Software Requirements Specification (SRS)

1. Introduction

1.1 Purpose

This SRS specifies the software requirements for the AI-Enhanced IETM system in compliance with IEEE 830 / ISO/IEC/IEEE 29148 standards.

1.2 Intended Audience

- Developers
- Test engineers
- Product managers
- System integrators

1.3 Definitions

- IETM: Interactive Electronic Technical Manual
- MM-LLM: Multimodal Large Language Model
- RAG: Retrieval-Augmented Generation
- AR/VR: Augmented Reality / Virtual Reality
- LLM: Large Language Model
- OCR: Optical Character Recognition
- ASR: Automatic Speech Recognition

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2. Overall Description

2.1 Product Perspective

The system is a layered AI agent platform integrating perception, reasoning, memory, and execution subsystems.

2.2 Product Functions

- Interpret multimodal inputs
- Generate structured task plans
- Retrieve contextual knowledge
- Execute actions via tools or AR
- Learn from past interactions
- Reflect on failures and adapt
- Ensure safety and compliance

2.3 User Characteristics

- Basic technical literacy
- Little to No AI expertise required
- Familiarity with AR/VR interfaces
- Maintenance and training tasks

2.4 Operating Environment

- Linux / Windows (with docker)
- AR headsets
- Edge and cloud GPUs
- Sensor interfaces

2.5 Design Constraints

- Limited context window
- GPU availability
- Real-time latency constraints
- Security and sandboxing (for code execution)
- Compliance with data privacy regulations
- Robust error handling

- **Maintainability and clear documentation**

3. System Features

3.1 Perception Subsystem

Description: Processes visual, textual, sensors, and audio inputs.

Requirements:

- SR-P1: Support OCR, ASR, and vision encoders
- SR-P2: Enable segmentation and depth maps
- SR-P3: Multimodal data fusion

3.2 Reasoning Subsystem

Description: Generates plans and decisions.

Requirements:

- SR-R1: Implement CoT, ToT, ReAct
- SR-R2: Support reflection loops
- SR-R3: Enable multi-plan generation
- SR-R4: Integrate failure detection
- SR-R5: Ensure self-consistent reasoning
- SR-R6: Provide auditability of decisions

3.3 Memory Subsystem

Description: Stores and retrieves knowledge.

Requirements:

- SR-M1: Vector DB integration
- SR-M2: Metadata filtering
- SR-M3: Short-term and long-term memory
- SR-M4: Case-based retrieval
- SR-M5: Memory pruning strategies
- SR-M6: Multimodal embeddings
- SR-M7: Context window management
- SR-M8: Memory optimised formats for optimal use of context window

3.4 Execution Subsystem

Description: Executes actions via tools.

Requirements:

- SR-E1: Tool-based execution
- SR-E2: Secure sandboxing
- SR-E3: XR support

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4. External Interface Requirements

- API interfaces (REST, gRPC)
- AR/VR SDK interfaces
- Database interfaces
- Sensor data interfaces
- GUI interfaces

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5. Non-Functional Requirements

- Reliability: >95% task success
- Performance: <2min response time
- Security: Role-based access
- Scalability: Modular microservices
- Maintainability: Clear documentation
- Usability: Intuitive UI/UX
- Compatibility: Cross-platform support
- Portability: Containerized deployment
- Compliance: Data privacy regulations
- Accessibility: ADA compliance

- **Logging & Monitoring: Centralized logs**

6. System Models

- Use-case diagrams
- Sequence diagrams
- Data flow diagrams
- Entity-relationship diagrams

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7. Verification & Validation

- Unit tests
- End-to-end tests
- User acceptance tests
- Performance benchmarks
- Security audits
- Usability testing
- Compliance checks

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8. Appendices

- Benchmark descriptions
- Dataset sources
- Glossary of terms
- References to standards