IoT sensors at parking locations and ensure compatibility with the system.	

WBS Item Number	5.1
WBS Item Name	Prototyping for Stakeholders and Users
Description Develop a low fatality/high fatality prototype for stakeholders and users to demonstrate the functionality and interface of the system, and gain feedback from them.	

WBS Item Number	5.2
WBS Item Name	Beta Testing
Description Gather a small amount of beta testers to test to identify if there's any issues. And find bugs in the testing phase to fix. Also run stress testing to ensure the system stability and can handle a lot of users during busy times.	

WBS Item Number	5.3
WBS Item Name	Optimize Performance
Description	

Analyze the performance in the backend system and frontend system, and implement optimization to the code, enhancing the system stability and user experience.

WBS Item Number	5.4
WBS Item Name	Final Launch
Description Ensure everything is alright and ready to go, then deploy the final version of the system. And monitor if there's any issues after the launch.	

WBS Item Number	6.1
WBS Item Name	System Monitoring and Maintenance
Description Ensure the system remains operational and efficient. This includes monitoring system uptime, calibrating IoT sensors for accurate parking detection, and maintaining payment gateway functionality.	

WBS Item Number	6.2
WBS Item Name	Customer Support and Assistance
Description Direct support is provided to users, mall operators, and security staff to resolve parking-related issues. A helpdesk offers assistance to handle inquiries, troubleshoot problems, escalate critical issues as well. This feature will enhance user experience and help manage smooth operations through responsive support.	

WBS Item Number	6.3
WBS Item Name	System updates and Security Patches
Description Provide regular software updates, security patches, and cloud infrastructure maintenance for system reliability. Updates will address performance improvements, bug fixes, and security vulnerabilities.	

WBS Item Number	6.4
WBS Item Name	User Support and Communication
Description Provide users and mall operators with self-help resources and direct communication channels. A knowledge base with FAQs and troubleshooting guides will also be available to reduce dependency on live support. Multi-channel support such as phone, email, and live chat, makes sure users receive timely assistance when needed.	

WBS Item Number	6.5
WBS Item Name	Data Analytics and Performance Optimization
Description Utilize real-time parking data to make the system run more efficiently and support better decision-making. By analyzing trends like peak hours, occupancy rates, and user behavior, the system can help improve how parking spaces are managed and adjust pricing if needed. Regular reports give mall management insights to improve parking operations.	

WBS Item Number	
WBS Item Name	
Description	