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**COMP 3059 – Capstone Project I****Software Requirements Analysis and Design Assignment**

This assignment is an overview to gather the software needs with requirements analysis and help to proceed with the design.

The requirements analysis helps to break down functional and nonfunctional requirements to a basic design view to provide a clear system development process framework. It involves various entities, including business, stakeholders and technology requirements.

The design is the activity following requirements specification and before programming. Software design usually involves problem solving and planning a software solution.

To work on this assignment you could use the references and a sample template given below. The sample template can be customized to suit the nature of your project.

Reference Readings/Example:

[http://www.uacg.bg/filebank/acadstaff/userfiles/publ\\_bg\\_397\\_SDP\\_activities\\_and\\_steps.pdf](http://www.uacg.bg/filebank/acadstaff/userfiles/publ_bg_397_SDP_activities_and_steps.pdf)

[www.cse.msu.edu/~chengb/RE-491/Papers/SRSEExample-webapp.doc](http://www.cse.msu.edu/~chengb/RE-491/Papers/SRSEExample-webapp.doc)

Source for this template:

[www.tricity.wsu.edu/~mckinnon/cpts322/cpts322-srs-v1.doc](http://www.tricity.wsu.edu/~mckinnon/cpts322/cpts322-srs-v1.doc)

## 1.0 Introduction

Our Daycare Attendance System is designed to improve attendance tracking and communication in childcare facilities through the use of RFID technology and automated SMS notifications. This system will streamline the check-in/check-out process, enhance parent-staff communication, and provide a secure, efficient way to manage attendance data.

The system will implement RFID-based check-in/check-out for children and staff, automate SMS notifications to parents about their child's attendance, and centralise attendance data for reporting and analysis. These features will help eliminate manual errors, enhance operational efficiency, and ensure only authorised personnel have access to sensitive attendance management functions. The system will also provide real-time insights into attendance patterns, which will assist in resource management and planning.

The scope of this system covers automated attendance tracking, secure parent communication via SMS notifications, and streamlined data management. It will also ensure secure pick-up authorization and enhance operational efficiency. Key stakeholders include daycare administrators, staff, and parents/guardians, with a design focused on ease of use and regulatory compliance. The system is built to be scalable, reliable, and secure, providing a seamless experience for both staff and parents.

### 1.1 Purpose

The purpose of this document is to define the high-level software requirements for the Daycare Attendance System. This requirements document focuses on what the system will achieve, rather than detailing how it will be implemented. The goal is to provide a clear understanding of the system's essential capabilities to all stakeholders, facilitating a shared vision and alignment throughout the development process.

- Daycare Owners and Administrators: To understand how the system will improve attendance tracking, security, and communication with parents, ultimately supporting efficient daycare operations.

- IT and Development Teams: To gain an actionable overview of system requirements, ensuring that design, development, and testing efforts are aligned with stakeholder needs.

- Daycare Staff and Parents: To provide insight into the system's role in enhancing daily operations and communication, making attendance tracking more accurate and transparent.

This document will guide subsequent phases of the project, from detailed design and implementation to testing and deployment, ensuring the system is built according to these outlined requirements and expectations.

## 1.2 Scope

The system is designed to automate daycare attendance tracking and parent notification using RFID technology and SMS alerts. Each parent has an RFID card that is scanned when they enter and exit the daycare. The system records attendance in real-time and sends automatic SMS notifications to parents when the child checks in or out.

### Inside The Scope (Will Do)

- *Automate Attendance Tracking*: The system will use RFID tags given to the parents/guardians of the child, allowing for quick check-ins and check-outs as they enter and leave the daycare center.
- *Secure Pick-Up Authorization*: The system will ensure that only authorized individuals can check out a child. An RFID scanner will verify the person's authorization to pick up the child, adding a layer of security.
- *SMS Notification Integration*: Parents will receive SMS alerts when their child is checked in or out, providing real-time updates. SMS alerts will also serve as a security measure by notifying parents of any attempts at unauthorized pick-up.
- *User-Friendly Interface for Staff Management*: A secure, user-friendly web interface will allow daycare staff to manage attendance records, register new children, assign new RFID tags, and update parents authorized pick-up contact information as needed.

### Outside The Scope (Will Not Do)

- *No Staff Attendance Tracking*: This system is designed solely for tracking children's attendance. It will not monitor staff attendance or time-logging.
- *No Detailed Child Activity Monitoring (Child Tracking)*: The system will only track entrance and exit times. It will not monitor other daily activities.
- *No Integrated Payment or Billing Management*: The system will not handle payment processing or billing-related tasks. Any financial transactions will need to be managed through a separate system.

### Benefits, Objectives, & Goals

- *Benefits*:
  - The system aims to increase safety, reduce manual errors in attendance records, and provide parents with real-time updates, enhancing trust in daycare services and staff.
- *Objectives*:

- To streamline check-in/check-out processes by reducing time spent on manual attendance.
- To implement secure access control, ensuring only authorized individuals can check out children.
- To provide Parents with immediate SMS notifications upon any change in their child's attendance status.
- **Goals:**
  - To create a secure, scalable attendance management system that meets the needs of daycare centers.
  - To enhance communication and security for both daycare staff and parents/guardians.

## 2.0 System Overview

The daycare attendance system leverages RFID (Radio Frequency IDentification) to enhance the security and accuracy for daycares while decreasing the risk of the children's safety. The system is designed to streamline the process in which daycare centers can monitor and record children's arrivals and departures while ensuring safer transitions between the daycares and the parents.

### 2.1 Project Perspective

The daycare attendance system is a replacement for the existing system as it is designed to replace manual sign-in sheets or attendance books, making attendance tracking more reliable and reducing the risk of human error. Ideal for large daycare centers, this solution offers a streamlined approach to attendance and security, especially when monitoring multiple children.

### 2.2 System Context

This system aligns with the industry trend toward automated attendance and security management. By leveraging advanced technology, it addresses the growing need for transparency, convenience, and data accuracy in childcare. This innovative solution sets a new benchmark for:

- Managing child attendance in daycares
- Minimizing human error
- Ensuring precise records
- Strengthening child safety protocols.

### 2.3 General Constraints

1. System constraints
  - *Technology requirements:* The system requires integration with compatible RFID and SMS service providers. Any limitations or changes from these providers could impact the system's functionality.
  - *Data Security & Privacy:* As the system handles sensitive data (children's attendance records, parental contact information, etc.), it

must comply with data privacy regulations requiring secure storage, access controls, and encryption for data protection.

## 2. Implementation Constraints

- *Hardware Availability*: The system requires RFID readers and tags for the parents, which could cause issues with cost effectiveness and compatibility issues.
- *Platform and Device Compatibility*: The system should work across different browsers, operating systems, and devices (such as mobile phones, laptops, tablets, desktops, etc.).

## 3. Testing Constraints

- *User Acceptance Testing*: Testing with real daycare staff and parents might be limited to certain hours or sessions, impacting the feedback loop and adjustments based on real user experience.

### 2.4 Assumptions and Dependencies

#### Assumptions

- *Stable Internet and Mobiles Network Availability*: It's assumed that the daycare center has stable internet and network coverage to support real-time RFID data logging and SMS notifications without interruptions.
- *Parent/Guardian Willingness to Use SMS Notifications*: It's assumed that parents/guardians are comfortable with and regularly check SMS notifications for updates about their child's attendance, enhancing the communication loop.
- *Reliable RFID Equipment Functionality*: The system assumes that the RFID tags and readers will function consistently and accurately without frequent technical issues or maintenance.

#### Dependencies

- *Third-Party SMS Service Provider*: The system relies on a third-party SMS provider for delivering notifications to parents/guardians. Any issues or changes in these services could disrupt notifications, affecting parental communication.
- *RFID Hardware and Software Vendors*: The system's attendance tracking is dependent on RFID hardware (tags, readers) and compatible software. Any malfunction, upgrade, or compatibility issues could impact the system's performance and functionality.
- *Internet Service Provider (ISP)*: Consistent internet service is crucial for real-time data transfer between the RFID reader, central database, and SMS gateway. Any disruption in the network could lead to delays in attendance logging and notifications.

- *Database Management System*: The central database storing attendance records must be reliable and secure. Any database issues, such as downtime or data corruption, could compromise data integrity and access.
- *Compliance with Daycare Operational Policies*: The system must align with daycare policies on attendance, and data handling. Changes in these policies could impact the system's operation or require modifications to meet new requirements.

### 3.0 Functional Requirements

This section describes specific features of the software project. If desired, some requirements may be specified in the use-case format and listed in the Use Cases Section.

#### 3.1 Functional Requirement #1: RFID-Based Attendance Tracking

- **Introduction**

This feature automates the process of tracking child attendance using RFID technology. When a child enters or leaves the daycare, they tap their RFID card, and the system records the check-in or check-out time automatically.

- **Inputs**

- I. RFID card tap (ChildID and timestamp)
- II. Child's unique RFID tag

- **Processing**

- I. System identifies the RFID tag associated with the child and verifies the tag's authenticity.
- II. The system logs the time as a **check-in** or **check-out** event, based on the previous recorded status.
- III. The system associates the event with the correct child's attendance record in the database.

- **Outputs**

- I. Updated attendance record in the database with check-in or check-out time.
- II. Confirmation for successful record update, which may be displayed on the system dashboard.

#### Functional Requirement #2: Real-Time SMS Notification to Parents

- **Introduction**

This feature sends an SMS notification to parents whenever their child checks in or out of the daycare, providing them with real-time updates on their child's attendance status.

- **Inputs**

- I. ChildID (from the attendance record)

- II. Parent's phone number (from the Parent table in the database)
- III. Attendance event (check-in or check-out)
- **Processing**
  - I. The system detects the attendance event (check-in or check-out) and retrieves the parent's phone number linked to the child's profile.
  - II. The system generates an SMS message with the child's name, event type (check-in or check-out), and timestamp.
  - III. The SMS message is sent to the parent's phone number through a third-party SMS service provider.
- **Outputs**
  - I. SMS message delivered to the parent's phone with the attendance update.
  - II. Notification status updated in the system, logged as "sent" or "failed" (for troubleshooting or verification).

### **Functional Requirement #3: User Interface for Daycare Staff and Administrators**

- **Introduction**

The system provides a web-based user interface for daycare staff and administrators to monitor and manage attendance, view check-in/out times, and generate reports..
- **Inputs**
  - I. User credentials for login (username and password)
  - II. Menu selections (e.g., "View Attendance", "Generate Report", "Add/Edit Child")
  - III. Date range or child selection for attendance reports
- **Processing**
  - I. System verifies user credentials and grants access based on the user role (staff, admin).
  - II. The selected data (e.g., child's attendance record, date range) is retrieved from the database.
  - III. The system formats the attendance data for display on the user interface or compiles it into a downloadable report.
- **Outputs**
  - I. Real-time display of attendance data for staff and administrators.
  - II. Attendance reports (PDF or CSV) that can be downloaded or printed by administrators.

### **Functional Requirement #4: Attendance Reporting and Analysis**

- **Introduction**

Administrators can generate reports on attendance patterns for specific children, time periods, or overall daycare statistics, which help in understanding attendance trends.
- **Inputs**
  - I. Date range, child's name, or selection criteria for the report
  - II. Report type (daily, weekly, monthly)
- **Processing**
  - I. System queries the attendance records based on selected criteria.
  - II. Data is compiled and organized according to the report type.
  - III. The report is formatted for export (PDF or CSV) for easy review or printing.
- **Outputs**
  - I. Detailed attendance report with timestamps and attendance status.
  - II. Exported report file available for download in the selected format.

#### **Functional Requirement #5: Role-Based Access Control**

- **Introduction**

The system restricts access based on user roles to ensure data security. Different roles (Daycare Admin, Daycare Owner, Our Admin, Teacher/Staff) have varying levels of access to system features.
- **Inputs**
  - I. User credentials (username, password)
  - II. Role information (stored in user profile)
- **Processing**
  - I. System authenticates the user and retrieves their assigned role.
  - II. Based on the role, the system grants access to specific features (e.g., admin access to reporting, staff access to child check-in/out logs).
- **Outputs**
  - I. Access to system features and modules according to user role.
  - II. Denial message if a user tries to access restricted functions outside their permissions.

#### **Functional Requirement #6: Notification Management and Logging**

- **Introduction**



This feature logs each notification sent to parents, tracking its status (sent, pending, failed) to ensure transparency and troubleshoot any issues with SMS delivery.

- **Inputs**

- I. Notification data (ChildID, ParentID, timestamp, message content)
- II. Status from SMS service provider (success or failure)

- **Processing**

- I. The system logs each notification attempt, capturing the child's details, timestamp, and message content.
- II. After the SMS is sent, the system receives a delivery status from the SMS provider.
- III. Status updates are recorded in the notification log.

- **Outputs**

- I. Notification log entry with complete details, available for admin review.
- II. Status summary showing successful and failed messages for troubleshooting.

### 3.2 Use Cases

#### 3.2.1 Use Case #1 Record Attendance Using RFID

- **Actors:** Child, RFID Reader, System
- **Description:** This use case describes how a child's attendance is recorded when they tap their RFID card.
- **Preconditions:** The child has a registered RFID card, and the RFID reader is connected to the system.
- **Trigger:** The child (or parent) taps the RFID card on the reader upon entry or exit.

**Main Flow:**

1. The child taps their RFID card at the RFID reader.
2. The RFID reader captures the card's unique ID and sends it to the system.
3. The system matches the RFID tag to the child's profile.
4. The system logs the timestamp as a **check-in** or **check-out** event based on the previous recorded status.
5. The system updates the child's attendance record in the database.

**Postconditions:** The child's attendance is recorded with the correct check-in or check-out time.

### 3.2.2 Use Case #2 Send SMS Notification to Parent

- **Actors:** System, Parent, SMS Service Provider
- **Description:** This use case describes how the system sends an SMS notification to a parent when their child checks in or out.
- **Preconditions:** The child's RFID has been tapped, and the parent's phone number is registered in the system.
- **Trigger:** Successful recording of a child's check-in or check-out event.

**Main Flow:**

1. The system identifies the parent associated with the child's profile.
2. The system generates an SMS message with the child's name, event type (check-in or check-out), and timestamp.
3. The system sends the SMS to the parent's phone number via the SMS service provider.
4. The SMS service provider confirms successful delivery.

**Postconditions:** The child's attendance is recorded with the correct check-in or check-out time.

### 3.2.3 Use Case #3 View Attendance Records

- **Actors:** Daycare Administrator, System
- **Description:** This use case describes how the daycare administrator views attendance records for children at the daycare.
- **Preconditions:** The daycare administrator has logged into the system.
- **Trigger:** The administrator selects the option to view attendance records.

**Main Flow:**

1. The administrator logs into the system with appropriate credentials.
2. The administrator navigates to the **View Attendance** section.
3. The system retrieves attendance data from the database.
4. The system displays attendance data in a table format, showing check-in and check-out times for each child.

**Postconditions:** The administrator views the most recent attendance records in the system.

### 3.2.4 Use Case #4 Generate Attendance Report

- **Actors:** Daycare Administrator, System
- **Description:** This use case describes how the daycare administrator generates an attendance report for a specified date range.
- **Preconditions:** The daycare administrator is logged into the system.
- **Trigger:** The administrator selects the option to generate an attendance report.

**Main Flow:**

1. The administrator logs in and navigates to the **Generate Report** section.
2. The administrator selects a date range and any other filters (e.g., specific child or class).
3. The system queries the database for attendance records matching the criteria.
4. The system compiles the data into a report format (PDF or CSV).
5. The system provides the report for download or printing.

**Postconditions:** The administrator downloads or prints the attendance report for the specified date range.

### 3.2.5 Use Case #5 Manage User Access

- **Actors:** System Administrator, System
- **Description:** This use case describes how the system administrator manages user accounts and roles, ensuring only authorized access to the system.
- **Preconditions:** The system administrator is logged in with appropriate permissions.
- **Trigger:** The system administrator selects the **User Management** option.

**Main Flow:**

1. The system administrator navigates to the **User Management** section.
2. The system administrator views a list of current users with their roles.
3. The system administrator can add a new user, update an existing user's role, or remove a user.
4. The system saves any changes made to the user list.

**Postconditions:** The user list is updated, with permissions adjusted according to each user's role.

### 3.2.6 Use Case #6 Track Notification Status

- **Actors:** System, Daycare Administrator
- **Description:** This use case describes how the system tracks the status of notifications sent to parents, allowing the administrator to verify delivery.
- **Preconditions:** Notifications are enabled, and SMS service is operational.
- **Trigger:** A check-in or check-out event triggers an SMS notification.

**Main Flow:**

1. After sending an SMS, the system records the notification details (e.g., timestamp, message content).
2. The system receives a delivery confirmation from the SMS service provider.
3. The system logs the notification status as **Sent** or **Failed**.
4. The daycare administrator can access a log of all notifications, including their status.

**Postconditions:** The system updates the notification log, showing which messages were successfully sent or failed.

### 3.2.7 Use Case #7 Update Child or Parent Information

- **Actors:** Daycare Administrator, System
- **Description:** This use case describes how the daycare administrator updates information for a child or their parent, such as phone numbers or RFID assignments.
- **Preconditions:** The administrator is logged in with the necessary permissions.
- **Trigger:** The administrator selects a child or parent's profile to edit.

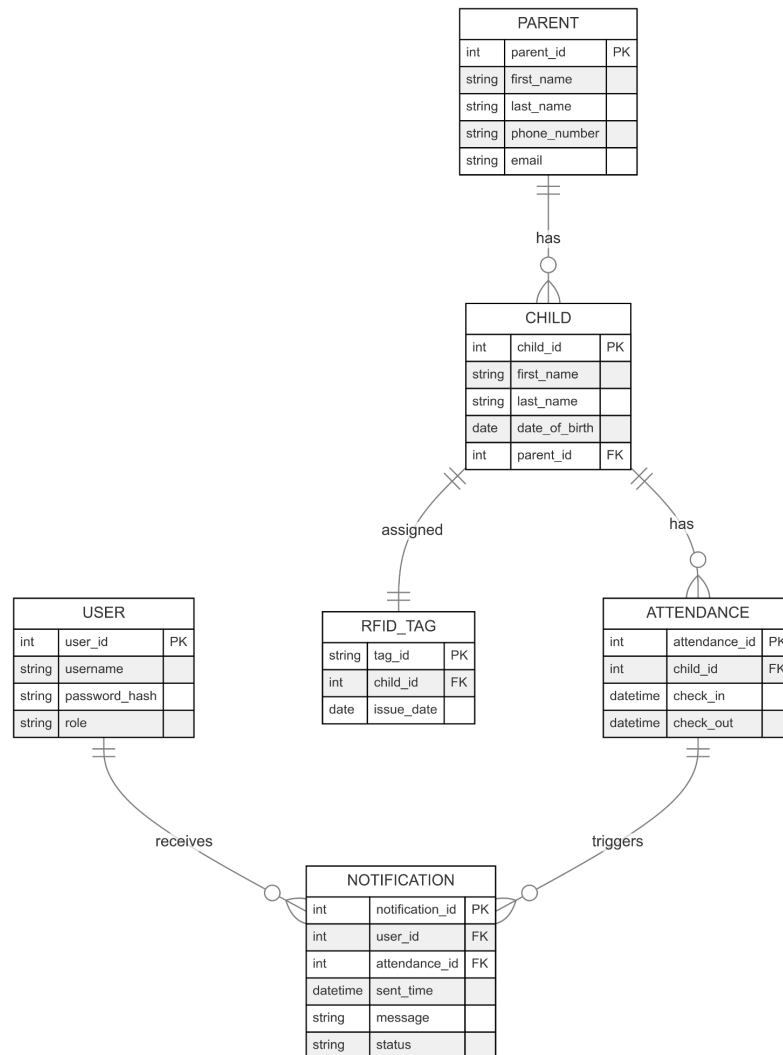
**Main Flow:**

1. The administrator navigates to the **Child/Parent Profile** section.
2. The administrator selects the profile they want to edit.
3. The administrator updates relevant fields, such as contact details or RFID tag assignment.
4. The system saves the changes in the database.

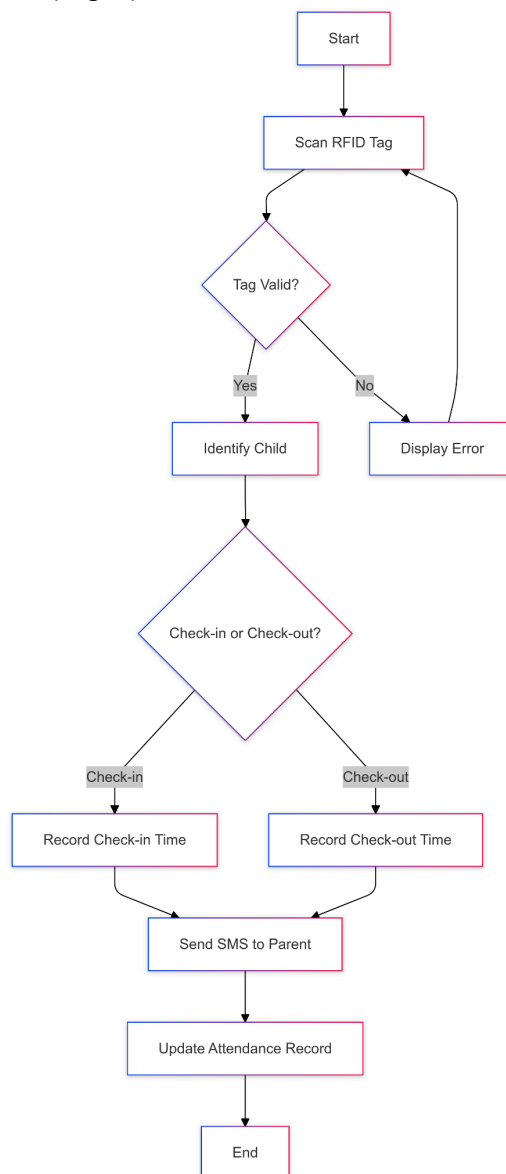
**Postconditions:** The child or parent's profile is updated in the system.

## 3.3 Data Modelling and Analysis

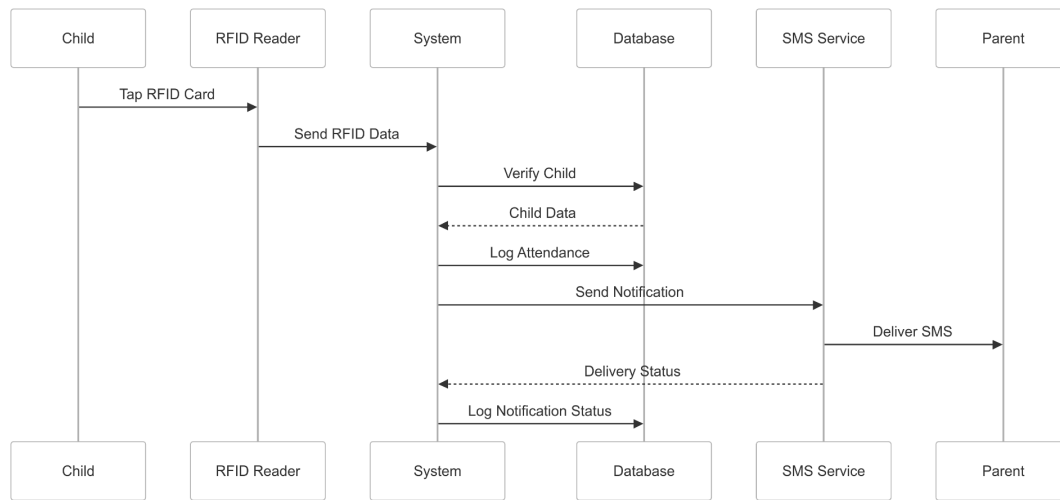
Normalized Data Model Diagram (Fig 1)



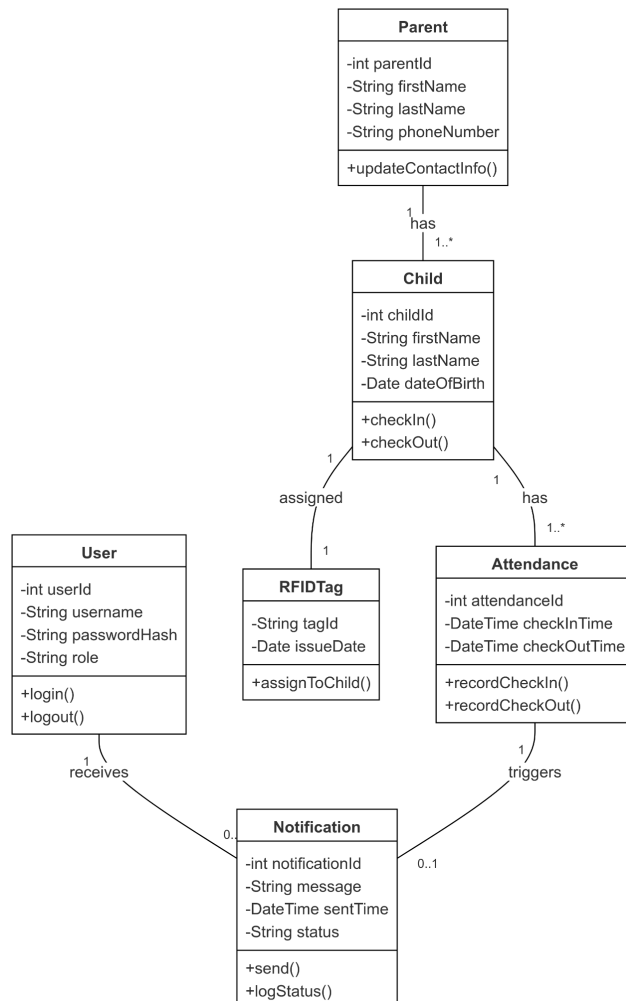
Activity Diagram (Fig 2)



Sequence Diagram (Fig 3)

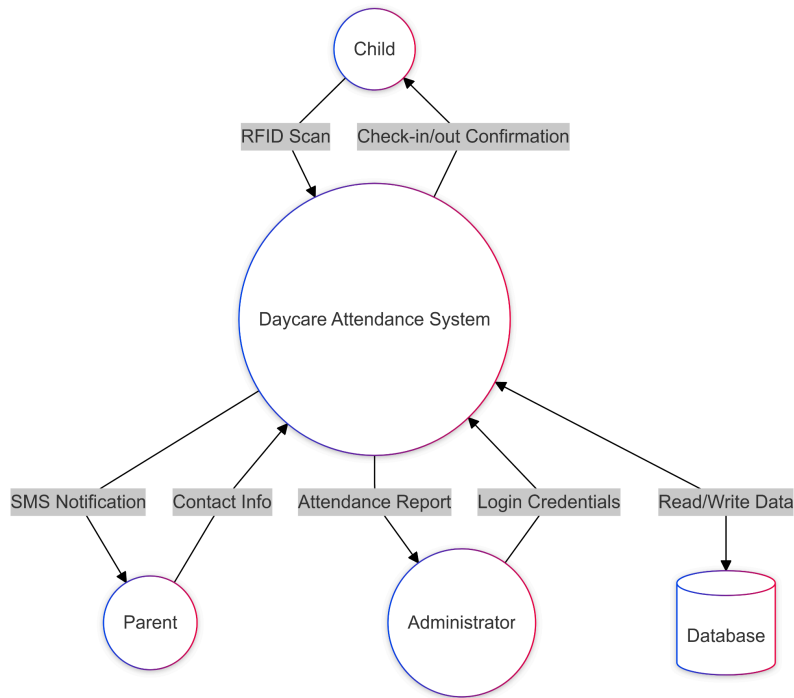


UML Class Diagram (Fig 4)



### 3.4 Process Modelling

Data Flow Diagram (Fig 5)



### 4.0 Non-Functional Requirements

These requirements ensure that the system is robust, secure, and efficient in meeting the daycare's operational needs while providing an optimal user experience for both staff and parents.

#### Performance:

- The system shall process each RFID check-in or check-out within 2 seconds to ensure quick transitions for both children and staff.
- SMS notifications to parents regarding their child's check-in or check-out shall be delivered within 10 seconds, with 95% of notifications successfully delivered in that time frame.

#### Reliability:

- The RFID scanning system shall have a 99.9% accuracy rate in matching the tags with the correct records to reduce errors.
- The SMS notification service should be fully dependable, with automated retry functions for failed attempts to ensure parents are notified.

#### Availability:



- The system should be maintained most of the time within daycare operational hours, allowing a set amount of hours for a planned maintenance per month.
- In case of failure, the system should be fully operational within an hour or less, with no data loss or disruption to attendance logging or SMS notifications.

**Security:**

- All data exchanged between the RFID readers, the daycare system, and the SMS service must be securely encrypted to protect privacy
- The system shall implement role-based access control (RBAC) to ensure only authorised daycare staff can access or manage attendance records and SMS notifications.

**Backup and Disaster Recovery:**

- The system shall have an automated daily backup of all critical data, including RFID attendance records and SMS logs. The backup system should be capable of restoring full system functionality within 30 minutes in case of catastrophic failure.

**Maintainability:**

- The system shall maintain logs of all RFID scan events and SMS notifications for troubleshooting and audit purposes, with logs retained for a minimum of 30 days.
- Code changes must meet high-quality standards, with automated testing coverage of at least 90% for all updates to the RFID or SMS functionality.

**Portability:**

- The system shall support deployment on both cloud and on-premises environments, ensuring flexibility for daycare centres of varying sizes and technical resources.
- The SMS notification service shall be compatible with major mobile carriers and platforms (Android and iOS), ensuring reliable delivery to parents on any device.

**Localization:**

- The system should support multi-language functionality to accommodate diverse user groups (e.g., multilingual daycare staff or parents), allowing for easy customization of language preferences in the interface and SMS notifications.

**Usability:**

- The system's user interface (UI) for daycare staff should be intuitive and easy to use, with no more than 3 clicks required for staff to check in or check out a child. The UI must be designed to reduce human error and minimise training time.

## 5.0 Logical Database Requirements

Will a database be used? If so, what logical requirements exist for data formats, storage capabilities, data retention, data integrity, etc?

Our system will use MongoDB as the database to store and manage attendance records and related data efficiently. MongoDB's flexible schema enables effective storage of information about children, parents, daycare staff, administrators, and daycare center branches. Below are key logical requirements regarding data storage format, storage capabilities, data retention and data integrity.

### 1. Data Format and Structure:

- Each child's attendance record will include fields like ChildID, child name, parent contact details (Id, name, email, phone number), timestamp, check-in, and check-out status.

- Each daycare branch will have a unique CenterID and store information like branch name, location, contact details, operating hours, capacity, and lists of associated staff and children.

- Administrator data will include AdminID, name, role (such as system administrator, database manager), email address, contact number, and assigned daycare center ID. Admin information is used to manage access permissions and oversee system settings and monitoring.

- MongoDB collections will be organized to allow easy retrieval of children's attendance data, parent contact details, and information about admins and daycare staff.

### 2. Data Storage and Retention:

- Attendance records will be retained for at least 6 months to enable reference to the current term's history. After each 6-month period, new term records will be stored, and outdated records may be archived or deleted as necessary.

- This retention policy allows the daycare to manage attendance on a term basis while adhering to data retention requirements.

### 3. Data Integrity and Validation:

- Data validation rules will ensure that key fields like ChildID, ParentID, CenterID, AdminID, and RFID tag are unique and correctly formatted.

- Relationships between collections (e.g. child and parent, child and daycare center, staff and center, admin and center) will be maintained by references to ensure data consistency.

- Updates to timestamps for check-in and check-out data are recorded, preventing unauthorized changes and ensuring the accuracy of attendance records.

#### 4. Data Privacy and Security

- Strict access controls will be applied to MongoDB collections, allowing only authorized users like IT admins and daycare administrators to view or modify sensitive information.

- Confidential data such as parent contact information, attendance records, and admin details will be encrypted both in transit and at rest to comply with data privacy standards.

- Role-based access ensures that daycare staff, parents, admins, and other stakeholders only have access to relevant information based on their roles.

#### 5. Scalability

- The database is designed to scale horizontally, accommodating additional branches (CenterID), children, staff and admin members as needed.

- When a new branch is added, a new document will be created in the Daycare Center collection, and associated children, staff, and admin can be linked accordingly.

#### 6. Backup and Disaster Recovery


- Regular backups will be scheduled to prevent data loss due to unforeseen system failures. This backup policy ensures that all critical data -such as attendance records, user information, admin details, and daycare branch information—can be restored within an appropriate time frame.






### 6.0 Other Requirements

Additional requirements, if any.

### 7.0 Approval

The signatures below indicate their approval of the contents of this document.

Project Role	Name	Signature	Date
Backend Developer	Jam Furaque		Nov. 5, 2024

Product Manager	Andrew Stewart		Nov 8, 2024
SMS Integrator	Daniel Konjarski		Nov. 8, 2024
RFID System Integrator	Carl Trinidad		Nov 8, 2024
Frontend Developer	Kei Ishikawa		Nov. 8, 2024
Quality Assurance	Matthew Ciavaerlla		Nov. 8, 2024