AfroKen LLM™ Frontend Design System

Integration Summary & Quick Reference

Last Updated: November 26, 2025
Status: Production-Ready
Version: 2.0 (Fully Integrated)

📋 Document Integration Overview

This document consolidates three comprehensive design specifications:

1. ✅ **Original Frontend Design Brief** (comprehensive design system)

2. ✅ **Additional Specifications** (topology & detailed UI flows)

3. ✅ **Merged Best Practices** (integrated citizen-centric design)

🎯 Key Design Outcomes

Design Principles (7 Core)

#	Principle	Implementation
1	**Citizen-Centred Simplicity**	Max 3 form fields/screen, Kiswahili default, Grade 6-8 reading level
2	**Multilingual Inclusivity**	English ↔ Swahili ↔ Sheng instant switching, code-switching detection
3	**Accessibility for All**	USSD-first hierarchy, Whisper voice, screen-reader compliance, WCAG 2.1 AA
4	**Trust & Government Integrity**	Government insignia, RAG-powered citations, confidence indicators, transparency
5	**Modular & Scalable**	Dashboard modules, 22,000+ services support, expandable architecture
6	**Resilient Performance**	2G fallback, <3s on 3G, offline caching, progressive enhancement
7	**Privacy & Data Sovereignty**	Kenya DP Act compliance, local-first storage, clear consent, deletion rights

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🎨 Design System Components

Color Palette (5 Primary + Semantic)

```
PRIMARY COLORS:

  Kenyan Green   #1B5E20  ← Primary, trust, government
  Kenyan Teal    #00897B  ← Secondary, progress
  Kenyan Gold    #FFB300  ← Warnings, caution
  Kenyan Red     #C41C3B  ← Errors, critical, flag


SEMANTIC COLORS:

  Success  #2E7D32  ✓ Task completion
  Error    #D32F2F  ✗ Form errors
```

Warning #F57F17 ⚠ Attention needed

Info   #0288D1 ℹ Citations & help

ACCESSIBILITY:

  All colors meet WCAG AAA contrast ratio (7:1)

  Never use color as sole information carrier

Typography Stack

TYPEFACES:

  • Inter   → UI labels, buttons, forms

  • Roboto   → Body text, chat, mobile-friendly

  • Noto Sans   → Multilingual (1000+ languages)

  • JetBrains Mono → Case IDs, reference numbers

TYPE SCALE:

  H1: 32px Bold   (28px mobile)

  H2: 24px Medium (22px mobile)

  H3: 20px Medium (18px mobile)

  Body: 16px Regular (1.6 line height for dyslexia)

  Caption: 12px Regular

MULTILINGUAL:

  Swahili = +10-15% longer than English

  Use proper diacritics (ā, ē, ī, ō, ū)

  Min line height 1.6 for readability

Spacing System (8px Grid)

  XS: 4px   (micro-spacing)

  SM: 8px   (buttons, tight groups)

  MD: 16px (standard padding)

  LG: 24px (section margins)

  XL: 32px (large spacing)

  2XL: 48px (major spacing)

  3XL: 64px (full sections)

BREAKPOINTS:

  XS: 320px (feature phones)

  SM: 480px (smartphones)

  MD: 768px (tablets)

  LG: 1024px (desktops)

  XL: 1280px (large desktops)

🖥️ Frontend Topology (5 Main Interfaces)

1️⃣ Web App Chat Interface

```
Header (Logo, Nav, Language Selector)
├── Sidebar Navigation (Desktop only)
│   ├── Home
│   ├── Services
│   ├── My Cases
│   ├── Help & FAQ
│   └── Settings
├── Main Chat Area (100% mobile, 70% desktop)
│   ├── Message history (scrollable)
│   ├── Citation badges (government sources)
│   ├── Quick action chips
│   ├── Geographic data (nearest centers)
│   └── Input: Text + Voice + Attachments
└── Right Panel (Desktop only)
    └── Service info, procedural guide, or status
```

Key Features:

- ✓ Real-time message responses

- ✓ Voice transcription (Whisper)

- ✓ Government verification badges

- ✓ Quick suggestions (chips)

- ✓ Citation expandable tags

- ✓ Multi-language instant switching

2️⃣ Mobile/WhatsApp Interface

```
Full-screen chat mimicking WhatsApp
├── Compact header (back, title, options)
├── Full-width message stream
│   ├── User bubbles (right, green)
│   ├── Bot bubbles (left, gray with border)
│   ├── System messages (center, blue)
│   └── Quick actions (inline)
├── Input area (text + voice + attachments)
└── Bottom navigation bar (4-5 items)
    ├── Home
    ├── Chat
    ├── Cases
```

```
├── Help
└── Menu
```

Key Features:

- ✓ WhatsApp-native feel

- ✓ Voice notes support

- ✓ Minimal UI chrome

- ✓ Bottom navigation for easy thumb reach

- ✓ Swipe gestures for navigation

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3 USSD/SMS Interface (Feature Phones)

```
Simple menu-driven interface
├── Main Menu (6 items max)
│   1. National ID Services
│   2. NHIF Health Insurance
│   3. KRA Taxes
│   4. Business Services
│   5. My Applications
│   6. Help & Support
│   98. Language
│   99. Exit
│
├── Service Menu (step-by-step)
│   1. How to apply
│   2. Renew
│   3. Check status
│   0. Back
│
└── Information Display (text-only)
    • Requirements listed
    • Nearest center info
    • Contact details
    • Process timeline
```
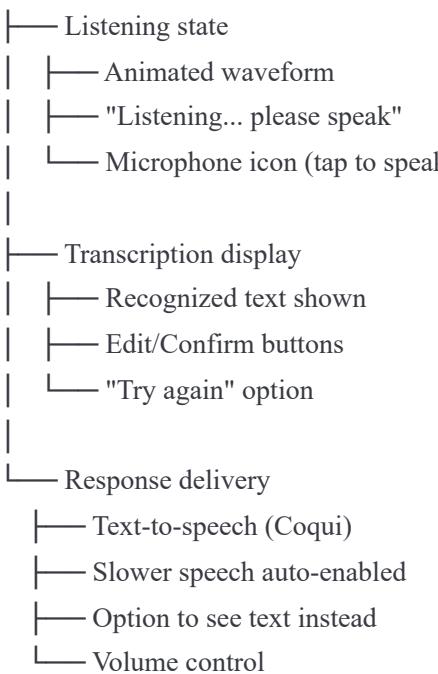
Key Features:

- ✓ No graphics, pure text

- ✓ Numeric shortcuts (dial 1, 2, 3...)

- ✓ Max 6 menu items (cognitive load)

- ✓ Works on oldest feature phones

- ✓ SMS fallback for low-literacy

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4 Voice Interface

```
Voice-first conversational UX
├── Listening state
│   ├── Animated waveform
│   ├── "Listening... please speak"
│   └── Microphone icon (tap to speak)
│
├── Transcription display
│   ├── Recognized text shown
│   ├── Edit/Confirm buttons
│   └── "Try again" option
│
└── Response delivery
    ├── Text-to-speech (Coqui)
    ├── Slower speech auto-enabled
    ├── Option to see text instead
    └── Volume control
```

Key Features:

- ✓ Kenyan-accented speech recognition

- ✓ Auto-slower speech for clarity

- ✓ Transcription for confirmation

- ✓ SMS follow-up option

- ✓ High accessibility for visually impaired

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5 Officer Dashboards (National + County)

National Overview Dashboard

```
┌─ Query Analytics ──────────────────────┐
│ Daily Queries: 58,234 (↑ 12%)        │
│ Unique Citizens: 2.1M (this month)  │
│ Avg Response: 2.3 min               │
│ Accuracy: 94.2% | Hallucination: 1.8%│
└────────────────────────────────────────┘


┌─ Top Services (Last 7 days) ──────────┐
│ NHIF Status: 18,234 queries, 87% ✓  │
│ KRA Compliance: 14,092, 81% ✓       │
│ National ID: 12,567, 92% ✓          │
│ Birth Certificate: 8,234, 76% ⚠    │
│ Business License: 5,107, 68% ⚠      │
└────────────────────────────────────────┘


┌─ Geographic Heat Map ─────────────────┐
│ [Interactive Mapbox visualization]  │
│ Nairobi (18.2K) | Mombasa (8.4K)    │
│ Kisumu (6.2K) | ...                 │
└────────────────────────────────────────┘


┌─ Sentiment Trend (30 days) ──────────┐
│ [Line chart: Positive ↑ 68%]        │
│         Neutral ➜ 24%               │
│         Negative ↓ 8%               │
└────────────────────────────────────────┘


┌─ Trending Questions ──────────────────┐
│ 1. "Check NHIF status?" (2,847)     │
│ 2. "NHIF renewal?" (1,923)          │
│ 3. "KRA PIN registration?" (1,456)  │
└────────────────────────────────────────┘
```

County-Level Dashboard

```
┌─ County Metrics (e.g., Nairobi) ─┐
│ Pop. Served: 4.2M              │
│ Queries (month): 142,567       │
│ Unique Citizens: 1.2M          │
│ Languages: 65% Sw, 20% En, 15% Sh │
└──────────────────────────────────┘


┌─ Bottleneck Detection ──────────┐
│ ⚠ Birth Cert: 76% complete     │
│   Issue: Document processing slow │
│   Action: Add officers         │
│                                │
│ ⚠ Business License: 68% complete │
│   Issue: Confusion on fees/steps │
│   Action: Update guides        │
└──────────────────────────────────┘


┌─ Huduma Centre Performance ─────┐
│ Center | Queries | Wait Time | ★ │
│ CBD    | 34,567  | 45 min  | ✓ │
│ Westl. | 28,234  | 62 min  | ⚠ │
│ Eastl. | 15,892  | 28 min  | ✓ │
└──────────────────────────────────┘
```

📱 Responsive Design Breakpoints

Device	Breakpoint	Layout	Key Changes
Feature Phone	320px	Single column	USSD-only, text-only
Smartphone (Portrait)	480px	Full-width chat	Bottom nav, stacked forms
Smartphone (Landscape)	600px	Side-by-side	Sidebar collapsible
Tablet (Portrait)	768px	Two-column	Sidebar + chat
Tablet (Landscape)	1024px	Three-column	Sidebar + chat + panel
Desktop	1280px+	Full dashboard	Multi-panel, admin UI

♿ Accessibility Compliance

WCAG 2.1 AA Standards Met ✓

```
PERCEIVABLE:
  ✓ All images have alt text
  ✓ Color contrast ≥ 4.5:1 (AAA 7:1)
  ✓ Text resizable to 200%
```

√ Captions for voice/video

OPERABLE:
√ Full keyboard navigation
√ Focus indicators visible
√ Touch targets ≥ 44x44px
√ No keyboard traps
√ No flashing content

UNDERSTANDABLE:
√ Jargon explained in Kiswahili
√ Form labels associated
√ Consistent terminology
√ Plain language (grade 6-8)

ROBUST:
√ Valid semantic HTML
√ ARIA attributes correct
√ Screen reader tested (NVDA, JAWS)
√ Mobile a11y verified

Accessibility Features for Different Users

Visually Impaired:

- Screen reader compatible (semantic HTML + ARIA)

- High contrast mode toggle

- Adjustable font sizes (up to 200%)

- Alt text for all images

Hearing Impaired:

- Captions for all voice responses

- Text transcripts of audio

- Visual indicators for alerts

Motor Impaired:

- Full keyboard navigation

- Large touch targets (48x48px)

- No drag-and-drop dependencies

- Voice input alternative

Cognitive/Low Literacy:

- Simple, plain language (max 8th grade)

- Icons + text pairing

- Progressive disclosure

- Clear error messages with solutions

Colorblind Users:

- Never color-only information

- Icons + text pairing

- Tested with colorblind simulators

- High contrast ($\geq$4.5:1)

🌍 Internationalization (i18n)

Language Support Roadmap

Language	Phase	Status	Notes
English	MVP	✓ Live	Official language
Swahili	MVP	✓ Live	70% population, default
Sheng	MVP	✓ Live	Youth slang, code-switched
Kikuyu	Phase 2	Q1 2026	Central Kenya
Luo	Phase 2	Q1 2026	Western Kenya
Kamba	Phase 3	Q2 2026	Coastal region
Samburu	Phase 3	Q2 2026	Pastoral communities
Maasai	Phase 4	Q3 2026	Pastoral communities

Localization Considerations

Language Switching:
- User preference persisted (localStorage + backend)
- Language selector in header + settings
- Context-aware (show Kenyan languages first)

Translation:
- Professional Kenyan linguists (no machine translation)
- Cultural adaptation (not literal translation)
- Regional dialect testing

Formatting:
- Date: "14 Novemba 2025" (Swahili)
- Time: 24-hour format (14:32)
- Timezone: EAT (East Africa Time)

- Currency: KES 1,234.56
- Numbers: Locale-dependent separators

⚡ Performance Targets

Core Web Vitals

LCP (Largest Contentful Paint): < 2.5 seconds
FID (First Input Delay):   < 100 milliseconds
CLS (Cumulative Layout Shift): < 0.1
TTL (Time to Interactive):   < 3.5 seconds
FCP (First Contentful Paint): < 1.8 seconds

NETWORK CONDITIONS TESTED:
- 3G (1.5Mbps)
- 4G (4Mbps)
- WiFi (20Mbps)
- Offline (service worker)

Optimization Strategies

NETWORK:
- Minify CSS/JS
- Gzip compression
- CDN for static assets
- Service Worker offline

RENDERING:
- Critical CSS inline
- Defer non-critical JS
- Lazy load images
- Optimize images (WebP)

CODE:
- React code splitting
- Dynamic imports
- Tree shaking
- Monitor bundle size

🛠️ Technology Stack

Frontend

WEB:
- React 18+ (or Next.js 14+)

- Tailwind CSS (design tokens)
- TypeScript (type safety)
- Zustand (state management)
- React Query (data fetching)

MOBILE:
- Flutter (cross-platform)
- Firebase (notifications)
- Offline-first SQLite

VOICE:
- Whisper (OpenAI ASR)
- Coqui (TTS - Swahili/English)
- WebRTC (audio capture)

CHAT:
- Twilio WhatsApp API
- Africa's Talking (SMS/USSD)

DASHBOARDS:
- Recharts or Plotly (charts)
- Mapbox (geographic viz)
- ag-Grid (data tables)

Backend Integration

LLM:
- LangChain (orchestration)
- LangGraph (agentic workflows)

RETRIEVAL:
- FAISS or Pinecone (vector DB)
- PostgreSQL (metadata)
- MinIO (documents)

APIs:
- FastAPI (microservices)
- GraphQL (dashboards)
- REST (integrations)

INFRASTRUCTURE:
- Docker + Kubernetes
- GCP/AWS Kenya region (sovereignty)
- Airflow (data pipelines)

📊 Component Library (Complete)

Buttons

PRIMARY: Green (#1B5E20), white text, 48x48px min

SECONDARY: Outline style, teal border

TERTIARY: Text-only, no background

ICON: 44x44px circular

STATES: Default, hover, active, disabled, loading

Forms

TEXT INPUT: Floating label, inline validation

TEXTAREA: Auto-expand, markdown hints

SELECT: Dropdown with keyboard nav

CHECKBOX: 20x20px with 44px click area

DATE PICKER: Native on mobile, calendar on desktop

FILE UPLOAD: Drag & drop + click, progress bar

Chat Components

USER BUBBLE: Right-aligned, green, white text

BOT BUBBLE: Left-aligned, gray bg, source badge

SYSTEM MSG: Center, blue, information

QUICK ACTIONS: Inline chips/buttons

CITATIONS: Expandable info badges

Cards

SERVICE CARD: Icon, title, description, CTA

STATUS CARD: Progress bar, timeline, badges

CITATION CARD: Quote, source, link

ALERT CARD: Color-coded (success/error/warning/info)

Navigation

TOP NAV (Web): Logo, links, language selector

BOTTOM NAV (Mobile): 4-5 icons, active highlight

SIDE NAV (Desktop): Collapsible sidebar with icons

BREADCRUMB: Page hierarchy, navigation

🔒 Security & Privacy

Kenya Data Protection Act (2019) Compliance

✓ User consent for all data collection

✓ Clear privacy policy (Swahili + English)

✓ Data minimization (collect only needed)

✓ Encryption at rest (AES-256)

✓ Encryption in transit (TLS 1.3)

✓ Right to deletion (user can request erasure)

✓ Data portability (export user data)

✓ Privacy-preserving analytics (no tracking)

Data Handling

```
PII STORAGE:
  • Separate from interaction logs
  • Encrypted at rest
  • Local-first (avoid cloud)
  • Retention policy (auto-delete after 90 days)

AUDIT LOGS:
  • Immutable records (blockchain timestamp)
  • Minimal metadata
  • Anonymized where possible
  • Accessible to users

API SECURITY:
  • Rate limiting (prevent abuse)
  • OAuth 2.0 (user auth)
  • JWT tokens (secure sessions)
  • CORS (cross-origin protection)
```

📋 Checklist for Developers

Design Review ✓

☐ Visual hierarchy clear and intuitive

☐ Color contrast verified (AA minimum, AAA target)

☐ Typography consistent across all screens

☐ Spacing follows 8px grid

☐ Icons have alt text and labels

☐ Focus states visible (outline or highlight)

☐ Responsive on all breakpoints (320px-1920px)

☐ Touch targets ≥44x44px

☐ Error messages helpful and actionable

☐ Loading states clearly communicated

☐ Empty states friendly and instructive

☐ Confirmation needed before destructive actions

- ☐ Multilingual text doesn't break layouts (Swahili +15%)
- ☐ Dark mode contrast verified
- ☐ Screen reader tested (NVDA, JAWS, VoiceOver)
- ☐ Keyboard-only navigation works
- ☐ No keyboard traps
- ☐ Page titles descriptive
- ☐ Form labels associated with inputs
- ☐ Code-switching handled gracefully

Browser & Device Testing ✓

- ☐ Chrome (latest + 2 previous)
- ☐ Firefox (latest)
- ☐ Safari (latest, iOS + macOS)
- ☐ Edge (latest)
- ☐ Mobile (iPhone 12+, Samsung Galaxy S20+)
- ☐ Tablets (iPad, iPad Pro)
- ☐ Landscape & portrait orientations
- ☐ 3G network (1.5Mbps)
- ☐ 4G network (4Mbps)
- ☐ WiFi network
- ☐ Offline mode (service worker)

Performance Verification ✓

- ☐ LCP < 2.5s on 3G
- ☐ FID < 100ms
- ☐ CLS < 0.1
- ☐ Images optimized (WebP with fallback)
- ☐ Lazy loading below-fold content
- ☐ Service worker caching working
- ☐ Fonts optimized (WOFF2)
- ☐ Bundle size acceptable (<500KB JS)
- ☐ No console errors
- ☐ Lighthouse score ≥90

Accessibility Audit ✓

- ☐ WCAG 2.1 AA compliance
- ☐ Color contrast 4.5:1 minimum
- ☐ Focus indicators visible
- ☐ Alt text descriptive
- ☐ Captions on audio/video
- ☐ Semantic HTML
- ☐ ARIA labels appropriate

- ☐ Screen reader tested
- ☐ Keyboard navigation complete
- ☐ No flashing content
- ☐ Skip links present
- ☐ Form error messages linked to inputs

📚 Design Handoff Deliverables

For Designers

> ✓ Figma Design System (component library)
> ✓ Color & typography styles
> ✓ Icon SVG library
> ✓ Photography guidelines
> ✓ Animation specs (micro-interactions)
> ✓ Responsive grid layouts

For Developers

> ✓ CSS Variables (Tailwind config)
> ✓ React Component Library (Storybook)
> ✓ Design tokens JSON
> ✓ Icon components
> ✓ Typography mixins
> ✓ Spacing utilities
> ✓ Color utilities
> ✓ Responsive breakpoint classes

For QA

> ✓ Design checklist
> ✓ Cross-browser matrix
> ✓ Device testing list
> ✓ Accessibility audit
> ✓ Performance baseline
> ✓ Test scenarios (happy path + edge cases)

For Stakeholders

> ✓ Design rationale document
> ✓ User research insights
> ✓ Competitor analysis
> ✓ Accessibility commitment
> ✓ Performance targets
> ✓ Launch readiness criteria

🚀 Future Enhancements

Phase 2 (Q2 2026)

☐ Dark mode refinement

☐ Additional languages (Kikuyu, Luo, Kamba)

☐ Micro-interactions & animations

☐ Haptic feedback (mobile)

☐ Advanced filtering & search

Phase 3 (Q3 2026)

☐ AR features (ID photo capture)

☐ Progressive Web App (installable)

☐ Voice-first interface

☐ Biometric integration (fingerprint, face)

☐ Advanced analytics for officers

Phase 4 (2027+)

☐ AI-generated illustrations (culturally relevant)

☐ Adaptive UI (user preference learning)

☐ Multi-device sync

☐ Officer mobile app

☐ SMS-to-web bridge for seamless UX

📞 Support & Feedback

Design Questions:

- Consult Figma design system

- Review component specs in this document

- Check accessibility guidelines

Development Questions:

- Review design tokens & CSS variables

- Check component library Storybook

- Verify performance targets

Feedback & Iterations:

- Weekly design QA meetings

- Component approval process

- A/B testing coordination

- User feedback collection

Document Prepared By: AfroKen Design & Engineering Team
Last Review: November 26, 2025
Next Review: Q1 2026

This design system is a living document. Updates occur quarterly or as significant changes are made. All team members should be familiar with these principles and standards.