

Tamrinak

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DEDICATION

We dedicate this project to our families, friends, and mentors who have supported us throughout this journey. Their encouragement, patience, and unwavering belief in our abilities have been invaluable. We also extend our gratitude to our instructors and teammates, whose collaboration and dedication made this project a reality. This work is a testament to our collective effort and shared passion for learning and innovation.

Acknowledgment

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A heartfelt thank you to all our families and friends for their unwavering support, patience, and encouragement. Their belief in us has been our greatest motivation.

Finally, we acknowledge all those who, in one way or another, contributed to this work. Your support and guidance have been truly invaluable.

DECLARATION

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Bachelor of Science in software engineering is entirely my own work, that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

Signed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student No.: \_\_\_\_\_\_\_\_\_\_\_

Date: Thursday, 01 05 2025.

ABSTRACT

This project focuses on the development of an online sports venue booking system that enables users to find, book, and manage sports facilities. The system aggregates data from multiple sources, allowing users to search venues based on sport type, location, pricing, availability, and user reviews. The platform supports secure authentication, real-time availability tracking, and payment processing. It also provides venue owners with tools to manage listings, approve bookings, and respond to user reviews. The project ensures scalability, performance, security, and responsiveness, aligning with industry best practices.

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| ABBREVIATION | | Definition of Abbreviation |
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Chapter One

# Introduction

## Background

Sports play a significant role in promoting physical well-being, social interactions, and community engagement. With the growing demand for sports facilities, there is an increasing need for a streamlined and efficient system to manage venue bookings. Traditional booking methods, such as phone calls or in-person reservations, can be time-consuming and inefficient. Technological advancements have enabled the development of online platforms that facilitate the discovery and reservation of sports facilities. This project aims to leverage these advancements by creating a comprehensive online sports venue booking system that simplifies the process for both users and venue owners.

## Problem Statement

Existing sports venue booking systems often suffer from limited availability, lack of real-time updates, and inefficient management tools for venue owners. Users face difficulties in finding appropriate venues that meet their specific needs, such as sport type, location, pricing, and availability. Moreover, venue owners struggle to manage bookings effectively, leading to overbooking or underutilization of facilities. The lack of a unified platform that aggregates data from multiple sources further complicates the booking process. Therefore, there is a need for a robust, user-friendly, and scalable system that addresses these challenges.

## Objectives

* The primary objectives of this project are:
* To develop an online sports venue booking system that aggregates data from multiple sources.
* To provide users with an intuitive platform to search and book venues based on sport type, location, pricing, availability, and user reviews.
* To integrate secure authentication and authorization mechanisms to ensure user data protection.
* To implement real-time availability tracking for accurate and up-to-date venue status.
* To facilitate secure payment processing for seamless transactions.
* To equip venue owners with management tools for handling bookings, approving reservations, and responding to user feedback.
* To ensure scalability, performance, security, and responsiveness of the system, aligning with industry best practices.

## Scope of the Project

This project will focus on developing a web-based platform for booking sports venues. The system will cater to both users and venue owners, providing functionalities such as:

* User registration and secure authentication.
* Venue search and filtering based on various criteria.
* Real-time booking and payment processing.
* Venue management tools for owners, including listing creation, booking approvals, and review management.
* Performance optimization to handle high traffic and large datasets.
* Security measures to protect user data and financial transactions.
* The platform will be designed for scalability, allowing future enhancements such as mobile applications and AI-driven recommendations.

## Methodology

The development of the online sports venue booking system will follow an agile methodology, ensuring iterative progress and continuous improvements. The key phases include:

* Requirement Analysis: Identifying user needs and defining system requirements.
* System Design: Creating architectural diagrams and database schemas.
* Development: Implementing core functionalities using ASP.NET API for backend and a suitable frontend framework.
* Testing: Conducting unit, integration, and user acceptance testing to ensure functionality and reliability.
* Deployment: Launching the system on a secure server with monitoring tools.
* Maintenance and Updates: Addressing user feedback and enhancing features post-launch.

## Document Organization

This document is structured as follows:

* Chapter 1: Introduction – Provides an overview of the project, including its background, problem statement, objectives, scope, methodology, and document organization.
* Chapter 2: Literature Review – Reviews existing booking systems, highlighting gaps and potential improvements.
* Chapter 3: System Analysis and Design – Details system architecture, database design, and technology stack.
* Chapter 4: Implementation – Describes the development process, including coding and integration of various modules.
* Chapter 5: Testing and Evaluation – Discusses testing methodologies, results, and system performance evaluation.
* Chapter 6: Conclusion and Future Work – Summarizes key findings and suggests future enhancements.

Chapter Two

# SYSTEM ANALYSIS

This section provides a detailed analysis of the system requirements, including functional and non-functional requirements, as well as the necessary hardware, software, and network specifications.

## FUNCTIONAL REQUIREMENTS

The system is designed to support various functionalities that facilitate sports venue booking and management. The core functional requirements include:

#### ****2.1.1 User Registration & Authentication****

* The system must allow users to create an account by providing personal details such as name, email, and password.
* Users should be able to log in securely using their credentials.
* The system must support password recovery via email.

#### ****2.1.2 User Profile Management****

* Users must be able to view and update their profile, including their name, contact information, and profile picture.
* Users should be able to change their password within their profile settings.

#### ****2.1.3**** Venue Listing Management (Facility Owners)

* Facility owners must be able to add, update, and delete venue listings.
* Venue listings should include: venue name, type of sport offered, location (address and GPS coordinates), pricing, available time slots, and photos of the facility.
* Owners can also add additional details such as facilities available (e.g., locker rooms, lighting, seating).

#### ****2.1.4**** Advanced Search

* Users should be able to search for sports venues by multiple criteria, including:
  + Sport type (e.g., football, basketball, tennis, etc.)
  + Location (e.g., address, proximity to user’s current location)
  + Price range
  + Ratings and reviews
  + Availability (e.g., specific dates and times)

#### ****2.1.5**** Real-Time Availability

* The system should show real-time availability for each venue.
* Users must be able to book a venue if it is available at the desired time.

#### ****2.1.****6 Booking & Payment

* Users must be able to book sports venues based on availability.
* The platform must integrate with a payment gateway (e.g., PayPal, Stripe) for online payment.
* Once the payment is processed, the user should receive an instant booking confirmation via email and/or SMS.

#### ****2.1.****7 Booking Management

* Users must be able to view a list of their upcoming and past bookings.
* Users should have the ability to cancel or modify their bookings, subject to the venue's cancellation policy.

#### ****2.1.****8 Reviews & Ratings

* After using a sports venue, users should be able to leave a rating (1-5 stars) and provide written feedback about the venue’s facilities and experience.
* Facility owners should be able to respond to reviews.

TODO

## NON-FUNCTIONAL REQUIREMENTS

The system must meet the following quality attributes to ensure efficiency, security, and usability:

#### ****2.2.1 Performance and Scalability****

* The platform must support at least 1000 active users simultaneously without performance issues or downtime.
* Search results should return in under 2 seconds.
* The system must handle booking requests in real-time, providing immediate availability updates.

#### ****2.2.2 Security Measures****

* Authentication should be handled using JWT tokens to ensure secure user sessions.
* All sensitive data (e.g., user passwords, payment details) should be encrypted using SSL/TLS encryption during transmission.
* The platform should be protected against common security vulnerabilities such as SQL injection, Cross-Site Scripting (XSS), and Cross-Site Request Forgery (CSRF).

#### ****2.2.3**** Responsiveness

* The platform must be fully responsive, ensuring it works seamlessly on desktop, tablet, and mobile devices.

#### ****2.2.4**** Data Privacy

* The system must comply with relevant data protection laws (e.g., GDPR or similar regulations), ensuring that users' personal data is securely stored and handled.

2.2.5 Usability and Accessibility

* User-friendly interface ensuring a smooth booking experience.
* Responsive design compatible with desktops, tablets, and mobile devices.
* Accessibility features for users with disabilities.

2.2.6 Maintainability and Extensibility

* Modular architecture allowing easy integration of new features.
* Well-documented code and APIs to facilitate future development.
* Support for automated software updates and patches.

2.2.7 Compliance with Standards

* Adherence to web and mobile application development standards.
* Ensuring legal compliance with data protection regulations.
* Conformance with international usability and security guidelines.

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## SYSTEM REQUIREMENTS

To ensure optimal performance, the system must fulfill the following technical requirements:

#### ****2.3.1**** Hardware Requirements

* Server: High-performance cloud or dedicated server with SSD storage.
* Minimum 8-core CPU and 16GB RAM for smooth operations.
* Redundant storage and backup solutions for data reliability.

#### ****2.3.2 Software Requirements****

* Operating System: Linux-based servers (Ubuntu, CentOS) or Windows Server.
* Web Server: Apache/Nginx with support for ASP.NET API and front-end technologies.
* Database: SQL Server or PostgreSQL for data management.
* Front-End: React or Angular for responsive UI development.
* Payment Gateway Integration: Stripe, PayPal, or local payment solutions.

#### ****2.3.3**** Payment Gateway

* The system must integrate with a third-party payment gateway such as Stripe to process online payments.

#### ****2.3.4**** Network Requirements

* High-speed internet connectivity for low-latency data transactions.
* Secure VPN access for administrators and venue owners.
* Load balancers and CDNs to optimize traffic distribution and performance.

#### ****2.3.5**** Notification Service

* The system should support email and SMS notifications to inform users about:
  + Booking confirmations
  + Booking reminders
  + Booking cancellations
  + Account updates

#### ****2.3.6**** Third-Party API Integration

* The system must integrate with Google Maps API to display venue locations on a map.
* It must also integrate with Twilio or SendGrid for sending SMS and email notifications.

Chapter Three

# SYSTEM DESIGN

## System Architecture

The system follows a multi-tier architecture comprising the client-side interface, backend services, and a database layer. The frontend is built using modern web technologies, ensuring a responsive user experience. The backend is designed using ASP.NET API, handling user authentication, venue management, and booking processes. The database layer is structured to efficiently store and retrieve venue details, bookings, user information, and reviews.

## Database Design

The database is designed using a relational model with tables for users, venues, bookings, payments, and reviews. Relationships between entities ensure data integrity and efficient retrieval. Key considerations include indexing for fast searches, normalization to avoid redundancy, and optimized queries for performance.

## User Interface Design

The UI is designed for an intuitive and seamless user experience, allowing users to search for venues, filter results based on criteria, and complete bookings effortlessly. Venue owners have access to a dashboard for managing listings, tracking reservations, and responding to user reviews. Mobile responsiveness and accessibility are key priorities.

## API Design

The system exposes a RESTful API to facilitate communication between the frontend and backend. The API handles authentication, venue searching, booking management, payment processing, and user reviews. Secure API endpoints ensure data privacy and prevent unauthorized access.

## Security Architecture

Security is a critical component of the system, incorporating user authentication via OAuth 2.0 or JWT tokens, role-based access control (RBAC), data encryption, and protection against common threats such as SQL injection and cross-site scripting (XSS). Secure payment processing is ensured using trusted third-party payment gateways.

## Data Flow Diagrams (DFD)

Data flow diagrams illustrate the movement of data within the system, depicting interactions between users, venue owners, the booking system, and external services such as payment gateways. These diagrams help in understanding system workflows and identifying optimization opportunities.

## Use Case Diagrams

Use case diagrams define the various interactions between users and the system, highlighting key functionalities such as user registration, venue search, booking, payment processing, and review management. These diagrams provide a clear overview of system requirements and user roles.

Chapter FOUR

# IMPLEMENTATION

The implementation of the online sports venue booking system involves a comprehensive approach that integrates modern web development practices. This chapter details the tools, technologies, and methodologies used in the backend and frontend development, integration with third-party services, and the deployment strategy.

## Development Tools and Technologies

To develop a robust and scalable sports venue booking system, the following technologies and tools are utilized:

* Programming Languages: C# (ASP.NET Core for backend), JavaScript (React for frontend)
* Database Management: Microsoft SQL Server
* Authentication: Identity framework with OAuth 2.0
* Hosting and Deployment: Azure Cloud Services
* Version Control: Git and GitHub
* Development Environment: Visual Studio, VS Code, Postman (API testing)

## Backend Development

The backend is built using ASP.NET Core Web API, ensuring scalability and security. The main components of the backend include:

* User Authentication & Authorization: Secure login with JWT authentication.
* Venue Management: CRUD operations for venue owners to manage listings.
* Booking System: Handles real-time availability and transactions.
* Review & Rating System: Users can submit and view venue ratings and reviews.
* Payment Gateway Integration: Secure payment processing via third-party APIs.
* Data Aggregation: Fetches and processes sports venue listings from various sources.

## Frontend Development

The frontend, developed with React, provides an intuitive user interface. Key features include:

* User Dashboard: Displays bookings, payments, and favorite venues.
* Search and Filter: Users can search venues by location, sport type, availability, and price.
* Venue Details Page: Showcases images, descriptions, pricing, and user reviews.
* Real-time Updates: Booking status and venue availability are updated dynamically.
* Mobile Responsiveness: Ensures accessibility on various devices.

## Integration with Third-Party Services

To enhance functionality, the system integrates with several third-party services:

* Google Maps API: Provides geolocation and directions.
* Stripe or PayPal API: Enables secure online payments.
* Firebase Notifications: Sends real-time booking and confirmation alerts.
* External Sports Venue APIs: Aggregates venue listings from external sources.

## Deployment Strategy

The deployment strategy ensures reliability and scalability:

* Cloud Hosting: The application is hosted on Azure for high availability.
* CI/CD Pipeline: Automated deployment using GitHub Actions.
* Database Management: Regular backups and optimized indexing.
* Monitoring & Logging: Implemented via Application Insights for performance tracking.
* Security Measures: SSL encryption, role-based access control, and regular security audits.

Chapter FIVE

# TESTING AND VALIDATION

## Testing Methodology

To ensure the reliability and robustness of the online sports venue booking system, a structured testing methodology is adopted. This includes unit testing, integration testing, system testing, user acceptance testing (UAT), performance testing, and security testing. Each testing phase follows industry best practices to validate functionality, performance, and security aspects of the platform.

Chapter SIX

# CONCLUSION AND DISCUSSION

This project presents the development of an online sports venue booking system that streamlines the process of finding, booking, and managing sports facilities. By aggregating data from various sources, the platform enhances accessibility, transparency, and efficiency for both users and venue owners. The system incorporates key functionalities such as secure authentication, real-time availability tracking, and payment processing, ensuring a seamless user experience. The following sections summarize the project's achievements, challenges, and future directions.

## Summary of Achievements

The project successfully implemented a robust and user-friendly online booking system for sports venues. Major achievements include:

* Comprehensive Search and Filtering: Users can search for venues based on sport type, location, pricing, availability, and user reviews.
* Real-time Availability Tracking: Ensuring up-to-date booking status for users.
* Secure Authentication: Implementing a reliable login system with role-based access control for users and venue owners.
* Payment Processing: Integrating secure online payment gateways.
* Venue Management Tools: Providing venue owners with capabilities to manage listings, approve bookings, and respond to user feedback.
* Scalability and Security: Adopting best practices in software development to ensure a responsive and secure system.

## Challenges and Limitations

Despite the successful implementation of core functionalities, the project faced several challenges:

* Data Aggregation Complexity: Integrating multiple sources for venue data required handling inconsistencies and data synchronization issues.
* Scalability Concerns: Managing high user traffic and concurrent bookings demanded efficient database and server optimization.
* Payment Integration Issues: Ensuring compliance with financial regulations and security standards posed additional development complexities.
* User Adoption and Engagement: Encouraging venue owners and users to adopt the platform required effective marketing and onboarding strategies.

## Future Enhancements

To further improve the system, the following enhancements are proposed:

* AI-Based Recommendations: Implementing machine learning algorithms to suggest venues based on user preferences and past bookings.
* Mobile Application Development: Expanding accessibility through dedicated iOS and Android applications.
* Dynamic Pricing Model: Allowing venue owners to adjust pricing based on demand and time slots.
* Advanced Analytics and Reporting: Providing venue owners with insights into booking trends and customer preferences.
* Integration with Wearable Devices: Enabling seamless check-in and booking confirmation through smart devices.

## Final Remarks

The development of this sports venue booking system represents a significant step toward digitizing and simplifying the booking process for sports enthusiasts and venue managers. By integrating key technological advancements, the platform enhances convenience, efficiency, and engagement in the sports industry. Continuous improvements and user feedback will drive further innovation, ensuring the system remains a valuable solution for all stakeholders.

Chapter SEVEN

# REFERENCES

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Chapter EIGHT

# APPENDICES

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## References Format

Sample correct formats for various types of references are as follows.

Books:

G. O. Young, “Synthetic structure of industrial plastics,” in *Plastics*, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.

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E. E. Reber, R. L. Mitchell, and C. J. Carter, “Oxygen absorption in the Earth’s atmosphere,” Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

## References to Electronic Sources

The guidelines for citing electronic information as offered below are a modified illustration of the adaptation by the International Standards Organization (ISO) documentation sys­tem and the American Psychological Association (APA) style. Three pieces of information are required to complete each reference: 1) protocol or service; 2) location where the item is to be found; and 3) item to be retrieved. It is not necessary to repeat the protocol (i.e., http) in Web addresses after “Available” since that is stated in the URL.

Books:

J. Jones. (1991, May 10). *Networks*. (2nd ed.) [Online]. Available: <http://www.atm.com>

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A. Harriman. (1993, June). Compendium of genealog­ical software. *Humanist*. [Online]. Available e-mail: HUMANIST@NYVM Message: get GENEALOGY REPORT