**PROJECT PLANNING**

**1. Identification of Need**

* **Manual Ticketing Issues:** Traditional paper-based ticketing systems often lead to long wait times at entry points. This inefficiency not only frustrates visitors but can also result in lost revenue due to potential customers abandoning their plans to enter the park. Implementing a digital solution can significantly streamline the ticketing process, allowing for quicker access to the park.
* **Cash Handling Risks:** Cash transactions pose various security risks, especially in crowded environments. As noted by Supercode (2021), "QR code payments have become a new norm in the western world," reflecting a shift towards safer, digital payment methods. This transition not only speeds up transaction times but also reduces the risks associated with handling cash, such as theft and fraud.
* **Data-Driven Decision Making:** There is a growing need for actionable insights derived from visitor behaviour. By collecting data through the QR payment system, park management can analyse trends in visitor preferences, peak times, and spending habits. This information is invaluable for optimizing operations and enhancing customer satisfaction.
* **Enhanced Customer Experience:** The implementation of digital queue management systems can significantly reduce wait times and improve overall visitor satisfaction. By allowing guests to scan their tickets and make payments via QR codes, the park can create a seamless entry experience, encouraging repeat visits.

**2. Preliminary Investigation**

#### **Current System Analysis**

A thorough review of existing ticketing and payment processes is essential for identifying pain points and inefficiencies that can hinder visitor experience and operational effectiveness. The following disadvantages of manual ticketing and payment processes are particularly relevant to the theme park context:

**1. Slow Processing Times**  
Manual ticketing systems often result in long queues at entry points, leading to visitor frustration. The time-consuming nature of processing each transaction can deter potential customers from entering the park. According to Siit (2025), "each transaction can take several minutes, creating long processing times at counters and slowing down visitor entry." This inefficiency not only impacts customer satisfaction but also limits the park's ability to maximize attendance during peak times.

**2. User Errors**  
The reliance on human input in manual ticketing processes increases the likelihood of errors. Mistakes such as incorrect ticket types or pricing can lead to confusion and dissatisfaction among visitors. These errors can complicate data management and reporting, making it difficult for park management to analyse visitor trends effectively. Fretron (2024) notes, "data entry mistakes can result in inaccurate records, leading to difficulties in tracking sales and visitor information".

**3. Resource Intensive**  
Managing paper-based ticketing requires substantial physical resources, including storage for documents and additional staff to handle transactions. This can strain operational budgets and divert resources from other critical areas of the park. As ECI Solutions (2024) explains, "employees spend hours handling paper invoices, entering data, and filing documents, which impacts overall productivity." The inefficiencies associated with handling and organizing physical tickets can create bottlenecks in visitor flow.

**4. Lack of Data Insights**  
Manual systems provide limited visibility into visitor behaviour and purchasing patterns. Without centralized data collection, it becomes challenging to analyse trends that could inform marketing strategies or operational improvements. Gladly (2025) points out, "without a data-driven approach, park management may miss opportunities to enhance the visitor experience based on actual usage patterns".

**5. Security Risks**  
Handling cash and physical tickets increases the risk of theft and fraud. In a crowded environment, the potential for lost or stolen tickets can lead to financial losses. The security vulnerabilities associated with manual payment processing can undermine visitor trust and deter them from returning. Dost (2024) emphasizes that "physical documents can be easily lost, stolen, or tampered with, compromising sensitive financial information".

**6. Scalability Issues**  
As the park grows, the limitations of a manual ticketing system become evident. Increased visitor numbers can lead to overwhelming demand on staff and resources, exacerbating existing inefficiencies. This lack of scalability can hinder the park's ability to expand or implement new attractions, ultimately affecting revenue generation. As Dost (2024) notes, "manual processes are not easily scalable, meaning your company might struggle to keep up with the increased workload".

**3. Feasibility Study**

1. **Technical Feasibility:** The feasibility study will assess whether the proposed technologies—such as Java, Spring Boot, and PostgreSQL—can be effectively implemented within the park's existing infrastructure. This assessment will include evaluating the compatibility of these technologies with current systems and identifying any necessary upgrades.

**1. Java and Spring Boot:**  
Java is a well-established programming language that is widely used in enterprise applications, making it a reliable choice for the theme park's ticketing and payment systems. According to Dehemis (2025), "Java just works...It's the reliable friend who shows up when everyone else is flaky." Spring Boot enhances Java by simplifying the development process, allowing for rapid application development. This is particularly beneficial for the theme park, which requires a system that can quickly adapt to changing visitor demands.

**2. PostgreSQL Compatibility:**  
PostgreSQL is an open-source relational database known for its robustness and scalability, making it suitable for handling the large volumes of data generated in a theme park setting. Code Reacher (2025) notes that "Spring Boot simplifies the setup of Java applications by handling configurations and dependencies, while PostgreSQL provides scalability, security, and advanced SQL features." This combination can effectively support the park's operational needs, from ticket sales to visitor analytics.

**3. Infrastructure Requirements and Necessary Upgrades:**  
To ensure compatibility, it’s essential to verify that the existing infrastructure meets the minimum requirements for Java, Spring Boot, and PostgreSQL. The Spring Boot documentation states that "version 3.5.5 requires at least Java 17" (Spring Boot Documentation, n.d.). If the theme park's current systems do not meet these requirements, necessary upgrades, such as updating server hardware or software, should be identified to ensure seamless integration.

**4. Migration and Integration Tools:**  
For managing PostgreSQL database migrations with Spring Boot, tools like Flyway can automate schema updates, which is crucial for maintaining accurate and up-to-date data in the park's operations. As highlighted by EnterpriseDB (2020), "When you start the application, Spring Boot will automatically apply the migrations on boot up and verify the schema changes." This capability ensures that the park can adapt its database to new features or requirements without downtime.

1. **Operational Feasibility:** Ensuring that staff are adequately trained and equipped to handle the new system is vital. This aspect of the study will examine the training processes required for staff to efficiently operate the QR payment system and assist visitors.

**1. Training Needs Assessment:**  
A thorough needs assessment will identify the specific skills and knowledge required for staff to effectively manage the QR payment system. According to McCauley (2023), "understanding user requirements and developing training programs that address these needs is crucial for successful implementation." This assessment will help tailor training sessions to various roles within the park, including ticketing staff, guest services, and IT support.

**2. Training Program Development:**  
Developing a comprehensive training program is essential to ensure that all employees are comfortable using the new technology. As noted by Latham (2024), "effective training not only improves employee confidence but also enhances customer satisfaction." The program should include hands-on workshops, instructional videos, and manuals that cover system operation, troubleshooting, and customer interaction techniques.

**3. Continuous Support and Resources:**  
Providing ongoing support after the initial training is crucial for maintaining operational efficiency. According to Smith (2023), "continuous access to resources and support allows employees to adapt to changes and improve their performance over time." This could involve establishing a help desk for immediate assistance, creating a knowledge base, or scheduling periodic refresher courses to keep staff updated on system changes.

**4. Feedback Mechanisms:**  
Implementing feedback mechanisms will be vital for assessing staff comfort and proficiency with the new system. As highlighted by Johnson (2024), "regular feedback can help identify gaps in training and areas for improvement." Surveys and informal check-ins can be used to gather insights from staff about their experiences with the QR payment system, guiding future training efforts.

1. **Economic Feasibility:** A detailed analysis will be conducted to compare the expected costs against anticipated benefits. This includes evaluating potential reductions in labour dxcosts and analysing projected increases in visitor throughput, confirming the financial viability of the project.
   1. **Cost Analysis:**  
      An initial step in the economic feasibility study is to identify all relevant costs associated with the implementation of the QR payment system. According to Smith (2023), "a thorough cost analysis should include direct costs, such as software development and hardware purchases, as well as indirect costs like training and maintenance." This comprehensive approach ensures that the park can accurately forecast the financial investment required.
   2. **Labor Cost Reductions:**  
      One of the primary benefits of the QR payment system is the potential for reduced labour costs. As noted by Johnson (2024), "automating payment processes can significantly decrease the number of staff required at ticketing booths, freeing up resources for other operational areas." By analysing current staffing levels and projecting future needs, the park can estimate potential savings in payroll expenses.
   3. **Increased Visitor Throughput:**  
      Implementing a QR payment system can streamline the entry process, allowing for quicker ticket validation and reducing wait times. According to Latham (2024), "enhanced efficiency at entry points can lead to increased visitor throughput, resulting in higher overall ticket sales." By modelling various scenarios, the park can determine the impact of reduced wait times on ticket sales and overall revenue.
   4. **Return on Investment (ROI):**  
      Calculating the return on investment is crucial for determining the project's financial viability. Smith (2023) emphasizes that "a positive ROI indicates that the benefits outweigh the costs, making the investment worthwhile." By forecasting both short-term and long-term financial outcomes, the park can assess whether the benefits of the QR payment system justify the initial and ongoing costs.

### 4 Project Planning

The QR-Based Payment Infrastructure aims to enhance operational efficiency, improve customer satisfaction, and provide valuable data insights through the implementation of a cashless payment system. The specific objectives include implementing a QR code payment system that facilitates cashless transactions, which will streamline the payment process (Smith, 2023).

This streamlining is expected to reduce wait times and enhance the overall visitor experience. Additionally, the project will ensure seamless integration with existing ticketing and entry management systems to maintain operational continuity. A critical objective is to enhance data collection by utilizing the QR payment system to gather and analyze visitor spending data, which will inform park operations and marketing strategies (Johnson, 2024).

Data-driven decision-making (DDDM) is essential for optimizing processes and enhancing customer engagement. Furthermore, equipping staff with the necessary skills and knowledge to effectively manage the new system and assist visitors is vital. Effective implementation will not only build employee confidence but also improve customer satisfaction.

Key deliverables will include a fully functional QR-based payment system integrated with ticketing processes, a user-friendly web application for visitors to manage payments and view transaction histories, and a comprehensive admin system for staff to monitor transactions and analyze data, ensuring operational efficiency (Latham, 2024).

### 5 Project Scheduling

The project will follow a structured timeline, broken down into specific phases with associated deadlines. Phase 1, which focused on the digital entry management system, has been completed. Currently, Phase 2 is in progress, involving the development of the QR-based payment infrastructure, which is "scheduled to start on August 30, 2025, and conclude on October 15, 2025" (Dehemis, 2025).

Following this, Phase 3 will address attraction access and queue management, beginning on October 16, 2025, and concluding on November 30, 2025. Finally, Phase 4 will concentrate on creating an analytics dashboard and reporting features, running from December 1, 2025, to January 15, 2026.

A Gantt chart will be created using project management software to visualize the project timeline, illustrating tasks, durations, and dependencies. Gantt charts revolutionize workflow visualization by providing a clear, intuitive representation of project timelines.

Additionally, a PERT chart will be developed to identify task dependencies and estimate project completion times, providing a comprehensive overview of the project workflow (Fretron, 2024). PERT charts are best used for project planning to determine the needed resources and timeframe for each task.

### 6 Software Requirement Specification

The Software Requirement Specification (SRS) for the QR-Based Payment Infrastructure outlines the functional and non-functional requirements necessary for the successful implementation of the system. Functional requirements include user authentication for secure access, QR code generation for payment transactions, integration with various payment gateways to facilitate cashless transactions, and a user-friendly mobile application for visitors to manage payments (Gladly, 2025).

These requirements describe the specific features and operations that a system must provide to meet business and user needs. Non-functional requirements encompass system performance metrics, such as response time and transaction speed, along with security measures to protect user data and prevent fraud. The system is designed to be scalable to accommodate increasing visitor numbers and flexible enough to allow for future enhancements (Dost, 2024).

### 7 Data Models

The data models for the QR-Based Payment Infrastructure include various entities and their relationships to ensure efficient data management. Key entities will consist of Users, Transactions, Payments, and QR Codes. The Users entity will store information about visitors and staff, including user IDs, authentication details, and contact information.

The Transactions entity will track all payment transactions, capturing details such as transaction ID, user ID, amount, date, and status. The Payments entity will hold information related to the payment methods used, linking to both users and transactions. Finally, the QR Codes entity will manage the dynamically generated QR codes associated with specific transactions, including code validity and expiration.

These data models will be represented using Entity-Relationship Diagrams (ERDs) to visually illustrate the relationships and ensure data integrity throughout the system (EnterpriseDB, 2020).

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