RMIT
UNIVERSITY

RBR/TRIMS

TECHNICAL REPORT

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1 EXECUTIVE SUMMARY

The Returned Book Record/ Textbook Management Information System (RBR/TRIMS) project was envisioned by Paul Gibbings to help improve textbook provision and distribution by ministries and any support organisations to schools in developing countries by replacing a previously tested method of using physically delivered Excel spreadsheets.

This project saw the development of a web application to replace this manual process. The app allows representatives of schools with mobile photos and internet access to be able to enter data about their textbook requirements for the upcoming school year. This provides government ministries and NGOs with the ability to more effectively supply the correct number of textbooks to the schools that need and on time.

This project followed an agile approach, consisting of two-week sprints. At the end of each sprint, we met with Paul Gibbings, to discuss our progress and plan our next steps.

2 INTRODUCTION

The objective of this project was to create a prototype for a web-based application that allows all schools in developing countries to report the number of returned reusable textbooks by the end of the school year, to be supplied with the correct top up amount for the following year.

In previous recipient nations, schools report the number of books they have and need by filling in a hard copy Excel spreadsheet which is then delivered to the education ministry. The education ministry is in charge of delivering book requests to the relevant provinces and districts.

The information required from the school at the end of each year is as follows:

- Actual number of students in each grade
- Number of books received
- Number of books returned by students
- Number of books that are reusable
- Number of usable books in school stock
- Estimated number of students for next school year

School principals must provide this information for each book in each grade. With an average of three books per grade and six grades in a primary school, this information needs to be entered eighteen times; highlighting how laborious this task can be.

The current process is inefficient and prone to errors that can occur during data re-entry. The hope is that an easy to use web application will result in more accurate data and will allow the data to get from schools to the education ministry and the supporting organisations more quickly.

Project Goals

- People with limited technical proficiency will use this app, so it must be intuitive and straightforward.
- The app must be able to run on most devices with a browser and internet connection.
- The app must restrict people's access based on their user level, e.g. a school principal can only see data related to their school.
- The prototype delivered at the end must be fully functional and bug-free, so it can be adequately demonstrated to organisations that may want to fund its deployment.

Stakeholders

STAKEHOLDER	STAKE IN PROJECT
Paul Gibbings	Envisioned the project, wants to have a working prototype to show to ministries and organisations that may potentially trial, adopt fund it.
Course Supervisor (Barti Murugesan)	In charge of the proposed project.
Education Ministry in Country of Deployment	Needs a system that will allow them to accurately see the number of textbooks needed in the different districts and provinces of the country.
Provincial Administrations in Country of Deployment	Needs an easy to use system that anyone can use regardless of technological proficiency, to monitor district and school textbook use.
District Administrations in Country of Deployment	At a data entry level, they need an easy to use system that anyone with limited technical proficiency can use.
Schools in Country of Deployment	WIth a successfully deployed the schools will receive the correct number of textbooks on time with greater consistency.

Table 1: Stakeholders

3 REQUIREMENTS

Use Case Diagram

Use Case Diagram can be found as ***Appendix B***.

Functional Requirement Specification

Sitemaps for functional requirements can be found at ***Appendix A***.

Req. ID	Description	Priority
F1 User accounts management		
F1.1 Login		
F1.1.1	*While the user is on the login page, the system shall load the following:* ● *Username (String)* ● *Password (String)* ● *Remember me (Checklist box)* ● *A clickable button (Forget password)* ● *A clickable button (Request account)* ● *A clickable button (Login)*	High
F1.1.2	*While the user is on the "Login" page, when the user clicks on "Login" button, If the user enters a value that does not contain "@" in the field "Username", the system shall highlight this field red and display above it a hint "The username value should contain @".*	High
F1.1.3	*While the user is on the "Login" page, when the user clicks on "Login" button, If the user enters no value in the field "Username", the system shall highlight this field red and display above it a hint "The username value should not be empty".*	High
F1.1.4	*While the user is on the "Login" page, when the user clicks on "Login" button, If the user enters no value in the field "Password", the system shall highlight this field red and display above it a hint "The password value should not be empty"*	High
F1.1.5	*While the user is on the "Login" page, when the user clicks on "Login" button, if the user ticks the "Checklist box", the system shall store the user's details in the DB.*	High

F1.2 Request account		
F1.2.1	*While the user is on the "Login" page, when the user clicks on "Request account" button, the system shall load a "Request account page" that contains the following:* ● *First name (String)* ● *Last name (String)* ● *Email (String)* ● *Password (String)* ● *Confirm password(String)* ● *A drop-down list shows the countries that is in the system and do not have ministers yet* ● *A clickable button "Request account"* 　*A clickable button "Back"*	High
F1.2.2	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters first letter as non-string (numbers or symbols) value in the field "First name", the system shall highlight this field red and display above it a hint "The first name should start with letter".*	High
F1.2.3	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters no value in the field "First name", the system shall highlight this field red and display above it a hint "The first name should not be empty".*	High
F1.2.4	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters first letter as non-string (numbers or symbols) value in the field "last name", the system shall highlight this field red and display above it a hint "The last name should start with letter".*	High
F1.2.5	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters no value in the field "last name", the system shall highlight this field red and display above it a hint "The last name should not be empty".*	High
F1.2.6	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters a value that does not contain "@" in the field "Email", the system shall highlight this field red and display above it a hint "The email value should contain @".*	High

F1.2.7	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters no value in the field "Email", the system shall highlight this field red and display above it a hint "The email value should not be empty"*	High
F1.2.8	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters no value in the field "Password", the system shall highlight this field red and display above it a hint "The password value should not be empty"*	High
F1.2.9	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters a value that does not match the value in "Password" field in the "Confirm Password" field, the system shall highlight this field red and display above it a hint "The password entered does not match"*	High
F1.2.10	*While the user is on the "Request account page", when the user clicks on "Request account" button, If the user enters no value in the "Confirm Password" field, the system shall highlight this field red and display above it a hint "The confirmed password should not be empty"*	High
F1.2.11	*While the user is on the "Request account page", when the user clicks on the countries drop down list, the system shall only show the list of countries that are in the system.*	High
F1.2.12	*While the user is on the "Request account page", when the user enters valid first name, last name, email, password, confirm password, select the country from the drop-down list and clicks the "Request account" button, the system shall display a message "The account has been created" and register the user as an observer.*	High
F1.2.13	*While the user is on the "Request account page", when the user clicks on "Back" button, the system shall redirect the super admin to the login page.*	High
F1.3 Forgot password		

F1.3.1	While the user is on the "Login" page, when the user clicks on "Forget password" button, the system shall load a "Forget password page" that contains the following: ● Text field (String) ● A clickable button "Reset" ● A clickable button "Back"	High
F1.3.2	While the user is on the "Forget password page", when the user clicks on "Reset" button, If the user enters a value that does not contain "@" in the field "Email", the system shall highlight this field red and display above it a hint "The email value should contain @".	High
F1.3.3	While the user is on the "Forget password page", when the user clicks on "Reset" button, if the user enters no value in the field "Email", the system shall highlight this field red and display above it a hint "The email value should not be empty"	High
F1.3.4	While the user is on the "Forget password page", when the user clicks on "Reset" button, the system shall compare the user's input with the emails in the DB.	High
F1.3.5	When the system completes the comparison process, if the user's input does not match the data in the DB, the system shall highlight this field red and display above it a hint "The email does not exist"	High
F1.3.6	When the system completes the comparison process, when the user enters a valid entry, the system shall send an email to the user to reset their password.	High
F1.3.7	While the user is on the "Forget password page", when the user clicks on "Back" button, the system shall redirect the Forget password page to the login page.	High
F1.4 Manage account		

F1.4.1	*While the registered user is on the homepage, when the registered user clicks on "Manage account" button in the header of homepage, the system shall load a page that contains the following:* ● *Change first name (String)* ● *Change Last name (String)* ● *Change Email (String)* ● *Change Password (String)* ● *Confirm password(String)* ● *Current access level (non-editable)* ● *Country of access (non-editable)* ● *Enter current password (String)* ● *A clickable button "Update account"* ● *A clickable button "Back"*	High
F1.4.2	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters first letter as non-string (numbers or symbols) value in the field "First name", the system shall highlight this field red and display above it a hint "The first name should start with letter".*	High
F1.4.3	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters no value in the field "First name", the system shall highlight this field red and display above it a hint "The first name should not be empty".*	High
F1.4.4	*While the registered user is on the "Manage Account" page, When the registered user clicks on "Update Account" button, If the registered user enters first letter as non-string (numbers or symbols) value in the field "last name", the system shall highlight this field red and display above it a hint "The last name should start with letter".*	High
F1.4.5	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters no value in the field "last name", the system shall highlight this field red and display above it a hint "The last name should not be empty".*	High

F1.4.6	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters a value that does not contain "@" in the field "Email", the system shall highlight this field red and display above it a hint "The email value should contain @".*	High
F1.4.7	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters no value in the field "Email", the system shall highlight this field red and display above it a hint "The email value should not be empty"*	High
F1.4.8	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters no value in the field "Password", the system shall highlight this field red and display above it a hint "The password value should not be empty"*	High
F1.4.9	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If The registered user enters a value that does not match the value in "Password" field in the "Confirm Password" field, the system shall highlight this field red and display above it a hint "The password entered does not match"*	High
F1.4.10	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters no value in the "Confirm Password" field, the system shall highlight this field red and display above it a hint "The confirmed password should not be empty"*	High
F1.4.11	*While the registered user is on the "Manage Account" page, when the registered user clicks on "Update Account" button, If the registered user enters a value in the "Enter current password" field, the system shall compare the user's input with the actual password.*	High
F1.4.12	*When the system compares the user's input with the actual password, if the user's input does not match the actual password, the system shall highlight this field red and display above it a hint "The current password does not match"*	High

F1.4.13	*While the registered user is on the "Manage Account" page, when the registered user enters valid first name, last name, email, password, confirmed password, current password and clicks the "Update Account" button, the system shall update the profile information in the DB and display a message "The account has been updated".*	High
F1.4.14	*While the registered user is on the "Manage Account" page,* when the *registered user* clicks on the "Back" button, the system shall redirect to the home*page.*	High
F2 Admin setting		
F2.1	*While the super admin is on the homepage, when the super admin clicks on "Admin setting" button in the header of homepage, the system shall show a drop-down list with the following:* ● *Manage countries* ● *Manage books* ● *Manage users*	High
F2.2	*While the super admin is on the homepage, when the super admin clicks on the "Manage users" from the drop-down list (cf. F1.2), the system shall display the user management page that contains the following:* ● *All users information (Email, Access level, Country) already in the system with "Deactivate" button beside each user except the admin.* ● *A clickable button "Back".* ● *A clickable button "Add staff".*	High
F2.3	*While the super admin is on the user management page, when the super admin clicks on "Deactivate" button, the system shall deactivate the user and display a message "The corresponding user has been deactivated"*	High
F2.4	*While the super admin is on the user management page, when the super admin clicks on "Back" button, the system shall redirect the super admin to the homepage.*	High
F2.5 *Adding staff*		

F2.5.1	*While the super admin is on the user management page, when the super admin clicks on "Add staff" button, the system shall load "Add staff account page" with request to fill out these fields:* ● *First name (String)* ● *Last name (String)* ● *Email (String)* ● *Password (String)* ● *Confirm password(String)* ● *A drop-down list shows the access level the super admin wants to give to the new staff* ● *"Add staff" button* ● *"Back" button*	High
F2.5.2	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If the super admin enters first letter as non-string (numbers or symbols) value in the field "First name", the system shall highlight this field red and display above it a hint "The first name should start with letter".*	High
F2.5.3	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If the super admin enters no value in the field "First name", the system shall highlight this field red and display above it a hint "The first name should not be empty".*	High
F2.5.4	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If the super admin enters first letter as non-string (numbers or symbols) value in the field "last name", the system shall highlight this field red and display above it a hint "The last name should start with letter".*	High
F2.5.5	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If the super admin enters no value in the field "last name", the system shall highlight this field red and display above it a hint "The last name should not be empty".*	High
F2.5.6	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If the super admin enters a value that does not contain "@" in the field "Email", the system shall highlight this field red and display above it a hint "The email value should contain @".*	High
F2.5.7	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If The super admin enters no value in the field "Email", the system shall highlight this field*	High

	red and display above it a hint "The email value should not be empty"	
F2.5.8	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If The super admin enters no value in the field "Password", the system shall highlight this field red and display above it a hint "The password value should not be empty"*	High
F2.5.9	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If The super admin enters a value that does not match the value in "Password" field in the "Confirm Password" field, the system shall highlight this field red and display above it a hint "The password entered does not match"*	High
F2.5.10	*While the super admin is on the "Add staff account page", when the super admin clicks on "Add staff", If the super admin enters no value in the "Confirm Password" field, the system shall highlight this field red and display above it a hint "The confirmed password should not be empty"*	High
F2.5.11	*While the super admin is on the "Add staff account page", when the super admin clicks on the countries drop down list, when the super admin clicks on the access level drop down list, the system shall show the four access levels (Minister, Provincial, District staff, School principal and Observer)*	High
F2.5.12	*While the super admin is on the "Add Ministry Account" page, when the super admin enters valid first name, last name, email, password, confirmed password, select the access level from the drop-down list and* clicks the "*Add staff*" button, the system shall display a message "The account has been created" and send an email to the new user with a clickable hyperlink to reset the initial password.	High
F2.5.13	While the super admin is on the "Add Ministry Account" page, when the super admin clicks on "Back" button, the system shall redirect the super admin to the users' management page.	High
F2.6 Adding country		
	Also applicable: F2.5.1	

F2.6.1	*While the super admin is on the homepage, when the super admin clicks on the button "Countries" (cf. F1.2), the system shall display a Countries page that contains the following:* ● *A drop-down list that present all countries that is not in the system yet and a clickable button "Add country".* ● *Table of all Countries exist in the system with two buttons "Deactivate" and "Show" beside each country.*	High
F2.6.2	*While the super admin is on the "Add new country" page, when the super admin selects a country from the drop-down list,* when the *super admin clicks on the button* "Add *country*", the system shall Insert the selected country code in DB and return a message ""*The corresponding country name* " has successfully been added* ".	High
F2.6.3	*While the super admin is on the "Add country" page, w*hen the super admin clicks on the "Deactivate" button, the system shall deactivate the country and display a message "The "*The corresponding country name*" has been deactivated"	High
F2.6.4	*While the super admin is on the "Add country" page, When the super admin clicks on the button "Show", the system shall display a "Add provinces" page that contains the following:* ● *"Name" (String)* ● *"Access code" (Numeric)* ● *"Add province" button.* ● *Table of all provinces exists for the selected country with two buttons "Deactivate" and "Show" beside each province* ● *"Back" button.*	High
F2.6.5	*While the super admin is on the "Add province" page, w*hen the super admin clicks on the "Back" button, the system shall redirect to the" Add *country" page.*	High
F2.6.6	*While the admin/minister is on the "Add province" page, w*hen *the super admin/minister clicks on "Add province" button, If the super admin/minister enters no value in the field "Name", the system shall highlight this field red and display above it a hint "The province name should not be empty".*	High
F2.6.7	*While the admin/minister is on the "Add province" page, w*hen *the super admin/minister clicks on "Add province" button, If the super admin/minister enters letters in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should only contain numbers".*	High

F2.6.8	*While the super admin is on the "Add province" page, w*hen *the super admin/minister clicks on "Add province" button, If the super admin/minister enters a number more than 998 in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should not exceed 998".*	High
F2.6.9	*While the super admin is on the "Add province" page, w*hen *the super admin/minister clicks on "Add province" button, If the super admin/minister enters an access code that is already assigned to another province, the system shall highlight this field red and display above it a hint "The province access code exists in the system".*	High
F2.6.10	*While the super admin/minister is on the "Add province page", when the super admin/minister enters a valid province name, access code and clicks on "Add province" button,* the system shall insert the province name with its access code in DB and return a message "*"Province Name " has successfully been added"*.	High
F2.6.11	*While the super admin/minister is on the "Add province" page, w*hen the super admin*/minister* clicks on the "Deactivate" button, the system shall deactivate the province and display a message "The *corresponding* "province name" has been deactivated"	High
F2.6.12	*While the super admin/minister is on the "Add province" page, When the super admin/minister clicks on the button "Show", the system shall display an "Add district" page that contains the following:* ● *"Name" (String)* ● *"Access code" (Numeric)* ● *"Add district" button.* ● *Table of all districts exist for the selected province with two buttons "Deactivate" and "Show" beside each district* ● *"Back" button.*	High
F2.6.13	*While the super admin/minister is on the "Add district" page, w*hen the super admin*/minister* clicks on the "Back" button, the system shall redirect to the" Add *province" page.*	High
F2.6.14	*While the super admin/minister is on the "Add district" page, w*hen *the super admin/minister clicks on "Add district" button, if the super admin/minister enters first letter as non-string (numbers or symbols) value in the field "Name", the system shall highlight this field red and display above it a hint "The district name should start with letter".*	High

F2.6.15	*While the super admin/minister is on the "Add district" page, when the super admin/minister clicks on "Add district" button, If the super admin/minister enters no value in the field "Name", the system shall highlight this field red and display above it a hint "The district name should not be empty".*	High
F2.6.16	*While the super admin/minister is on the "Add district" page, when the super admin/minister clicks on "Add district" button, If the super admin/minister enters letters in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should only contain numbers".*	High
F2.6.17	*While the super admin/minister is on the "Add district" page, when the super admin/minister clicks on "Add district" button, If the super admin/minister enters a number more than 998 in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should not exceed 998".*	High
F2.6.18	*While the super admin/minister is on the "Add district" page, when the super admin/minister clicks on "Add district" button, If the super admin/minister enters an access code that is already assigned to another district, the system shall highlight this field red and display above it a hint "The district access code exists in the system".*	High
F2.6.19	*While the super admin/minister is on the "Add district page", when the super admin/minister enters a valid province name, access code and clicks on "Add district" button,* the system shall insert the district name with its access code in DB and return a message ""district Name " has successfully been added".*	High
F2.6.20	*While the super admin/minister is on the "Add district" page, when the super admin/minister clicks on the "Deactivate" button,* the system shall deactivate the district and display a message "The "district name" has been deactivated"	High

F2.6.21	*While the super admin/minister is on the "Add district" page, when the super admin/minister clicks on the button "Show", the system shall display an "Add school" page that contains the following:* ● *Name (String)* ● *Access code (Numeric)* ● *Address (String)* ● *Contact number (Numeric)* ● *"Add school" button.* ● *Table of all schools exist in the selected district with two buttons "Deactivate" and "Show" beside each district* ● *"Back" button.*	High
F2.6.22	*While the super admin/minister is on the "Add school" page, w*hen the super admin*/minister* clicks on the "Back" button, the system shall redirect to the" Add *district" page.*	High
F2.6.23	*While the super admin/minister is on the "Add school" page, w*hen *the super admin/minister clicks on "Add school" button, if the super admin/minister enters first letter as non-string (numbers or symbols) value in the field "Name", the system shall highlight this field red and display above it a hint "The school name should start with letter".*	High
F2.6.24	*While the super admin/minister is on the "Add school" page, w*hen *the super admin/minister clicks on "Add school" button, If the super admin/minister enters no value in the field "Name", the system shall highlight this field red and display above it a hint "The school name should not be empty".*	High
F2.6.25	*While the super admin/minister is on the "Add school" page, w*hen *the super admin/minister clicks on "Add school" button, If the super admin/minister enters letters in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should only contain numbers".*	High
F2.6.26	*While the super admin/minister is on the "Add school" page, w*hen *the super admin/minister clicks on "Add school" button, If the super admin/minister enters a number more than 998 in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should not exceed 998".*	High

F2.6.27	*While the super admin/minister is on the "Add school" page, when the super admin/minister clicks on "Add school" button, If the super admin/minister enters an access code that is already assigned to another school, the system shall highlight this field red and display above it a hint "The school access code exists in the system".*	High
F2.6.28	*While the super admin/minister is on the "Add school" page, when the super admin/minister clicks on "Add school" button, If the super admin/minister enters no value in the field "Address", the system shall highlight this field red and display above it a hint "The school address should not be empty".*	High
F2.6.29	*While the super admin/minister is on the "Add school" page, when the super admin/minister enters a valid school name, access code, address and contact number and clicks on "Add school" button,* the system shall Insert the school name, access code, *address, contact number* in DB and return a message *""school Name " has successfully been added* ".	High
F2.6.30	*While the super admin/minister is on the "Add school" page, when the super admin/minister* clicks on the "Deactivate" button, the system shall deactivate the school and display a message "The *corresponding* "school name" has been deactivated"	High
F2.6.31	*While the super admin/minister is on the "Add school" page, when the super admin/minister clicks on the button "Show", the system shall display an "school details" page that contains the following:* ● *School Name (Non-editable field)* ● *Non-editable Access code* ● *Non-editable Address* ● *Non-editable Contact number* ● *"Edit school" button.* ● *"Back" button.*	High
F2.6.32	*While the super admin/minister is on the "school details" page, when the super admin/minister* clicks on the "Back" button, the system shall redirect to the" Add *school" page.*	High

F2.6.33	*While the super admin/minister is on the "school details" page, when the super admin/minister clicks on the "Edit school" button, the system shall display a "School details" page that contains the following:* ● *Name (String)* ● *Access code (Numeric)* ● *Address (String)* ● *Contact number (Numeric)* ● *"Update school" button.* ● *"Back" button.*	High
F2.6.34	*While the super admin/minister is on the "Edit school details" page,* w*hen the super admin/minister clicks on the "Back" button, the system shall redirect to the" S*chool details" page.*	High
F2.6.35	*While the super admin/minister is on the "Edit school details" page,* w*hen the super admin/minister clicks on "Update school" button, if the super admin/minister enters first letter as non-string (numbers or symbols) value in the field "Name", the system shall highlight this field red and display above it a hint "The school name should start with letter".*	High
F2.6.36	*While the super admin/minister is on the "Edit school details" page,* w*hen the super admin/minister clicks on "Update school" button, If the super admin/minister enters no value in the field "Name", the system shall highlight this field red and display above it a hint "The school name should not be empty".*	High
F2.6.37	*While the super admin/minister is on the "Edit school details" page,* w*hen the super admin/minister clicks on "Update school" button, If the super admin/minister enters letters in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should only contain numbers".*	High
F2.6.38	*While the super admin/minister is on the "Edit school details" page,* w*hen the super admin/minister clicks on "Update school" button, If the super admin/minister enters a number more than 998 in the field "Access code", the system shall highlight this field red and display above it a hint "The access code should not exceed 998".*	High

F2.6.39	*While the super admin/minister is on the "Edit school details" page, w*hen *the super admin/minister clicks on "Update school" button, If the super admin/minister enters an access code that is already taken by another school in the field "Access code", the system shall highlight this field red and display above it a hint "The school access code exists in the system".*	High
F2.6.40	*While the super admin/minister is on the "Edit school details" page, w*hen *the super admin/minister clicks on "Update school" button, If the super admin/minister enters no value in the field "Address", the system shall highlight this field red and display above it a hint "The school address should not be empty".*	High
F2.6.41	*While the super admin/minister is on the "Edit school" page, when the super admin/minister edits valid school name, access code, address and contact number and clicks on "Update school" button,* the system shall update the school name, access code, *address, contact number* in DB and return a message ""school Name " has successfully been updated ".*	High
F3 Books management		
F3.1 Adding books		
	As applicable: F1.2	
F3.1.1	*When the super admin/minister clicks on the "Manage books" from the drop-down list (cf. F1.2), the system shall display the "books management" page that contains the following:* ● *Table of all books exist with two buttons "Deactivate" and "Show" beside each book.* ● *"Add another book" button.*	High
F3.1.2	*While the super admin/minister is on the "books management" page, w*hen the super admin*/minister* clicks on the "Deactivate" button, the system shall deactivate the book and display a message "The "corresponding book name" has been deactivated"	High
F3.1.3	*While the super admin/minister is on the "books management" page, when the super admin/minister clicks on "Add another book" button, the system shall load "Add another book" page with request to fill out these fields:* ● *ISBN number (String),* ● *Book title (String),* ● *Date published (Date),* ● *Author name (String)* ● *Version (numeric)*	High

	● *Weight (Decimal)* ● *Volume (Decimal)* ● *Price (Decimal)*	
F3.1.4	*While the super admin/minister is on the "Add another book" page, when the super admin/minister clicks on "Add new book" button, if the super admin/minister enters letters in the field "ISBN number", then the system shall highlight this field red and display above it a hint "The ISBN number should not contain letters"*	High
F3.1.5	*While the super admin/minister is on the "Add another book" page, when the super admin/minister clicks on "Add new book" button, if the super admin/minister enters letters in the field "ISBN number", if the super admin/minister enters no value in the field "ISBN number", then the system shall highlight this field red and display above it a hint "The book ISBN should not be empty".*	High
F3.1.6	*While the super admin/minister is on the "Add another book" page, when the super admin/minister clicks on "Add new book" button, If the super admin/minister enters a first letter as non-string (numbers or symbols) value in the field "Book title", then the system shall highlight this field red and display above it a hint "The book title should start with a letter".*	High
F3.1.7	*While the super admin/minister is on the "Add another book" page, when the super admin/minister clicks on "Add new book" button, If the minister enters no value in the field "Book title", then the system shall highlight this field red and display above it a hint "The book title should not be empty".*	High
F3.1.8	*While the super admin/minister is on the "Add another book" page, when the super admin/minister clicks on "Add new book" button, If the super admin/minister enters a date after the current date in the field "Date published", then the system shall highlight this field red and display above it a hint "The published date cannot be after today's date".*	High
F3.1.9	*While the super admin/minister is on the "Add another book" page, when the super admin/minister clicks on "Add new book" button, If the super admin/minister enters no value in the field "Date published", then the system shall highlight this field red and display above it a hint "The date published of the book should not be empty".*	High
F3.1.10	*While the super admin/minister is on the "Add another book" page, when the super admin/minister clicks on "Add new book" button, If the super admin/minister enters no value in the field "Date published", then the system shall highlight this field red and display above it a hint "The date published of the book should not be empty".*	High

F3.1.11	*While the super admin/minister is on the "Add another book" page, w*hen *the super admin/minister clicks on "Add new book" button, If the super admin/minister enters non numeric value (letters or symbols) in the field "Version", then the system shall highlight this field red and display above it a hint "The Version value should be numeric"*	High
F3.1.12	*While the super admin/minister is on the "Add another book" page, w*hen *the super admin/minister clicks on "Add new book" button, If the super admin/minister enters no value in the field "Version", then the system shall highlight this field red and display above it a hint "The Version value should not be empty".*	High
F3.1.13	*While the super admin/minister is on the "Add another book" page, when the super admin/minister enters the ISBN number, book title, date published, book author, version, weight, volume, price and clicks on "Add new book", the system* shall add the book's information in DB and return a message "You have added the book %name% to the system." and redirect the user to the "Books management" page.	High
F3.1.14	*While the super admin/minister is on the "book management" page, When the super admin/minister clicks on the button "Show" for the desired book, the system shall display a "book details" page that contains the following:* ● *ISBN number (Non-editable field)* ● *Book title (Non-editable field)* ● *Date published (Non-editable field)* ● *Author name (Non-editable field)* ● *Version (Non-editable field)* ● *Weight (Non-editable field)* ● *Volume (Non-editable field)* ● *Price (Non-editable field)* ● *"Edit book" button* ● *"Back" button*	High
F3.1.15	*While the super admin/minister is on the "book details" page, w*hen the super admin*/minister* clicks on the "Back" button, the system shall redirect to the"*book management" page.*	High
F3.1.16	*While the super admin/minister is on the "Book details" page, w*hen the super admin*/minister* clicks on the "*Edit book*" button, *the system shall display a "Edit book" page that contains the following:* ● *ISBN number (String),* ● *Book title (String),* ● *Date published (Date),*	High

	● *Author name (String)* ● *Version (numeric)* ● *Weight (Decimal)* ● *Volume (Decimal)* ● *Price (Decimal)* ● *Grade in countries (String)* ● *"Update book" button.* ● *"Back" button.*	
F3.1.17	*While the super admin/minister is on the "Edit book" page, when the super admin/minister clicks on "Update book" button, if the minister enters letters in the field "ISBN number", then the system shall highlight this field red and display above it a hint "The ISBN number should not contain letters"*	High
F3.1.18	*While the super admin/minister is on the "Edit book" page, when the super admin/minister clicks on "Update book" button, if the minister enters letters in the field "ISBN number", if the minister enters no value in the field "ISBN number", then the system shall highlight this field red and display above it a hint "The book ISBN should not be empty".*	High
F3.1.19	*While the super admin/minister is on the "Edit book" page, when the super admin/minister clicks on "Update book" button, If the super admin/minister enters a first letter as non-string (numbers or symbols) value in the field "Book title", then the system shall highlight this field red and display above it a hint "The book title should start with a letter".*	High
F3.1.20	*While the super admin/minister is on the "Edit book" page, when the super admin/minister clicks on "Update book" button, If the minister enters no value in the field "Book title", then the system shall highlight this field red and display above it a hint "The book title should not be empty".*	High
F3.1.21	*While the super admin/minister is on the "Edit book" page, when the super admin/minister clicks on "Update book" button, If the super admin/minister enters a date after the current date in the field "Date published", then the system shall highlight this field red and display above it a hint "The published date cannot be after today's date".*	High
F3.1.22	*While the super admin/minister is on the "Edit book" page, when the super admin/minister clicks on "Update book" button, If the super admin/minister enters no value in the field "Date published", then the system shall highlight this field red and display above it a hint "The date published of the book should not be empty".*	High

F3.1.23	*While the super admin/minister is on the "Edit book" page,* when the super admin/minister clicks on "Update book" button, If the super admin/minister enters no value in the field "Date published", then the system shall highlight this field red and display above it a hint "The date published of the book should not be empty".	High
F3.1.24	*While the super admin/minister is on the "Edit book" page,* when the super admin/minister clicks on "Update book" button, If the super admin/minister enters non numeric value (letters or symbols) in the field "Version", then the system shall highlight this field red and display above it a hint "The Version value should be numeric"	High
F3.1.25	*While the super admin/minister is on the "Edit book" page,* when the super admin/minister clicks on "Update book" button, If the super admin/minister enters no value in the field "Version", then the system shall highlight this field red and display above it a hint "The Version value should not be empty".	High
F3.1.26	*While the super admin/minister is on the "Edit book" page, when the super admin/minister enters the ISBN number, book title, date published, book author, version, weight, volume, price and clicks on "Update book", the system* shall Add the book's information in DB and return a message "The book details have been *Updated*".	High
F3.1.27	*While the super admin/minister is on the "Edit book" page,* when the super admin/*minister* clicks on the "Back" button, the system shall redirect to the"*book details" page.*	High
F4 *Reporting management*		
F4.1 School reporting by grade		
F4.1.1	*While the minster/school principal is on the homepage, when minster/school principal clicks on "Reports" button in the header of homepage, the system shall load a "Reporting page" that contains the following:* ● *A drop-down list that contains the school that school principal is associated with.*	High
F4.1.2	*While the school principal is on the "Reporting page", when the school principal selects from the drop-down list the associated school, the system shall display the "School summary details" page that contains the following:* ● *All grades associated with the selected school and "Start new" button beside them.* ● *A clickable button "Reselect"*	High

F4.1.3	*While the school principal is on the "School summary details", when the school principal clicks on "Reselect" button, the system shall redirect the school principal to the Reporting page.*	High
F4.1.4	*While the school principal is on the "School summary details", when the school principal clicks on "Start new", the system shall change the status for the school report from "Start new" to "Continue".*	High
F4.1.5	• *When the system changes the status of report, the system shall load a "grade page" that contains the following table:* • *Book title associated with grade (non-editable)* • *Current Students (Numeric)* • *Books Received by School (Numeric)* • *Books Returned by Students (Numeric)* • *Reusable Books (Numeric)* • *Books in Stock (Numeric)* • *Estimated Future Students (Numeric)*	High
F4.1.6	*While the school principal is on "grade page", when the school principal clicks on "Close report" button, if the school principal enters non-numeric values in the fields Current Students, Books Received by School, Books Returned by Students, Reusable Books, Books in Stock and Estimated Future Students, the system shall highlight these fields red and show above it a hint "The values should only contain numbers"*	High
F4.1.7	*While the school principal is on "grade page" when the school principal clicks on "Close report" button, if the school principal enters numeric values in the fields Current Students, Books Received by School, Books Returned by Students, Reusable Books, Books in Stock and Estimated Future Students, the system shall show a pop-up window that says "You cannot reopen the report one it has been closed, are you sure you want to close this report?" with two buttons "Ok" and "Cancel"*	High
F4.1.8	*While the school principal is on "grade page" when the school principal clicks on "OK" button in the pop-up window, the system shall change the status of the report from "continue" to "View report" only.*	High
F4.1.9	*While the school principal is on "grade page" when the school principal clicks on "Cancel" button in the pop-up window, the system shall redirect the school principal to "grade page" and leave the status as "Continue".*	High
F4.2 District report		

F4.2.1	*While the district staff is on the homepage, when district staff clicks on "Reports" button in the header of homepage, the system shall load a "Reporting page" that contains the following:* ● *A drop-down list that contains the districts that district staff is associated with.*	High
F4.2.2	*While the district staff is on the "Reporting page", when the district staff selects from the drop-down list the associated district, the system shall display the "District summary details" page that contains the following:* ● *District name (Non-editable)* ● *All schools name with their access code (Non-editable)* ● *School summary status which represents how many schools completed their summary out of the total (Non-editable)* ● *A clickable button "Start district report".* ● *A clickable button "Reselect".*	High
F4.2.3	● *While the district staff is on the "District summary details" page, when the district staff clicks on "Reselect" button, the system shall redirect the minister/district staff to the "Reporting page".*	High
F4.2.4	*While the district staff is on the "District summary details" page, when the district staff clicks on the "Start district report" button, the system shall request from the DB the number of districts that completed their reports.*	High
F4.2.5	*When the system receives the number of schools that already submitted their reports from the DB, the system shall show a pop-up window that contains:* ● *A message to notify the district staff that the schools in the selected district completed their report or not.* ● *Two clickable buttons under the message "OK" button if you wish to continue or "Cancel" if not.*	High
F4.2.6	● *While the district staff is on the "pop up" window, when the district staff clicks on the "Cancel" button, the system shall redirect the district staff to "District details" page*	High
F4.2.7	*While the district staff is on the "pop up" window, when the district staff clicks on the "OK" button, the system shall request from the DB the values of Current Students, Books Received by*	High

	School, Books Returned by Students, Reusable Books, Books in Stock and Estimated Future Students	
F4.2.8	*When the system receives the values of Current Students, Books Received by School, Books Returned by Students, Reusable Books, Books in Stock and Estimated Future Students from the DB, the system shall enable the district staff to enter numeric value for "Less DEO stock" and three clickable buttons "Close" for each grade, "Back" and "Close report"*	High
F4.2.9	*While the district staff is on the "District report" page, when the district staff clicks on "Back" button, the system shall redirect the district staff to the "Grade list".*	High
F4.2.10	*While the district staff is on the "District report" page, when the district staff enters the value of "Less DEO stock" and clicks on "Close" button, the system shall change the value in the DB and display a page that has the completed grade report.*	High
F4.2.11	*While the district staff is on the "District report" page, when the district staff clicks on "Close report" button, the system shall display a page that has the completed district report.*	High
F4.3 Province report		
F4.3.1	*While the minister is on the homepage, when minister clicks on "Reports" button in the header of homepage, the system shall load a "Reporting page" that contains the following:* ● *A drop-down list that contains all schools associated with the registered user* ● *A drop-down list that contains all districts associated with the registered user* ● *A drop-down list that contains all provinces associated with the registered user*	High
F4.3.2	*While the minister is on the "Reporting page", when the minister selects from the drop-down list the desired province, the system shall display the "Province summary details" page that contains the following:* ● *Province name (Non-editable)* ● *All districts name with their access code(Non-editable)* ● *District summary status which represents how many districts completed their summary out of the total (Non-editable)* ● *A clickable button "Start province report".* ● *A clickable button "Reselect".*	High

F4.3.3	*While the minister is on the "Province summary details", when the minister clicks on "Reselect" button, the system shall redirect the minister to the "Reporting page".*	High
F4.3.4	*While the minister is on the "Province summary details" page, when the minister clicks on the "Start province report" button, the system shall request from the DB the number of district which completed their reports.*	High
F4.3.5	*When the system receives the number of district that already submitted their reports from the DB, the system shall show a pop-up window that contains:* ● *A message to notify the minister that the districts in the selected province completed their report or not.* ● *Two clickable buttons under the message "OK" button if you wish to continue or "Cancel" if not.*	High
F4.3.6	*While the minister is on the "pop up" window, when the minister clicks on the "Cancel" button, the system shall redirect the minister to "Province details" page*	High
F4.3.7	*While the minister is on the "pop up" window, when the minister clicks on the "OK" button, the system shall request from the DB the values of column 10 (Final school total) and column 11 (5% to be kept in stock). Then, calculate the Total to supply DEO on the basis of (1) column 10 (Final school total) (2) column 11 (5% to be kept in stock).*	High
F4.3.8	*When the system completes the calculation of the total to supply DEO, the system shall display the calculation results for each district grouped by book title and grade in the following format:* ● *Grade (Non-editable)* ● *Book Title (Non-editable)* ● *Actual Number of Students for current year (Non-editable)* ● *Number of Books Received All Sources (Non-editable)* ● *Total Number of Returned Books (Non-editable)* ● *Number of Reusable Books (Non-editable)* ● *Number of Books in Stock (Non-editable)* ● *Estimated Number of Students for next year (Non-editable)* ● *Total usable books (Non-editable)* ● *Textbooks needed for next year (Non-editable)* ● *Final school totals rounded up to nearest 5 (Non-editable)* ● *DEO 5% extra to be kept in stock (Non-editable)* ● *Less Deo Stock (Non-editable)* ● *Total to supply DEO (Non-editable)*	High

	● *A clickable button "Back to reporting page"*	
F4.3.9	*While the minister is on the "Calculation of the total to supply DEO" page, when the minister clicks on "Back to reporting page" button, the system shall redirect the minister to the "reporting page".*	High

F5 Homepage display		
F5.1	*While the registered user is on the homepage, the system shall display the following:* ● *A search bar that allows the registered user to search by the access code* ● *A drop-down list that shows all provinces in the country* ● *A drop-down list that shows all the districts within a selected province* ● *A drop-down list that shows all the schools within a selected district*	High
F5.2	*While the registered user is on the homepage, when the registered user enters an access code, the system shall retrieve all the matched access code for (province, district, school) and display the (province, district, school) details* ● *Province details (Province code, total number of districts and total number of schools in province).* ● *District details (District code, total number of schools in the district).* ● *School details (School code, school type and number of students).*	High
F5.3	*While the registered user is on the homepage, when the registered user clicks on "Province drop-down list", the system shall display all provinces in the country and display the province details (Province code, total number of districts and total number of schools in province).*	High
F5.4	*While the registered user is on the homepage, when the registered user clicks on "Province drop-down list", the system shall activate the "District drop-down list" with all districts within the province.*	High
F5.5	*While the registered user is on the homepage, when the registered user clicks on "District drop-down list", the system shall display all districts in the province and display the district details (District code, total number of schools in the district).*	High

F5.6	*While the registered user is on the homepage, when the registered user clicks on "District drop-down list", the system shall activate the "School drop-down list".*	High
F5.7	*While the registered user is on the homepage, when the registered user clicks on "School drop-down list", the system shall display all schools in the district and display the school details (School code, school type and number of students).*	High
F6 Receipt generation		
F6.1	*While the minister is on the homepage, when minister clicks on "Receipts" button in the header of homepage, the system shall load a "Receipts page" that contains the following:* ● *A drop-down list that contains all schools that have completed all their grades reports correctly and closed them.* ● *A clickable button "Allocate books"*	High
F6.2	*While the minister is on the "Receipts page", when the minister selects a school from the the drop-down list and clicks on "Allocate books" button, the system shall load a "School receipt" page that contains the following grouped by grade:* ● *Grade (Non-editable)* ● *Textbook title (Non-editable)* ● *Books needed based on expected enrolment (Non-editable)* ● *Book allocation* ● *A clickable button "Back"*	High
F6.3	*While the minister is on the "School receipt", when the minister clicks on "Back" button, the system shall redirect the minister to "Receipts page".*	High
F6.4	*While the minister is on the "School receipt", when the minister enters numeric values in the books allocation fields and clicks "Back" button, the system shall redirect the minister to "Receipts page" and activate "Download PDF" button.*	High
F6.5	*While the "Download PDF" button is activated, when the minister clicks on "Download PDF", the system shall show a PDF file that contains the receipt for the selected school.*	High
F7 Mobile accessibility		
F7.1 Manage account		

F7.1.1	*While the registered user is on the mobile homepage, when the registered user clicks on the "Menu" icon, the system shall display the following:* • *A clickable "Manage account"* • *A clickable "Admin setting"* • *A clickable "Province/Districts/Schools"* • *A clickable "Reports"* • *A clickable "Receipts"* • *Viewing as* • *"Logout" button*	High
F.7.1.2	*While the registered user is on the "Menu" icon, when the registered user clicks on "Manage account", the system shall load "Manage Account" page.*	High
	As applicable 1.4.2 - 1.4.14	
F7.2 Add staff		
	As applicable F7.1.1	
F7.2.1	*While the super admin/minister is on the "Menu" icon, when the super admin/minister clicks on "Admin setting", the system shall load "Add staff account" page.*	High
	As applicable 2.5.1 - 2.5.13	
F7.3 Manage countries		
	As applicable F7.1.1	
F7.3.1	*While the super admin/minister is on the "Menu" icon, when the super admin/minister clicks on "Manage countries", the system shall load "Add new country" page.*	High
	As applicable	
F7.4 Manage books		
	As applicable F7.1.1	
F7.4.1	*While the super admin/minister is on the "Menu" icon, when the super admin/minister clicks on "Manage books", the system shall load "books management" page.*	High
	As applicable F3.1.3 - F3.1.13	
F7.5 Homepage		

	As applicable F7.1.1	
F7.5.1	*While the super admin/minister is on the "Menu" icon, when the super admin/minister clicks on "Province/Districts/Schools", the system shall load the homepage.*	High
	As applicable F5.2 - F5.7	

F7.6 Reporting management

F7.6.1 School reporting by grade

	As applicable F7.1.1	
F7.6.1.1	*While the school principal is on the "Menu" icon, when the school principal clicks on "Reports", the system shall load the "Reporting page" that contains the following:* ● *A drop-down list that contains the school that school principal is associated with.*	High
	As applicable F4.1.2 - 4.1.9	

F7.6.2 District report

	As applicable F7.1.1	
F7.6.2.2	*While the school principal is on the "Menu" icon, when the school principal clicks on "Reports", the system shall load the "Reporting page" that contains the following:* ● *A drop-down list that contains the districts that district staff is associated with.*	High
	As applicable 4.2.2 - 4.2.11	

F7.6.3 Province report

	As applicable F7.1.1	
F7.6.3.1	*While the school principal is on the "Menu" icon, when the school principal clicks on "Reports", the system shall load the "Reporting page" that contains the following:* ● *A drop-down list that contains all schools associated with the registered user* ● *A drop-down list that contains all districts associated with the registered user* ● *A drop-down list that contains all provinces associated with the registered user*	High

	As applicable 4.3.2 - 4.3.9	
F7.7 Login		
	As applicable F7.1.1	
F7.8 Request account		
	As applicable	
F7.9 Forget password		
	As applicable	
F7.10 Receipt generation		
	As applicable F7.1.1	
F7.10.1	*While the super admin/minister is on the "Menu" icon, when the super admin/minister clicks on "*Receipts*", the system shall load the "*Receipts *page" that contains the following:* ● *A drop-down list that contains all schools that have completed all their grades reports correctly and closed them.* ● *A clickable button "Allocate books".*	High
	As applicable F6.2 - F6.5	
F8 Logout		
F8.1	*While the registered user is on any page of the system, when the registered user clicks on the "Logout" button on the top of the page, the system shall redirect the user to the login page*	High

Table 2: Functional Requirements

Nonfunctional Requirement Specification

	Qualities	Priority	Justification
Internal	Reusability	Low	The system RBR/TRIMS is specific to a single situation, which means that the source code of RBR/TRIMS or part of it would not be used in other systems intellectual property .
	Maintainability	High	Because the system RBR/TRIMS will be deployed on the cloud as many countries need to access the system , so it's important that the app can be easily maintained to lower downtime. In addition, the availability of the system would be increased by reducing the maintenance times.
	Modifiability	Low	When RBR/TRIMS system is completed, only a few changes would be required.
	Scalability	High	As many developing countries are expected to use the system, the system would need to deal with quite large number of users.
	Verifiability	High	The system shall require extensive testing to confirm that the system is implemented correctly
	Efficiency	Low	The system RBR/TRIMS is not resource intensive.
	Portability	low	The system will be hosted on cloud so there is only one operating system will be used.
External	Availability	High	High priority, the system would be used in different countries, which means different time zone and different starting dates of schools' year. Especially important during the peak period days, which is the preparation for the upcoming school year
	Performance	Medium	low priority. The TRIMS/RBR system will not require any sophisticated algorithms or calculation. Medium priority. Poor performance hindering the users in developing countries because of the bad internet connection. RBR/TRIMS will not require any sophisticated algorithms or calculation.
	Reliability	High	High priority, because this would assist in increasing availability which is one of the important factors. Also, to increase system credibility among developing countries.
	Robustness	High	High priority. The system has to recover the user's input before saving it as the failure of internet connection in developing countries is common.
	Safety	Low	Low priority, this system is not safety-critical
	Security	High	High priority. The system shall be able to preserve the data

			privacy (create, see, change, copy, print, and delete information). There are different levels of users and each type has different privileges.
	Usability	High	High priority. As the system will be developed for users in developing countries. Those users might have less experience in using computer technology.
	Interoperability	Low	Low priority, the system is going to be independent .
	Installability	Low	Low priority,there is no need to install the system. RBR/TRIMS is a Web application .
	Integrity	High	High priority, Because there are many countries using the system, the system shall protect the quality of the data. The system shall prohibit unauthorized users from addition, deletion or edition of data.

Table 3: Nonfunctional Requirement

4   WIREFRAMES

Wireframes can be found as *Appendix C*.

5   DATABASE STRUCTURE

Database ER diagram can be found as *Appendix D*.

6 ARCHITECTURE

Ruby on Rails enforces the Model-View-Controller pattern (MVC) and follows the rule of convention over configuration. This means that there are many things that Rails has decided for us implementation wise.

The architecture of our Rails application can be shown as follows:
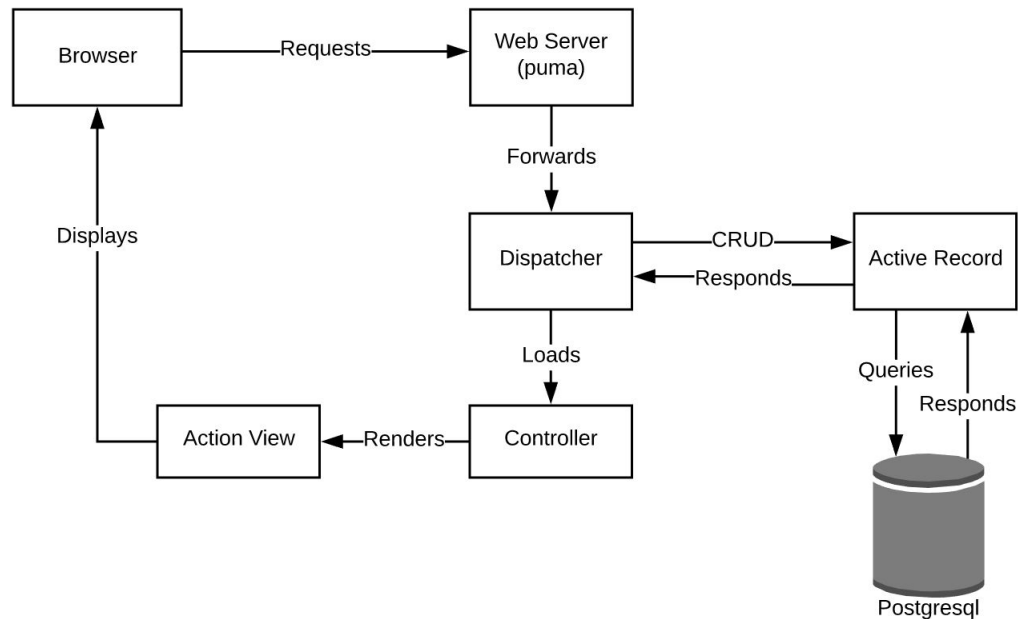

Figure 6.1 Rails Architecture Outline

Rails has an executable server (Puma), which instantiates a web server and accepts requests from the browser.

The dispatcher is responsible looking at requests and deciding which controller to send it to.

Active Record is the "M" part (business data and logic) of this MVC pattern. It helps to facilitate data that requires persistence. In Rails, objects carry both data and logic to operate on that data. ActiveRecord acts as an Object Relational Mapping (ORM) framework, which connects objects in our application to tables in a relational database.

The Ruby on Rails guides defines the Controller as follows:
"After the router has determined which controller to use for a request, the controller is responsible for making sense of the request and producing the appropriate output. Luckily, Action Controller does most of the groundwork for you and uses smart conventions to make this as straightforward as possible."[5]

The default rails asset pipeline contains gems such as sass-rails and uglifier which concatenates and compresses assets (js, scss). Concatenation joins the files together, which helps to reduce the number of requests the browser needs to make to be able to render the page. Compression or minification makes the file as small as possible. There is much more that can be done within the asset pipeline that we haven't implemented, but already these two things alone work towards limiting the number of requests needed and the size of the responses, which will utilise less bandwidth.

Translations

One of our core requirements was that "The content should be easily adaptable to different languages". By default, Rails installs a gem called I18n (Internationalization) which allows additional languages to be added without any complex changes.

Inside `config/locales` is an `en.yml` file, where `en` is the English locale. This file contains all strings within the system in a key-value pair,
e.g.
`no_schools_in_district: "There are no schools in this district."`

Usually, you would do something like:
```
<h1>There are no schools in this district.</h1>
```

But with I18n, you instead reference the key inside a `t()` function:
```
<h1><%= t('no_schools_in_district') %></h1>
```

In order to add additional languages, you would create another locale file with the same set of keys, but the translated strings. If a Norwegian translation was required, for example:
`no_schools_in_district: "Det er ingen skoler i dette distriktet."`

Because this prototype was required to be English only, we haven't completed the engineering steps to switch between languages automatically. This means it would need a front-end element that allows a user to switch languages and a backend section that will facilitate that change, remember it between pages, and preferably remember it between sessions.

You can find further documentation about I18n on the Ruby on Rails guides
http://guides.rubyonrails.org/i18n.html

7   TECHNICAL FRAMEWORK

TECHNOLOGIES / ENVIRONMENTS / LANGUAGES USED	USED FOR
HTML	Frontend
Sass (CSS)	Frontend
Postgresql	Database
Ruby on Rails	Backend
Heroku	Deployment
Travis	Continuous Integration
VSCode, Atom, Vim	Development Environments

Table 4: Technologies / Environments / Languages Used

8 IMPLEMENTATION

As mentioned previously, Rails adheres to a "convention over configuration" approach, and our repository structure follows this. The `app` directory is where most of the work is done within Rails codebase, which holds folders for models, views, controllers and other things.

The primary users of the RBR/TRIMS app will be people with expensive, low bandwidth and high latency internet connection and this is a complex domain to operate within. We had a choice to make, cheap and slow or expensive and faster.

One approach could have been to make heavy use of JavaScript to have most of our app operating on client devices. This reduces the visibility of network latency by having to make fewer round-trips to our server and database. There are a few problems with this, however.

Firstly, a significant portion of users would be operating on mobile devices. Devices with small CPUs can experience difficulty when having to execute an abundance of JavaScript, so even with a reduction of network latency users may still experience a slow app.

Secondly, having internet connection in many developing countries is expensive, and JavaScript doesn't play nicely with this restriction.

Following on from both of these points, once downloaded, it then needs to be parsed and compiled which is the most substantial cost of JS. The delay in compilation means that a user has to wait before they're able to interact with anything, an issue that is even more prevalent for users with high latency and low bandwidth.

We settled on the second approach, server-side rendering. The ActionView templates that Rails provides allow us to serve HTML pages directly. There are more round-trip requests and database calls, but as soon as the content is downloaded users are immediately able to begin interacting with it. Server-side execution is also less taxing on mobile devices.

Gems

RBR/TRIMS makes heavy use of Ruby Gems, which are libraries of code we can include in our app. Using gems is standard practice, it means we can use code that has already been tried and tested rather than reimplementing it ourselves and introducing potential bugs. Rails projects generally have a set of gems installed by default, but we can include any other gem we want.

Some of the more critical gems in this project are as follows:

Devise

https://github.com/plataformatec/devise

Used for user authentication and session management. The primary functions devise handles within RBR/TRIMS is the login, logout and signup functionality.

Country Select

https://github.com/stefanpenner/country_select

We built RBR/TRIMS with the ability to expand to countries other than Laos. To make it easier on the user and create less chance for error, we've used Country Select to give us access to a complete list of countries under the ISO 3166-1 standard, which defines codes for the names of countries.

Bootstrap

https://github.com/twbs/bootstrap-rubygem
https://getbootstrap.com

Bootstrap is a front-end component library. It's prolific throughout the web and is adaptable to a variety of languages.
It comes with a set of mobile responsive styled components that you can insert into your app.

Best In Place

https://github.com/bernat/best_in_place

The reporting system implemented has a lot of inline editing, which isn't something that would be easy without a gem like Best In Place.
The alternative to inline editing would be a standard form submission, where you have to fill out a set of fields and then submit the whole form to the server.
Best In Place lets you edit a field directly like you would in an excel spreadsheet, and each change is saved to the database automatically without manual form submission.
With network interruptions being prevalent in third world countries, this means that user data is frequently saved, and there's less chance for data loss.

Prawn & Prawn Table

https://github.com/prawnpdf/prawn
https://github.com/prawnpdf/prawn-table

Prawn is used for programmatic generation of PDF files, with Prawn Table being an extension to it that enables you to add tables to these PDFs. In this project it has been utilised to generate the receipts of school reports.

This gem is highly flexible and supports vector drawing, internationalisation features for text rendering, image embedding and much more. One thing this gem does not allow you to do is to automatically generate a PDF file from a HTML page. If that feature is desirable to future developers then they should look into *FlyingSaucer via JRuby*, *Wicked* or *PDFKit.*

User Hierarchy

Admin

The system admin has control over the system, and is the only user able to add/remove/edit countries. The admin is capable of accessing all countries in case of emergency, and is able to view any information currently held on the portal. The designated admin, most likely to be future admins of the site has permissions to add or remove countries, provinces, districts, schools, books, and users.

Ministry

A ministry user is assigned to a specific country upon account creation. The assigned country is the only country a ministry user has access to, and they cannot view any information pertaining to other countries. A ministry account can view all data relating to their country, including provinces, districts, and schools data.

A ministry user is capable of adding books to the system, as well as connecting new districts and schools to their country hierarchy. Ministers can also edit any existing provinces, districts, and schools attached to their country, and are able to remove users from the system with a lower permissions level than them.

Province

A province account is assigned to a single province within a country. This user type can only access their specific province, and in turn can only view information on districts and schools associated to it. Province users, with Ministry approval, can add new districts and schools to their province hierarchy, and also have the capabilities to edit any existing districts or schools attached to it.

District

A district user is assigned to a single district within a province, and can only access data pertaining to their district. District users have very limited access and are only capable of adding new schools, with Ministry approval, to the system for their district. They can also edit any existing schools that they have access to.

School

School users only have access to a single school. These accounts will primarily be held by school principals, who are in charge of entering school data to the system when each report is due. School users can only edit information relating to their school, such as address and contact details, and have no ability to add anything to the system.
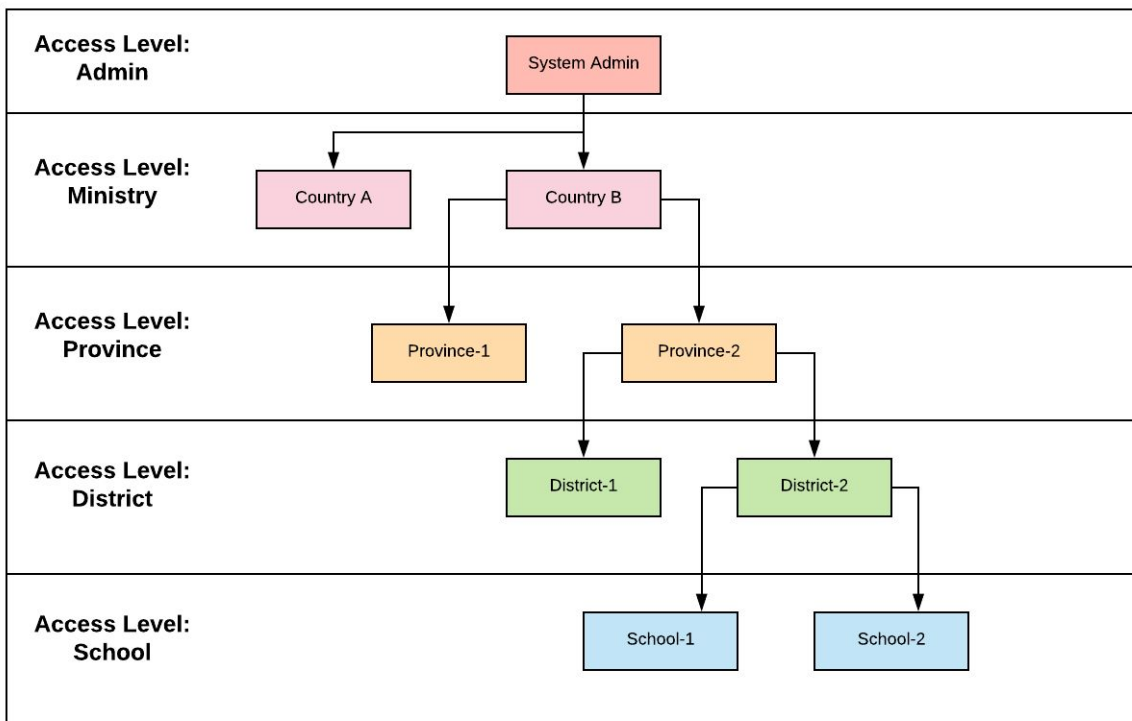
Figure 8.1 User Hierarchy

9   DEPLOYMENT INSTRUCTIONS

RBR/TRIMS is deployed via Heroku, a Platform as a Service. We chose Heroku essentially because our product is only required to be in a prototype state, and deploying via Heroku gives us more time to focus on the product itself.

Being a business problem not an engineering problem, we didn't find it necessary to have to use an Infrastructure as a Service model, such as Amazon Web Services (AWS). There is no need to implement or configure our own services when Heroku can take care of it for us.

Using Heroku is also an advantage for future maintainers. It's unclear at this stage who will be responsible for maintaining this project in the future, so a Heroku deployment means it can theoretically remain in production without any specific ops knowledge.

In your local repository running `heroku create` sets up a Heroku project and associates your GitHub repository with it.

There are two main ways to deploy your code, and we used both of them within this project.

In our early phases, deploys to production were done manually on Johana Foster's equipment by running `git push heroku master`. Although it was a bit more work, this helped keep production in a working state while a lot of the team were familiarising themselves with the git flow and pushing modular functioning code.

Towards the end of the project where code deploys were less volatile, we set up automated deploys. Now each commit or merge to our master branch on GitHub triggers a deploy to production.

10 TEST SPECIFICATIONS

All test specifications can be found as **Appendix E**.

Black Box Testing

Black Box Testing is the act of testing the system the way in which a user would interact with it.
In order to conduct black box testing the tester, or user, does not need any prior knowledge of the system, nor do they require any programming experience. The steps to successful black box testing lie with the test specifications (as mentioned above) that they test against. Each case documented within the specifications must be attempted multiple times during several phases of the system to confirm each specification functions as intended.

See **Appendix F**.
Documentation provided for RBR/TRIMS black box testing is organised by date conducted, with each test labelled according to the test case it specifies. Over time it's visible which test cases we had problems with determined by how many runs they were given throughout the process.

Steps for testing (Referring to the test specifications):
- Select a test case, taking note of it's ID on the far left of the row.
- Confirm that both the **Test Data** and **Preconditions** are met within the system (Test data exists, and all Precondition statements are true)
- Carefully follow each of the **Steps**, making sure to keep in mind the preconditions.
- If all steps are completed successfully, the test is considered a success.
- If at least **one** step is completed unsuccessfully, then the test as a whole is considered unsuccessful.
- Document findings clearly so future readers can understand completely the results.

Format

Green Highlight - Test step functions as is expected.

Red Highlight - Test step functions not as expected.

- When 'Expected' and 'Actual' results are the same, but a bug/error still occurs regardless of the task executing correctly, red highlight is still used to document the problem (see figure 10.1 below).

Red Text - Added if an error or bug was noticed that was outside of the specific test case that did NOT cause the test case to fail.

Table Contents (also see figure 10.1 below):

- **ID**: Refers to the ID of the test specification being tested against.
- **Attempt Description**: Documents the *Steps* and how each one functions.
- **Expected Result**: The result required for a successful outcome.
- **Actual Result**: The result actually given by the test.
- **Conclusion**: Brief summary of the test, notifying of any errors or bugs.

ID	Attempt Description	Expected Result	Actual Result
1	Admin accesses Laos	Pass	Pass
	Admin accesses Bokeo province	Pass	Pass
	Admin accesses Packta district	Pass	Pass
	Admin creates new school 'Test School' with already existing Access Code: 106	Fail	Fail
	Admin creates new school 'Test School' with new Access Code: 111	Pass	Pass

Conclusion:

An error still occurs here but at a different stage. The error occurs when attempting to add a school with an access code that already exists in the system.

figure 10.1 - Documenting the outlying error occuring during testing.

11 FUTURE WORK

Paid Hosting Service

For RBR/TRIMS to be trailed, the system will have to be hosted on a paid service. At the moment the free service Heroku provides is adequate because a minimal amount of users access it.

It's difficult to estimate what kind of service would be required without knowing where the system will be operating and how many concurrent users it will need to be able to support.

A breakdown of Heroku pricing can be found on their site, something like their standard service may be suitable.

https://www.heroku.com/pricing

Load & Stress Testing

In order to ensure that RBR/TRIMS is ready for trailing and the amount of traffic that is expected, the system should be load tested. Load testing is a type of performance testing that simulates real conditions. An example would be to test if the site can respond to, for example, 10,000 simultaneous requests to the home page or 10,000 form submissions. Load testing is done to ensure that the site behaves expectedly in what is considered normal circumstances.

It can be taken one step further into stress testing, we we test for unexpected conditions like someone performing malicious activity, or opening the system to another trail country without checking if our server can handle it.

Testing these things generally requires specialised software, something like https://loader.io/ which you configure to send traffic to your app. It's important to check with your hosting provider about any load testing regulations they have to make sure they're also prepared for it. Heroku allows 10,000 requests per second without any notice, but any more than that and you need to contact them ahead if time to get permission.

https://devcenter.heroku.com/articles/load-testing-guidelines

Mailing System

RBR/TRIMS has been build with the ability to send emails, but it hasn't been hooked up with a mailing system because we didn't feel it was necessary for a prototype.

Heroku allows you to install add-ons to provide your app with additional functionality, so email systems are easy to implement.

SendGrid, an email delivery service that integrates with Heroku, may be suitable if you wanted the ability to manage any promotional or marketing emails, as well as creating email templates.

https://sendgrid.com/

For us to implement this add-on, Heroku requires credit card authorisation. We felt that this isn't something we as students should do, and we didn't want to do this under Paul's name in case any unexpected costs accumulated.

A second option would be direct SMTP (Simple Mail Transfer Protocol) configuration in the app. It would be suitable if no promotional emails were required, and the only ones sent were to do with user accounts. Typical account emails would be things such as confirmation of account registration and reset email passwords. This change would need to be implemented by a developer.

The issue with this is that you need to provide the address and password of the account that will send emails. An email address or domain doesn't exist for RBR/TRIMS, so we would need to configure it with either a personal or a dummy account. Either one of these options requires reimplementation at a later date, so this was deemed unnecessary for this prototype phase.

Data Visualisation & Further Reporting

The reporting system in RBR/TRIMS will collect a lot of data that would be interesting and useful to see a further dissection of.

You would be able to create a breakdown of things like:

- Books that are commonly not returned
- Particular schools/districts/provinces where a lack of book returns or damage are more prevalent
- An increase in returns and decrease of damage over time with the implementation of RBR/TRIMS and education of the importance of book reuse
- Textbook quality can be measured in terms of lifespan - determining why some books last longer than others
- Viewing total pricing, weights and volumes of book orders

Receipt commenting

Each generated receipt is unique for a school. In one of our later meetings, Paul informed us of the importance of being able to generate the receipt with a comment or explanation from the Ministry of why specific book allocations don't meet the requested requirements.

Training Materials

As the system will be used by those with lower levels of tech proficiency, training materials and guides on how to use the system would be beneficial.

Logging History

To add accountability to the users of the system, the history of changes committed to reports should be recorded.. This way if numbers seem to be out of order, higher privileged users would have been able to see who made that change.

Performance Optimisation

The app will be used in areas with high latency and low bandwidth. The default for rails is to compile and serve all assets at once, so there is room for optimisation here to serve only certain assets when necessary.

Docker

Docker is a container platform service that packages up an application and all of its dependencies in a standardised unit and provides many technical benefits as well as becoming an industry standard. For developers, it means environments are far more robust and can be set up within minutes. Scaling websites to handle higher traffic becomes more efficient.

Transfer app to Amazon Web Services (AWS)

Although we don't believe it to be entirely necessary to deploy RBR/TRIMS on AWS - an Infrastructure as a Service model - it would be cheaper. However, a move like that would require developers to have more specialised skills.

User Testing

See *Appendix G*.

User Testing is the process of trialling the system with users that have no prior knowledge of it, all with different skill sets with regards to technology. By doing these trials it gives the developers vital information on how regular users navigate around the website. More experienced users may look in certain areas for particular links or information, whereas less experienced users may react differently.

To successfully complete a user test it's important to have a list of tasks ready for each user to complete. All users will complete the same tasks, regardless of their tech-literacy, and their responses, actions, thoughts, process will all be recorded to give a better understanding of how to improve the website, or what on the website has been done well. When completing these set tasks, the testers are to receive no hints from any observers and are to complete the tasks as they believe they are to be completed.

To have been able to do some user testing for RBR/TRIMS would've been quite informative. As the system currently is, there are only a few people that have used it, and it's hard to judge how the target audience will attempt to use it. Having a test pool of both tech-literate and illiterate people would help to further adjust the portal for the needs of the countries that will use it. We would be able to identify any difficulties with navigation, or any inconsistencies between pages. For example, at points it may even be possible for users to become stuck on a page due to the buttons or links not being obvious enough for them to notice. All of these small problems can be detrimental, and are hard for developers to see because of the familiarity they have with the project.

We did attempt a slight amount of user testing with our sponsor, Paul, within some of our weekly meetings. Even these brief trials identified potential problems for users that none of us had foreseen, and allowed us to update the system in a way to make it easier for him to use. To have had time for more in depth testing scenarios would have no doubt revealed extra issues with the portal layout and structure that we were unaware of.
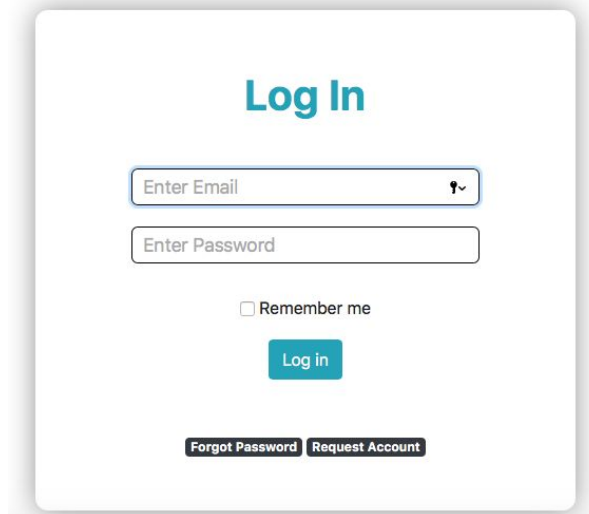
12 How-To RBR/TRIMS

This section documents instructions for a user to use each part of the portal. Each section is clearly labelled depending on the page to which it's referring, and provides information on the subsections of each view as well.

Login

The login page is the initial page a user is directed to upon accessing the portal. Anytime the portal is accessed by a user that is logged out they will be directed, regardless of the entered url, to this page.

To login, the user must simply enter their credentials (email + password) into the specified input fields on this page.

- It's important to understand that an account must already exist within the system to be able to login. Currently only an ADMIN has the correct permissions to create accounts belonging to countries, while ADMINS and MINISTRY users have privileges to create accounts for provinces, districts, and schools.
- Using the 'Request Account' feature on the login page will only create an OBSERVER account which can view, but not edit any information.

A gem called Devise was talked about previously, and it manages all of this logic for us. However, it allowed us to expose and style the default views it provided which can be found in `views/devise/`

Information Page

The information page will be the first page you land on after you log in. This view acts as the homepage for the portal. Depending on user permissions, the user will have the option to view some limited data on provinces, districts, and/or schools that they have access to.

- To view a province, select the 'Select Province' dropdown and choose one.
- To view a district a province must already be selected, the select the 'Select District' dropdown and choose one.
- To view a school a province >> district must be selected, then select the 'Select School' dropdown and choose one.
- With the correct permissions a user can also use the province/district/school code in the search bar to bring up information for that specific item.

It's important to understand that no further functionality is available on this page. For **Reports** and **Receipts**, the user must select these options from the header bar at the top of the page.

Search...	Search

Bokeo ⬍	Select District ⬍	Select School ⬍

Province: Bokeo

Province Code:	105
Districts in Province:	5
Schools in Province:	10

Reports Page

This page acts as a hub for all reports. A user **MUST** have correct permissions to access reports to be able to edit, begin, or close one. This page is setup in a straightforward, hierarchical model, beginning with the most used - Grade Reports >> District Reports >> Province Reports.

Grade Reports

This specific section focuses on reporting for specific grades for specific schools that the user has access to. Selecting a school from this dropdown will show a list of grades for that school.

Each grade will have a button to the right of it titled 'Start New', 'Continue', or 'View Closed Report'.

- *No Data Entered* begins a report for that grade. This button will only exist until it's clicked the first time. Entering into a report will set the report status to 'Started', and in turn changes the button to 'Continue'.
- *Work in Progress* acts the same as 'No Data Entered'. The button is just named as such to inform the user that this report has already been started, but has not been completed. Once the information is added to the report and it has been closed, the button will change to 'View Closed Report'.
- *View Closed Report* informs the user that the report for this grade has been completed. Clicking this button will allow the user to view the report, though it can no longer be modified in any way.

When inside the report for a grade, the user is required to give data regarding **Current Students**, **Books Received by School**, **Books Returned by Students**, **Reusable Books**, **Books in Stock**, and **Estimated Future Students**. This data is crucial to get an exact value for the books required for the next school year. To give this data, the user must click on the hyphen (-) in each cell and enter it manually. When all cells of the report table have been filled, the 'Close Report' button will set the report to 'Complete'.

Houaylumphae Primary - Grade 5

Report Status: OPEN

Back   Close Report

1	2	3	4	5	6	7
Book Title	Actual Number of Students	Number of Books Received All Sources	Total Number of Returned Books	Number of Reusable Books	Number of Books in Stock	Estimated Number of Students
Math-5		-	-	-	-	
Lao-5	35	-	-	-	-	40
Moral-5		-	-	-	-	

District Reports

This specific section focuses on reporting for specific districts that the user has access to. Selecting a district from this dropdown will show a list of all schools belonging to the district as well as a status of the district's school report completion. A report can be started for a district without all school reports being completed, however, this will give incomplete results and should only be used as a last resort for emergency cases. When a district is selected there will be **Start District Report** and **Reselect** buttons underneath the school list.

- **Start District Report** acts the same as **No Data Entered** and **Work in Progress** from the school/grade report section. This loads the report for the district, allowing editing if the user has appropriate access. When started but not complete, the button will read **Work in Progress**, and when closed will change to **View Recent Report**. The buttons are colour coded to give immediate feedback to the user how completed the report is. Red signals that the report has not yet been started on, while yellow means it has but the data is not all there. A green button means the report has been finished.

- **Reselect** simply closes the report summary and reloads the default report view, allowing the user to select a different report to load.

When inside the district report, the user is only required to provide data on the **Less DEO Stock** in the far right column. Clicking the hyphen (-) will allow the user to edit this cell, or if the cell has already been modified then clicking the number will do the same. Again, this data is crucial to the final book tally required for the district, so it's important to make sure it's filled out correctly. Clicking 'Close Report' will save and complete the report, halting any further attempts to change the data.

If some data is added and you know it will not change, you have the ability to close individual book records. This allows you to lock in some fields while keeping the rest open.

Province Reports

This specific section focuses on reporting for specific provinces that the user has access to. Selecting a province from this dropdown will show a list of all provinces belonging to the user's assigned country as well as a status of the province's district report completion. A report can be started for a province without all district reports being completed, however, this will give incomplete results and should only be used as a last resort for emergency cases.

When a province is selected there will be *View Province Report* and *Reselect* buttons underneath the district list.

- *View Province Report* acts the same as *View Recent Report* from the district report section. This loads the report for the province, allowing only viewing if the user has appropriate access. This report is final and cannot be edited. The only way data can be changed within this report is if a district or school linked to it has their report altered.
- *Reselect* simply closes the report summary and reloads the default report view, allowing the user to select a different report to load.

The difference between the province report compared to district and school reports is the fact that it requires no input from the user. The province report acts more like a final summary of each grade within the province. All data entered by users in school and district reports is calculated to output the final totals, and is the data that's used for the final receipts.

Technical Implementation of Reports

The reports section has the most complex system in our app as it deals with a cross section of ActiveRecords.

The naming of these records was difficult, and over time their purpose shifted and their names became less accurate.

On creation of a new grade report, a few things happen.

1. Based on the country and grade, we need to find all the books that this report needs.
2. For each grade, a new "SchoolYear" record is created. As referenced in the Entity Relationship (ER) diagram, the School Year holds the start and end dates of the year, as well as information on student numbers. The entity itself is correct, but our implementation of it (or the naming of it), isn't. It means that approximately six School Year objects are created per primary school, which isn't truly representational to what the name suggests.
3. For each book in each grade, a new "BookStatsSchool" object is created - this holds all the information about the current book status and how many of these books are required for the next school year.

The district report is an accumulation of all of the Book Stats Schools for each book in each grade within a district. It also holds additional information of how much stock of a particular book the District has, in a BookStatsDistrict record.

Similar to the district report, the province report is an accumulation of all district reports for each book in each grade. All of this is calculated asynchronously and isn't stored in the database.
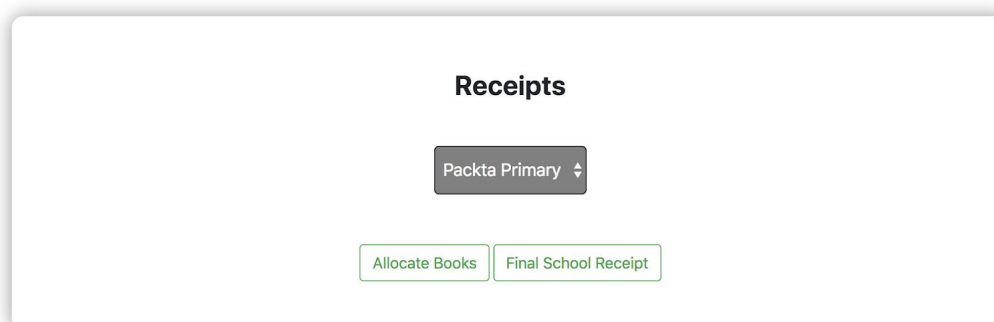
Receipts

The receipts section has multiple functions to aid with the generation of a PDF receipt. To begin with, a receipt ***cannot*** be generated for a school unless that school's reports have been fully completed - all grade reports filled out correctly and closed.

When selecting a school to view a receipt for, only schools that have been completed will appear in the dropdown. If the school you are trying to generate for is ***not*** in the dropdown, then it has not been completed at the current time.

When you have chosen a school and selected 'Allocate Books', it will direct you to another screen similar to the reports view where the user can add data for book allocation prior to viewing a receipt.

- This screen is solely for ministry (or higher) users to assign books to each school depending on available stock (Eg. The school may require 15 math books, but there may only be 10 available books to provide to them).
- Cells needing attention are coloured red, and have the words `Click me` in the cell to prompt user actions.
- After all data is added, a new button, 'Final School Receipt' will appear both at the top of the current receipt page, and next to ***Allocate Books*** action on the previous page.
- The Final School Receipt button will take the data and create a receipt to send to the school along with the books. This receipt is generated in PDF form and can be downloaded as a PDf file on any browser.

Receipts

Packta Primary ⬍

Allocate Books | Final School Receipt

As receipts are created per School, they make use of the *BookStatsSchool* database entity. It displays how many books are needed based on the expected number of students for the next school year which is held in the associated *SchoolYear* record. The data entered in the `Book allocation` column for the receipt is stored in the *BookStatsSchool* record for each associated book.

Receipt of Packta Primary

Back

Grade	Textbook Title	Books needed based on expected enrolment	Book allocation
	Math-1	24	12
1	Lao-1	-4	15
	Moral-1	12	Click Here
	Math-2	-4	Click Here
2	Lao-2	24	Click Here
	Moral-2	12	Click Here
	Math-3	4	Click Here
3	Lao-3	22	Click Here
	Moral-3	18	Click Here

Lao People's Democratic Republic   1/2

Bokeo Province Department of Education
Packta District Office of Education

Receipt for new textbooks - Academic Year 2018 - 2019
Packta Primary - School code 105105101

School address:
Tel/Mobile:

Grade	Textbook Title	Books received from all sources	Total number of books returned by students	Number of books that are reusable (A)	Number of usable books in the school stock (B)	Total usable books (A+B)	Books needed based on expected enrolment	Book allocation	Initials of school staff receiving books
	Math-1	23	18	13	3	16	24	15	
1	Lao-1	58	46	44	0	44	-4	15	
	Moral-1	28	24	21	7	28	12	5	
	Math-2	58	46	44	0	44	-4	5	
2	Lao-2	23	18	13	3	16	24	5	
	Moral-2	28	24	21	7	28	12	5	
	Math-3	54	42	40	1	41	4	5	
3	Lao-3	27	20	19	4	23	22	25	
	Moral-3	32	27	25	2	27	18	5	

Name of staff member ....   Signature of staff member ....   Date: /   /

Manage Account

This page is for the editing of a user account. It allows the user to modify their details and save them to the system, as long as their correct password is entered upon saving. It's also possible to cancel your account from this page with the red 'Deactivate Account' button at the base of the view.

To modify a certain detail, click within the text input box to the right of the descriptive text label and enter the new data to update. At the base of the page input the account password and click the green 'Update Account' button.

Manage Account

Account Type (ADMIN) of
Lao People's Democratic Republic

Change First Name   Johana

Change Last Name   Foster

Change Email   johanafoster@gmail.com

Change Password   Minimum 6 Characters

Confirm Password

Enter Current Password

Update Account

Back

Deactivate Account

Admin Settings

This is another option that can be selected from the header bar at the top of the screen, and can only be selected by ministry users or admins. This option is hidden from other users due to it relating to addition, deletion, and modification of items within the system (such as books, users, provinces, districts, and schools). The admin is the only user that has permission to add, remove, or edit countries.
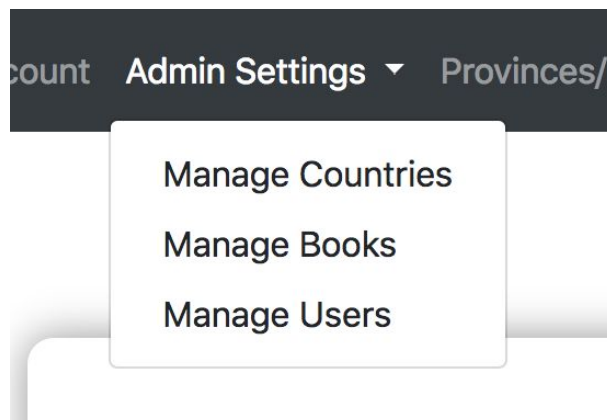
When selecting **Admin Settings** (or **Ministry Settings** for ministry users) a dropdown appears with three more options: **Manage Users**, **Manage Books**, **Manage Countries** (or **Manage Provinces** for ministry users). It is important to note that an admin will only see data belonging to the country they are currently assigned to, which can be changed from the header bar option on the far right - **Viewing As:**.

- **Manage Users** allows the current user to view a list of users in the system. Admins have the ability to see all users, while ministry users can only view other users assigned within the same country. Users can only deactivate accounts that have lesser permissions than themselves, and the system prevents deactivating a user with equal or higher permissions. Staff can be added to the portal through the 'Add Staff' button on this page, although ministers have more restrictions on the type of staff they can add when compared to an admin.

- **Manage Books** allows the user to view, add, remove, and edit books. As with the user section, ministers can only see book data related to their country, whereas an admin can view all books for all countries. Each book has two buttons beside it - **Show** and **Deactivate**. **Show** sends the user to the book information page, from where 'Edit Book' can be used to modify its data.

  - **Edit Book** acts very similar to the **Add Another Book** button at the base of the **Manage Books** view. It displays all data currently related to the book, and allows the user to modify the data if anything changes.
  - It is important to note here how the Grades and Countries are actually assigned to the book. The 'Grades in Countries' label sits beside a large input field. The formatting of what's entered into this field is extremely important. Anything entered into this field incorrectly, no matter how minor the error, will cause the book to be assigned to nothing.

    The format is as follows:
    {**"Country Code"** : [**"grade"**]}

So using this format we can add a book to Australian grade 1 classes by entering:

{**"au" : ["1"]**}

If the book needs to be added to multiple grades, or even multiple countries, then it can be done this way:

{**"au" : ["1", "2"], "la" : ["5", "6"]**}

This piece of text will add the current book to Australian grade 1 and grade 2 classes, as well as add it to Laos grade 5 and grade 6 classes.

Deactivate will remove a book from the system (if it has no connections), or just set it to inactive if it's already in use. Any book with attached reporting data can only be deactivated and can be easily reactivated again.

- *Manage Countries/Provinces* sends users to the section of the portal that handles countries, provinces, districts, and schools. Admins have the authority to add new countries to the system, as well as any connections to new or existing countries at any level in the hierarchy. Ministers when selecting this option will be sent directly to their assigned country, and will have no access or permissions to add or modify any other countries in any way. These views are presented in a simple list view, assigning a *Show* and *Deactivate* button to each item in the list. *Show* will send the user to the corresponding information page for their selection, while *Deactivate* will either remove the item (if it has no connections), or set it to inactive if it's in use already.

At the top of each of these sections is the option to add a new item to the current selection (Eg. add a province to the current country, or add a district to the current province). The only information necessary for this is the name and access code, which will then be automatically allocated to the correct position within the country hierarchy.

To navigate through this view to your preferred item, the user must do so through the country hierarchy using the green 'Show' buttons.
- To get to a school, you must navigate to it through the schools parent district.
- To get to a district, you must navigate to it through the districts parent province.
- To get to a province:
  - As an admin, you must navigate to it through the parent country.
  - As a minister, you will be automatically directed to the province the account is assigned to. No other province can be accessed by a ministry account.

Provinces List

101	Sientiane	Show	Deactivate
102	Pongsali	Show	Deactivate
103	Louang	Show	Deactivate

13 REFERENCES

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14 APPENDICES

- ● *Appendix A* - Sitemaps (sitemaps.pdf)
- ● *Appendix B* - Use Case Diagram (use_case_diagram.pdf)
- ● *Appendix C* - Wireframes (wireframes.pdf)
- ● *Appendix D* - ER diagram (database_er_diagram.pdf)
- ● *Appendix E* - Test Specifications (test_specifications.pdf)
- ● *Appendix F* - Black Box Testing (black_box_documentation.pdf)
- ● *Appendix G* - User Testing (user_testing_scenarios.pdf)