Primary Health Care (PHC) AI Dashboard & Chatbot – Project Report

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Overview

The PHC AI Dashboard is a web-based application built using Streamlit, designed to provide real-time insights into primary healthcare facilities, their operations, stock/inventory, patient visits, health workers, and disease trends.

It includes a smart AI chatbot assistant capable of responding to natural-language queries in multiple languages (English, Igbo, Yoruba, Hausa).

The application interacts with Amazon Redshift to retrieve structured datasets. For operational relevance, only functional and partially functional facilities are considered.

Types of Data Used:

- Facility information: location, type, ownership, operational status
- Health worker details: role, qualifications, availability
- Patient visits: age, gender, diagnosis, outcome
- Disease reports: cases and deaths over time
- Inventory data: stock levels, reorder thresholds, restock dates

Note: For demonstration purposes, only a subset of the data was loaded from Redshift to ensure fast performance and efficient rendering.

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1. Facility Dashboard Tab

Purpose:

Provides an overview of individual PHC facilities, including key metrics, patient visits, and health worker counts.

Functionalities:

- Dropdown to select a facility
- Displays key metrics:
  - Number of Health Workers
  - Number of Beds
  - Average Daily Patients
- Line chart showing patient visits over time

Data Selection:

- Only facilities with operational_status as Functional or Partially Functional are considered
- Patient visits are filtered by facility_id
- Limited number of records are used for performance

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2. PHC AI Chatbot Tab

Purpose:

An intelligent assistant that answers natural-language queries about facilities, stock, patients, health workers, and diseases.

Capabilities:

The AI chatbot responds to queries related to:

Facility / Operational Status Queries:

- “Which facilities are in operation in Lagos?”
- “Show me functional PHC in Aba LGA.”
- “Are PHCs in Abuja active?”
- “List all running PHCs in Kaduna State.”

Inventory / Stock Queries:

- “Which PHC in Abuja have Paracetamol?”
- “What is the stock of Insulin in XYZ facility?”
- “Show available items in Lagos PHCs.”
- “Do any PHCs in Enugu have Amoxicillin?”
- “Stock level of Oxygen in [Facility Name]?”

Health Worker Queries:

- “List all nurses in ABC PHC.”
- “How many doctors are available in Aba LGA?”
- “Show staff in XYZ facility.”
- “Who are the laboratory technicians in Lagos PHC?”

Patient / Visit Queries:

- “Total patient visits in [Facility Name] last month.”
- “How many children visited this facility?”
- “Patient attendance in XYZ PHC.”
- “Number of patients for last week in Lagos PHC.”

Disease Queries:

- “How many malaria cases reported in [Facility Name]?”
- “Total cholera cases in Lagos PHCs.”
- “Forecast malaria cases for next 6 months in XYZ PHC.”
- “Cases of measles in Aba LGA.”

Data Selection:

- Filters queries to functional and partially functional facilities only
- Aggregates relevant data from facilities, patients, workers, inventory, and disease datasets
- Filters by state or LGA if mentioned
- Uses a limited subset of data for responsive demo performance

Example Chatbot Workflow:

- User: “Which PHC in Abuja have Paracetamol?”
- System: Filters functional/partially functional facilities in Abuja
- System: Searches inventory for Paracetamol and returns a table of available stock
- User: “How many nurses are in XYZ facility?”
- System: Filters for functional/partially functional XYZ facility and lists all nurses
- User: “Total malaria cases in Lagos PHC.”
- System: Aggregates disease data for functional/partially functional Lagos PHCs and returns total cases

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3. Disease Forecasting Tab

Purpose:

Visualizes and forecasts disease trends using historical case data.

Functionalities:

- Dropdown to select a disease
- Generates a line chart of historical cases
- Forecasts future disease trends for 6 months using Prophet

Data Selection:

- Only diseases reported in functional/partially functional facilities are considered
- Cases aggregated per month (month_dt)
- Limited historical data used for fast rendering and forecasting

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4. Inventory Overview Tab

Purpose:

Provides detailed stock levels and highlights low-stock items per facility.

Functionalities:

- Dropdown to select a facility
- Displays columns: Item Name, Stock Level, Reorder Level, Last Restock Date
- Automatically highlights low-stock items in red

Data Selection:

- Only includes functional and partially functional facilities
- Numeric columns validated and converted for consistency
- Limited subset of inventory records for smooth performance

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5. Facility Operational Status Tab

Purpose:

Displays the operational status of all facilities clearly.

Functionalities:

- Table shows: Facility Name, State, LGA, Operational Status
- Color coding:
  - Green = Functional
  - Orange = Partially Functional

Data Selection:

- Only functional or partially functional facilities are included
- Limited number of records loaded for fast display

Data Sources and Filtering Logic

- All datasets are stored in Amazon Redshift and loaded with Streamlit caching for efficiency
- Facilities: Filtered for functional and partially functional operational status
- Workers, Patients, Inventory, Diseases: Filtered by facility_id matching selected facilities
- Missing values handled with Pandas .fillna()
- Numeric columns validated and converted to enable charts and metrics

- Subset of data used to make the app responsive for demo purposes

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AI Chatbot Logic Summary

1. Detects facility names mentioned in queries
2. Identifies context keywords: stock, workers, patients, diseases, operational
3. Filters data based on operational status and location (state/LGA)
4. Returns human-readable answers and visualizations (charts for disease forecast)
5. Translates responses into selected language if needed
6. Uses subset of data for efficient demo performance