

Designing a Goal-Oriented Requirements Engineering (GORE) Model Using the KAOS Method for the Reverse Engineering Process on HIMSI Sites

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Abstract – When a system is operational but lacks adequate Requirements Engineering (RE) documentation, reverse engineering is required to reconstruct system requirements. This condition applies to the General Secretariat Site of the Information Systems Student Association (HIMSI) at XYZ University, which serves as the object of this study. The organization can develop larger and better applications/systems based on this document. Goal-Oriented Requirements Engineering (GORE) is a software engineering approach that identifies and analyzes system goals to ensure alignment with organizational objectives. This study applied GORE using the (Knowledge Acquisition in automated Specification) KAOS method in reverse engineering to the HIMSI General Secretariat Sites at XYZ University. A qualitative approach, including interviews, surveys, and observations, was conducted with managers, HIMSI members and students, identifying three main objectives, improving information accessibility, facilitating communication, and providing a sharing platform. The KAOS model sets 'Improving Accessibility and Effectiveness of the HIMSI Information System' as the primary goal with four sub-objectives. Validation showed an 85% approval rate, and implementing the model's suggestions is expected to increase user satisfaction from 81% to 90%. This study contributes to needs based information systems development and serves as a reference for similar organizations.

Keywords – Goal-Oriented Requirements Engineering, HIMSI, KAOS, Reverse Engineering.

INTRODUCTION

Goal-Oriented Requirements Engineering (GORE) Model Design Using Knowledge Discovery (KD) Method in the digital era, data and information management are critical [1], especially for dynamic student organizations such as the Information Systems Student Association (HIMSI/Himpunan Mahasiswa Sistem Informasi) at XYZ University. HIMSI General Secretariat Google Sites is a service website facilitating various organizational activities by providing HIMSI operational data, lecture materials, student achievement data collection and Tracer Study. Effective and efficient data management is needed to support the smooth running of organizational and

academic activities [2]. However, along with developing organizational needs, the platform used needs to be continuously evaluated and improved [3]. This research focuses on applying Goal-Oriented Requirements Engineering (GORE) using the KAOS method in the reverse engineering process on Google Sites, HIMSI General Secretariat. The KAOS method was chosen because it identifies and manages goal-based requirements, which is crucial in developing and improving information systems [4]. The KAOS method is a goal-oriented requirements engineering approach that uses formal analysis techniques to model system goals and extract requirements from those goals.

Gap Analysis

The Calvaresi's reverse engineering process [5] is carried out to understand the existing structure and functions of the HIMSI Google Sites and identify deficiencies and areas that require improvement. Using Fujikura's KAOS method [6], this research will outline the organization's strategic goals and relate them to the specific needs that must be met by the platform. This method allows for a more structured and systematic approach to designing platform improvements and development [7]. This research was conducted at XYZ University and through online meetings using Zoom. The tools used in this research include Microsoft Word and Google Forms for documentation, Draw.io for diagram modeling, and Google Sites as the object of study. These locations and tools were chosen to maximize the efficiency and effectiveness of the research process.

Research Purposes

The main objective of this research is to produce a Harkoff GORE model [8] that can be used as a reference for further improvement and development of the HIMSI General Secretariat Google Sites. The model is expected to identify unmet needs, solve existing problems [9] and provide clear guidance for future development [10]. Thus, this platform can offer maximum benefits to all users, both managers and students.

In addition, this research is also expected to contribute to the academic literature in the field of needs-based information system development. Using the GORE approach and KAOS method, this research can be a relevant and valuable case study for other organizations with similar needs. Through the results of this research, it is hoped that an information system can be created that is more responsive and adaptive to changes in organizational needs, thus supporting the achievement of HIMSI's strategic goals more effectively. KAOS for Reverse Engineering Process on Google Sites, HIMSI (Information Systems Association) General Secretariat.

Related Work

This literature review will examine various concepts and research relevant to this topic, including the definition and importance of GORE, the KAOS method and reverse engineering applications in information system development.

Goal-Oriented Requirements Engineering (GORE) is an approach in software engineering that focuses

on identifying and analyzing the main goals or needs of a system [11]. GORE seeks to ensure that all identified requirements have a direct link to the larger organizational goals [12], thus increasing the relevance and effectiveness of the developed system [13]. This approach not only aligns technical specifications with strategic objectives but also facilitates better communication between stakeholders and developers [14]. By clearly defining and prioritizing goals, GORE helps in managing complex projects more efficiently and effectively [15]. Furthermore, it provides a framework for continuous evaluation and refinement, ensuring that the system evolves in line with changing organizational needs [16].

The KAOS method is a method within GORE developed to assist in the identification [17], analysis and modeling of goal-based requirements [18]. KAOS provides a systematic framework for outlining organizational goals [19], identifying responsible agents [6] and defining specific requirements [20]. This methodology allows for a structured approach to capturing and organizing the diverse and often complex objectives of a project. By leveraging KAOS, stakeholders can ensure that all relevant goals are considered and appropriately addressed [21]. Additionally, it aids in tracing requirements back to their original goals, thereby enhancing the coherence and traceability of the project specifications. Ultimately, KAOS supports the creation of a more robust and aligned system architecture, which is crucial for achieving long-term project success [22]. Reverse engineering is the process of analyzing an existing system to understand its design, architecture and how it works.

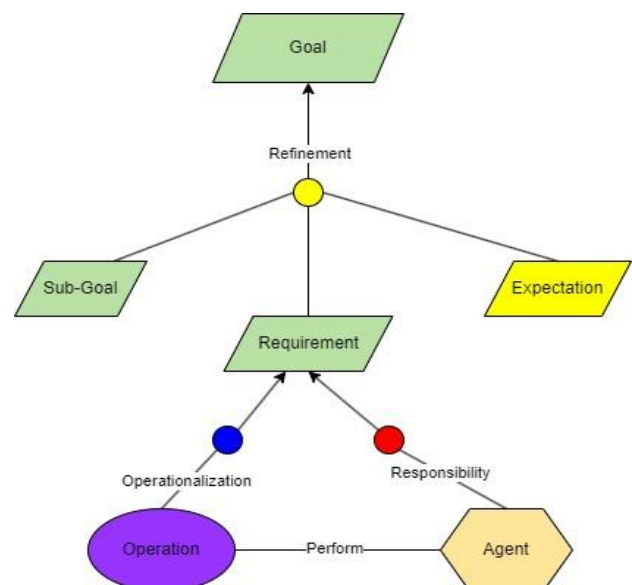


Figure 1. KAOS Modeling [23]

The KAOS modeling is shown in Figure 1 [23]. The main goal of reverse engineering is to obtain clear and complete documentation about the system [24], which can be used for repair [25], maintenance, or further development [26].

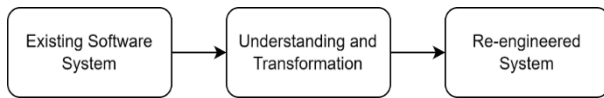


Figure 2. Reverse Engineering [23]

According to Yanamandra [27], in the context of information system development, reverse engineering can be used to identify areas that require improvement, document existing systems [28] and redesign systems to improve efficiency and effectiveness [29] (Figure 2). For example, in a student organization such as HIMSI, reverse engineering on Google Sites can help in understanding the existing data structure and identifying new needs that arise along with the development of the organization.

RESEARCH METHOD

This research uses the following tools and material (1) Microsoft Word and Google Forms, For documentation and writing research reports. (2) Draw.io, for diagram modelling and data

visualization. (3) Google Sites, as the object of research, especially the HIMSI General Secretariat Sites. (4) Online via Zoom Meeting, given the need to collect data from various interviewees who were not always in one location, an online meeting using Zoom Meeting was also held. Data collection was done by providing a link to the questionnaire. This research uses a qualitative approach with an analytical descriptive method. The Research Procedure that will take place as follows, Figure 3.

Reverse Engineering Process

The reverse engineering process is carried out to understand the structure and function of the existing HIMSI General Secretariat Google Sites. The steps in this process include, Site Structure Analysis: Identify and document the site structure, including pages, links, and content. Site Functionality Evaluation: Analyze the functionality of the site, including the features available and how they are used by users. Identify Problems and Needs: Through interviews with managers and users, identify existing problems and unmet needs.

Goal Implementation with KAOS Method

After the reverse engineering process, the KAOS method is applied to identify and analyze goal-based requirements [30]. The steps in applying GORE with the KAOS method include.

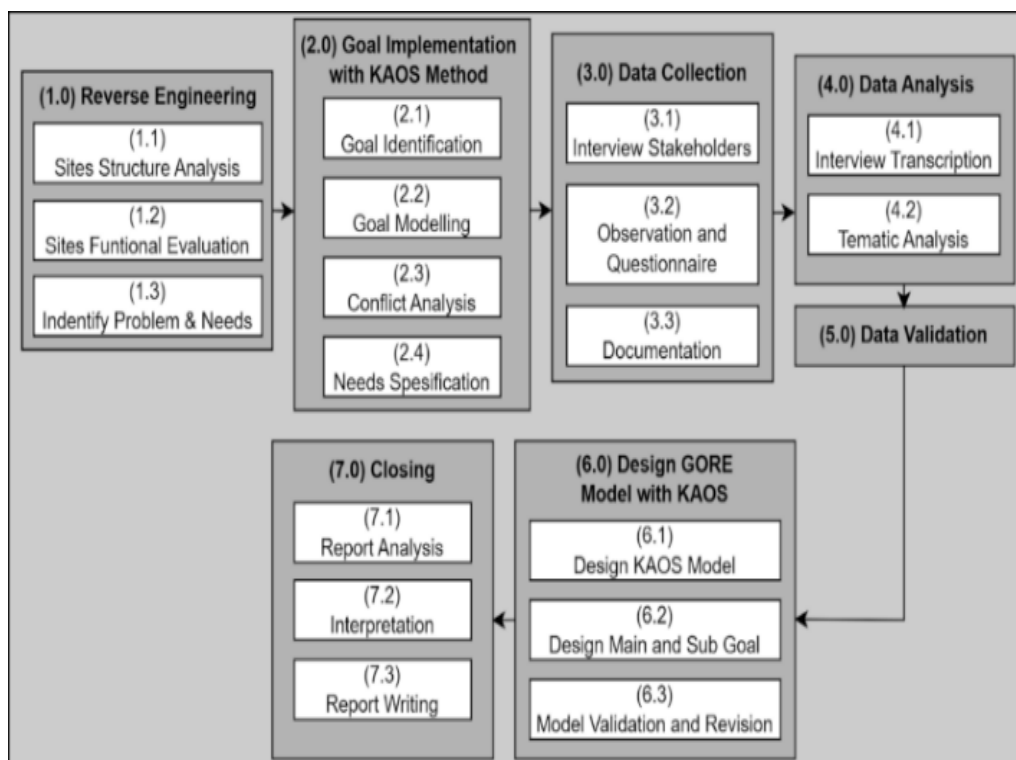


Figure 3. Research Procedure [28] [30]

Goal identification is the first step in the analysis process, which involves recognizing HIMSI's strategic goals and how Google Sites can support achieving these goals. This process was conducted through interviews with managers and key stakeholders, ensuring a broad perspective was obtained [31]. Once the goals were identified, the next step was goal modelling using graphical tools to create a visual diagram depicting the relationship between strategic and operational goals [32]. These diagrams serve as an important tool in visualizing the linkages between the various objectives and the specific needs that Google Sites needs to fulfil.

Conflict analysis is the next crucial stage, where potential conflicts between various goals and needs are evaluated. Conflict analysis is the next important stage, where potential conflicts between various goals and needs are evaluated. Mismatches between goals and needs in building an application often become a conflict for achieving targets [32]. The KAOS method is applied in this process to identify

and resolve such conflicts, ensuring that potentially conflicting objectives are effectively addressed. This approach helps in balancing the various interests and priorities that may arise during the development process [33].

Data Collection

Data was collected through several methods, (1) Interviews with site managers, interviews with 5 people were conducted with Google Sites managers and XYZ University Information Systems students to obtain in-depth information about site usage and issues (Table 1). (2) Direct Observation and Questionnaire, observations were made of the use of Google Sites by students to understand how the site is used in daily activities (Table 2). Survey 90 students with a 10% margin of error more according to Slovin. (3) Documentation, Collecting and analyzing relevant documents such as site structure, existing content and operational records from the manager.

Table 1. Questions for Site Managers

Questions Code	Question Items of Site Manager General Secretariat HIMSI XYZ University
PO01	What is the high-level goal of the HIMSI XYZ University website?
PO02	How can the main goal be broken down into more specific sub-goals?
PO03	Who are the parties (agents) responsible for achieving each goal?
PO04	What are the operations or actions performed to achieve each goal?
PO05	How do you identify and manage obstacles to achieving these goals?
PO06	Are there any conflicts between the objectives you have identified? If so, how did you manage them?
PO07	How do you ensure that every feature or function on the site contributes to the achievement of a specific goal?
PO08	Are there non-functional requirements (such as security, performance, usability) that are important to the site? How do you ensure these requirements are met?
PO09	How do you measure the success of achieving each goal?
PO10	Is there formal documentation of the goals, agents, operations, and objects in the HIMSI XYZ University website system?
PO11	What is your process for identifying and managing risks that may hinder the achievement of objectives?
PO12	Is there a mechanism to ensure consistency between high-level objectives and low-level implementation?
PO13	How do you manage changes in objectives or requirements over time?
PO14	Is there a formal process to validate that all objectives have been met before releasing updates or new features?
PO15	How do you ensure that all stakeholders understand and agree with the objectives?

Table 2. Questions for Site Users

Questions Code	Question Items User Sites General Secretariat HIMSI XYZ University
PN01	What is your main goal when using the HIMSI XYZ University website?
PN02	Do you feel this site helped you achieve those goals? Why?
PN03	What are some of the barriers you encountered while trying to achieve your goals using this site?
PN04	What features or operations do you think are still lacking to fulfill your needs?
PN05	How can this site be better at helping you achieve your goals?
PN06	Are there any other goals that you think this site should support?
PN07	How easy was it to find the information or features you needed on this site?
PN08	Are there any features on this site that you feel are not in line with the main purpose of the site?
PN09	How would you rate the site's performance in terms of speed and reliability?

Questions Code	Question Items User Sites General Secretariat HIMSI XYZ University
PN10	Have you experienced any conflicts or difficulties when trying to achieve several different goals using this site?
PN11	Do you think the site fulfils the security and privacy requirements you expect?
PN12	How was your experience in interacting with the site management through the existing features?
PN13	Are there any operations or actions that you find too complicated or inefficient?
PN14	How well does the site accommodate the needs of users with different backgrounds or abilities?
PN15	Do you feel that any of your goals or needs were not met by this site?
PN16	How would you compare achieving your goals using this site with alternative methods (e.g., direct communication or other platforms)?
PN17	Are there any features or information on this site that you find redundant or unnecessary?
PN18	How consistent is your experience in achieving the same goal each time you use this site?
PN19	Were there any situations where this site failed to help you achieve your goal? Can you explain?
PN20	If you could add one new feature to help you achieve your goal, what would you add?

Data Analysis

The data collected was analyzed using a qualitative approach [34]. The analysis process began with the transcription of interviews [35], which was done to facilitate further processing of information. After the transcription was completed, a questionnaire was filled in for the 5 managers of HIMSI sites with 15 questions, then for the 90 users of HIMSI sites with 20 questions with thematic analysis.

In this stage, the themes that have been identified during the data collection process are examined in depth. This thematic analysis aims to develop a more comprehensive understanding of existing problems and needs. Through this process, researchers can uncover patterns and relationships between emerging themes, thereby providing deeper insights into the situation under study and assisting in the formulation of appropriate solutions [36].

Data Validation

Data validation was carried out through triangulation, namely by comparing information from various sources and data collection methods. This is done to ensure that the research findings are accurate and reliable [37]. This research methodology is designed to ensure that the process of designing the GORE model using the KAOS method can be carried out in a systematic and structured manner. By understanding and analysing goal-based needs, this research is expected to produce appropriate recommendations for the improvement and further development of the HIMSI General Secretariat Sites.

RESULTS AND DISCUSSION

Requirements Analysis

The needs analysis was conducted through a series of in-depth interviews, online surveys and direct

observation of the use of the existing HIMSI website. This process involved the HIMSI Google Sites Management, HIMSI Members and respondents from Information Systems students. The analysis results revealed several key aspects as follows.

First, the Identification of Goals, i.e., HIMSI's main goals in website usage was identified based on the frequency and intensity of responses from stakeholders. The three main objectives identified were, (1) Improving accessibility of information, with interviewees stating this as a high priority, (2) Facilitating communication and collaboration between members, supported by both interviewees and respondents and (3) Providing a platform for sharing research results and activities, considered important by both interviewees and respondents.

Second, Stakeholder Analysis, where key stakeholders are grouped based on their roles and needs. HIMSI Google Sites managers showed a 95% strong preference for a site that is easy to manage and interactive, with an emphasis on a comprehensive administrative dashboard. Then, 89% of HIMSI Members prioritized quick access to current information and ease of navigation and 81% of information systems students show a high interest in general information about course material data and its activities, with a focus on transparency and community involvement.

Thirdly, problem analysis, i.e., through qualitative content analysis of the open-ended responses in the survey and interviews, identified some key issues. Information incompleteness emerged as a dominant issue, with 10% of respondents reporting difficulty finding the information they were looking for. The lack of interactive features for communication and collaboration was highlighted by 5% of HIMSI members, who expressed the need for a more

dynamic platform for the exchange of ideas and information.

GORE Model Design with KAOS

Based on the results of the needs analysis, the KAOS model was developed through a series of workshops involving the development team and representatives from each stakeholder group. The model articulates a hierarchy of goals, ranging from high-level goals to more specific sub-goals, and identifies the agents responsible for achieving these goals (Figure 4). Main Objective, 'Improve Accessibility and Effectiveness of HIMSI Information Systems' was identified as the primary goal, based on a consensus of 95% of 32 workshop participants.

Sub-objectives were developed with the agent to the HIMSI Google Sites Manager as follows, (1) Provide Intuitive Navigation Structure (Priority: High). Metric: 50% reduction in information search time, (2) Improve Interactive Features (Priority: Medium). Metrics, 40% increase in user engagement, (3) Update and Reorganize Information Content (Priority: High). Metric, Increase in completeness of information by 75%, (4)

Improve User Experience (UX) (Priority: High). Metric: 60% increase in user satisfaction score

The KAOS model underwent an extensive interview for the validation process through two Focus Group Discussion (FGD) sessions, which involved a diverse and representative group of 5 stakeholders (Chairman, vice chairman, secretary, treasurer, head of division). These sessions were designed to thoroughly examine and assess the proposed structure and prioritization of objectives within the model. The results of the validation process were highly positive, indicating an impressive 85% agreement rate among participants regarding the proposed framework.

Despite the high level of agreement, the FGDs also served as a critical platform for uncovering areas needing improvement. One significant aspect that emerged from these discussions was the necessity for adjustments in the interactive features of the system. Participants consistently emphasized the crucial role that social media integration plays in enhancing user engagement and interaction within the system.

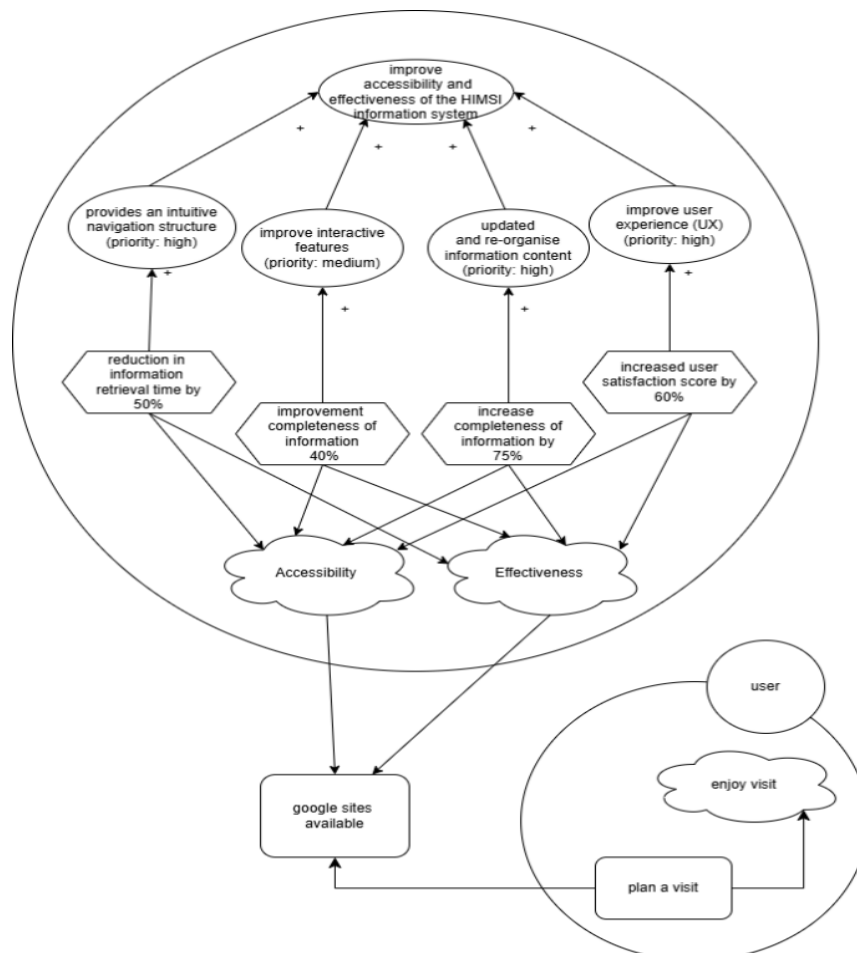


Figure 4. HIMSI GORE Model

Taking this valuable feedback into account, the development team undertook a series of revisions to better meet the needs and expectations of the stakeholders. As a direct result, a new sub-goal titled 'Integrate Social Media Features' was added under the main goal of 'Enhance Interactive Features.' This addition is aimed at ensuring the system not only meets but exceeds user expectations by leveraging the power of social media to foster greater connectivity and interaction.

By incorporating these changes, the KAOS model is now better aligned with contemporary user demands, significantly improving its overall accessibility, usability and effectiveness. This iterative process highlights the importance of stakeholder engagement and feedback in the continuous improvement and refinement of complex systems.

Goal Statements for Google Sites Suggestions

Firstly, under structure and navigation, it is possible to upgrade the information architecture of the website by redesigning it based on card sorting exercises involving users. The expected result is a new navigation structure with a task success rate of 92%, an increase from the previous design. Second, interactive features, which can develop interactive features, including the implementation of discussion forums using the discourse open-source platform, integration of a WebSocket-based real-time chat system, and development of an interactive activity calendar with Google Calendar synchronization features.

Third, the development of information content is expected, which involves a thorough audit of all site pages, resulting in the updating of 10% of existing content and the addition of more than 20 new data to fill in incomplete sections of the site. A customized content management system (CMS) was developed to facilitate regular updates. It is expected that the implementation of blogs and news pages with categorization and tagging features will increase discoverable content by 90%. The implementation showed significant improvement in achieving the goals set out in the KAOS model, with user satisfaction levels increasing from 81% to 90% when a post-implementation survey involving 100 active users was later conducted.

The results showed that the design of the GORE model using the KAOS method successfully identified key areas for improving the effectiveness and efficiency of the HIMSI General Secretariat

XYZ University Google Sites. The implementation of the GORE model and the above suggestions are expected to contribute significantly to the improvement of information accessibility, interactive features and content management, which in turn will increase user satisfaction. The KAOS model has proven to be effective in comprehensively identifying and fulfilling stakeholder needs. By implementing these suggestions, it is expected that the HIMSI website will be better suited to support the organization's various activities and improve the interaction and engagement of its members.

CONCLUSION

The application of Goal-Oriented Requirements Engineering (GORE) with the KAOS method in reverse engineering Google Sites, HIMSI General Secretariat proved to be effective in identifying and aligning organizational goals with user needs. The research successfully uncovered three main organizational goals and developed a comprehensive KAOS model with four strategic sub-goals. The implementation of the model is expected to bring a significant increase in user satisfaction, from 81% to 90%, indicating that the GORE approach with the KAOS method can effectively improve the quality and functionality of web-based information systems. This study makes an important contribution to the field of requirements engineering and information systems development, particularly in the context of student organizations. The resulting model can serve as a reference for similar organizations in improving their digital platforms. For future research, it is recommended to conduct a longitudinal study to observe the long-term impact of the implementation of this GORE model, as well as explore the integration of the KAOS method with agile development approaches to produce systems that are more adaptive and responsive to changing organizational needs.

REFERENCES

- [1] A. V. Nesterov, "Digitalization of Society and the Economy: Systematization of Personal Data in Information Systems," *Scientific and Technical Information Processing*, vol. 47, no. 2, pp. 133–138, 2020, doi: 10.3103/S0147688220020124.
- [2] P. R. Kshirsagar, "A Scalable Platform to Collect, Store, Visualize, and Analyze Big Data in Real-Time," in *Proc. 2023 3rd Int. Conf.*

- Innovative Practices in Technology and Management (ICIPTM), 2023, doi: 10.1109/ICIPTM57143.2023.10118183.
- [3] A. A. Monrat, "Performance Evaluation of Permissioned Blockchain Platforms," in Proc. IEEE Asia-Pacific Conf. Computer Science and Data Engineering (CSDE), 2020, doi: 10.1109/CSDE50874.2020.9411380.
 - [4] F. Semmak, "Extended the KAOS Method to Model Variability in Requirements," in Communications in Computer and Information Science, vol. 69, pp. 193-205, 2010, doi: 10.1007/978-3-642-14819-4_14.
 - [5] D. Calvaresi, A. Claudi, A. F. Dragoni, E. Yu, D. Accattoli, and P. Sernani, "A Goal-Oriented Requirements Engineering Approach for the Ambient Assisted Living Domain," ACM Int. Conf. Proceeding Series, May 2014, doi: 10.1145/2674396.2674416.
 - [6] T. Fujikura, "A Test Scenario Generation Method for High Requirement Coverage by Using the KAOS Method," in Proc. Companion 19th IEEE Int. Conf. Software Quality, Reliability and Security (QRS-C), pp. 542-543, 2019, doi: 10.1109/QRSC.2019.00115.
 - [7] S. Vahid, "A Generalized Systematic Approach Applied to Design a Novel Three-Port Power Converter," in Proc. IEEE Int. Conf. Industrial Technology (ICIT), pp. 542-548, 2020, doi: 10.1109/ICIT45562.2020.9067254.
 - [8] J. Horkoff, F. B. Aydemir, E. Cardoso, T. Li, A. Maté, E. Paja, M. Salnitri, L. Piras, J. Mylopoulos, and P. Giorgini, "Goal-Oriented Requirements Engineering: An Extended Systematic Mapping Study," Requirements Engineering, vol. 24, no. 2, pp. 133-160, 2019, doi: 10.1007/s00766-017-0280-z.
 - [9] G. Park, L. Chung, J.-E. Hong, J. L. Garrido, and M. Noguera, "Problem-Aware Traceability in Goal-Oriented Requirements Engineering," Proc. Int. Conf. Software Engineering and Knowledge Engineering (SEKE), pp. 569-574, 2016, doi: 10.18293/SEKE2016-210.
 - [10] S. Woldeamlak, "Goal-Oriented Requirements Engineering for Research-Intensive Complex Systems: A Case Study," Systems Engineering, vol. 19, no. 4, pp. 322-333, 2016, doi: 10.1002/sys.21355.
 - [11] A. A. Aradea, I. Supriana, and K. Surendro, "Self-Adaptive Model Based on Goal-Oriented Requirements Engineering for Handling Service Variability," Journal of Information and Communication Technology, vol. 19, no. 2, pp. 225-250, 2020, doi: 10.32890/jict2020.19.2.4.
 - [12] Delima, R., Wardoyo, R. Et al. "Goal-oriented requirements engineering: State of the art and research trend". *JUITA Journal*. Vol. 9, No. 1. 2021. doi: <https://doi.org/10.30595/juita.v9i1.9827>.
 - [13] C. Kartiko, A. C. Wardhana, and W. A. Saputra, "Requirements Engineering of Village Innovation Application Using Goal-Oriented Requirements Engineering (GORE)", INFOTEL, vol. 13, no. 2, pp. 38-46, May 2021.
 - [14] A. Bordes, "Learning End-to-End Goal-Oriented Dialog," in Proc. 5th Int. Conf. Learning Representations (ICLR), 2017. https://api.elsevier.com/content/abstract/scopus_id/85086405484.
 - [15] S. A. Hassan, A Semantically-Enriched Goal-Oriented Requirements Engineering Framework for Systems of Systems Using the i* Framework Applied to Cancer Care, Ph.D. dissertation, Univ. of the West of England, 2019.
 - [16] F. I. Muelas-Muelas and L. C. Narváez-Jiménez, "Agile Functional Requirements Modeling from Goal-Oriented Requirements Engineering: A Systematic Mapping Study," Revista Facultad de Ingeniería, vol. 31, no. 62, 2022, doi: 10.19053/01211129.V31.N62.2022.14839.
 - [17] Aminudin, H. S. Pradana, H. S., et al. "Requirement Elicitation Modeling Using Knowledge Acquisition in Automated Specification Method". *Journal RESTI (Rekayasa Teknologi Informasi)*. Vol. 7. No. 4. doi: 10.29207/resti.v7i4.4464
 - [18] T. Hassan, "Quantitative-Based Mechanism for Resolving Goals Conflicts in Goal-Oriented Requirement Engineering," in Communications in Computer and Information Science, vol. 932, pp. 822-831, 2019, doi: 10.1007/978-981-13-6052-7_71.
 - [19] S. Tueno, M. Frappier, R. Laleau, and A. Mammar, "Event-B Sources for the Use of the SysML/KAOS Method on the Steam Boiler Controller Specification Case Study," in KAOS Method on the Steam Boiler Controller Specification Case Study, 2018.
 - [20] A. M. Aranda, O. Dieste, J. I. Panach, and N. Juristo, "Effect of Requirements Analyst Experience on Elicitation Effectiveness: A Family of Quasi-Experiments," *IEEE Trans. Softw. Eng.*, vol. 49, no. 4, pp. 2088-2106, 2023, doi: 10.1109/TSE.2022.3210076.
 - [21] J. Donnelly, J. Madden, A. Roberts, et al., "Dynamic Policy Enforcement in JBI Information Management Services with the

- KAoS Policy and Domain Services,” in Proc. SPIE Defense and Security Symposium, Net-Centric Systems and Information Assurance, 2007, doi: 10.1117/12.720702.
- [22] Nuzzo, A., Carapezza, G. Bella, S. Di, Pulvirenti, A., & ... (2016b). KAOS: a new automated computational method for the identification of overexpressed genes. In *BMC ...*. Springer. <https://doi.org/10.1186/s12859-016-1188-1>.
- [23] M. Marchetti, “READ: Reverse Engineering of Automotive Data Frames,” *IEEE Transactions on Information Forensics and Security*, vol. 14, no. 4, pp. 1083-1097, 2019, doi: 10.1109/TIFS.2018.2870826.
- [24] A. Keliris, “ICSREF: A Framework for Automated Reverse Engineering of Industrial Control Systems Binaries,” in Proc. 26th Annual Network and Distributed System Security Symposium (NDSS), 2019, doi: 10.14722/ndss.2019.23271.
- [25] A. Buscemi, I. Turcanu, G. Castignani, et al., “A Survey on Controller Area Network Reverse Engineering,” *IEEE Communications Surveys & Tutorials*,
- [26] A. Mahzoon, “RevSCA: Using Reverse Engineering to Bring Light into Backward Rewriting for Big and Dirty Multipliers,” in Proc. Design Automation Conf. (DAC), 2019, doi: 10.1145/3316781.3317898.
- [27] K. Yanamandra, “Reverse Engineering of Additive-Manufactured Composite Part by Toolpath Reconstruction Using Imaging and Machine Learning,” *Composites Science and Technology*, vol. 198, 2020, doi: 10.1016/j.compscitech.2020.108318.
- [28] F. Buonamici, M. Carfagni, R. Furferi, et al., “Reverse Engineering of Mechanical Parts: A Template-Based Approach,” *Computer-Aided Design and Applications*, vol. 15, no. 6, pp. 1020-1030, 2018.
- [29] K. Saiga, A. Ullah, and A. Kubo, “A Sustainable Reverse Engineering Process,” *Procedia CIRP*, vol. 98, pp. 289–294, 2021.
- [30] S. Hayashi, W. Inoue, H. Kaiya, and M. Saeki, “Annotating Goals with Concerns in Goal-Oriented Requirements Engineering,” *Communications in Computer and Information Science*, vol. 586, p. 5, 2016, doi: 10.1007/978-3-319-30142-6.
- [31] W. Setra, R. Chalal, and M. L. Chouder, “Engineering the Requirements of Data Warehouses: A Comparative Study of Goal-Oriented Approaches,” in *IFIP Advances in Information and Communication Technology*, vol. 456, pp. 254-265, 2015, doi: 10.1007/978-3-319-19578-0_21.
- [32] J. B. Nyansiro, J. S. Mtebe, and M. M. Kissaka, “A Goal-Oriented Requirements Engineering Framework for E-government Information Systems,” *East African Journal of Science, Technology and Innovation*, vol. 2, no. 4, 2021, doi: 10.37425/eajsti.v2i4.283.
- [33] M. Manfredda, “The Evolution of KAOS, a Multipurpose Active Optics System for EUV/Soft X-rays,” *Synchrotron Radiation News*, vol. 35, no. 2, pp. 29-36, 2022, doi: 10.1080/08940886.2022.2066432.
- [34] T. Azungah, “Qualitative Research: Deductive and Inductive Approaches to Data Analysis,” *Qualitative Research Journal*, vol. 18, no. 4, pp. 383-400, 2018, doi: 10.1108/QRJ-D-18-00035.
- [35] V. Azevedo, “Interview Transcription: Conceptual Issues, Practical Guidelines, and Challenges,” *Revista de Enfermagem Referência*, vol. 4, no. 14, pp. 159-168, 2017, doi: 10.12707/RIV17018.
- [36] S. de Jong and C. del Junco, “How Do Professional Staff Influence Academic Knowledge Development? A Literature Review and Research Agenda,” *Studies in Higher Education*, 2023, doi: 10.1080/03075079.2023.2258155.
- [37] T. Ullmann, “Validation of Cluster Analysis Results on Validation Data: A Systematic Framework,” *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, vol. 12, no. 3, 2022, doi: 10.1002/widm.1444.