

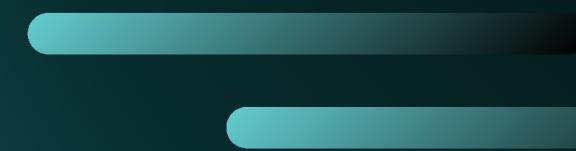
IRENO



IRENO Smart Assistant: AI-Powered Electric Utility Management System

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Introduction

- What is IRENO?
 - Intelligent electric utility management platform for smart grid operations
 - AI-powered assistant for real-time monitoring and decision support
 - Comprehensive solution for utility operators, field technicians, and management

Domain Information

- Collector: A device/system that gathers meter readings (from smart meters) at regular time intervals.
- Interval Read Success (%): Percentage of successful meter data readings collected within a given time interval.
- Read Interval success rate (weekly ,Monthly):The time gap at which the collector pulls data
- KPI :Key Performance Indicators in IRENO
- Collector Health → how well collectors are communicating.
- HES API Latency → time taken to fetch data from Head-End System.
- MDMS Processing Success → how many collected reads were successfully validated/stored.
- Zone-Level Performance → success rates grouped by geographical zones (East, West, etc.).

Problem Statement

1

Electric utility management faces critical challenges with data scattered across disconnected systems, making real-time monitoring and decision-making inefficient.

2

Technical documentation and Standard Operating Procedures are buried in complex file systems, causing delays during emergencies when quick access to information is crucial.

3

The lack of unified dashboards and natural language interfaces forces operators to navigate multiple complex systems, resulting in increased downtime, slower incident response, and reduced system reliability.

TECHNICAL TOOLS &

TECHNOLOGIES

01 Frontend Technologies:

- React.js 18+ - Modern UI framework
- Vite - Fast build tool and development server
- CSS Modules - Component-scoped styling
- Context API - State management
- Fetch API - HTTP client for backend communication

02 Backend Technologies:

- Flask - Python web framework
- SQLAlchemy - Database ORM
- PyMySQL - MySQL database connector
- Flask-CORS - Cross-origin resource sharing
- Werkzeug - Password hashing and security

03 AI/ML Stack:

- Azure OpenAI - GPT-4o model deployment
- LangChain - AI agent framework and tool integration
- Tool-calling Agents - Specialized function execution
- Conversation Memory - Context-aware interactions

04 Cloud & Storage:

- Azure Blob Storage - Document storage and retrieval
- Azure OpenAI Service - Managed AI model hosting
- MySQL - Relational database management
- Environment Configuration - Secure credential management

05 API Integration:

- IRENO Device Management API - Real-time collector monitoring
- IRENO KPI Management API - Performance metrics and analytics
- Custom Tool Framework - 9 specialized data retrieval tools
- RESTful Architecture - Standardized API design

METHODOLOGY

Phase 1: System Design & Architecture

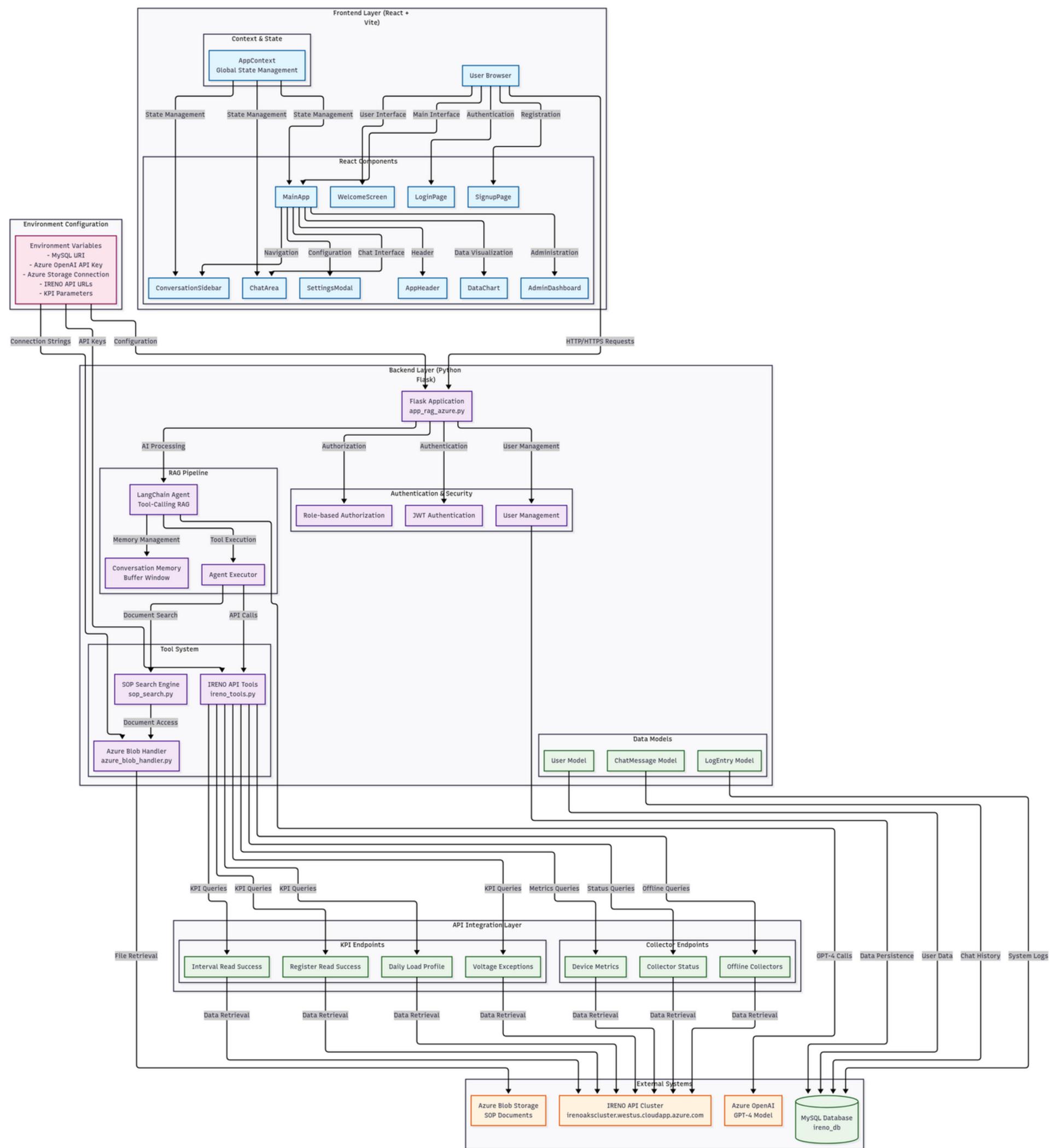
Phase 2: Core Backend Development

Phase 3: AI Integration & Tool Development

Phase 4: Frontend Development

Phase 5: Testing & Quality Assurance

System Architecture



End User Journey Flow

1. Account Creation & Authentication

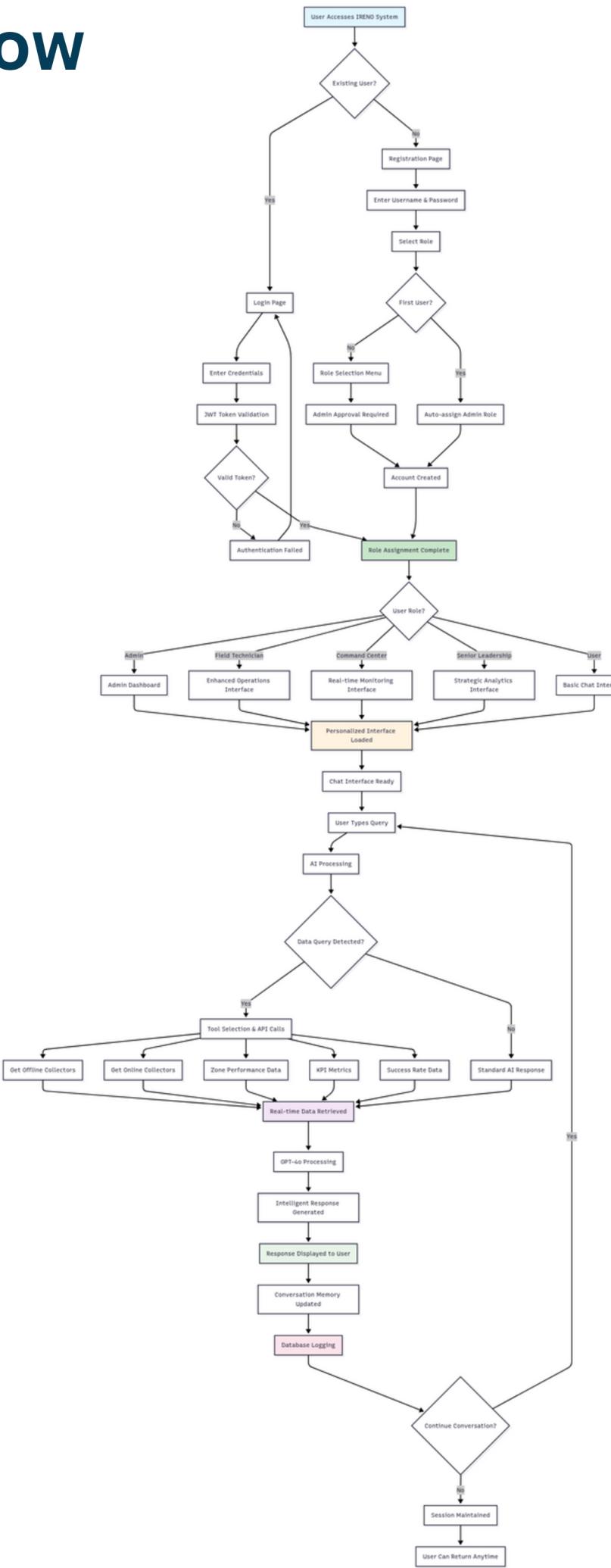
- First User: Automatically becomes Admin
 - Subsequent Users: Choose role during signup (Admin approval required for elevated roles)
 - JWT Token: 12-hour secure session management
 - Persistent Login: Automatic session restoration

2. Personalized Dashboard

- Role-based UI: Different interfaces based on user permissions
 - Conversation History: Persistent chat history across sessions
 - Quick Actions: Role-specific shortcuts and tools

3. AI-Powered Interactions

- Natural Language: Ask questions in plain English
 - Real-time Data: Access to live IRENO system metrics
 - Context Awareness: AI remembers conversation history (10 messages)
 - Anti-hallucination: Guaranteed accurate data from live APIs



User Types & Access Levels

Role	Access Level	Capabilities
Admin	Full System Access	User management & deletion
Field Technician	Enhanced Operations	Zone-specific diagnostics
Command Center	Real-time Monitoring	Operational insights
Senior Leadership	Strategic Analytics	Strategic insights
User	Basic Chat Access	Basic system queries

What End Users Can Ask

Performance Queries

"What was the interval read success rate on August 10th, 2025?"

"Which zone has the highest offline collectors?"

"Show me Brooklyn's performance this week"

"Compare Queens vs Manhattan collector status"

Operational Insights

"How many collectors are offline in Bronx?"

"What's the total collector count by zone?"

"Show me the last 7 days performance trends"

"Which areas need immediate attention?"

Strategic Analysis

"Monthly performance summary for all zones"

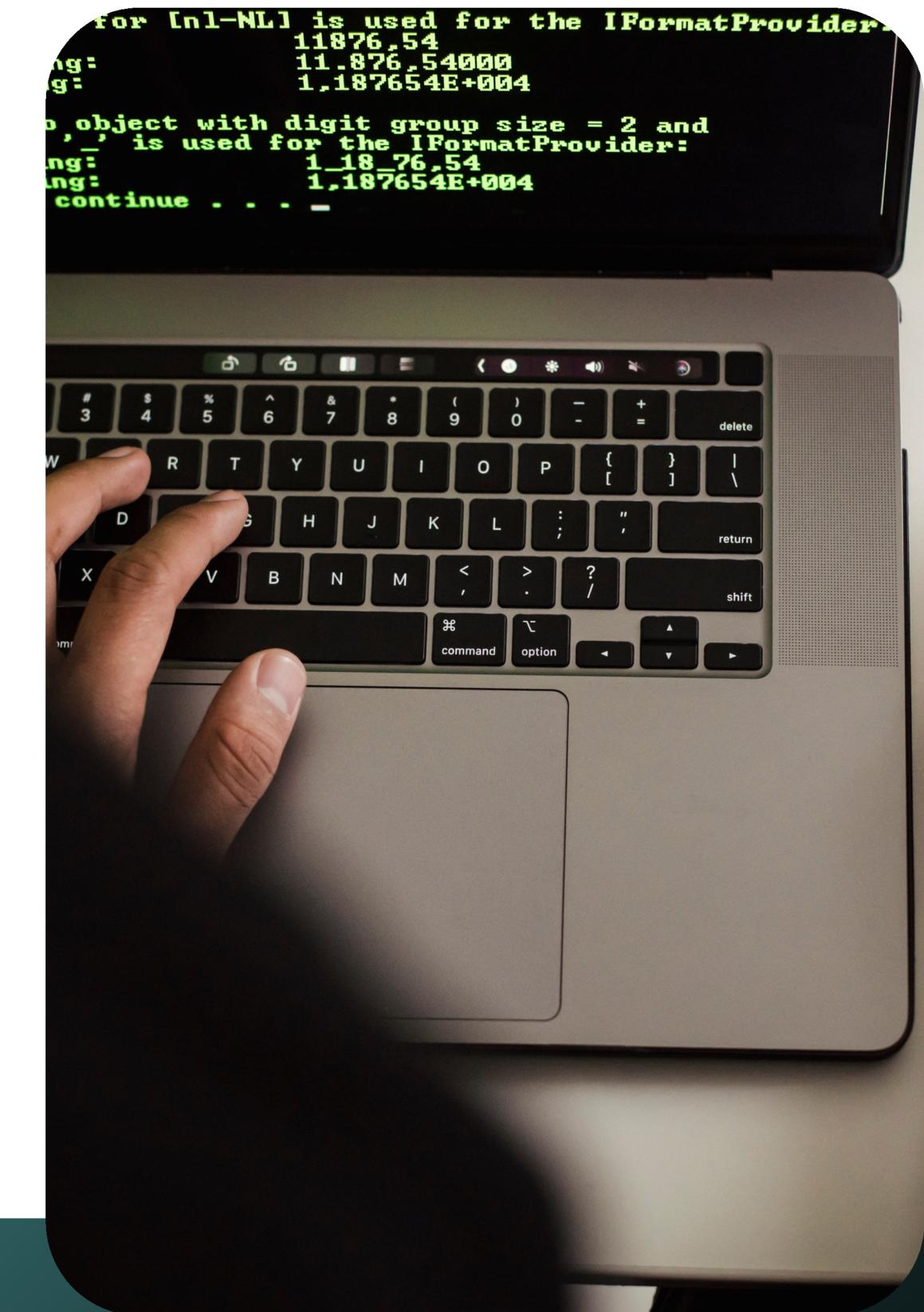
"Identify underperforming areas"

"Generate KPI report for senior management"

"What are the system-wide statistics?"

Future Scope

- Voice Interface: Voice commands for hands-free operation
- Multi-language Support: Internationalization capabilities
- Computer Vision: Visual inspection and analysis capabilities
- Security & Compliance: Multi-factor authentication and encryption
- image extraction from documents.



Thank You !

