

ABC Bank Branch Network Dashboard - Technical Summary

Overview

A comprehensive real-time visualization dashboard for monitoring bank branch performance across the United States, featuring interactive mapping, workflow analysis, and live data streaming capabilities.

Key Features

Interactive Geographic Visualization

- **US Map Integration:** Interactive map displaying 56+ bank branches across all US states
- **Dynamic Branch Representation:** Circle-based visualization with size indicating account volume (25-3300+ accounts)
- **Status Indicators:** Color-coded branch status (Normal/Anomaly Detection)
- **Zoom & Pan Controls:** Mouse wheel zoom and drag-to-pan functionality with reset view option

Real-Time Data Streaming

- **Live Updates:** Configurable update intervals (1s, 5s, 15s, 30s)
- **Simulated Data Generation:** Real-time account growth simulation with 90% update probability
- **Visual Feedback:** Pulse rings and animated notifications for data changes
- **Performance Metrics:** Live tracking of total branches, accounts, and update counts

Account Opening Workflow Visualization

- **9-Stage Process Flow:** Complete account opening pipeline from Initial Application to Account Setup
- **Force Simulation:** D3.js physics-based bubble animation showing application progress
- **Milestone Tracking:** Visual representation of applications at each workflow stage
- **Drop-out Analysis:** 5% application drop rate with dedicated tracking
- **Account Type Differentiation:** Separate tracking for Checking and Savings accounts

Analytics & Insights Dashboard

- **Performance Overview:** Branch rankings, account totals, growth metrics
- **Alert Center:** Real-time anomaly detection and status monitoring
- **Growth Trends:** Top performing branches and projected growth calculations

- **Activity Feed:** Real-time activity log with recent updates and changes

Technical Architecture

Frontend Technologies

- **HTML5/CSS3:** Responsive design with modern CSS Grid and Flexbox layouts
- **Vanilla JavaScript:** Pure JS implementation without frameworks for optimal performance
- **D3.js v7.8.5:** Advanced data visualization and force simulation engine
- **TopoJSON v3.0.2:** Geographic data processing and map rendering

Data Visualization Components

- **Geographic Projection:** Albers USA projection for accurate state representation
- **Force Simulation:** Physics-based animation system for workflow bubbles
- **Collision Detection:** Prevents visual overlapping of branch circles and workflow elements
- **Responsive Scaling:** Dynamic font and element sizing based on zoom levels

Real-Time Simulation Engine

- **Data Generator:** Custom algorithm simulating realistic bank branch activity
- **Update Probability:** 90% chance of updates per cycle with random account increments
- **Status Changes:** 5% probability of branch status transitions (Normal ↔ Anomaly)
- **Notification System:** Toast-style notifications with auto-dismiss functionality

Workflow Process Simulation

- **9-Milestone Pipeline:** M1 (Initial) → M9 (Account Opened) progression
- **Timing Controls:** 5-second minimum stay duration per milestone
- **Drop Probability:** 5% application abandonment rate throughout process
- **Speed Controls:** Adjustable simulation speed (1x-10x multiplier)
- **Account Type Distribution:** Configurable Checking/Savings account creation

Performance Optimizations

Efficient Rendering

- **SVG-based Graphics:** Scalable vector graphics for crisp visuals at any zoom level
- **Selective Updates:** Only modified elements are re-rendered during real-time updates
- **Memory Management:** Automatic cleanup of completed animations and notifications

- **Viewport Optimization:** Content clipping and efficient coordinate transformations

Data Management

- **In-Memory State:** Fast data access without external database dependencies
- **Incremental Updates:** Delta-based updates to minimize processing overhead
- **Collision Avoidance:** Optimized force simulation for smooth animations
- **State Persistence:** Maintains application state during view transitions

User Experience Features

Interactive Controls

- **Dual View Modes:** Map overview and detailed workflow views
- **Real-time Toggles:** Start/stop/pause controls for live data streaming
- **Workflow Simulation:** Independent simulation controls with speed adjustment
- **Filter Options:** Account type filtering for workflow analysis

Responsive Design

- **Mobile-Friendly:** Responsive layout adapting to different screen sizes
- **Touch Support:** Mobile gesture support for zoom and pan operations
- **Accessibility:** High contrast colors and readable font sizing
- **Cross-Browser:** Compatible with modern web browsers

Visual Feedback

- **Hover Tooltips:** Detailed information on mouse hover
- **Pulse Animations:** Visual indicators for real-time updates
- **State Transitions:** Smooth animations between different views
- **Progress Indicators:** Clear visual representation of workflow stages

Data Model

Branch Entity

```
javascript
```

```
{  
  name: "Branch Name",  
  state: "State Code",  
  lat: latitude,  
  lng: longitude,  
  accounts: account_count,  
  status: "Normal|Anomaly Detected"  
}
```

Application Entity

```
javascript
```

```
{  
  id: unique_identifier,  
  milestone: "M1-M9|Dropped",  
  accountType: "checking|savings",  
  createdAt: timestamp,  
  progressHistory: [milestone_array]  
}
```

Deployment Requirements

- **Static Hosting:** Can be deployed as static files (HTML/CSS/JS)
- **No Backend Dependencies:** Fully client-side implementation
- **Local Assets:** All libraries and data files can be stored locally
- **CORS Considerations:** Requires HTTP server for external data sources

Future Enhancement Opportunities

- **API Integration:** Connect to real banking systems for live data
- **Historical Analytics:** Time-series data analysis and trending
- **Advanced Filtering:** Complex query capabilities for branch analysis
- **Export Functionality:** Data export and reporting features
- **Multi-Bank Support:** Extension to multiple banking institutions