Development of Student Management System

Tharindu Vidanagamage[1], D. Supiniduni Pragathika Piyadali[2], M.G. Shamali Dilrukshi[3], H.D. Shonali Romeshika[4], D.I De Silva[5] and Dulanji Cooray[6]

[1]Department of Computer Science & Software Engineering, Faculty of Computing, Sri Lanka Institute of Information Technology(SLIIT), Malabe, SRI LANKA

[2]Department of Computer Science & Software Engineering, Faculty of Computing, Sri Lanka Institute of Information Technology(SLIIT), Malabe, SRI LANKA

[3]Department of Computer Science & Software Engineering, Faculty of Computing, Sri Lanka Institute of Information Technology(SLIIT), Malabe, SRI LANKA

[4]Department of Computer Science & Software Engineering, Faculty of Computing, Sri Lanka Institute of Information Technology(SLIIT), Malabe, SRI LANKA

[5]Department of Computer Science & Software Engineering, Faculty of Computing, Sri Lanka Institute of Information Technology(SLIIT), Malabe, SRI LANKA

[6]Department of Computer Science & Software Engineering, Faculty of Computing, Sri Lanka Institute of Information Technology(SLIIT), Malabe, SRI LANKA

[1]Corresponding Author: it20168872@my.sliit.lk

ABSTRACT

The focus of this essay is to demonstrate the consequences of using an automated web application for a student management system, how it eases the school operations, what technologies, tools, and methodologies used in developing the web application, a systematic explanation of the flow of functions through a proposed system and reveal the essential findings and expected results of the research. A student management system is a process or system that provides the data required to efficiently administer an educational institute. It supports the institution's strategic goals and provides an independent framework for collecting and storing data. By using management systems, administrative operations and formal procedures at educational institutions can be made much easier. Using student management systems, it is possible to maintain school records and data efficiently. The purpose of this research paper is to analyze the development of a web-based school management system that can be used by educational institutions to enhance the effectiveness and efficiency of learning, teaching, and administrative activities. This essay discusses the design and workflow of a developed web-based system and aims to present a complete overview of our well-authorized and authenticated school management system that was developed using Node JS, React JS, and MongoDB.

Keywords-- Student Management System, Web Application, MERN Stack, React JS, Node JS, MongoDB

I. INTRODUCTION

Today, any country's development depends greatly on its educational system. Numerous educational institutions work hard to improve the standard of education and modernize their education methodologies. Every technical innovation represents a small step in the direction of human progress. Technological advancements influence educational institutions as well. The management of school resources is one of the key aspects of this development. The growth and future of our country highly depend upon the quality of the present school education system and in a good school, the chief objective is to stimulate interest and curiosity in the students and provide all facilities for teachers and staff to achieve the desired goal which is a better and easier educational way for students. Therefore, to accomplish that goal, there should be a web application that simultaneously serves all user needs.

According to Brumbulli, et al, [1], they define the school management system is a big database system, that can be used by schools for supporting day-to-day activities in school. A large database system designed as a school management system can be used to manage the day-to-day operations of schools. It is a multi-user system that can be accessed concurrently by hundreds or even thousands of users. Users of school management systems can virtually store all their institution's data electronically. Most importantly, this data is readily available for authorized individuals to view, share, and search, and it is easy to generate reports by using a web-based school management system.

Most of the time teachers and academic staff face problems in convincing the distribution process of classes, class fees, exam timetables, exam results, and notices to the students. Further, teachers face problems in viewing their payment details. The proposed system developed to overcome those problems. The system, which facilitates constant communication between teachers and students, is a crucial fact in this management process. The objective of this school management system is to assist school administration

in improving all the services the educational institute offers. This web-based application automates all the operational functions of the institution including user management, course pay management, class management, exam management, exam results management, teacher salary management, and notice management. All these functions consist of insert, retrieve, update, delete, search operations, and report generation. Further users must register to the system with a unique username and password on the first visit and then they can log in and proceed with the authorized operations in the web application.

Main Benefits of the developed system.

1. Increased Efficiency.
2. Improved usability due to user friendliness.
3. Accessibility is high.
4. Higher scalability and flexibility.
5. Integrity and reliability of data.
6. Easy to store large data collections.
7. Time saving due to automation.
8. Ease of report generation.

This research paper consists of the related work (literature review), which includes the important systems that tie in with work, methodology explaining the techniques, tools, and approaches used in developing the web-based school management system and proposed system with explanations of the main functions. In the discussion, the key findings and expected results are described in a logical sequence by using illustrations, and the testing methods used in the testing of the designed web application are demonstrated with examples. Finally, a summary of the findings and expected results of this paper and the importance of our research is well explained in the conclusion.

II.   RELATED WORK

Several research papers on the development of student management systems were studied before developing the system [2][3][4][5][6].

S.R. Bharamagoudar, Geeta R.B., and S.G. Totad designed a web-based student information management system [2] to address the issues with manual paper records. The purpose was to develop a college website with current information about the institution. The effectiveness of managing college records should increase as a result. The proposed system primarily focuses on managing the information that the college administration, through multiple levels of control, maintains on students, teachers, placement cells, exam sections, and associated data. HTML, CSS, JavaScript, PHP, and SQL were the technologies used to develop the system.

Zhibing Liu and Huixia[3] Wang identified several tedious tasks that need a heavy workload and absolute accuracy, such .as managing classes, scores, and other tasks that would take a lot of staff time and effort to do manually.

They found that using computers to handle student information offers incomparable benefits like quick searches, convenient finders, high reliability, large memory capacities, confidentiality, long life, and low cost, among others, which can significantly increase the effectiveness of student information management. The main function of the system is the management and upkeep of data, such as student records, curriculum details, and class and informational details. The system was created using Visual Basic 6.0 and SQL Server 2000.

If the student information management procedure is given manually, Ibrahim and Gleb[4] found that it will be very difficult to manage a large number of students, teachers, and courses. One must put in a lot of effort to update the schedule or the information about the classes. They proposed a software solution that enables administration and access to such information to give quick access to such information. They stated that using a cloud solution as a platform and client-side web access to this system would be the ideal method to deliver such a system. This strategy would release us from the need to
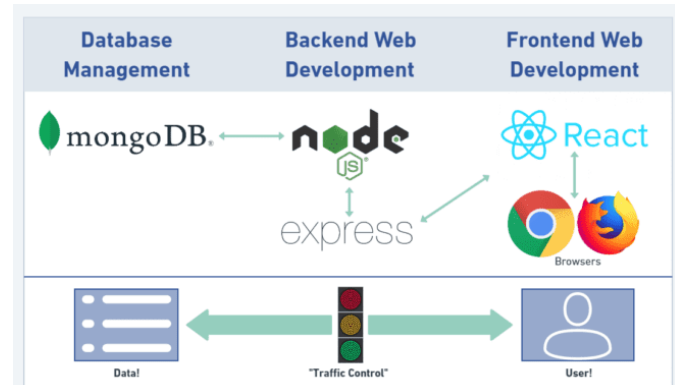

Figure 1: Technologies used – MERN Stack

set up our data center and provide every user simple access to the system's resources via a web browser. Admin, teacher, head of the department, head of the college, and student are the five main users of the proposed system. Microsoft Azure cloud, ASP.NET, and Windows Azure SQL were the technologies used to develop the system.

An integrated student activities management system for higher education during the COVID-19 period in Malaysia was presented by a group that included Jamaluddin Jasmis[5]. They noted that the majority of current labor involving the scheduling and documentation of the pupils' activities is still mainly done on paper. Such an approach is very time-consuming and fraught with dangers. Therefore, they found that the incorporation of technology in the form of an Integrated Management System can address these issues by, among other things, managing and speeding up the work flow of student activities and related proposals, tracking paperwork, minimizing errors, speeding up turnaround times,

reducing redundancy, and improving the quality of data collection. This student activity management system has five actors and performs eight different functions. Students, university staff, the counselor, the sports recreation committee, and representatives from the student affairs division make up the five actors in this system. The functions of the system are: making and viewing memos; making and editing proposals; logging in; creating and seeing comments; and making approvals.

Gatete Marcel and Uwizeyimana Faustin[6] proposed developing an online integrated student information management system for the "University of Gitwe' in Rwanda. The current manual approach frequently causes difficulties with information flow, space wastage, information loss during the transition from one service to another, etc. The University of Gitwe Student Management Information System's major goal is to enable the registrar to access student information, course information, curriculum information, instructor information, and student grades in order to track student information and manage student-related data. The database, object-oriented programming, and networking strategies form the system's foundation. HTML, CSS, JavaScript, PHP, and MySQL were the technologies used to develop the system.
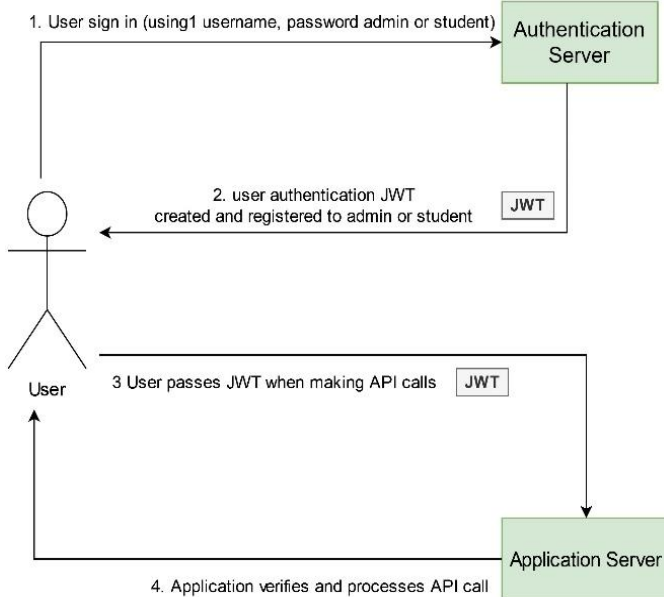
Figure 2: JWT Authentication

III. METHODOLOGY

The evolving school management system, which will utilize a three-tier architecture, is using MERN Stack technology (see Figure 1). SCRUM agile methodology will be applied in this project due to its agile environment, which will allow those engaged to interact continually during the sprint, and then the agile development. In the system

environment, Visual Studio Code (VS Code) used as the coding platform.

The system design makes it apparent that the built-in backend server will be utilized to process the data that has been sourced from the client application and deliver the processed data back to the client application. The server side consists of two parts: the web service and the MongoDB database. The web service, which includes several features to process data from the database and generate output that can be accessed by the application using the URL methods GET, POST, PUT, and DELETE, uses the REST API design. All of the data from the student management application's components are kept in the database [7].

The development of the student management learning website has utilized the following frameworks, technologies, and platforms.

- Frontend – React JS, Bootstrap
- Backend – Node JS

- Database – MongoDB
- Tools – Postman / Selenium / SonarQube/ Github /VS code

- The front end of the execution process contains the react JS and back-end contains node JS.

- React JS - React JS is an open-source JavaScript library that will be used to develop the frontend interface.

- Bootstrap – react-bootstrap replaces bootstrap JavaScript. It's a flexible and powerful fronted framework. That introduces a free tool collection for creating a web & mobile application, which makes it easier for responsive sites.

- Node JS - is an open-source, cross-platform, backend JavaScript runtime environment that will be used to implement the backend process.

- MongoDB – is a virtual database it can assign to anyone without permission. Classified as a NoSQL database program. MongoDB is used in JSON format.

- Tools – Postman is used to check the URL of get/post/put/delete requests. The second tool is selenium which acts as a testing tool it will be used for testing all functions like login authentication/forms (within crud operations). SonarQube is also a testing tool it covers the full system and catches all issues that can't find. GitHub is one of the hosting platforms. It has repositories

and branches. The team member can share and implement their code through GitHub. The last one is VS Code that's a coding platform it has features for developers to make it easier to implement their system.

Login Authentication Web Server

Every system user or customer first looks for product security. then the developer should add authentications in the login registration function. JWT (JSON web token) is one of the methods implemented to secure the system. [8]

When a user uses his username and password to sign in to a mobile application, the authentication server normally produces and sends back JWT. Then, this JWT is sent together with the following API request to the server. JWT remains active until it expires or the user logs out of the program. The graphic in Figure 2. illustrates this process.

Backend Process

In the student management system, all the functions such as register, student payment, class details, exam details, teacher salary, and notices, all functions of the backend are implemented on crud operations (see Figure.3). According to Figure 3 first operation is to create one, user needs to submit all the necessary details then it will save in the database and display an alert record saved successfully. The second operation is data retrieving. Type a relevant keyword passed into the database and checked if it similar keyword is present or not then display all details accordingly or display some error. The update operation proceeds the same as the retrieve operation passing the unique keyword user entered, editing action to the database, and checking and updating relevant details. The last operation, delete same as the update operation user sends a delete request with the id to the database then the database had similar data then accepts the request, and deletes it.
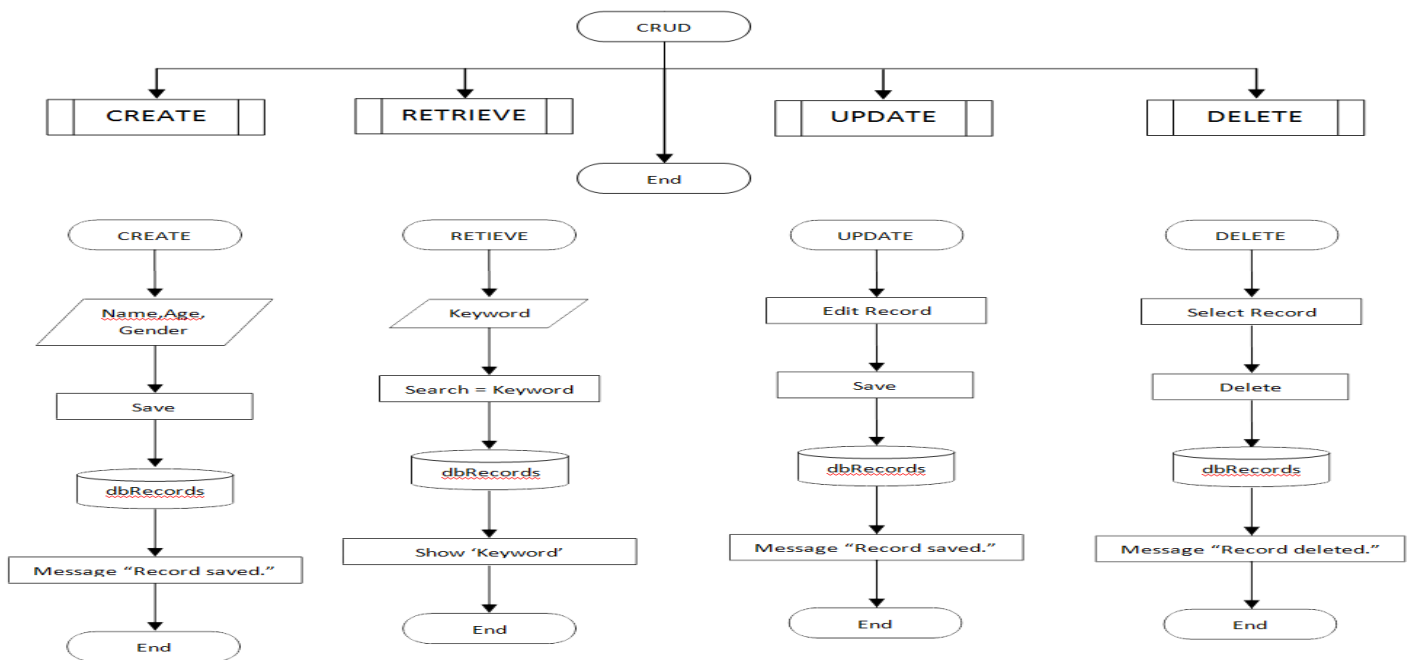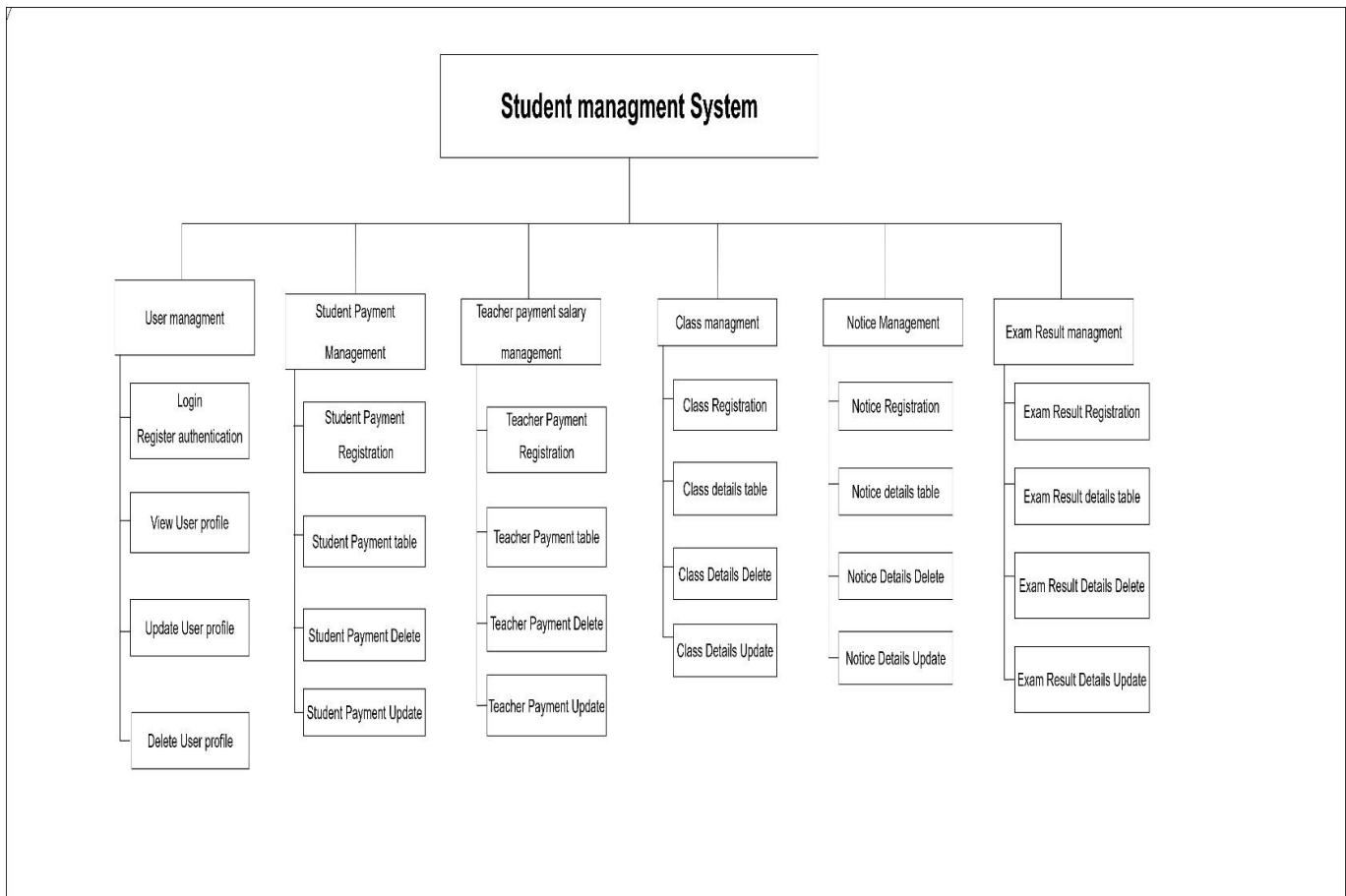

Figure 3: Backend Process

Figure 4: System functions of the proposed work

IV. PROPOSED WORK

The user, class, exam schedule, exam results, and teacher/ student payments management are the five main functions of this system. Figure 4 illustrates the functions of the system. User register function has two roles of admin and student. They can register to the system with a password. They can have registered to the system. Therefore, the user can delete or update his account details. In user, management has a user name, birthday, gender, age, address, Gmail, username, and password are main attributes. Admin would be able to download user details report as a pdf**.**

In the class management function, the admin can insert, update, retrieve, delete and search class details. Here class name, class type(theory/revision/paper), student's grade, teacher's name, class date, and time are the main attributes. Students would be able to download the PDF of all class details as a report.

In the exam time table management function, Admin can create exam timetables. To create exam timetables, the admin should fill out a form with a grade, subject, date, start time, end time, and exam hall. Admin can view all created

Exam timetables on the Exam timetable page of the admin side. If the admin wants to delete a particular exam timetable record from the table, he/she can delete that by clicking the delete icon. Admin can edit the exam timetables by using the edit exam timetable update form. Admin can search exam timetable records by subject, grade, and date. Also, he/she can download the exam timetable. Students can view all created Exam timetables on the Exam timetable page of the student side. Students can download the relevant exam timetable according to the grade that they are studying in. Students can search exam timetable records by subject, grade, and date.

Consider the exam result function Admin can examine the results of the students. To enter exam results, the admin should fill out a form with a grade, subject, student name, student id number, marks, and the grade that the student received. Admin can view all exam results on the Exam results page of the admin side. Admin should select the grade and the subject that he wants to view the results. If the admin wants to delete a particular exam result, he/she can delete that by clicking the delete icon. Admin can edit the exam results by using the edit exam results update form.

Admin can search exam results by student name or student id number. Also, he/she can download the exam results sheets. Student can view their exam results on the Exam results page of the student side. Students can download the exam results sheets. Also, they can search their exam results by their name or student id number.

In teacher payment management admin can insert, update, retrieve, delete and search salary details. In here teacher name, id, working days, EPF, department, and department are the main attributes. The teacher would be able to download the PDF of all Teacher salary details as a report. and student payment management function students can insert, update, and retrieve all student details. Admin can delete student payment by searching relevant id. Here student name, student id, student grade level, mobile, email, parent name, method of payment, and parent contact number are the main attributes. Admin would be able to download the PDF of all student payment details as a report.

V. DISCUSSION

Results
The following figures are the results of the developed student management system. Some user interfaces of the user management, class management, exam timetable management, and payment management functions can be presented as follows.

a. User Management
As seen in Figure 5 and 6 admin or student can login to the system. Admin can manage all the users using the system.

Figure 5: Registration form of the users

Figure 6: Administration page of the users

b. Class Management
As seen in Figure 7 and 8 admin can add classes to the system. Admin can manage all the created classes using the system.
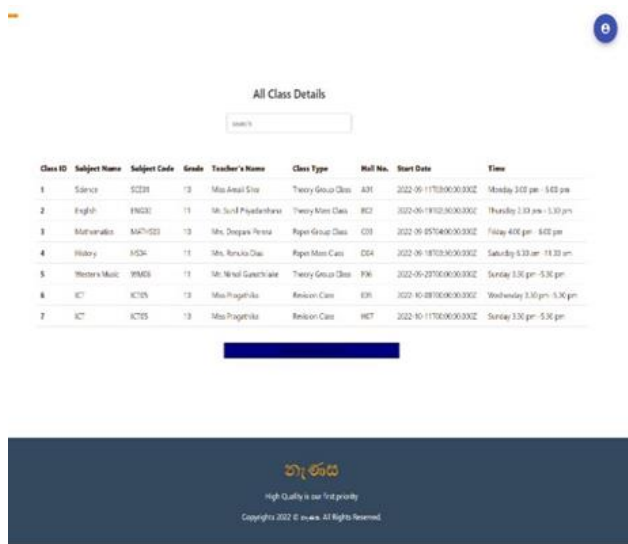

Figure 7: Add Class Details Form

Figure 8: Retrieve page of Classes

c. *Payment Management*

As seen in Figure 9 and 10 students can add payment details to the system. Admin can manage all the created payments using the system.
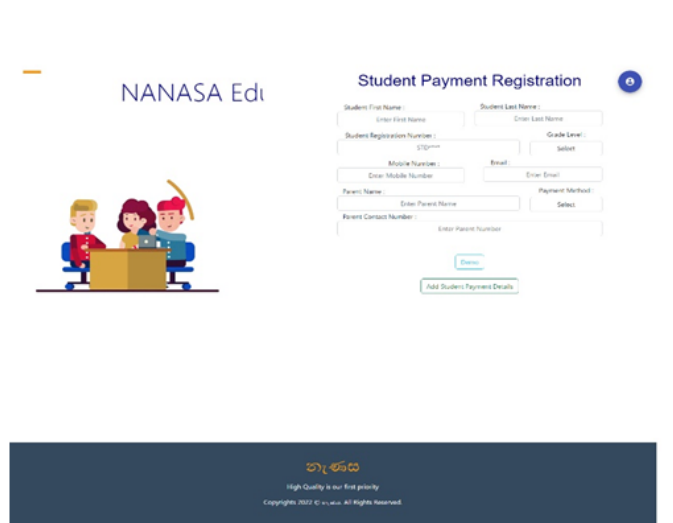

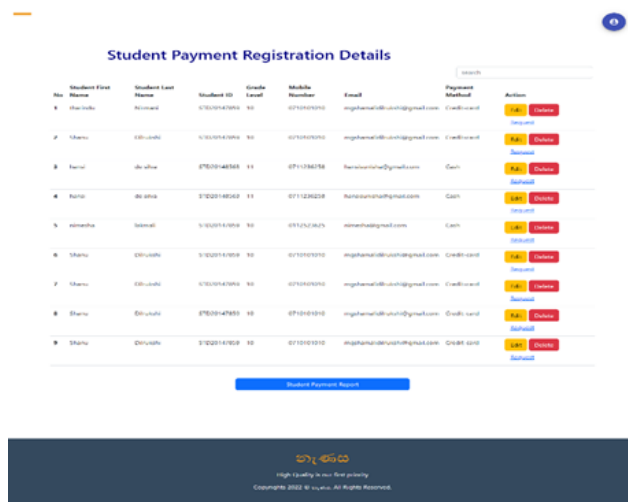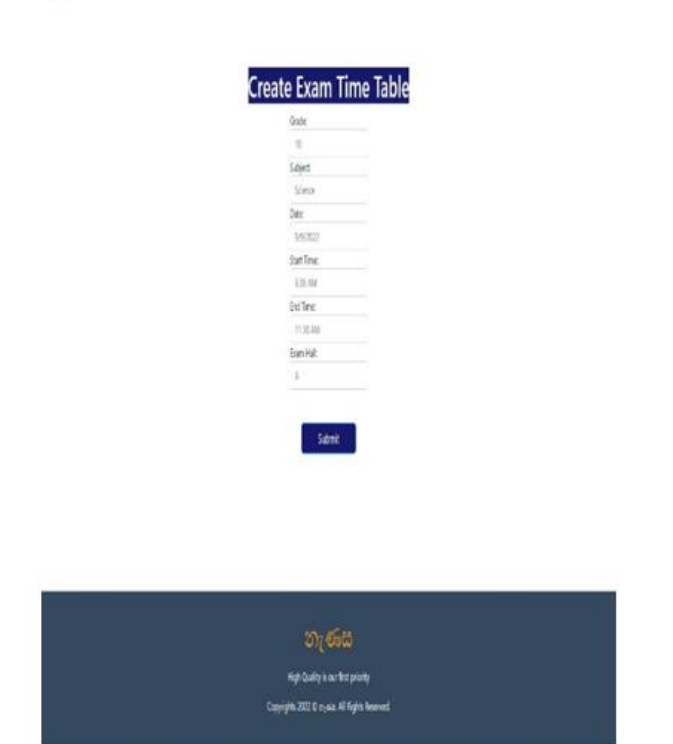**Figure 9:** Student Payment Registration Page

Figure 10: Student Payment Administration Page

d. *Exam Time Table Management*

As seen in Figure 11 and 12 students can add payment details to the system. Admin can manage all the created payments using the system.

Figure 11: Admin Create Exam Table Page

Figure 12: Exam Time Table Page

Testing Methods

Selenium and SonarQube, two testing tools, have been used to evaluate the Student Management System.

a. Selenium

An open-source browser extension tool is selenium. It offers a Without having to understand a test scripting language. it provides to check all testing activities in a current web browser such as chrome and Firefox. In our system, selenium was used for all operations. Figure 13 and Figure 14 illustrate the test scripts for login function and register function.

b. SonarQube

SonarQube is a tool for checking the quality of the code of the project. that gathers, examines, and produces a report with information on issues and code coverage. Blocking, critical, major, and minor are issues in the report. The developer should pay special attention to blocking and critical issues. Figure 15 illustrates the project issues that caught by SonarQube.

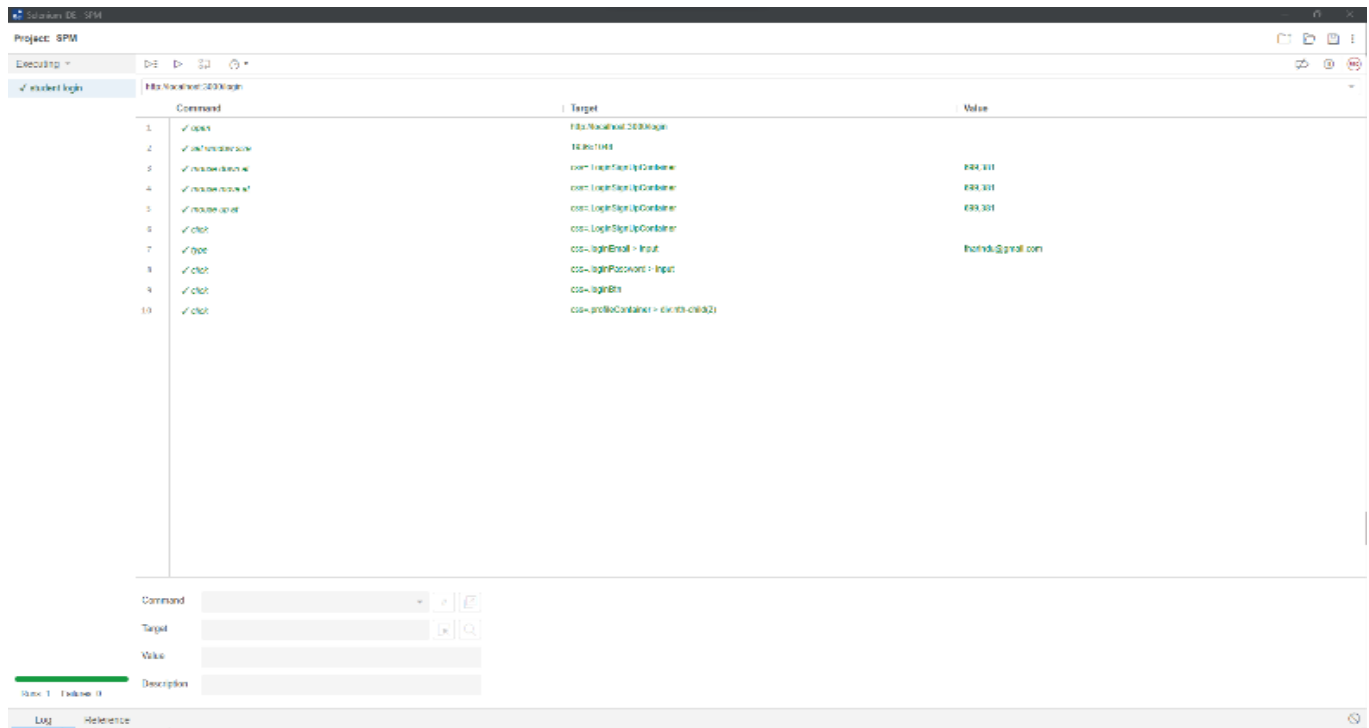**Figure 13:** Selenium Test Script for Register Function

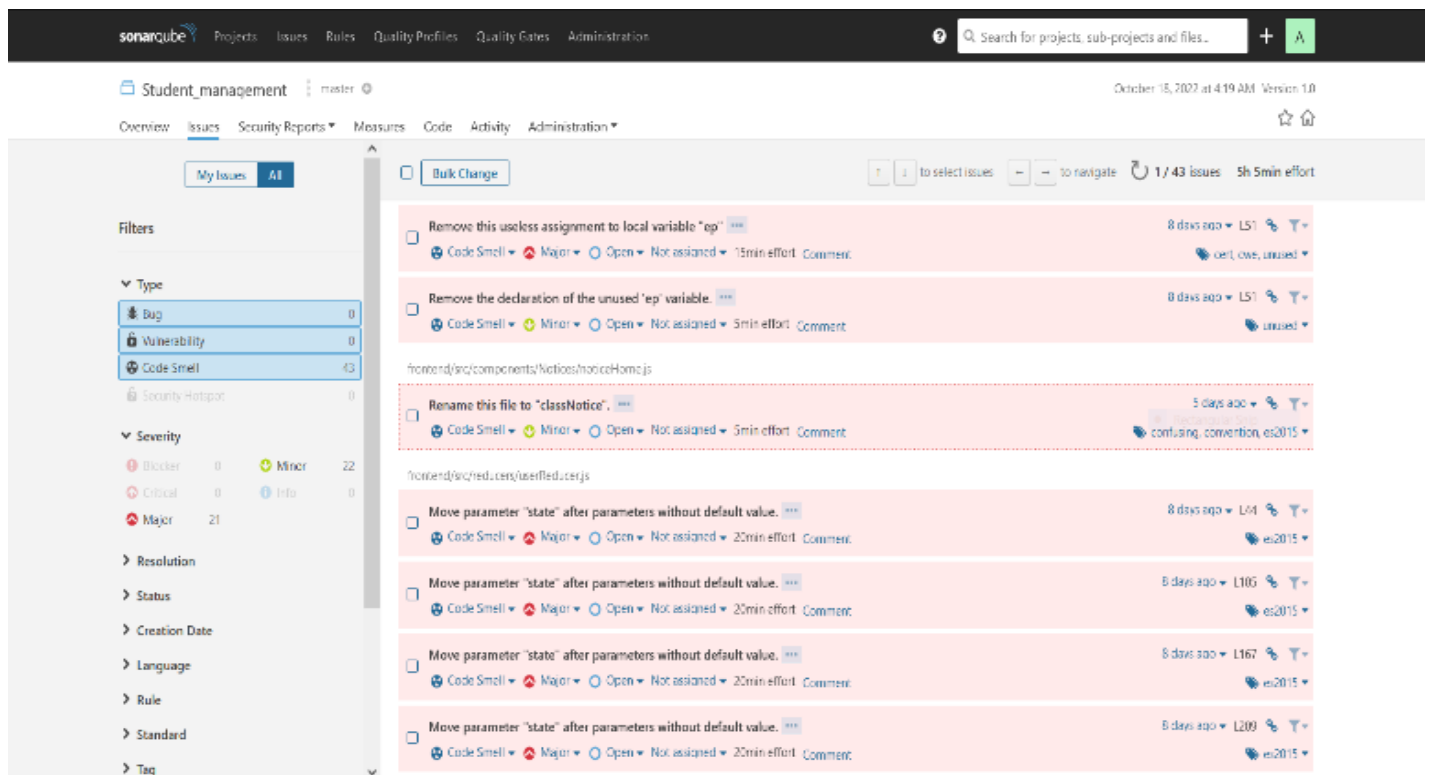**Figure 14:** Selenium Test Script for Login Function

Figure 15: Project Issues of SonarQube

VI. CONCLUSIONS

The quality of the country's current educational system has a significant impact on the growth and future of the nation. In a good school, the main goal is to stimulate students' interest and curiosity while also giving teachers and staff the tools they need to accomplish the goal, which is to improve and simplify the educational process for students. Therefore, a web application that concurrently meets all user needs was proposed to achieve that goal.

This proposed student management system has three actors and performs five different functions. The student, teacher, and admin make up the three actors in this system. User management, class management, exam timetable management, exam results management, and teacher payment management are the functions of the system. RecatJS as frontend technology, NodeJS as backend technology, and, MongoDB as the database was the technologies used to develop the system. Postman, VS Code, and GitHub were the other tools used to develop the system. SonarQube and Selenium were used to test the developed system. All the results of the developed system are presented in the discussion section of the paper.

Increased efficiency and accessibility, high scalability and flexibility, integrity and reliability of data, easiness of storing large data collections, and time-saving can be achieved through the developed student student management system. As this system is limited to only five functions, the system can further modify by adding notice management, e-Library management, learning management, and parent details management as future work.

REFERENCES

[1] Brumbulli, M., Topçiu, B., & Dalaçi, A. (2008). *SMIS: A web-based school management.*

[2] G. R. S. S.R.Bharamagoudar. (2013). Web based student information management. *International Journal of Advanced Research in Computer and Communication Engineering, 2*(6), 7.

[3] H. W. Zhibing Liu. (2010). Design and implementation of student information management system. *International Symposium on Intelligence Information Processing and Trusted Computing,* pp. 4.

[4] G. R. Ibrahim & A. ALAMERI. 92017). Development of student information management system based on cloud. *Journal of Applied Computer Science & Mathematics, 11*(2), 6.

[5] A. A. Z. F. Jamaluddin Jasmis. (2020). An analysis model for an integrated student activities management system for higher education during an analysis model for an integrated student activitie. In: *5th International Conference on Computer Science and Computational Intelligence*.

[6] U. F. Gatete Marcel. 92019). Development of an online integrated student management. *International Journal of Advanced Research in Computer Science,* 10(5), 9.

[7] Monika Mehra, Manish Kumar, Anjali Maurya, Charu Sharma & Shanu. (2021). MERN Stack Web Development. *Annals of the Romanian Society for Cell Biology*, *25*(6), 11756–11761. Available at: https://www.annalsofrscb.ro/index.php/journal/article/view/7719.

[8] K. Devika Rani Dhivyaa & N.Sangeethab. (2021). *Json web token used in MERN stack for makinge-commerce web-application.*