Software Requirements Specification (SRS) for Trinity AI Mining App

1. Introduction

1.1 Purpose

This Software Requirements Specification (SRS) document defines the functional and non-functional requirements for the **Trinity AI Mining App**, a cryptocurrency mining application that enables users to mine **TIX coins** and earn additional TIX through a Chat to Earn AI-driven feature. The document serves as a guide for developers, testers, and stakeholders to ensure the system meets user needs, provides efficient mining and chat-based earning capabilities, and complies with industry standards.

1.2 Scope

The Trinity AI Mining App is currently a mobile-based platform for iOS and Android, allowing users to mine TIX coins using their devices or cloud-based mining pools and earn TIX through AI-driven chat interactions. Future versions will expand to desktop platforms (Windows, macOS, Linux). Key features include:

- AI-driven mining optimization for energy efficiency and higher yields.
- Secure wallet integration for storing and managing TIX coins.
- Real-time mining performance analytics and rewards tracking.
- Chat to Earn functionality where users earn TIX by engaging in AI-driven conversations.
- Compliance with regulatory standards (e.g., KYC for high-volume miners).
- Support for solo and pool mining modes. The app targets individual miners, hobbyists, and users interested in earning through chat, offering an intuitive interface and advanced AI tools, with future desktop support for broader accessibility.

1.3 Definitions, Acronyms, and Abbreviations

- **AI**: Artificial Intelligence
- **KYC**: Know Your Customer
- **TIX**: Native utility coin of the Trinity ecosystem
- **PoW**: Proof of Work, a consensus mechanism for mining
- **PoS**: Proof of Stake, an alternative consensus mechanism
- **ERC-20**: Ethereum token standard (if TIX is ERC-20 compatible)

- **2FA**: Two-Factor Authentication
- **API**: Application Programming Interface
- **UI/UX**: User Interface/User Experience
- **GDPR**: General Data Protection Regulation
- **CCPA**: California Consumer Privacy Act
- **Hashrate**: Computational power used for mining
- **Mining Pool**: A group of miners combining computational resources
- **NLP**: Natural Language Processing, used for Chat to Earn AI

1.4 References

- IEEE Std 830-1998: IEEE Recommended Practice for Software Requirements Specifications
- Ethereum and Binance Smart Chain documentation for token standards (if applicable)
- Regulatory guidelines from the Monetary Authority of Singapore (MAS) and SEC
- OWASP Top 10 for security standards

1.5 Overview

This SRS is organized into sections covering system overview, functional requirements, non-functional requirements, system architecture, use cases, acceptance criteria, and risk analysis. It provides a comprehensive blueprint for the development of the Trinity AI Mining App, with TIX coin mining and Chat to Earn functionality, initially for iOS and Android, with planned desktop support.

2. Overall Description

2.1 Product Perspective

The Trinity AI Mining App is a standalone system integrated with blockchain networks (e.g., Ethereum, Binance Smart Chain, or a custom blockchain for TIX) for coin mining, wallet management, and chat-based rewards. It interfaces with:

- **Blockchain networks** for mining operations and transaction processing.
- **AI engines** for optimizing mining algorithms and processing chat interactions.
- **Third-party APIs** for market data, hardware monitoring, and NLP services.
- **KYC providers** for regulatory compliance. The app currently supports solo mining (using mobile device hardware), pool mining (via cloud-based resources), and Chat to Earn, with future expansion to desktop platforms.

2.2 Product Functions

- **User Account Management**: Registration, login, and KYC verification for miners and chat participants.
- **Wallet Integration**: Secure storage and transfer of mined or earned TIX coins.
- **Mining Module**: Solo and pool mining with AI-optimized performance.
- **Chat to Earn Module**: AI-driven chat interactions to earn TIX coins based on engagement.
- **AI Optimization**: Dynamic adjustment of mining parameters for efficiency.
- **Analytics Dashboard**: Real-time tracking of hashrate, TIX rewards, and chat earnings.
- **Security**: 2FA, encryption, and AI-based anomaly detection.
- **Compliance**: KYC verification for users exceeding mining or earning thresholds.
- **Notifications**: Alerts for mining performance, chat rewards, and system updates.

2.3 User Classes and Characteristics

- **Individual Miners**: Users mining TIX with mobile devices, seeking ease of use.
- **Hobbyist Miners**: Enthusiasts with moderate hardware, needing analytics and optimization.
- **Pool Miners**: Users joining TIX mining pools for higher rewards, requiring pool management tools.
- **Chat Participants**: Users engaging in AI-driven chats to earn TIX, seeking engaging and rewarding interactions.
- **Administrators**: System operators managing user accounts, mining pools, and chat systems.
- **Support Staff**: Handle user queries and technical issues.

2.4 Operating Environment

- **Current Platforms**: iOS (14+), Android (10+), with web access via mobile browsers (Chrome, Safari).
- **Future Platforms**: Desktop applications for Windows (10+), macOS (11+), and Linux (Ubuntu 20.04+), planned for future releases.
- **Blockchain Networks**: Ethereum, Binance Smart Chain, or a custom blockchain for TIX coin mining and transactions.
- **Hardware**: Smartphones and tablets with CPU/GPU support for solo mining; future desktop support for enhanced mining capabilities.
- **Software**: Compatible with MetaMask, Trust Wallet, and TrinityWALLET (if TIX is ERC-20 compatible); NLP frameworks for chat functionality.

2.5 Design and Implementation Constraints

- Compliance with global cryptocurrency regulations (e.g., MAS, SEC).
- Support for TIX coin, potentially as an ERC-20 token or on a custom blockchain.
- AI models must optimize mining within mobile device hardware limits and process chat interactions in real-time.
- Scalability to support thousands of concurrent miners and chat participants.
- Energy-efficient mining to minimize environmental impact on mobile devices.
- Security standards to protect user funds and data.
- Future desktop versions must maintain feature parity with mobile apps.

2.6 Assumptions and Dependencies

- Users have compatible mobile devices for solo TIX mining.
- Stable internet connection for pool mining, chat interactions, and real-time updates.
- Third-party APIs (e.g., market data, KYC providers, NLP services) are reliable.
- Blockchain network for TIX maintains consistent mining difficulty.
- Regulatory frameworks remain stable during development.
- TIX coin is supported by compatible wallets (e.g., MetaMask, if ERC-20).
- Future desktop versions will leverage similar backend infrastructure.

3. System Features

3.1 User Account Management

3.1.1 Description

Users can create, manage, and secure accounts with KYC verification for high-volume TIX mining or chat earnings.

3.1.2 Functional Requirements

- **REQ-1.1**: Users shall register using email, phone number, or social media (e.g., Google, X).
- **REQ-1.2**: Users mining or earning above 100 TIX/day shall complete KYC verification (ID upload, facial recognition).
- **REQ-1.3**: Users shall enable 2FA (SMS, authenticator app) for login.
- **REQ-1.4**: Users shall update profile details (e.g., preferred currency, mining/chat mode).
- **REQ-1.5**: System shall lock accounts after 5 failed login attempts for 30 minutes.
- **REQ-1.6**: Users shall recover accounts using a recovery email or phone number.

3.1.3 Acceptance Criteria

- Registration completes in <5 minutes for 90% of users.
- KYC verification is approved/rejected within 24 hours.
- 2FA setup is mandatory for mining or earning above 10 TIX/day.

3.2 Wallet Integration

3.2.1 Description

Users can connect or create a wallet to store and transfer mined or earned TIX coins.

3.2.2 Functional Requirements

- **REQ-2.1**: System shall support MetaMask, Trust Wallet, and TrinityWALLET for TIX coins (if ERC-20 compatible).
- **REQ-2.2**: Users shall create a new wallet with a private key and 12-word recovery phrase.
- **REQ-2.3**: Users shall transfer TIX coins to external wallets via address or QR code.
- **REQ-2.4**: System shall display real-time wallet balances in TIX and USD.
- **REQ-2.5**: System shall encrypt private keys using AES-256 and store them offline.
- **REQ-2.6**: Users shall import existing wallets using private keys or recovery phrases.

3.2.3 Acceptance Criteria

- Wallet integration completes in <1 minute.
- TIX coin transfers are confirmed on the blockchain within 30 seconds (network-dependent).
- Balance updates reflect in <5 seconds.

3.3 Mining Module

3.3.1 Description

Users can mine TIX coins using solo or pool mining modes, optimized by AI.

3.3.2 Functional Requirements

- **REQ-3.1**: System shall support solo mining using mobile device CPU/GPU (and desktop CPU/GPU in future releases).
- **REQ-3.2**: System shall support pool mining via cloud-based mining pools.
- **REQ-3.3**: Users shall select mining mode (solo or pool) and configure hardware settings.
- **REQ-3.4**: System shall distribute TIX coin rewards based on hashrate contribution.

- **REQ-3.5**: Users shall pay mining pool fees (e.g., 1% of rewards) in TIX.
- **REQ-3.6**: System shall pause mining if device temperature exceeds 80°C.

3.3.3 Acceptance Criteria

- Mining starts within 10 seconds of user initiation.
- TIX rewards are credited to wallet within 1 minute of block confirmation.
- Pool fees are deducted accurately and displayed in transaction history.

3.4 Chat to Earn Module

3.4.1 Description

Users can earn TIX coins by engaging in AI-driven chat interactions, rewarded based on engagement quality and duration.

3.4.2 Functional Requirements

- **REQ-4.1**: System shall provide an AI-powered chatbot using NLP to engage users in conversations (e.g., crypto trivia, market discussions).
- **REQ-4.2**: Users shall earn TIX based on chat engagement (e.g., 0.1 TIX per 5 minutes of meaningful interaction).
- **REQ-4.3**: System shall evaluate engagement quality using AI (e.g., response relevance, session duration).
- **REQ-4.4**: Users shall view chat earning history and rewards in the analytics dashboard.
- **REQ-4.5**: System shall limit daily chat earnings to 50 TIX to prevent abuse.
- **REQ-4.6**: Users shall toggle Chat to Earn feature on/off.

3.4.3 Acceptance Criteria

- Chatbot responds to user input in <1 second with >95% relevance.
- TIX rewards for chat are credited within 1 minute of session completion.
- Engagement evaluation prevents spam (e.g., repetitive or irrelevant inputs).

3.5 AI Optimization

3.5.1 Description

AI-driven algorithms optimize TIX mining efficiency and resource usage.

3.5.2 Functional Requirements

- **REQ-5.1**: System shall use AI to adjust mining parameters (e.g., hashrate, power usage) based on device capabilities.

- **REQ-5.2**: System shall predict optimal mining times based on TIX network difficulty and market data.
- **REQ-5.3**: Users shall toggle AI optimization on/off for manual control.
- **REQ-5.4**: System shall monitor device health (e.g., CPU/GPU usage, temperature) and adjust mining intensity.
- **REQ-5.5**: AI models shall update optimization parameters every 10 seconds.

3.5.3 Acceptance Criteria

- AI optimization improves TIX mining efficiency by at least 10% compared to manual settings.
- Device health alerts are triggered within 1 second of threshold breach.
- Optimization updates apply without interrupting mining.

3.6 Analytics Dashboard

3.6.1 Description

Users can track mining performance, TIX rewards, chat earnings, and energy usage in real-time.

3.6.2 Functional Requirements

- **REQ-6.1**: System shall display hashrate, TIX rewards (mining and chat), and energy usage in real-time.
- **REQ-6.2**: Users shall view mining and chat earning history with filters (date, mode).
- **REQ-6.3**: System shall generate performance charts (hourly, daily, weekly).
- **REQ-6.4**: Users shall export mining and chat data as CSV or PDF.
- **REQ-6.5**: System shall update analytics data with <1-second latency.

3.6.3 Acceptance Criteria

- Dashboard updates reflect TIX mining and chat changes in <1 second.
- History loads in <2 seconds for up to 1,000 records.
- Export functionality completes in <5 seconds.

3.7 Security Module

3.7.1 Description

Ensures protection of user data, TIX coins, and mining/chat operations.

3.7.2 Functional Requirements

- **REQ-7.1**: System shall use AES-256 encryption for sensitive data (e.g., private keys, KYC documents).
- **REQ-7.2**: System shall implement AI-based anomaly detection for unauthorized access.
- **REQ-7.3**: Users shall receive alerts for suspicious activities (e.g., logins from new devices).
- **REQ-7.4**: System shall store 90% of mined/earned TIX coins in cold wallets.
- **REQ-7.5**: System shall conduct third-party security audits every 6 months.
- **REQ-7.6**: System shall implement rate-limiting to prevent DDoS attacks.

3.7.3 Acceptance Criteria

- Encryption is applied to all sensitive data with no decryption errors.
- Anomaly detection flags 95% of suspicious activities within 1 second.
- Cold wallet transfers require multi-signature approval.

3.8 Compliance Module

3.8.1 Description

Ensures adherence to regulatory standards for high-volume TIX miners and chat earners.

3.8.2 Functional Requirements

- **REQ-8.1**: System shall require KYC for users mining or earning >100 TIX/day.
- **REQ-8.2**: System shall monitor mining and chat activities for AML compliance.
- **REQ-8.3**: System shall report suspicious activities to authorities within 24 hours.
- **REQ-8.4**: Users shall upload KYC documents via a secure portal.
- **REQ-8.5**: System shall retain compliance records for 5 years.
- **REQ-8.6**: System shall support tax reporting for TIX mining and chat rewards.

3.8.3 Acceptance Criteria

- KYC verification completes within 24 hours for 95% of submissions.
- AML monitoring flags suspicious activities with <1% false positives.
- Tax reports are generated accurately per user jurisdiction.

3.9 Notification System

3.9.1 Description

Provides real-time alerts for TIX mining events, chat rewards, and system updates.

3.9.2 Functional Requirements

- **REQ-9.1**: System shall send push notifications for TIX mining rewards, chat earnings, and performance alerts.
- **REQ-9.2**: Users shall receive email/SMS alerts for security events (e.g., login attempts).
- **REQ-9.3**: Users shall customize notification preferences (e.g., frequency, type).
- **REQ-9.4**: System shall log all notifications for audit purposes.

3.9.3 Acceptance Criteria

- Notifications are delivered in <5 seconds.
- Users can enable/disable notifications without errors.
- Notification logs are retained for 1 year.

4. External Interface Requirements

4.1 User Interfaces

- **UI-1**: Mobile app interface with dark/light mode and customizable dashboards, optimized for iOS and Android.
- **UI-2**: Mobile app with biometric login (fingerprint, face ID) and offline mode for analytics.
- **UI-3**: Interactive charts for hashrate, TIX rewards (mining and chat), and energy usage.
- **UI-4**: Accessible UI compliant with WCAG 2.1 standards.
- **UI-5**: Future desktop interfaces for Windows, macOS, and Linux, mirroring mobile UI/UX.

4.2 Hardware Interfaces

- Smartphones and tablets with CPU/GPU support for solo TIX mining (future support for desktop CPU/GPU).
- Temperature sensors for mobile device health monitoring.
- Support for hardware wallets (e.g., Ledger, Trezor) for TIX storage.

4.3 Software Interfaces

- **SI-1**: Blockchain nodes (Ethereum, BSC, or custom TIX blockchain) for mining and transactions.
- **SI-2**: APIs for market data (e.g., CoinGecko, CoinMarketCap).
- **SI-3**: Hardware monitoring APIs for CPU/GPU usage and temperature.
- **SI-4**: AI engine APIs (e.g., TensorFlow, NLP frameworks like Hugging Face) for mining optimization and chat processing.
- **SI-5**: Integration with KYC providers (e.g., Jumio, Onfido).

4.4 Communications Interfaces

- **CI-1**: HTTPS for secure data transmission.
- **CI-2**: WebSocket for real-time TIX mining, chat, and analytics updates.
- **CI-3**: SMTP for email notifications.
- **CI-4**: APNs (Apple Push Notification Service) and FCM (Firebase Cloud Messaging) for mobile alerts.

5. Non-Functional Requirements

5.1 Performance Requirements

- **PERF-1**: System shall support 10,000 concurrent TIX miners and chat participants.
- **PERF-2**: AI optimization for mining and chat processing shall complete in <100 ms.
- **PERF-3**: Page load time shall be <2 seconds on a 4G connection.
- **PERF-4**: TIX reward updates (mining and chat) shall reflect in <1 minute.

5.2 Security Requirements

- **SEC-1**: Compliance with GDPR, CCPA, and other data privacy regulations.
- **SEC-2**: Penetration testing conducted every 6 months.
- **SEC-3**: Multi-signature wallets for TIX withdrawals.
- **SEC-4**: Session timeouts after 15 minutes of inactivity.

5.3 Scalability Requirements

- **SCALE-1**: System shall support 1 million registered users.
- **SCALE-2**: Database shall handle 50 TB of TIX mining and chat data with <1-second query response.
- **SCALE-3**: Mining pools shall scale to support 100,000 miners per pool.

5.4 Reliability Requirements

- **REL-1**: System uptime shall be 99.99% (less than 4 minutes of downtime per month).
- **REL-2**: Mean time to recover (MTTR) shall be <5 minutes.
- **REL-3**: TIX mining and chat operations shall continue during network interruptions using cached data.

5.5 Usability Requirements

- **USE-1**: 90% of users shall start TIX mining or chatting in <5 minutes.
- **USE-2**: UI shall support multiple languages (English, Mandarin, Spanish).

- **USE-3**: System shall provide in-app tutorials for new TIX miners and chat participants.

5.6 Maintainability Requirements

- **MAINT-1**: Codebase shall follow modular design with documentation.
- **MAINT-2**: System shall support hotfixes without stopping TIX mining or chat.
- **MAINT-3**: Automated tests shall cover 90% of critical code paths.

5.7 Portability Requirements

- **PORT-1**: System shall run on iOS 14+, Android 10+, and mobile browsers.
- **PORT-2**: App shall support offline analytics for cached TIX data.
- **PORT-3**: Future desktop versions shall support Windows 10+, macOS 11+, and Ubuntu 20.04+.

6. Other Requirements

6.1 Regulatory Requirements

- Compliance with MAS, SEC, and EU regulations for TIX mining and chat earnings.
- Support for tax reporting of TIX mining and chat rewards per user jurisdiction.
- Adherence to FATF guidelines for cryptocurrency mining.

6.2 Audit Requirements

- Monthly audits of TIX mining and chat rewards to ensure transparency.
- Quarterly security audits by certified firms (e.g., Certik, Hacken).
- Annual compliance audits for KYC/AML adherence.

6.3 Data Retention

- TIX mining and chat data shall be retained for 7 years per regulatory requirements.
- User data shall be deleted within 30 days of account closure (per GDPR).
- Notification logs shall be retained for 1 year.

6.4 Environmental Considerations

- System shall optimize energy usage to reduce environmental impact on mobile devices.
- AI shall prioritize low-power mining modes for mobile devices.
- Future desktop versions shall include energy-efficient mining options.

7. System Architecture

7.1 High-Level Architecture

- **Frontend**: React Native (mobile) with Tailwind CSS; future desktop apps in Electron or similar.
- **Backend**: Node.js with Express for RESTful APIs, hosted on AWS.
- **Database**: MongoDB for user data, PostgreSQL for TIX mining and chat records.
- **Blockchain**: Ethereum, BSC, or custom TIX blockchain for mining and transactions.
- **AI Engine**: Python-based ML models (TensorFlow, Hugging Face for NLP) for optimization and chat processing.
- **Infrastructure**: AWS with Kubernetes for scalability, S3 for storage, CloudFront for CDN.

7.2 Data Flow

- **User Input**: TIX mining/chat settings → Frontend → Backend APIs.
- **Blockchain**: TIX mining tasks → Blockchain nodes → Reward distribution.
- **AI Optimization**: Hardware/chat data → AI engine → Optimized parameters.
- **Real-Time Updates**: TIX mining/chat data → WebSocket → Frontend.

7.3 Component Diagram

- **Client Layer**: Mobile UI (iOS, Android), wallet integration, TIX mining/chat interface; future desktop UI.
- **Application Layer**: APIs, AI engine, authentication service.
- **Data Layer**: MongoDB, PostgreSQL, blockchain nodes.
- **External Services**: KYC providers, market data APIs, hardware monitoring, NLP services.

8. Use Cases

8.1 Use Case 1: User Registration and KYC

- **Actor**: New User
- **Description**: User registers and completes KYC to start mining or earning TIX coins.
- **Preconditions**: User has a valid email or phone number.
- **Steps**:
    1. User navigates to the registration page.
    2. User enters email/phone and password.
    3. System sends a verification code to email/phone.
    4. User verifies the code and completes KYC (if required).
    5. System approves KYC within 24 hours.

- **Postconditions**: User account is active and ready for TIX mining or chatting.
- **Exceptions**: Invalid KYC documents → User is prompted to retry.

8.2 Use Case 2: Start Solo TIX Mining

- **Actor**: Registered User
- **Description**: User starts solo mining TIX coins using mobile device hardware.
- **Preconditions**: User is logged in, device supports mining.
- **Steps**:
  1. User selects solo mining mode.
  2. User configures hardware settings (e.g., CPU usage).
  3. System activates AI optimization (if enabled).
  4. TIX mining starts, and rewards are credited to wallet.
- **Postconditions**: TIX mining is active, rewards are logged.
- **Exceptions**: Device overheating → Mining pauses, user is notified.

8.3 Use Case 3: Join a TIX Mining Pool

- **Actor**: Registered User
- **Description**: User joins a mining pool to earn TIX rewards.
- **Preconditions**: User is verified, has sufficient TIX for pool fees.
- **Steps**:
  1. User navigates to mining pool section.
  2. User selects a pool based on size and reward structure.
  3. System connects user's device to the pool.
  4. TIX mining starts, and rewards are distributed based on hashrate.
- **Postconditions**: User earns TIX pool rewards, fees are deducted.
- **Exceptions**: Insufficient balance for fees → Error message displayed.

8.4 Use Case 4: Earn TIX via Chat

- **Actor**: Registered User
- **Description**: User engages in AI-driven chat to earn TIX coins.
- **Preconditions**: User is logged in, Chat to Earn feature is enabled.
- **Steps**:
  1. User navigates to Chat to Earn section.
  2. User starts a conversation with the AI chatbot (e.g., crypto trivia).
  3. System evaluates engagement quality and duration.
  4. TIX rewards are credited based on engagement (e.g., 0.1 TIX per 5 minutes).
- **Postconditions**: TIX rewards are credited, chat history is logged.
- **Exceptions**: Low-quality engagement → Rewards reduced or denied.

9. Risk Analysis

9.1 Technical Risks

- **Risk**: High TIX network difficulty reduces mining rewards.
  - **Mitigation**: AI predicts optimal mining times and adjusts parameters.
- **Risk**: Device overheating during solo TIX mining on mobile.
  - **Mitigation**: Monitor temperature and pause mining if thresholds are exceeded.
- **Risk**: Scalability issues in TIX mining pools or chat system.
  - **Mitigation**: Use Kubernetes for auto-scaling resources.
- **Risk**: Future desktop versions require significant UI/UX redesign.
  - **Mitigation**: Use cross-platform frameworks like Electron for consistency.

9.2 Security Risks

- **Risk**: Unauthorized access to TIX wallets.
  - **Mitigation**: Implement 2FA, AES-256 encryption, and cold storage.
- **Risk**: DDoS attacks disrupt TIX mining or chat operations.
  - **Mitigation**: Use rate-limiting and AWS Shield for protection.

9.3 Regulatory Risks

- **Risk**: Regulatory restrictions on TIX mining or chat earnings.
  - **Mitigation**: Monitor regulations and implement modular compliance features.
- **Risk**: Non-compliance with KYC/AML requirements.
  - **Mitigation**: Automate KYC for high-volume TIX miners/earners and monitor AML.

9.4 Operational Risks

- **Risk**: Third-party API downtime affects TIX mining, chat, or analytics.
  - **Mitigation**: Use multiple API providers and cache data for offline use.
- **Risk**: User errors in TIX wallet configuration lead to coin loss.
  - **Mitigation**: Implement validation checks and confirmation prompts.

10. Appendices

10.1 Glossary

- **Hashrate**: Computational power used for TIX mining.
- **Mining Pool**: Collaborative TIX mining to share rewards.
- **Cold Wallet**: Offline storage for TIX coins to enhance security.

- **Smart Contract**: Self-executing contract on the TIX blockchain (if applicable).
- **Chat to Earn**: Earning TIX through AI-driven chat interactions.

10.2 Assumptions

- Users have compatible mobile devices for solo TIX mining.
- TIX blockchain network maintains stable mining difficulty.
- Third-party services (e.g., KYC providers, NLP services) are reliable.
- TIX coin is supported by compatible wallets (e.g., MetaMask, if ERC-20).
- Future desktop versions will leverage existing mobile infrastructure.

10.3 Constraints

- Budget for AI model training and cloud infrastructure.
- Regulatory changes may require system updates.
- Limited support for non-TIX coins in initial release.
- Desktop versions are planned but not included in initial release.