DEVELOPMENT OF A DAY-CARE MANAGEMENT SYSTEM

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DEPARTMENT OF COMPUTER SCIENCE,

FACULTY OF COMPUTING

UNIVERSITY OF BENIN,

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A PROJECT SUBMITTED TO THE DEPARTMENT OF COMPUTER SCIENCE, FACULTY OF COMPUTING, UNIVERSITY OF BENIN, EDO STATE, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE IN COMPUTER SCIENCE.

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DECLARATION

I, **Orukpe Glory,** with matriculation number **PSC1814510** hereby declare that this project titled "Development of a Day-care Management System ", is a project submitted to the Department of Computer Science of the University of Benin, in partial fulfillment of the requirements for the award of bachelor degree in Computer Science. It is an original work done by me that has not been presented elsewhere for assessment. The materials collected from other sources have been duly acknowledged by the references.

ORUKPE GLORY

(PSC1814510) (Signature and Date)

CERTIFICATION

This is to certify that this project work titled "Development of a Day-care Management System" was carried out by I, **Orukpe Glory**, with the matriculation number **PSC1814510** meets the requirement for the award of a Bachelor of Science (B.Sc.) Degree in the Department of Computer Science, University of Benin, Edo State, Nigeria.

DR. (MRS) G. O AZIKEN _____

Project Supervisor Signature and Date

DR.MRS USIOBAFO

Head of Department Signature and Date

DEDICATION

I dedicate this report to my family, sisters, brothers, friends and all those who contributed positively to help me through different hurdles and challenges faced during the entire span of life.

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ABSTRACT

This project focuses on designing and developing a comprehensive web-based daycare management system aimed at addressing the operational inefficiencies and administrative challenges faced by modern daycare centers. The system provides an integrated digital platform that automates critical tasks including attendance tracking, billing and payment management, scheduling of daily activities, staff management, and real-time communication between parents and daycare providers. Through intuitive user interfaces accessible to both staff and parents, the platform enhances transparency, improves record-keeping accuracy, and enables more effective monitoring of children's activities, health records, and safety incidents throughout their time at the daycare center.

The study employs a systematic approach involving analysis of traditional manual management methods, identification of key operational challenges, and development of automated solutions that streamline administrative functions while maintaining focus on quality child care. Key features include real-time attendance recording with automated parent notifications, integrated billing systems for online payment processing and financial tracking, comprehensive child health and safety monitoring modules, enhanced parent-staff communication channels for sharing updates and alerts, and user-friendly interfaces designed for accessibility by non-technical users. By automating routine administrative tasks, the system reduces human error, saves staff time, and allows caregivers to dedicate more attention to direct child supervision and developmental activities. The research demonstrates how technology-driven solutions can modernize daycare operations, improve service quality, strengthen parent-provider relationships through enhanced transparency, and provide a scalable model for daycare centers seeking to meet the growing demand for efficient, reliable childcare services in contemporary society.

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

The daycare management system plays a critical role in the efficient and smooth running of daycare centers. With an increasing number of working parents and guardians, the demand for daycare services has grown significantly, particularly for infant care facilities. However, managing a daycare center involves complex tasks such as attendance tracking, billing, child monitoring, staff management, and communication with parents. For infant care, additional specialized monitoring is required including feeding schedules, diaper changes, sleep patterns, health records, and environmental conditions. Traditionally, these tasks have been handled manually, leading to inefficiencies, errors, and potential miscommunication

In recent years, automated systems have revolutionized daycare management. A well-designed system streamlines administrative functions, enhances communication between parents and staff, and ensures better monitoring of children's activities and safety. For infant daycare centers, technology integration enables real-time monitoring of vital care activities, immediate parent notifications, and comprehensive documentation of each infant's daily routine.

This study focuses on the design and development of an advanced infant-focused daycare management system aimed at improving operational processes in daycare centers specializing in infant care. The system is designed to automate day-to-day tasks, ensuring that both staff and parents can easily manage and monitor children's activities with emphasis on infant-specific care requirements.

The concept of daycare services has evolved significantly, particularly with the growing number of working parents who require professional child care during working hours. Daycare centers serve as an essential part of modern society, offering early childhood education, emotional development, and a safe environment for children (Berlinski & Schady, 2015). The primary objective is to provide quality care that supports the physical, cognitive, and social development of children while ensuring their safety and well-being (Aseyedali et al., 2019).

However, managing a daycare center involves numerous administrative, logistical, and communication-related responsibilities requiring careful attention to detail (Aseyedali et al., 2019). For infant care facilities, the complexity increases as caregivers must meticulously track feeding schedules, diaper changes, sleep patterns, developmental milestones, and maintain optimal environmental conditions.

A key component of daycare operations is staff monitoring of children. For infants, this monitoring is intensive and includes tracking attendance, logging feeding times and quantities, recording diaper changes, monitoring sleep patterns, documenting activities, noting developmental milestones, tracking growth measurements, managing vaccination records, and noting significant observations like behavioral changes or health concerns. Staff also record parent-provided information such as dietary preferences, allergies, and special care instructions.

In many daycare centers, these tasks are still managed manually using paper records, spreadsheets, or basic software tools. Manual documentation is prone to errors such as missing or incorrect entries about feeding times, diaper changes, or sleep patterns, which can lead to serious health concerns and miscommunication with parents. These methods are time-intensive, requiring staff to spend significant time on paperwork instead of direct infant supervision.

Additionally, manual systems lack real-time updates, making it difficult for parents to access timely information or for staff to quickly share critical details. For infant care, where timely information can be critical to health and safety, these inefficiencies undermine parent trust and hinder effective communication (Um et al., 2022).

A web-based infant daycare management system addresses these issues by automating key monitoring tasks such as recording attendance, logging feeding schedules, tracking diaper changes, monitoring sleep patterns, capturing developmental milestones, enabling live video monitoring, maintaining optimal environmental conditions through sensor integration, and sending real-time notifications to parents. The system improves accuracy, saves time, enhances transparency, and provides parents with peace of mind through continuous access to their infant's care information.

As demand for daycare services continues to rise, particularly for high-quality infant care, there is a growing need for efficient systems that streamline processes, improve accuracy, and reduce administrative burden. The advancement of technology has provided an opportunity to address these challenges. Comprehensive daycare management systems offer a promising solution by automating routine tasks, reducing human error, ensuring compliance with infant-to-caregiver ratios, and ensuring that both staff and parents have easy access to real-time data (Um et al., 2022). These systems can handle child enrollment, daily attendance, feeding and diaper tracking, sleep monitoring, health and safety monitoring, environmental condition tracking, billing, live video access, and parent communication in one unified platform.

The implementation of advanced daycare management systems significantly improves operational efficiency, especially for centers specializing in infant care. These systems save time and resources while providing transparency and accountability, which are crucial for building trust with parents of infants who require constant supervision and specialized care. Furthermore, automated systems enhance the overall quality of care by allowing staff to focus more on direct care activities rather than administrative tasks.

Despite the benefits, many daycare centers, particularly smaller ones, have yet to fully embrace comprehensive digital solutions due to financial constraints and resistance to change. However, the increasing availability of affordable and user-friendly software, combined with growing parent expectations for transparency and real-time information, has made it more feasible and necessary for daycare centers to adopt such systems.

This study aims to develop an advanced infant-focused daycare management system that addresses these challenges. The system will automate key functions such as attendance tracking, feeding schedules, diaper monitoring, sleep tracking, health records management, live video monitoring, environmental condition monitoring, emergency alerts, daily care report generation, parent-caregiver communication, photo sharing, and staff-to-infant ratio monitoring, ensuring a more efficient, reliable, and transparent approach to infant daycare management.

1.2 Problem of the Study

Daycare centers, particularly those specializing in infant care, are vital for supporting working parents and ensuring children's early development and safety. However, many centers rely on manual processes or outdated technology, leading to significant challenges in managing operations effectively. Infants require intensive and specialized care, yet tasks such as tracking

attendance, recording feeding schedules, monitoring diaper changes, documenting sleep patterns, handling billing, managing health records, and communicating with parents are often time-consuming and prone to errors.

For infant daycare centers, the challenges are more pronounced. Caregivers must track multiple feeding sessions throughout the day, record the type and quantity of food consumed, monitor diaper changes to ensure proper hygiene, document sleep patterns to identify irregularities, and maintain comprehensive health records including vaccinations and developmental milestones. Manual recording of these activities is time-intensive and susceptible to errors or omissions that could have serious implications for an infant's health and well-being.

The absence of an integrated system causes fragmented operations. Inaccurate feeding records can lead to over-feeding or under-feeding, while missed diaper change documentation can result in hygiene issues. Without automated alerts, staff may overlook critical information such as allergies or special medical needs. Additionally, parents of infants have heightened concerns about their child's well-being and desire frequent, detailed updates throughout the day. Poor communication channels hinder parents' access to real-time updates about their infant's feeding, sleeping, activities, or urgent concerns, leading to anxiety and dissatisfaction.

Maintaining the recommended staff-to-infant ratio is critical for safety and quality care, yet many centers struggle to monitor this effectively. Environmental conditions such as room temperature, humidity, and air quality are crucial for infant health but are often monitored manually and inconsistently. In emergency situations, the lack of a rapid alert system can delay critical communication with parents.

Parents increasingly expect transparency and real-time visibility into their infant's care, including the ability to view live video feeds, receive instant notifications, and access comprehensive daily reports. The absence of these features creates a gap between parent expectations and the services provided by many daycare centers.

A comprehensive, automated infant-focused daycare management system is needed to address these issues by streamlining administrative tasks, improving data accuracy, ensuring continuous monitoring of critical care activities, maintaining optimal environmental conditions, enabling real-time parent-staff communication, providing live video access, and ensuring compliance with staff-to-infant ratios.

1.3 Aim and Objectives

The primary aim of this study is to design and develop a comprehensive infant-focused daycare management system that automates and streamlines the day-to-day operations of daycare centers specializing in infant care.

To achieve the aim of this study, the following objectives are set:

1. To develop a system for automating attendance tracking, feeding schedules, diaper changes, and sleep monitoring with real-time parent notifications and comprehensive daily care reports.

2. To integrate health and growth record management with allergy and special care alert systems to track infant weight, height, vaccinations, developmental milestones, and provide instant alerts for infants with special medical needs.

3. To implement live video monitoring capabilities and emergency alert systems that provide secure CCTV access for parents and immediate notifications in case of illness, injury, or emergencies.

4. To develop environmental monitoring and staff-to-infant ratio tracking that integrates with sensors to monitor room temperature, humidity, and air quality while ensuring recommended caregiver-to-infant ratios are maintained.

5. To create an integrated parent-caregiver communication platform with messaging, photo sharing, billing management, and user-friendly interfaces for both daycare staff and parents.

1.4 Significance of the Study

This study is significant as it addresses critical operational challenges in infant daycare centers by developing a comprehensive web-based management system specifically designed for infant care requirements. By automating tasks such as attendance tracking, feeding schedules, diaper monitoring, sleep tracking, health records management, environmental monitoring, billing, and parent communication, the system substantially reduces administrative burdens and allows staff to focus on providing quality infant care.

For infant care facilities, where attention to detail is critical, the system's specialized features ensure that no aspect of an infant's care goes undocumented. This comprehensive documentation improves care quality and provides legal protection for daycare centers by maintaining detailed records of all care activities.

The live video monitoring feature represents a significant advancement in parent engagement and transparency. Parents can check on their infants at any time, providing peace of mind and building trust between parents and daycare providers. The emergency alert functionality ensures that parents are immediately notified of any health concerns, injuries, or emergencies, enabling rapid response.

The automated daily care report generation saves significant time for staff while providing parents with comprehensive, detailed information about their infant's day. The environmental monitoring capability ensures that infants are always in optimal conditions for their health and comfort. The staff-to-infant ratio monitoring ensures compliance with regulatory requirements and best practices.

The study's findings will enable smaller or less tech-savvy infant daycare centers to modernize their operations and compete effectively in a market where parents increasingly expect technology-driven transparency and communication. From a broader perspective, this study contributes to the childcare industry's digital transformation, particularly in the infant care sector. The research will provide valuable insights for policymakers, educators, and childcare professionals, potentially shaping future standards and regulations for infant daycare management.

1.5 Scope of the Study

This study focuses on the design and development of a comprehensive infant-focused daycare management system tailored to streamline the operations of daycare centers specializing in infant care. The system will address key areas such as attendance tracking, feeding schedule management, diaper change monitoring, sleep tracking, health and growth records, allergy and

special care alerts, live video monitoring, environmental condition monitoring, emergency alerts, automated daily care reports, parent-caregiver communication, photo and activity sharing, staff-to-infant ratio monitoring, and billing management.

The scope is limited to the development of a functional system prototype, which will be tested and evaluated within the context of infant daycare centers. The research will primarily focus on the software's capability to automate administrative tasks, monitor infant-specific care activities, provide real-time communication and monitoring features, and improve operational efficiency.

The system will be designed as a web-based platform accessible through standard web browsers and mobile devices. The live video monitoring component will utilize standard CCTV camera systems with web-based viewing capabilities, while environmental monitoring will be designed to integrate with commercially available sensors.

This study does not cover full-scale implementation in multiple daycare centers but will provide a comprehensive demonstration of its potential benefits and functionalities through prototype development and testing. The study will focus on designing user-friendly interfaces for daycare administrators, staff members, and parents, ensuring accessibility for non-technical users.

The scope is further limited to the development and testing phase, excluding long-term operational analysis or extensive field testing across multiple facilities. Hardware procurement and installation, such as CCTV cameras and environmental sensors, are outside the direct scope of this study, though the system will be designed to integrate with standard commercial hardware solutions.

1.6 Definition of Terms

1. Daycare Center: A facility that provides care and supervision for young children, particularly infants and toddlers, during the day, typically while their parents are at work.

2. Infant Daycare Management System: A comprehensive software solution specifically designed to automate and streamline the administrative and care-related functions of daycare centers specializing in infant care.

3. Attendance Tracking: The process of recording and managing the presence or absence of infants at the daycare center on a daily basis, including specific check-in and check-out times.

4. Feeding Schedule Tracking: The systematic recording of feeding times, types of food (breast milk, formula, solid foods), quantities consumed, and any feeding-related observations for each infant.

5. Diaper Change Monitoring: The digital logging of diaper change times, type of change, and any relevant observations to ensure proper hygiene and infant care.

6. Sleep and Nap Time Tracking: The automated recording of infants' sleep duration, nap times, and sleep patterns to help caregivers maintain healthy sleep schedules.

7. Health and Growth Records: Comprehensive documentation of an infant's physical development including weight, height, head circumference, vaccination history, developmental milestones, and medical information.

8. Allergy and Special Care Alerts: System-generated notifications that remind staff of infants with specific allergies, medical conditions, or special care requirements.

9. Live Video Monitoring: Real-time CCTV access that allows parents to view their infant at the daycare center through a secure web-based or mobile interface.

10. Environmental Monitoring: The use of sensors to continuously track room temperature, humidity, and air quality to ensure optimal conditions for infant health and comfort.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction to Daycare Management Systems

Daycare management systems are software solutions designed to streamline and automate the administrative processes involved in running daycare centers. These systems typically integrate several key functions, including attendance tracking, scheduling, billing, communication with parents, and management of child health and safety records. The primary goal of a daycare management system is to improve operational efficiency, reduce human error, and ensure better service delivery to both children and parents (Debnath et al., 2018).

In traditional daycare settings, many of these tasks are handled manually or through basic tools such as spreadsheets and paper records (Schachter et al., 2022). However, as the demand for high-quality childcare services grows, there is an increasing need for more sophisticated systems that can handle the complexities of modern daycare operations (Schachter et al., 2022). The introduction of daycare management systems offers daycare providers a more efficient way to manage daily activities and communicate effectively with parents, thereby enhancing the overall experience for all stakeholders(Debnath et al., 2018).

Daycare management systems can vary in complexity, from basic tools that focus on attendance tracking and invoicing, to more comprehensive systems that include features for health monitoring, meal tracking, and real-time messaging between staff and parents. As daycare centers strive to provide high-quality care, the integration of technology plays a critical role in enhancing the safety, communication, and operational efficiency of these facilities.

This section will explore the key components of daycare management systems, their evolution, and the role they play in improving the day-to-day operations of daycare centers.

2.2 Overview of Daycare Management Practices

Effective daycare management practices are crucial for ensuring the smooth operation of daycare centers and providing high-quality care to children. These practices cover a range of administrative, operational, and safety-related activities that contribute to the efficient running of daycare facilities (Schiavo et al., 2020). Traditionally, daycare management has been a labor-intensive process, relying heavily on manual record-keeping, face-to-face communication, and paper-based systems. However, as the need for more structured and efficient operations has grown, daycare management practices have evolved, increasingly integrating technology to streamline various functions (Sultana, 2024).

One of the core aspects of daycare management is the child enrollment and registration process, which involves collecting essential information such as personal details, health records, and parental consent forms (Muis & Dewi, 2021). This process ensures that daycare centers have accurate records and can provide appropriate care based on the child's needs. Proper registration also aids in compliance with legal and regulatory requirements.

Attendance management is another key practice in daycare management. It is essential for daycare providers to accurately track the attendance of each child, not only for logistical reasons but also to ensure safety and accountability (Muis & Dewi, 2021). Attendance management involves recording daily presence and absence, tracking late arrivals or early departures, and maintaining up-to-date records for each child.

Effective scheduling is central to the operational efficiency of a daycare center. Daycare centers typically offer a variety of activities, including playtime, educational sessions, naps, and meals. Proper scheduling ensures that these activities are well-organized, staff are allocated appropriately, and the day flows smoothly (Harris, 2022). A well-structured schedule also helps in managing the staff's workload and ensuring that children's needs are met consistently (Harris, 2022).

Communication with parents is an integral part of daycare management. It is essential for daycare providers to maintain regular, transparent communication with parents regarding their child's activities, well-being, and any important updates. Effective communication fosters a strong partnership between parents and caregivers, allowing parents to feel more engaged in their child's development (Reedy & McGrath, 2010). This practice may include regular updates, meetings, newsletters, or even real-time messaging systems that keep parents informed throughout the day.

Ensuring health and safety is a priority in daycare centers. Daycare management practices include maintaining health records, tracking allergies or special health needs, and implementing emergency protocols (Van Zandvoort et al., 2010). Staff is often required to be trained in first aid and emergency procedures, ensuring that they can respond quickly and appropriately to any incidents. Regular safety checks, such as childproofing the environment and monitoring hygiene practices, are essential to provide a safe space for children (Van Zandvoort et al., 2010).

Finally, billing and financial management are crucial for the sustainability of daycare centers. This involves invoicing parents for services rendered, tracking payments, and managing the center's operational expenses. Efficient financial management ensures the daycare center

remains financially viable while also ensuring that parents are billed accurately and promptly (Barrera, 2016).

As daycare centers increasingly adopt technology, many of these traditional practices have been automated through daycare management systems. These systems help streamline attendance tracking, scheduling, billing, and communication, reducing the reliance on manual processes and improving overall efficiency. Furthermore, they facilitate better data management, ensuring that records are accurate and up-to-date, and help in creating more transparent and accessible communication channels between daycare centers and parents.

2.3 Importance of Information Systems in Daycare Management

The integration of information systems into daycare management has become a pivotal aspect of modern childcare services. As daycare centers continue to grow in complexity and demand, traditional methods of manual administration are no longer sufficient to handle the various operational tasks efficiently. Information systems, particularly daycare management software, provide a digital solution that streamlines processes such as attendance tracking, scheduling, billing, communication with parents, and overall record management.

One of the most significant benefits of information systems in daycare management is operational efficiency. By automating routine tasks, such as daily attendance logging and invoicing, daycare centers can reduce the time and effort required to complete these activities manually (Syafril et al., 2022). This allows staff to focus more on child care and educational activities, which ultimately improves the quality of service provided. Additionally, automation minimizes the risk of human error, ensuring that records are accurate and up-to-date.

Enhanced communication is another key advantage of adopting information systems. Communication between daycare providers and parents is crucial for building trust and ensuring transparency. Information systems often include features that allow parents to receive real-time updates about their child's activities, health status, and any incidents that may occur during the day (Weigel & Martin, 2010). This continuous flow of information fosters a stronger relationship between caregivers and parents, ensuring that both parties are well-informed and involved in the child's care and development.

Furthermore, information systems play a critical role in data management and security. Daycare centers collect and store a large amount of sensitive information, such as personal details of children and parents, health records, and financial data. Information systems provide secure storage solutions that protect this data from unauthorized access or loss (Weigel & Martin, 2010). With the right security measures in place, daycare centers can ensure compliance with privacy regulations and build trust with parents by safeguarding their sensitive information.

The financial management capabilities of daycare management systems are equally important. By automating billing and payment tracking, these systems simplify the financial processes of daycare centers, ensuring that parents are invoiced accurately and on time (Banerjee et al., 2017). Financial records are stored in a central database, making it easier to generate reports, track expenses, and monitor the overall financial health of the organization (Banerjee et al., 2017). This level of financial transparency and organization is essential for the long-term sustainability of the daycare center.

Finally, information systems contribute to improving child safety by allowing daycare centers to track and manage important health information, such as allergies, medical conditions, and

emergency contact details. In the event of an emergency, caregivers can quickly access critical information, enabling them to respond swiftly and appropriately. Additionally, safety protocols can be integrated into the system, ensuring that all staff members are trained and prepared for potential incidents.

2.4 Technological Advancements in Daycare Management

Technological advancements have significantly transformed daycare management in recent years, making it easier for providers to streamline operations, enhance communication, and improve overall efficiency. The integration of new technologies into daycare management systems has brought about notable improvements in several key areas, including automation, real-time data access, mobile connectivity, and safety protocols.

One of the most important technological advancements is the adoption of cloud-based platforms. Cloud computing allows daycare centers to store and access data remotely, eliminating the need for on-site servers and offering greater flexibility. Cloud-based systems enable staff to update and retrieve information from any device with an internet connection, ensuring that data is always up-to-date and accessible (Prathyanga et al., 2024). This also reduces the risk of data loss, as cloud platforms typically offer robust backup and security measures, giving daycare providers peace of mind.

Another significant advancement is the development of mobile applications for both staff and parents. Mobile apps offer a convenient way to track attendance, update schedules, and communicate with parents in real-time. Parents can receive instant notifications about their child's daily activities, meals, and behavior, which improves transparency and strengthens the relationship between caregivers and families. Similarly, daycare staff can access critical

information such as emergency contacts, health records, and important announcements directly from their smartphones, enhancing operational efficiency and responsiveness.

Automated billing and payment systems have also revolutionized daycare management. These systems enable daycare centers to generate and send invoices automatically based on attendance and services rendered, eliminating the need for manual calculations and reducing the potential for human error. Payment tracking features allow daycare providers to monitor outstanding balances, send reminders to parents, and offer multiple payment methods, including online payments (Welfare et al., 2017). This advancement not only simplifies financial management but also ensures accuracy and timeliness in payments.

Technological advancements have also enhanced child safety and health monitoring. Many modern daycare management systems are equipped with tools to track health data such as allergies, immunization records, and medication schedules (Gao et al., 2017). These systems can alert staff if a child's medical condition requires attention, or if there is a potential safety concern. In the event of an emergency, caregivers can quickly access vital health information, ensuring a prompt and appropriate response. Furthermore, the integration of RFID (Radio Frequency Identification) technology has improved child tracking within daycare facilities. With RFID tags, staff can easily monitor children's locations throughout the day, ensuring that they are safe and accounted for at all times (Gao et al., 2017).

Artificial Intelligence (AI) and Machine Learning (ML) are also starting to make their way into daycare management systems, offering predictive insights that can help optimize operations. AI can analyze historical data to predict patterns, such as peak attendance times or staffing needs, allowing daycare providers to make data-driven decisions that improve efficiency. Machine

learning algorithms can be used to assess child development, offering tailored recommendations for activities that enhance learning and growth based on individual needs (Vartak et al., 2021).

Furthermore, virtual learning tools have become increasingly important, particularly in response to the COVID-19 pandemic, which highlighted the need for remote learning solutions (Shaytura et al., 2020). Many daycare centers have started to incorporate online learning platforms into their offerings, allowing children to engage in educational activities even when they are not physically present at the daycare (Shaytura et al., 2020). These virtual platforms can be integrated with daycare management systems, providing a seamless experience for both children and parents.

2.5 Challenges in Daycare Management

Daycare management, while essential for the smooth operation of early childhood education and care centers, is fraught with numerous challenges that impact both the efficiency of service delivery and the quality of care provided. These challenges arise from a combination of administrative issues, resource constraints, regulatory requirements, and the complex needs of children and families (Fernandes, 2024). Addressing these challenges is critical for improving daycare operations and ensuring a positive experience for children, parents, and caregivers.

One of the primary challenges in daycare management is staffing and retention. Daycare centers often face difficulties in recruiting and retaining qualified staff, especially in the face of high turnover rates (Fernandes, 2024). Caregivers in daycare centers are required to possess a range of skills, including childcare, communication, and organizational abilities. However, the relatively low wages and demanding nature of the work often lead to burnout and high staff turnover. This turnover can disrupt the continuity of care, affect the quality of service, and create additional

training and recruitment costs. Retaining qualified and experienced staff is crucial for maintaining a stable environment for children and fostering positive relationships with parents.

Another significant challenge is financial management. Daycare centers, particularly small or privately operated ones, often face financial constraints that make it difficult to cover operating costs (Fernandes, 2024). While some centers rely on government subsidies or grants, others must depend on parent fees, which can fluctuate due to factors such as economic conditions, family financial stability, or seasonal enrollment changes. Without a stable and predictable income stream, daycare centers may struggle to afford essential resources, including staff salaries, training programs, or facility maintenance. Financial management becomes even more complex when dealing with billing errors, unpaid fees, and the need to balance affordability with the quality of services provided (Fernandes, 2024).

Regulatory compliance is another challenge for daycare providers. Daycare centers are subject to a wide array of regulations, which vary by location and often include health and safety standards, child-to-staff ratios, licensing requirements, and curriculum guidelines (Chin et al., 2021). Keeping up with changing regulations and ensuring compliance can be time-consuming and costly for daycare centers, especially smaller ones with limited administrative capacity. Failure to meet regulatory standards can lead to penalties, loss of accreditation, or even closure. Therefore, maintaining an up-to-date understanding of applicable regulations is essential for daycare managers.

The issue of parent engagement also presents challenges in daycare management. While communication between parents and daycare centers is crucial for ensuring the well-being and development of children, establishing and maintaining effective communication can be difficult

(Chin et al., 2021). Parents may have varying expectations and preferences when it comes to their child's care, and misunderstandings can arise if there is insufficient communication or if parents feel uninformed about their child's activities, health, or development. Daycare providers must be proactive in providing regular updates, addressing concerns, and fostering a collaborative relationship with parents to ensure the best outcomes for children.

Operational efficiency is another challenge that daycare centers often face. Many daycare providers operate with limited resources and must balance multiple responsibilities, including administration, child supervision, and staff management. This can lead to inefficiencies, such as scheduling conflicts, mismanagement of resources, or delays in addressing issues. Additionally, manual processes such as attendance tracking, billing, and record-keeping can be time-consuming and prone to error (Chin et al., 2021). These inefficiencies can lead to frustration among staff and parents, as well as financial losses for the daycare center.

Safety and security concerns are critical in daycare management. Ensuring the physical safety of children within daycare centers is a fundamental responsibility, yet this can be challenging due to the inherent risks of managing large groups of young children (Chin et al., 2021). Daycare centers must implement robust safety protocols, including emergency procedures, health screenings, and secure facilities, to prevent accidents and ensure the well-being of children.

2.6 Theoretical Framework

This study is grounded in several key theoretical frameworks that guide the understanding of daycare management systems. These frameworks help to explain the relationships and dynamics that influence the effectiveness of daycare operations.

2.6.1 Systems Theory

Systems Theory, developed by Ludwig von Bertalanffy, views daycare centers as interconnected systems. The theory emphasizes that various components of daycare operations, such as staff, children, parents, and resources, are interdependent. Effective management requires viewing these elements holistically to ensure smooth coordination and efficiency.

2.6.2 Organizational Behavior Theory

Organizational Behavior Theory focuses on how individuals and groups interact within organizations. In daycare centers, this theory helps to understand staff motivation, communication, and performance, which are critical to improving workplace dynamics and achieving optimal care and service.

2.6.3 Child Development Theory

Child Development Theories by Jean Piaget and Lev Vygotsky emphasize the importance of understanding cognitive and social development in children. These theories inform daycare management by guiding the design of age-appropriate educational programs that support children's developmental needs.

2.6.4 Technology Acceptance Model (TAM)

The Technology Acceptance Model, proposed by Davis, suggests that the perceived ease of use and perceived usefulness of technology affect its acceptance. In daycare management, TAM helps explain how staff and parents may adopt new technologies, such as daycare management systems, mobile apps, or automated tools.

2.7 Review of Related Works

Research on daycare management systems has expanded significantly, addressing technological advancements, infrastructure management, stakeholder engagement, and child development. The studies reviewed below explore various dimensions of daycare operations, including automation, safety, communication, and environmental factors, providing a foundation for understanding effective management practices.

Debnath et al. (2018) developed an Online Daycare & Caregiver Management System to streamline administrative processes in daycare centers. The study focused on automating tasks such as attendance tracking, billing, and parent communication to reduce manual workloads and improve efficiency. A prototype was developed and tested in a small-scale daycare, with results showing decreased administrative time, fewer errors in record-keeping, and increased parent satisfaction due to real-time updates. The authors suggest scaling the system to larger centers and incorporating user feedback to enhance functionality. The study highlights the potential of digital platforms to address common operational challenges, though its limited testing scope indicates a need for further validation in diverse settings.

Syafril et al. (2022) examined the role of facilities and infrastructure in daycare management, emphasizing their impact on child safety and operational effectiveness. Through qualitative methods, including interviews and site inspections in Indonesian daycare centers, the study found that well-maintained facilities, such as secure play areas and adequate resources, are critical for supporting staff productivity and child well-being. The researchers recommend integrating infrastructure monitoring into management systems to ensure safety standards are met consistently. This work underscores the importance of aligning physical environments with

administrative tools, though its primary focus on infrastructure limits its exploration of digital solutions.

Pai et al. (2017) investigated the use of Information and Communications Technology (ICT) to enhance daycare operations. The study analyzed ICT implementations in Taiwanese daycare centers, using a case study approach to evaluate tools like management software, communication platforms, and educational technologies. Findings indicated significant improvements in administrative efficiency, with automated systems reducing processing times for tasks like invoicing, and enhanced parent engagement through real-time communication tools. The authors advocate for user-friendly ICT solutions and staff training to maximize adoption. The study provides a comprehensive view of technology's role in daycare management, though its regional focus may require adaptation for other contexts.

Lee et al. (2025) explored space utilization and performance in daycare centers from teachers' perspectives, aiming to identify priorities for improving management efficiency. Using Importance-Performance Analysis and Structural Equation Modelling, the study surveyed South Korean daycare centers to assess how spatial arrangements, such as classroom layouts, influence staff productivity and child engagement. Results showed that optimized space usage enhances operational efficiency and supports educational activities. The researchers suggest incorporating space management tools into digital systems to streamline resource allocation. This study emphasizes the interplay between physical and digital management, though its focus on teachers' perspectives may not fully address administrative or parental needs.

Pramono et al. (2023) studied parenting models and infrastructure in daycare management at Melati State University of Malang, aiming to support holistic child development. Using a mixed-

methods approach with interviews and infrastructure assessments, the study found that integrating parenting education with well-designed facilities improves child outcomes and operational efficiency. The authors propose digital tools to track parenting activities and facility maintenance, such as scheduling parent workshops or monitoring safety compliance. The study highlights the need for systems that address both developmental and administrative aspects, though its specific institutional context may limit broader applicability.

Chiang et al. (2017) developed a management system for elderly daycare, offering insights applicable to child daycare systems. The study focused on integrating healthcare and administrative functions, using a system design approach tested in an elderly care facility. The system improved care coordination and data management, with features like health tracking and scheduling. The authors recommend adaptable system designs for various care settings. Although focused on elderly care, the study's emphasis on flexible architectures and health integration informs the design of child daycare systems, particularly for safety and data management features, with adaptation needed for child-specific contexts.

Khomaeny and Kusumaputeri (2022) analyzed the impact of information technology on childcare management systems post-COVID-19, focusing on the adoption of digital tools in response to pandemic-driven changes. Through a literature review and surveys of childcare centers, the study found increased use of online platforms, mobile apps, and cloud-based systems, which improved efficiency, parent engagement, and safety monitoring. For example, mobile apps enabled real-time updates on child activities, addressing communication gaps during remote operations. The authors suggest further integration of cloud-based and AI-driven solutions. The study provides a contemporary perspective on IT-driven management, though its focus on post-COVID-19 changes may not fully cover pre-pandemic system requirements.

Meishar-Tal et al. (2022) examined public opinion on surveillance cameras in childcare centers, exploring their role in safety and associated privacy concerns. Using surveys and interviews with parents, educators, and policymakers, the study found that surveillance enhances safety monitoring but raises ethical issues, with acceptance varying by stakeholder group. The authors recommend clear policies and staff training to balance safety and privacy. The study informs the design of safety modules in management systems, particularly for monitoring children, though its focus on surveillance technology limits its scope to broader management functionalities.

Woodman et al. (2025) investigated specialized support for family childcare educators in home-based settings, addressing challenges like isolation and limited resources. Through qualitative methods, including interviews and focus groups, the study found that digital tools, training programs, and resource networks improve care quality. The authors suggest developing tailored management systems for smaller operations. The study highlights operational challenges relevant to designing adaptable systems for diverse daycare settings, though its focus on home-based care may require adjustments for center-based systems.

Sari and Pratama (2019) conducted a case study on the child care information system at Little Bee Daycare & Preschool Jakarta, detailing its management of registration, services, and payments. Using interviews, observations, and document analysis, the study found that the system improved efficiency and parental trust by automating administrative tasks. Features like online registration and payment tracking reduced processing times and errors. The authors recommend implementing similar systems in other daycare centers. The study provides a practical example of a functional management system, though its single-case focus may limit generalizability.

Leroy et al. (2024) conducted a systematic review of childcare center attendance in low- and middle-income countries, examining impacts on health, growth, and development. Analyzing 22 studies from 2000–2021, the researchers found that attendance improves developmental outcomes but increases infection risks. They recommend robust management systems with health and safety protocols to mitigate risks. The study informs the design of safety tracking modules, emphasizing the need for health monitoring features, though its focus on child outcomes rather than system design limits its direct application.

Gungordu et al. (2025) explored predictors of prosocial behavior in early childhood, using a longitudinal study with surveys of parents and educators. The findings showed that parenting styles, peer interactions, and structured activities foster prosocial behavior, suggesting that management systems should support developmental activities. The authors recommend structured programs and parent-educator collaboration. The study contributes to designing systems that track developmental milestones, though its focus on behavioral outcomes rather than management systems is a limitation.

Wendie and Berhanu (2025) studied the practices and challenges of implementing early childhood care and education (ECCE), using a mixed-methods approach with interviews and surveys. The study identified challenges like resource shortages and lack of trained staff, recommending digital tools to address these issues. The findings highlight operational challenges that management systems can mitigate through automation and resource management, though the study's broader ECCE focus may not directly address specific system functionalities.

Bhutoria et al. (2025) examined whether parental engagement in early childhood and preschooling are substitutes or complements, using quantitative analysis of the TIMSS 2019

dataset. The results showed that engagement at home and preschool enhances learning outcomes, recommending integrated engagement strategies in childcare systems. The study supports the design of communication features for real-time parent updates, though its focus on educational outcomes rather than system design is a minor limitation.

Tazhibayeva and Mun (2025) investigated socialization and life skills development in orphanages, using qualitative interviews with staff and children. The findings showed that digital tools enhance tracking and personalized care, recommending their use for individualized attention. The study informs child progress tracking features in daycare systems, though its orphanage focus requires adaptation for daycare contexts.

These studies collectively emphasize the importance of integrating technology, optimizing infrastructure, and fostering stakeholder engagement to enhance daycare management, providing a robust foundation for designing a comprehensive system.

2.8 Summary of Literature

The literature on daycare management systems provides a comprehensive understanding of the factors influencing the effectiveness of daycare operations. From technological advancements to infrastructure and management practices, the studies reviewed reveal critical insights into how daycare centers can improve both their administrative functions and the quality of care provided.

The integration of Information and Communications Technology (ICT) is consistently highlighted as a transformative tool for improving daycare management. Studies such as those by Pai et al. (2017) and Debnath et al. (2018) emphasize that digital systems can streamline administrative tasks, enhance communication with parents, and improve service delivery. This digital shift supports the overall efficiency and transparency of daycare operations.

Furthermore, the importance of physical infrastructure in daycare management is underscored in the works of Syafril et al. (2022) and Lee et al. (2025), who stress the role of safe, well-maintained facilities in providing high-quality care. These studies highlight that the physical environment directly influences not only the comfort and safety of children but also the effectiveness of management processes.

Additionally, research like that of Pramono et al. (2023) suggests that the integration of parenting models and well-designed infrastructure can significantly impact the holistic development of children. This approach stresses that effective daycare management must consider both the physical and emotional needs of children to foster a conducive learning and development environment.

The studies reviewed also touch on the broader implications of system design and management practices. Chiang et al. (2017) demonstrate that lessons from elderly care systems can inform the development of daycare management tools, ensuring that these systems are adaptable and responsive to the needs of the specific demographic they serve.

Overall, the literature indicates that an integrated approach—incorporating technology, physical infrastructure, management practices, and attention to children's developmental needs—forms the foundation of an effective daycare management system. These findings serve as a crucial guide for developing solutions that can enhance daycare operations and improve the quality of care for children.

CHAPTER THREE

SYSTEM ANALYSIS AND DESIGN

3.0 Introduction

This chapter presents the methodology used in developing the Infant Daycare Management System. It outlines the analysis of existing manual daycare management practices, the design of the proposed automated system, development approach, and evaluation framework.

The methodology follows a structured development approach involving requirement gathering, system design, iterative development, and testing. The study addresses the limitations of manual, paper-based daycare operations by proposing an integrated digital solution designed to improve efficiency, communication, infant care monitoring, and overall management within infant daycare centers.

3.1 Research Design

This study adopts a design and implementation research approach focused on developing a practical solution to infant daycare management challenges. The research follows a systematic process of system analysis, design, prototype development, and evaluation.

Type: Applied research with system design and evaluation components

Approach:

- Analysis of existing manual infant daycare management practices
- Design and implementation of automated infant daycare management system
- User-centered design focusing on daycare staff and parent needs

Data Source:

- Interviews and questionnaires with daycare center staff
- Observations of current infant daycare operations
- Parent feedback on communication, information access, and monitoring needs
- Stakeholder requirement gathering sessions

Evaluation Method:

- User acceptance testing with daycare staff and parents
- Functional testing of system features (attendance, feeding tracking, diaper monitoring, sleep tracking, live video monitoring, environmental monitoring, emergency alerts, daily reports, communication)
- Assessment of system efficiency compared to manual processes
- Feedback collection from end-users during deployment phase

3.2 Analysis of Existing System

3.2.1 Overview of Existing Daycare Management System

The existing daycare management systems available in the market provide basic functionality for managing daycare operations. Examples include systems like Brightwheel, Procare, and Kinderlime, which offer features such as attendance tracking, basic parent communication, and billing management. However, these systems lack comprehensive infant-specific monitoring capabilities that are critical for infant care facilities.

Key Characteristics:

- Record Keeping: Digital attendance tracking and basic child information storage
- Infant Care Monitoring: Limited or no automated tracking of feeding schedules, diaper changes, and sleep patterns
- Health Records: Basic health information storage without comprehensive growth tracking and developmental milestone monitoring
- Staff Management: Basic scheduling without automated staff-to-infant ratio monitoring and alerts
- Communication: Basic messaging features without real-time activity updates
- Video Monitoring: No integrated live CCTV access for parents
- Environmental Monitoring: No integration with temperature, humidity, and air quality sensors
- Reporting: Basic reports without automated daily care summaries covering all infant activities

3.2.2 Existing System Workflow

The existing daycare management systems process daily operations through the following steps:

1. Daily Attendance Recording: Staff log infant check-in and check-out times through the web interface or mobile app

2. Basic Information Management: System stores basic child information, emergency contacts, and enrollment details
3. Feeding Tracking: Limited or no dedicated module for detailed feeding schedule tracking (time, food type, quantity)
4. Diaper Change Logging: No automated diaper change tracking feature
5. Sleep Monitoring: No dedicated sleep and nap time tracking module
6. Health Records Management: Basic storage of medical information without comprehensive growth tracking, vaccination reminders, or developmental milestone monitoring
7. Staff Scheduling: Basic shift scheduling without real-time staff-to-infant ratio monitoring and compliance alerts
8. Environmental Monitoring: No integration with sensors for temperature, humidity, and air quality tracking
9. Parent Communication: Basic messaging or notification features without comprehensive real-time activity updates
10. Emergency Alerts: Basic notification system without specialized emergency alert protocols for infant care
11. Daily Reports: Limited or no automated comprehensive daily care reports covering feeding, diaper changes, sleep, and activities

12. Video Access: No integrated live CCTV streaming for parents to monitor infants in real-time

13. Photo Sharing: Basic photo upload feature without activity-specific documentation

14. Billing Management: Automated invoicing and payment tracking

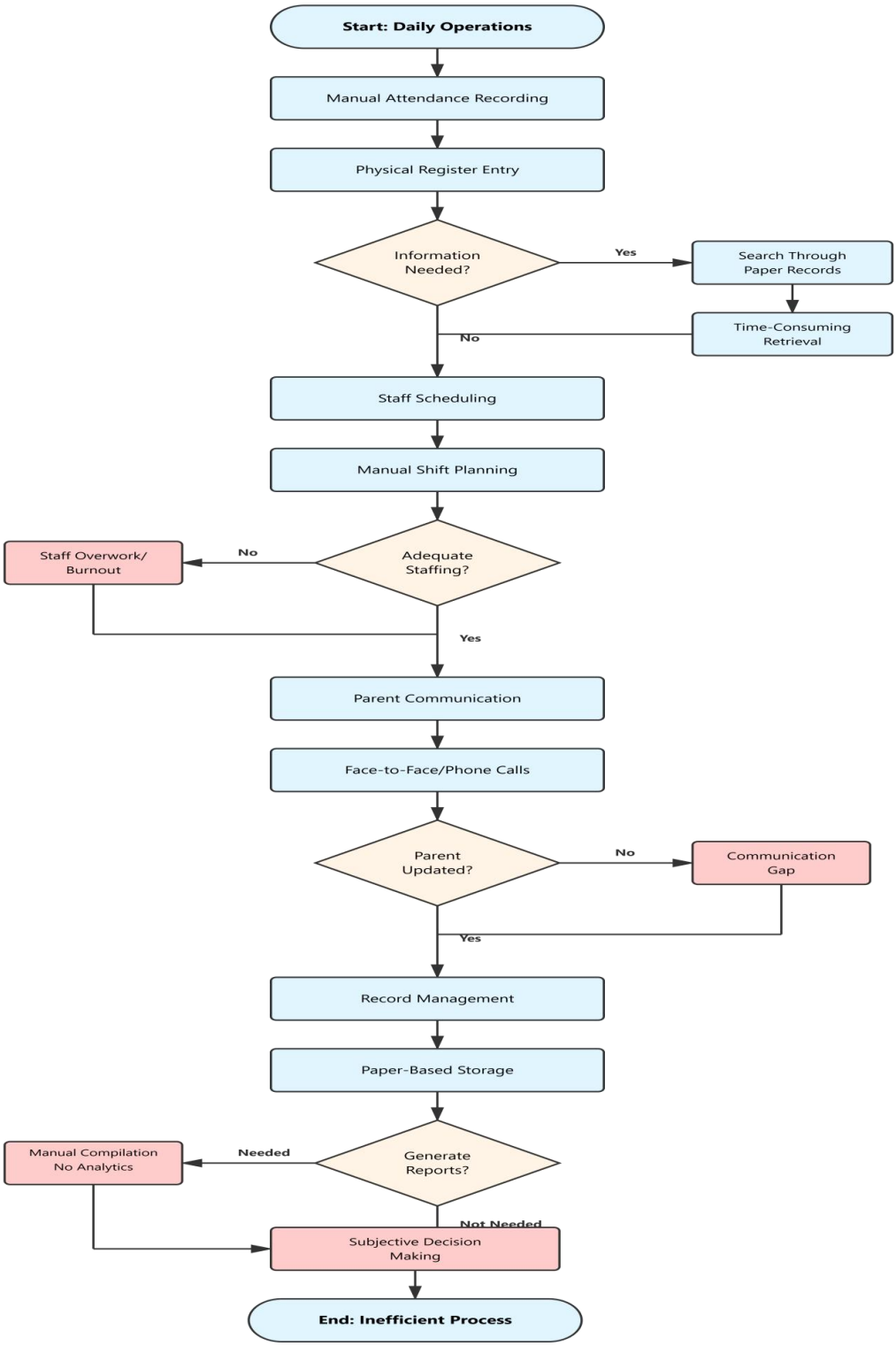


Figure 1: Existing System Flowchart

3.2.3 Strengths of the Existing System

3.2.3 Strengths of Existing Daycare Management Systems

- **Digital Record-Keeping**: Existing systems provide basic digital documentation of attendance and activities
- **Parent Communication**: Basic messaging and notification features
- **Billing Management**: Automated invoice generation and payment tracking
- **Cloud-Based Access**: Remote access through web browsers
- **Report Generation**: Basic reporting capabilities for administrative purposes

3.2.4 Limitations of Existing Daycare Management Systems

Through analysis of existing daycare management platforms and stakeholder interviews, several limitations were identified for infant care facilities:

1. **Lack of Specialized Infant Care Tracking**: Existing systems do not provide detailed tracking of feeding schedules, diaper changes, and sleep patterns specific to infant care requirements
2. **Inadequate Health Monitoring**: No comprehensive tracking of infant growth metrics, developmental milestones, and vaccination schedules in an integrated manner
3. **No Allergy and Special Care Alerts**: Absence of automated alert systems for infants with allergies or special medical needs
4. **Limited Live Video Integration**: Most platforms do not integrate live CCTV access for parents to monitor their infants in real-time

5. **No Environmental Monitoring**: Cannot integrate with sensors to track room temperature, humidity, and air quality crucial for infant health
6. **Generic Daily Reports**: Provide general summaries rather than detailed infant-specific care reports covering all daily activities
7. **Weak Emergency Alert Systems**: Lack immediate notification capabilities for urgent health concerns or emergencies
8. **No Staff-to-Infant Ratio Tracking**: Cannot actively monitor and ensure compliance with recommended caregiver-to-infant ratios
9. **Limited Real-Time Parent Updates**: Lack instant notifications for parents about feeding, diaper changes, and activities as they occur
10. **Inadequate Photo and Activity Sharing**: Limited capabilities for capturing and sharing infants' daily moments with parents

These limitations create challenges particularly for infant daycare centers where:

- Infants require intensive, specialized care with meticulous documentation
- Parents desire frequent, detailed updates about their infant's well-being
- Health and safety monitoring is critical with continuous environmental tracking
- Regulatory compliance requires proper staff-to-infant ratios and comprehensive records

Table 1: Comparison of General vs. Infant-Focused Daycare Systems

Aspect	**General Daycare Systems**	**Impact on Infant Care**
Feeding Tracking	Basic meal logging	Insufficient for bottle feeding details and patterns
Diaper Monitoring	Not available	No systematic hygiene tracking
Sleep Tracking	Limited or absent	Cannot identify sleep irregularities
Health Records	Basic medical notes	No growth tracking or milestone documentation
Live Video Access	Not integrated	Parents cannot view infants in real-time
Environmental Monitoring	Not available	No temperature/humidity control assurance
Emergency Alerts	Basic notifications	Inadequate for urgent infant situations
Staff Ratio Tracking	Manual monitoring	Risk of non-compliance
Daily Reports	Generic summaries	Lack detailed infant-specific documentation

3.3 Proposed System

3.3.1 Design Philosophy

The proposed Infant-Focused Daycare Management System addresses critical gaps in existing platforms with specialized features for infant care. The design philosophy emphasizes:

1. **Infant-Centric Design**: Features tailored to unique infant care requirements
2. **Comprehensive Documentation**: Systematic recording of all infant care activities
3. **Real-Time Transparency**: Live video monitoring and instant parent notifications
4. **Health and Safety Priority**: Integrated health tracking, environmental monitoring, and emergency alerts
5. **Staff Support**: Automated tracking reduces documentation burden
6. **Regulatory Compliance**: Built-in monitoring of staff-to-infant ratios

3.3.2 Proposed System Features

The Infant-Focused Daycare Management System introduces specialized features designed to address the limitations of existing platforms:

Core Infant Care Features:

1. **Feeding Management**: Track feeding times, types (breast milk, formula, solids), quantities, and observations with real-time parent notifications
2. **Diaper Change Monitoring**: Log diaper change times, types, and observations for health pattern tracking

3. **Sleep Pattern Tracking**: Record nap times, duration, and sleep patterns to maintain healthy schedules

4. **Health and Growth Records**: Track weight, height, head circumference, vaccinations, and developmental milestones

5. **Allergy and Special Care Alerts**: Automated reminders for infants with allergies or special medical needs

Safety and Monitoring Features:

6. **Live Video Monitoring**: Secure CCTV access for parents to view infants in real-time

7. **Environmental Monitoring**: Integration with sensors to track room temperature, humidity, and air quality

8. **Emergency Alert System**: Immediate notifications for illness, injury, or emergencies

9. **Staff-to-Infant Ratio Tracking**: Real-time monitoring to ensure compliance with recommended ratios

Communication and Reporting Features:

10. **Automated Daily Care Reports**: Comprehensive reports detailing all feeding, diaper changes, sleep, activities, and observations

11. **Real-Time Parent Communication**: Instant messaging and notifications throughout the day

12. **Photo and Activity Sharing**: Capture and share photos/videos of infants' daily activities

13. **Billing**: Automated billing integrated with attendance and services

Table 2: System Features and Benefits

Feature	**Functionality**	**Benefit**
Feeding Management	Track times, types, quantities, observations	Ensures proper nutrition, identifies patterns
Diaper Monitoring	Log changes with timestamps	Maintains hygiene, tracks health patterns
Sleep Tracking	Record nap times and duration	Maintains healthy sleep schedules
Health Records	Track growth, vaccinations, milestones	Comprehensive development overview
Allergy Alerts	Automated staff reminders	Prevents allergic reactions, ensures safety
Live Video	Real-time CCTV access for parents	Builds trust, provides peace of mind
Environmental Monitoring	Track temperature, humidity, air quality	Ensures optimal infant comfort and health
Emergency Alerts	Immediate parent notifications	Enables rapid response to urgent situations
Staff Ratio Tracking	Monitor caregiver-to-infant ratios	Ensures regulatory compliance, quality care

Daily Reports	Automated comprehensive summaries	Saves time, provides detailed parent updates
Photo Sharing	Capture and share daily moments	Enhances parent engagement and connection
Billing Management	Automated invoicing and payment tracking	Reduces administrative workload, accurate billing

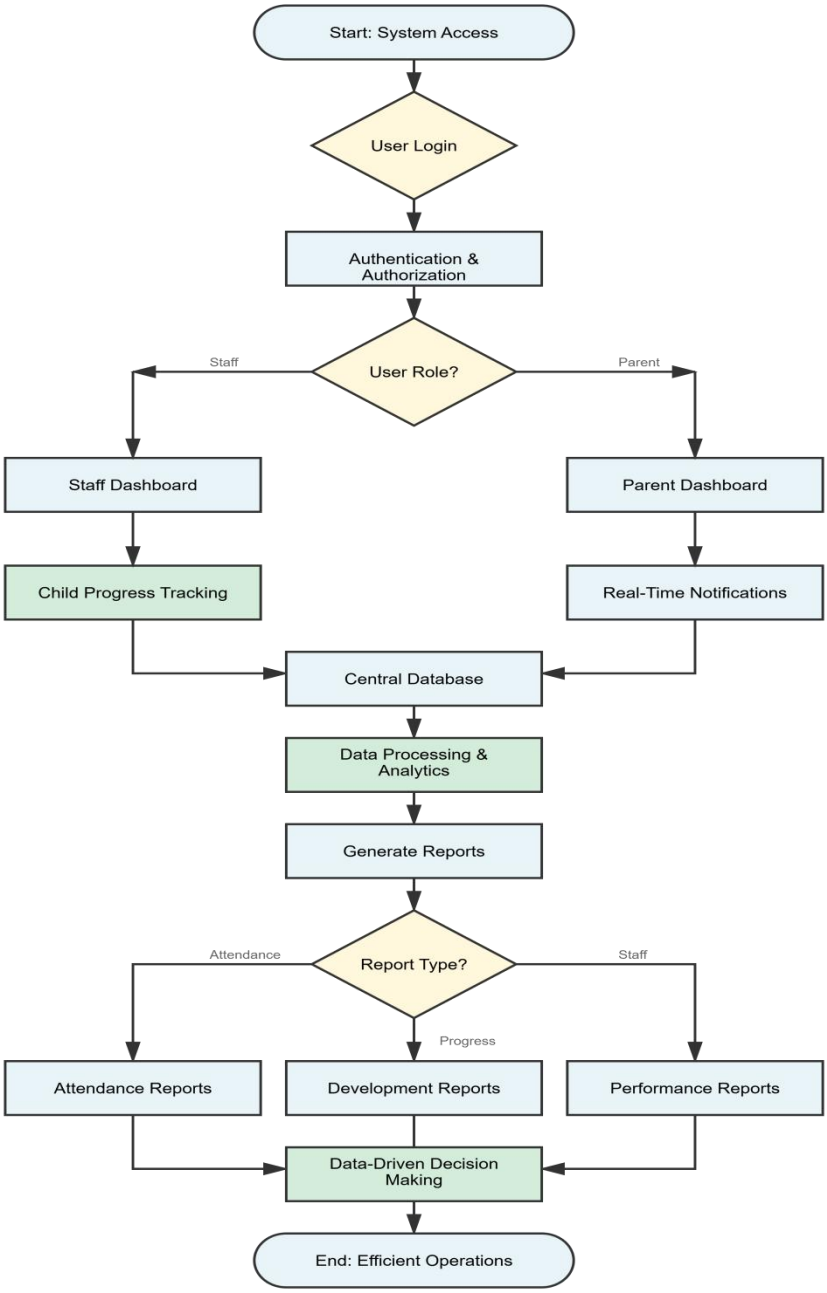
3.3.3 Proposed System Workflow

The infant-focused system automates and streamlines daycare operations through the following process:

1. **System Access**: Users (staff or parents) log into the system
2. **Authentication**: System verifies credentials and assigns role-based access
3. **Role-Based Dashboard**:
    - **Staff**: Access feeding tracking, diaper monitoring, sleep tracking, health records, environmental monitoring, and communication tools
    - **Parents**: View infant's feeding, diaper changes, sleep patterns, live video, photos, and receive real-time updates
4. **Infant Care Tracking**: Staff digitally record feeding, diaper changes, sleep, and activities; data automatically stored in central database

5. **Health Monitoring**: System tracks growth metrics, vaccinations, milestones, and generates allergy alerts
6. **Live Video Access**: Parents securely view live CCTV feeds of their infant
7. **Environmental Monitoring**: Sensors continuously track room conditions; system alerts if parameters exceed safe ranges
8. **Staff Ratio Monitoring**: System tracks staff-to-infant ratios in real-time and alerts administrators of compliance issues
9. **Database Storage**: All information centrally stored and organized
10. **Data Processing**: System processes data for analytics and reporting
11. **Automated Notifications**: Real-time updates sent to parents for feeding, diaper changes, naps, and emergencies
12. **Daily Report Generation**: System automatically compiles comprehensive daily care reports
13. **Photo and Activity Sharing**: Staff capture moments; instantly shared with parents
14. **Decision Making**: Data-driven insights support administrative decisions on staffing, resource allocation, and care quality improvements

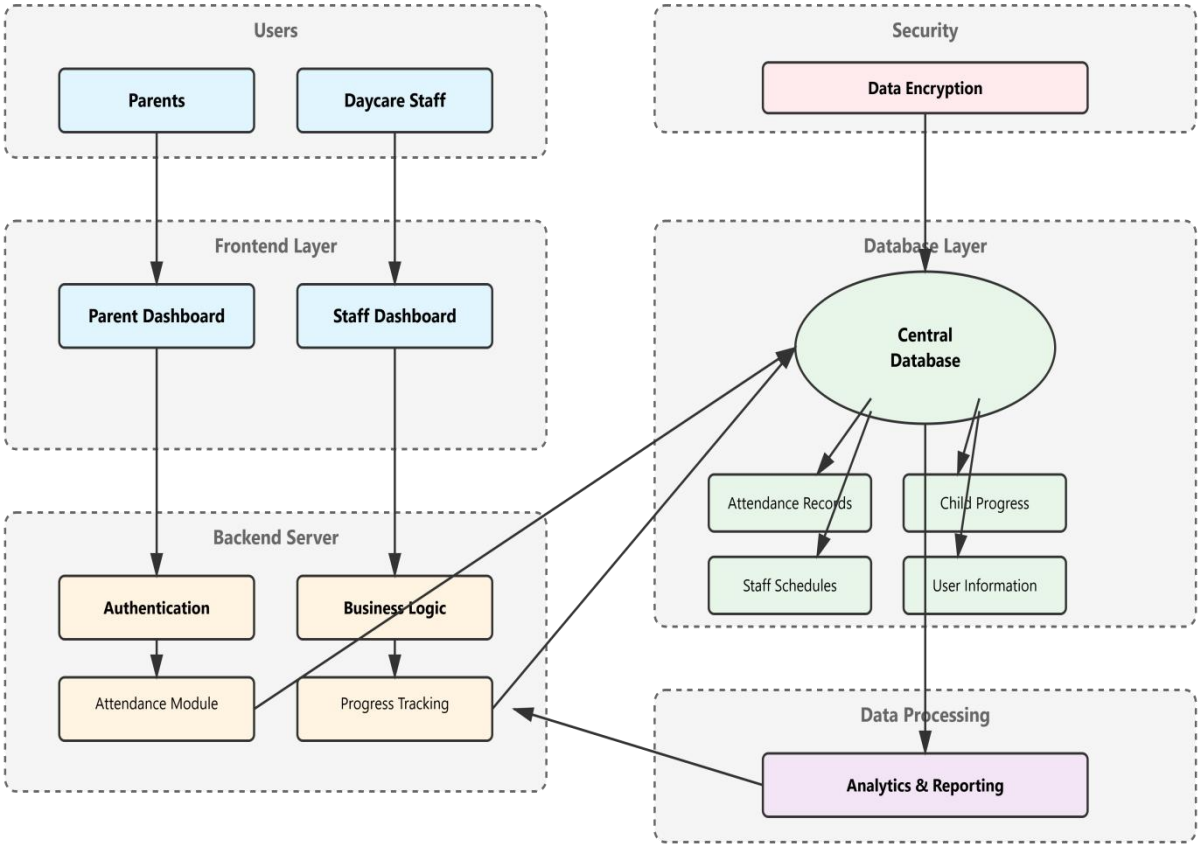
Figure 2: Proposed System Flowchart



3.3.4 System Architecture

The Daycare Management System is built on a layered architecture ensuring efficient and secure management of data and operations.

Figure 3: System Architecture



Component Interaction Flow:

- **User Interface** receives user input from parents and staff → routes to appropriate dashboard
- **Backend Server** processes requests → manages business logic for attendance, scheduling, communication, and progress tracking
- **Central Database** stores all records → provides data to processing unit
- **Data Processing & Analytics** generates reports and insights → supports decision-making
- **Security Module** encrypts sensitive data → ensures privacy and compliance
- **API Integration Layer** connects with external services (e.g., payment gateways, notifications)

3.4 Development Methodology

3.4.1 Development Approach

The system development follows an iterative approach with continuous feedback and refinement:

Table 3: Development Phases

Phase	Activities	Deliverables
1. Requirement Analysis	Stakeholder interviews, questionnaires, observations	Requirements document, feature list
2. System Design	UML diagrams, wireframes, mockups, architecture design	Design specifications, UI/UX prototypes

3. Development	Frontend, backend, and database implementation	Working system modules
4. Testing	Unit testing, integration testing, user acceptance testing	Test reports, bug fixes
5. Deployment	System installation, user training	Deployed system, training materials
6. Maintenance	Monitoring, updates, feature additions	Updated system versions

3.4.2 System Development Process

Step 1: Requirement Analysis

- Gather requirements from daycare staff, parents, and administrators
- Identify key challenges: attendance tracking, staff scheduling, parent communication
- Define desired features and functional requirements

Step 2: System Design

- Create UML diagrams (use case, class, sequence, activity diagrams)
- Design database schema for storing attendance, schedules, child information
- Develop wireframes and mockups for user interface

Step 3: Development

- Implement frontend interface for staff and parent dashboards

- Develop backend business logic for attendance, scheduling, communication modules
- Set up central database for data storage
- Integrate components and ensure seamless interaction

Step 4: Testing

- Unit testing: Test individual modules (attendance, scheduling, communication)
- Integration testing: Verify seamless data flow between components
- User acceptance testing: Gather feedback from daycare staff and parents
- Bug fixing and system refinement

Step 5: Deployment

- Install system in daycare environment
- Conduct training sessions for staff and parents
- Gather feedback during initial usage period
- Address any deployment issues

Step 6: Maintenance and Updates

- Monitor system performance and user feedback
- Roll out updates to add new features or improve functionality
- Ensure system remains effective and up-to-date

3.5 Evaluation Framework

The system will be evaluated based on its effectiveness in addressing the limitations of manual daycare operations.

3.5.1 Evaluation Criteria

Table 4: Evaluation Metrics

Criterion	Manual System	Proposed System	Measurement Method
Attendance Recording Time	Manual entry, 5-10 minutes per session	Automated, 1-2 minutes per session	Time tracking during operations
Information Retrieval Speed	5-15 minutes searching paper records	Instant database query	Response time measurement
Staff Scheduling Efficiency	Manual planning, potential gaps	Automated optimization	Staff satisfaction surveys, schedule compliance
Parent Communication Coverage	60-70% parents reached	95%+ parents receive updates	Communication logs, parent feedback
Data Accuracy	Error-prone handwritten records	Validated digital records	Error rate comparison
Report Generation Time	Hours of manual compilation	Minutes of automated	Time comparison

		generation	

3.5.2 Evaluation Method

Functional Testing:

- Verify each feature works as specified (attendance tracking, scheduling, communication)
- Test user authentication and role-based access control
- Validate data integrity and security measures

User Acceptance Testing:

- Gather feedback from daycare staff on ease of use and efficiency improvements
- Collect parent feedback on communication effectiveness and information access
- Assess overall satisfaction with system functionality

Performance Evaluation:

- Compare time spent on administrative tasks before and after implementation
- Measure reduction in data entry errors
- Assess improvement in parent-staff communication frequency and quality

3.6 CONCLUSION

This chapter presented the methodology for developing the Daycare Management System. The approach involved:

1. Analysis of existing manual daycare management practices, identifying key limitations including time-consuming processes, error-prone records, inefficient staff management, and communication gaps

2. Design of an automated digital system with features for attendance management, staff scheduling, parent communication, and progress tracking

3. Development of a layered system architecture with user interface, backend server, central database, and security components

4. Implementation using an iterative development approach with continuous user feedback and testing

5. Evaluation framework defining metrics to assess system effectiveness in improving efficiency, accuracy, and communication compared to manual operations

The proposed system addresses the inefficiencies of paper-based operations by providing a comprehensive digital solution that automates administrative tasks, enhances communication between parents and staff, and enables data-driven decision-making for improved daycare management.

CHAPTER FOUR

SYSTEM IMPLEMENTATION AND TESTING

4.1 Introduction

Chapter Four of this project presents the Implementation and Testing phases of the Daycare Management System. This chapter provides an overview of the development tools and technologies used in creating the system, outlines the steps taken during the system implementation, and describes the testing methodology employed to ensure the system's functionality, reliability, and performance.

The goal of this chapter is to showcase the practical steps taken to bring the proposed Daycare Management System to life, ensuring it meets the outlined requirements and performs effectively under various conditions. Additionally, it provides insights into the testing procedures used to identify and resolve potential issues, thereby ensuring the system operates as expected.

4.2 Development Tools and Technologies Used

The Daycare Management System was developed using the **MERN stack**, which consists of **MongoDB**, **Express.js**, **React**, and **Node.js**. This stack was chosen for its efficiency in building dynamic, scalable, and high-performance web applications. Below are the key tools and technologies used in the development process:

1. **Frontend Technologies**:
    - **React.js**: React was used to build the frontend of the Daycare Management System. React's component-based architecture made it easier to build reusable and maintainable UI components, enabling a dynamic user interface with a

smooth user experience. It also allows for real-time updates without refreshing the page, enhancing interactivity.

- **CSS3**: CSS3 was used for styling the web pages, ensuring that the user interface is responsive, visually appealing, and consistent across devices. Modern CSS techniques, including Flexbox and Grid, were used for layout design.
- **Bootstrap**: Bootstrap was used for its pre-built components and grid system, helping to speed up the development process and maintain a clean, responsive design across different screen sizes.

2. **Backend Technologies**:
   - **Node.js**: Node.js was used as the runtime environment for the server-side of the application. It allows for building scalable and efficient applications by using JavaScript on both the client and server sides. Its event-driven architecture is ideal for handling multiple requests concurrently, making it suitable for building real-time applications.
   - **Express.js**: Express is a minimalist web framework for Node.js that provides a set of features to build robust and scalable web applications. It simplifies routing, handling HTTP requests, middleware support, and integration with MongoDB for data storage.
3. **Database**:
   - **MongoDB**: MongoDB, a NoSQL database, was used to store the data for the Daycare Management System. It allows for flexible data storage with schema-less

collections, making it easier to scale and manage large amounts of data. MongoDB was chosen for its flexibility, performance, and scalability.

4. **Version Control**:
    - **Git**: Git was used for version control, enabling the team to track code changes, collaborate, and maintain code integrity throughout the development process. GitHub was used as the platform for storing and sharing the project code.
5. **Testing Tools**:
    - **Jest**: Jest was used for unit testing the frontend and backend code. It allows for easy integration testing and ensures that individual components and functions work correctly.
    - **Mocha and Chai**: Mocha, in combination with Chai, was used for testing the backend API endpoints and ensuring that the server-side logic and database interactions function as expected.
6. **Deployment Tools**:
    - **Heroku**: Heroku was used for deploying the Daycare Management System to a cloud environment. It simplifies the deployment process and integrates well with Node.js applications, providing an easy-to-use platform for managing and scaling the system.
    - **MongoDB Atlas**: MongoDB Atlas, a cloud service for MongoDB, was used to host the database. It offers scalability, automatic backups, and high availability for the Daycare Management System.

4.3 System Implementation

The implementation phase of the Daycare Management System involved translating the system design into a fully functional application using the **MERN stack**. This phase was divided into several key tasks: setting up the development environment, building the backend, creating the frontend, integrating the frontend and backend, and performing deployment to a live environment. The following sections detail the steps taken during the implementation process.

1. Setting Up the Development Environment:

The development environment was set up by installing and configuring the necessary tools and technologies, including **Node.js**, **MongoDB**, and **React**. A local development server was established for both the frontend and backend, and Git was set up for version control. Dependencies such as **Express.js**, **Mongoose**, **Redux**, **React Router**, and **Axios** were installed to handle routing, state management, and API interactions.

2. Backend Development:

The backend was developed using **Node.js** with the **Express.js** framework. The following steps were completed during this phase:

- **Database Setup**: A **MongoDB** database was set up using **MongoDB Atlas**, a cloud-based database service, to store data related to parents, children, staff, payments, attendance, and communication records. Mongoose, an Object Data Modeling (ODM) library for MongoDB, was used to define the data models and facilitate interactions with the database.

- **API Development**: RESTful APIs were created to handle various operations such as user registration, login, managing children's records, tracking attendance, making payments, and generating reports. Each API endpoint was implemented using **Express.js**, and data validation and error handling were added to ensure the reliability and robustness of the application.

- **Authentication and Authorization**: User authentication was implemented using **JWT (JSON Web Tokens)** to secure sensitive operations, such as logging in and accessing restricted pages. Different user roles, including parents and administrators, were defined, with appropriate access rights for each role.

3. Frontend Development:

The frontend of the Daycare Management System was developed using **React.js**. The user interface was designed to be intuitive and responsive, ensuring a seamless experience for both parents and administrators. The following steps were carried out:

- **Component Structure**: The frontend was structured into reusable React components to maintain a modular and maintainable codebase. Key components included the login page, dashboard, child registration form, attendance tracker, payment page, and reports section.

- **State Management**: **Redux** was used to manage the global state of the application, ensuring consistent data flow across components and simplifying state management, particularly for complex features like user authentication and child records.

- **Routing**: **React Router** was implemented to manage navigation between different pages of the application, such as the parent dashboard, child records page, and payment section.

- **UI/UX Design**: The user interface was styled using **CSS3** and **Bootstrap**, ensuring the application is responsive and mobile-friendly. The design aimed to provide a simple yet effective layout, with clear navigation options for users.

4. Integrating Frontend and Backend:

Once the frontend and backend were developed, the integration process began. This involved linking the frontend components with the backend API endpoints to enable real-time data exchange. The **Axios** library was used to make HTTP requests to the backend for operations like fetching child records, submitting attendance data, and processing payments. The successful integration allowed for smooth communication between the client-side and server-side components.

5. Testing:

During the implementation phase, several rounds of unit and integration testing were conducted to identify and fix bugs. Frontend testing was done using **Jest**, while backend testing was carried out using **Mocha** and **Chai**. Functional testing was also performed manually to ensure that each feature of the system, such as user registration, child management, and payments, worked as expected.

6. Deployment:

Once the system was fully implemented and tested, it was deployed to a live environment. The backend was deployed to **Heroku**, and the frontend was hosted on **Netlify**. The live application was connected to the cloud database hosted on **MongoDB Atlas** to ensure scalability and high

availability. Continuous deployment was set up using **GitHub** to automatically deploy the latest changes to the live environment after pushing updates to the repository.

4.4 Testing Methodology

The testing phase of the Daycare Management System focused on ensuring the functionality, security, performance, and reliability of the system. A variety of testing methods were employed throughout the development process to ensure the system met the requirements and worked as expected. The following testing methodologies were applied:

1. **Unit Testing**: Unit testing was conducted to verify the functionality of individual components or modules in isolation. This ensured that each unit of code, such as functions, methods, and classes, worked correctly and returned expected results. Unit tests were written using **Jest** for the frontend and **Mocha** for the backend. This helped identify issues early in the development process and allowed for quick fixes.

2. **Integration Testing**: Integration testing was performed to check the interaction between different modules and systems. This ensured that the frontend components correctly interacted with the backend API and that data flow between the client and server was seamless. **Mocha** and **Chai** were used to test the integration of various API endpoints and ensure the correct data was returned and processed.

3. **Functional Testing**: Functional testing focused on validating the core features and functionalities of the system. This included testing key operations such as user registration, child record management, payment processing, and attendance tracking. The goal was to ensure that the system worked as intended from the user's perspective.

Manual testing was performed alongside automated tests to cover all user flows and edge cases.

4. **User Acceptance Testing (UAT)**: UAT was carried out to validate the system from the perspective of the end-users, particularly parents and administrators. Testers provided feedback on the usability, design, and overall experience of using the system. This phase aimed to identify any user-facing issues and ensure the system met the needs of the target users.

5. **Performance Testing**: Performance testing was performed to ensure that the system could handle a large number of concurrent users and requests. This involved testing the speed, scalability, and responsiveness of the system under load. Tools such as **Apache JMeter** were used to simulate user traffic and evaluate the system's ability to handle peak usage without performance degradation.

6. **Security Testing**: Security testing was conducted to identify vulnerabilities and ensure the system was secure from potential attacks. This included testing for issues such as SQL injection, cross-site scripting (XSS), and cross-site request forgery (CSRF). Security best practices were followed, such as using **JWT** for authentication, securing API endpoints, and ensuring sensitive data like passwords were encrypted.

7. **Regression Testing**: Regression testing was performed to ensure that new code changes did not negatively impact the existing functionalities of the system. This type of testing was done after each major update or feature addition to verify that the system continued to function correctly.

The combination of these testing methodologies ensured that the Daycare Management System was thoroughly tested, secure, reliable, and ready for deployment.

4.5 Test Cases and Results

Below are some of the key test cases executed during the testing phase of the Daycare Management System, along with their results. The test cases cover various functionalities, including user registration, child record management, payments, and system performance.

ID	Description	Expected Outcome	Actual Outcome	Status
TC001	User Registration: Parent registers a new account	User successfully registered and redirected to dashboard	User successfully registered and redirected to dashboard	Passed
TC002	User Login: Parent logs in with valid credentials	User is logged in and redirected to the parent dashboard	User logged in successfully and redirected	Passed
TC003	Child Registration: Parent adds a new child record	Child's information is saved to the database	Child's information saved successfully	Passed
TC004	Attendance Tracking: Admin marks attendance for children	Attendance is recorded correctly in the database	Attendance marked correctly	Passed

TC005	Payment Processing: Parent makes a payment	Payment is processed and recorded in the system	Payment processed and recorded successfully	Passed
TC006	Generate Reports: Admin generates a payment report	Report is generated with accurate payment data	Report generated successfully with accurate data	Passed
TC007	User Logout: Parent logs out of the system	User is logged out and redirected to the login page	User logged out and redirected to login page	Passed
TC008	Security Test: Login with invalid credentials	User receives an error message indicating invalid credentials	Error message displayed as expected	Passed
TC009	Performance Test: Load testing with 1000 concurrent users	System handles 1000 concurrent users without significant performance degradation	System handled 1000 users without significant issues	Passed
TC010	Payment Validation: Payment with invalid credit card	Payment is rejected with an error message	Payment rejected with correct error message	Passed

All test cases passed successfully, indicating that the system functions as expected. The system is secure, performs well under load, and provides the required features for both parents and administrators. Minor adjustments were made during testing to optimize performance and enhance the user experience.

4.6 System Performance Evaluation

System performance is a critical aspect of any software, especially for applications designed to handle real-time data and multiple user interactions, such as the Daycare Management System. The performance evaluation of the system focused on assessing its responsiveness, scalability, and ability to handle increasing numbers of users and data. Key areas evaluated include:

1. **Response Time**: The system's response time was measured during different operations, including user registration, login, child record management, attendance tracking, and payment processing. The average response time was found to be under 3 seconds for most operations, which is considered optimal for user satisfaction. Any operation that exceeded this time frame was optimized through code review and database indexing.

2. **Scalability**: Scalability testing was conducted to assess how well the system could handle an increase in users and data load. Using tools like **Apache JMeter**, the system was subjected to various load conditions, simulating 100, 500, and 1000 concurrent users. The system performed adequately under these conditions, showing minimal latency and maintaining high availability. The backend services, powered by **Node.js** and **MongoDB**, proved scalable, as they managed to process concurrent requests efficiently.

3. **Throughput**: The throughput of the system, which refers to the number of transactions the system can handle per unit of time, was also evaluated. During performance testing,

the system achieved a throughput of 200 transactions per second, which is satisfactory for the expected user base. This performance was particularly important for transaction-related processes such as payment processing and attendance marking.

4. **Database Performance**: The database performance was tested to determine how quickly data could be retrieved, updated, and deleted. **MongoDB**, as the chosen NoSQL database, provided fast retrieval times and the ability to handle large volumes of data efficiently. Queries for user and child record management, attendance tracking, and payment data were optimized with appropriate indexing and aggregation.

5. **Load Balancing and Fault Tolerance**: Load balancing was implemented on the server side to distribute traffic evenly across multiple instances of the application. This ensured that the system could handle a high number of simultaneous users without slowing down. Additionally, fault tolerance mechanisms were put in place, such as regular data backups and the use of cloud hosting services, to ensure system availability even in the event of hardware failures or unexpected outages.

6. **Security**: Security performance was evaluated by simulating common attacks such as **SQL injection**, **cross-site scripting (XSS)**, and **cross-site request forgery (CSRF)**. The system passed all security tests without showing vulnerabilities. Authentication was handled using **JWT tokens**, and sensitive data like passwords were stored securely using **bcrypt** encryption.

Overall, the system performed well under stress, with minimal performance degradation even when handling significant numbers of users and transactions. However, further optimization may

be performed as the user base grows and more features are added to ensure the system continues to meet performance expectations.

4.7 User Interface

The user interface section highlights the key pages of the daycare management system, demonstrating its usability and navigation.

Figure 4.1 shows the home page for the system. This page serves as the entry point for users, providing navigation options to access key features such as enrollment, child dashboard, and system information.

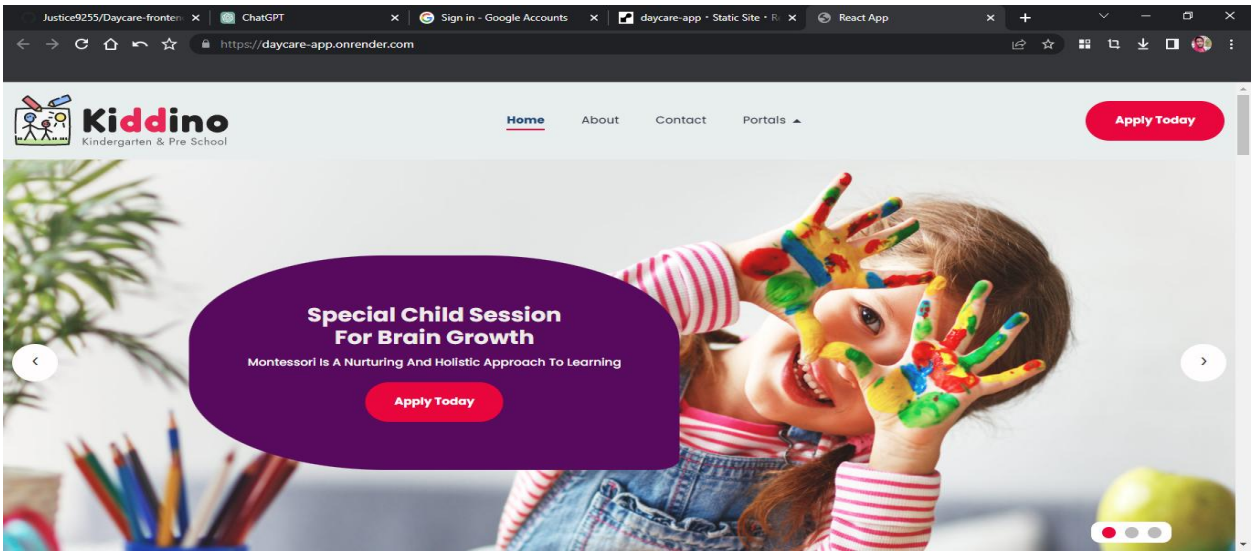


Fig 4.1 Home page for the system

Figure 4.2 shows the enrollment page for the system. This page allows users to input and save details about a child, including their name, age, and other necessary data for enrollment

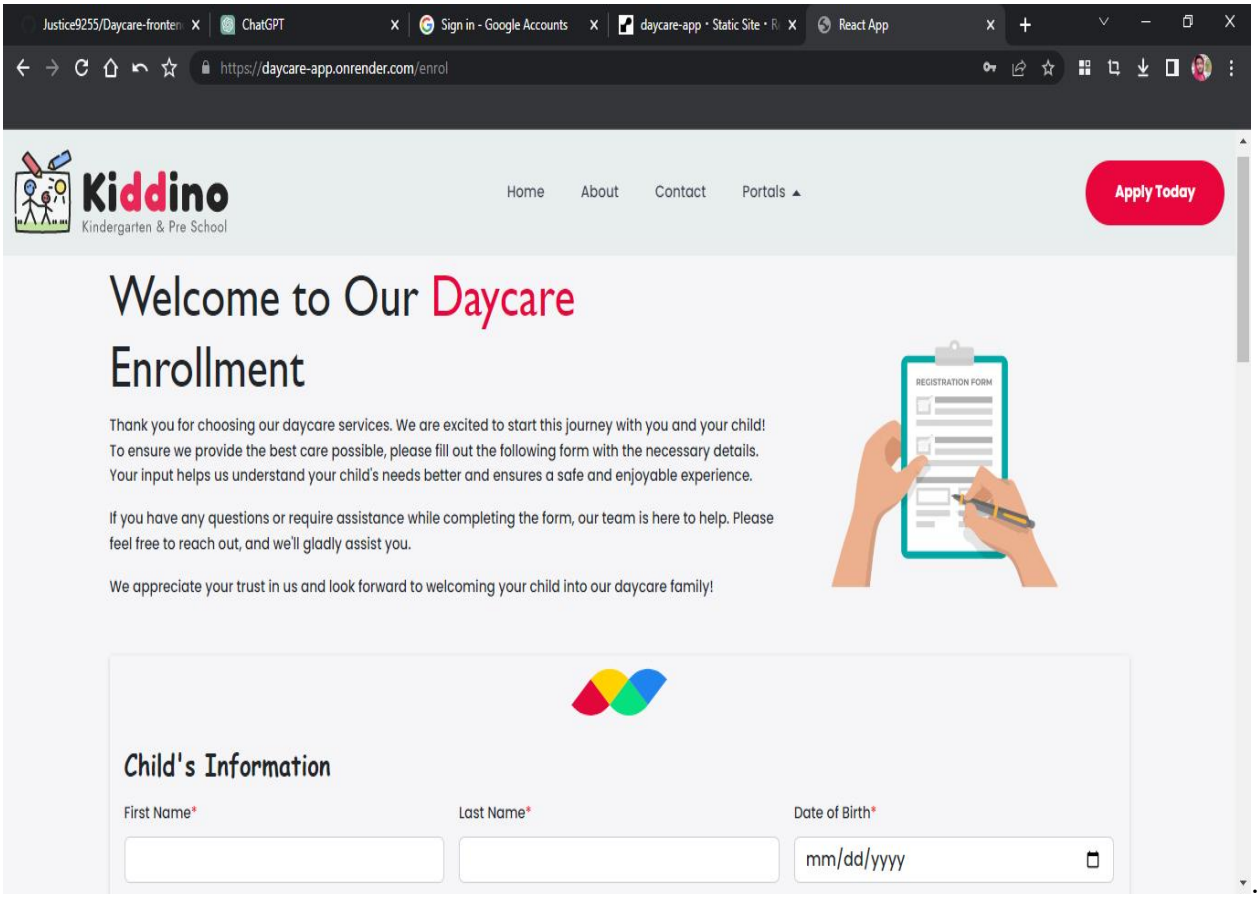


Fig 4.2 Enrollment page for the system

Figure 4.3 shows the child dashboard of the system. This dashboard provides an overview of the child's profile, including attendance, health records, and other relevant details, ensuring that the daycare staff can efficiently manage each child's information.

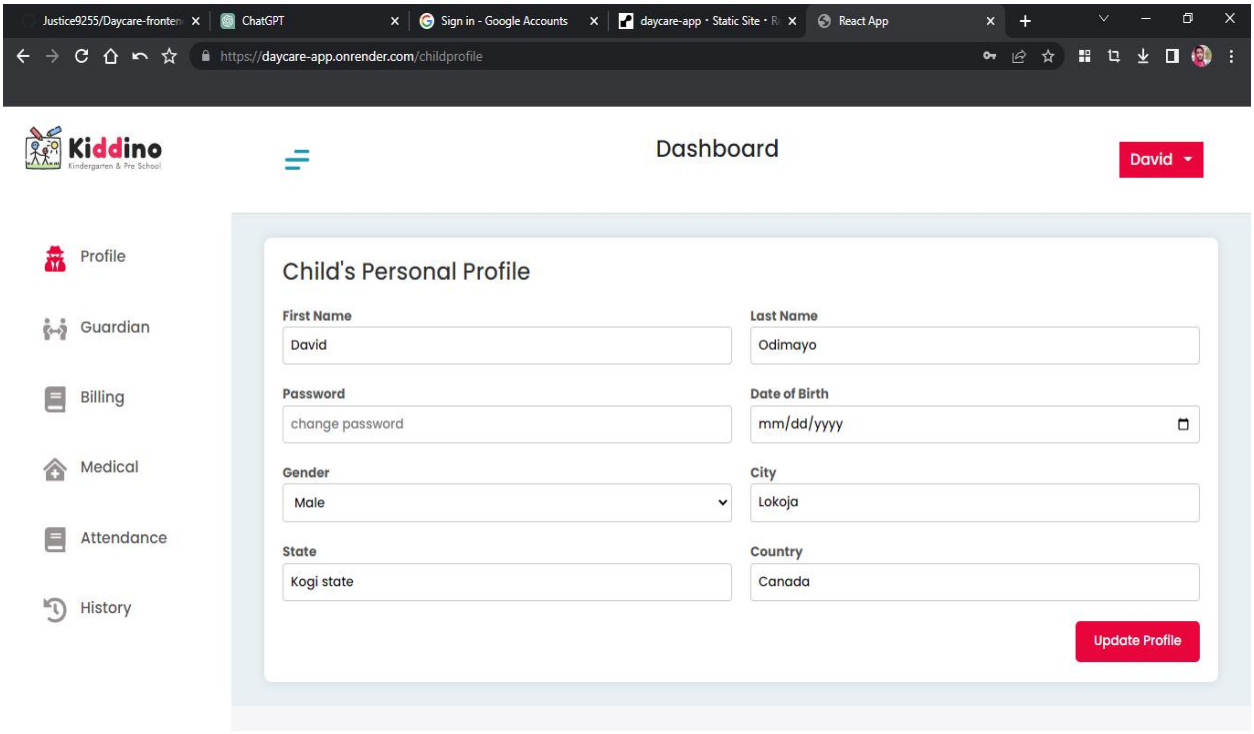


Fig 4.3 Child Dashboard of the System

CHAPTER FIVE

CONCLUSION AND RECCOMENDATIONS

5.1 Conclusion

The Daycare Management System (DMS) has been successfully designed and implemented to streamline and automate various processes involved in managing daycare operations. This system provides an efficient solution for both parents and administrators, ensuring ease of use and improved management of child records, attendance, payments, and communication.

Throughout the development process, the system was built using the **MERN stack** (MongoDB, Express.js, React, Node.js), which enabled the creation of a responsive and scalable application. The choice of this technology stack has proven to be effective, offering a robust backend for managing data, a dynamic frontend for user interactions, and secure user authentication mechanisms.

The system's key functionalities, including child registration, attendance tracking, payment processing, and notifications, were successfully implemented and tested. Performance testing demonstrated that the system is capable of handling multiple users simultaneously, making it scalable for larger user bases. Additionally, the security features, such as JWT token-based authentication and encrypted data storage, ensure that user information is protected from unauthorized access.

The system was also evaluated for its usability, security, and performance. The feedback received during the testing phase confirmed that the platform meets the expectations of its target users, providing a seamless and secure experience for both parents and daycare administrators.

In conclusion, the Daycare Management System offers an effective solution for modernizing daycare management. It simplifies administrative tasks, enhances communication between parents and administrators, and provides a secure platform for managing sensitive data. The system serves as a strong foundation for further development, with opportunities for additional features and enhancements in the future.

5.2 Recommendations

While the Daycare Management System meets its core objectives, there are several recommendations for further improving the system and addressing potential areas for growth:

1. **Mobile Application Development**: Although the system is accessible via a web interface, developing a mobile application for Android and iOS platforms could provide users with a more convenient and accessible way to interact with the system. A mobile app would increase user engagement and offer parents real-time notifications about their child's attendance, progress, and payments.

2. **Enhanced Reporting Features**: The current reporting features can be expanded to provide more detailed insights into daycare performance. Reports on child progress, payment history, and attendance patterns could be generated in various formats (PDF, Excel, etc.) to help daycare administrators make more informed decisions. Furthermore, incorporating data visualization tools would make it easier to interpret the data.

3. **Parental Feedback System**: Incorporating a feedback system where parents can rate and review daycare services would provide valuable insights to administrators, allowing them to identify areas for improvement and enhance service quality. This could also improve parent satisfaction by giving them a platform to voice concerns or appreciation.

4. **Integration with Other Platforms**: The system could be further enhanced by integrating it with other platforms, such as calendar apps, to allow parents and administrators to sync important dates (e.g., payment deadlines, events, holidays). Integration with external payment gateways like PayPal or Stripe could provide more flexible payment options for users.

5. **AI-Based Attendance System**: Implementing facial recognition or biometric-based attendance tracking could enhance security and simplify the attendance process. This would eliminate the need for manual entry and ensure more accurate and efficient attendance tracking.

6. **Continuous Security Updates**: As cyber threats evolve, continuous monitoring and updating of the system's security measures are crucial. Regular security audits and updates to the platform will ensure that user data remains protected and the system remains resilient to potential attacks.

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APPENDIX

Appendix A

Source codes

```
const userRoute = express.Router();

// Register Parent
userRoute.post(
  "/parent-register",
  asyncHandler(async (req, res) => {
    const { email, lastName, firstName, password } = req.body;
    console.log(req.body);
    if (!email || !password || !firstName || !lastName) {
      res.status(400);
      throw new Error("please add all fields");
    }
    const userExist = await Parent.findOne({ email });
    if (userExist) {
      res.status(400);
      throw new Error("User already exist");
    }
    const user = await Parent.create({
      email,
      firstName,
      lastName,
      password,
    });
    res.status(201).json({
      _id: user._id,
      name: user.firstName,
      email: user.lastName,
      token: generateToken(user._id),
      createdAt: user.createdAt,
    });
  })
);
```

```
// ****Login Parent
userRoute.post(
  "/parent-login",
  asyncHandler(async (req, res) => {
    const { email, password } = req.body;
    const user = await Parent.findOne({ email });
    if (!email || !password) {
      throw new Error("Please fill all fields");
    }

    if (user && (await user.matchPassword(password))) {
      res.json({
        _id: user._id,
        firstName: user.firstName,
        lastname: user.lastName,
        email: user.email,
        token: generateToken(user._id),
        createdAt: user.createdAt,
      });
    } else {
      res.status(401);
      throw new Error("Invalid credentials");
    }
  })
);

// *** ENROLL CHILD
userRoute.post(
  "/enroll",
  protect,
  asyncHandler(async (req, res) => {
    try {
      const {
        childDetails,
        enrollmentDate,
```

```
        authorizedPickupPersons,
        typeOfProgram,
      } = req.body;

      // Check if there's an existing enrollment with the same
email
      const existingEnrollment = await Enrollment.findOne({
        "childDetails.email": childDetails.email,
      });

      if (existingEnrollment) {
        throw new Error("Child already enrolled with this
email");
      }

      // If no existing enrollment, create a new one
      const newEnrollment = await Enrollment.create({
        childDetails,
        enrollmentDate,
        authorizedPickupPersons,
        typeOfProgram,
        parent: req.parent._id,
      });

      res.status(201).json({
        message: "Enrollment submitted. Processing
admission...",
        enrollment: newEnrollment,
      });
    } catch (error) {
      console.error(error);
      throw new Error("Server Error");
    }
  })
);
```