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Institution: MULTIMEDIA UNIVERSITY OF KENYA

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DOCUMENTATION FOR CHLORIL WATER CLOSETS MANAGEMENT SYSTEM

IN FULFILMENT FOR THE REQUIREMENTS FOR ATTACHMENT ASSESSMENT BY THE KENYA FILM CLASSIFICATION BOARD AND THE MULTIMEDIA UNIVERSITY OF KENYA

Declaration

I hereby declare that this project is as a result of my own effort and time and that it has not been done and presented by anyone else.

Attachee's name: _____ Supervisor's name: _____

Signature: _____ Signature: _____

Date: _____ Date: _____

Dedication

I dedicate this project to Chloril Water Closets management, my parents, my aunts and uncles, and me.

Acknowledgement

- ✔ First and foremost, I would like to thank the Almighty God for giving me the strength, life, and willpower to get to this point.
- ✔ I thank my loving parents for giving me the required emotional and financial support.
- ✔ I also thank the Kenya Film Classification Board for giving me a conducive environment for me to work on this project.
- ✔ Finally, I would like to thank my fellow attachees for aiding me in testing and reviewing this project.

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CHLORIL WATER CLOSETS MANAGEMENT SYSTEM

1: Introduction

Chloril Water Closets is the fourth largest fully private provider of public toilets in the country, with it currently having 21 branches nationwide. It has strived to meet a balance of accessibility and quality, something that other toilet providers have yet to do; most of them are either good quality but limited to hotels and office spaces, or accessible to the general public but horribly maintained. Due to the balance that Chloril offers, it has become a popular choice by both the public and private companies.

2: System analysis

2.1: Overview of the existing system

The existing system is flat file i.e. spreadsheets(.xlsx files) are localised to each branch to keep track of the state of toilet components and finances.

2.2: Problem statement

Both the management team and executive team have recognised the upward trajetory of the company and know that it is necessary to not only maintain the balance that the company offers, but to improve on both aspects as well in order to ensure that Chloril does not go down the path of poor maintenance/irrelevancy that other toilet providers have gone down. However, with the current flat file system, this is very difficult to do. Despite being decentralised thus being less susceptible to attacks such as Dos/Ddos attacks, it is much more difficult to regulate branches, occassionally leading to varying standards of toilets in different branches. The flat file system is also prone to data loss as there are no data encryption or hashing methods put in place, putting sensitive data (e.g. finances) in a vulnerable position.

2.3: Overview of the proposed system

The teams decided that the optimal way of going about this was to make a secure, efficient, and cost-effective real-time digital management system. Thus, the new system is expected to have the following features:

- A page containing a table of branches, with each record having two buttons; one to edit the branch details, and another to delete the branch. A user can also add a new branch.
- A login system where users have one of two roles; a Manager or an Admin. Each user must have an account to use the system.
- A form that allows each user to change the password to their account.
- An admin-only page containing a table of users, with each record having three buttons; one to edit user details, one to edit user password [in case a user has difficulty changing their own password], and one to delete a user account. An admin can also add a new user.

- A dashboard that provides a simple overview of branch data, and an auto-generated report.

2.4: Objectives of the new system

The new system is expected to perform the following functions:

- Maintaining records of branches, their revenue and allocated budget, toilet information.
- Keeping track of employees' accounts.
- Allowing employees to add, edit and delete branches.
- Breaking down branch data and present it to employees in a format that is easy to understand and digest.

2.5: Advantages of the new system

The new system has the following advantages over the old system:

- **Scalability**: Due to data being added/recorded dynamically in a database, the new system can be expanded upwards to handle larger amounts of data with ease.
- **Security**: Every action in the system requires one to log in as a management worker for it to work. This prevents unauthorised users form making any unwanted changes in the system. In addition, an account can only be created by an admin/one cannot self-register, ensuring that non-employees cannot create an account. Any password stored in the database is hashed using complex algorithms, ensuring that they cannot be accessed even by decryption.
- **Cost-effectiveness**: Since the database is deployed securely to the cloud, cost of on-site hosting is greatly reduced with minimal compromise, and cost of data loss is averted.
- **Real-time updating** to the database, ensuring easy accessibility of required data to everyone within the company, making standardisation and regulation easier.
- **CIA aspects of data security are observed.** Data is only accessible to authorised users(confidentiality), data is readily available to authorised users who request it(availability), and data remains unchanged unless an authorised user makes changes to it without malicious intent(integrity).
- Data is **visualised and summarised** by use of charts and a report, making data easier to digest, compare, and contrast.

2.6: Scope of the new system

The new system targets the Chloril Water Closets management team.

2.7: Feasibility study

2.7.1: Economic feasibility

While the new system may be more expensive than the old one purely in terms of initial development and maintenance cost, it will also save the company a lot of money that would have been lost in shady deals and data breaches. Table 1 shows the breakdown of estimated maintenance costs per month in Kenyan Shillings.

Expenditure	**Maximum Cost (Kshs) per month**
Maintenance team	65,000 * 5 = 325,000
Domain rights	1,000
Database hosting	13 * 24 * 31 = 9,672
Training employees	6,000
Total	341,672

Table 1: Maintenance expenditures

2.7.2: Operational feasibility

The system is expected to be incredibly user friendly. There will be various elements that the user can hover over using their mouse for details. There will also be a navigation bar fixed at the top of most pages except forms. If an error occurs, the application will display a modal giving details on what happened, ensuring that the user does not panic when something goes wrong, and instead instilling calm.. A solid linear gradient going from top left to bottom right(cyan and gold at the corners) will serve as the background image for every page of the system, save for the report. The main section will have a light gray/dark gray background depending on the light/dark theme browser settings. This is to ensure that the website is more aesthetically pleasing, enhancing the user friendliness. The system will have an automated dashboard and report, which may make several jobs at Chloril redundant.

2.7.3: Schedule feasibility

The system is expected to be complete in 6 weeks.

2.7.4: Technical feasibility

While the system may utilise some methods that are only accessible in modern browsers, great care will be taken to ensure that the system will be functional in all major browsers i.e. Google Chrome, Microsoft Edge, Mozilla Firefox, and Safari.

2.7.5: Legal feasibility

The system will operate under all legal and fair conditions, and will, under no circumstance, be subject to unfair actions against it.

2.8: Technologies to be used

The following languages, frameworks, packages and programs will be used to design and delevop the system:

- **Figma:** Designing/making a prototype of the website.
- **HTML:** Creating the web pages for the project.
- **CSS:** Styling the web pages.
- **JavaScript:** Scripting language to handle client-side logic.
- **Node.js:** JavaScript framework to enable the developer to write JavaScript in the backend. It contains the Node Package Manager(NPM) that is used to download various packages used in the server-side.
- **Express.js:** NPM package that allows one to handle server-side logic.
- **Argon2:** NPM package for hashing and verifying passwords.
- **Mongodb:** Online NoSQL database service.
- **Mongoose:** NPM package for creating and managing Mongodb models.
- **CORS:** Cross-Origin Resource Server; NPM package for coordinating protocol transfer.
- **JWT:** JSON Web Token; used for storing login sessions.
- **Nodemon:** NPM package that restarts a live server once it detects changes. Only used in production.
- **Postman:** Application that allows one to test HTTP requests.
- **Chart.js:** JavaScript framework used to create charts.
- **ErrorHandler:** NPM package used for handling errors.

3: System design

3.1: Database collections

Collection	Attribute		Type
Users	_id		ObjectID
	username		String
	email		String
	password		String
	role		String: Enum [“Admin”, “Manager”]
	timestamps	createdAt	Datetime
		updatedAt	Datetime
	__v		Number
Branches	_id		ObjectID
	branchName		String
	branchRevenue		Number
	branchBudget		Number
	timestamps	createdAt	Datetime
		updatedAt	Datetime
	__v		Number
Toilets	_id		ObjectID
	branchName		String: Ref [Branches]
	menToiletStallNo		Number

	menToiletStallStatus	bowlAndCisternStatus	Object {
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”]
			}

		bidetStatus	
		toiletPaperStatus	
	menToiletStallStatusDetails		Array [String, String, String]
	menToiletUrinalNo		Number

	menToiletUrinalStatus	urinalStatus	Object {
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”]
			}

	menToiletUrinalStatusDetails		Array [String]

	menToiletSinkNo		Number

	menToiletSinkStatus	tapAndDrainStatus	Object {
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”]
			}

		soapStatus	
		paperTowelStatus	
	menToiletSinkStatusDetails		Array [String, String, String]
	womenToiletStallNo		Number

	womenToiletStallStatus	bowlAndCisternStatus	Object {
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”]
			}

		bidetStatus	
		toiletPaperStatus	
	womenToiletStallStatusDetails		Array [String, String, String]
	womenToiletSinkNo		Number

	womenToiletSinkStatus	tapAndDrainStatus	Object {
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”],
			String: Enum [“Good”, “Acceptable”, “Bad”, “Critical”]
			}

		soapStatus	
		bowlAndCisternStatus	
	womenToiletSinkStatusDetails		Array [String, String, String]
	timestamps	createdAt	Datetime
		updatedAt	Datetime
	__v		Number

Table 2: Database collections

3.2: System DFDs

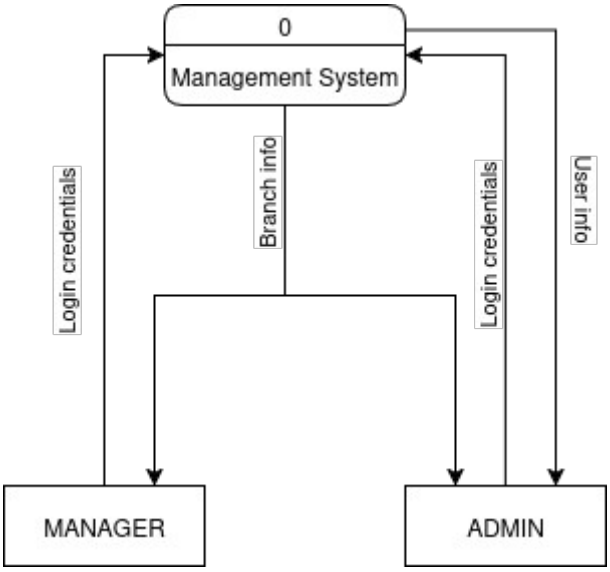

Figure 1: Level 0 Context Diagram

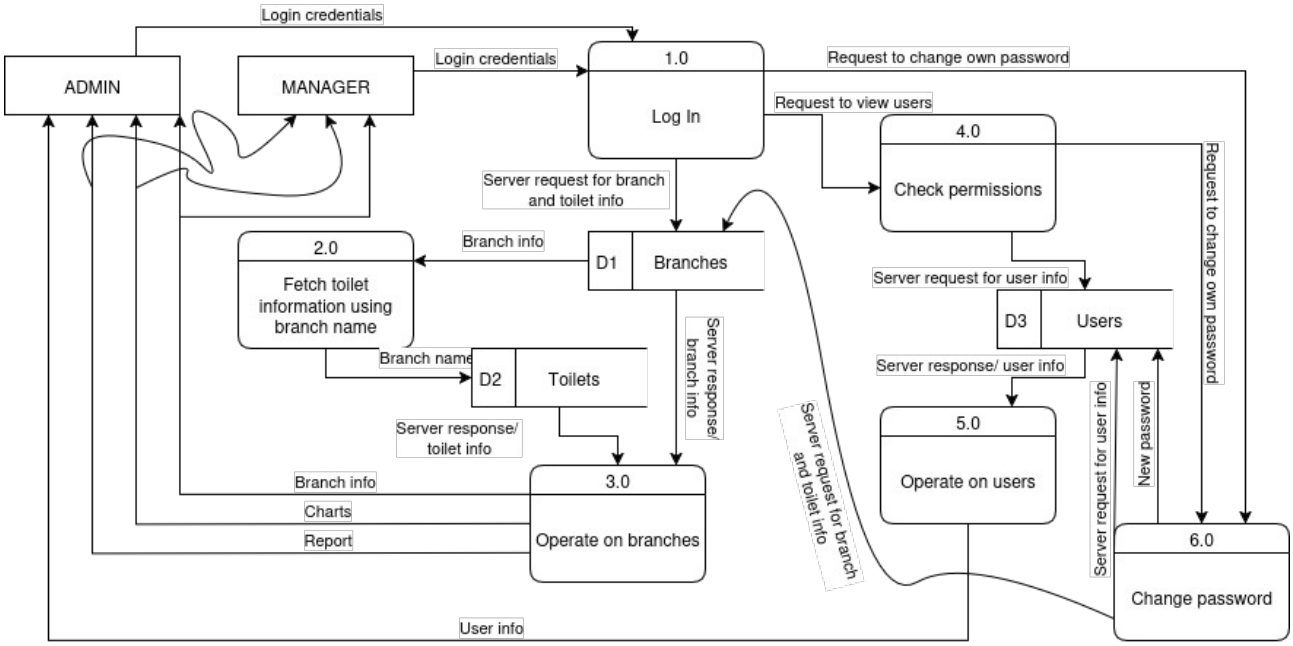

Figure 2: Level 1

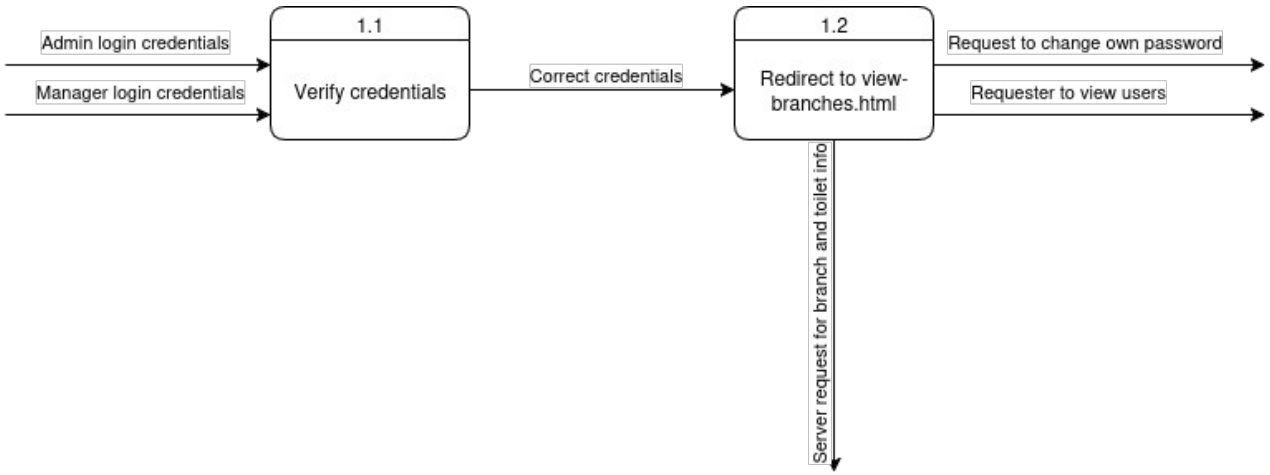

Figure 3: Level 2 Process 1

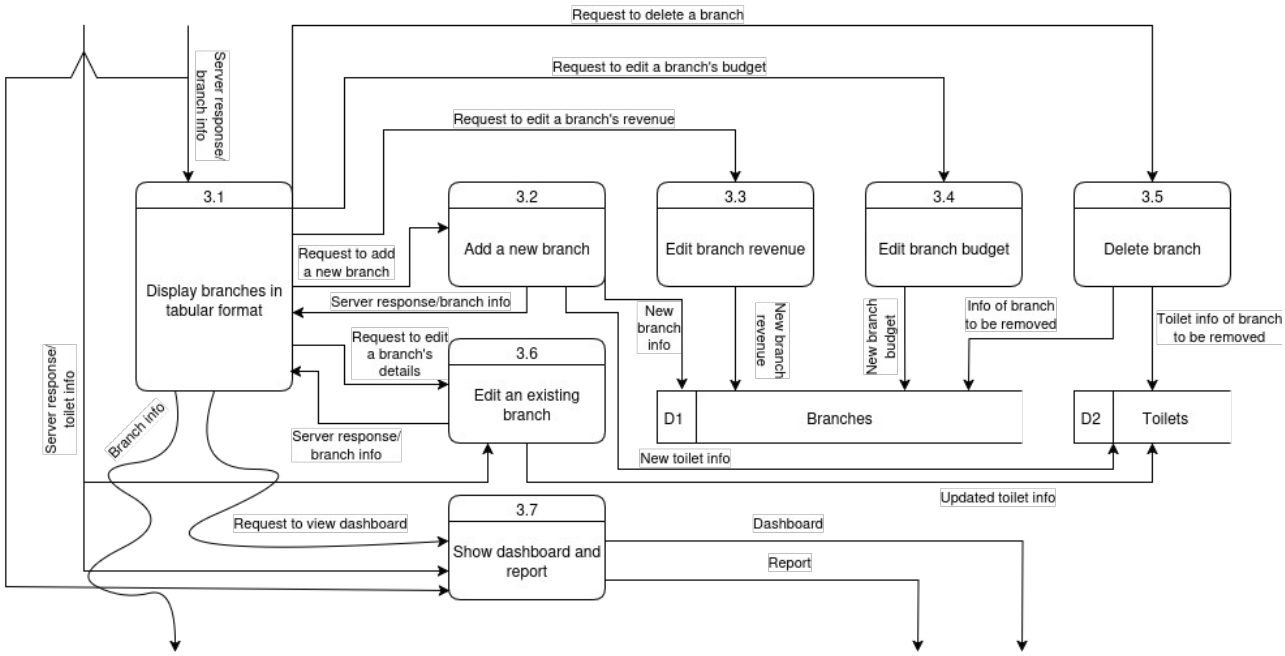

Figure 4: Level 2 Process 3

Figure 5: Level 2 Process 4

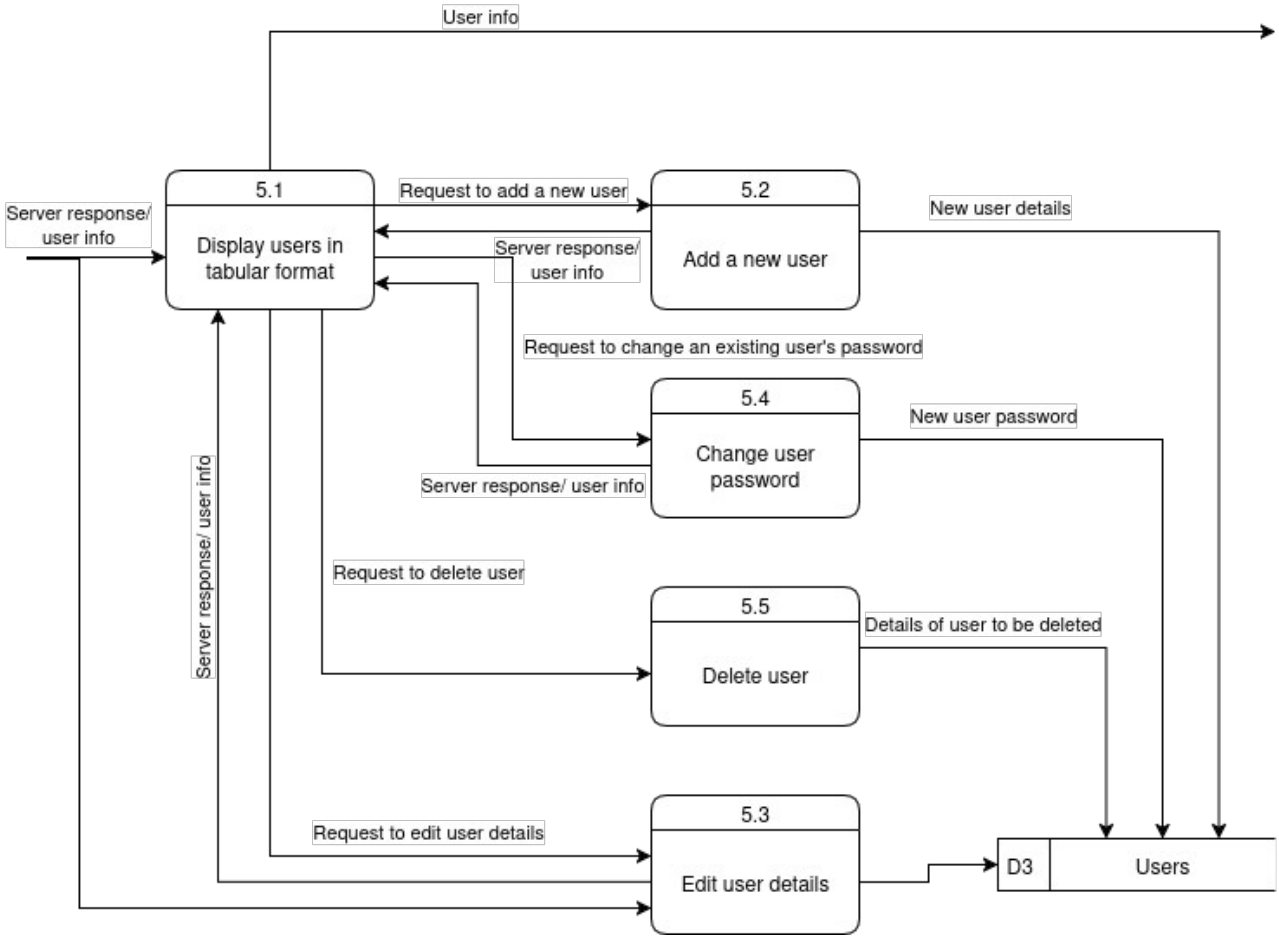

Figure 6: Level 2 Process 5

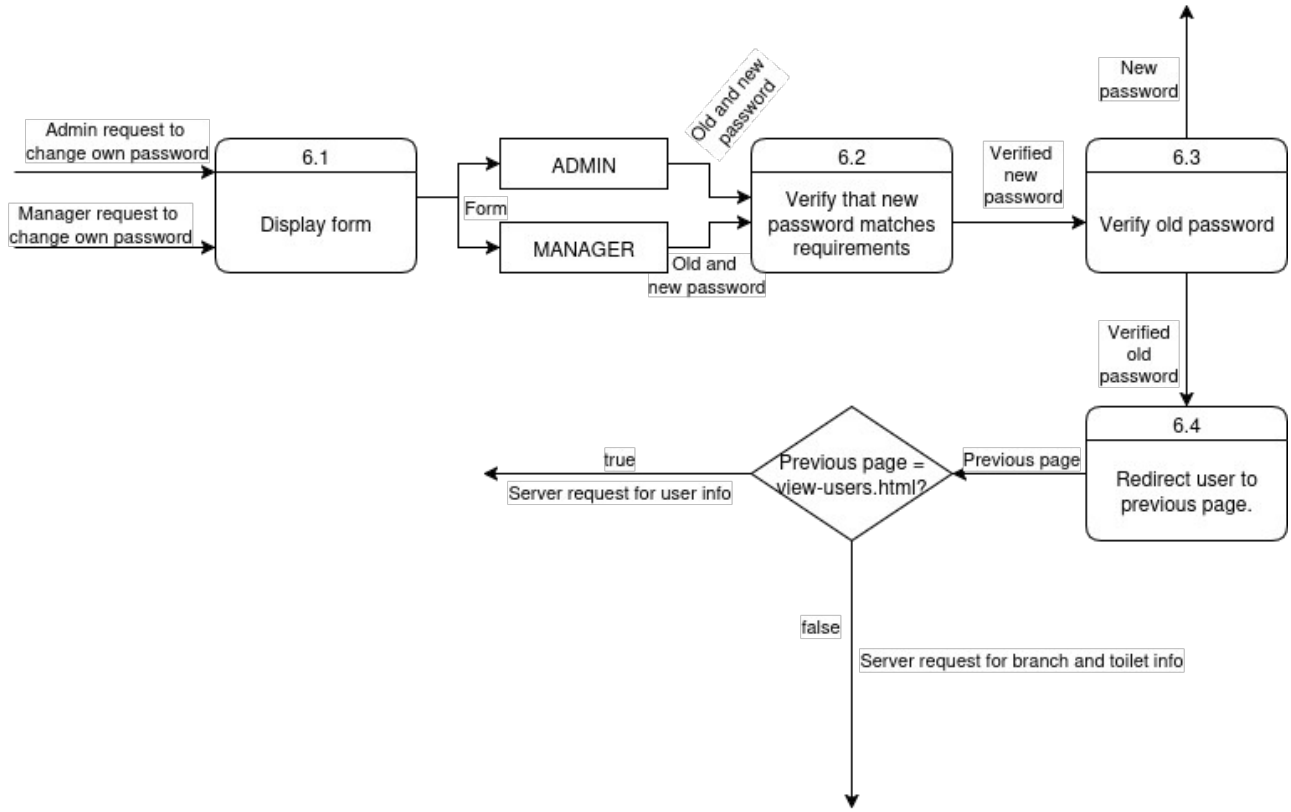

Figure 7: Level 2 Process 6

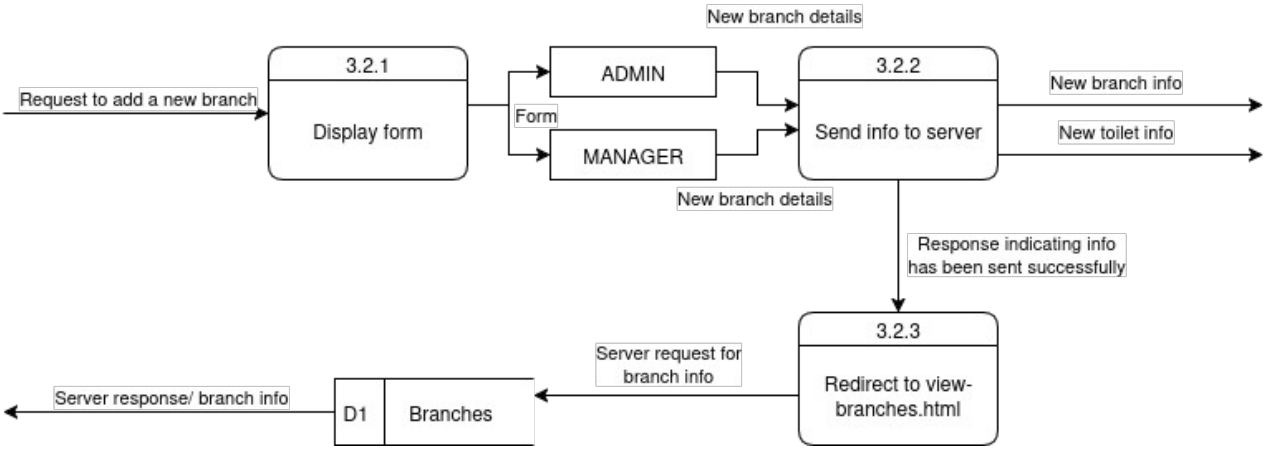

Figure 8: Level 3 Process 3.2

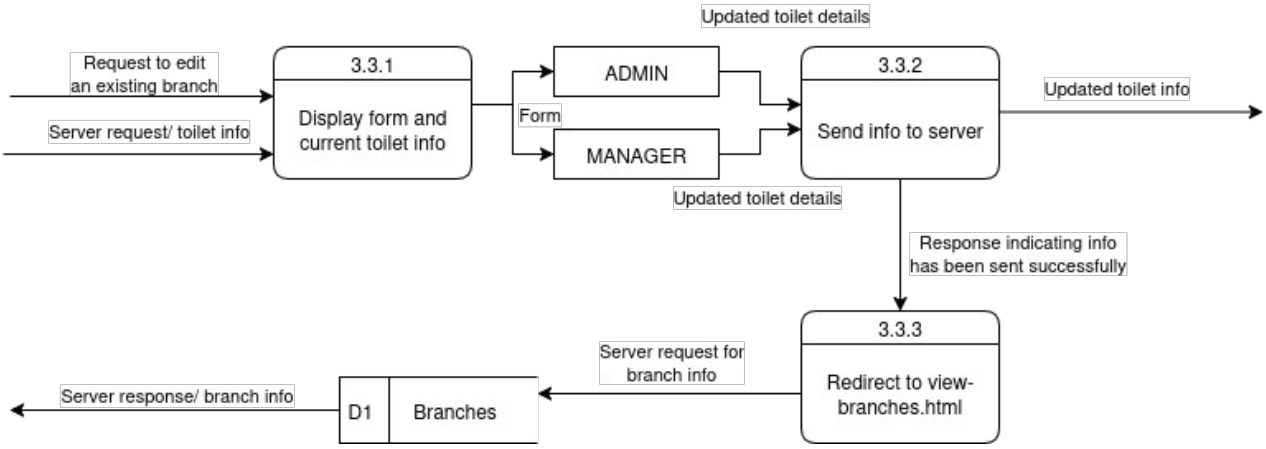

Figure 9: Level 3 Process 3.3

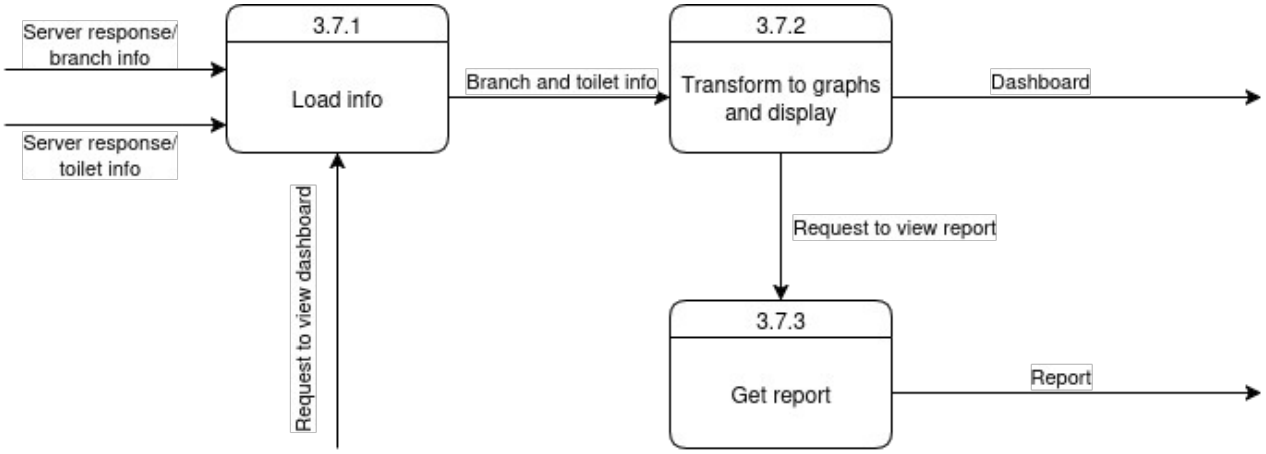

Figure 10: Level 3 Process 3.7

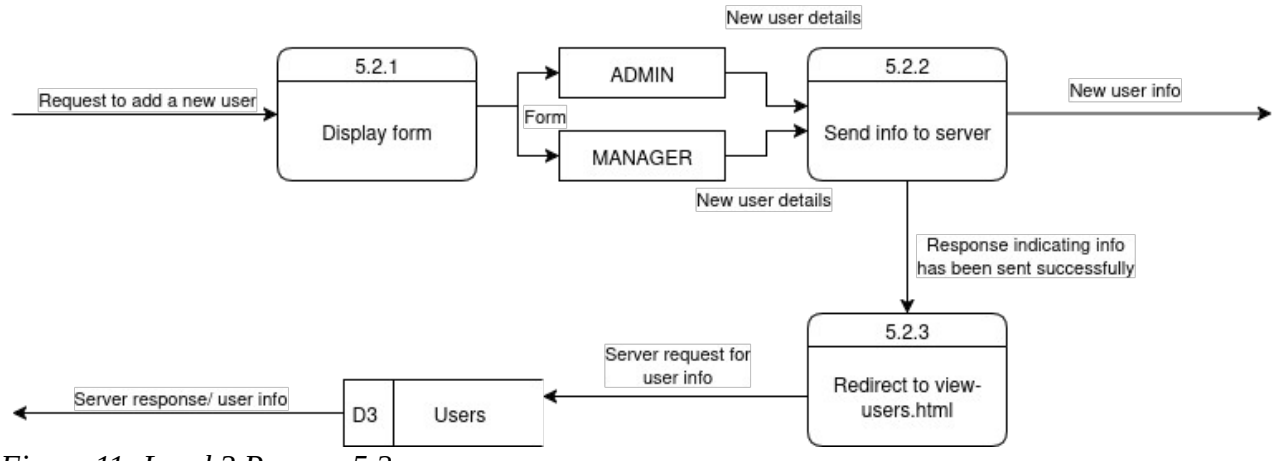

Figure 11: Level 3 Process 5.2

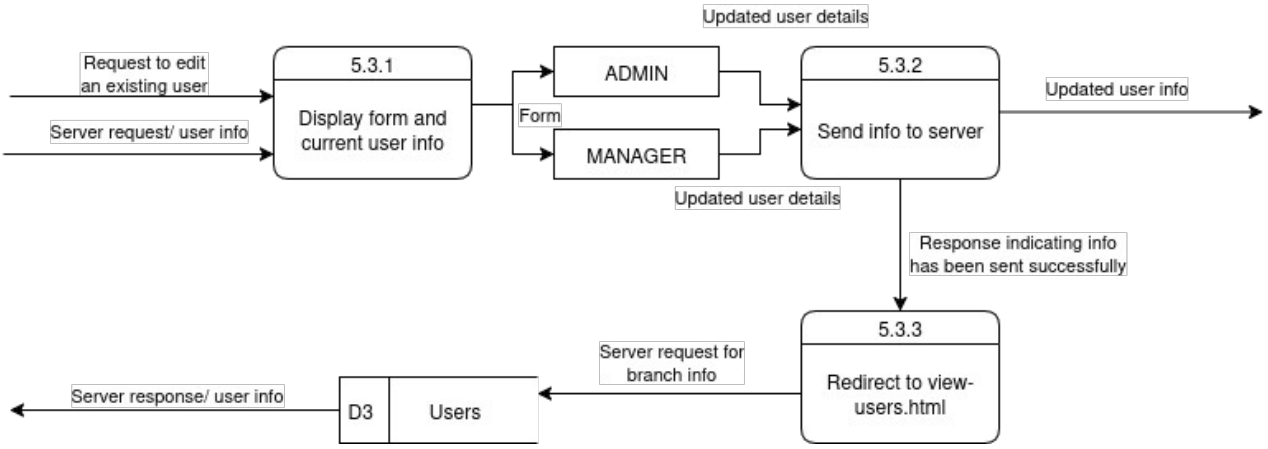

Figure 12: Level 3 Process 5.3

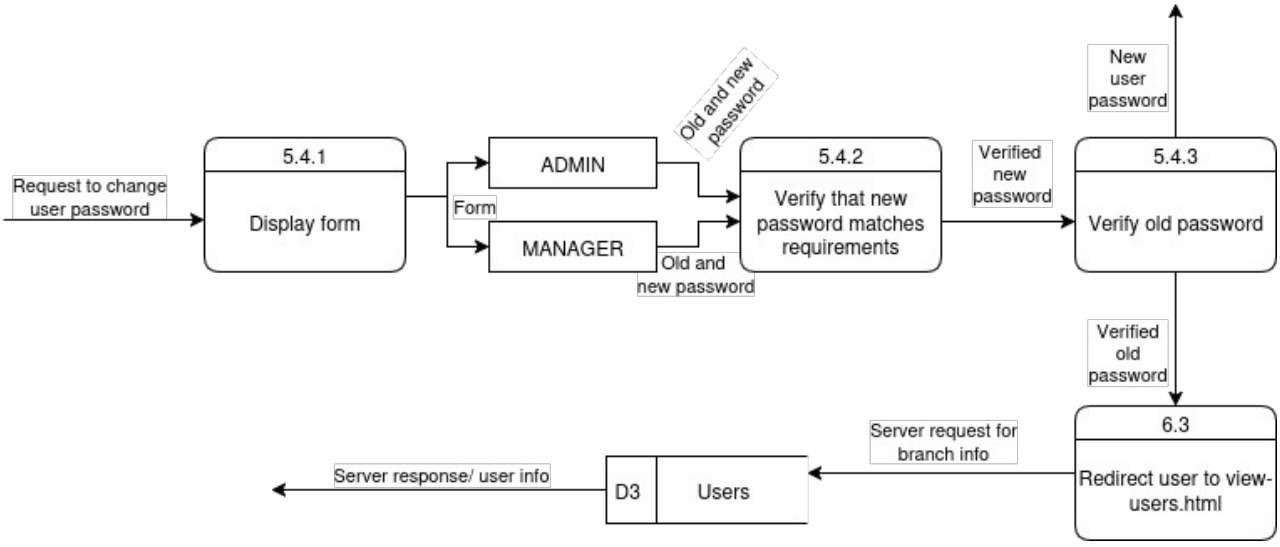

Figure 13: Level 3 Process 5.4

3.3: System wireframe

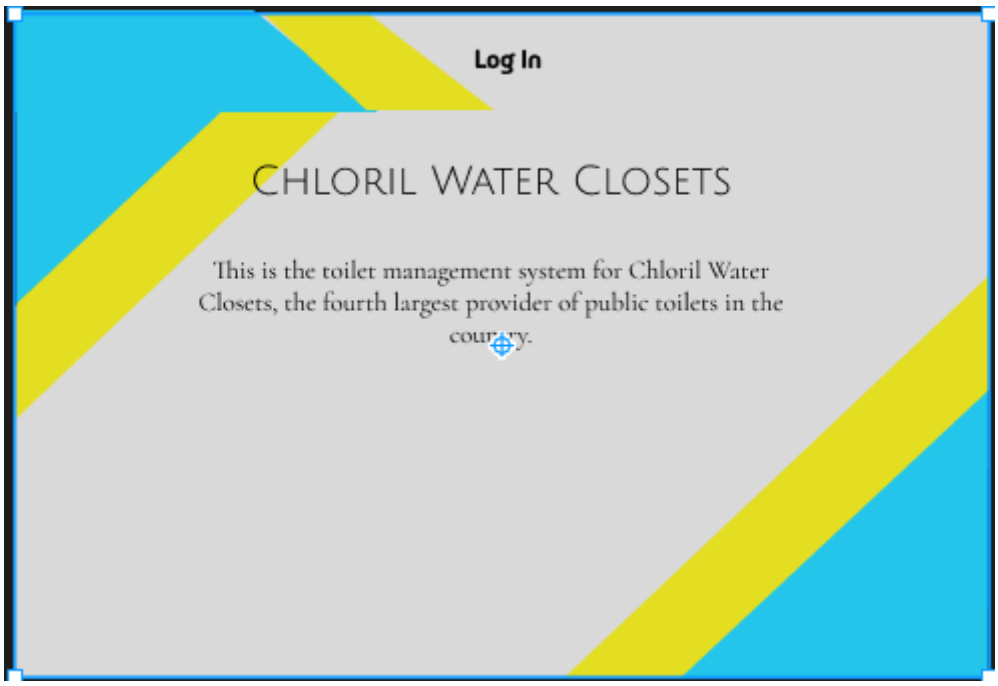

Figure 14: Homepage wireframe

4: System construction

4.1: Tables

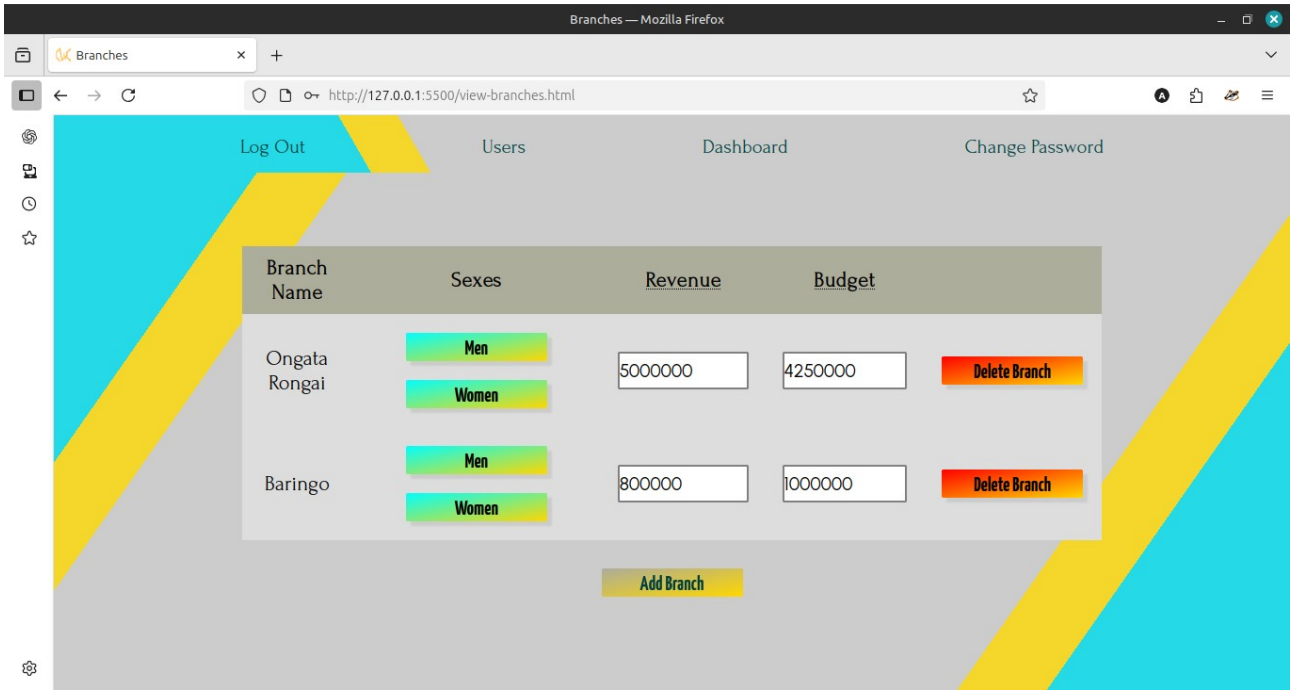

Figure 15: Viewing branches as an admin

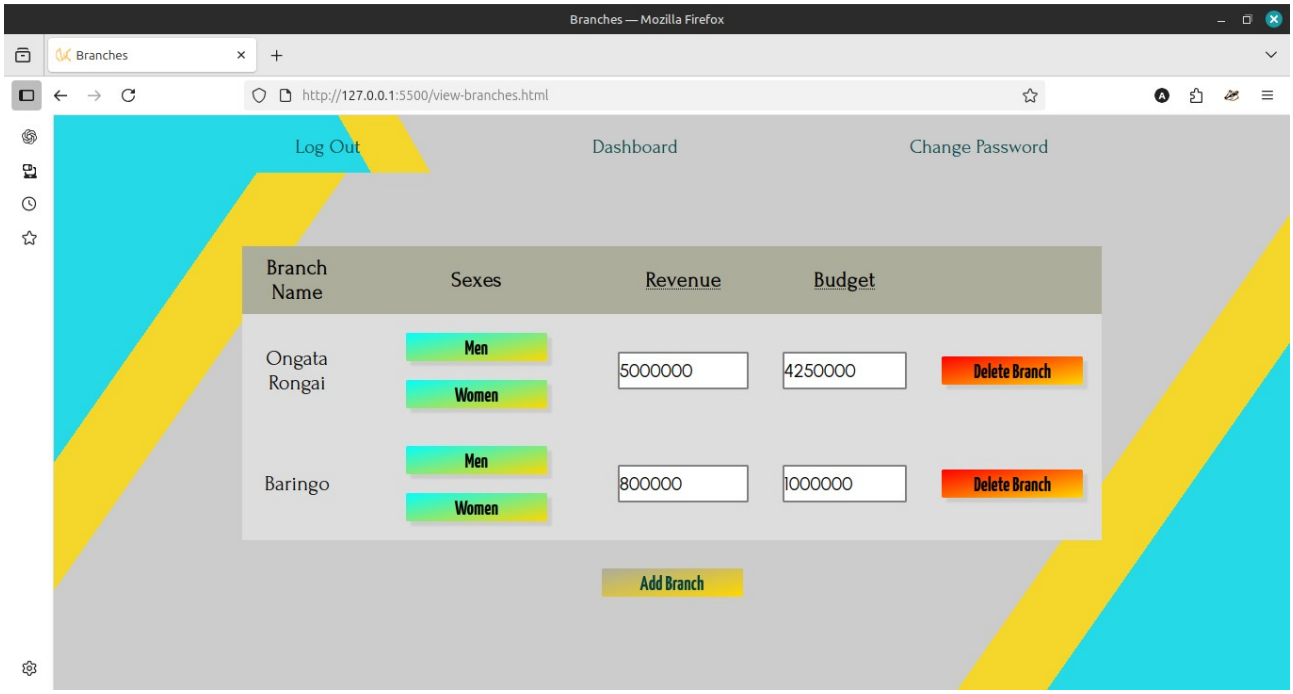

Figure 16: Viewing branches as a user

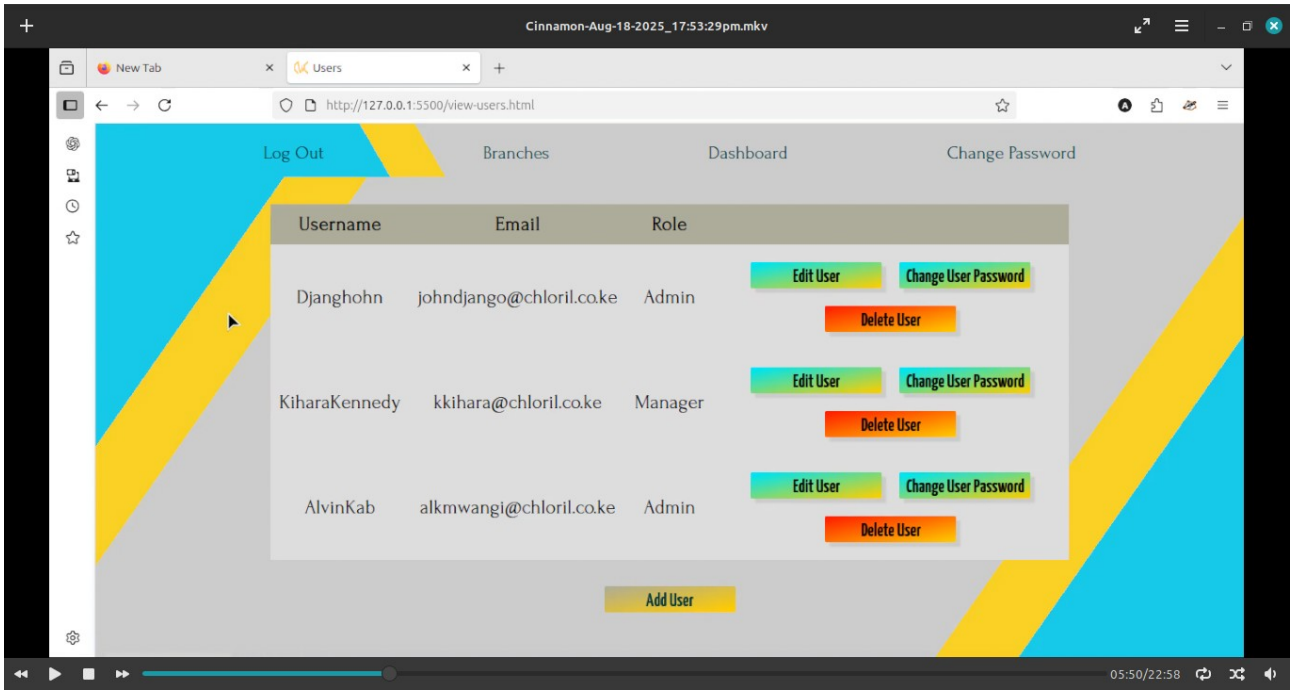

Figure 17: Viewing users (Admin Only)

4.2: Forms

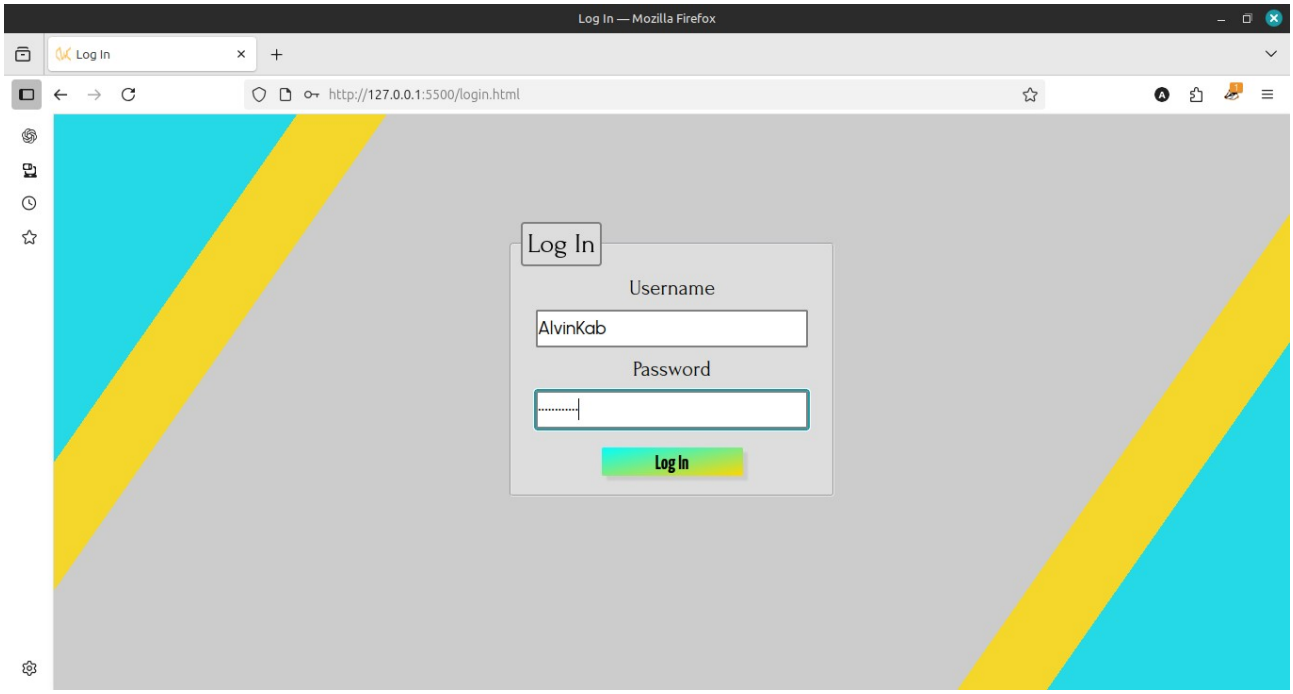

Figure 18: Login form

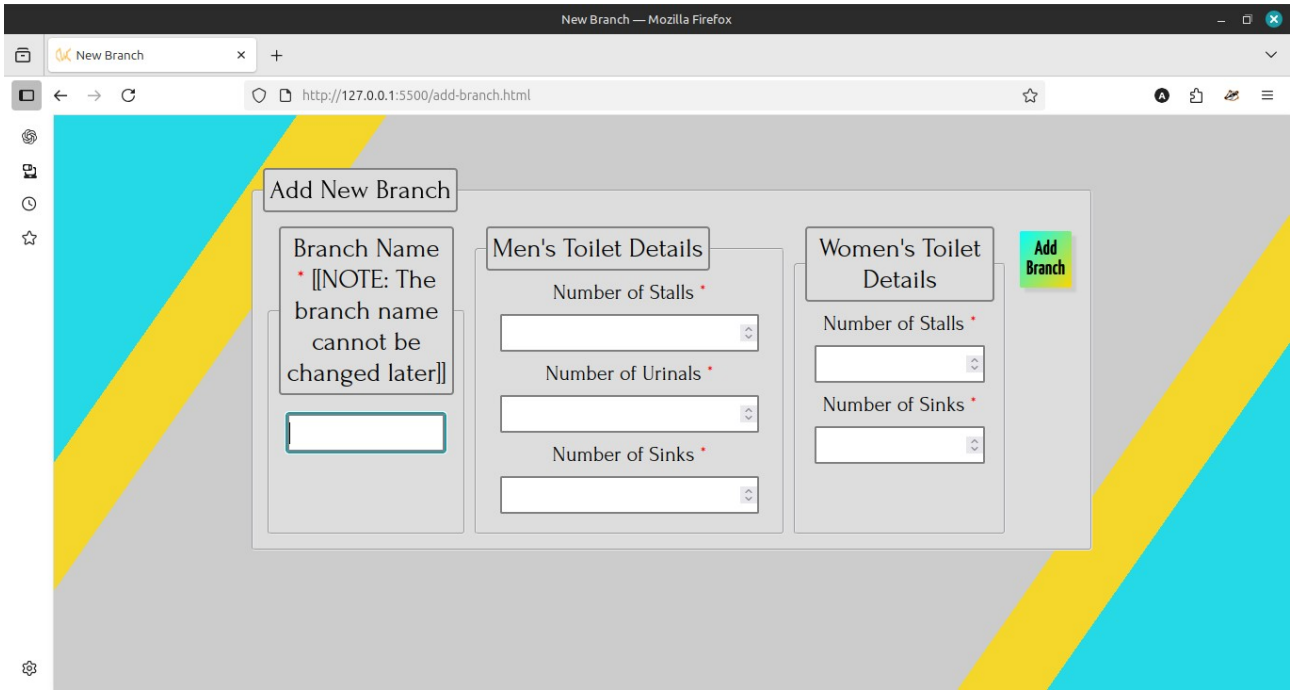

Figure 19: Adding a new branch

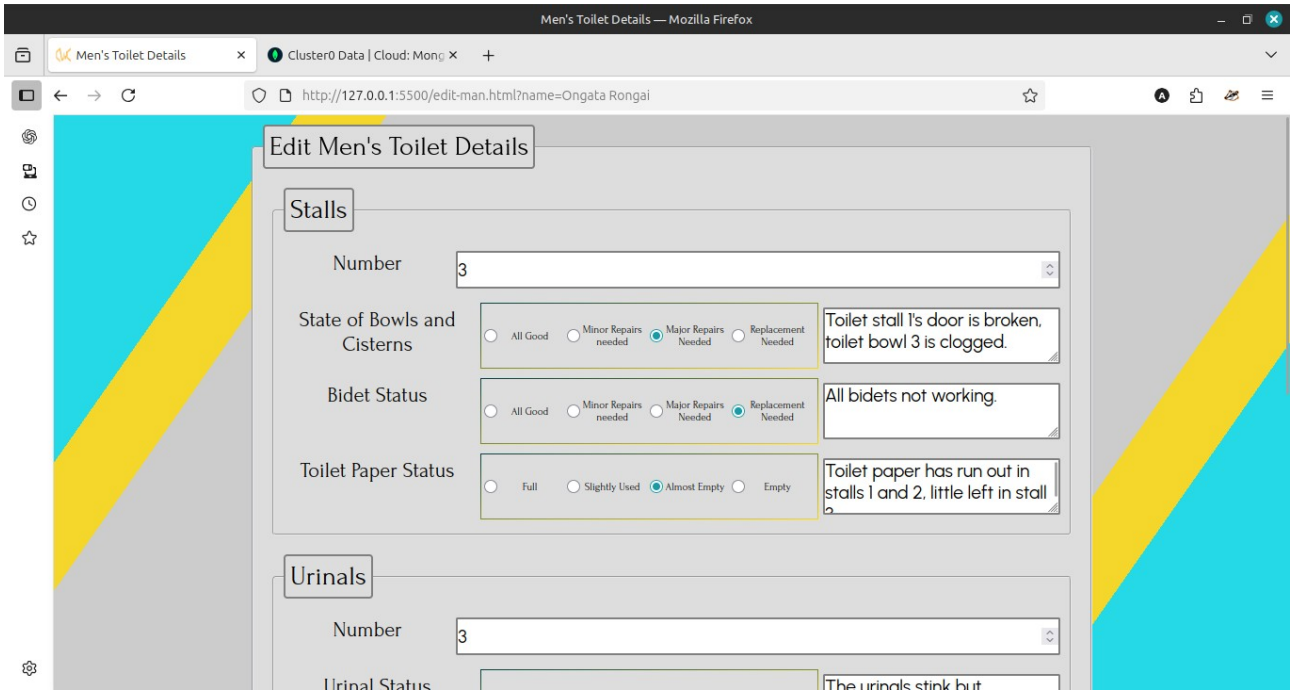

Figure 20: Editing the men's toilet section of a branch

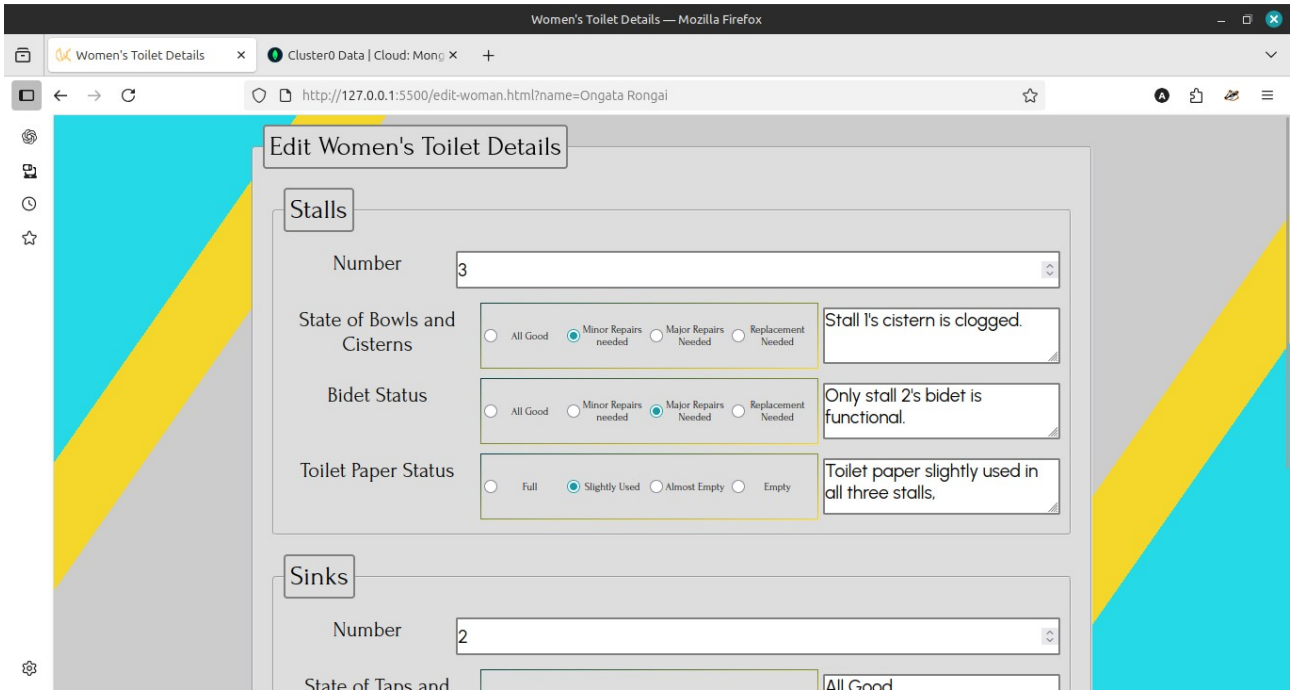

Figure 21: Editing the women's toilet section of a branch

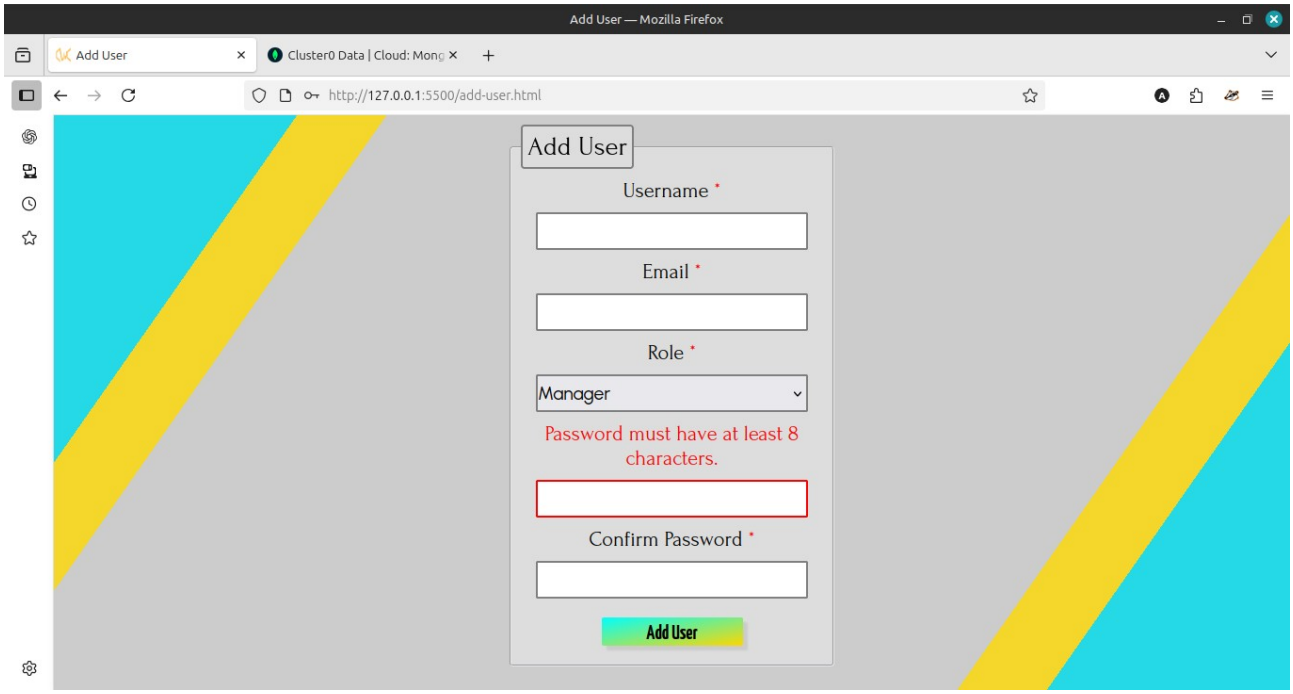

Figure 22: Adding a new user account (Admin only).

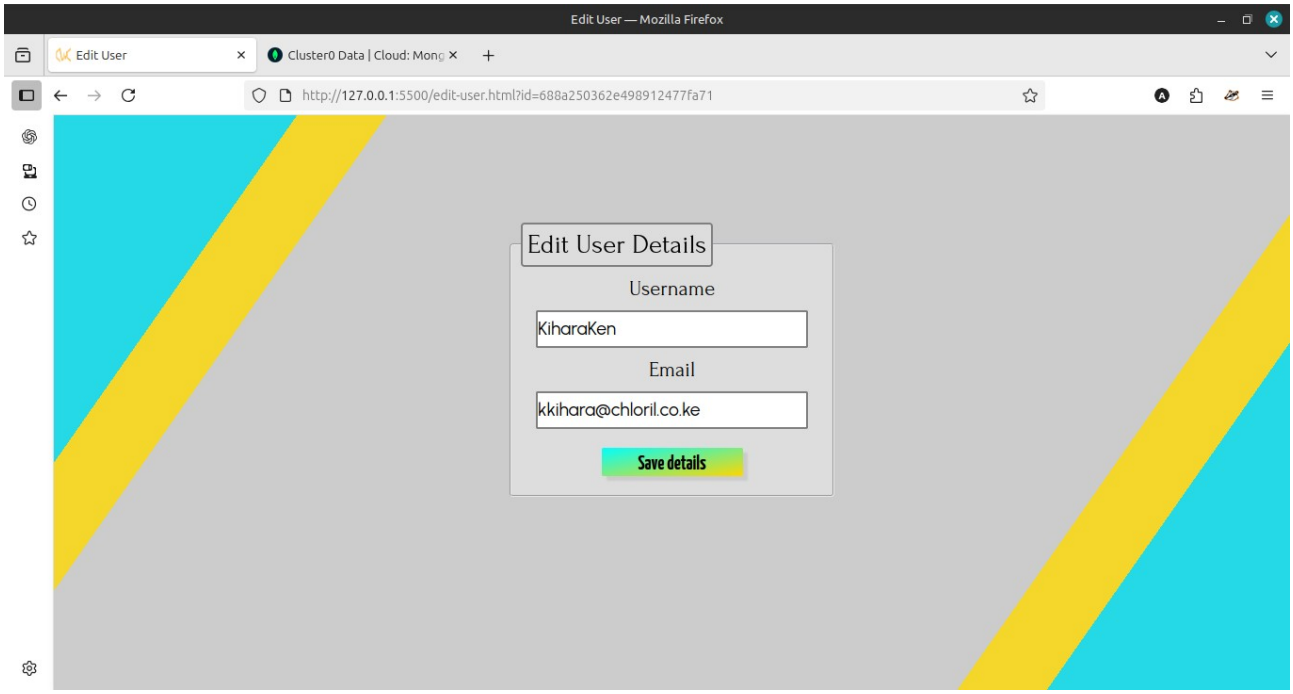

Figure 23: Editing a user's details

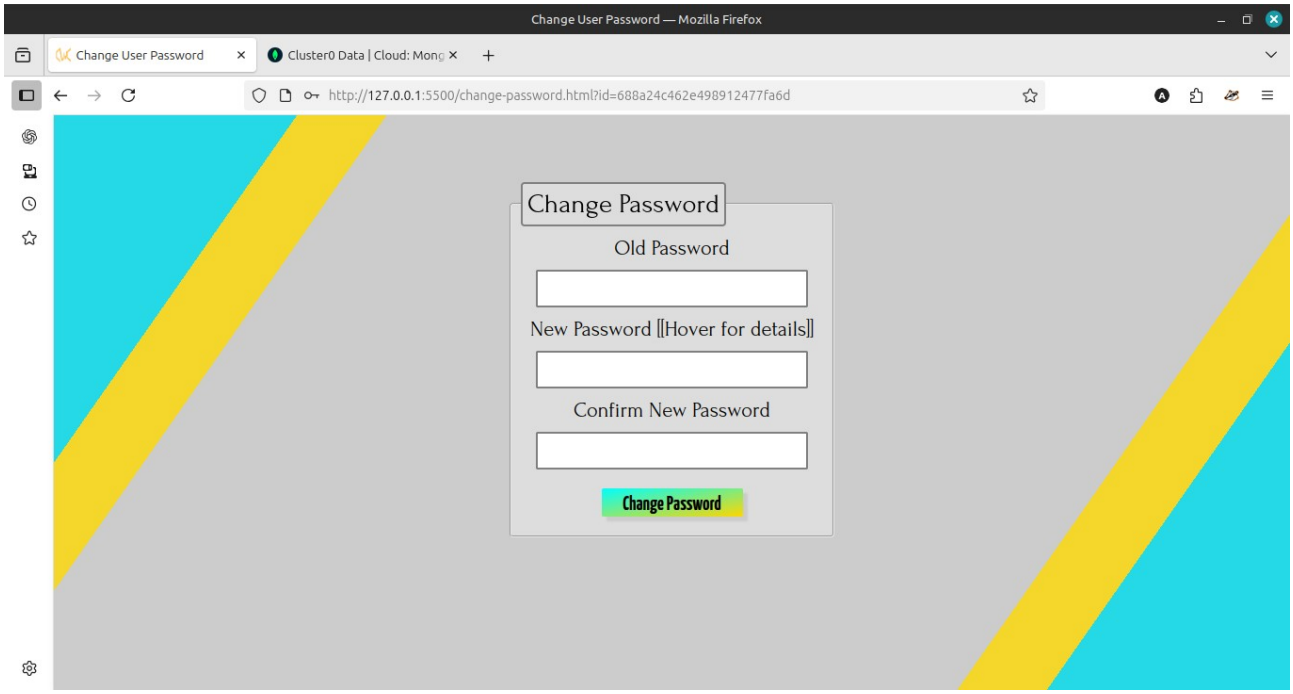

Figure 24: Changing password

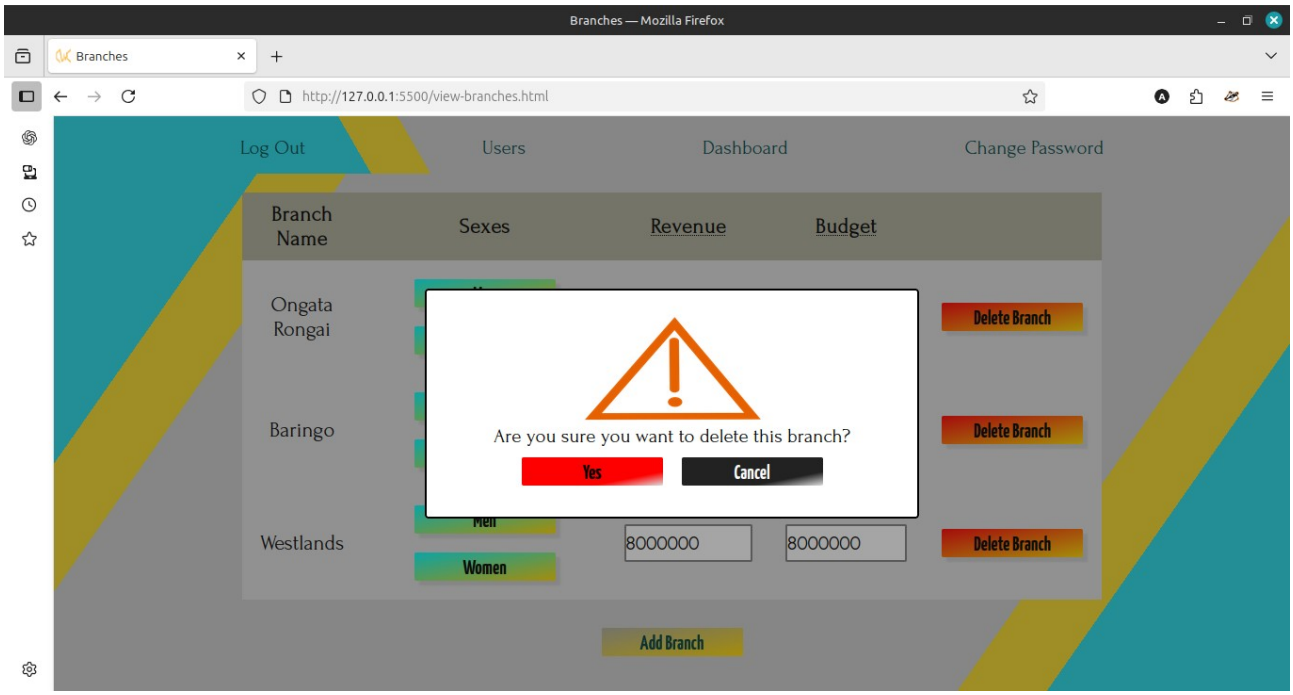

Figure 25: Deleting a branch

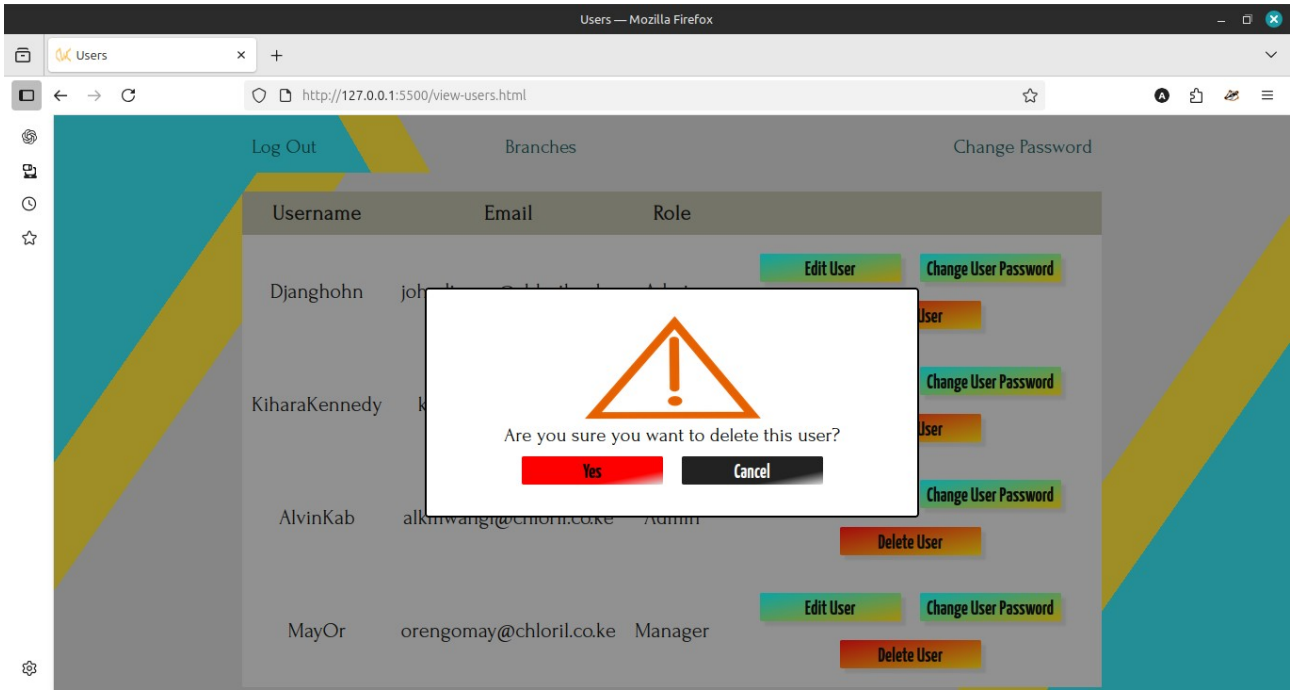

Figure 26: Deleting a user account (Admin only)

Input validation

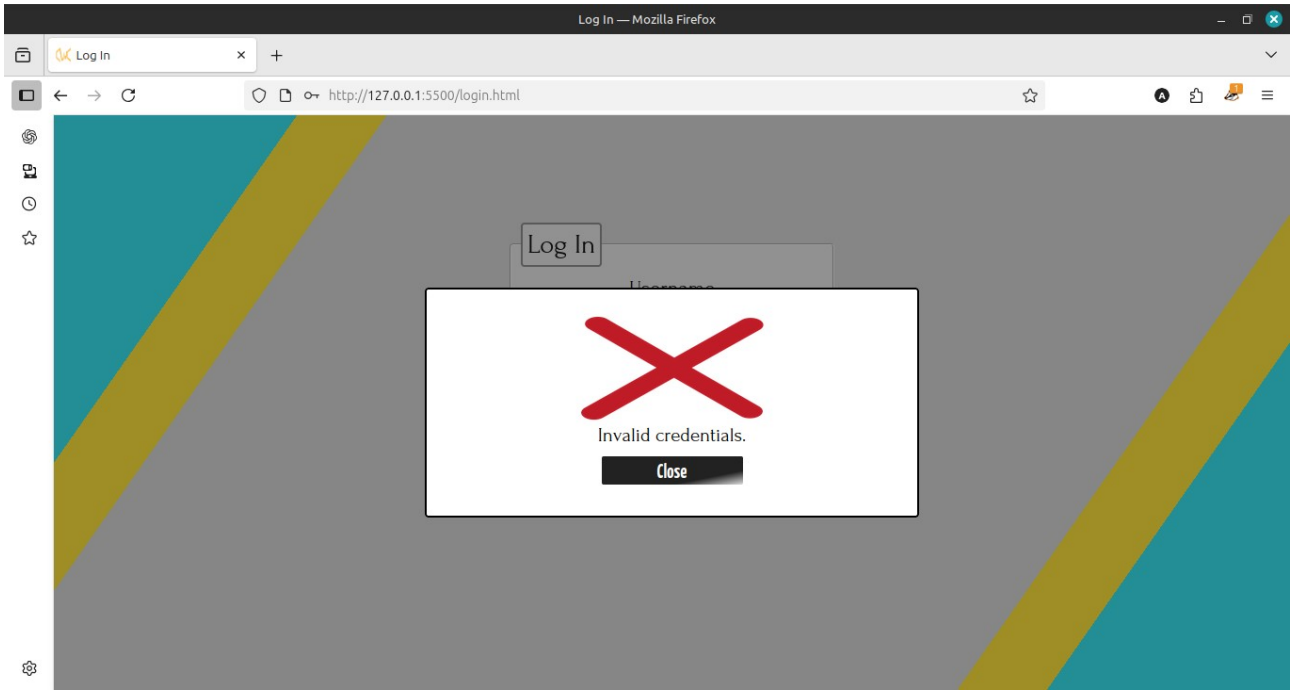

Figure 27: Failed login due to incorrect username or password entered

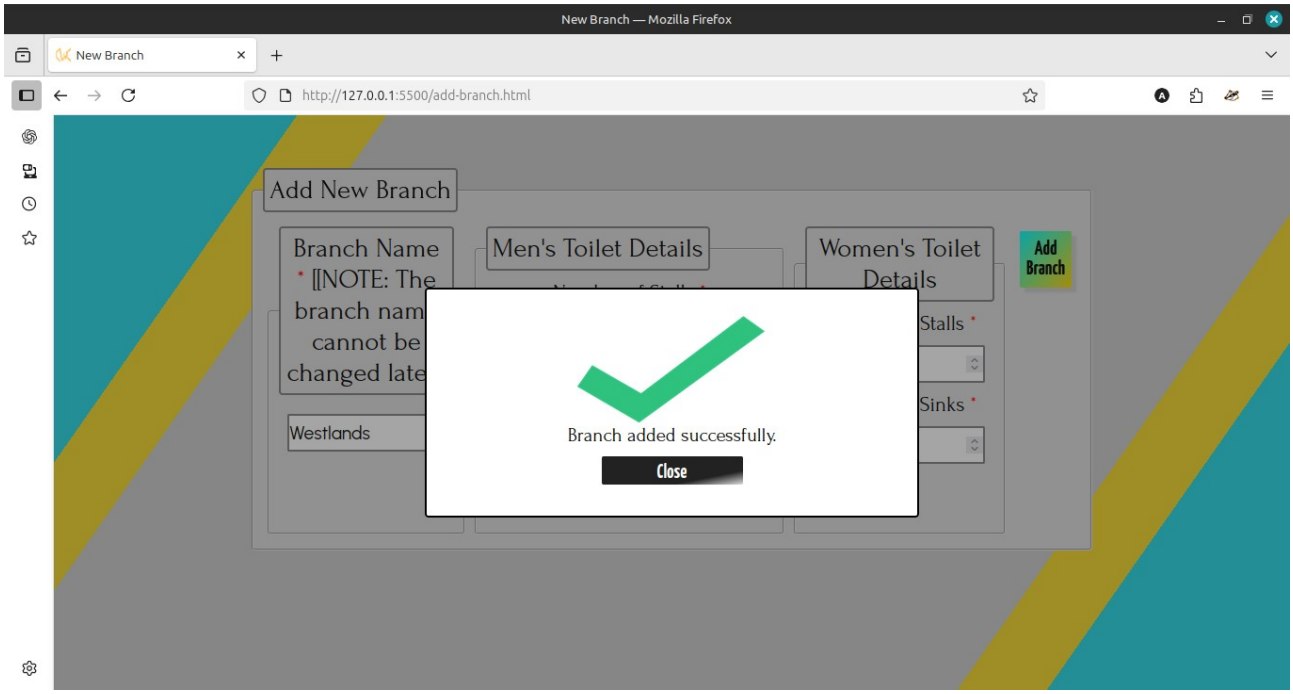

Figure 28: Successful adding of a branch to the system

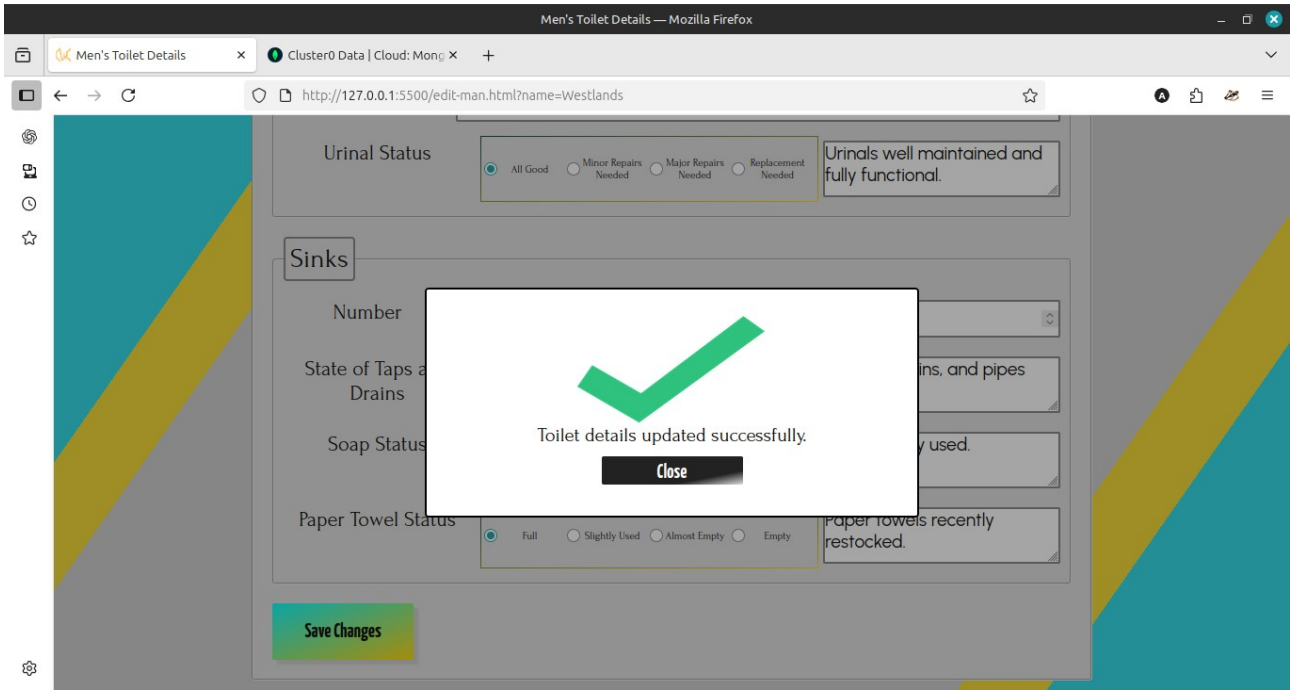

Figure 29: Successful change of toilet details of a branch

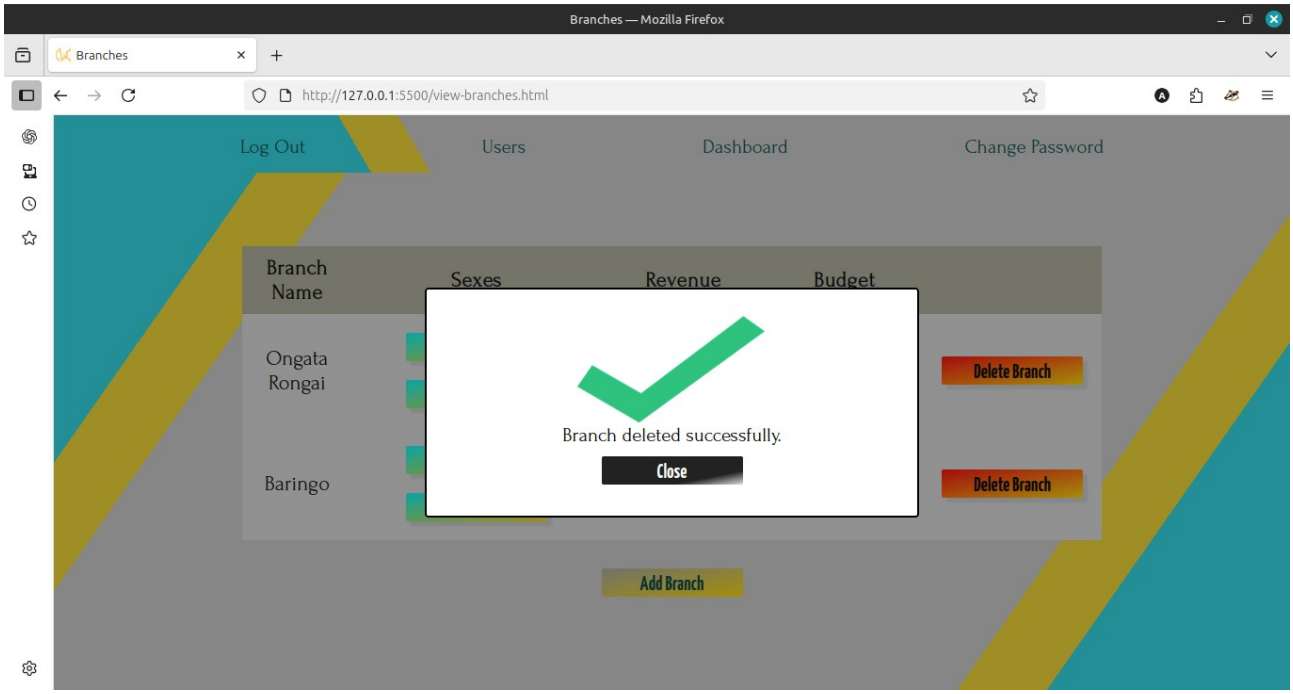

Figure 30: Successful deletion of a branch

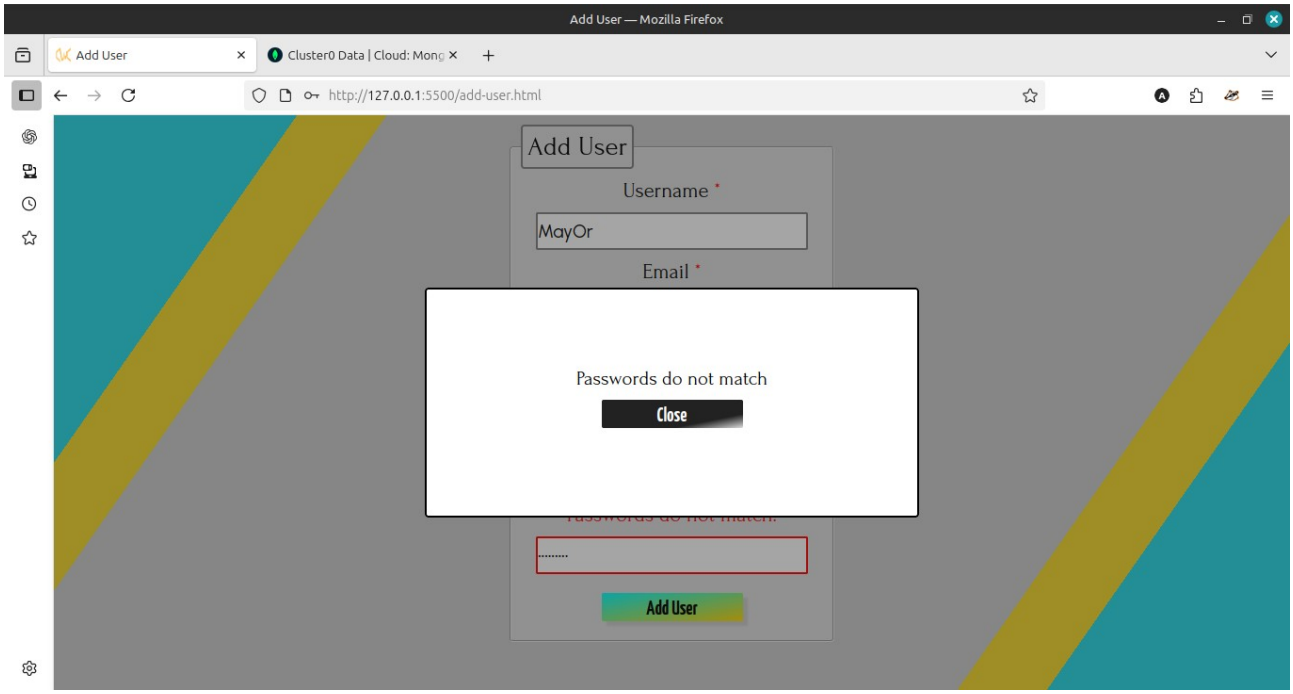

Figure 31: Failed adding of a new user due to password mismatch

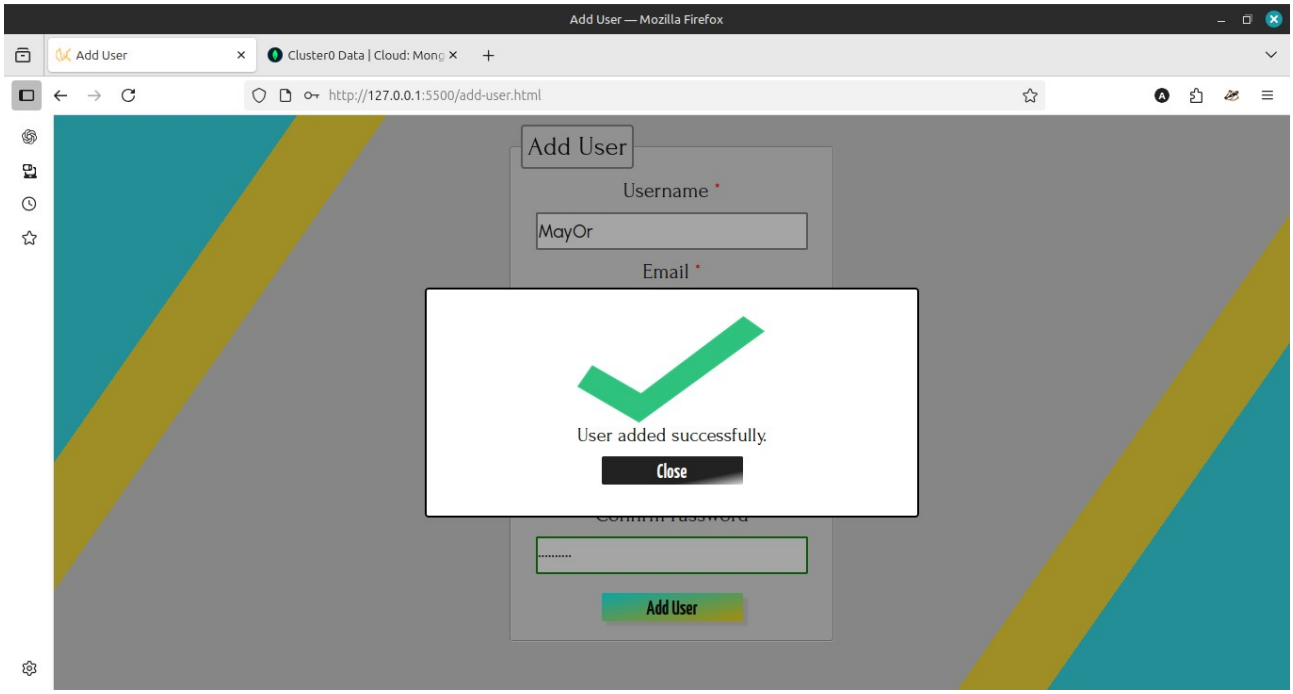

Figure 32: Successful adding of a user to the system

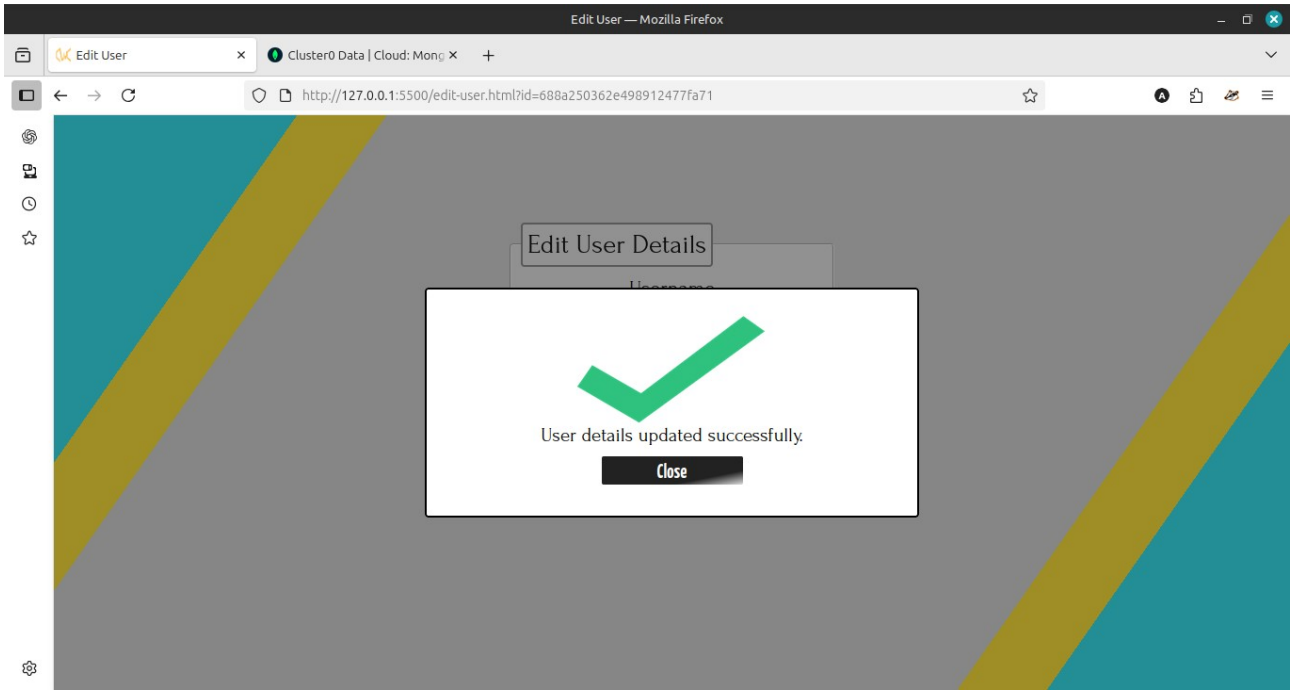

Figure 33: Successful change of user details by admin

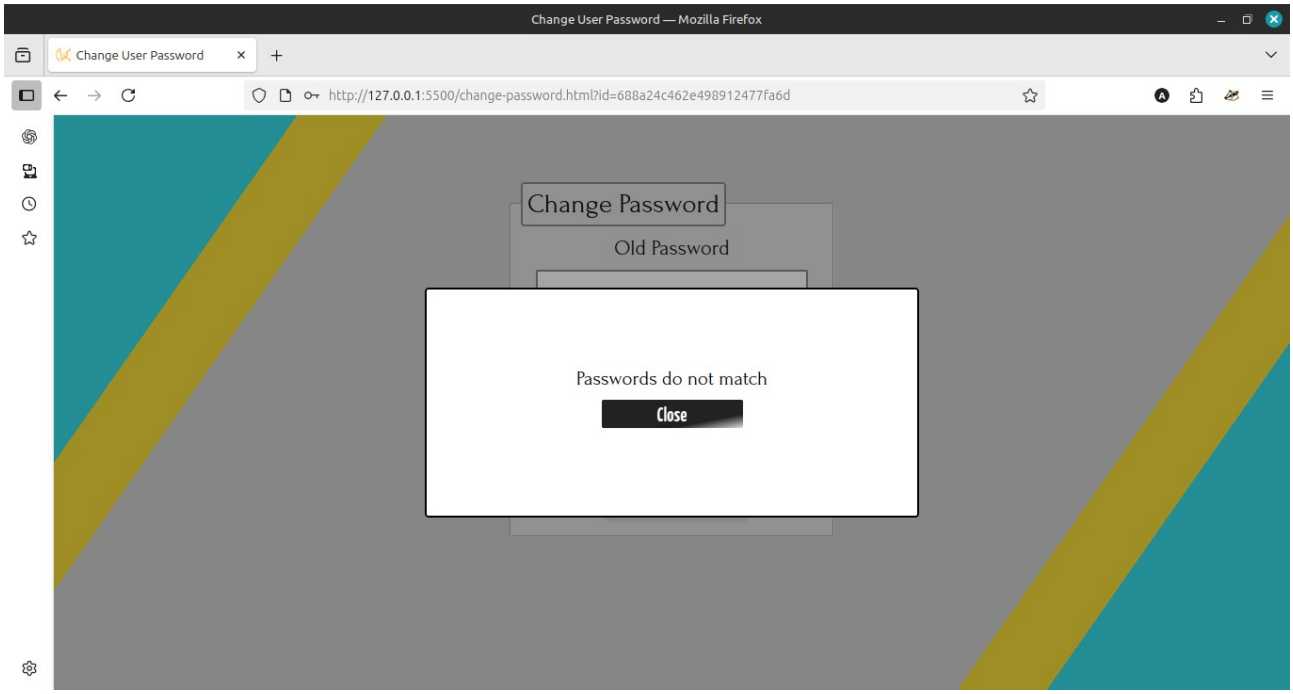

Figure 34: Password change failed due to password mismatch

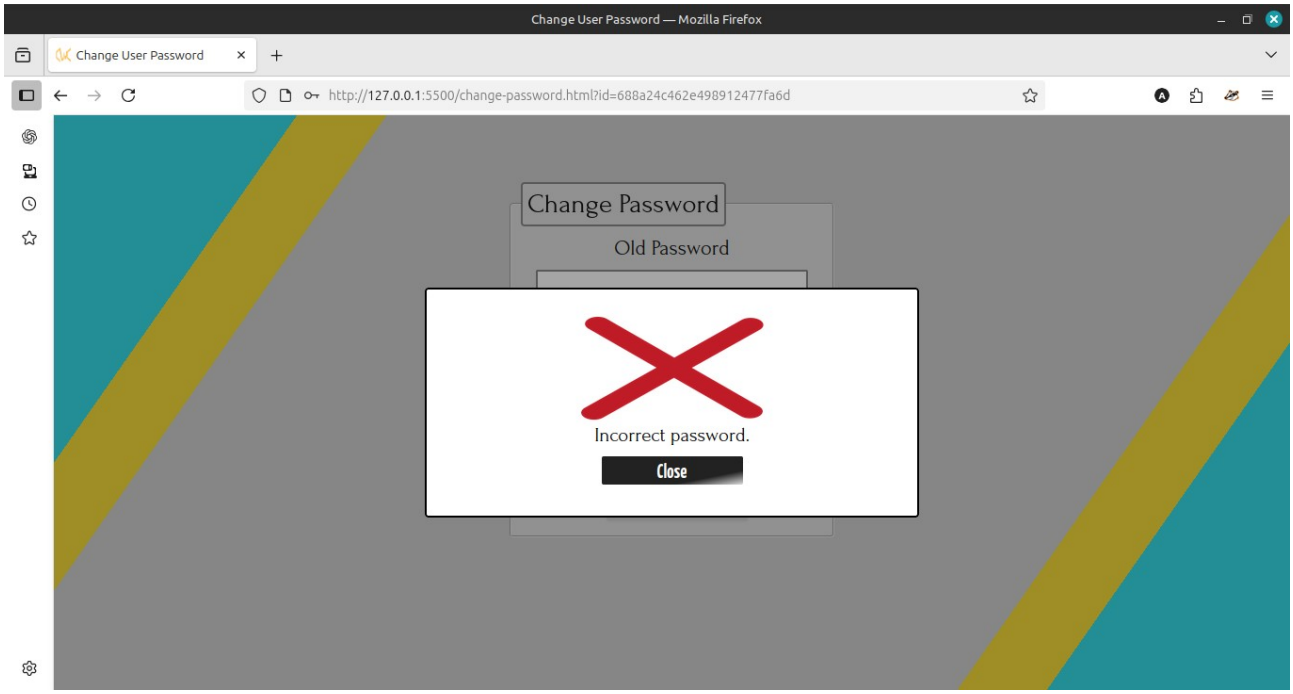

Figure 35: Password change failed due to old password being incorrect

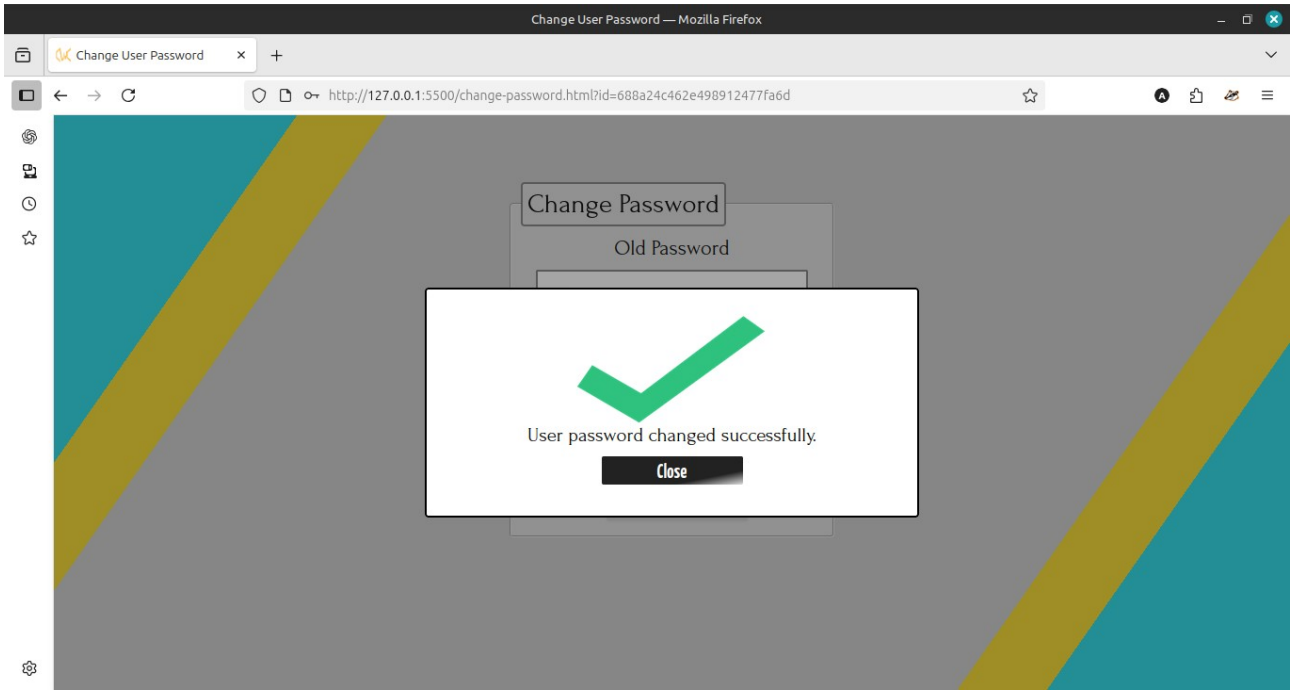

Figure 36: Successful change of user password by admin

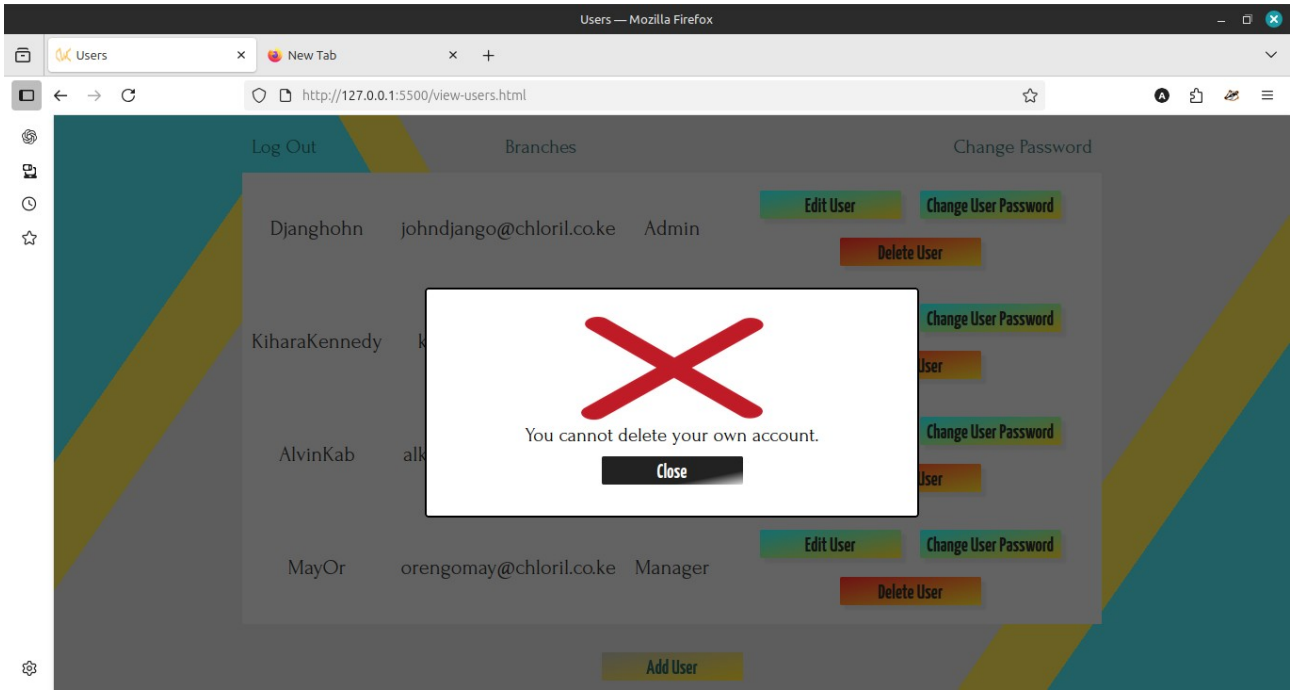

Figure 37: Failed deletion of own user account

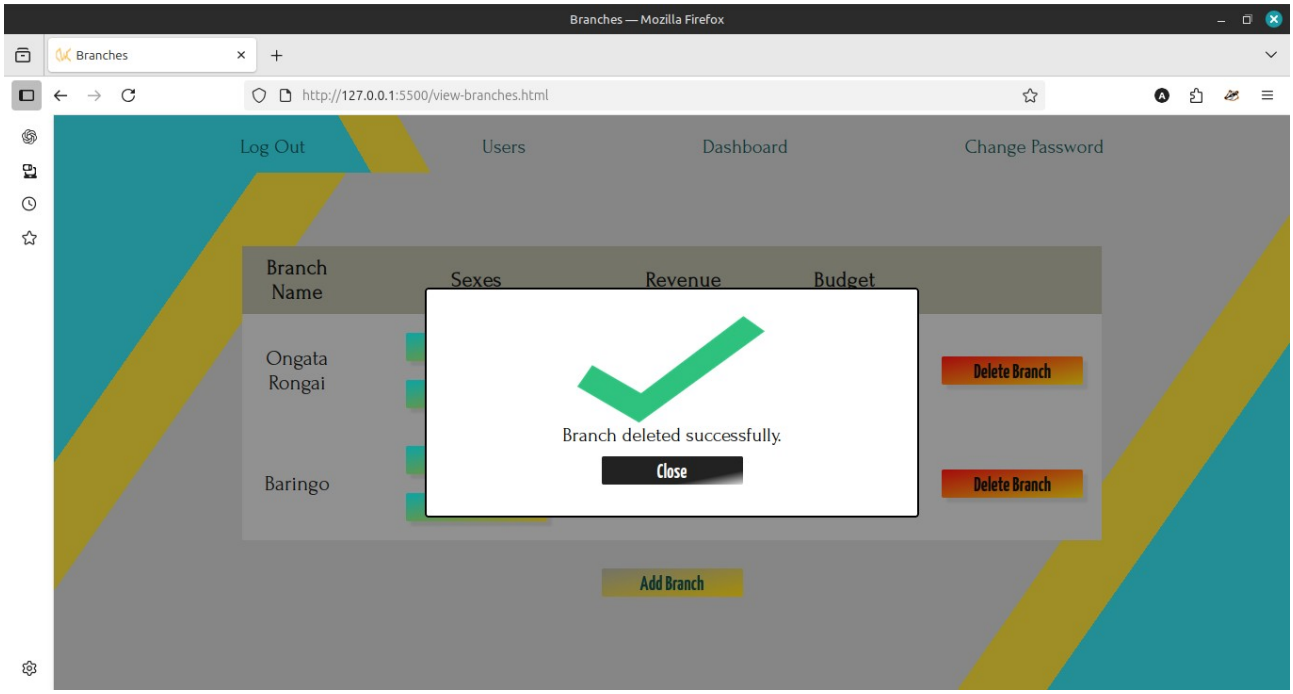

Figure 38: Successful account deletion by admin

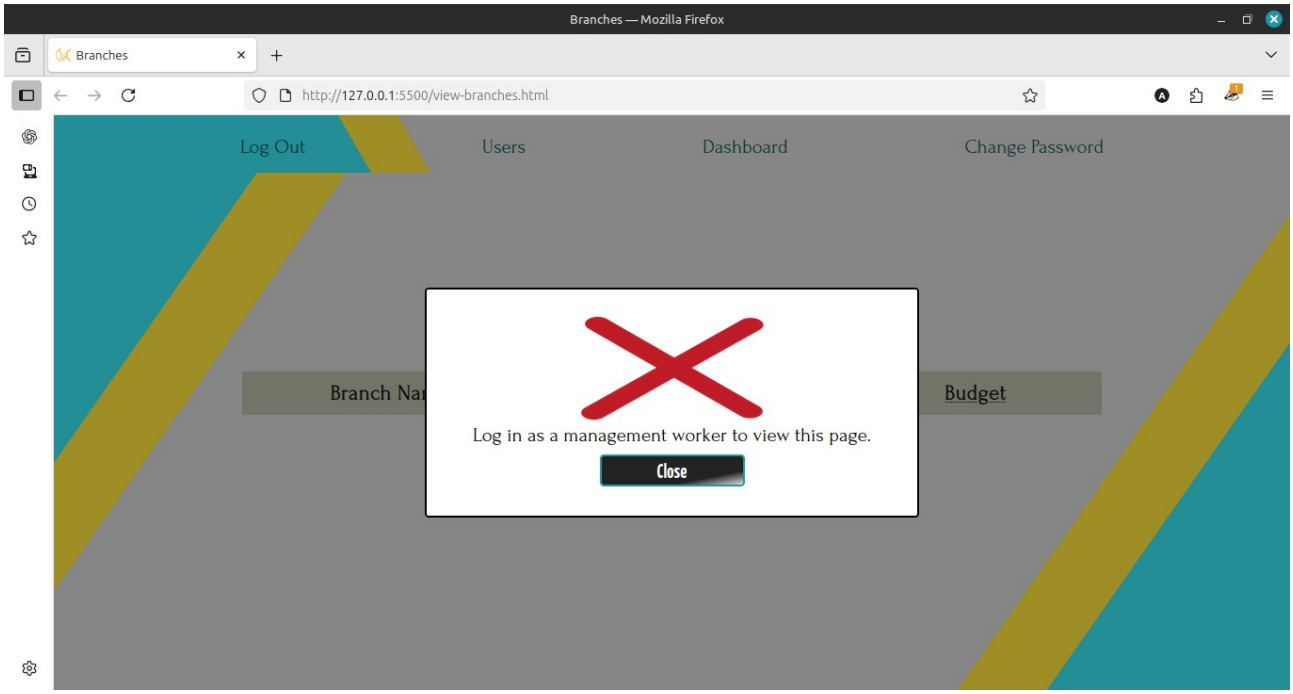

Figure 39: User denied access unless they log in

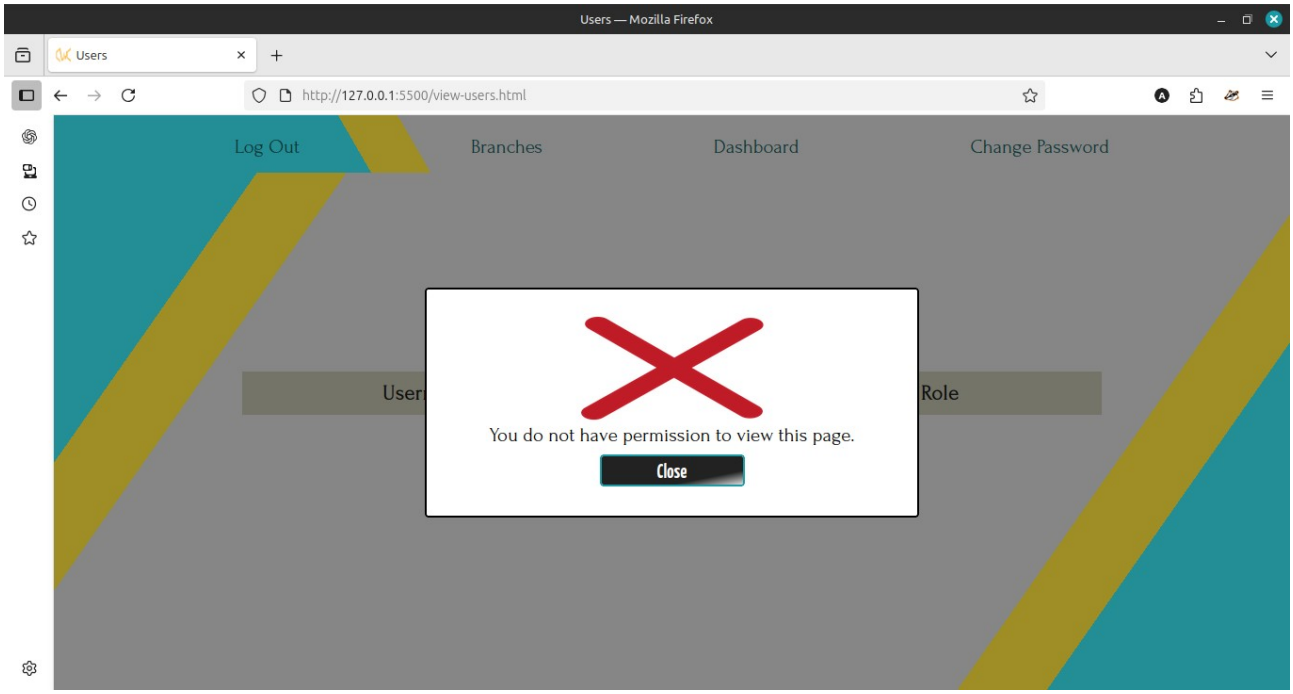

Figure 40: User denied access since they do not have admin permissions

4.3: Reports

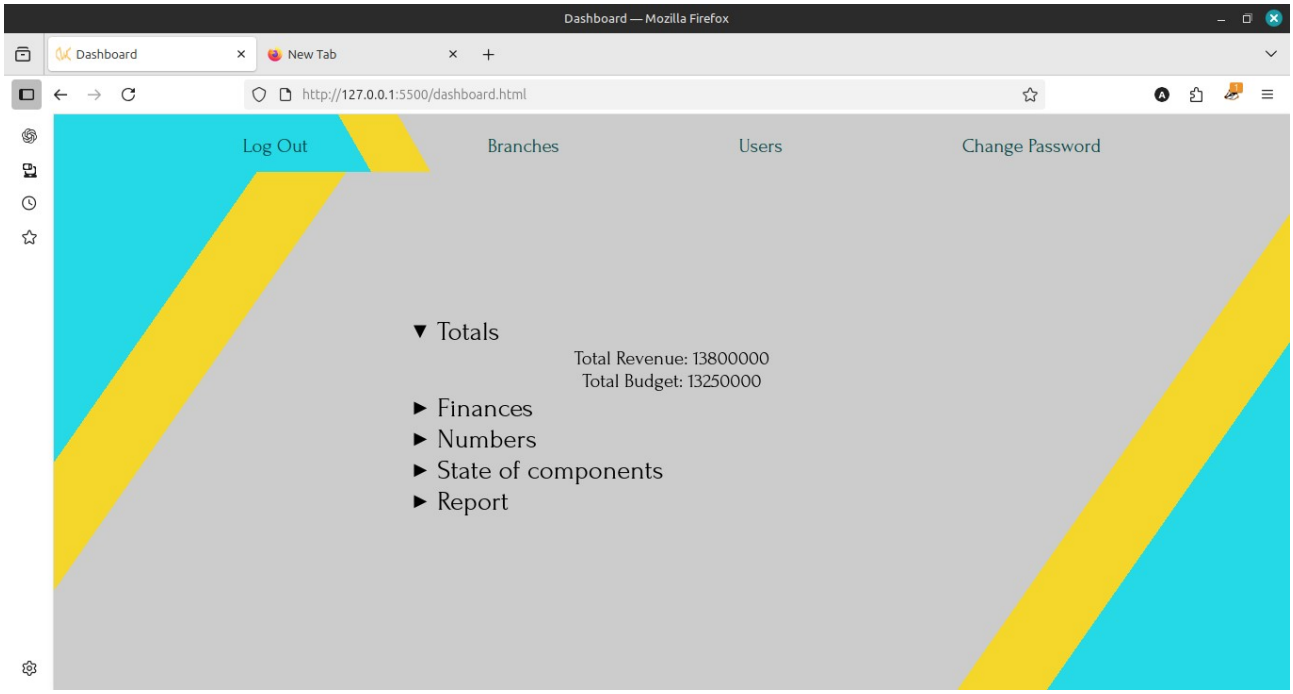

Figure 41: Total revenue and budget

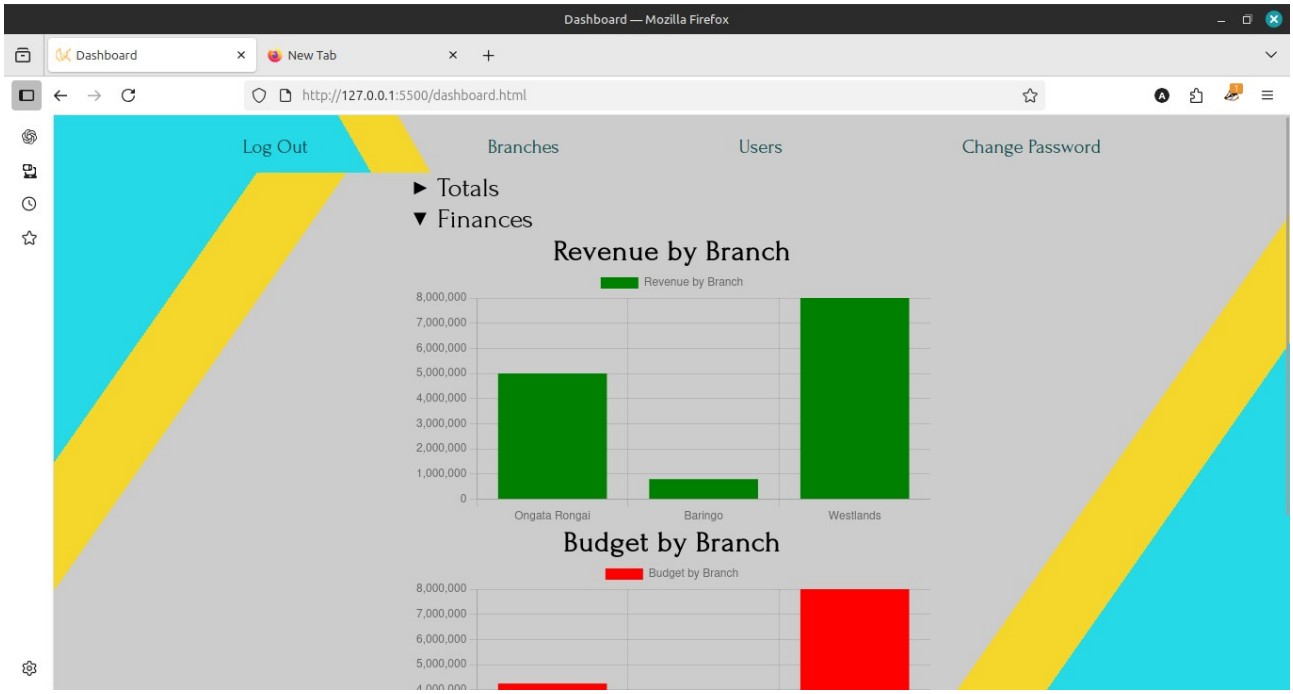

Figure 42: Column charts showing finances by branch

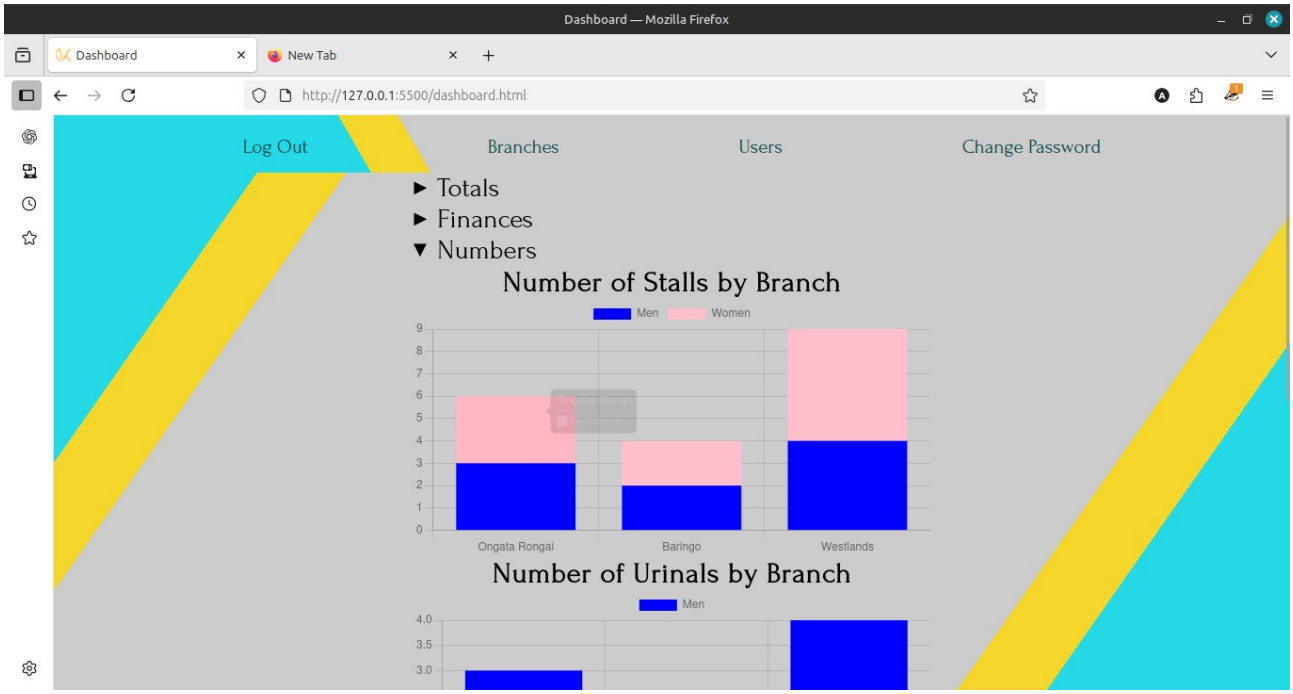

Figure 43: Column charts showing quantities by branch

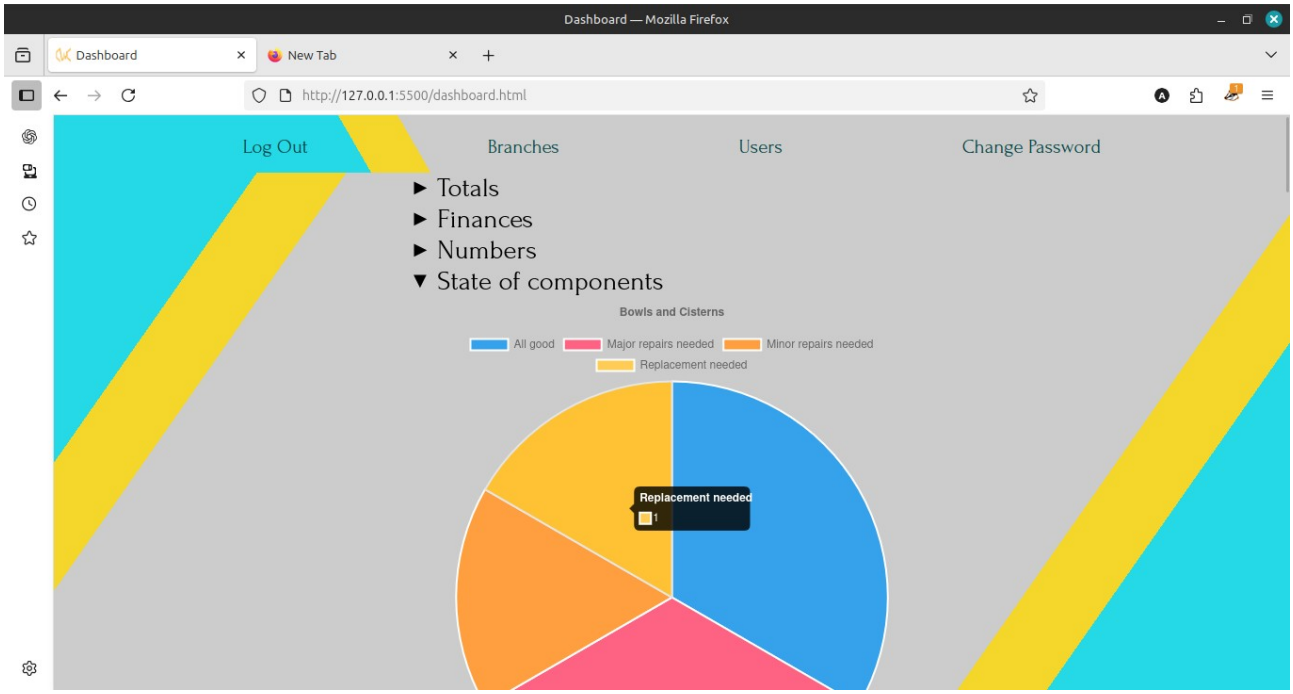

Figure 44: Pie charts showing proportions of state of components

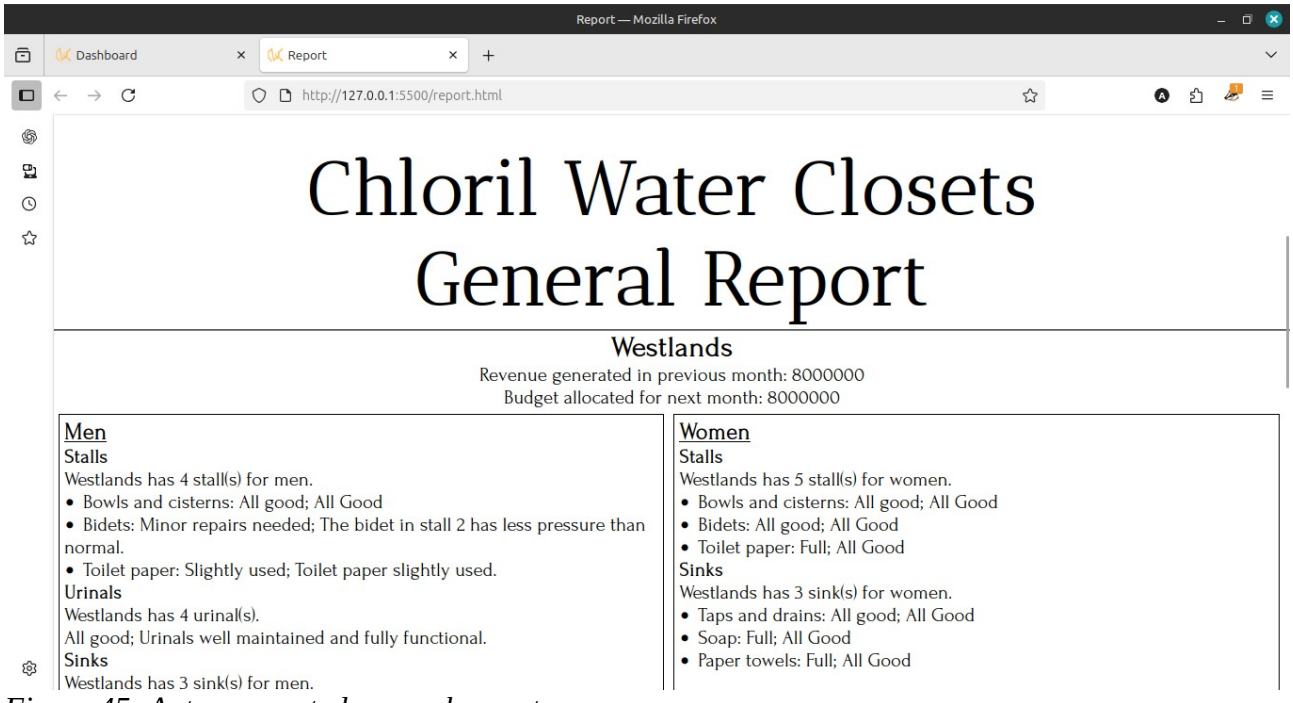

Figure 45: Auto-generated general report

5: User manual

5.1: System requirements

The system must have a modern web browser installed.

5.2: How to operate the system

5.2.1: Getting started

Your user account is to be created by an admin. The admin should then give you your credentials. You can change your password once you have logged into the system.

If you have not logged in, you will be at the homepage as shown in Figure 46.

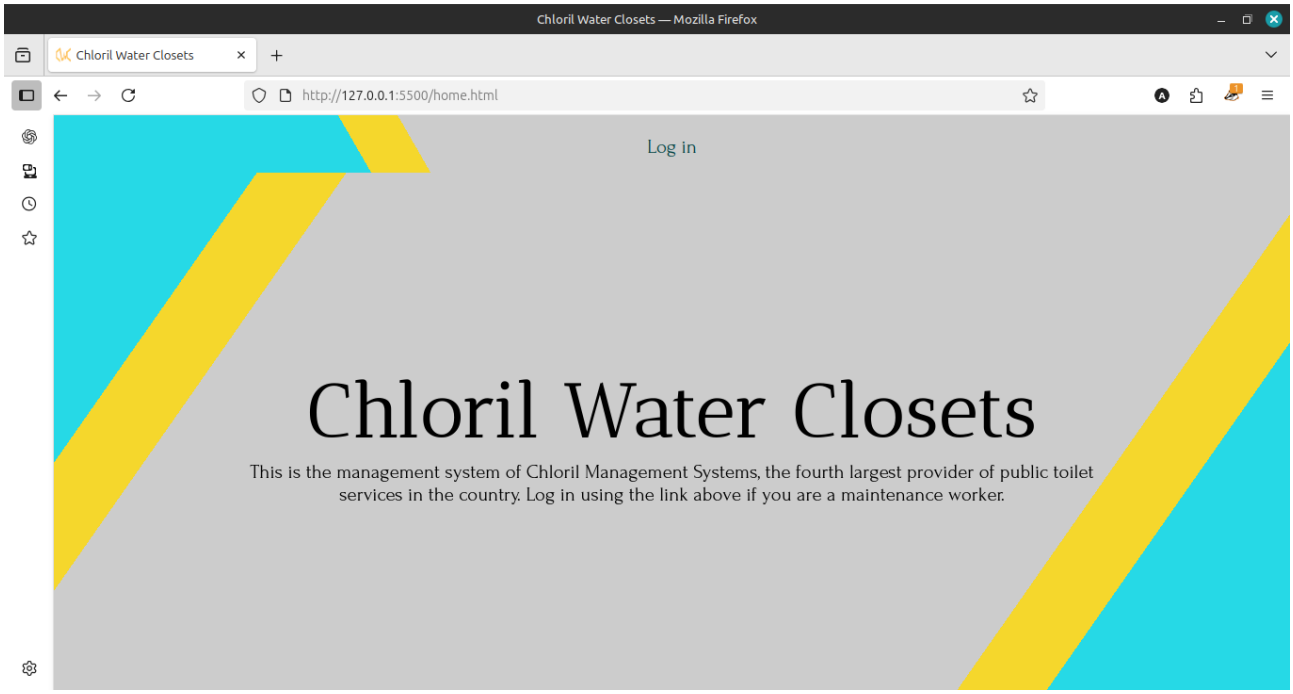

Figure 46: Homepage

Login

To log in, press the ‘Log in’ option available to you at the navigation bar in the homepage. You will be redirected to a login form as shown in Figure 47.

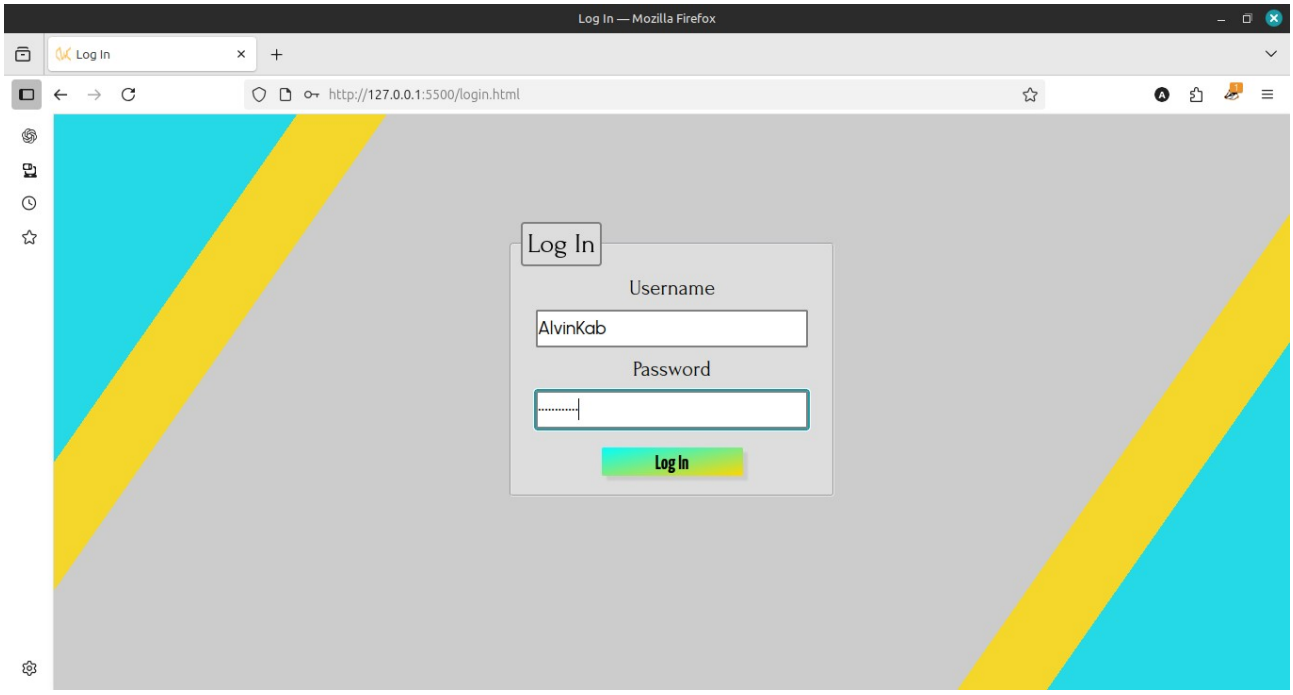

Figure 47: Login form

If your credentials are correct, you will be redirected to the branches page shown in Figure 48 if you are an admin, or to the branches page shown in Figure 49 if you are a manager.

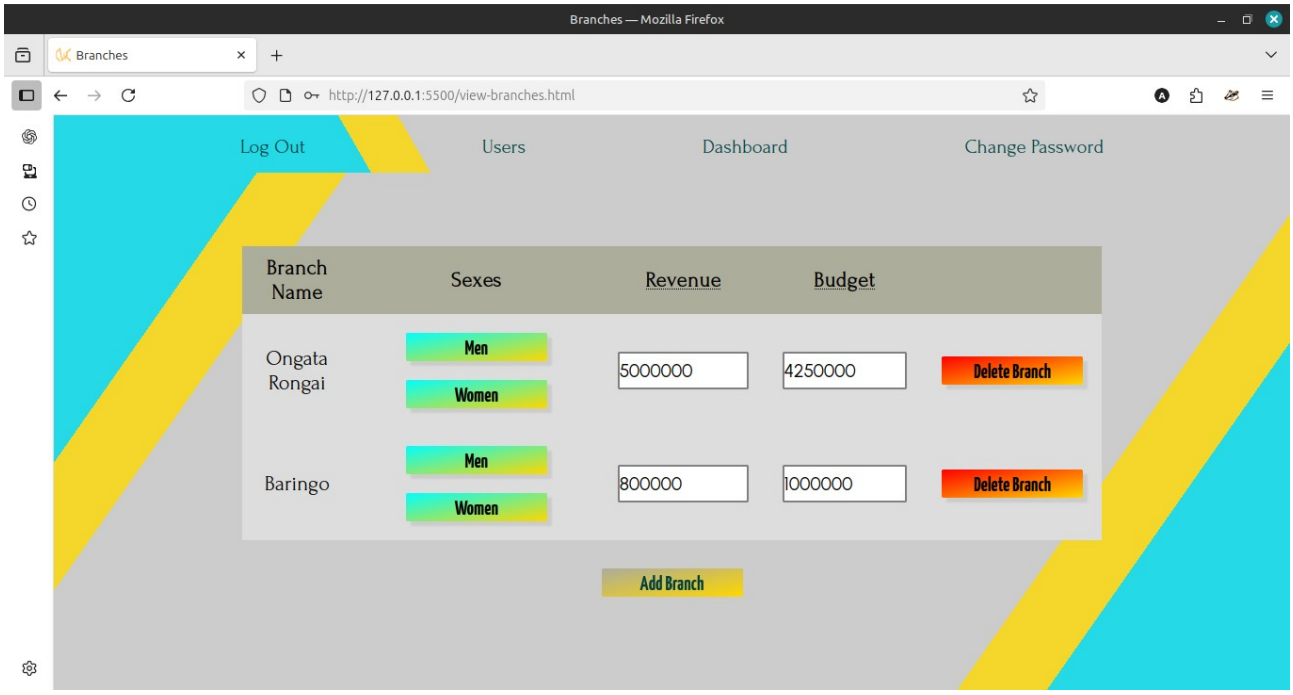

Figure 48: Admin's view of branches page

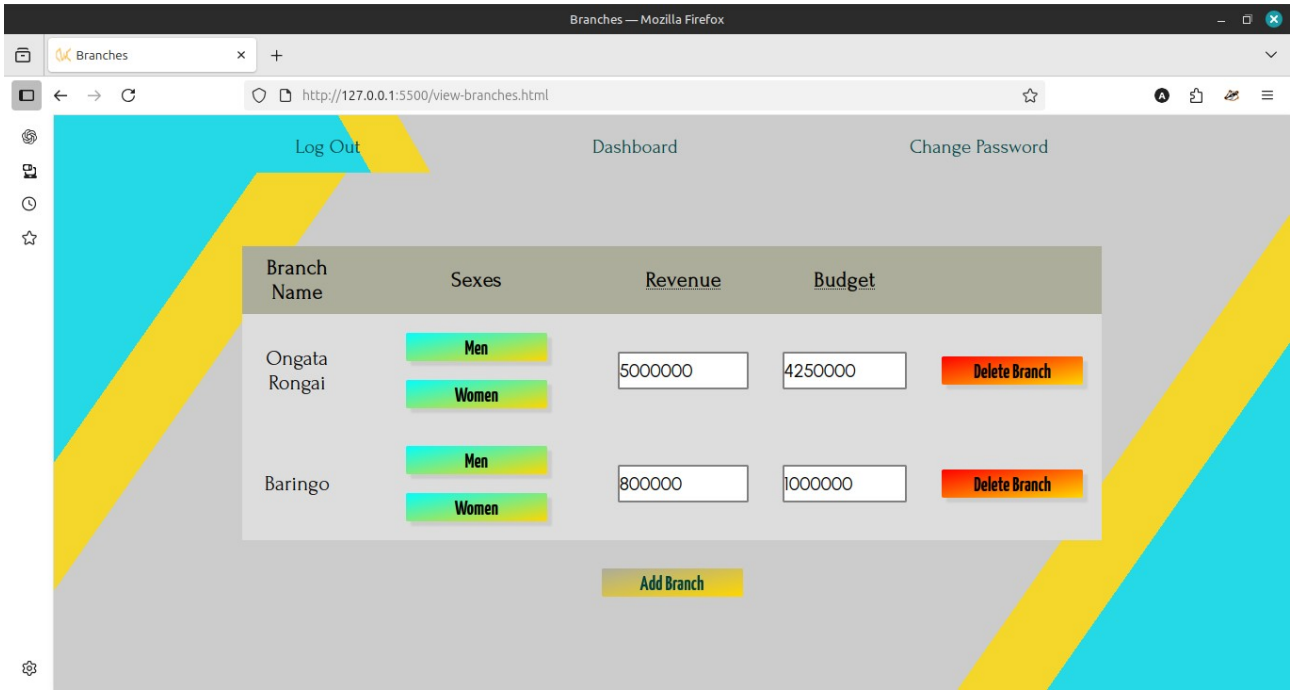

Figure 49: Manager's view of branches page

Note that the major difference between the manager and admin pages is that you cannot access the users page as a manager, while you can as an admin.

5.2.2: Branches

Adding a new branch to the system

To add a new branch, click on the ‘Add Branch’ button below the table of branches in the branches page. You will be redirected to a form such as the one shown in Figure 50.

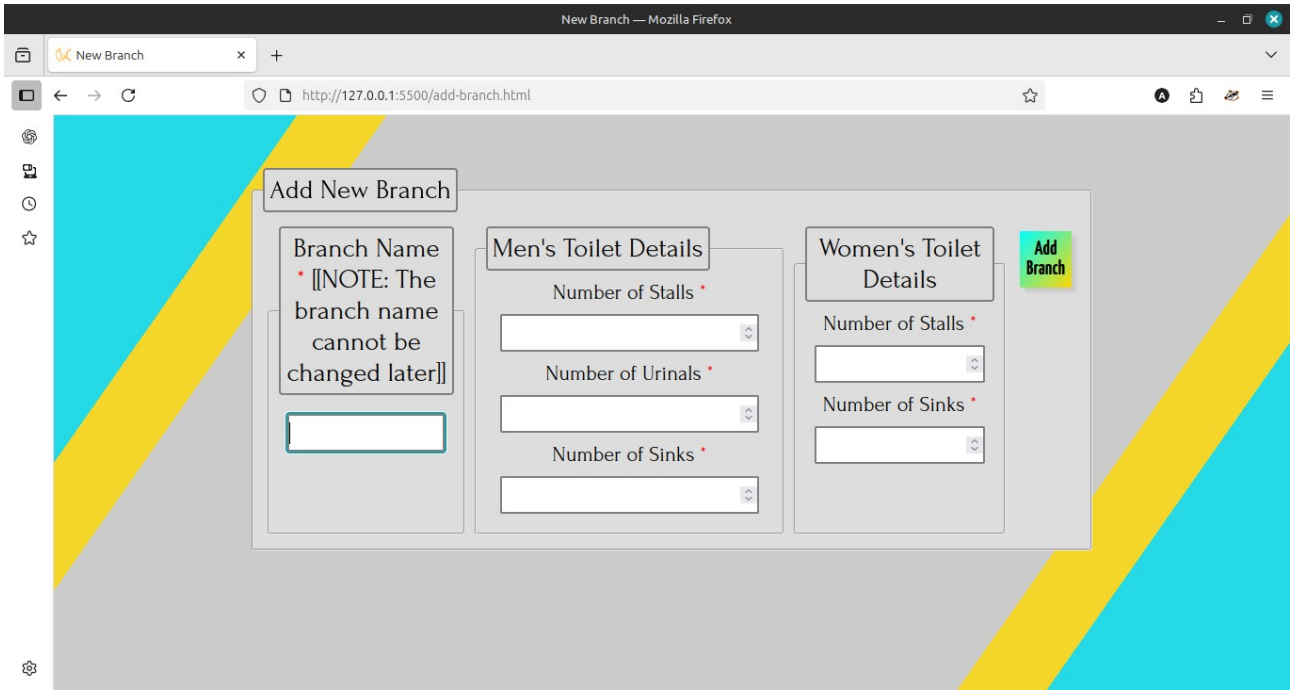

Figure 50: Adding a new branch

Note that all fields are mandatory, you cannot change the branch name, and that you cannot enter negative values.

If successful, you will be redirected to the branches page, and you should see the new branch you have just added at the bottom of the table. Note that the branch's budget and revenue are 0. This is because by default, it is assumed to be a new branch, thus has not started generating revenue.

Editing the details of an existing branch

Each branch in the branches table in the branches page has buttons for editing the Men and Women sections of the branch, fields for entering revenue and budget, and a button for deleting the branch.

To set a new branch revenue or budget value, simply enter the new value in the input fields. Note that 'Revenue' means revenue that the branch has gotten in the previous month, and 'Budget' means budget allocated to the branch for the next month. Clicking away form the input field saves the new values to the database immediately. Note that the budget cannot be zero but the revenue can. This is because a branch can lose revenue but cannot be allocated a negative budget.

To update the various toilet sections of a branch, click 'Men' to update the men's section. Doing so should redirect you to a form such as the one in Figure 51.

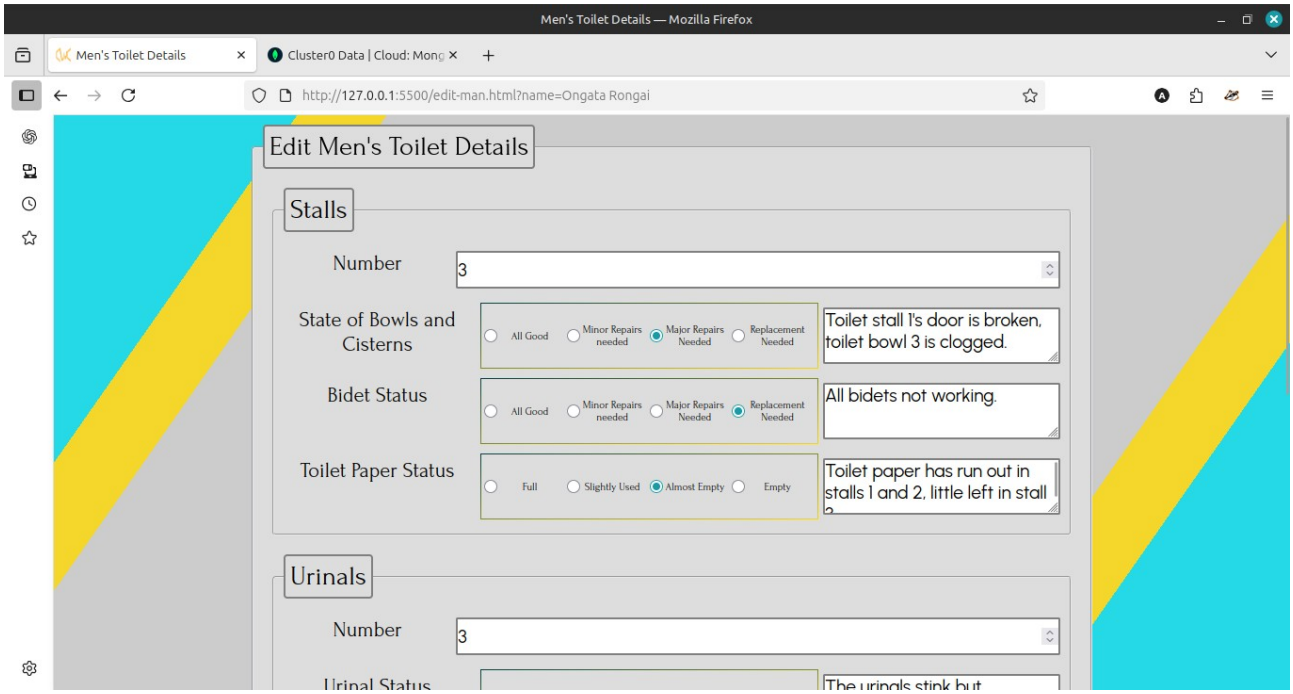

Figure 51: Editing the men's toilet section of a branch

Likewise, to update thw women's section, click 'Women'. Doing so should redirect you to a form such as the one in Figure 52.

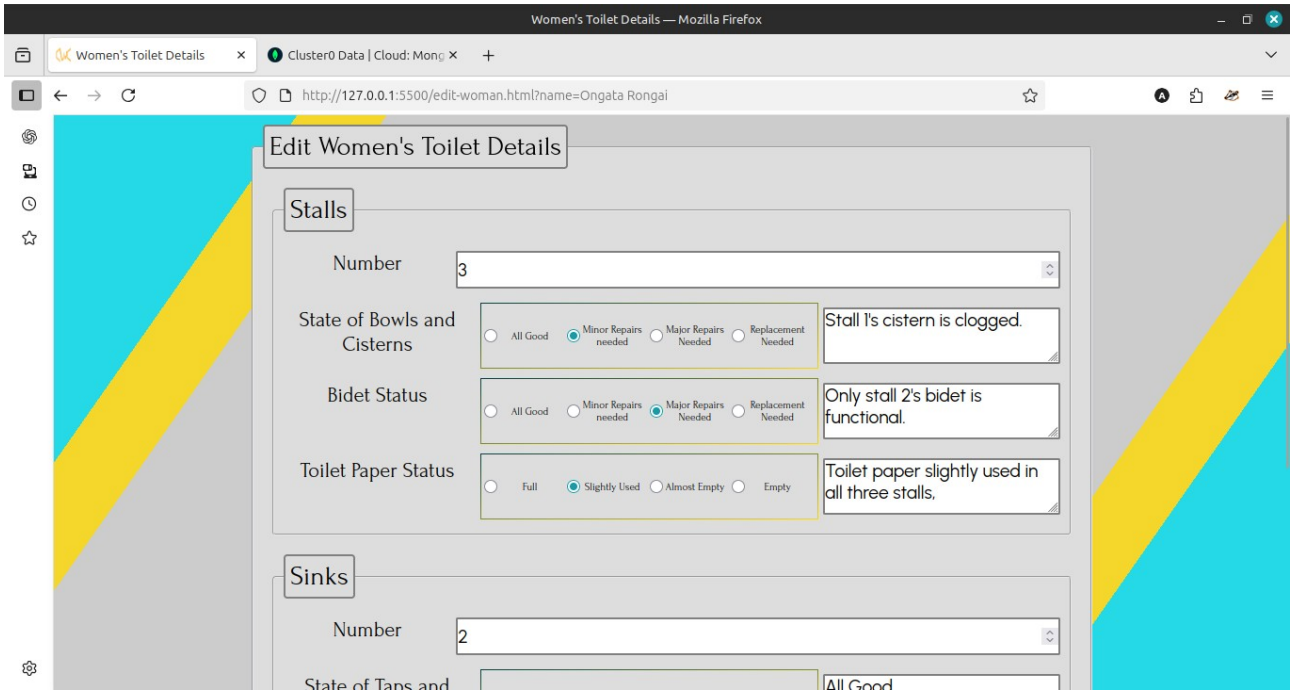

Figure 52: Editing the women's toilet section of a branch

Note that data comes preloaded to ensure that you do not make unwanted changes. Also note that if a branch has just been added, the default status will be 'All Good' or 'Full' depending on the

component, and the status details field will have the text ‘All Good’ by default. You can change these settings or you can keep them depending on the state of the component.

If successful, you should be redirected to the branches page.

Deleting a branch

Click the corrsponding ‘Delete Branch’ for the branch you want to delete.

A confirmation dialog box such as the one in Figure 53 should appear.

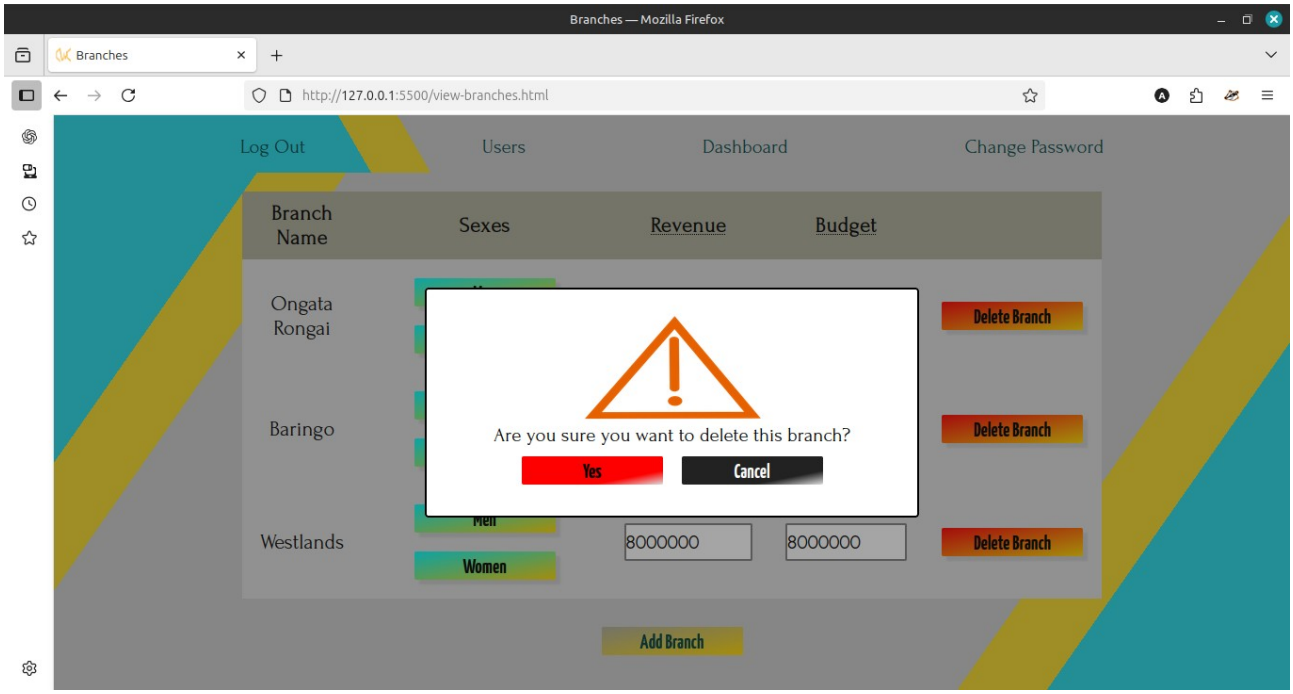

Figure 53: Deleting a branch

Clicking ‘Cancel’ closes the dialog box and retains the branch in the system. Clicking ‘Yes’ removes the branch from the table and the system at large.

5.2.3: Users [Admin Only]

To view users, click ‘Users’ in the navigation panel of either the branches page or the dashboard. You should be redirected to the users page that appears as shown in Figure 54.

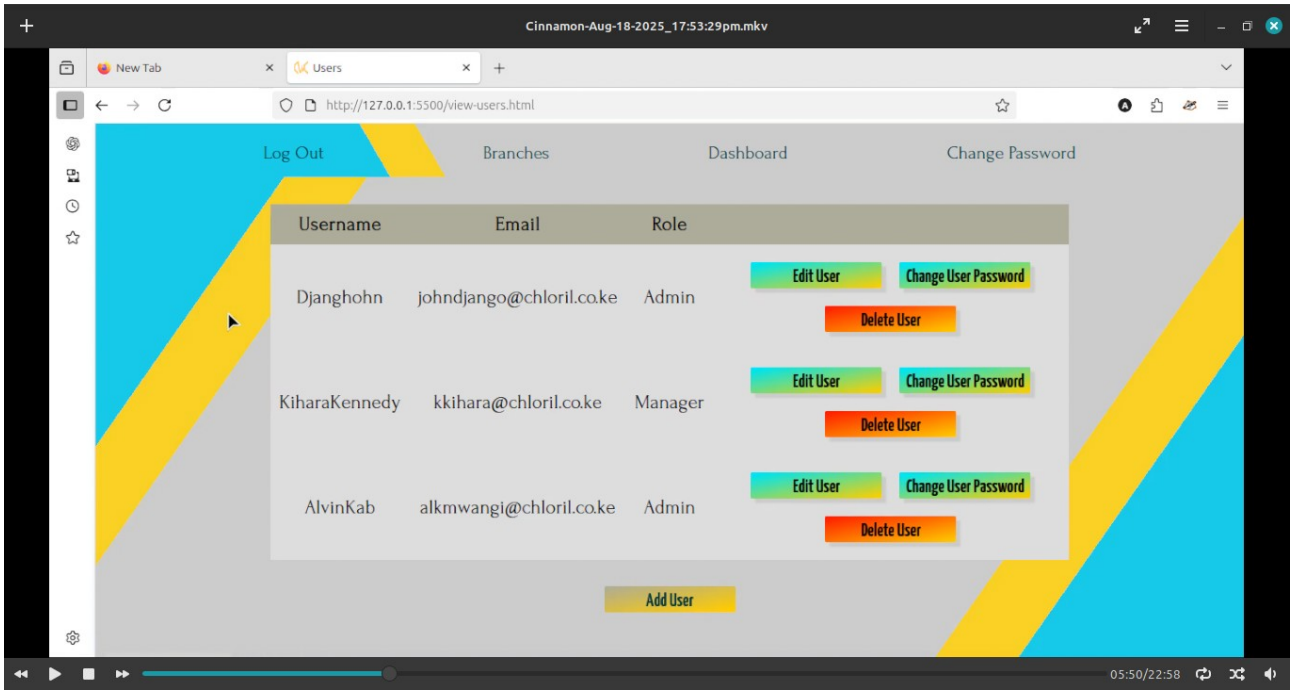

Figure 54: Users page

Each user in the users table in the users page has a button for editing the user details(username and email), a button for changing the user's password, and a button for deleting the branch.

Adding a new user account to the system

To add a new user, click on the 'Add User' button below the table of users in the users page. You will be redirected to a form such as the one shown in Figure 55.

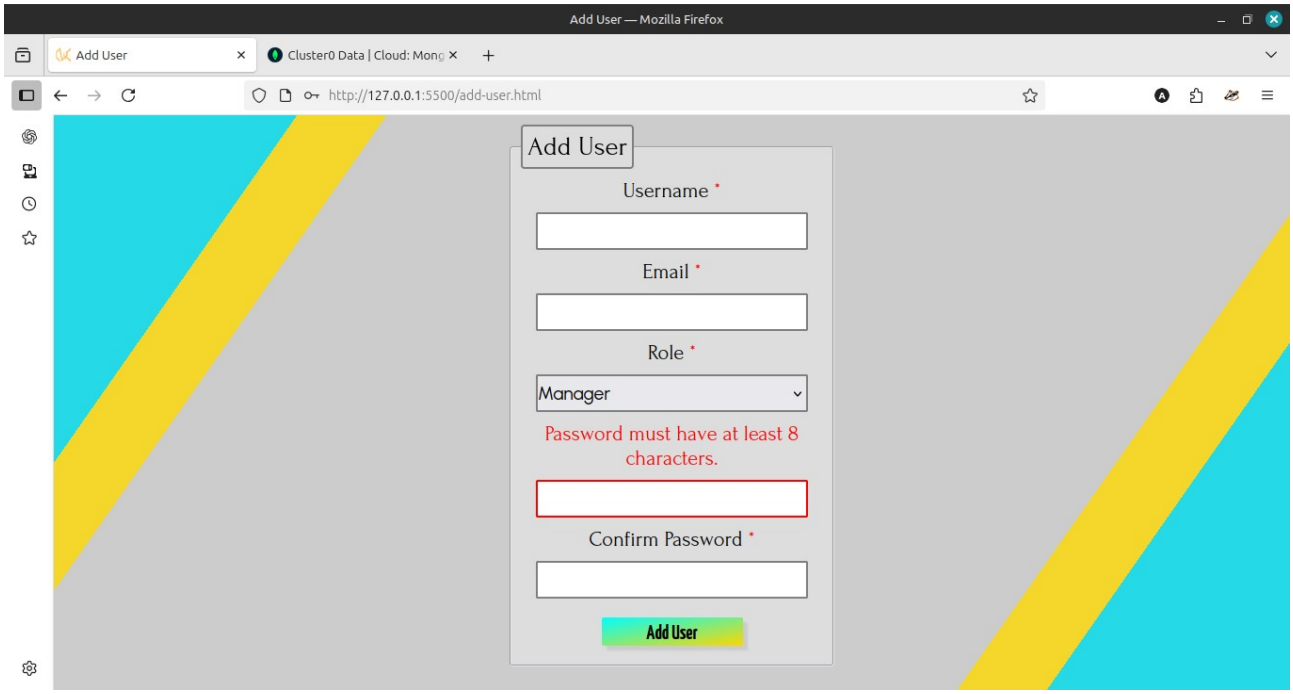

Figure 55: Adding a new user

Note that all fields are mandatory, the password must contain at least 8 characters, the password cannot contain a backstroke or double quotation marks, and that you must confirm the password before adding the new user.

If successful, you will be redirected to the users page, and you should see the new user you have just added at the bottom of the table.

Editing the username and password of an existing user account

Click on ‘Edit User’ for the user whose details you want to change. You will be redirected to a form such as the one in Figure 56.

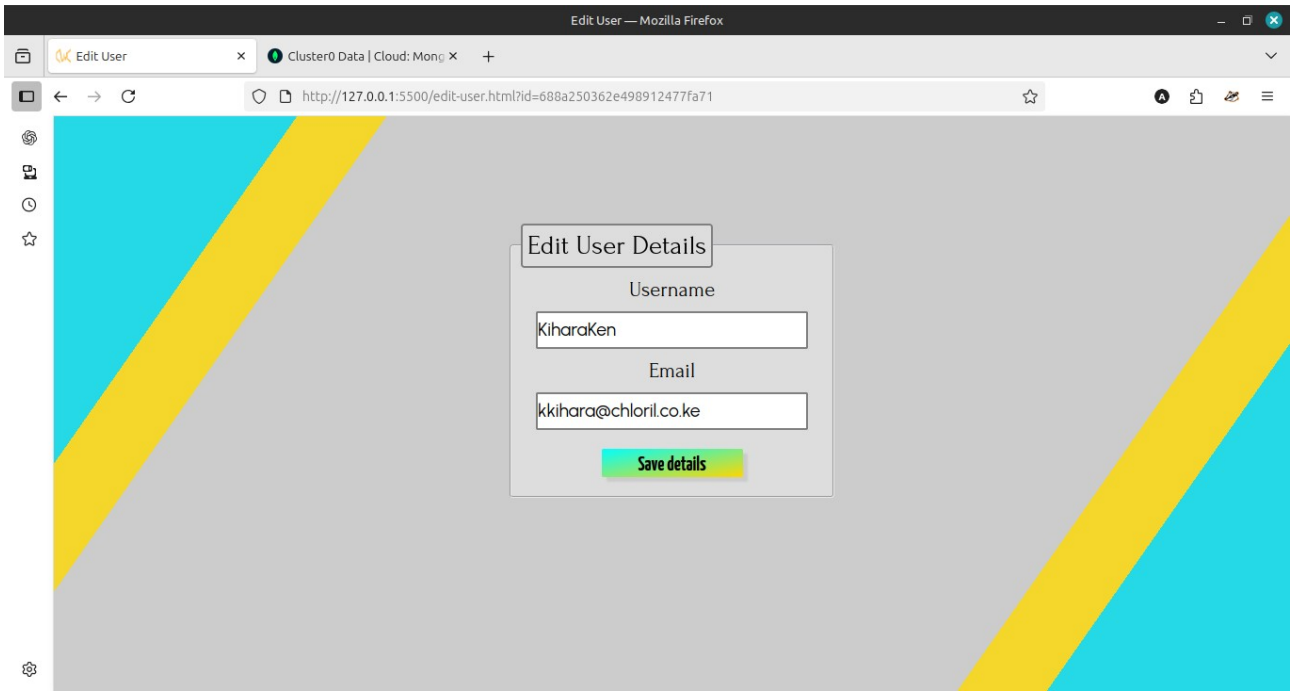

Figure 56: Editing details of a user account

If successful, you will be redirected to the users page, and you should see the updated details.

Changing the password of a user account

Click on ‘Change User Password’ for the user whose password you want to change. You will be redirected to a form such as the one in Figure 57.

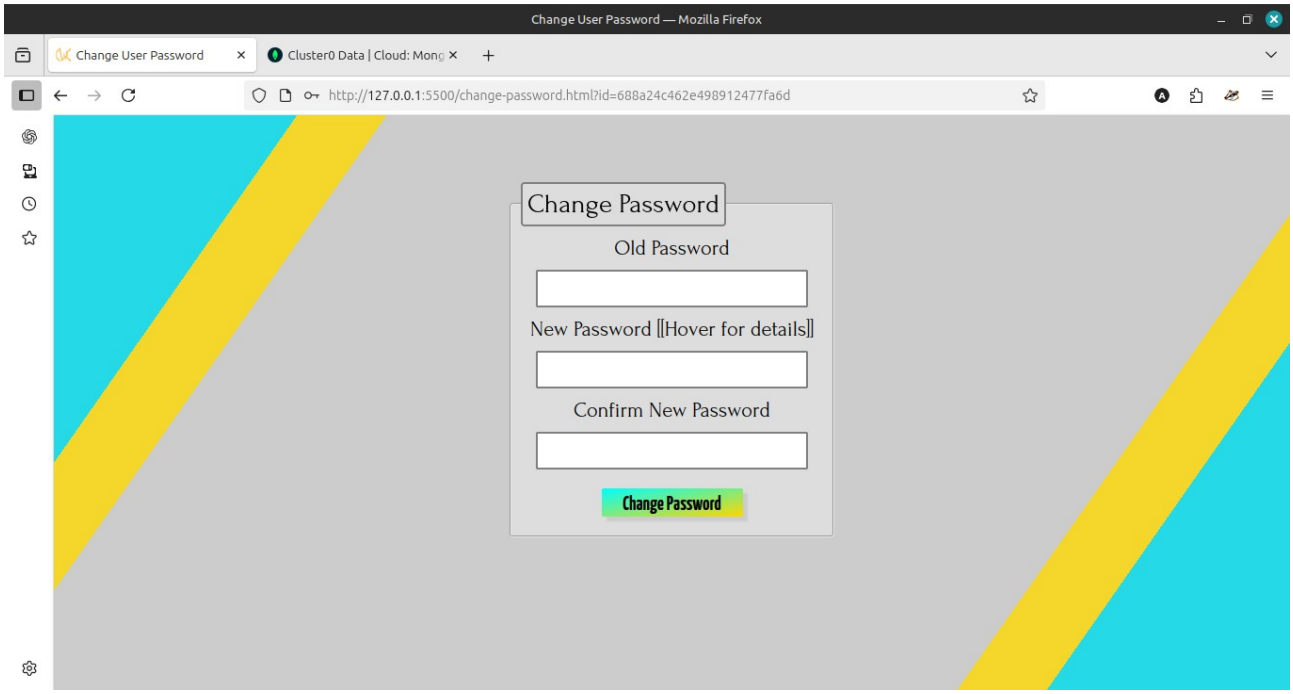

Figure 57: Changing a user account's password

Note that the old password must be correct, the new password must contain at least 8 characters, the new password cannot contain a backstroke or double quotation marks, and that you must confirm the new password.

If successful, you will be redirected to the users page.

Deleting a user account

Click the corrsponding ‘Delete User’ for the user you want to delete.

A confirmation dialog box such as the one in Figure 58 should appear.

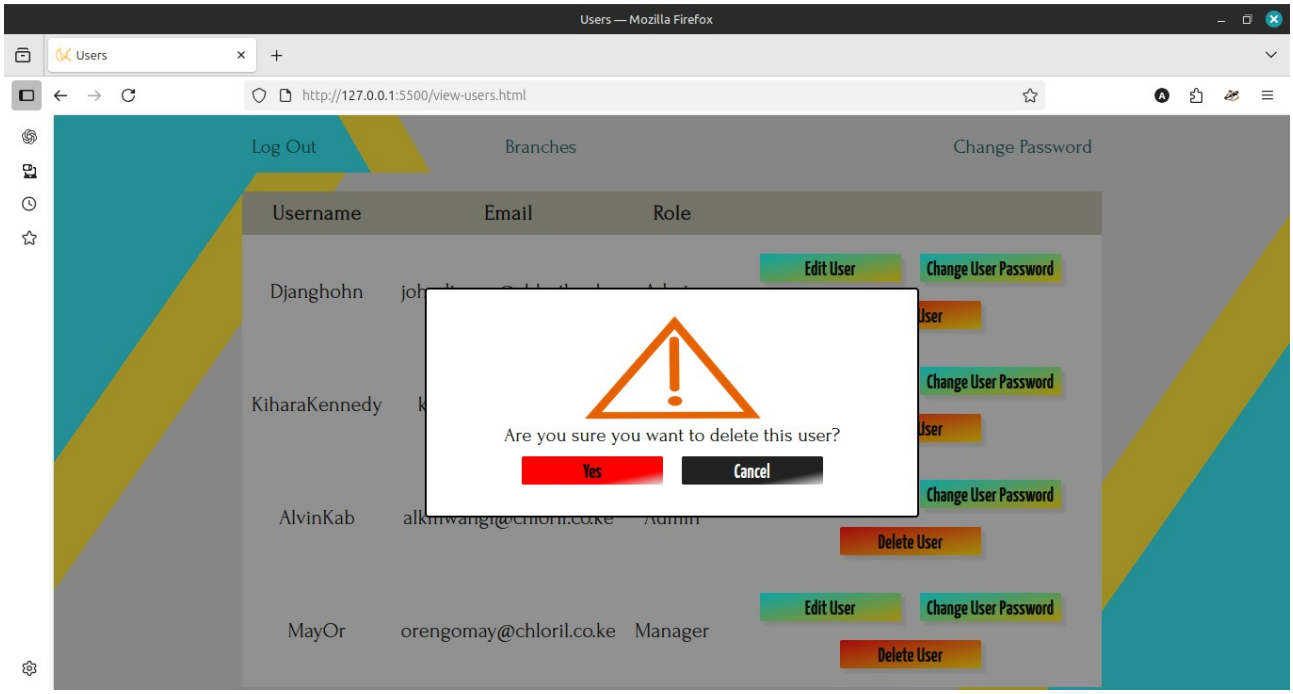

Figure 58: Deleting a user account

Clicking ‘Cancel’ closes the dialog box and retains the user in the system. Clicking ‘Yes’ removes the user from the table and the system at large. Note that you cannot delete your own account.

5.2.4: Dashboard

This is where you can view and visualise branch data. Click on ‘Dashboard’ in the navigation bar of either the branches page or the users page. You should be redirected to a page such as the one shown in Figure 59.

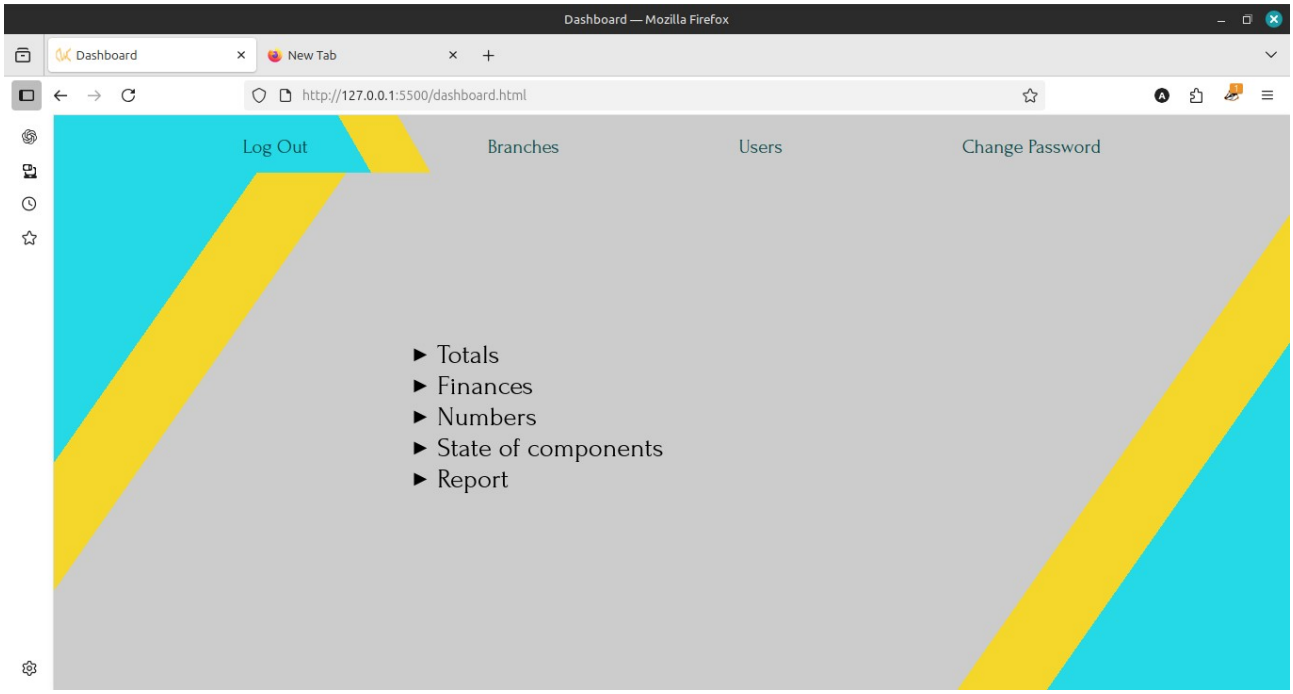

Figure 59: Dashboard

Note the various sections. You can expand each one of them. Opening one section closes another for neatness. The sections will be described below.

Totals

This displays the total revenue and total budget of all branches combined.

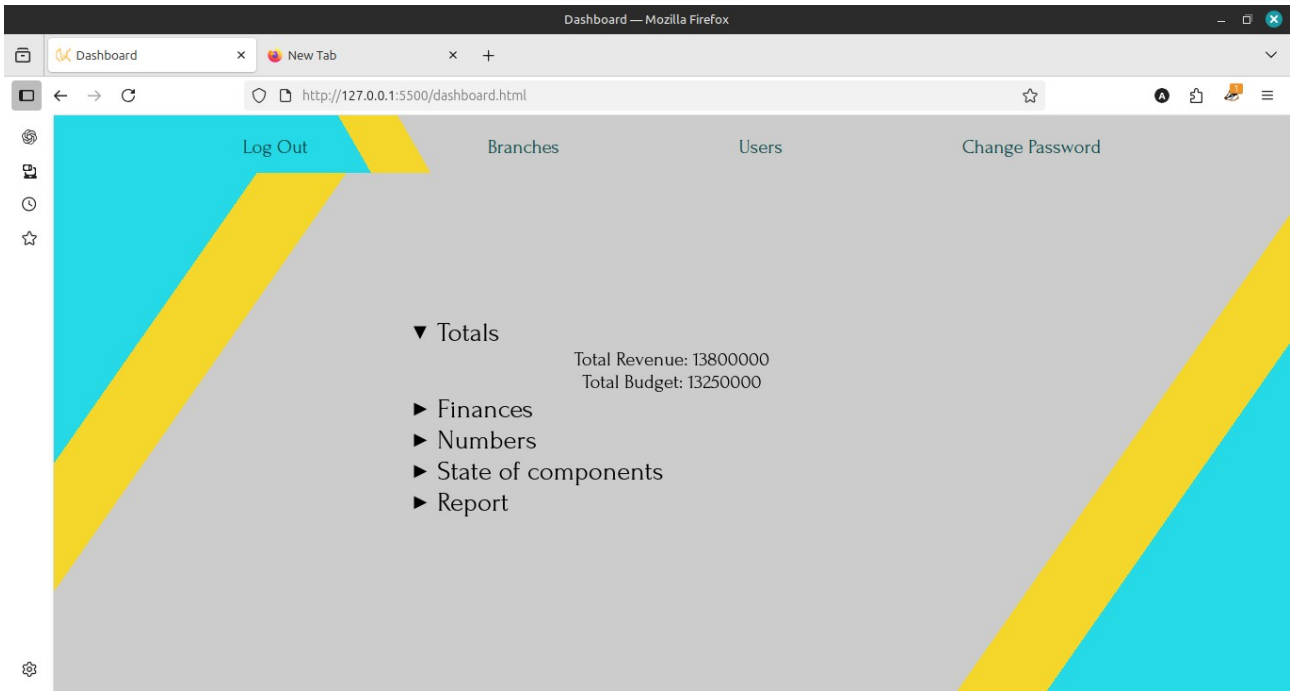

Figure 60: Totals

Finances

This displays two column charts; the first one shows revenue by branch, the second shows budget by branch.

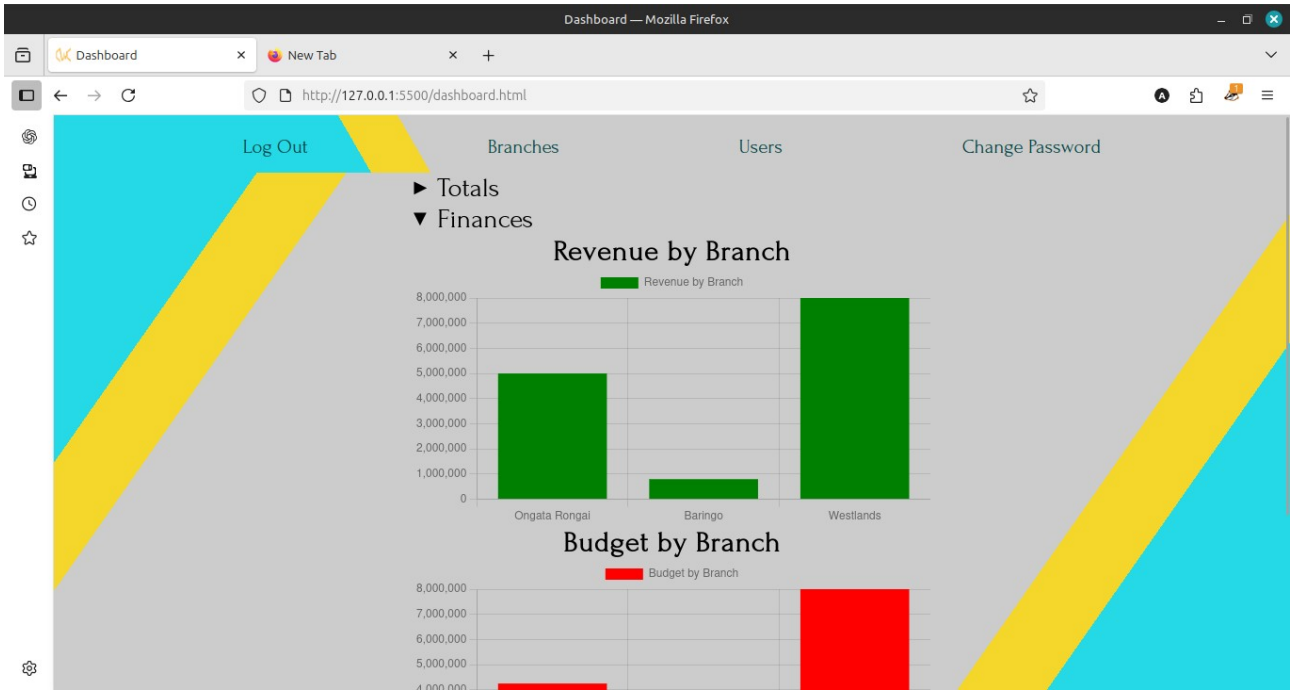

Figure 61: Finances

Numbers

This section shows three column charts, representing the number of stalls, urinals, and sinks respectively by branch.

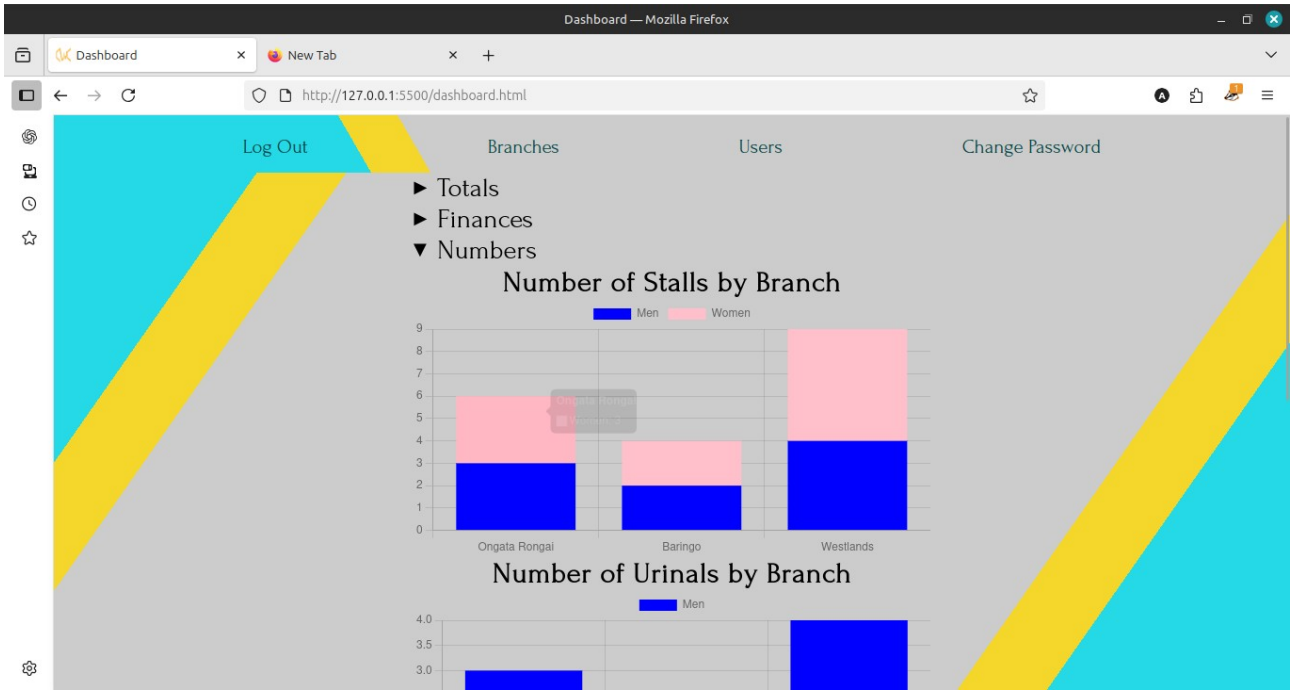

Figure 62: Numbers

State of Components

This section shows seven pie charts, showing the distribution of states by component.

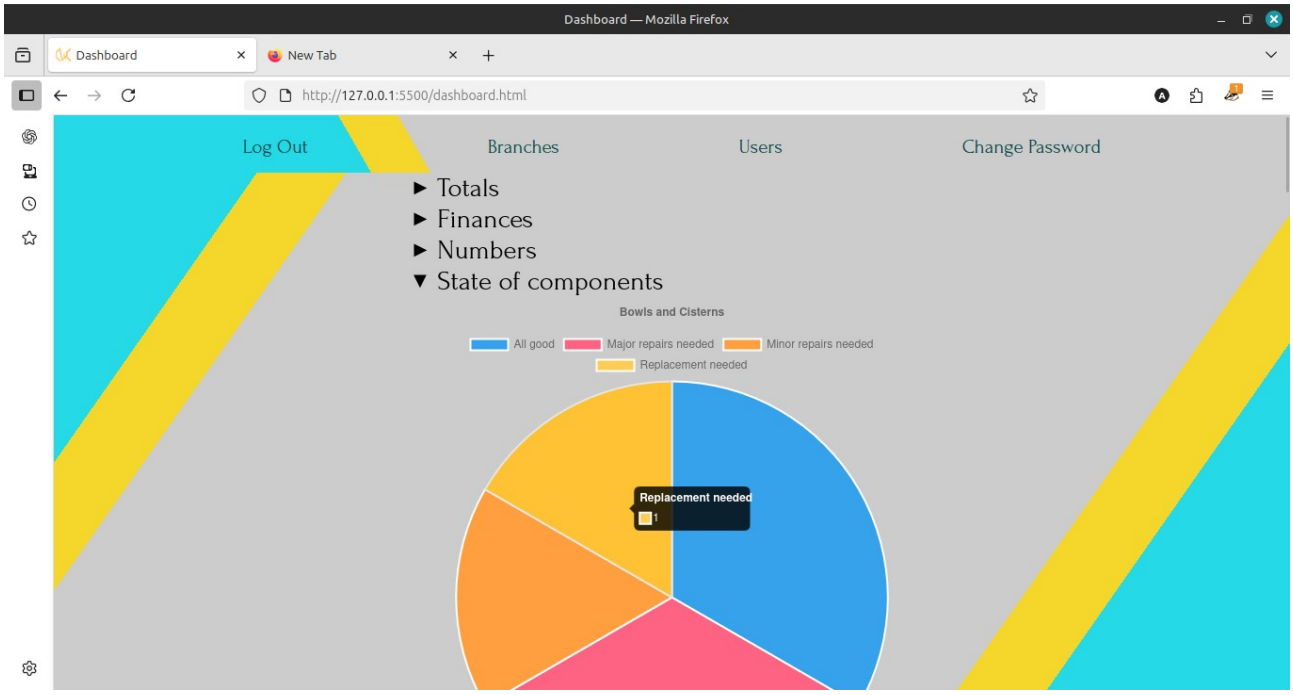

Figure 63: State of components

Report

This section contains a link that opens an auto-generated report of each branch in a new tab.

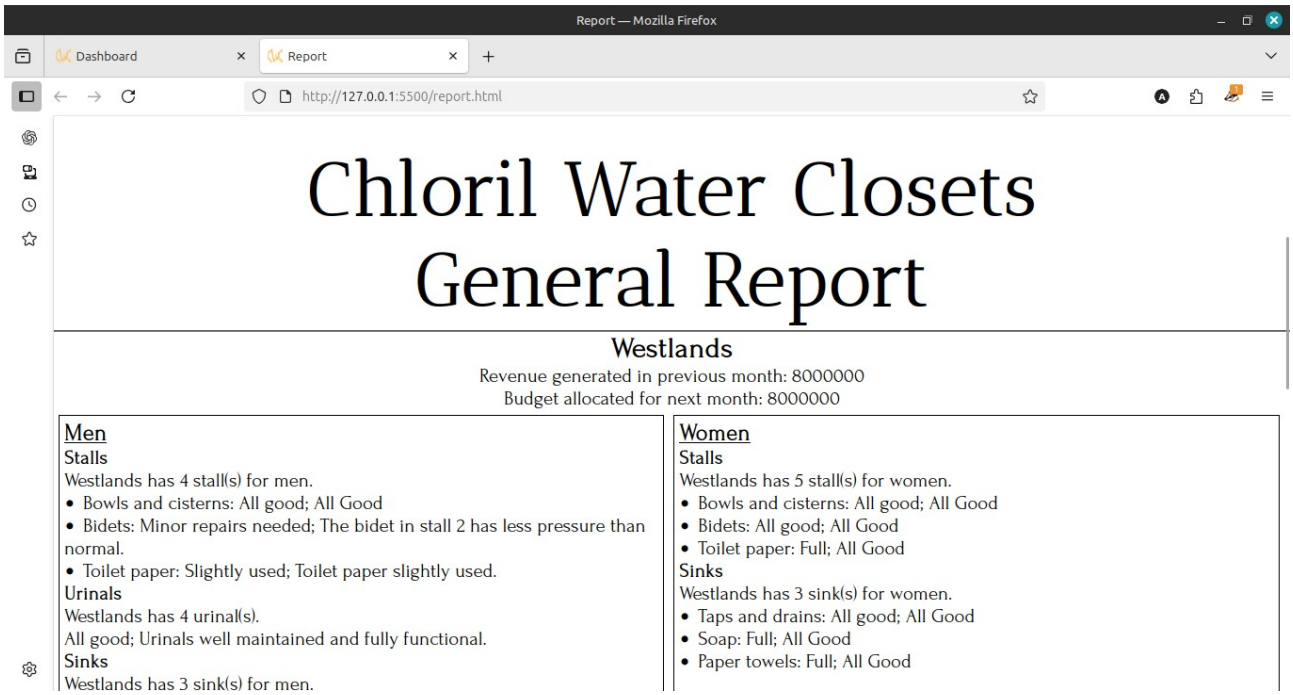

Figure 64: Report

5.2.5: Changing your own password

Click on ‘Change Password’ in the navigation bar of either the dashboard, the branches page, or the users page. This redirects you to a form as shown in Figure 65.

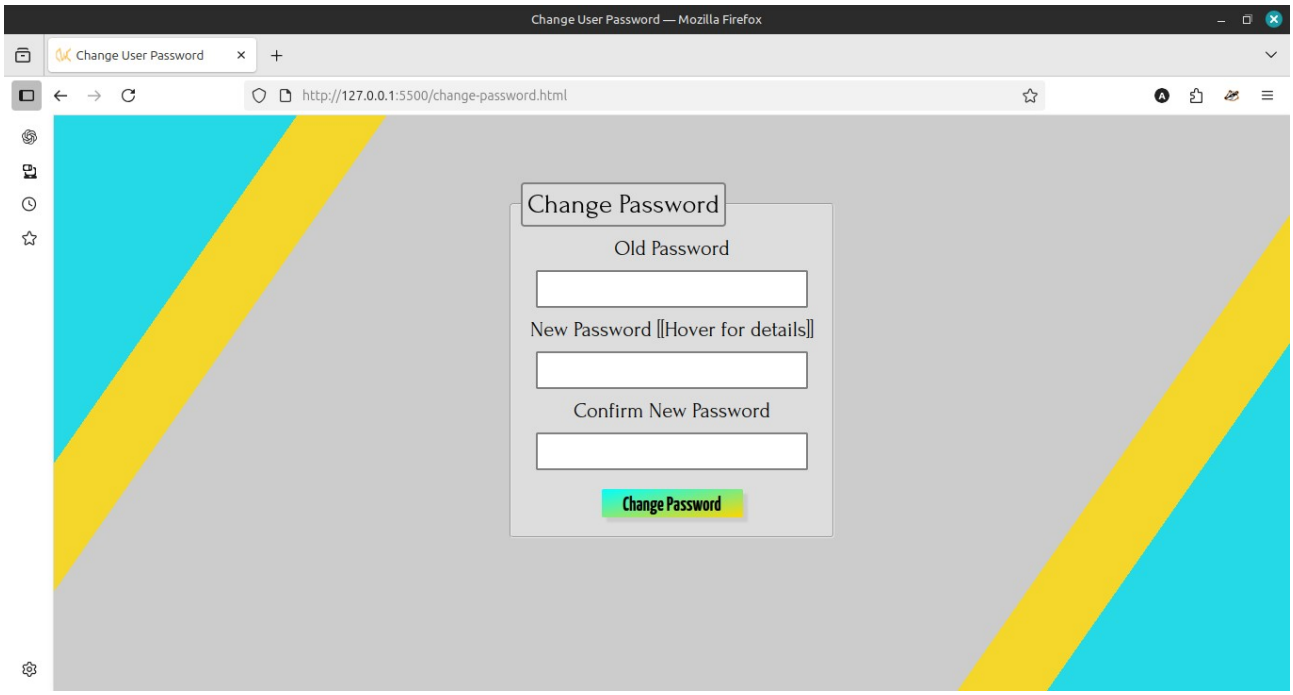

Figure 65: Changing your own password

Note that your old password must be correct, your new password must contain at least 8 characters, your new password cannot contain a backstroke or double quotation marks, and that you must confirm your new password.

If successful, you will be redirected to the page you were previously in.

5.2.6: Logging out

To log out of the system, simply click ‘Log Out’ in the navigation bar of either the branches page, the users page, or the dashboard.

Conclusion

This management system will be a great benefit to Chloril Water Closets and a net positive to everyone involved. The longevity of this system will be noteworthy, and the company will not need to worry about soaring maintenance costs.

Recommendations

To enhance the system’s capabilities, it is recommended to implement the following in future updates:

- API to record transactions in real time.
- Make revenue automatically refresh after each month based on recorded transactions.
- Make budget only updateable at the end of a month.

Bibliography

https://mongoosejs.com/docs/api/schema.html

https://www.chartjs.org/docs/latest/samples/information.html