

Smart Queuing Systems in Modern Banking: A Comprehensive Analysis of Technology Integration and Mathematical Optimization

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Abstract: *The banking sector has witnessed a paradigm shift from traditional physical queuing to intelligent, technology-enabled queue management systems. This research article presents a comprehensive analysis of smart queuing systems deployed in modern banking environments, examining their architectural components, mathematical foundations, and operational benefits. We investigate the integration of mobile applications, real-time dashboards, token dispensers, and predictive analytics in contemporary banking branches. Through queuing theory models particularly M/M/1 and M/M/c systems—we demonstrate how banks optimize service delivery by balancing customer wait times, server utilization, and operational costs. Case studies from leading Indian banks including ICICI Bank, State Bank of India, and HDFC Bank illustrate practical implementations and quantifiable improvements in key performance indicators. The study reveals that smart queuing systems reduce average wait times by up to 60%, improve server utilization by 30-40%, and significantly enhance customer satisfaction. We also explore emerging trends including AI-driven forecasting, biometric authentication, IoT-based monitoring, and sentiment analysis. This article provides actionable insights for banking institutions seeking to modernize their branch operations and offers a mathematical framework for optimal queue design. Our findings suggest that smart queuing is not merely a technological upgrade but a strategic imperative for banks aiming to deliver superior customer experience in an increasingly competitive landscape.*

Keywords: Smart Queuing Systems, Banking Technology, Queuing Theory, M/M/c Model, Customer Experience, Operational Optimization, Mobile Banking, Real-time Analytics, Digital Transformation.

