

## **Student Registration System for SMK Bandar Sungai Petani**

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**Abstract:** Student registration system for SMK Bandar Sungai Petani aims to create a student management system with role-based access control, encrypted database, and dual authentication. The student welfare members will be the admin of this system and they can add others as admins and add staff into the system. The staff are allowed to register students into the system by entering the students' details. Only those students who have been allowed by the admins will be registered into the system. When logging in, users need to enter their username and password as first factor authentication and need to enter an OTP sent to their email as second factor authentication. This feature is to make sure only allowed personnel get access to the system and to secure the system from getting breached by attackers. The project will be built in portions using the iterative waterfall methodology, resulting in faster development and product visibility, and the process can be repeated in subsequent versions based on feedback. This system was tested by a member of the school staff to ensure that it complied with their requirements.

**Keywords:** Authentication, Role-based access control

### **1. Introduction**

When registering in SMK Bandar Sungai Petani, students need to bring their documents and certificates such previous school results when registering. The staffs encounter few major issues during student registration process which usually delays the process and troubles other students too. It might bring out a lot of burdensome to students and staffs too. As a result, computerized system should be used to tackle this type of problem. In this proposed system, a web-based system is proposed in favor of the SMK Bandar Sungai Petani teachers which helps them to record the student's data. All this information is readily handled online and may be viewed from anywhere at any time via the Internet. The objective of the system is to design an online student registration system for SMK Bandar Sungai Petani, to develop the system using PHP and MySQL and to test the functionality and usability of the system with teachers and staffs. The proposed system has a few key scope aspects that will help it achieve its goals. The main users of this student registration system are admins, teachers, and staff. Admins will add the teachers and staff only they can access the system for registration. Teachers and

the school staffs will add the new student's details such as their name, address, previous school exam results, family status and parents name into the system. The proposed system will also implement several security features including RBAC, two factor authentication (2FA), and encrypted database.

## 2. Related Work

This chapter discusses the literature review of the proposed system. Section 2 gives an overview on what a student registration system is.

### 2.1 Student Registration System

Admins and staff have access to this system, where admins can add and delete other admins and staff. Students' information can be added, viewed, edited, or removed from the system by school personnel. With the suggested data registration method, it is straightforward to enhance registration at SMK Bandar Sungai Petani. Because it incorporates all departments and connects them on a single platform. As previously said, it reduces human effort in data entering by retrieving data from one entry to another [1].

### 2.2 Role-Based Access Control

Access control is a security technique that regulates who or what can view or use resources in a computing environment. It is a fundamental concept in security that minimizes risk to the business or organization [2]. RBAC is a mechanism of controlling network access based on the responsibilities of individual users inside a company. RBAC guarantees that workers only have access to the information they need to conduct their jobs and prohibits them from obtaining information that is irrelevant to them. Admins must align personnel to roles and determine their access privileges after developing a list of roles and associated access rights. Ensure that RBAC is implemented across all systems in the organization [3].

### 2.3 Two-Factor Authentication

Authentication technology controls system access by determining if a user's credentials match those in a database of authorized users or in a data authentication server. Authentication ensures safe systems, secure processes, and organizational information security in this way. After the user provides his/her username to login into their account, first gateway will be the Alphanumeric Password which the user has chosen at the time of registration for that site. Once it's got authenticated, the user must provide the password for the second gate way which will be a one-time password which has been sent to their phone or email [4]. The produced one-time password is only valid for time specified by the user, and it is generated using factors that are unique to both the user and the mobile device.

### 2.4 Database Management System

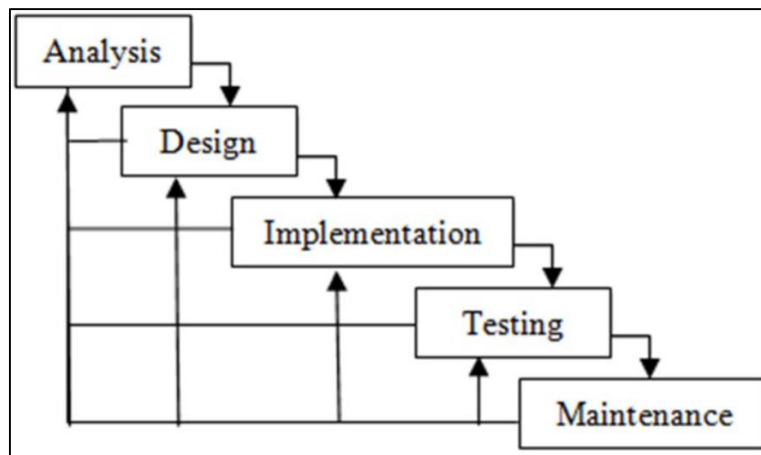
An encryption technique turns data within a database from a readable state to cipher text of unreadable characters with database encryption. A user can decrypt the data and get the useable information as needed using the algorithm's produced key. There are several ways of encrypting database based on the purpose and requirement of the system. API method is application-level encryption that may be used with any database product such Oracle and MySQL. Queries within encrypted columns are updated within the program, necessitating manual intervention. In plug-in method, you will install an encryption module, often known as a "package," on the database management system. This technique operates independently of the application, necessitates less code administration and change, is more adaptable and can be used with both commercial and open-source databases. TDE Method is transparent data encryption (TDE) encrypts and decrypts data within the database engine. This solution does not involve database or application code update and is easier to administer for administrators [5]. Table 1 shows the comparison of existing student registrations and the proposed system.

**Table 1: Comparison of existing and proposed systems**

Features/System	Creatrix Campus [6]	iSAMS [7]	Proposed System
Register Module	√	√	√
Login Module	X	X	√
Profile Module	√	√	√
Admin Module	√	√	√
Staff Module	√	√	√
Security Features	X	√	√
Role-Based Access	√	√	√

### 3. Methodology

The Iterative Waterfall Model as in Figure 1 is nearly identical to the waterfall model, except for several alterations introduced to increase the efficiency of software development. Iterative waterfall allows you to go back to a previous phase and update the criteria and make changes based on client feedback if necessary [8].



**Figure 1: Iterative Waterfall Model**

#### 3.1 Requirement Analysis Phase

During this first phase, all pertinent information is gathered from the client (staff of SMK Bandar Sungai Petani) to design the student registration system in accordance with their expectations. As this proposed system is a student registration system, the end-user will be the staffs of the school. Three types of security are required in the proposed system: role-based access control, dual authentication, and an encrypted database to store confidential information.

**Table 2: Functional requirement of the system**

Modules	Functionalities
Login	User must input valid staff ID and password. Users need to input valid OTP that they receive through email. The system will notify user if credentials are invalid.
Profile	Allow users to update their password and log out from system
Admin	Admin can add a new admin or staff into the system. Admin can manage registered admins and staffs such viewing, updating, or removing their details
Staff	Staffs can view, update, and delete students' details from the system
Register	Staff can add new students into the system

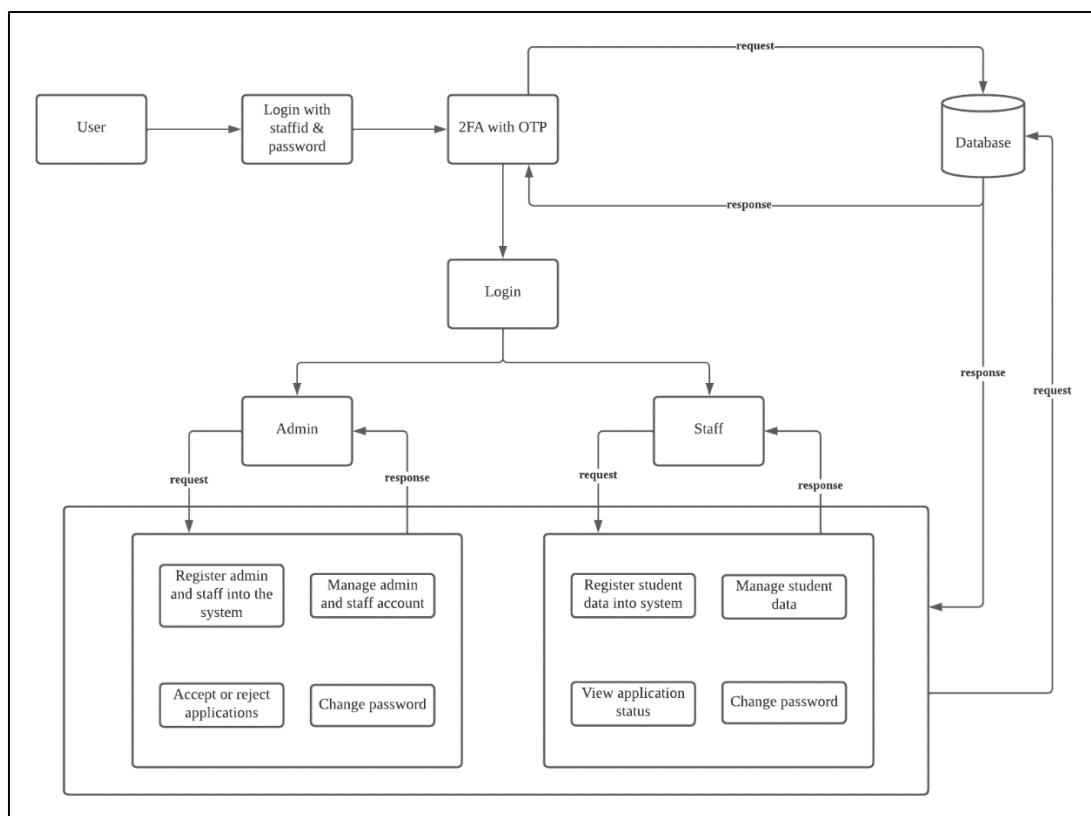
Table 2 shows the functional requirements while Table 3 depicts the non-functional requirements of the system.

**Table 3: Non-functional requirement of the system.**

No.	Requirements	Description
1	Operational	- The system is available offline.
2	Security	- Staff and admin may gain access to the system with valid staff ID and password. - Passwords will be hashed in the database. - To secure the system, role-based access control will be implemented to allow limited access to users. - Two factor authentication will also be implied.

### 3.2 Design Phase

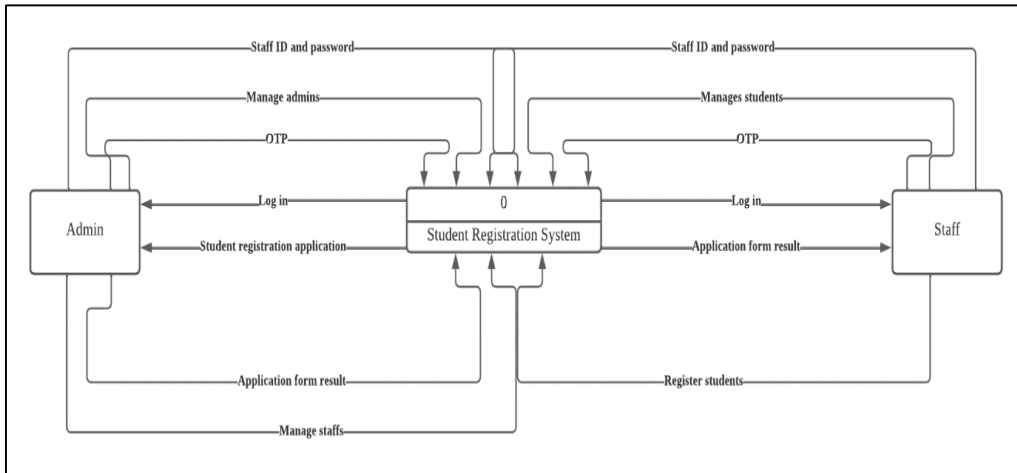
The project's system design is determined during the design phase. The system's user interface, database, architecture, and flowchart have all been planned out and created.



**Figure 2: General system architecture**

Figure 2 shows the general system architecture on how the proposed system works. First, the user needs to go through the login page with their credentials and an OTP will be sent to their email. With the correct credentials and OTP, the user will successfully get into the system. As for the admins, they are allowed to register a new member as an admin or a staff into the system and manage the pre-registered admins and staffs such viewing, updating, and removing. The admins also have access to accept or reject a student’s registration form by reviewing his previous grades. Whenever a staff logs in to the system, there will be three pages stating, ‘Student registration’, ‘Student data’ and ‘Profile’ page. Under the student registration page, the staff is allowed to add a new student into the system and

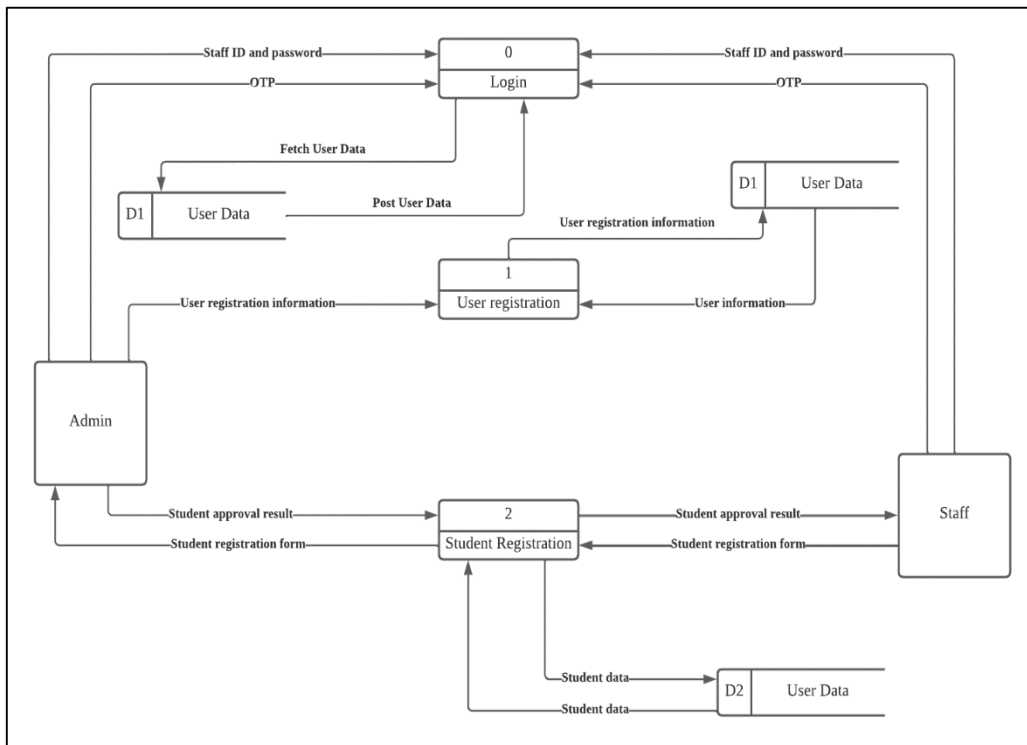
wait for the approval status form. Staff also can manage the pre-registered student’s data like viewing, updating, and deleting their data under the student data page.



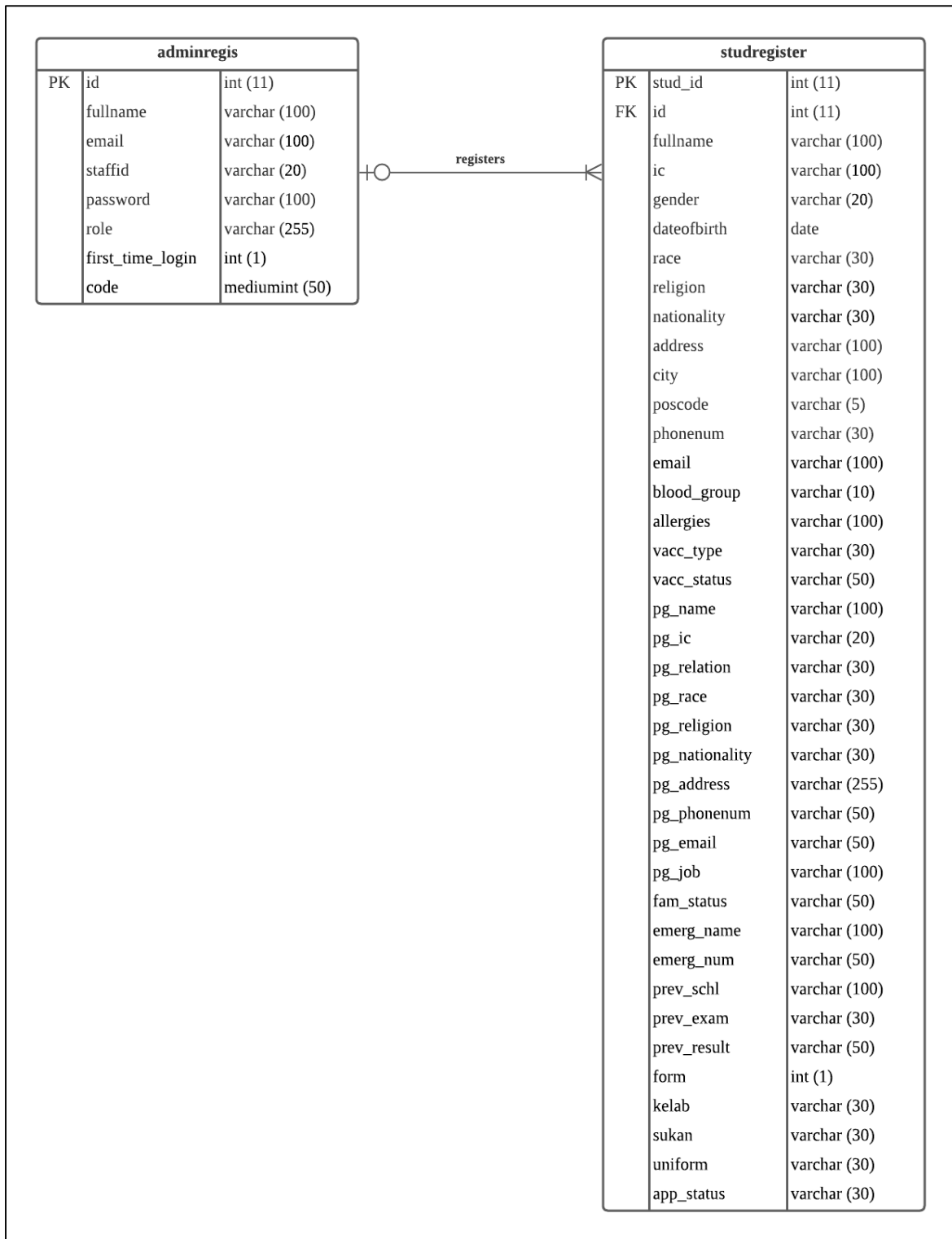
**Figure 3: Context Diagram**

Figure 3 shows the context diagram for the proposed system. After logging in with staff ID and password, and completing the two-factor authentication with OTP, both admin and staff will gain access to the system. As for admins, they can add new admins and staff and manage current admins and staffs in the system. The admins can also accept or reject student application forms. As for staffs, they can register new students into the system by filling up a form. Staffs can also manage current students’ data in the system.

Figure 4 shows Data Flow Diagram (DFD) Level 0 and the processes that occurs between the system and users which are login, user registration and student registration. Figure 5 shows the Entity Relationship Diagram (ERD) for Student Registration System. Figure 6 and Figure 7 shows the flowchart for admin and staff respectively.



**Figure 4: DFD Level 0**



**Figure 5: Entity Relationship Diagram (ERD)**

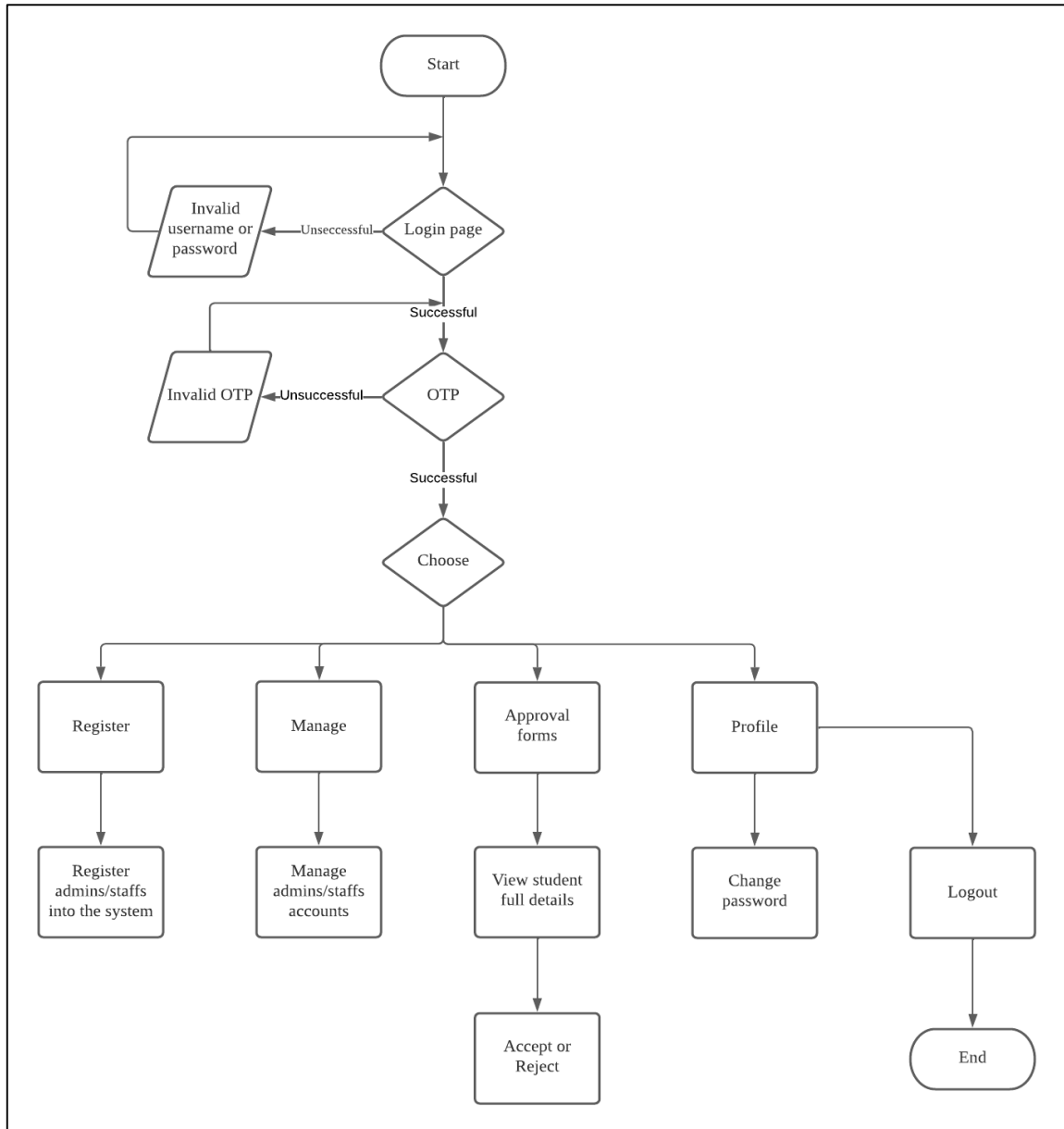
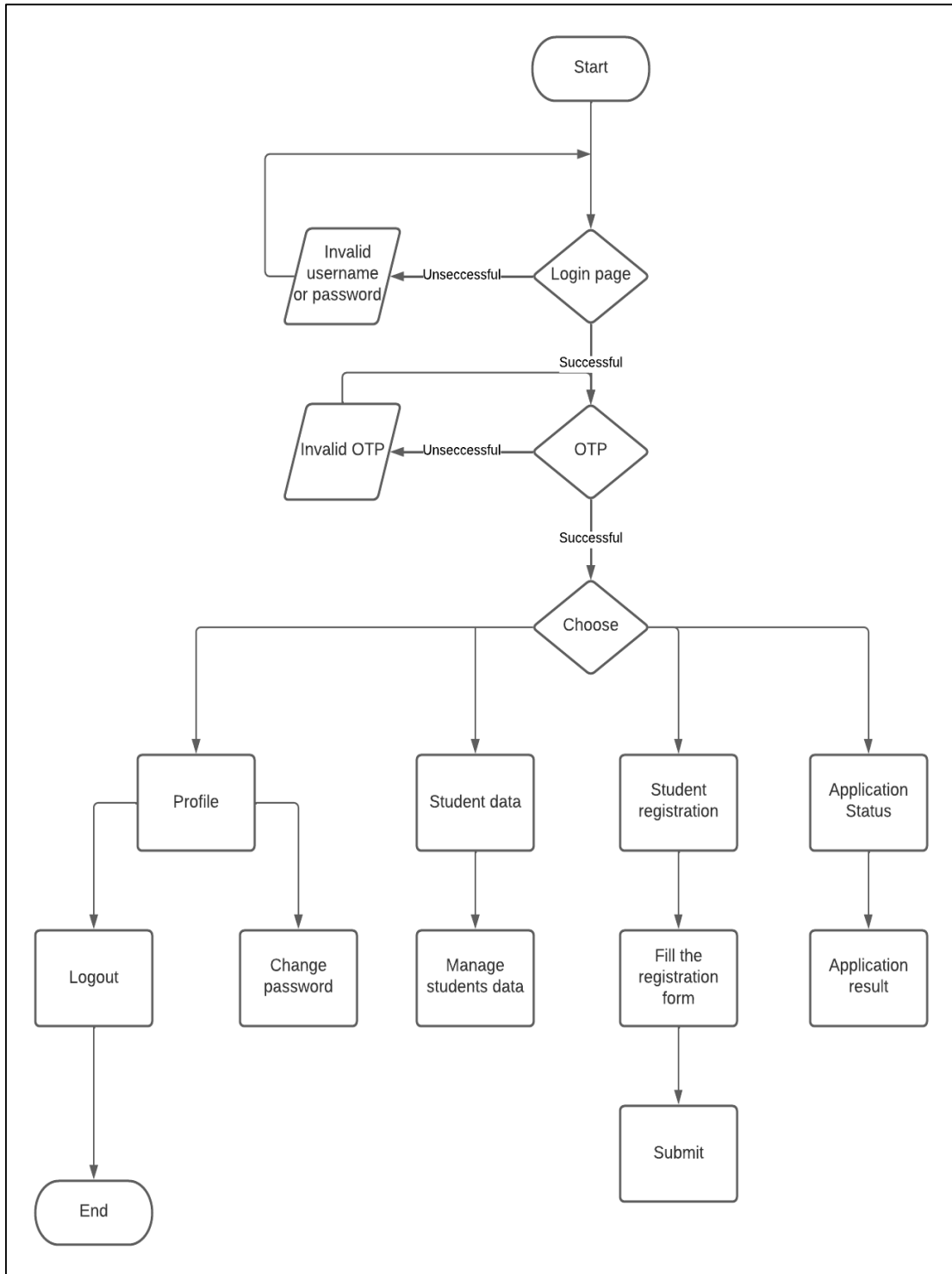


Figure 6: Flowchart for Admin



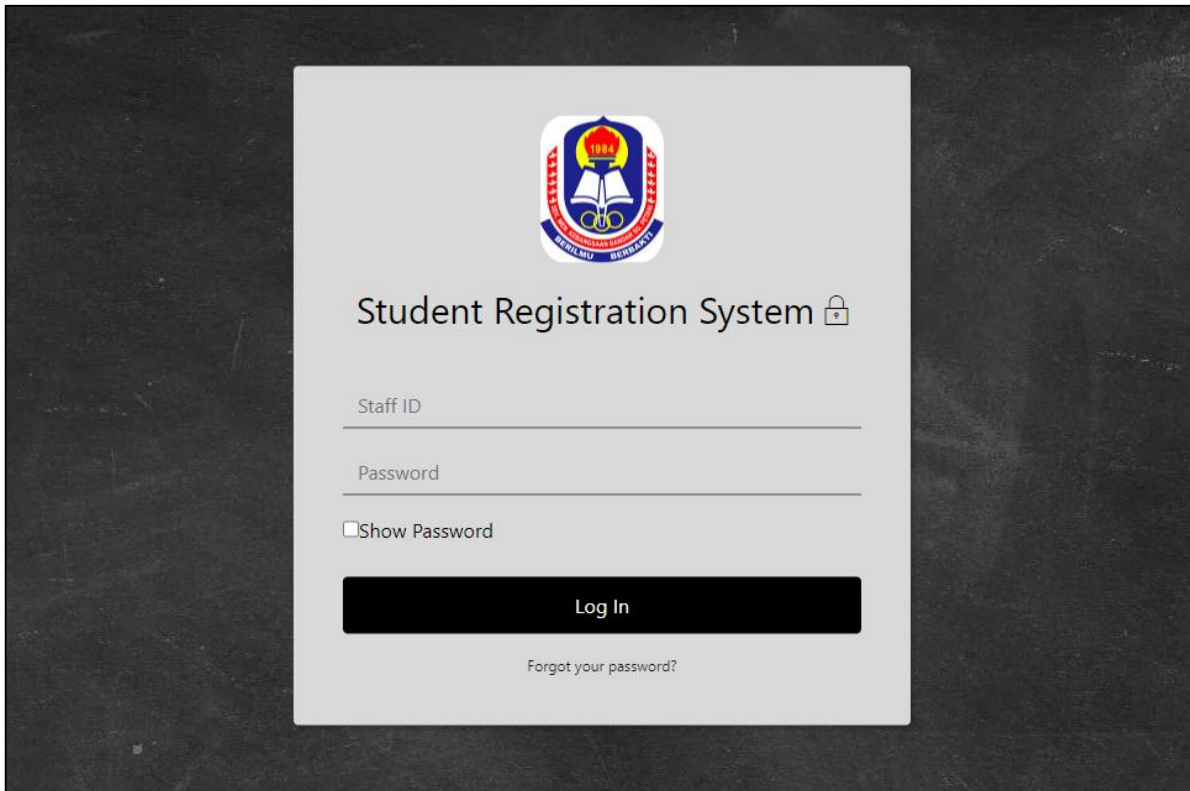
**Figure 7: Flowchart for Staff**



### 3.3 Implementation Phase

Developers begin coding in this phase based on the requirements and design specified in earlier phases. The essential data in the database, as well as the necessary interfaces and GUI in the front-end to communicate with the back end, will be established in accordance with the company's norms and practices. User feedback and evaluation will be provided, followed by a return to the analytical step to revise requirements.

Figure 8 shows the login interface for Student Registration System SMK Bandar Sungai Petani. Figure 9 and Figure 10 shows admin and staff home page interface respectively. Figure 11 shows the student registration page interface. Then, Figure 12 shows the student data page interface.



**Figure 8: Login Interface**



**Figure 9: Admin Home Page Interface**



Figure 10: Staff Home Page Interface

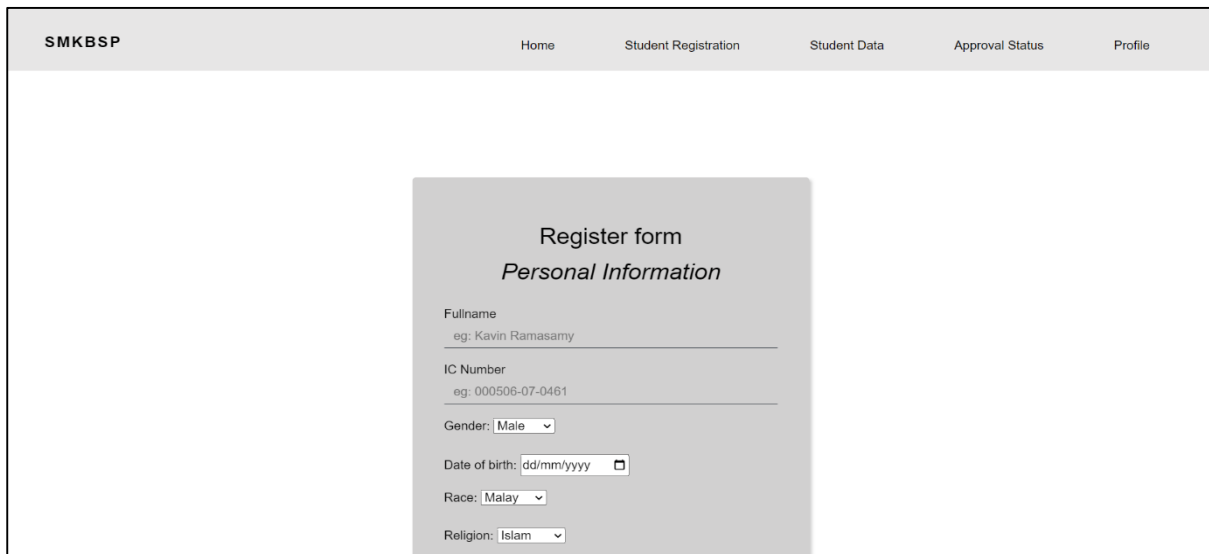


Figure 11: Student Registration Page Interface

ID	Full Name	Gender	Race	Blood Group	Vaccination Status	Family Status	Form	Kelab	Sukan	Badan Beruniform	Operations
1	Raj	male	malay	O+	not vaccinated	B40(B1)	1	English Club	Hockey	Taekwondo	<a href="#">View</a> <a href="#">Update</a> <a href="#">Delete</a>
2	Mohd Aliff Iskandar bin Abdullah	male	malay	A-	1st dose only	M40(M3)	6	Malay Club	Sepak Takraw	Pengakap	<a href="#">View</a> <a href="#">Update</a> <a href="#">Delete</a>
3	Ong Qi Wen	female	chinese	A+	not vaccinated	T20(T2)	1	Chinese Club	Badminton	PBSM	<a href="#">View</a> <a href="#">Update</a> <a href="#">Delete</a>
4	Kavin Raj a/l Ramu	male	indian	AB-	fully vaccinated with booster shot	B40(B1)	1	English Club	Archery	Kadet Polis	<a href="#">View</a> <a href="#">Update</a> <a href="#">Delete</a>
5	Christopher Kai	male	malay	O+	not vaccinated	B40(B1)	1	Science & Technology	Badminton	BSM	<a href="#">View</a> <a href="#">Update</a> <a href="#">Delete</a>

Figure 12: Student Data Page Interface

### 3.4 Testing Phase

During testing, the developer and users begin to put the system through its paces against the requirements. The testers' goal is to uncover flaws in the system as well as to ensure that the application operates as intended and in accordance with what was stated during the requirements analysis process. A school staff became the tester of this system to confirm whether the produced system meets the requirement of the school staff.

**Table 4: Login module functionality testing**

Number	Test Case	Expected Result	Actual Output
1	Correct staff id/password and correct OTP code.	- Login successful	Pass
2	Empty input field of staff id or password	- Login failed - Error message	Pass
3	Incorrect user credentials	- Login Failed - Error message	Pass
4	Incorrect or empty OTP field	-Login failed - Error message	Pass

**Table 5: Register module functionality testing**

Number	Test Case	Expected Result	Actual Output
1	Input details in the correct format with no empty fields.	- Register successful	Pass
2	Empty input field	- Register failed - Error message	Pass
3	Existing IC number	- Login Failed - Error message	Pass
4	Invalid format of IC number	-Login failed - Error message	Pass
5	Invalid format of email address	-Login failed - Error message	Pass

**Table 6: Profile module functionality testing**

Number	Test Case	Expected Result	Actual Output
1	Logging out from the system	- Logout successful	Pass
2	Change password with required condition	- Change password successful	Pass
3	Password less than 8 characters	- Change password failed - Error message	Pass
4	Password does not have at least 1 uppercase letter	- Change password failed - Error message	Pass
5	Password does not have at least 1 number	- Change password failed - Error message	Pass
6	Password does not have at least 1 special character	- Change password failed - Error message	Pass
7	Password does not match	- Change password failed - Error message	Pass

### 3.5 Maintenance Phase

Software maintenance might involve software upgrades, repairs, and patches if the software breaks. During the maintenance phase, faults or flaws may occur, necessitating corrections during subsequent software testing. However, due to the time limitation, this phase will not be performed in this project.

## 4. Results and Discussion

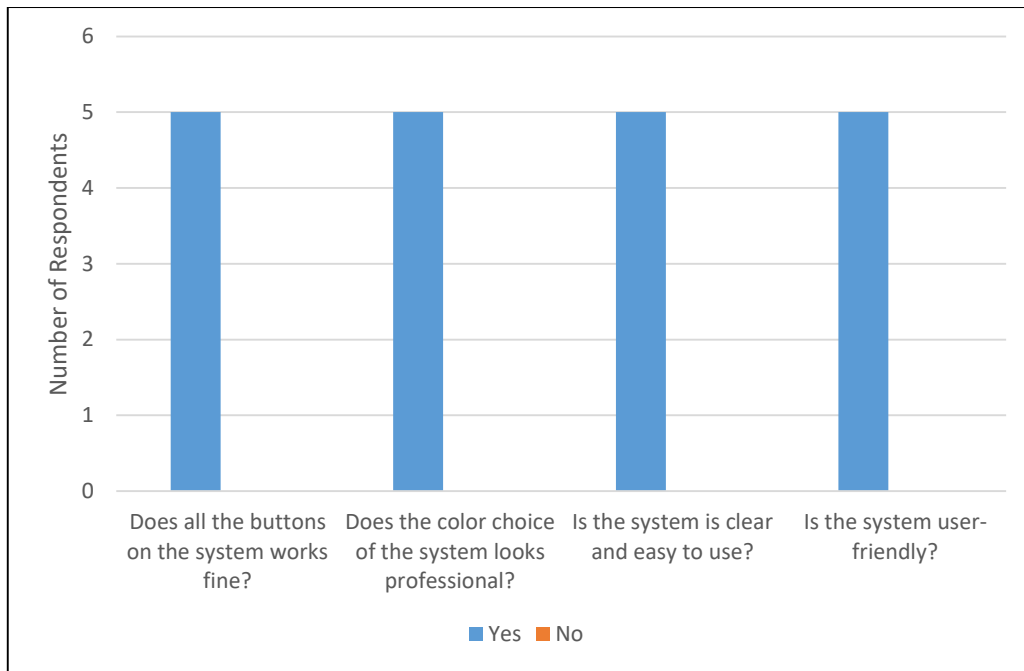
### 4.1 User Acceptance Test Result

The user acceptance of the system is collected through online survey questionnaire using Google Form that has been distributed to five respondents for user acceptance testing. Figure 13 shows the response for system functionality testing. All five respondents agreed that admin and staff able to login into the system with OTP verification, admin able to manage other admins and staffs, staff able to register new students and admin also able to accept or reject student application form. This system was tested by a member of the school staff to ensure that it complied with their requirements.



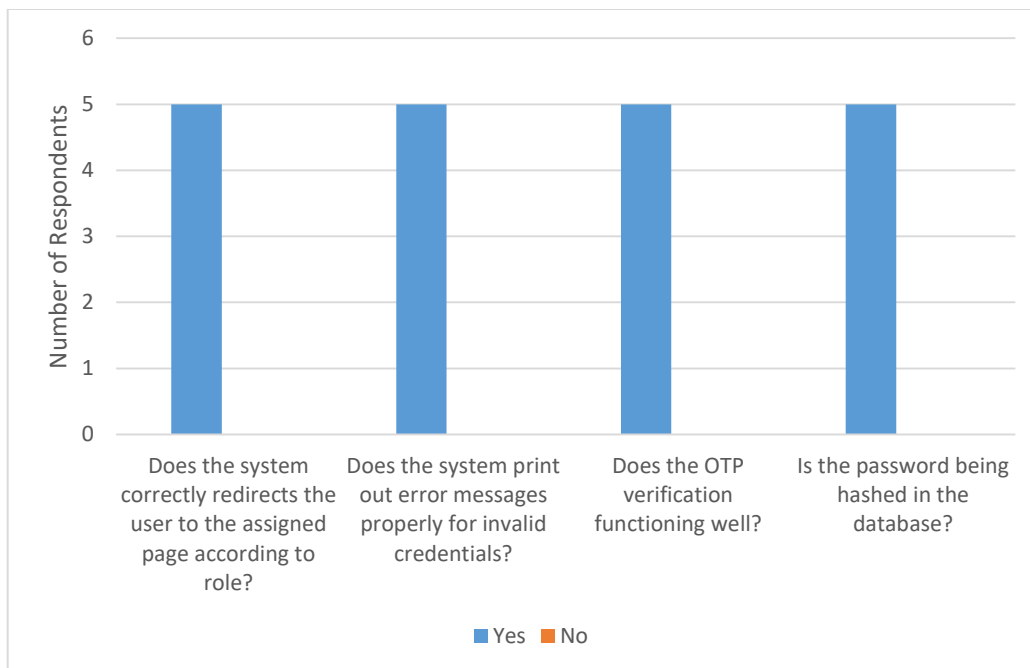
**Figure 13: Bar graph for system functionality testing**

Figure 14 shows the response for system design testing. All five respondents agreed that all the buttons are working fine, the color choice of the system looks professional, the system is clear and easy to use, and the respondents also agreed that the system is user friendly.



**Figure 14: Bar graph for system design testing**

Figure 15 shows the response for system security testing. All five respondents agreed that the system correctly redirects the user to the assigned page according to their role, the system prints out error message properly for invalid credentials, OTP verification functioning well, and the password being hashed in the database.



**Figure 15: Bar graph for system security testing**

## 5. Conclusion

As a conclusion, student registration system for SMK Bandar Sungai Petani may help the school to organize students' details in a much effective and secure way. Staffs can easily review students' data hassle free by using the proposed system and can export in preferred file type in case of sharing student details. A strong password policy is enforced by the system, which requires users to create strong

passwords. In addition, the system employs the SHA algorithm to hash the user's password. The system controls network access based on a person's job within the school organization by adopting role-based access control. One-time passwords are used as part of two-factor authentication to add an additional degree of protection.

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### References

- [1] Dixit, V., 2022. 4 Benefits of Student Record Management System | Academia ERP. [online] Academia ERP. Available at: <<https://www.academiaerp.com/blog/4-benefits-of-student-record-management-system-institutions-must-know/>> [Accessed 20 October 2021].
- [2] T. Ganesan, A. Akila, A. Jaya, and M. Thamizhpriya, "International journal of research publication and reviews," Ijrpr.com. [Online]. Available: <https://ijrpr.com/uploads/V3ISSUE5/IJRPR4291.pdf>. [Accessed: 14-Jun-2022].
- [3] ZHANG, E., 2022. What is Role-Based Access Control (RBAC)? Examples, Benefits, and More. [online] Digital Guardian. Available at: <<https://digitalguardian.com/blog/what-role-based-access-control-rbac-examples-benefits-and-more>> [Accessed 20 October 2021].
- [4] Rosencrance, L., 2022. What is Two-Factor Authentication (2FA) and How Does It Work?. [online] SearchSecurity. Available at: <<https://searchsecurity.techtarget.com/definition/two-factor-authentication>> [Accessed 20 October 2021].
- [5] N-able. 2022. Types of Database Encryption Methods | N-able. [online] Available at: <<https://www.n-able.com/blog/types-database-encryption-methods>> [Accessed 20 October 2021].
- [6] Request a demo | Creatrix Campus. (2021). Creatrix Campus. <https://www.creatrixcampus.com/request-demo>
- [7] Sign-Up to Watch our Admissions Demo. (2021, October 1). ISAMS. <https://www.isams.com/sign-up-to-watch-a-demo-admissions/>
- [8] PREP INSTA. 2022. Iterative Waterfall Model in SDLC » PREP INSTA. [online] Available at: <<https://prepinsta.com/software-engineering/iterative-waterfall-model/>> [Accessed 20 October 2021].