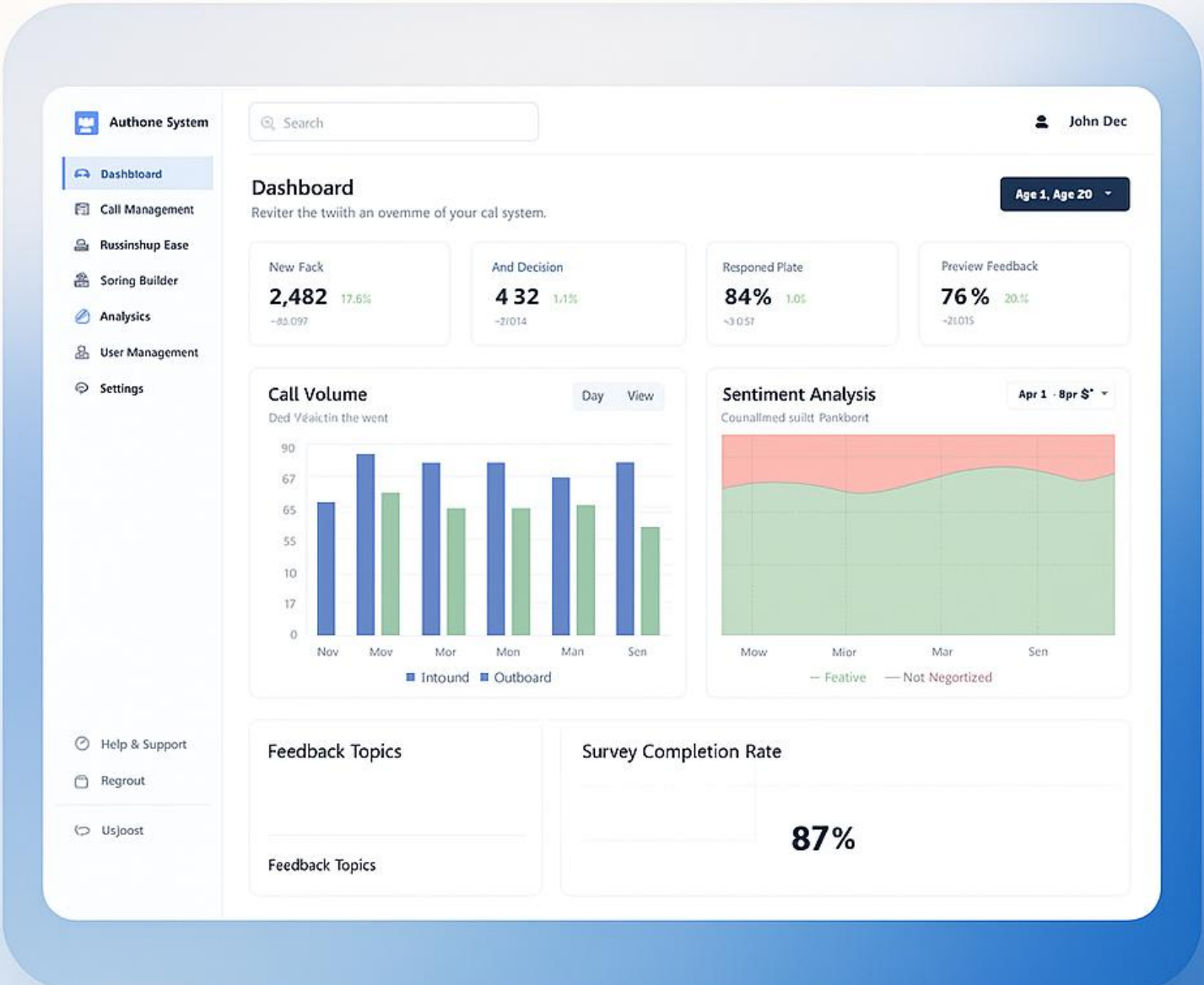
LLM-ENHANCED PHONE FEEDBACK SYSTEM



SPECIFICATIONS FOR LLM-ENHANCED PHONE FEEDBACK SYSTEM

1. PROJECT OVERVIEW

The LLM-Enhanced **Phone Feedback System** is an automated solution that uses large language models to conduct phone surveys and collect structured feedback from users. The system integrates with telephony services to make outbound calls and process inbound calls, with an intelligent AI agent handling the conversations using **Chain-of-Thought (CoT)** reasoning to adapt to user responses.

2. SYSTEM ARCHITECTURE

2.1 Core Components

1. Web Interface

- Dashboard
- Knowledge Manager
- Call Manager
- Survey Builder
- User Manager
- Twilio Integration
- Analytics & Reporting

2. Backend Services

- REST API
- Authentication Service
- Role & Permissions Manager
- Call Scheduler

3. Knowledge Processing

- Document Storage
- Text Extraction
- Text Chunking
- Embedding Service
- Vector Database

4. Telephony Services

- Twilio Connector
- Call Recording
- Speech-to-Text (STT)
- Text-to-Speech (TTS)

5. LLM Agent System

- LLM Orchestrator
- Chain-of-Thought Engine
- Prompt Templates
- Action Tools (Knowledge Base, Survey, Sentiment, Logging)

6. Database Layer

- MongoDB for document and structured data
- Redis for caching and session management
- Vector database for knowledge embeddings

3. FUNCTIONAL REQUIREMENTS

3.1 Authentication & User Management

- Secure login and registration system
- Role-based access control (Admin, Manager, Agent, Viewer)
- User profile management
- Password reset and account recovery

3.2 Knowledge Base Management

- Document upload and processing
- Support for multiple file formats (PDF, DOCX, TXT, CSV)
- Automatic text extraction and chunking
- Vector embedding generation
- Knowledge base organization and tagging

3.3 Survey Builder

- Drag-and-drop survey creation interface
- Multiple question types (open-ended, numeric, yes/no, multiple choice)
- Conditional logic for question branching
- Voice prompt customization
- Survey templates and duplication

3.4 Call Management

- Outbound call campaign creation
- Call scheduling and throttling
- Real-time call monitoring
- Call recording and transcription
- Call status tracking and reporting

3.5 Twilio Integration

- Account configuration
- Phone number management
- Webhook setup and monitoring
- Call logs and usage tracking
- Quality and compliance settings

3.6 LLM Agent Capabilities

- Natural conversation handling
- Chain-of-Thought reasoning for complex scenarios
- Dynamic prompt generation based on context
- Sentiment analysis during calls
- Fallback mechanisms for handling unexpected responses

3.7 Analytics & Reporting

- Call volume and completion metrics
- Survey response analysis
- Sentiment trend analysis
- Feedback topic extraction
- Custom report generation
- Data export (CSV, PDF)

4. TECHNICAL SPECIFICATIONS

4.1 Frontend

- Framework: React.js with React Router
- UI Components: shadcn/ui component library
- Styling: TailwindCSS
- State Management: React Context API or Redux
- Chart Visualization: Recharts
- Form Handling: React Hook Form

4.2 Backend

- **API Framework**: Python with FastAPI
- **Authentication**: Clerk
- **Database**: MongoDB for document storage, Redis for caching
- **Vector Database**: Pinecone or Weaviate
- **File Storage**: S3-compatible storage
- **Task Queue**: Bull or Celery for background processing

4.3 LLM Integration

- **LLM Provider**: OpenAI API (GPT-4) or Anthropic (Claude)
- **Embedding Model**: text-embedding-ada-002 or equivalent
- **Context Window**: Minimum 8k tokens for handling complex conversations
- **Chain-of-Thought**: Structured prompting for reasoning steps
- **Tool Calling**: Function calling for external actions

4.4 Telephony Services

- **Provider**: Twilio
- **Voice Capabilities**: Text-to-Speech, Speech-to-Text
- **Call Recording**: Secure storage with encryption
- **Concurrent Calls**: Configurable based on plan
- **Fallback Mechanisms**: Error handling for dropped calls

4.5 Security Requirements

- **Data Encryption**: All sensitive data encrypted at rest and in transit
- **Authentication**: Strong password policies and MFA support
- **Authorization**: Granular permissions system
- **Audit Logging**: Comprehensive logging of system actions
- **Compliance**: GDPR and CCPA compliance for personal data

5. USER INTERFACE SPECIFICATIONS

5.1 Authentication Pages

- Login page with email/password
- Registration page for new accounts
- Password recovery workflow
- Two-factor authentication (optional)

5.2 Dashboard

- Key performance metrics display
- Recent activity feed
- Upcoming scheduled calls
- Quick action buttons
- Chart visualizations for call metrics and sentiment

5.3 Knowledge Management

- Document upload interface
- Processing status indicators
- Document organization system
- Search and filter capabilities
- Content preview

5.4 Survey Builder

- Visual survey editor
- Question type selection
- Conditional logic builder
- Voice prompt editor
- Survey testing and preview

5.5 Call Management

- Active calls monitor
- Scheduled calls calendar
- Call history and logs
- Campaign management
- Call detail view with transcript and analytics

5.6 Settings

- User profile settings
- Twilio integration configuration
- System preferences
- Voice and TTS settings
- Notification preferences

6. DEPLOYMENT AND INFRASTRUCTURE

6.1 Development Environment

- Docker containers for local development
- CI/CD pipeline with GitHub Actions
- Automated testing framework
- Development, staging, and production environments

6.2 Production Environment

- Cloud hosting (AWS, GCP, or Azure)
- Load balancing for API servers
- Database clustering and replication
- CDN for static assets
- Monitoring and alerting system

6.3 Scalability Considerations

- Horizontal scaling for API servers
- Database sharding for large datasets
- Rate limiting for Twilio API calls
- Caching strategy for frequent queries
- Efficient vector search implementation

7. PROJECT MILESTONES AND DELIVERABLES

7.1 Phase 1: Foundation (Weeks 1-2)

- Project setup and infrastructure
- Authentication system
- Basic UI components
- Database schema design
- Twilio integration framework

7.2 Phase 2: Core Functionality (Weeks 3-4)

- Knowledge base management
- Survey builder
- Call management interface
- LLM integration with basic CoT reasoning
- Initial telephony integration

7.3 Phase 3: Advanced Features (Weeks 7-8)

- Enhanced Chain-of-Thought reasoning
- Sentiment analysis implementation
- Advanced survey logic
- Analytics dashboard
- User and role management

7.4 Phase 4: Refinement (Weeks 5-6)

- UI/UX improvements
- Performance optimization
- Security audit
- Testing and bug fixing
- Documentation

7.5 Deliverables

- Complete source code with documentation
- Database schemas and migration scripts
- User manual and administrator guide
- API documentation
- Deployment instructions

8. SUCCESS CRITERIA

- ✓ System can successfully conduct automated phone surveys
- ✓ LLM agent demonstrates effective Chain-of-Thought reasoning
- ✓ Survey responses are accurately captured and analyzed
- ✓ System can handle at least 100 concurrent calls
- ✓ Analytics provide actionable insights from feedback
- ✓ User interface is intuitive and responsive
- ✓ System maintains 99.9% uptime during operation

9. FUTURE EXPANSION POSSIBILITIES

- ✓ Multi-language support
- ✓ Integration with CRM systems
- ✓ Advanced conversational AI capabilities
- ✓ Predictive analytics for customer sentiment
- ✓ Mobile application for on-the-go management
- ✓ Voice biometrics for authentication
- ✓ Real-time translation services

This specification document provides a comprehensive blueprint for implementing the LLM-Enhanced Phone Feedback System, with detailed requirements for all major components and functionality.

LLM-Enhanced Phone Feedback System: Use Case Overview

➔ PRIMARY USE CASES

1. AUTOMATED CUSTOMER SATISFACTION SURVEYS

Workflow:

1. **Campaign Setup**: An administrator creates a survey campaign, defining questions, target customers, and scheduling parameters.
2. **Outbound Calling**: The system automatically calls customers according to the schedule.
3. **AI Conversation**: When a customer answers, the LLM agent conducts the survey using natural language.
4. **Adaptive Questioning**: Based on customer responses, the agent uses Chain-of-Thought reasoning to ask appropriate follow-up questions.
5. **Response Analysis**: Responses are analyzed for sentiment and key insights.
6. **Reporting**: Results are compiled into actionable reports for business stakeholders.

2. POST-PURCHASE FEEDBACK COLLECTION

Workflow:

1. After a customer makes a purchase, they're added to a feedback queue.
2. The system calls the customer within a defined timeframe (e.g., 3-5 days after purchase).
3. The LLM agent inquires about their satisfaction with both the product and purchasing experience.
4. If issues are detected, the agent notes details for follow-up by customer service.
5. Positive feedback is tagged for potential marketing use (with permission).

3. TECHNICAL SUPPORT FOLLOW-UP

Workflow:

1. After technical support interactions, the system schedules follow-up calls.
2. The agent checks if the issue was resolved satisfactorily.
3. If unresolved, the agent gathers additional information to help support teams understand persistent issues.
4. The system can offer to reconnect customers with support if necessary.
5. Support metrics are tracked and analyzed to improve service quality.

➔ SYSTEM COMPONENTS IN ACTION

Web Interface

1. **Dashboard**: Administrators monitor real-time call statistics, response rates, and sentiment analysis.
2. **Knowledge Base**: Support documentation is uploaded and processed to inform AI responses.

3. **Survey Builder**: Staff create and modify survey flows with conditional logic.
4. **Call Management**: Teams schedule campaigns, monitor active calls, and review completed ones.
5. **User Management**: Admin controls permission levels for different team members.

➔ **AI AGENT WITH CHAIN-OF-THOUGHT REASONING**

1. The AI plans its approach for each call based on survey goals.
2. During conversations, it:
   - ✦ Understands nuanced responses beyond simple yes/no answers
   - ✦ Adapts to unexpected customer inputs
   - ✦ Follows branching logic based on previous answers
   - ✦ Maintains context throughout the conversation
   - ✦ Uses appropriate tones and pacing

➔ **TELEPHONY INTEGRATION**

1. Connects to phone systems through Twilio
2. Manages call queues and retry logic
3. Implements call recording (with appropriate permissions)
4. Handles text-to-speech and speech-to-text conversions

➔ **EXAMPLE SCENARIO**

1. A retail company wants feedback on a recent product line.
2. The marketing team creates a survey with questions about product quality, pricing, and overall satisfaction.
3. They upload a list of recent customers and schedule the campaign.
4. The system automatically calls customers during business hours.
5. When a customer answers, the AI introduces itself: "Hello, this is [Company] calling about your recent purchase. Do you have a few minutes to share your feedback?"
6. Based on customer responses, the AI navigates the conversation naturally, asking follow-up questions as needed.
7. The system records and analyzes all responses, identifying common themes and sentiment.
8. Management reviews the compiled report, noting that 72% of customers mentioned price concerns, prompting a pricing strategy review.

➔ **BUSINESS IMPACT**

1. **Increased Response Rates**: Natural conversation leads to higher completion rates than traditional automated surveys.
2. **Rich Insights**: Open-ended questions yield more detailed feedback than rigid forms.
3. **Cost Efficiency**: Automation reduces the need for human call agents while maintaining conversation quality.
4. **Scalability**: The system can handle thousands of calls simultaneously.

5. **Actionable Data**: Structured analysis helps identify specific improvement opportunities.

This system transforms traditional phone surveys from rigid, menu-driven experiences into natural conversations that yield better insights while reducing operational costs.