

Design and Development of CARE Visitor Management System

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Abstract: Begun in 2021 Malaysia government officially announced that the education sectors allowed to switch their learning method back to physical. A safer method that controls the contact between the students and the public becomes the first consideration that the education sector should take care of. The CARE Visitor Management System is a system that controls and monitors the visitation of the public in the building which is requested by Stellar International School. With the system, the students' parents are allowed to enter the school building and pick up the students with a safe and efficient method. The system is developed by using Prototype software processing model. The development of the project will assist Stellar International School to control and manage the visitation of students' parents and reduce Student-Public Contact during the pandemic period.

Keywords: Management System, Visitor Management System, Web Application

1. Introduction

The Stellar Education Group [1], founded in 2016 and situated in Puteri Harbour, Johor, Malaysia, contains Stellar International School (SIS). Stellar International School was one of the first to switch to online learning under COVID-19 and is noted for its flexibility and productivity. Prime Minister of Malaysia Tan Sri Muhyiddin Yassin announced the movement control order under the Prevention and Control of Infectious Diseases Act 1988 and the Police Act 1967 in March 2020. [2]. Stellar International School follows government restrictions that temporarily close the institution center until the Ministry of Education Malaysia announces the private educational institution can open based on the calendar of school terms and educational institutions for 2021 [3]. Stellar International School implemented a Drive-Thru Pickup Procedure to decrease student-parent contact and to comply with Malaysia's Standard Operating Procedure (SOP). A few issues arise after a short time executing the Drive-Thru Pickup Procedure. Students waiting in the hall were always bewildered by the teachers' calls. To make sure all children can hear, teachers must remove their facial masks to speak kids' names clearly, which raises their risk of Covid-19. Stellar International School sought an automated management system to minimize pressure and lighten school procedures. A CARE Visitor Management System is proposed, and the proposed system is expected to simplify and enhance the current procedure executing in school.

The purpose of the system proposal is to study and design the Care Visitor Management System based on Stellar International School's needs, then create and test the system's functionality and usability.

This article consists of five sections. The first section is an introduction that describes the project's context. The second section analyses the related work. The third section describes the methodology. In the fourth section, the results associated with the designed system, including interface and database design, implementation, and testing, are described. In the final section, the project's conclusion is presented.

2. Literature Review

2.1 Management System

Management systems align internal and external components to boost financial performance, customer share, and employee engagement [4]. Innovative technology and methods for activity analysis and development management are essential for enterprises [5]. Lean management practices affect organizational performance and human factors [6]. Cloud computing is getting more popular in healthcare because it's cost-effective and secure [7]. Sustainable production methods require precision livestock farming, which uses spatial heterogeneity to focus on individual animals [8]. Internal control systems include risk management, control methods, information and communication, and monitoring [9]. Budgeting requires internal control. Enterprise risk management is essential to risk management and considered ethical [10]. Context sharing allows objects and systems to communicate in an Internet of Things (IoT) context [11]. Facility managers use Building Information Modelling (BIM) to improve maintenance and equipment management [12]. QSRs face various competitors and increasingly use technology to ensure product quality, service consistency, and cost effectiveness [13]. An effective management system includes alignment, innovation, lean practices, technology adoption, precision farming, internal control, risk management, context sharing, BIM, and quick-service restaurant technology.

2.2 Visitor Management

A Visitor Management System (VMS) monitors visitors in a corporate or public building [14]. VMS provides security and information on visitors, such as their name and reason for coming. VMS can be implemented using various technologies. These include video surveillance cameras, badge scanners, and fingerprint readers. Using a visitor management system can also boost brand reputation. A good system can build employee and visitor trust [15]. Strong security impresses visitors to buildings, schools, and organizations. When people realize that event organizers handle security, it affects the brand's reputation. Thus, the on-duty staff can identify guests and avoid undesirable events [15]. Staff must monitor visitors entering and departing the building. When the system is implemented, some security tasks can be automated using software. Such automation will minimize the security staff's burden so the staff may focus on other activities, such as avoiding theft and other safety threats. It will minimize labor costs because fewer security officers will be needed.

2.3 Web Application

Web applications let consumers access and interact with data online. Web apps let users submit data requests and receive results from a web server. Web apps can be browser-based or standalone [16]. Web browsers allow people to access computer data and the Internet. A web application consists of online pages linked by hyperlinks to form a tree structure on the screen. A web-based system includes a web application server and database software on a network server [16]. HTTP is the client-server protocol.

Web apps are convenient since users may update material without aid. Web apps are getting increasingly popular, attracting consumers and hackers. Web apps store sensitive data that hackers can use to profit [17].

2.4 Comparison with the Existing System

In this section a comparison on the functionality between the existing system or application with the proposed system is made.

Table 1: Comparison between 3 existing system and the proposed system

Features \ Systems	Smart Touch	Yeastar Workplace	Vyrox	CARE Visitor Management System
Admin Panel	√	√	√	√
Free Implementation Cost	×	×	×	×
Mobile Application	×	×	×	√
Access by Internet	√	√	√	√
QR Code	×	√	√	√
Face Recognition	×	√	√	×
Data Log	√	√	√	√

√ - Present of function × - Absent of function

3. Methodology

Prototyping software process model is used to develop prototype objects or systems. Prototyping [18] is a rapid and inexpensive way to test hypotheses and discover new opportunities. Prototyping is part of the system's life cycle analysis step. The selected model contains the Requirement Analysis phase, Design and Develop phase, Testing and Evaluation phase, Refining Prototype phase, and Implementation and Maintenance phase.

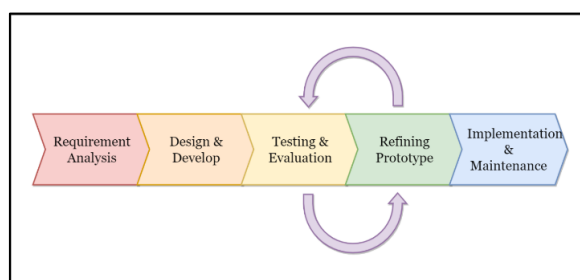


Figure 1: Project Phase

3.1 System Development Workflow

The prototyping model has 5 steps. Table 3.1 categories each phase's tasks and outcomes.

Table 2: Software development activities, task and output

Phase	Task	Output
Requirement Analysis	<ul style="list-style-type: none"> • Meeting with stakeholders, gathering the requirements and information. • Analysis the information and the requirement as listed below: • The existing procedure is executed by stakeholders. • The requirements that stakeholders request for the proposed system. 	A complete requirement documentation for the proposed system: Stellar Care Visitor Management System.
Design and Develop	<ul style="list-style-type: none"> • Design the system including system design, database design and interface design of proposed system. • Design the workflow for each functionality requirement. 	The first prototype is developed and ready to be tested.
Testing and Evaluation	<ul style="list-style-type: none"> • Design test case for each functional requirement and nonfunctional requirement. • Involve the stakeholders in testing the system. • Execute testing to every functional and nonfunctional requirement. • Updates and amend the documentation after every test execute by different stakeholders. 	Complete test result documentation.
Refining Prototype	<ul style="list-style-type: none"> • Review the test result documentation. • Refine the prototype based on the requirements stated in the documentations. 	A new version prototype is ready to be sent to Testing and Evaluation phase and testing.
Implementation and Maintenance	<ul style="list-style-type: none"> • Deploy the testing prototype to production. • Maintain the production to prevent failure. 	A complete system deployed to production and officially launched.

4. Results and Discussion

This section will discuss the system requirement analysis which includes the discussion of functional and non-functional requirement. Besides, the UML is also discussed in this section. Lastly, the interface design is also included in this section.

4.1 Functional Requirements

Functional requirements are system operations that allow users to complete transactions and meet requirements. Functional requirements describe the system's module behavior.

Table 3: Functional Requirement included in proposed system

Module	No.	Description	Involved User
Students Information Management	FR-01	The user is allowed to create, edit, and delete students' information.	Teacher
Parents Information Management	FR-02	The user is allowed to create, edit, and delete parents' information.	Teacher
	FR-03	The user is allowed to manage the relationship between parents and students.	Teacher
Users Information Management	FR-04	The user is allowed to create, edit, and delete users' information.	Teacher
	FR-05	The user can log in by username and password and log out current session.	Teacher, Parent
	FR-06	The user can change their own account password.	Teacher, Parent
Classes Information Management	FR-07	The user is allowed to create, edit, and delete classes' information.	Teacher
Waiting Hall - QR Codes Information Management	FR-08	This user is allowed to create, view, edit and delete the QR Code information which is used for the waiting hall management module.	Teacher
Waiting Hall - Create Fetch Records	FR-09	The user is allowed to access to this module and create the fetch record	Teacher, Parent

Module	No.	Description	Involved User
Waiting Hall - View Records	FR-10	The fetch record will be display by this module and will update on real time.	Teacher
Generate Reports	FR-11	The user is allowed to view the fetch records and generate into report with date range selected.	Teacher

4.2 Non-functional Requirements

Non-functional requirements include system operation. Non-functional demands must be analyzed to ensure consumers are satisfied.

Table 4 Non-functional Requirements included in proposed system

No.	Requirements	Descriptions
1.	Security	<ul style="list-style-type: none"> The system is only can be accessed by authorized person with valid account information
2.	Portability	<ul style="list-style-type: none"> The system can be accessed even if the user changes their current device. The system can be accessed by using different types of devices such as Android Device, iOS Device and other devices with different operating systems.
3.	Compatibility	<ul style="list-style-type: none"> The system can support different version of operating system installed in the device.
4.	Availability	<ul style="list-style-type: none"> The system can be accessed 24/7.
5.	Usability	<ul style="list-style-type: none"> The system provides user friendly interface. The system is easy to learn and understand for first time user. The system gives the correct respond for every action that user does.

4.3 Use Case Diagram

Use case diagrams show how teachers and parents engage with Stellar Care Visitor Management System. Figure 2 shows the designed use case diagram for the proposed system.

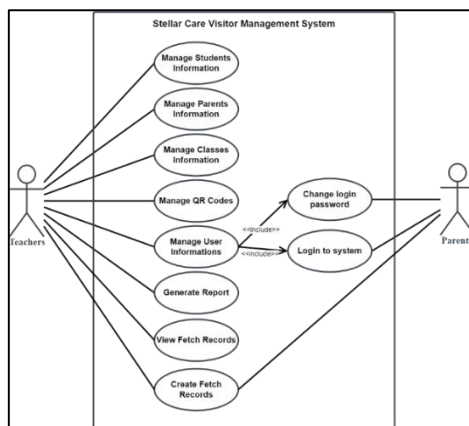


Figure 2 Use Case Diagram

4.4 Class Diagram

Class diagrams show the relationships between OO classes. Also used in testing and debugging. Class diagrams illustrate class relationships. Figure 3 shows the class diagram designed for the proposed system.

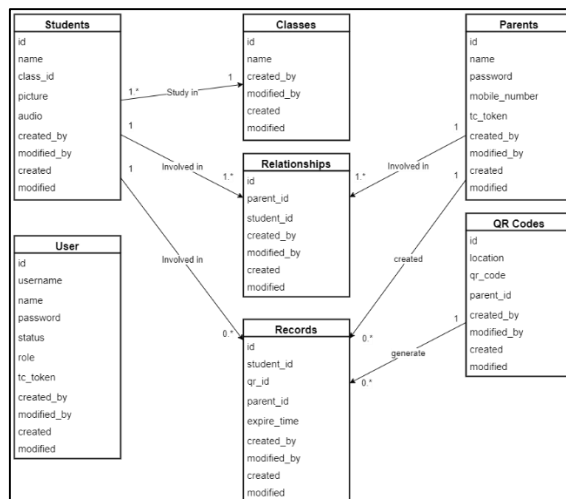


Figure 3 Class Diagram for the proposed system

4.5 Interface Design

This section discusses the interface design for the proposed system. Figure 4 to Figure 9 show the interface design for the proposed system.

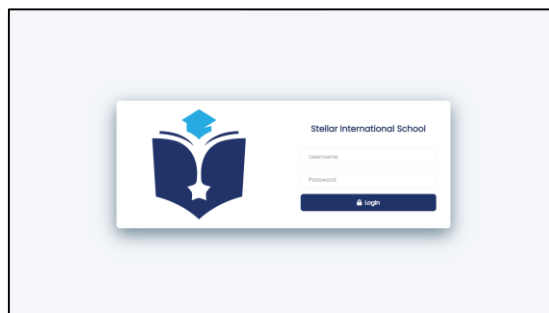


Figure 4 Login interface design for desktop view

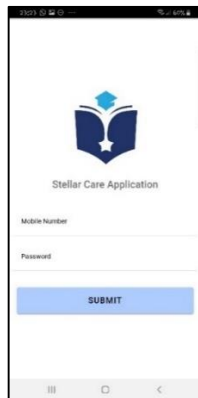


Figure 5 Login interface design for mobile application

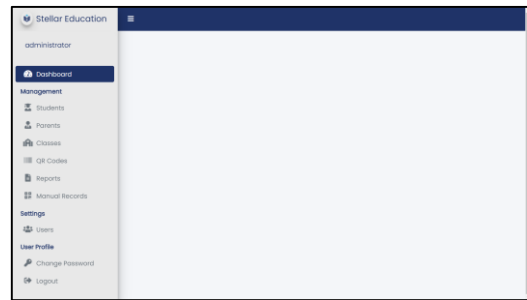


Figure 6 Dashboard pages after login

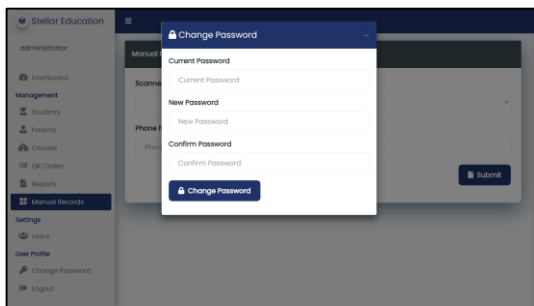


Figure 7 Interface design for change password

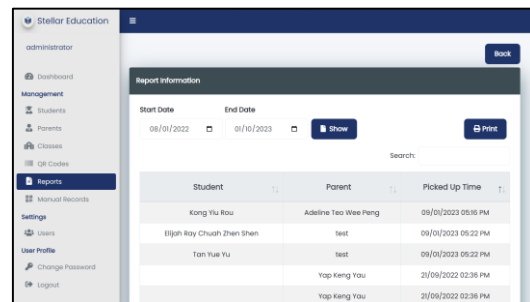


Figure 8 Interface design for view reports



Figure 9 Interface used to choose QR codes and shows the record in list

4.6 Implementation

This section will exhibit and illustrate the user interface and source code that have been implemented for each module. The Stellar Care Visitor Management System consists of eight modules in total.

4.6.1 Students Information Management Module

The Stellar Care Visitor Management System's Students Information Management module lets teachers easily manage and organize student data. This module lets teachers search, sort, and examine student records. Figure 10 shows the index page of the Students Information Management module, where teachers interact with student records. Figure 11 shows the search, sort, and display code. The student information management section is only accessible to teachers.

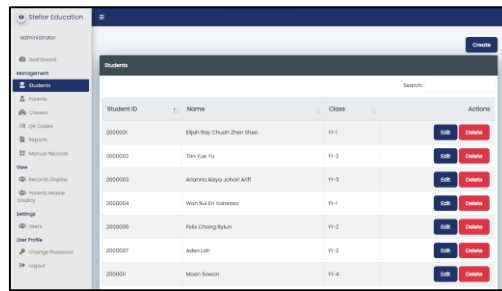


Figure 10 Index page of student information management module

The index page contains user-friendly elements that make it simple for instructors to navigate and locate the required student information. Teachers can use the search function to locate specific pupils based on criteria such as name, ID, or class. Sorting options permit entries to be arranged in ascending or descending order according to criteria such as name, student ID, and courses.

```

<code>
</code>

```

Figure 11 Code Segment for Searching, Sorting, and Displaying Student Records

The Students Information Management module includes security mechanisms to restrict access to student information to only authorised instructors. This assures the privacy and confidentiality of student information. Using the Students Information Management module, educators can easily maintain accurate and up-to-date student records, quickly retrieve student information, and expedite administrative tasks associated with student management.

4.6.2 Parents Information Management Module

The Parents Information Management module of the Stellar Care Visitor Management System provides instructors with comprehensive capabilities for managing and organizing parents' information. This module provides instructors with a centralized location from which to access and manage vital parent information. Using this module, teachers can ensure successful parent communication, involvement, and collaboration. The index page of the Parents Information Management module, which functions as the primary interface for instructors to interact with parents' information, is depicted in Figure 11.

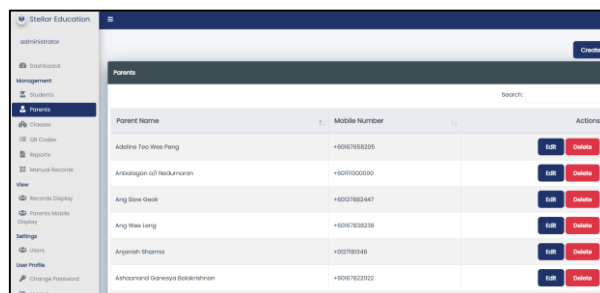


Figure 12 Index Page of Parents Information Management Module

The index page displays parents' names, contact information, and comments in a tabular style. Teachers can easily search for parents and quickly find the needed data. The feature lets instructors search for parents by name and contact information. This simplified search feature lets instructors rapidly find and present parents' information without scanning and browsing.

The Parents Information Management module also adds, updates, and manages parent profiles. Figure 12 shows how teachers can add new parent entries by entering names, contact information, and other notes. The module makes updating parent documents for contact information changes and other changes easier.

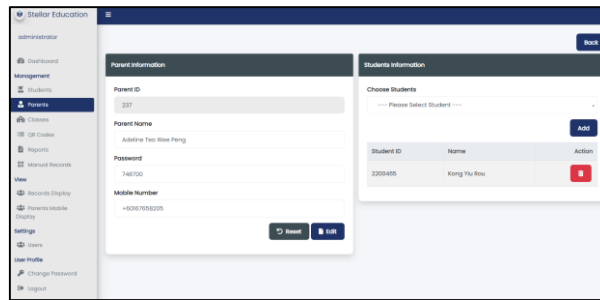


Figure 13 Information Update Page of Parents Information Management Module

The module provides code segments responsible for coordinating parent data activities to improve usability. These code segments make it easier to add new parent records, update current information, and handle data validation to ensure data integrity. Teachers may effectively interface with parent information, execute appropriate modifications, and keep parent records accurate and up to date by leveraging these code parts in figure 14.



Figure 14 Code Segment for Adding, Updating, and Validating Parent Records

4.6.3 Classes Information Management Module

The Classes Information Management module of the Stellar Care Visitor Management System assists instructors in organizing and managing class data. This module assists instructors in organizing class names and IDs. This module assists instructors with class administration, enrollment tracking, and streamlining operations. The index page of the Classes Information Management module, where instructors interact with class information, is depicted in Figure 15.

administrators to manage user accounts, access, and security. Figure 17 depicts the index page of the Users Information Management module, which allows administrators to interact with user data.

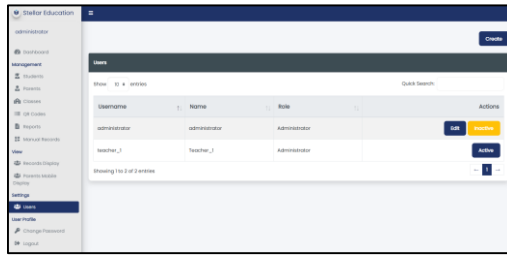


Figure 17 Index Page of Users Information Management Module

The index page contains a tabular format of usernames, responsibilities, and other pertinent information. Administrators are able to quickly seek for users and examine comprehensive information. The module enables administrators to conduct searches by login or role. This search feature enables administrators to locate and examine user data without extensive manual scouring.

Users Information Management enables administrators to perform essential user account administration duties. Users' roles and permissions can be created, edited, and assigned by administrators. When creating new accounts, administrators can assign user roles and provide usernames and passwords. Administrators can easily modify and update user account information to accurately reflect account details or module permissions. The Code Segment for Creating and Updating User Records is depicted in Figure 18.

```

public function create() {
    if ($this->request->isAjax()) {
        $data = $this->request->getPostData();
        $user = $this->model->read($data['username'], ['username' => true]);
        $password = $this->request->getPostData();
        $password = $this->request->getPostData();
        $password = $this->request->getPostData();
    } else {
        $password = $password;
        $password = $password;
        $password = $password;
    }
    if ($this->request->isAjax()) {
        $data = $this->request->getPostData();
        $password = $password;
        $password = $password;
    } else {
        $password = $password;
        $password = $password;
    }
    $password = $password;
    $password = $password;
    $password = $password;
}

public function edit($id = null) {
    $id = $this->request->getPostData();
    $data = $this->request->getPostData();
    $password = $password;
    $password = $password;
    $password = $password;
}

```

Figure 18 Code Segment for Creating, and Updating User Records

The module administers user data operations to protect data. These code segments facilitate the creation, modification, and authentication of user accounts. These segments of code enable administrators to access user data, modify it, and enforce security.

Users Information Management places a premium on data security and confidentiality. User identification, password encryption, and access control prevent unauthorized administrators from accessing user data. This safeguards sensitive user data and the integrity of the system.

The Users Information Management module assists administrators in managing user credentials, securing the Stellar Care Visitor Management System, and controlling system access. This module assists administrators with user account management, data protection, and system security.

4.6.5 QR Codes Information Management Module

The Stellar Care Visitor Management System's QR Codes Information Management module allows administrators to manage and organize QR codes within the system. This module makes it easier to

The administrator interface for Create Fetch Records is depicted in Figure 21. This interface manages visitor-related information.

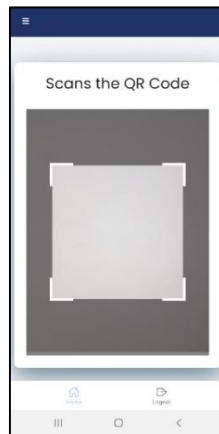


Figure 21 Interface of Create Fetch Records Module

Create Fetch Records guides parents through the creation of visitor records. Parents can generate the records by scanning the QR codes. The module validates data to prevent data entry errors. The Code Segment for Creating Fetch Records is depicted in Figure 22.



Figure 22 Code Segment for Creating Fetch Records

Create Fetch Records safeguards data privacy and integrity. Parents only have access to create the records, safeguarding sensitive visitor data. The module also encrypts and securely stores visitor data.

4.6.7 View Records Module

The View Records module of Stellar Care enables administrators to simply examine and manage visitor records. This module centralizes visitor data for simple administration access and analysis.

The View Records module enables administrators to navigate the system's extensive visitor database. The module displays the visitor's related students identity, the date of their visit. Administrators can easily search and organize records to locate the information they require. Figure 23 depicts the straightforward interface of the View Records module, which makes record exploration simple.

Administrators can generate reports in real time and on demand. They have access to current information and can respond swiftly to emerging trends and security concerns. PDF reports facilitate further investigation and collaboration. The Code Segment for Creating Fetch Records is depicted in Figure 25.

```

1  * Fetch Records *
2  * Fetch Records *
3  * Fetch Records *
4  * Fetch Records *
5  * Fetch Records *
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7  * Fetch Records *
8  * Fetch Records *
9  * Fetch Records *
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```

Figure 26 Code Segment View and Generate Reports Module

Privacy and security are prioritised by View and Generate Reports. The module is only accessible to administrators, safeguarding sensitive data. Encryption and access controls protect report information.

The View and Generate Reports module enables administrators to comprehend visitor activity, make decisions based on data, and enhance security and guest management. The module's user-friendly interface, flexible reporting options, and real-time data access aid administrators in evaluating and enhancing visitor statistics.

4.7 Testing

The Stellar Care Visitor Management System testing procedure verifies that all system features are operational and conform to the established criteria. The author presents the test cases, requirement traceability matrix, and test results for the system in this section.

4.7.1 Test Case

Table 5: Test cases of the system

Test Cases ID	Requirements ID	Descriptions	Status
TC_100	REQ_100	Add Student	
TC_100_01	REQ_101	The system shall allow users to add a new student to the database.	PASS
TC_100_02	REQ_102	The system shall validate and store the student's information, including name, age, and contact details.	PASS
TC_100_03	REQ_103	The system shall generate a unique student ID for each added student.	PASS
TC_100_04	REQ_104	The system shall display a success message upon successfully adding a student.	PASS
TC_200	REQ_200	Add Parent	

Test Cases ID	Requirements ID	Descriptions	Status
TC_200_01	REQ_201	The system shall allow users to add a new parent to the database.	PASS
TC_200_02	REQ_202	The system shall validate and store the parent's information, including name, contact details, and relationship to the student.	PASS
TC_200_03	REQ_203	The system shall associate the parent with the corresponding student using their unique IDs.	PASS
TC_200_04	REQ_204	The system shall display a success message upon successfully adding a parent.	PASS
TC_300	REQ_300	Create User Account	
TC_300_01	REQ_301	The system shall allow users to create a new user account with a username and password.	PASS
TC_300_02	REQ_302	The system shall validate and store the user's account information.	PASS
TC_300_03	REQ_303	The system shall encrypt and securely store user passwords.	PASS
TC_300_04	REQ_304	The system shall send a confirmation email to the registered user.	PASS
TC_400	REQ_400	Add Class	
TC_400_01	REQ_401	The system shall allow users to add a new class to the system.	PASS
TC_400_02	REQ_402	The system shall validate and store the class information, including class name, grade level, and teacher.	PASS
TC_400_03	REQ_403	The system shall generate a unique class ID for each added class.	PASS
TC_400_04	REQ_404	The system shall display a success message upon successfully adding a class.	PASS

Test Cases ID	Requirements ID	Descriptions	Status
C_500	REQ_500	Generate QR Code	
TC_500_01	REQ_501	The system shall generate a QR code for each student in the database.	PASS
TC_500_02	REQ_502	The QR code shall contain the student's information and unique ID.	PASS
TC_500_03	REQ_503	The system shall display the generated QR code for each student.	PASS
TC_600	REQ_600	Fetch Student Records	
TC_600_01	REQ_601	The system shall allow users to fetch student records based on specific criteria, such as grade or class.	PASS
TC_600_02	REQ_602	The system shall retrieve and display the relevant student records.	PASS
TC_700	REQ_700	View Student Records	
TC_700_01	REQ_701	The system shall allow users to view individual student records by searching with their unique ID.	PASS
TC_700_02	REQ_702	The system shall display the student's information and related details, including parent contact information and class enrollment.	PASS
TC_800	REQ_800	Generate Student Reports	
TC_800_01	REQ_801	The system shall allow users to generate reports on student information, such as class enrollment, attendance, and academic performance.	PASS
TC_800_02	REQ_802	The system shall display the generated reports in a printable format.	PASS

4.7.2 User Acceptance Testing

User acceptance testing evaluated the functionality and efficacy of the Stellar Care Visitor Management System. The aggregate test results indicate that the system complied with the requirements and maintained student data. The system was capable of adding new students to the TC_100 database. The

system validated and stored the student's name, age, and contact details. To ensure system accuracy, a unique student ID was assigned to each new student.

The TC_200 test cases allowed database users to add new progenitors. The system validated and saved the parent's identity, contact information, and student-parent relationship. The technology connected parents and pupils through their individual IDs.

With a username and password, users could quickly create TC_300 accounts. For security purposes, passwords and account information were encrypted. After registering, users receive a confirmation email.

Adding a class (TC_400) demonstrated that the system permits users to enter class name, grade level, and instructor information. Unique class IDs ensured identification and organisation. Users received satisfactory messages after class creation, indicating system stability.

The system issued a QR code (TC_500) to each database student. These QR codes contained pupil data and unique identification numbers. The technology displays QR codes to make scanning and retrieval easier.

The retrieval and presentation of pupil records for TC_600 and TC_700 were effective. The system successfully retrieved and displayed student records organised by grade or class. Using unique student IDs, a search revealed parent contact information and enrolment in classes.

Finally, student reports for TC_800 were superb. Users could generate enrolment, attendance, and academic performance reports. The system generated reports for user convenience.

According to user acceptability tests, the Stellar Care Visitor Management System meets objectives and handles student information efficiently and dependably. The system's dependability, user-friendliness, and comprehensive reports make it indispensable for the efficient administration of students in educational institutions.

5. Conclusion

The CARE Visitor Management System is proposed as a solution to the problem mentioned previously that Stellar International School faces. The proposed system is concluded with the requirement analysis, which identifies the organization's needs, and the system design, which outlines the development process and specifies the terms and criteria necessary to meet those needs. In addition, the appealing and concise interface is an essential component of a web application's interface design.

Acknowledgement

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