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NGORONGORO CONSERVATION AREA AUTHORITY

Software Requirements Specification

NCAA Digital Transformation - Nasera AI: Digital Information and Knowledge System

Version: 1.0

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Status: Draft

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1 Document Information

Field	Value
Project Name	NCAA Digital Transformation - Nasera AI: Digital Information and Knowledge System
Version	1.0
Date	2025-11-12
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Qa Lead	TBD
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Document Status	Draft
Module Code	NASERA_AI
Parent Project	NCAA Digital Transformation - Ngorongoro Gateway System

2 Project Overview

2.1 What Are We Building

2.1.1 System Function

Nasera AI is NCAA's centralized, AI-driven knowledge and information management platform serving as both a digital information hub and an intelligent operational assistant. The system consolidates data from all NCAA departments (Tourism, Finance, Conservation, ICT, Human Resources, Operations) to train specialized AI and ML models that continuously improve accuracy, responsiveness, and relevance. By leveraging Natural Language Processing (NLP) and Large Language Models (LLMs) connected through secured APIs across all NCAA systems, Nasera AI delivers instant answers, predictive insights, and data-driven support to both internal staff and external stakeholders including tourists and tour operators.

2.1.2 Users

- Tourists: Information about NCAA, permits, facilities, wildlife, and regulations via multilingual interface
- Tour Operators: Booking information, permit requirements, operational guidelines, and real-time updates
- NCAA Staff: Operational assistance, data queries, document retrieval, and decision support across all departments
- Management: Predictive analytics, performance insights, and strategic recommendations
- Conservation Officers: Wildlife data analysis, threat intelligence, and research support
- Finance Team: Revenue forecasting, budget analysis, and financial insights
- ICT Team: System monitoring, performance analytics, and technical documentation

2.1.3 Problem Solved

Fragmented institutional knowledge scattered across departments, inconsistent information provided to tourists and operators, time-consuming manual information searches, lack of predictive capabilities for planning, inability to answer complex questions requiring cross-departmental data, language barriers limiting accessibility (English-only systems), and absence of intelligent assistance for data-driven decision-making across the organization.

2.1.4 Key Success Metric

95% accuracy in answering factual questions about NCAA operations, <2 second response time for standard queries, multilingual support (English, Swahili, French, German, Chinese), 80% reduction in manual information requests, predictive analytics with 80%+ forecast accuracy, complete integration with all 10+ NCAA digital systems, natural language interface requiring no technical training, and 24/7 availability for tourists and staff.

2.2 Scope

2.2.1 In Scope

- Centralized knowledge base covering all NCAA departments and operations
- Natural Language Processing (NLP) for question understanding and intent recognition
- Large Language Model (LLM) integration for conversational AI capabilities
- Multilingual support (English, Swahili, French, German, Chinese)
- Web-based conversational interface for tourists and operators
- Mobile app integration for on-the-go queries
- SMS-based query interface for low-connectivity users
- Staff portal for advanced queries and analytics
- API integration with all NCAA systems (Gateway, Mobile, Fleet, Surveillance, BI, Finance, HR)
- Predictive analytics for visitor trends, revenue forecasting, resource allocation
- Machine learning models trained on NCAA-specific data
- Automated content curation and knowledge base updates
- Performance monitoring and accuracy improvement systems
- Administrator interface for content management and model training
- Analytics dashboard for query patterns and system performance
- Document retrieval and summarization from NCAA document repositories

2.2.2 Out Of Scope

- Booking and payment processing (handled by Mobile App and Gateway)
- Real-time vehicle tracking (handled by Fleet Management)
- Live camera feeds (handled by Surveillance System)
- Transactional operations (Nasera AI provides information and insights only)
- Human resources management functions (HR system integration only)
- Financial transaction processing (Finance system integration only)

- Content creation (Nasera AI curates and presents existing content)
- Legal advice or official policy interpretation (provides information only)

3 User Requirements

3.1 Conversational Interface

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-CHAT-NL	Ask questions in natural language (conversational style)	Get information without learning technical query syntax	Must	Supports colloquial language, typos, and incomplete questions. Context-aware multi-turn conversations. Remembers conversation history within session.
FT-NASERA-CHAT-MULTILANG	Interact with Nasera AI in my preferred language	Access information regardless of language barriers	Must	Priority languages: English, Swahili (primary). Secondary: French, German, Chinese. Automatic language detection. Translation quality 95%+ for primary languages.
FT-NASERA-CHAT-CONTEXT	Have multi-turn conversations where AI remembers context	Ask follow-up questions without repeating information	Must	Maintains conversation context for session duration. References previous questions and

Feature Code	I Want To	So That I Can	Priority	Notes
				answers. Clarifies ambiguous queries based on context.
FT-NASERA-CHAT-VOICE	Use voice input for queries via mobile app	Ask questions hands-free while traveling or in the field	Should	Speech-to-text integration. Multilingual voice recognition. Works offline with on-device processing for basic queries.

3.2 Knowledge Base

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-KB-COMPREHENSIVE	Access comprehensive information about NCAA operations, policies, and services	Find accurate answers to any NCAA-related question	Must	Covers: tariffs, regulations, wildlife, conservation, tourism, facilities, history, geography, safety, permits, bookings, accommodation, transportation, accessibility.
FT-NASERA-KB-REALTIME	Receive real-time information synchronized from operational systems	Get current data on availability, capacity, incidents, and operations	Must	API integration with Gateway (capacity), Fleet (availability), Surveillance (incidents), BI (analytics). Data freshness <5

Feature Code	I Want To	So That I Can	Priority	Notes
				minutes for operational queries.
FT-NASERA-KB-STRUCTURED	Access structured data from NCAA databases alongside unstructured documents	Get precise answers from policies, reports, and operational data	Must	Integrates structured data (databases) and unstructured (documents, PDFs, websites). Hybrid retrieval combining keyword and semantic search.
FT-NASERA-KB-UPDATES	Ensure knowledge base is automatically updated as systems change	Trust that information is current and accurate	Must	Automated sync from source systems. Version control for policy documents. Change detection and notification. Manual review for critical updates.

3.3 Predictive Analytics

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-PREDICT-VISITORS	Forecast visitor numbers for upcoming periods	Plan staffing, resources, and capacity management proactively	Must	Daily, weekly, monthly forecasts. Seasonal pattern recognition. Event-based adjustments (holidays, festivals). 80%+ accuracy target

Feature Code	I Want To	So That I Can	Priority	Notes
				for 7-day forecasts.
FT-NASERA-PREDICT-REVENUE	Forecast revenue by category (permits, fees, services)	Support budget planning and financial decision-making	Must	Revenue forecasting by category and gate. Monthly, quarterly, annual projections. Confidence intervals provided. Integration with Finance systems.
FT-NASERA-PREDICT-MAINTENANCE	Predict equipment maintenance needs before failures occur	Schedule preventive maintenance and reduce downtime	Must	Fleet Management integration for vehicle predictions. Infrastructure monitoring for facilities. Risk scoring and prioritization. 30-day advance predictions.
FT-NASERA-PREDICT-THREATS	Predict security threat hotspots and high-risk periods	Deploy security resources proactively	Must	Surveillance System integration. Historical incident analysis. Environmental factor correlation. Geographic and temporal predictions. Daily updates.
FT-NASERA-PREDICT-OPTIMIZATION	Receive optimization recommendations for operations	Improve efficiency and reduce costs based on data-driven insights	Should	Resource allocation recommendations. Route optimization

Feature Code	I Want To	So That I Can	Priority	Notes
				suggestions. Staffing optimization. Cost reduction opportunities. Prioritized by impact.

3.4 Departmental Integration

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-INT-GATEWAY	Query real-time gate operations data (capacity, permits, vehicles)	Provide current operational status to stakeholders	Must	API integration with Gateway System. Current capacity by gate. Permit status queries. Vehicle entry/exit data. <5 minute data freshness.
FT-NASERA-INT-MOBILE	Access booking and user data from Mobile App	Answer questions about reservations and user accounts	Must	Booking status queries. Permit retrieval. User account information (privacy-protected). Upcoming reservations. Payment status (not processing).
FT-NASERA-INT-FLEET	Query fleet data for vehicle availability and performance	Provide transportation information and support fleet optimization	Must	Vehicle availability queries. Maintenance schedules. Fuel efficiency data. Route optimization

Feature Code	I Want To	So That I Can	Priority	Notes
				input. Driver performance (privacy-protected).
FT-NASERA-INT-SURVEILLANCE	Access surveillance data for security insights and threat intelligence	Support security decision-making with AI-powered analysis	Must	Incident data access (security-cleared users only). Threat pattern analysis. Hotspot predictions. Security analytics. Alert correlation.
FT-NASERA-INT-BI	Query BI System data for analytics and reporting	Answer complex questions requiring cross-departmental data analysis	Must	Bidirectional integration - queries BI and feeds AI insights back. Complex analytics queries. Historical trend analysis. Executive reporting data.
FT-NASERA-INT-FINANCE	Access financial data for budget and revenue queries	Support financial planning and reporting with accurate data	Should	Revenue by category and period. Budget utilization. Cost analysis. Financial forecasts. Role-based access control for sensitive data.
FT-NASERA-INT-HR	Query HR data for staffing and performance information	Support HR planning and employee information requests	Should	Staff directory (public information only). Staffing levels by

Feature Code	I Want To	So That I Can	Priority	Notes
				department. Leave schedules (privacy-protected). Performance metrics (aggregated). Training records.

3.5 Staff Portal

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-STAFF-ADVANCED	Access advanced analytics and complex queries beyond tourist information	Perform my job more effectively with AI-powered insights	Must	Staff-only portal with authentication. Advanced query capabilities. Data visualization. Report generation. Export functionality. Role-based access.
FT-NASERA-STAFF-DOCS	Search and retrieve documents from NCAA repositories	Find policies, procedures, and reports quickly without manual searching	Must	Document search across file servers and SharePoint. Semantic search (meaning-based, not just keywords). Document summarization. Version awareness.
	Receive proactive insights and recommendations	Stay informed of important trends and	Should	Role-based insight generation. Daily

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-STAFF-INSIGHTS	relevant to my role	optimization opportunities		briefings. Anomaly alerts. Recommendation engine. Configurable preferences. Email or app notifications.
FT-NASERA-STAFF-ANALYSIS	Perform ad-hoc data analysis using natural language queries	Answer business questions without technical SQL or data science skills	Should	Natural language to SQL translation. Data visualization generation. Statistical analysis. Trend identification. Export results to Excel/PDF.

3.6 Tourist Portal

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-TOURIST-INFO	Ask questions about visiting NCAA in multiple languages	Plan my visit with accurate, easy-to-understand information	Must	Conversational interface on NCAA website and mobile app. Common topics: permits, fees, rules, wildlife, safety, best times to visit, what to bring, accommodation.
FT-NASERA-TOURIST-REALTIME	Get real-time information on capacity and conditions	Make informed decisions about when	Must	Current capacity levels. Weather conditions. Road status. Facility availability. Wildlife sighting

Feature Code	I Want To	So That I Can	Priority	Notes
		and where to visit		reports (recent). Gate wait times.
FT-NASERA-TOURIST-RECOMMENDATIONS	Receive personalized recommendations based on my interests and constraints	Have a better experience tailored to my preferences	Should	Recommendation engine based on: interests (wildlife, culture, photography), time available, season, fitness level, budget. Suggests routes, activities, timing.
FT-NASERA-TOURIST-SMS	Query Nasera AI via SMS when I have no internet access	Get essential information even in low-connectivity areas	Should	SMS gateway integration. Keyword-based queries. Simple responses (character-limited). Common queries: capacity, rules, emergency contacts. English and Swahili.

3.7 Administration

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-ADMIN-CONTENT	Manage knowledge base content and approve updates	Ensure information accuracy and quality control	Must	Content management interface. Approval workflows for critical updates. Version control. Content categorization and tagging.

Feature Code	I Want To	So That I Can	Priority	Notes
				Search and filter functionality.
FT-NASERA-ADMIN-TRAINING	Train and fine-tune AI models using NCAA-specific data	Improve accuracy and relevance for NCAA use cases	Must	Model training interface. Training data curation. Evaluation metrics. A/B testing capability. Model version management. Rollback functionality.
FT-NASERA-ADMIN-ANALYTICS	Monitor system performance, query patterns, and user satisfaction	Identify issues and improvement opportunities	Must	Analytics dashboard: query volume, response times, accuracy metrics, user feedback, popular topics, failed queries, system health. Daily/weekly reports.
FT-NASERA-ADMIN-FEEDBACK	Review user feedback and incorrect responses	Continuously improve system accuracy	Must	User feedback collection (thumbs up/down, comments). Incorrect response flagging. Review queue for administrators. Feedback-driven training.

3.8 Performance Reliability

Feature Code	I Want To	So That I Can	Priority	Notes
FT-NASERA-PERF-RESPONSE	Receive responses to standard queries in under 2 seconds	Have a smooth, real-time conversational experience	Must	Response time <2 seconds for 95% of queries. Complex analytics queries <10 seconds. Caching for common queries. Progressive response for long answers.
FT-NASERA-PERF-AVAILABILITY	Access Nasera AI 24/7 with minimal downtime	Get information whenever needed, regardless of time zone	Must	99.5% uptime target. Redundant infrastructure. Graceful degradation (basic functionality if advanced features unavailable). Scheduled maintenance windows.
FT-NASERA-PERF-SCALE	Use the system even during high-traffic periods (peak tourist season)	Rely on Nasera AI regardless of concurrent users	Must	Auto-scaling infrastructure. Load testing for 500+ concurrent users. Queue management for complex queries. Rate limiting to prevent abuse.
FT-NASERA-PERF-ACCURACY	Trust that responses are accurate and cite	Rely on information for decision-making	Must	95%+ accuracy for factual queries. Source

Feature Code	I Want To	So That I Can	Priority	Notes
	sources when applicable			citation for policies and official information. Confidence scoring. 'I don't know' responses when uncertain.

4 Technical Requirements

4.1 Performance Standards

Requirement	Target	How To Test
Query response time	< 2 seconds for 95% of standard queries, < 10 seconds for complex analytics	Performance testing with representative query mix, load testing with concurrent users
Prediction accuracy	≥ 80% accuracy for visitor forecasts (7-day), ≥ 85% for revenue forecasts (monthly)	Backtesting with historical data, ongoing validation against actuals
Question answering accuracy	≥ 95% accuracy for factual queries about NCAA operations	Human evaluation on curated test set, user feedback tracking
System availability	99.5% uptime	Uptime monitoring over 90-day periods
Translation quality	≥ 95% for English-Swahili, ≥ 90% for secondary languages	Human evaluation by native speakers, BLEU score benchmarking
Concurrent user support	500+ concurrent users without performance degradation	Load testing with simulated concurrent users
API integration latency	< 500ms for API calls to integrated systems	Integration testing with latency monitoring

4.2 Platform Requirements

Platform	Minimum Version	Target Version	Notes
LLM Foundation	GPT-3.5 equivalent or open-source alternative (LLaMA 2 70B)	GPT-4 equivalent or state-of-the-art open-source model	Self-hosted option preferred for data privacy, cloud API fallback acceptable

Platform	Minimum Version	Target Version	Notes
NLP Pipeline	spaCy 3.0+ or NLTK 3.6+	Latest stable versions with custom NCAA models	Multilingual support essential, domain adaptation for conservation/tourism
ML Framework	TensorFlow 2.8+ or PyTorch 1.12+	Latest stable versions	GPU support for training, CPU inference acceptable for deployment
Vector Database	Pinecone, Weaviate, or Milvus	Latest stable with semantic search capabilities	For knowledge base embedding storage and retrieval
Backend Infrastructure	Python 3.9+, FastAPI or Flask	Python 3.11+, FastAPI with async support	Containerized deployment (Docker), Kubernetes for orchestration
Database	PostgreSQL 13+ for structured data	PostgreSQL 15+ with pgvector extension	Conversation history, user profiles, analytics storage

4.3 Security Privacy

Requirement	Must Have	Implementation
Data privacy	True	No storage of personally identifiable information without consent, anonymized analytics, conversation history opt-in, GDPR-style data subject rights
Authentication & authorization	True	OAuth 2.0 for staff portal, role-based access control (RBAC), anonymous access for tourist queries, API key authentication for system integrations
Data encryption	True	

Requirement	Must Have	Implementation
		TLS 1.3 for all communications, AES-256 for data at rest, encrypted API keys, secure credential storage
Audit logging	True	Comprehensive logging of queries (anonymized), system access, administrative actions, API calls, compliance with NCAA audit requirements
Model security	True	Protection against prompt injection attacks, output filtering for inappropriate content, rate limiting, abuse detection

5 External Dependencies

5.1 Third Party Services

Service	What It Does	Criticality	Backup Plan
LLM API Service	Provide large language model capabilities if not self-hosted	High	Self-hosted open-source LLM (LLaMA, Falcon) for data privacy and cost control
Translation Service	Provide machine translation for secondary languages	Medium	Open-source translation models (NLLB, Helsinki NLP)
Speech-to-Text API	Convert voice queries to text for voice interface	Low	On-device speech recognition for basic functionality
SMS Gateway	Enable SMS-based queries and responses	Medium	Web and app interfaces only (SMS nice-to-have)

5.2 Internal Dependencies

System	Integration Type	Data Exchanged	Criticality
Gateway System	RESTful API	Capacity, permits, vehicle entries, operational status	High
Mobile Application	RESTful API + embedded chat widget	Bookings, user data, permit status	High
Fleet Management	RESTful API	Vehicle availability, performance, maintenance data	High

System	Integration Type	Data Exchanged	Criticality
Surveillance System	RESTful API	Incident data, threat intelligence (security-cleared only)	High
BI System	Bidirectional RESTful API + direct database access	All analytics data, historical trends, predictions	High
Finance System	RESTful API	Revenue, costs, budgets (role-based access)	Medium
HR System	RESTful API	Staff directory, staffing levels (privacy-protected)	Medium

6 Release Planning

6.1 Development Phases

Phase	Features Included	Timeline	Success Criteria
Phase 1 (Core Knowledge Base & Tourist Interface - MVP)	['Knowledge base for tourist information (permits, fees, rules, wildlife)', 'Web-based chat interface (English and Swahili)', 'Basic NLP for question understanding', 'Integration with Gateway for real-time capacity', 'Simple admin interface for content management', 'Tourist-facing website and mobile app integration']	16 weeks	Tourist queries answered with 90%+ accuracy, <3 second response time, English and Swahili fully functional, real-time capacity data available
Phase 2 (Staff Portal & System Integration)	['Staff-only portal with authentication', 'Advanced queries and analytics', 'Integration with Fleet, Surveillance, BI systems', 'Document search and retrieval', 'Multilingual expansion (French, German, Chinese)', 'Voice interface (mobile app)', 'Admin analytics dashboard']	16 weeks	All system integrations operational, staff portal adoption by 80%+ of users, multilingual support tested and functional, document retrieval working
Phase 3 (Predictive Analytics & AI Enhancement)	['Visitor forecasting models', 'Revenue prediction', 'Threat	16 weeks	Predictive models achieving 80%+ accuracy,

Phase	Features Included	Timeline	Success Criteria
	hotspot prediction (Surveillance integration)', 'Maintenance prediction (Fleet integration)', 'Optimization recommendations', 'Proactive insights for staff', 'SMS interface', 'Performance optimization']		optimization recommendations generating measurable improvements, SMS interface functional, system optimized for scale

6.2 Release Checklist

- Knowledge base populated with comprehensive NCAA information
- All Must-Have features implemented and tested
- LLM foundation deployed (self-hosted or API)
- Vector database operational with embedded knowledge
- NLP pipeline trained on NCAA-specific data
- Web chat interface deployed on NCAA website
- Mobile app integration complete
- Staff portal operational with RBAC
- All system integrations tested and functional
- Multilingual support validated by native speakers
- Predictive models trained and validated
- Admin interface complete with analytics
- Performance testing passed (500+ concurrent users)
- Security audit completed
- Privacy compliance verified (data protection policies)
- User acceptance testing completed (staff and tourist pilot groups)
- Documentation complete (user guides, API docs, admin manuals)
- Training materials prepared for administrators
- Monitoring and alerting configured
- Backup and disaster recovery tested

7 Risks Assumptions

7.1 Risks

Risk	Probability	Impact	Mitigation
LLM hallucinations providing incorrect information to users	Medium	High	Retrieval-augmented generation (RAG) architecture grounding responses in knowledge base, confidence scoring, human review of high-stakes responses, user feedback mechanism, regular accuracy audits
Insufficient training data for NCAA-specific domain	Medium	Medium	Data curation from all NCAA systems and documents, synthetic data generation, continuous learning from user interactions, partnership with NCAA experts for validation
API integration failures affecting real-time data availability	Low	Medium	Graceful degradation to cached data, clear messaging when real-time data unavailable, redundant API endpoints, comprehensive error handling, fallback data sources
	Medium	Low	

Risk	Probability	Impact	Mitigation
Translation quality issues for secondary languages			Professional translation review for common queries, user feedback on translation quality, progressive rollout of secondary languages, fallback to English with notification
Performance issues during peak tourist season	Low	Medium	Auto-scaling infrastructure, load testing before peak season, caching strategies, query queue management, performance monitoring with automated scaling triggers
User adoption lower than expected (staff resistance)	Medium	Medium	Change management program, early staff involvement in design, champion identification, training and support, demonstrating time savings, iterative improvements based on feedback
Data privacy concerns limiting data access for training	Low	Medium	Clear data governance policies, anonymization techniques, role-based data access, compliance with Tanzania Data Protection Act, privacy-preserving ML techniques

7.2 Assumptions

- All NCAA systems will provide APIs for data integration
- Sufficient historical data available for training predictive models
- Internet connectivity adequate for cloud-based LLM (if not self-hosted)
- Staff willing to adopt AI-powered tools with appropriate training
- Tourists will find conversational interface intuitive and useful
- Translation services adequate for conservation/tourism domain
- NCAA management committed to data-driven decision-making
- Budget available for LLM API costs or self-hosting infrastructure
- Multilingual content can be sourced or translated accurately
- User feedback will be provided to improve system accuracy

8 Market Specific Considerations

8.1 Primary Market

- Ngorongoro Conservation Area, Tanzania - tourists, tour operators, NCAA staff

8.2 Target Demographics

- International tourists (varying technical literacy and languages)
- Tour operators (need efficient access to operational information)
- NCAA staff (diverse roles from rangers to executives)

8.3 Local Considerations

- Multilingual support essential (English, Swahili mandatory; French, German, Chinese important for tourists)
- Low connectivity in conservation area requiring offline capabilities for mobile app
- Cultural sensitivity in language and content (conservation values, Maasai heritage)
- Tanzania Data Protection Act compliance for handling user data
- Local hosting preferred for data sovereignty and latency
- SMS interface important for low-connectivity scenarios
- Integration with national tourism databases for holistic information
- Seasonal patterns (tourist seasons) requiring scalable infrastructure
- Currency and measurement unit localization (TSh vs USD, metric system)
- Time zone considerations (EAT - East Africa Time)

8.4 Conservation Context

8.4.1 Unesco Heritage

Information accuracy critical for World Heritage Site status

8.4.2 Wildlife Protection

Support for anti-poaching through threat intelligence

8.4.3 Community Engagement

Accessible information supporting community relations

8.4.4 Research Support

Data analysis capabilities supporting conservation research

9 Sign Off

9.1 Approval

Role	Name	Signature	Date

9.2 Document History

Version	Date	Changes Made	Changed By
1.0	2025-11-12	Initial draft based on NCAA Digital Transformation roadmap Section 2.5	SRS Development Team

10 Detailed Feature Requirements

10.1 Ft Nasera Chat Nl

10.1.1 Priority

Must Have

10.1.2 User Story

As a user (tourist or staff), I want to ask questions in natural language so that I can get information without learning technical query syntax

10.1.3 Preconditions

NLP pipeline operational; LLM deployed; Knowledge base populated

10.1.4 Postconditions

Query understood; Relevant response generated; Conversation context maintained

10.1.5 Test Cases

Id	Description	Weight
NASERA-CHAT-TC-001	Answer simple factual question (e.g., 'What are the entry fees?')	High
NASERA-CHAT-TC-002	Handle colloquial language (e.g., 'How much to get in?')	High
NASERA-CHAT-TC-003	Understand questions with typos and grammatical errors	Medium
NASERA-CHAT-TC-004	Maintain context across multi-turn conversation (3-5 exchanges)	High
NASERA-CHAT-TC-005		Medium

Id	Description	Weight
	Clarify ambiguous questions before answering	

10.2 Ft Nasera Chat Multilang

10.2.1 Priority

Must Have

10.2.2 User Story

As an international tourist, I want to interact with Nasera AI in my preferred language so that I can access information without language barriers

10.2.3 Preconditions

Translation models deployed; Multilingual knowledge base; Language detection operational

10.2.4 Postconditions

Query answered in user's language; Translation quality high; Language maintained throughout conversation

10.2.5 Test Cases

Id	Description	Weight
NASERA-LANG-TC-001	Automatically detect language from query (English, Swahili, French, German, Chinese)	High
NASERA-LANG-TC-002	Answer in same language as query with 95%+ translation quality (English/Swahili)	High
NASERA-LANG-TC-003	Answer in same language as query with 90%+ translation quality (secondary languages)	High
NASERA-LANG-TC-004		Medium

Id	Description	Weight
	Allow user to manually switch language mid-conversation	
NASERA-LANG-TC-005	Handle domain-specific terms (conservation, wildlife) accurately across languages	High

10.3 Ft Nasera Kb Realtime

10.3.1 Priority

Must Have

10.3.2 User Story

As a user, I want to receive real-time information synchronized from operational systems so that I get current data on availability, capacity, and operations

10.3.3 Preconditions

API integrations operational; Data sync pipeline running; Knowledge base updated

10.3.4 Postconditions

Real-time data retrieved; Response includes current information; Data freshness indicated

10.3.5 Test Cases

Id	Description	Weight
NASERA-KB-TC-001	Query Gateway for current capacity and receive data <5 minutes old	High
NASERA-KB-TC-002	Query Fleet for vehicle availability and receive real-time status	High
NASERA-KB-TC-003		Medium

Id	Description	Weight
	Query Surveillance for recent incidents (security-cleared users)	
NASERA-KB-TC-004	Indicate data freshness in response (e.g., ‘as of 2 minutes ago’)	Medium
NASERA-KB-TC-005	Gracefully handle API failures with cached data and clear notification	High

10.4 Ft Nasera Predict Visitors

10.4.1 Priority

Must Have

10.4.2 User Story

As an operations manager, I want to forecast visitor numbers for upcoming periods so that I can plan staffing and resources proactively

10.4.3 Preconditions

Historical visitor data available (2+ years); ML models trained; Seasonal patterns identified

10.4.4 Postconditions

Forecast generated; Confidence intervals provided; Predictions updated daily

10.4.5 Test Cases

Id	Description	Weight
NASERA-PRED-TC-001	Generate 7-day visitor forecast with 80%+ accuracy	High
NASERA-PRED-TC-002	Generate monthly visitor forecast with 75%+ accuracy	High

Id	Description	Weight
NASERA-PRED-TC-003	Include confidence intervals for all predictions	Medium
NASERA-PRED-TC-004	Adjust for seasonal patterns (high/low tourist seasons)	High
NASERA-PRED-TC-005	Account for holidays and special events	Medium
NASERA-PRED-TC-006	Update forecasts daily with latest actual data	High

10.5 Ft Nasera Int Gateway

10.5.1 Priority

Must Have

10.5.2 User Story

As Nasera AI, I want to query real-time gate operations data so that I can provide current operational status to stakeholders

10.5.3 Preconditions

Gateway API accessible; Authentication configured; Data mapping established

10.5.4 Postconditions

Gateway data retrieved; Response includes current capacity/permits/vehicles; API latency <500ms

10.5.5 Test Cases

Id	Description	Weight
NASERA-INT-TC-001	Query current capacity by gate via Gateway API	High
NASERA-INT-TC-002	Retrieve permit status for specific permit ID	High

Id	Description	Weight
NASERA-INT-TC-003	Get vehicle entry/exit data for today	Medium
NASERA-INT-TC-004	API response time <500ms	High
NASERA-INT-TC-005	Handle API errors gracefully with user-friendly messages	High

10.6 Ft Nasera Staff Advanced

10.6.1 Priority

Must Have

10.6.2 User Story

As a staff member, I want to access advanced analytics and complex queries so that I can perform my job more effectively with AI-powered insights

10.6.3 Preconditions

Staff portal deployed; Authentication and RBAC operational; Advanced query engine ready

10.6.4 Postconditions

Staff authenticated; Advanced queries answered; Visualizations generated; Data exportable

10.6.5 Test Cases

Id	Description	Weight
NASERA-STAFF-TC-001	Authenticate staff user and enforce role-based access	High
NASERA-STAFF-TC-002	Answer complex cross-departmental query (e.g., 'visitor trends vs revenue by month')	High
NASERA-STAFF-TC-003		Medium

Id	Description	Weight
	Generate data visualization (chart/graph) for query result	
NASERA-STAFF-TC-004	Export query results to Excel or PDF	Medium
NASERA-STAFF-TC-005	Restrict sensitive data based on user role	High

10.7 Ft Nasera Admin Training

10.7.1 Priority

Must Have

10.7.2 User Story

As an administrator, I want to train and fine-tune AI models using NCAA-specific data so that I can improve accuracy and relevance

10.7.3 Preconditions

Training data curated; ML infrastructure available; Admin interface operational

10.7.4 Postconditions

Model trained; Performance metrics evaluated; New model deployed or rolled back

10.7.5 Test Cases

Id	Description	Weight
NASERA-ADMIN-TC-001	Upload training data and initiate model training	High
NASERA-ADMIN-TC-002	Monitor training progress and view metrics	Medium
NASERA-ADMIN-TC-003	Evaluate model performance on test set	High

Id	Description	Weight
NASERA-ADMIN-TC-004	Deploy new model version to production	High
NASERA-ADMIN-TC-005	Rollback to previous model version if performance degrades	High

11 Additional Context

11.1 Success Metrics

11.1.1 Query Accuracy

95%+ for factual queries (measured by user feedback and expert evaluation)

11.1.2 Response Time

<2 seconds for 95% of queries, <10 seconds for complex analytics

11.1.3 User Satisfaction

80%+ positive feedback ratings from users

11.1.4 Adoption Rate

80%+ of staff actively using staff portal within 6 months

11.1.5 Tourist Usage

50%+ of website visitors engaging with chat interface

11.1.6 Prediction Accuracy

80%+ for visitor forecasts (7-day), 85%+ for revenue (monthly)

11.1.7 System Availability

99.5% uptime

11.1.8 Multilingual Quality

95%+ translation quality for English/Swahili, 90%+ for secondary languages

11.1.9 Time Savings

80% reduction in manual information requests to staff

11.2 Architecture Overview

11.2.1 Knowledge Base Layer

Vector database storing embedded NCAA knowledge from documents, databases, and systems

11.2.2 Llm Layer

Large language model (self-hosted or API) for natural language understanding and generation

11.2.3 Npl Pipeline

Intent recognition, entity extraction, context management, multilingual processing

11.2.4 Integration Layer

API connectors to all NCAA systems for real-time data retrieval

11.2.5 Ml Models

Predictive models for forecasting (visitors, revenue, maintenance, threats)

11.2.6 Presentation Layer

Web chat interface, mobile app integration, SMS gateway, staff portal

11.2.7 Admin Layer

Content management, model training, analytics dashboard, user feedback review

11.3 Ai Capabilities

11.3.1 Understanding

Natural language understanding, intent classification, entity extraction, context tracking

11.3.2 Generation

Natural language response generation, multilingual translation, text summarization

11.3.3 Retrieval

Semantic search, hybrid retrieval (keyword + embedding), source citation

11.3.4 Prediction

Time series forecasting, anomaly detection, pattern recognition, optimization

11.3.5 Reasoning

Multi-step reasoning for complex queries, cross-referencing multiple data sources