



PROJECT: AGRICULTURAL PRODUCE MANAGEMENT SYSTEM

INSTITUTION: UNIVERSITY OF NAIROBI

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## Executive Summary

This is a produce management system designed to help farmers monitor and manage their produce from harvest to sale. The application aims to streamline produce management, providing real-time updates on inventory and sales, and offering valuable insights to improve efficiency and profitability. The scope includes 3 primary modules Produce, Sales & Reports.

This is an online platform. It allows farmers to manage update and monitor their agricultural business by accessing various services, and perform administrative tasks. Some functionalities provided by the system include produce management , sales tracking and the generation of various reports to allow farmers to keenly analyze and modernize their businesses in an efficient, professional and in a comprehensive manner no matter the scale of their operations. The system is designed to be accessed through a web-based platform that ensures secure access and centralized data storage. The platform is organized into modules which are accessed individually based on the users' needs to provide ease of access.

# Contents

Executive Summary.....	1
1. Introduction .....	4
Background .....	4
Problem Statement.....	4
Objectives .....	5
Scope.....	5
Assumptions.....	6
2. System Overview.....	7
3. Functional Requirements .....	8
4. Technical Architecture.....	10
Actors .....	11
4.1 Authentication.....	12
Why DFDs Matter for APMS .....	13
6. System Design .....	14
Sequence diagrams .....	14
7. Data Model / Database Design.....	19
1. Dashboard.....	21
Recent activities section .....	22
2. Produce Tab .....	23
Produce Entry Form .....	23
This is where you add details of your produce based on the input variables provided.....	23
Make sure you have first added a storage location in the Form below it this will ensure the storage locations are dynamically loaded into the form.....	23
Storage Location Section.....	24
2.2 Storage Location input variable .....	24
After adding a storage location, this is when you can comfortably add produce in the produce form.	24
Add storage Location form .....	25
Output.....	26
3. Sales Tab .....	27
Sale Form and Sale entries Output .....	28
Schedule sale Form .....	28
4. Reports tab.....	30

Create new Report Form.....	31
Example Reports .....	32
5.    Notification's tab.....	33
6.    Account tab.....	35
7.    Help Tab .....	37
FAQs (FREQUENTLY ASKED QUESTIONS SECTION) .....	39
8. Nonfunctional Requirements .....	40
1. Security & Authorization.....	40
2. Real-Time Responsiveness .....	40
3. Error Handling & Availability.....	40
4. Usability & Maintainability.....	41
5. Browser Compatibility.....	41
10. Appendices .....	42

## 1. Introduction

### Purpose of the system

The Agricultural Produce Management System (APMS) is a web-based application developed to help farmers monitor and manage their produce from harvest to sale. Designed for use in both small- and large-scale operations, the platform centralizes inventory, sales, and reporting functionalities, with real-time updates and an intuitive interface.

### Background

Managing produce efficiently is a significant challenge for farmers, leading to potential losses and reduced profitability. The system addresses this need by providing a tracking system that helps farmers monitor production, inventory, and sales.

### Problem Statement

There are numerous instances of produce tracking systems, however, most of them are expensive to small scale farmers and complex to use hence small-scale farmers currently lack a simple and effective way to monitor and manage their produce from harvest to sale. This project aims to fill that gap by offering a user-friendly produce tracking system.

## Objectives

### 1. Centralize Produce Management

Enable farmers to digitally record and monitor harvested produce, including types, quantities, storage details, and harvest dates.

### 2. Streamline Sales Tracking

Allow users to record sales, schedule future transactions, and automatically calculate sales revenue and units sold.

### 3. Enable Real-Time Inventory Updates

Provide dynamic summaries of produce totals and storage statuses through a dashboard view.

### 4. Automate Report Generation

Generate and export reports (e.g., sales, total sales, inventory) based on custom date ranges to support business analysis.

### 5. Deliver Notifications to users

Notify users of important events (e.g., new sales, produce additions, scheduled transactions) to improve awareness and planning.

### 6. Provide Weather Updates

Integrate real-time weather data to help farmers make informed operational decisions.

### 7. Ensure Data Accessibility and Security

Use Firebase authentication to securely manage user data and provide access from any internet-enabled device.

## Scope

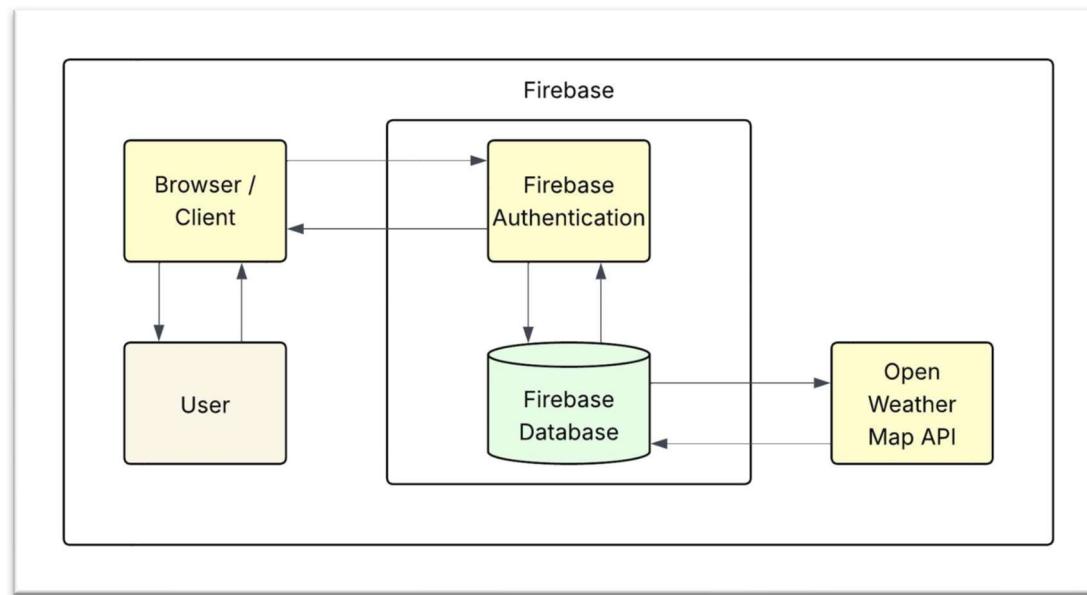
This will include three primary modules: Sales, Produce, and Reports, as well as additional modules Account, Help and Notifications on a web-based platform.

## Assumptions

- Users have internet connectivity.
- Users have a device to access the web.

## 2. System Overview

- **Platform:** Web-based (Client Server Architecture)
- **Frontend:** HTML, CSS, JavaScript
- **Backend:** Firebase (Authentication + Realtime Database)
- **Libraries/Tools:** Chart.js, html2pdf.js, OpenWeatherMap API
- **Documentation Software :** Microsoft Word and Lucid Chart



### Key Modules:

- Dashboard (Homepage)
- Produce Management
- Sales Management
- Reports Generation
- Notifications Center
- User Account
- Help

### 3. Functional Requirements

#### 3.1 Dashboard

- **Quick Access Cards:** Navigate to Produce, Sales, or view Weather.
- **Weather Widget:** Displays real-time weather info via OpenWeatherMap API.
- **Recent Activities:** Users can add quick personal notes; stored per user in Firebase.

#### 3.2 Produce Module

- **Produce Entry Form:** Input produce type, quantity, harvest date, category, and storage location.
- **Storage Location Form:** Add storage location details (name, country, county).
- **Produce Table:** Displays all entries with delete options.
- **Summary Display:** Real-time aggregation of total and per-produce quantities.
- **Validation:** Users must add at least one storage location before submitting produce.

#### 3.3 Sales Module

- **Sales Entry Form:** Record sales with produce type, quantity, price, date, buyer name & contact.
- **Sales Table:** Shows historical entries with delete option.
- **Scheduled Sales:** Allow users to schedule future sales with automatic notifications.
- **Analytics Dashboard:** Displays total revenue and units sold.

#### 3.4 Reports Module

- **Generate Reports:** Three types - Sales, Total Sales, Inventory.
- **Filter Reports:** View by report type.
- **Chart.js Integration:** Graphical data representation.
- **Export to PDF:** Using html2pdf.js.
- **Delete Reports:** Old reports can be removed.

### **3.5 Notifications Module**

- **View Notifications:** Real-time alerts for actions like new sales or produce additions.
- **Mark as Read:** Deletes notification from Firebase.

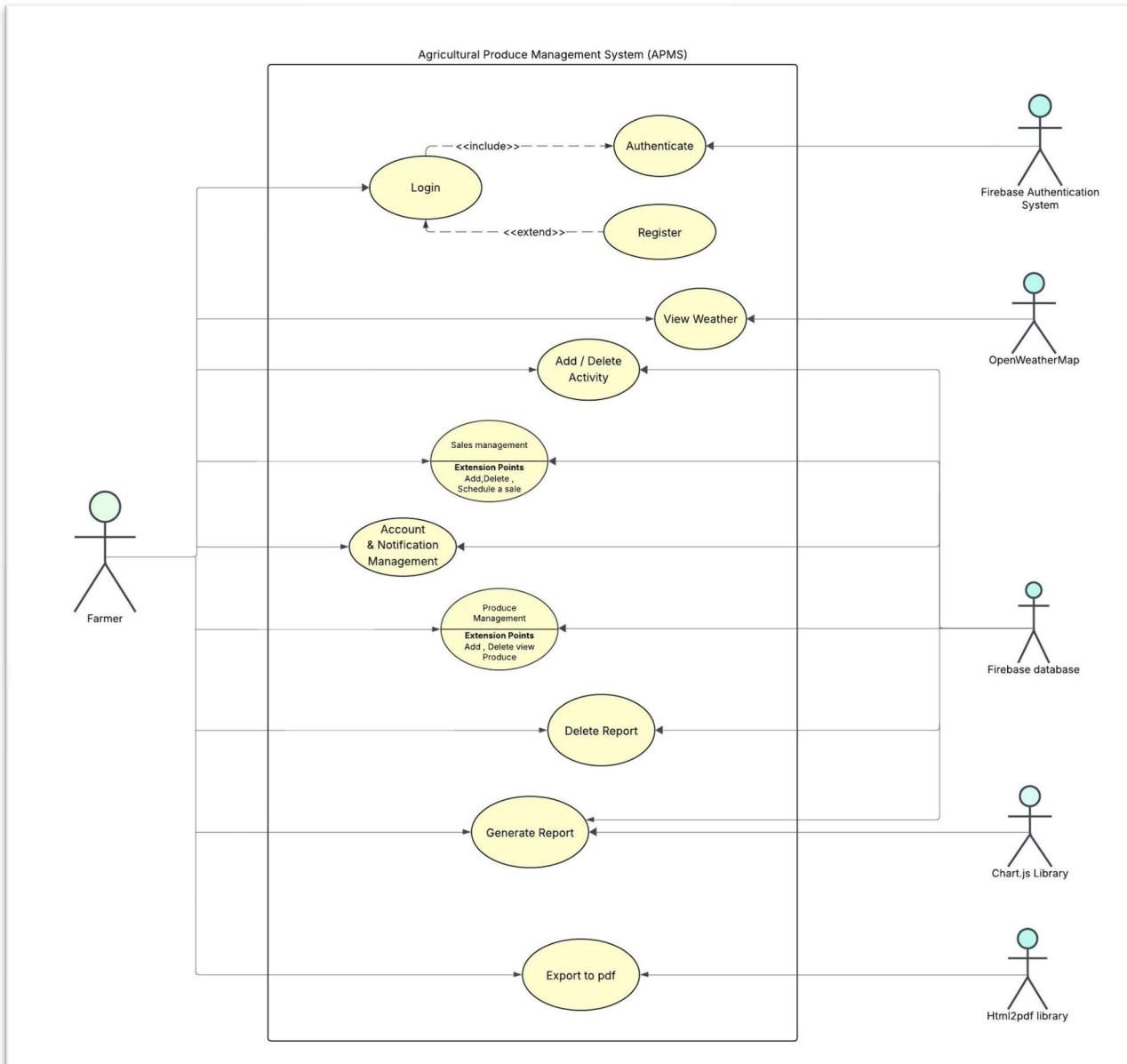
### **3.6 Account & Help Modules**

- **Account:** View, update, or delete user profile.
- **Help:** Access user guide, FAQs, and support contact info.

## 4. Technical Architecture

### 4.0 USE CASE MODEL

Use case diagram



## Actors

1. **Farmer (User)**

The human operator who logs in, manages produce, records/schedules sales, generates reports, views notifications, etc.

2. **OpenWeatherMap Service**

External system that provides weather data to the dashboard.

3. **Firebase Authentication Service**

External system responsible for user authentication (log in/log out).

4. **Firebase Realtime Database**

External data store that persists produce, sales, reports, notifications, and activity notes.

5. **Chart.js service**

External javascript library that allows the creation of visual charts necessary for reports analytics.

6. **Html2pdf service**

An external javascript service that facilitates the downloading of generated reports and allows offline access.

#### **4.1 Authentication**

- Firebase Authentication (Redirects to Login.html if not logged in)
- onAuthStateChanged listener validates sessions across modules

#### **4.2 Firebase Realtime Database Rules**

Allows access to the database from any device as well as stores them in a JSON format, the database is structured to allow users to only access data that is relevant to them (their respective user ids). This is enforced through firebase rules which also ensures the validation of input variables entered by the user.

#### **4.3 API Usage**

- **OpenWeatherMap API:** Fetches current weather conditions (city: default Nairobi)

## 5. Data flow diagram

### Purpose

The **purpose of Data Flow Diagrams (DFDs)** in the Agricultural Produce Management System (APMS) is to **visually model how data moves through the system** — from user input to backend processing and storage — in a clear, structured way.

### Why DFDs Matter for APMS

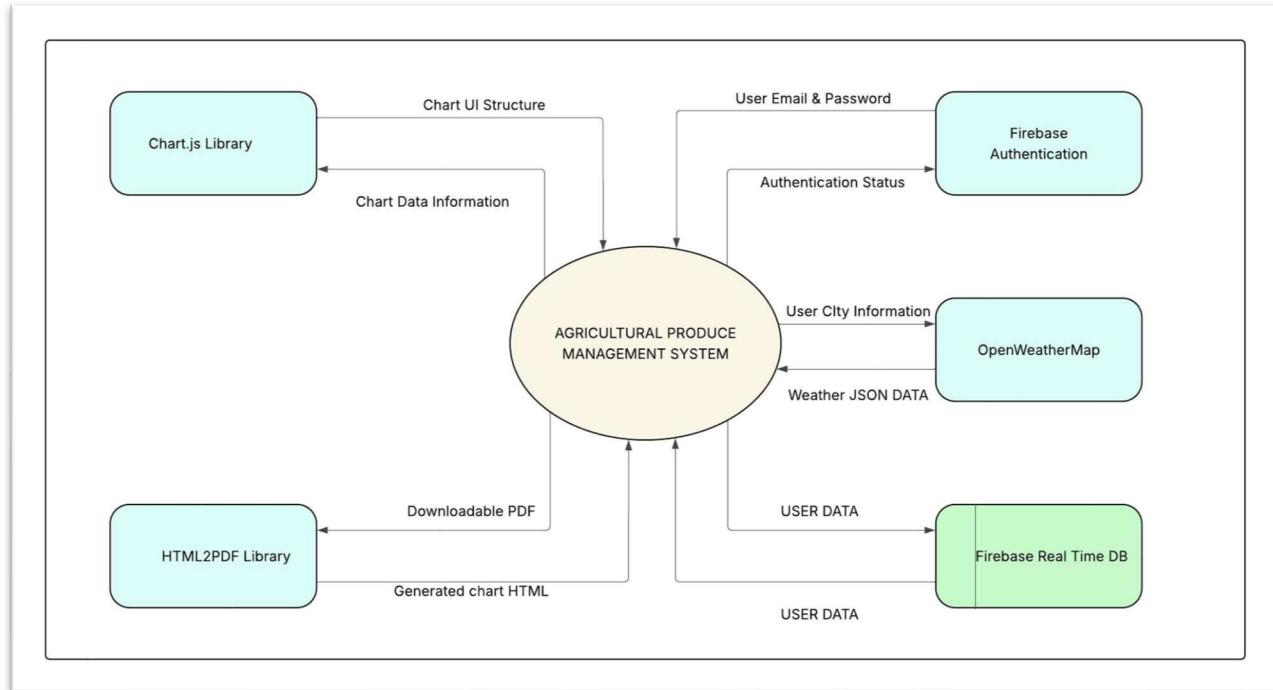
#### 1. Clarify System Scope and Boundaries

- DFD Level 0 defines APMS as a system interacting with external entities like users and APIs.

#### 2. Expose Data Dependencies

- Help identify which parts of the system rely on Firebase, user input, or external APIs like OpenWeather.

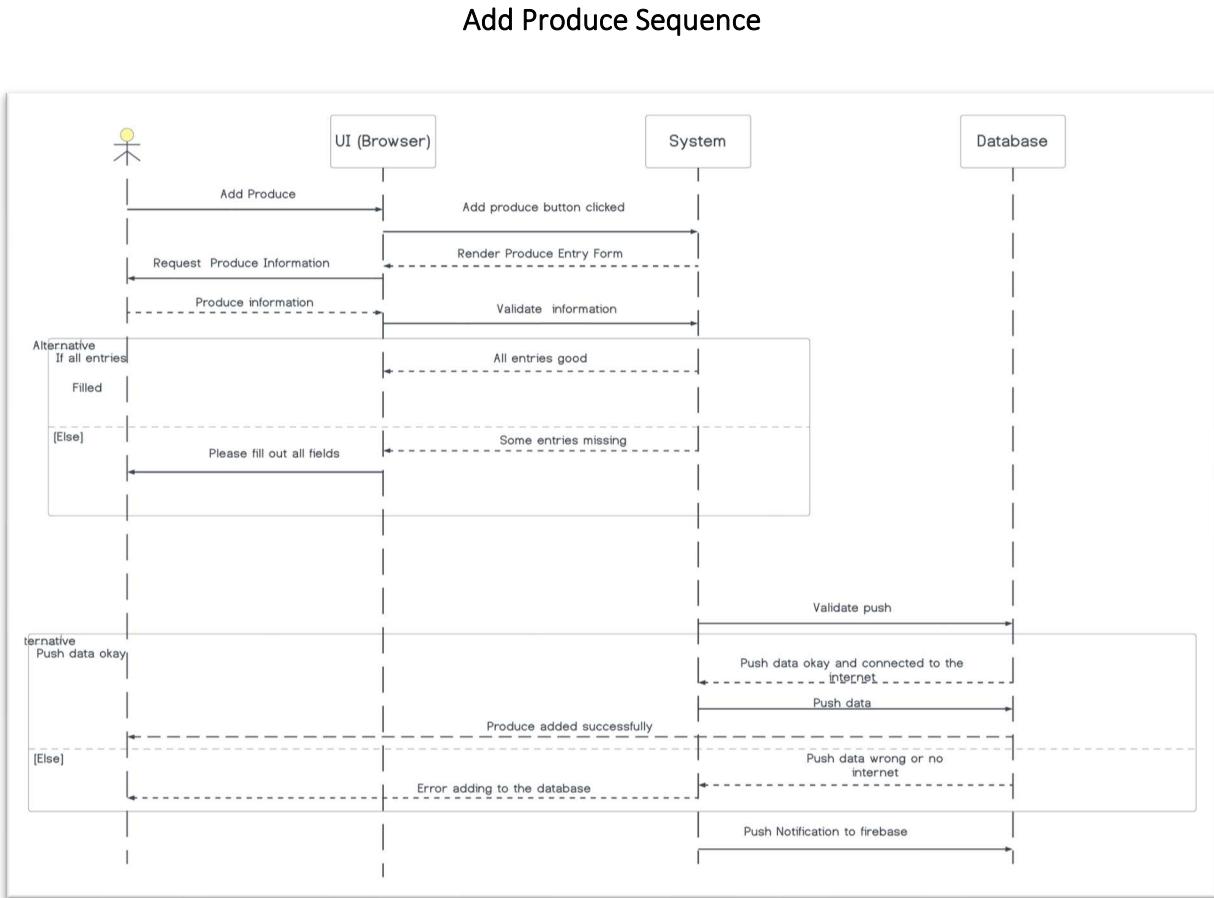
Context diagram



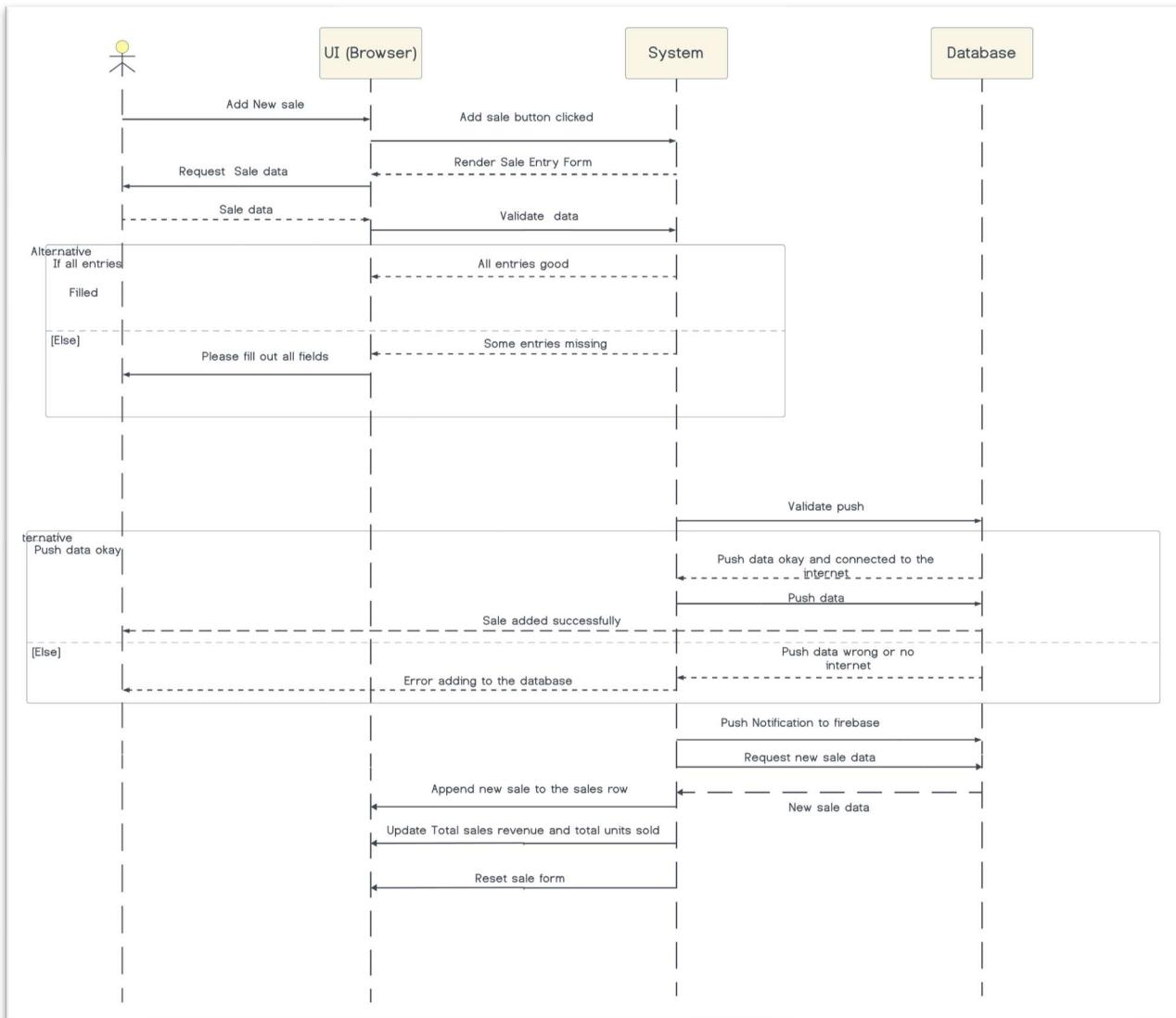
## 6. System Design

### Sequence diagrams

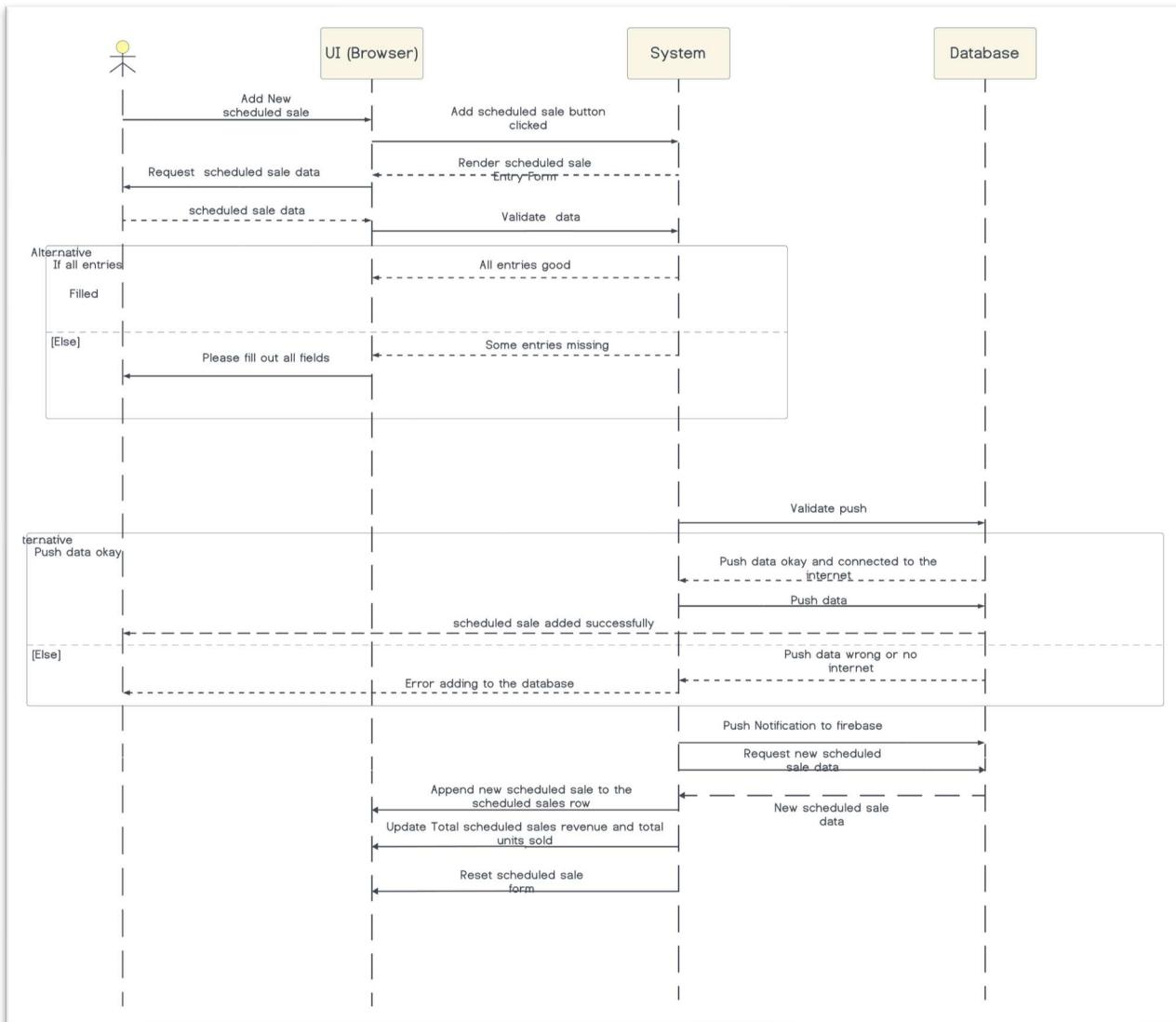
The three main modules are : produce, sales and reports. The following are the sequences of the various processes in each of the modules as well as their respective sequence diagrams.



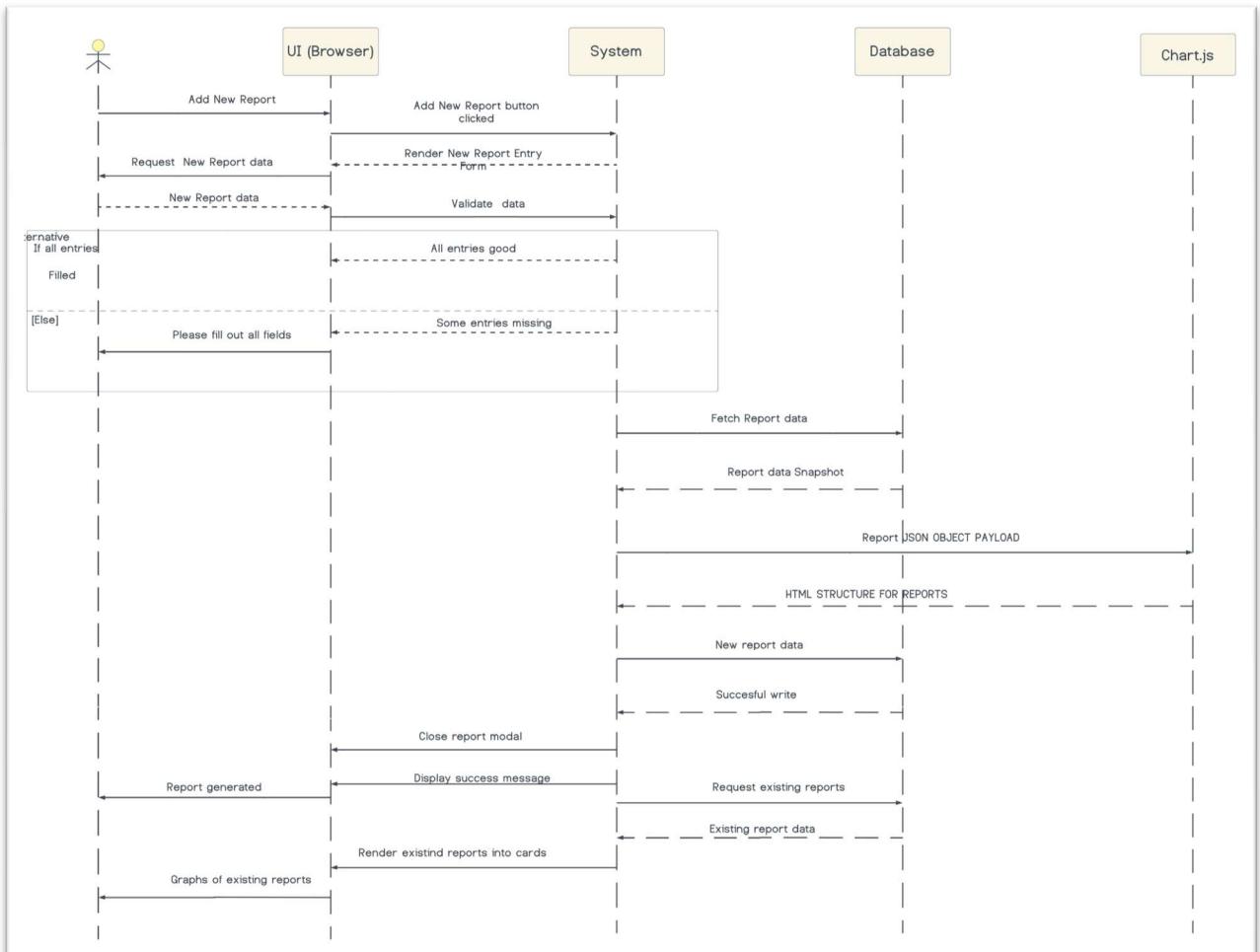
## Sequence Flow for “Record Sale”



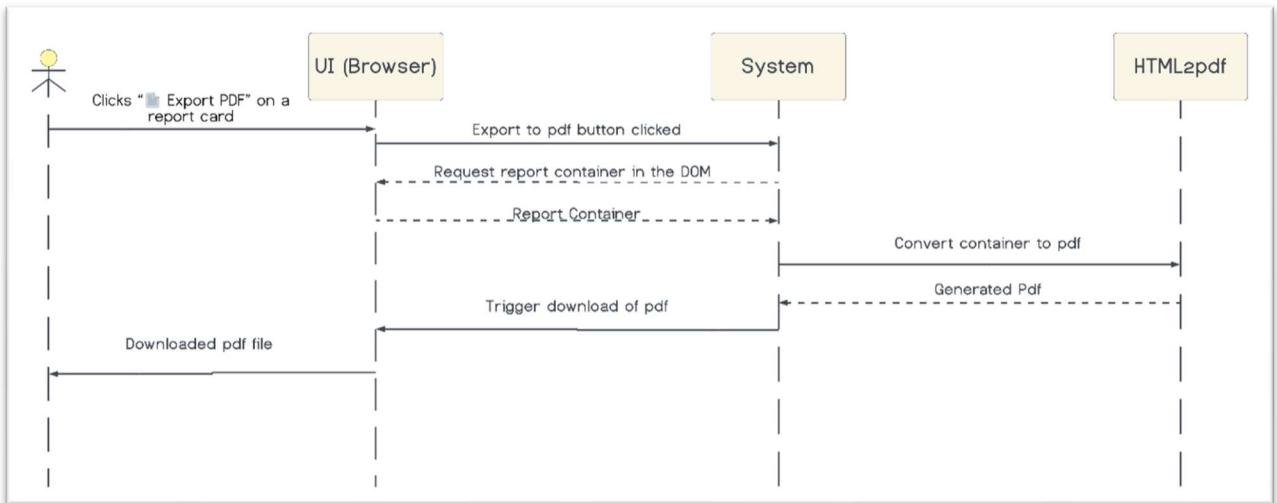
## Sequence Flow for “Schedule Sale”



## Sequence Flow for “Generate Report”



### Sequence Flow for “Export Report to PDF”

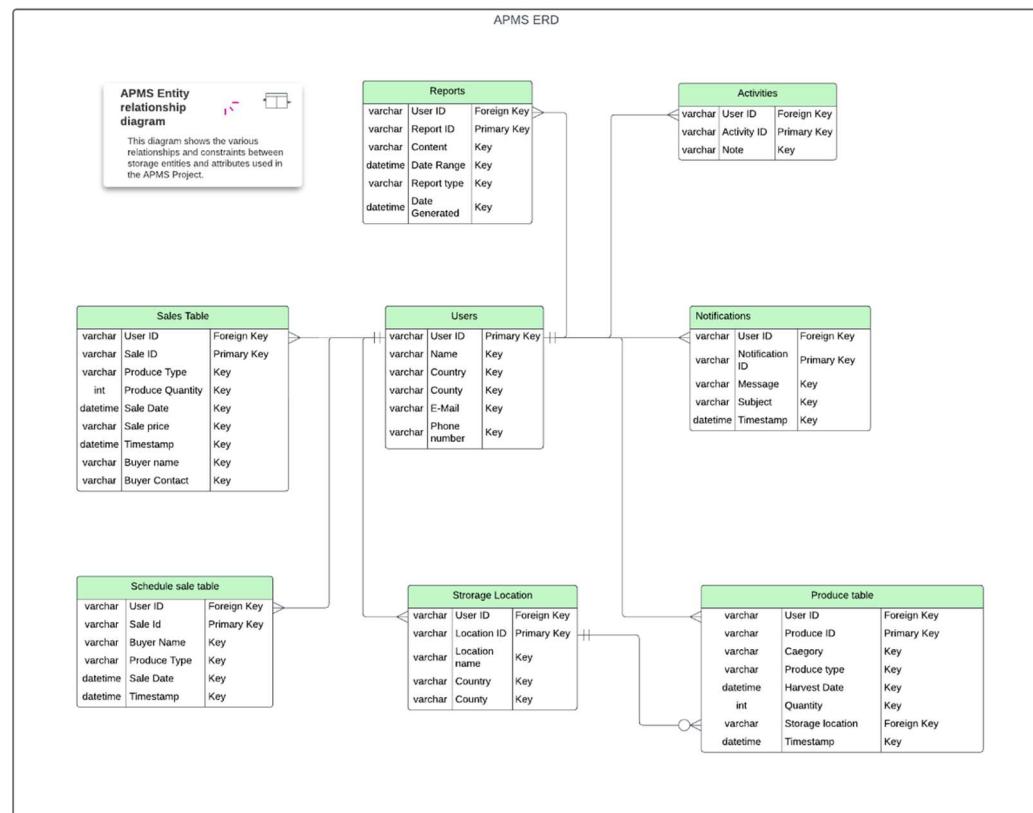


## 7. Data Model / Database Design

Firebase real-time Database was chosen to hold data since it is reliable and can be accessed from any device with internet connectivity. Moreover, its added security features and robust authentication system ensures user-data is safe from theft.

The schema is just a visual representation of the ERD however it was implemented in JSON format.

ENTITY RELATIONSHIP DIAGRAM ERD



## **Security Measures**

To ensure secure access to only one's user data and prevent entry of incompatible (redundant) data strict firebase rules should be applied regarding reading and writing into the database.

The database rules have been attached in the file firebaseRules

## 8. UI Design

### 1. Dashboard

After Registration and log in you will be directed to this page which is the landing page.

It consists of a nav bar with quick links to the four main sections and a user icon where when you point at using your cursor it reveals four new functionalities

- Account – Directs to the account page
- Notifications – Directs to the notifications page
- Help – Directs to the help page
- Logout – when pressed you log out of the system and will be directed to the log in page

#### 1.1 Landing page

The screenshot shows the APMS dashboard. At the top, there is a green header bar with the APMS logo on the left, a user icon on the right, and navigation links for Dashboard, Produce, Sales, and Reports. A dropdown menu is open from the user icon, listing Account, Notifications, Help, and Logout. Below the header, a large "Welcome Back!" message is displayed. The dashboard features three main cards: "Sales" (Manage your sales records, Go to Sales), "Weather" (Get the latest weather updates, Nairobi: 22.99°C, Humidity: 60%), and "Inventory" (Track your farm produce, Go to Produce). At the bottom, there is a section for "Recent Activities" with a placeholder for adding a new activity.

This page consists of a nav bar and four different sections namely

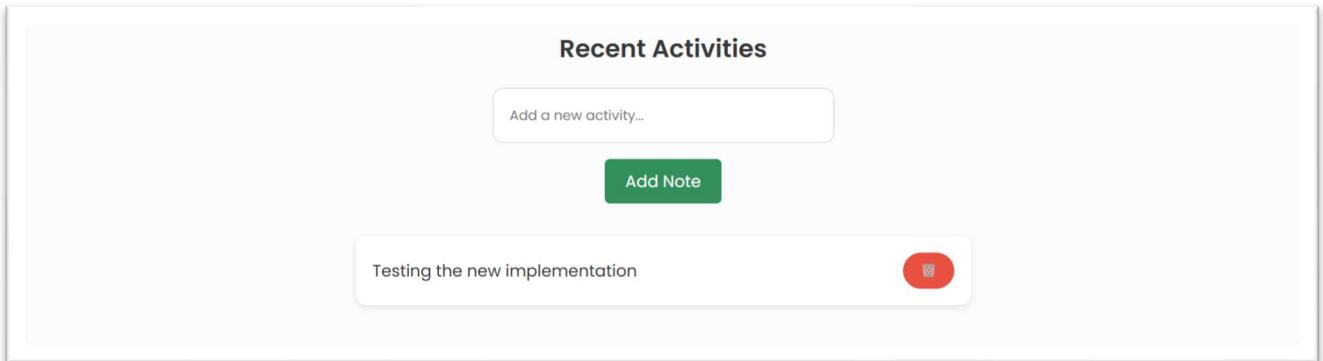
- Sales card - Directs to the sales module.
- Weather card – Displays the weather of the area you input during registration.
- Inventory card – Directs to the produce tab
- Recent activities section – Where you add quick notes of your progress.

### Recent activities section

This is where you can add quick notes to your system and can easily review them immediately you log in to the system.

Every activity added will be displayed under the add note button with a trash icon next to it allowing you to update them and delete them when you have no need for them anymore.

#### *1.2 Recent Activities Section*



## 2. Produce Tab

This is where you add, view & delete details about your produce as well as relevant storage locations.

The first thing you see will be a summary of every produce you have added together with the total units and each individual produce quantity.

### 2.1 Produce tab

The screenshot shows the APMS software interface. At the top, there is a green header bar with the logo 'APMS' on the left, followed by 'Dashboard', 'Produce' (which is highlighted in a green circle), 'Sales', and 'Reports'. On the right side of the header is a user profile icon. Below the header, the main content area has a title 'Manage Your Produce' in green. A central box is titled 'Produce Summary' and contains the following information:  
Total Quantity: 60  
Tomatoes: 40  
potatoes: 20  
At the bottom of this box is a button labeled 'Add Produce'.

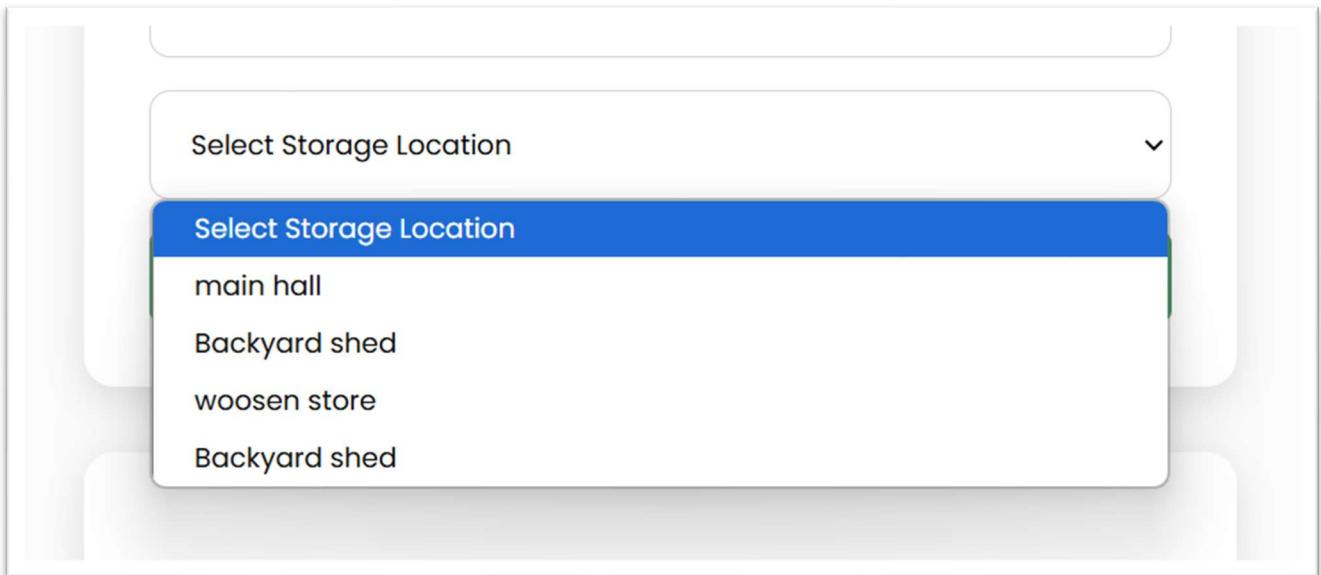
### Produce Entry Form

This is where you add details of your produce based on the input variables provided.

Make sure you have first added a storage location in the Form below it this will ensure the storage locations are dynamically loaded into the form.

## Storage Location Section

### 2.2 Storage Location input variable



After adding a storage location, this is when you can comfortably add produce in the produce form.

### 2.3 Produce Form

### Add Produce

Add storage Location form

Where you add storage locations.

View fig 2.4

*2.4 Storage Location Form*

## Add Storage Location

**Output**

This is the last section of the produce tab where you can see details of produce that you added they can be deleted if a mistake was made.

## 2.5 Produce Output table

Produce Type	Quantity	Harvest Date	Category	Storage Location	Action
Tomatoes	40	2025-04-27	Veggies	main hall	Delete
potatoes	10	2025-04-29	Tuber	Backyard shed	Delete

## 3. Sales Tab

This is where you can view details about your sales as well as add sales and delete them.

Moreover, you can schedule sales and a notification will be created to remind you of it.

### 3.1 Sales tab

The screenshot shows the APMS application interface. At the top, there is a green navigation bar with the logo 'APMS' on the left and menu items 'Dashboard', 'Produce', 'Sales' (which is highlighted in blue), and 'Reports' on the right. On the far right of the bar is a user profile icon. Below the navigation bar, the main content area has a title 'Sales Overview'. It features two large, rounded rectangular boxes side-by-side. The left box contains the text 'Total Sales Revenue' followed by '\$200.00'. The right box contains the text 'Total Units Sold' followed by '12'. At the bottom of the main content area are two buttons: a blue button labeled 'View Sales' and a grey button labeled 'Schedule Sale'.

## Sale Form and Sale entries Output

To add a sale, press the view sales button and a form will be displayed and below it, you will see details of any sales made and you can delete them if need be.

### 3.2 Add sale form

The screenshot shows a Sales Dashboard interface. At the top right are two buttons: "View Sales" (blue) and "Schedule Sale" (grey). Below these is a section titled "Add New Sale" containing input fields for "Produce Type", "Quantity Sold", "Sale Price (\$)", "Date" (with a calendar icon), "Buyer Name", and "Buyer Contact". A large green "Add Sale" button is at the bottom of this section. Below this is a table with columns: Produce, Quantity, Price (\$), Date, Buyer, Contact, and Actions. Two rows of data are shown:

Produce	Quantity	Price (\$)	Date	Buyer	Contact	Actions
Tomatoes	10	\$100	4/21/2025	Thoma	66637-387	
Tomatoes	2	\$100	4/27/2025	John	0700639776	

## Schedule sale Form

Here is where you can schedule a sale and a notification will be created when you complete the scheduling which can be viewed in the notifications tab.

### 3.3 Schedule sale form

The screenshot shows a web-based application for scheduling sales. At the top, there is a navigation bar with a search icon and a 'Schedule Sale' button. Below the navigation is a green header bar containing the title 'Schedule Sale'. Underneath the header, there are several input fields: 'Buyer Name' (with placeholder 'Enter name...'), 'Scheduled Date' (a date picker with placeholder 'mm/dd/yyyy'), 'Producer Type' (a dropdown menu), and a 'Schedule Sale' button. To the right of these fields, there are three small buttons labeled 'Buyer', 'Produce', and 'Scheduled Date'. The main body of the page is currently empty, showing a light gray background.

#### 4. Reports tab

This is where users can generate and view reports created as well as delete them and export them to pdf. There are also filter buttons to view only selected reports

There are 3 types of reports

- Sales report – The total revenue generated by a produce.
- Total Sales report – The total amount of each produce sold.
- Inventory Report – View storage locations

##### *4.1 Reports tab*

The screenshot shows the APMS software interface. At the top, there is a green header bar with the APMS logo on the left, and navigation tabs for Dashboard, Produce, Sales, and Reports. The Reports tab is currently active. On the right side of the header is a user profile icon. Below the header, the main content area has a white background. The title "Analytics Reports" is centered at the top of the content area. Below the title, a sub-header reads "Manage your reports, track your farm's progress, and export your data easily." A blue button labeled "+ Create New Report" is positioned below the sub-header. At the bottom of the content area, there is a row of four green buttons with white text: "Sales Reports", "Total Sales Reports", "Inventory Reports", and "Show All".

## Create new Report Form

Where new reports are created based on a specific date range.

### 4.2 Create new report

The screenshot shows the APMS (Agricultural Produce Management System) interface. At the top, there is a navigation bar with links for Dashboard, Produce, Sales, and Reports. The Reports link is highlighted with a green background. Below the navigation bar, there are several sections: a 'Total Sales Report' card with a chart showing revenue, a 'Sales Report' card with a chart showing sales, and a 'Report' card with a chart showing production. In the center, a modal dialog box titled 'Create New Report' is open. It contains three input fields: 'Report Type' (a dropdown menu currently showing 'Select Report Type'), 'Start Date' (a date input field showing 'mm/dd/yyyy'), and 'End Date' (another date input field showing 'mm/dd/yyyy'). At the bottom of the modal are two buttons: 'Cancel' and 'Generate Report' (which is highlighted with a blue background). The background of the main interface is dimmed to indicate that the modal is active.

## Example Reports

There are the example outputs of the different reports you can hover over each value in the graph to get an exact value.

### 4.3 Example Reports

## Analytics Reports

Manage your reports, track your farm's progress, and export your data easily.

+ Create New Report

Sales Reports   Total Sales Reports   Inventory Reports   Show All

**Total Sales Report**  
Created: 4/29/2025

Total Revenue (\$)

Tomatoes   Tomatoes

[Export PDF](#) [Delete Report](#)

**Sales Report**  
Created: 4/29/2025

Tomatoes   Sale Price (\$): 100

Tomatoes   Tomatoes

[Export PDF](#) [Delete Report](#)

**Inventory Report**  
Created: 4/29/2025

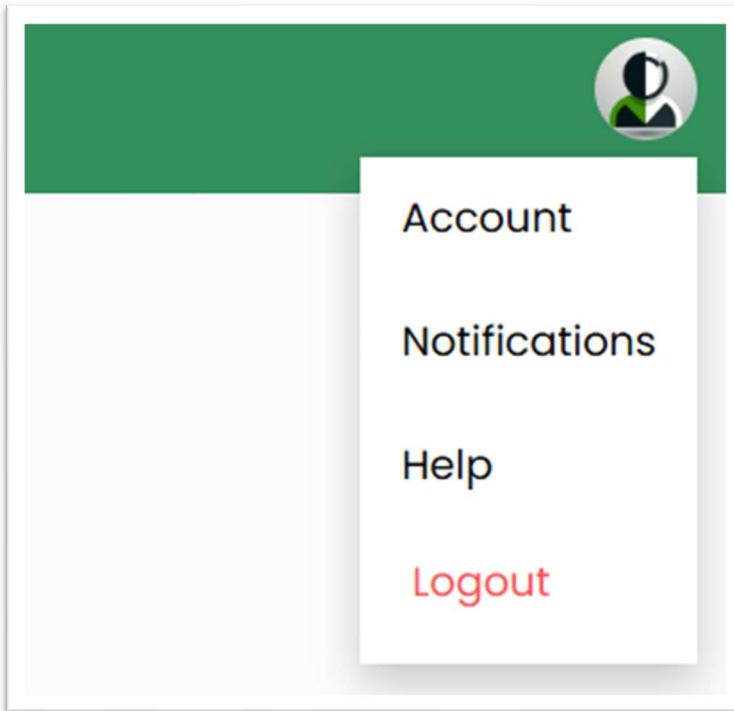
Name	Country	County
main hall	kenya	nairobi
Backyard shed	kenya	Nairobi
woosen store	kenya	Bomet
Backyard shed	kenya	Nairobi

[Export PDF](#) [Delete Report](#)

## 5. Notification's tab

It is accessed by hovering over the user icon in any page that you are in.

*5.1 User icon Hover output*



This is where you view details of notifications made by the system and you can delete them by pressing the mark as read button.

Notifications can be when:

- A new sale was added
- A new sale was scheduled
- A new produce was added
- A new report was created.

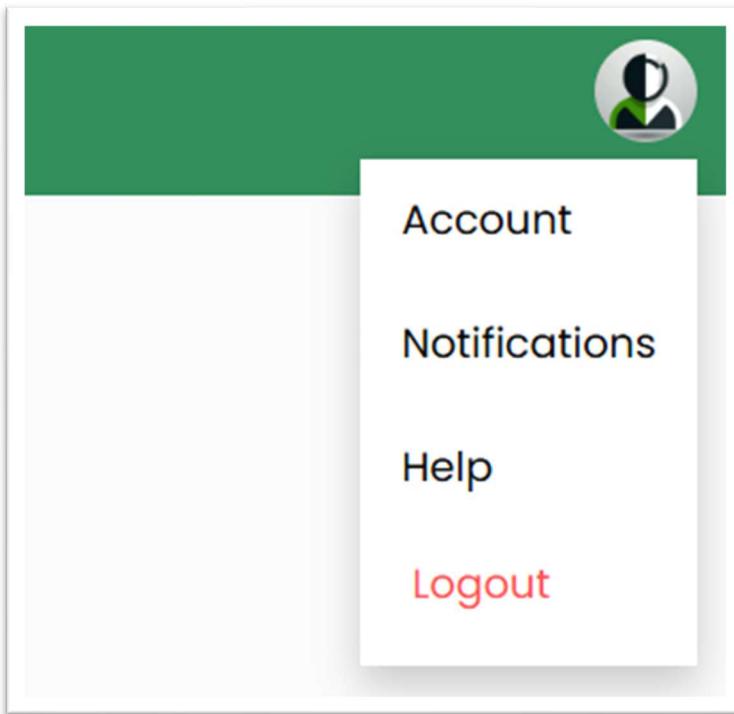
## 5.2 Notifications tab

The screenshot shows the APMS (Agricultural Produce Management System) application interface. At the top, there is a green header bar with the APMS logo on the left, and 'Dashboard', 'Produce', 'Sales', and 'Reports' menu items on the right. On the far right of the header is a user profile icon. Below the header, the main content area has a white background. It features a section titled 'Recent Notifications:' in green text. Under this title, there are three notification cards, each with a green header and a grey body. The first card is for a 'New Sale Added' (Sale recorded for Tomatoes to Thoma, scheduled for 4/27/2025). The second card is for a 'Sale Scheduled' (Scheduled sale of potatoes for hh on 4/27/2025). The third card is for another 'New Sale Added' (Sale recorded for Tomatoes to John). Each card includes a 'Mark as Read' button at the bottom.

## 6. Account tab

It is accessed by hovering over the user icon in any page that you are in.

### 6.1 Account tab location



This is where you can view , update and delete details of your account the current details will be displayed in the form.

## 6.2 Account tab

The screenshot shows the 'My Account' page of the Agricultural Produce Management System. At the top, there is a green navigation bar with links for Dashboard, Produce, Sales, and Reports. On the far right of the navigation bar is a user icon. Below the navigation bar, the page title 'My Account' is centered. Underneath the title, there is a section titled 'Account Details' containing several input fields:

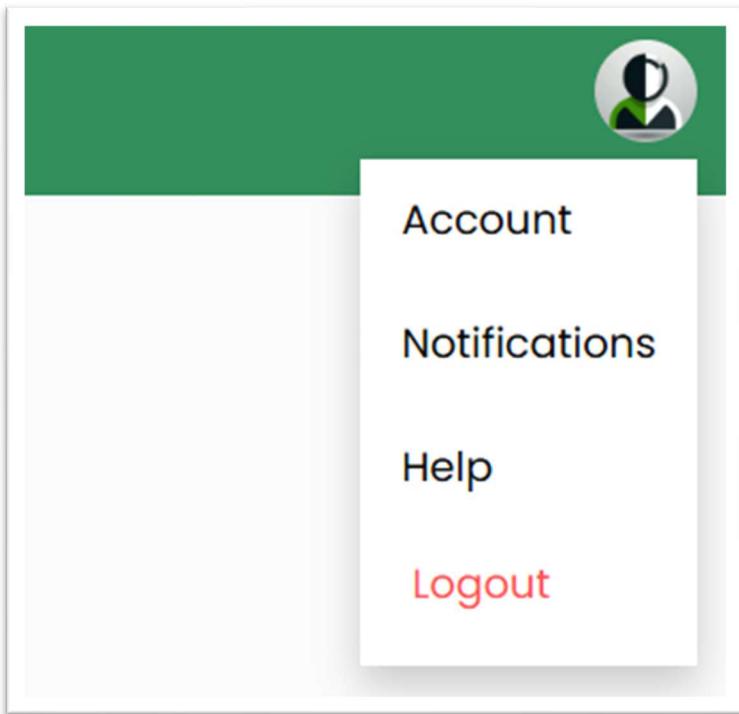
- Name: John Otieno
- Email: johnotieno77@gmail.com
- Phone: 0700939776
- Country: Kenya
- County: Nairobi
- Password: (A redacted password field)

Below these fields are two buttons: a green 'Save Changes' button and a red 'Delete Account' button. At the very bottom of the page, there is a dark footer bar with the text '© 2025 Agricultural Produce Management System. All rights reserved.'

## 7. Help Tab

It is accessed by hovering over the user icon in any page that you are in.

### 7.1 Help tab location



This is where you can find the user guide , view frequently asked questions and contact support.

## 7.2 Help tab

The screenshot shows the 'Help' tab interface. At the top, there is a navigation bar with links for Dashboard, Produce, Sales, Reports, Account, Notifications, Help, and Logout. Below the navigation bar, a green header bar displays the title 'Need Help?'. A sub-header below it says 'Find answers to common questions or contact our team directly.' There is a blue button labeled 'Download User Guide' with a file icon. Under the 'Frequently Asked Questions' section, there are three collapsed questions: 'How do I create a report?', 'How do I schedule a sale?', and 'Can I export my data?'. Below this is a 'Contact Support' section with three input fields: 'Your Name', 'Your Email', and 'Your Message...' (with a text area and a small image of a person). A blue 'Send Message' button is located at the bottom of this section. At the very bottom of the page, a dark footer bar contains the text '© 2025 Agricultural Produce Management System. All rights reserved.'

## FAQs (FREQUENTLY ASKED QUESTIONS SECTION)

### 7.3 FAQs SECTION

#### Frequently Asked Questions

##### **How do I create a report?**

Click the "+ Create New Report" button on the Reports page and fill in the required details.

##### **How do I schedule a sale?**

##### **Can I export my data?**

## 8. Nonfunctional Requirements

### 1. Security & Authorization

- **Authentication Enforcement**

Every page imports `onAuthStateChanged` and immediately redirects unauthenticated users to `Login.html`, so no part of the app is accessible without a valid Firebase session.

- **Per-User Data Isolation**

All reads/writes use the current user's UID in the database path (e.g., `produce/${uid}`, `sales/${uid}`, etc.), effectively ensuring users can only see and manipulate their own data.

### 2. Real-Time Responsiveness

- **Realtime Database Listeners**

Use of `onValue` listeners for `produce`, `sales`, `notifications`, and `activities` so that the UI updates automatically within milliseconds of any data change.

- **Low-Latency Feedback**

`Toast` notifications (`showToast`) appear immediately after each write operation completes, giving users near-instant acknowledgment.

### 3. Error Handling & Availability

- **Graceful Degradation**

- **Weather Widget:** if the OpenWeather fetch fails or returns an error code, you display “Failed to load weather” or “City not found.”
- **Permission Errors:** if a data fetch fails (e.g., due to Firebase rules), you show a clear message in the table (“ You don't have permission...”) rather than crashing.

## 4. Usability & Maintainability

- **Modular Code Structure**

Separation of each major feature into its own ES6 module (homepage.js, produce.js, sales.js, etc.), which aids maintainability and future extensibility.

- **Client-Side Validation**

All forms check for required fields (e.g., non-empty inputs) before writing to the database, preventing blank or malformed records.

## 5. Browser Compatibility

- By relying on standard DOM APIs and ES6 modules (and not any bleeding-edge features), the app runs in all modern evergreen browsers (Chrome, Firefox, Edge, Safari).

## 10. Appendices

- **A. Glossary:**
  - APMS: Agricultural Produce Management System
  - CRUD: Create, Read, Update, Delete
  - UID: User ID
- **B. References:**
  - Firebase: <https://firebase.google.com/>
  - Chart.js: <https://www.chartjs.org/>
  - html2pdf.js: <https://ekoopmans.github.io/html2pdf.js/>
  - OpenWeather: <https://openweathermap.org/>
  - Lucidchart <https://www.lucidchart.com/>