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DEVELOPMENT OF AN ONLINE CLIENT APPOINTMENT BOOKING SOFTWARE FOR SMALL SERVICE BUSINESSES

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Анотація

У роботі розглянуто розробку програмного засобу онлайн-запису клієнтів на послуги для малого сервісного бізнесу (салони краси, майстерні, приватні кабінети тощо). Метою є створення інтегрованої системи самообслуговування для клієнтів та «єдиного вікна» для адміністратора/менеджера, що забезпечує вибір послуги й майстра, бронювання часу, керування розкладом і завантаженням персоналу, облік клієнтської бази, нагадування та контроль оплат. Запропоновано модульну архітектуру з доменними сутностями Client, Service, Staff, Slot, Booking, Payment і Notification, інтеграційним API та подієвою моделлю для узгодження змін між розкладом, бронюваннями та платежами. Передбачено механізми зниження кількості неявок (нагадування, підтвердження, правила скасування), а також базові політики безпеки для вебзастосунку і платіжних інтеграцій. Запропоновано підхід до оцінки KPI до/після впровадження: час обробки звернень, конверсія записів, частка неявок, точність обліку та рівномірність завантаження майстрів.

Ключові слова: онлайн-запис, керування розкладом, малий бізнес, сервісні послуги, бронювання, платежі, нагадування, KPI, API, безпека.

Abstract

This paper addresses the development of an online appointment booking software product for small service businesses (e.g., beauty salons, repair workshops, private studios). The objective is to deliver a single-window system for managers and a self-service flow for clients, covering service selection, staff availability, time-slot booking, reminders, and payment control. A modular architecture is proposed, with core domain entities (Client, Service, Staff, Slot, Booking, Payment, Notification) and well-defined APIs and events to maintain consistency in schedules, bookings, and payments. The solution includes mechanisms to reduce no-shows (multi-channel reminders, confirmations, and cancellation rules) and a baseline security posture for web and payment integrations aligned with modern application security guidance. An evaluation approach is defined to measure KPIs before and after adoption, including request-to-booking lead time, booking conversion, no-show rate, accounting accuracy, and staff utilisation.

Keywords: online booking, appointment scheduling, small service business, calendar management, payments, reminders, KPIs, API, security.

Small service businesses frequently manage appointments through phone calls, direct messages or ad hoc spreadsheets. These channels fragment customer communications, make it difficult to keep staff calendars up to date, and increase the risk of double-booking, idle time and missed revenue opportunities. From the customer perspective, limited call opening hours and slow response times reduce conversion from enquiry to booking. A dedicated online booking workflow with automated confirmations and reminders is a practical way to reduce administrative overhead and improve service capacity utilisation [1, 2].

The objective of this work is to design and implement a minimum viable product (MVP) of an online appointment booking tool that enables clients to self-book services and allows the business to manage staff availability, schedules and workloads in a single interface. The object of study is the end-to-end appointment management process in a small service business, while the subject is the architectural and software solutions

for integrating client records, service catalogue, scheduling, payments and notifications. The system targets measurable improvements in key performance indicators (KPIs), including lead time from enquiry to booking, booking conversion, no-show rate and staff utilisation [1, 3].

BUSINESS PROCESS AND FUNCTIONAL REQUIREMENTS

Requirements are derived by modelling the business process from first contact to service delivery and post-visit accounting. The process starts with a client selecting a service and preferred staff member, proceeds to time-slot discovery based on staff schedules and service duration, continues with booking creation and confirmation, and finishes with attendance tracking and optional payment settlement. Capturing these steps as explicit states allows the system to compute KPIs from timestamped transitions rather than manual reporting [3, 4].

The client-facing flow must support service search, pricing and duration display, time-zone safe slot selection, and cancellation or rescheduling within business rules. The manager-facing workspace must support staff calendars, working hours, breaks, exceptions, overbooking policies, and visibility into upcoming workload. To reduce no-shows, the system implements multi-channel notifications (email/SMS/messenger), confirmation prompts, and configurable cancellation windows, supported by evidence from large-scale reminder programmes [4, 5].

Payment handling is modelled as an optional but critical module: deposit collection, prepaid packages, and post-visit settlement. To limit financial risk, payment processing should be delegated to compliant providers, and the application should avoid storing card data, aligning operational controls with current PCI DSS requirements [6].

ARCHITECTURE AND INTEGRATION APPROACH

A modular architecture is proposed to preserve the separation of concerns while maintaining end-to-end traceability. Core domain entities include Client, Service, Staff, AvailabilitySlot, Booking, Payment and Notification. The scheduling module exposes a versioned API for slot search and booking operations and publishes domain events (BookingCreated, BookingCancelled, PaymentCaptured) that trigger downstream updates in reporting and communication modules. This approach reduces coupling and supports incremental delivery of the MVP [3, 7].

Scheduling correctness is addressed through idempotent booking commands and optimistic concurrency control on slot resources to prevent double-booking during concurrent requests. Business constraints (minimum notice, buffer times, service bundles) are enforced at the service layer. An adapter layer isolates external integrations such as calendar synchronisation, messaging gateways and payment providers, allowing the core domain to remain stable when vendors change. Where applicable, time and date interchange follows current ISO guidance to avoid ambiguity across time zones and daylight-saving transitions [7, 8].

The role model includes an administrator (configuration and user management), a manager (schedule and booking oversight), a staff member (view and confirm assigned bookings), and an auditor (read-only access to reports). A reporting read model aggregates events into operational dashboards: bookings per period, utilisation per staff member, no-show and cancellation rates, and revenue by service. These indicators provide a basis for before/after evaluation and continuous improvement [1, 3, 4].

SECURITY AND RELIABILITY

Given that the system processes personal data (client contacts, visit history) and may initiate payments, security and reliability are treated as first-class requirements. Access is governed by role-based access control with least-privilege scopes, and sensitive actions (refunds, staff schedule edits, exports) are logged for accountability. The security baseline follows modern web risk guidance, emphasising access control, secure design, input validation, and secure session management [2, 7].

Secure software development practices are incorporated across the lifecycle, including threat modelling, dependency and vulnerability management, secure defaults, and periodic review of critical paths. These practices align with the NIST Secure Software Development Framework and help reduce the probability and impact of exploitable defects in production deployments [7].

Payment integration is implemented through hosted checkout or tokenisation patterns to minimise exposure of account data. Operational controls and monitoring are designed in accordance with current PCI DSS releases, including requirements for authentication, logging, and protection of transmission channels [6].

KPI EVALUATION AND EXPECTED RESULT

To evaluate impact, a before-and-after comparison is proposed using baseline data from existing appointment logs (calls, messages, spreadsheets) and post-deployment event logs. Primary KPIs include (i)

enquiry-to-booking lead time, (ii) booking conversion rate, (iii) no-show rate, (iv) schedule utilisation and idle time, and (v) accounting accuracy for deposits and packages. In addition, distributional metrics (e.g., the proportion of bookings exceeding a target lead time) are tracked to capture tail behaviour rather than relying only on averages [1, 3, 4-6, 8].

The expected result is an MVP that provides a client self-service booking interface, a manager console for schedule administration, an integrated notification module, and optional payment support, all backed by consistent identifiers, audit-ready logs and exportable reports. Future work includes integrating demand forecasting for capacity planning and experimenting with optimisation policies for slot allocation under heterogeneous service types and non-stationary arrivals [3, 4].

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