Notification No: COE/Ph.D./(Notification)/595/2026

Notification Date: 26th February, 2026

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Topic:	An Intelligent Approach for Goal-Oriented Software Requirements Analysis
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Keywords:	Goal-Oriented Requirements Analysis, RAGOSRA, Rough Set Theory, TOPSIS, Stakeholder Clustering, Software Requirements

Findings

• Intelligent Integration Enhances Goal-Oriented Requirements Analysis

The integration of intelligent techniques such as Rough Set Theory (RST), TOPSIS, and clustering significantly improves the effectiveness of goal-oriented requirements analysis. The study demonstrates enhanced accuracy, reduced ambiguity, and improved objectivity in decision-making within complex software development environments.

• Selection of Appropriate Elicitation Techniques is Crucial

The proposed SelectGoREATech model provides a systematic approach for selecting suitable combinations of goal-oriented elicitation and analysis techniques. This ensures comprehensive identification of both functional and non-functional requirements based on project-specific characteristics.

• RAGOSRA Improves Requirement Prioritization under Uncertainty

The RAGOSRA method effectively handles vagueness and imprecision in stakeholder inputs using rough numbers. It provides more reliable and consistent ranking of goals compared to traditional and fuzzy-based approaches, enhancing decision-making quality.

• **Stakeholder Clustering Enhances Decision Quality**

The application of rough c-means clustering enables grouping of stakeholders based on similar preferences. This reduces conflicts, improves consensus-building, and ensures more efficient and accurate requirement evaluation.

• **Hybrid RST–TOPSIS Approach Provides Robust Ranking Mechanism**

The integration of Rough Set Theory with TOPSIS enables efficient multi-criteria decision-making. It allows prioritization of requirements based on multiple evaluation criteria, leading to structured and transparent analysis.

• **GRAInSD Framework Strengthens Information System Design**

The proposed GRAInSD methodology integrates stakeholder modeling, decisional modeling, and goal analysis. This structured framework improves requirement analysis and supports effective and reliable information system design.

• **Systematic Goal Decomposition Improves Requirement Clarity**

The use of AND/OR graph structures enables systematic decomposition of high-level goals into detailed sub-goals. This improves clarity, traceability, and completeness of requirements throughout the development process.

• **Handling of Stakeholder Diversity is Significantly Improved**

The methodologies effectively address the challenges of multiple stakeholders with diverse perspectives, ensuring balanced representation and minimizing bias during requirements elicitation and analysis.

• **Detection of Stakeholder Discordance Prevents System Failure**

Early detection and resolution of conflicts among stakeholders reduce inconsistencies and significantly lower the risk of software project failure due to misaligned expectations.

• **Reduction in Subjectivity Compared to Fuzzy Methods**

Unlike fuzzy-based approaches, the proposed methods eliminate dependency on predefined membership functions, thereby reducing subjectivity and enhancing objectivity in requirements analysis.

• **Improved Accuracy in Goal Ranking and Selection**

The intelligent techniques ensure precise ranking of goals, enabling better selection of critical requirements and improving the overall quality and effectiveness of software systems.

• **Comprehensive Treatment of Functional and Non-Functional Requirements**

The proposed approaches ensure balanced consideration of both functional and non-functional requirements, leading to the development of robust, efficient, and reliable software systems.

• **Enhanced Decision-Making through Multi-Criteria Evaluation**

The application of MCDM techniques enables evaluation of requirements based on multiple criteria such as performance, security, and reliability, resulting in more informed and balanced decisions.

• **Comparative Analysis Validates Superiority of Proposed Methods**

Experimental evaluation using the Institute Examination System (IES) case study demonstrates that the proposed methods outperform existing techniques such as AGORA and FAGOSRA in terms of accuracy, consistency, and effectiveness.

• **Improved Computational Efficiency and Consistency**

The proposed methodologies exhibit improved computational efficiency and provide consistent results across different scenarios, enhancing their practical applicability.

• **Applicability to Real-World Complex Systems**

The approaches are suitable for real-world applications involving large-scale systems, multiple stakeholders, and complex decision-making environments.

• **Scalability of the Proposed Frameworks**

The methodologies are scalable and adaptable to various domains beyond information systems, making them applicable across diverse software engineering contexts.

• **Bridging Research Gaps in GORA Techniques**

The study addresses key limitations in existing GORA methods, including lack of stakeholder clustering, inadequate handling of uncertainty, and absence of systematic technique selection.

• **Integration of Soft Computing Techniques Strengthens GORA**

The incorporation of soft computing methods such as RST and clustering enhances the analytical strength and flexibility of traditional goal-oriented approaches.

• **Framework Supports Iterative and Adaptive Requirement Analysis**

The proposed methodologies follow an iterative approach, allowing continuous refinement of goals and requirements in response to changing stakeholder needs and project dynamics.