Journal of Theoretical and Applied Information Technology
29th February 2024. Vol.102. No 4

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

CONSISTENCY AND CORRECTNESS OF REQUIREMENTS FOR ARTIFICIAL INTELLIGENCE SYSTEMS

[1]DR.M.R RAJA RAMESH, [2]DEVAKIVADA GANESH, [3]NALLABARIKI PRAVEEN KUMAR, [4]PROF. M. JAMES STEPHEN

[1]Associate Professor, Department of IT, Vishnu Institute of Technology, Bhimavaram, W G (D), Andhra Pradesh, India.
[2]Assistant Professor, Department of IT, Vishnu Institute of Technology, Bhimavaram, W G (D), Andhra Pradesh, India.
[3]Assistant Professor, Department of CSE, CMR Institute of Technology, Hyderabad, Telangana, India.
[4]Registrar, Andhra University, Visakhapatnam. Andhra Pradesh, India.

E-mail: [1]rajaramesh.m@vishnu.edu.in, [2]ganesh.d@vishnu.edu.in, [3]pinku463@gmail.com, [4]registrar@andhrauniversity.edu.in

ABSTRACT

Artificial intelligence has become the part of our life with its advancement and involvement in our day to day activities. Due to the trust we place on the artificial intelligence systems, they must work as per the human expectations with zero deviation. This can be achieved if the requirements are specified correctly and all the requirements stated for the system must be consistent with one another. Measuring consistency and correctness is sacrosanct for attaining quality in the system that is to be developed. This paper proposes a set metrics for measuring the correctness and consistency of the requirements stated in the software requirements specification document. Initially the requirements document was restructured according the format that is suitable for applying the metrics. The factors consistency and correctness are divided into sub factors and sub metrics are developed for measuring the same. Finally, the sub metrics are combined to calculate the final metrics for consistency and correctness. The proposed metrics are applied on the SRS document of Navigation and Maps artificial intelligence system and this approach is compared with the existing model and the results are satisfactory.
Key words: *Consistency, Correctness, SRS, Metrics And Artificial Intelligence*.

1. INTRODUCTION

The concept of providing artificial intelligence to the machines was first discussed in the workshop which was held in Dartmouth College of USA in the year 1956. Now we cannot imagine our life without AI [2]. People are developing the machines and machines are directing the people. The care we take while developing machines will be the result of correctness of direction provided by the machines. Everything must begin with requirements engineering, once all the requirements are collected the design will start. Before going to the design we need to cross check weather all the requirements are correct are not? Are they really reflecting what we are planning to develop? This cross checking will results the correct design and the correct design eventually results in the development of correct machine[2][3]. If the requirements are incorrect and if they are uncovered before the project delivery they have to be corrected. If the bugs in the requirements are uncovered in the initial stages of software development process the cost of correction is negligible. The delay in finding the bugs decides the cost of correction. If they are identified at system testing or later the correction cost is 50 to 100 times more than the cost of initial stages[17]. If the bugs are not identified, then based on the functionality of the AI system[3] consequences varies from mild to catastrophic and even leads to loss of invaluable things, hence having correct and consistent requirements for AI[4] based systems is at most important.

According to IEEE standard 830(1993) [1] a good SRS must have eight characteristics in which Correct and Consistency are two important characteristics. Here measuring the correctness also involves the consistency of requirements. If the requirements are not consistent with other requirements stated in the SRS or if the requirements are not consistent with its other

related documents then there is a problem which needs to be taken care of. An SRS is correct [1] if every stated requirement is validated by the customer and expected to be met by the software system. An SRS is consistent [1] if all the requirements stated in the requirements document are compatible with one another and at the same time they must be compatible with all the input documents and related documents which were used to prepare the software requirements specification. Out of eight good characteristics of SRS this paper concentrated on only two characteristics not because they are superior to other remaining six characteristics, but all the characteristics are equally important and in some cases it is practically difficult to measure few characteristics and also the work done in the past regarding the good characteristics of SRS is negligible.

In artificial intelligence, systems are developed by analyzing the thinking patterns of human beings and creating an artificial human being just like cloning. During the process of gathering or collecting the requirements for creating any artificial intelligent machine, .01% deviation of the requirement also creates a problem and the consequences are not imaginable and damages are unrecoverable [3]. After identifying the importance of the correctness and consistency of requirements for AI systems [4], this paper has proposed a set of concrete metrics for measuring the same.

2. LITERATURE SURVEY

So far the work on the consistency and correctness of requirements stated in software requirements specification is very nominal. C and C analysis of requirements for distributed systems by Liayan yu et al.[5] proposed a formal scenario model where requirements are represented in the tree structure and performed consistency analysis. Fredrick et al [6] used Zed to identify and remove the ambiguity and later activity charts and state charts were used to execute Zed for assessing the completeness and consistency of requirements written in natural language. According to Matthew et al.[7] checking whether the requirements are internally complete or not by using completeness of Trigger Events and checking the completeness of Output specifications. Matthew et al. mainly concentrated on requirements of real time systems[7]. Shaoying liu[8] used the technique refinement for netting accurate and complete requirements. In [8] conventional prescribed approaches are used and completeness of formal specifications is explained with the help of examples. Wei Liu et al.[9] performed the completeness analysis of service based province requirements.[9] uses directed graph for representing construction and optimization of requirements components. R S Knett [10] proposed a quantifiable approach to measure the correctness and consistency of requirements; he has proposed metrics for quality quantification SRS documents. B labaw et al. [11] proposed consistency examination of SCR style requirements documents.[11] uses formal study which checks mechanically SRS documents of all the applications(domain independent) represented in SCR tabular scheme.[11] is applicable only for documents uses SCR style, for other types of documents this approach is not suggestible. S acharya et al.[12] uses inspection of specification and testing of executable specification for evaluating the consistency of requirements documents and applied on mobile computing domain. [13] has developed metrics for both correctness and consistency by the taking the different measures of SRS document. The metrics developed in [13] are compared with different approaches developed in the past and applied on two different case studies. Activity based assessment method is used in [14] for measuring the entire quality of SRS document which includes both correctness and completeness. In [14] first the requirements in the SRS are identified as activities and then these activities are used as measures for developing the metrics in order to measure the quality of same. Cloud based approach is used in [15] which includes neural network techniques for measuring the quality of requirements containing all the good characteristics of SRS document stated in IEEE standard 830(1993).The work in [15] differentiated the requirements from quality requirements in assessing correctness and consistency. Zowghi et al.[21] concentrated on three factors of SRS document i.e consistency, correctness and completeness of requirements document and it emphasizes on the evolutionary framework. This work [21] performs different type of checks in order to ensure that all these three properties are properly assessed and crosschecked. Atish et al.[22] used a framework which uses expert agents relying on knowledge base for defining the consistent requirements and an Object oriented tool assisting for consistent requirements identification. Daoust et al[23] discussed the importance role of inconsistency in violating rationality of other requirements. This work [23] describes the impact of consistency and the measures that should be taken to achieve the consistency in the stated requirements. Nistala et al.[24] used different

models as framework for identification of inconsistency and calculating the index to show how consistent the stated requirements are and this frame work also addresses the factors correctness and completeness. According to Jaroslaw Kuchata[25] as the number of requirements increases there is a lot of impact on the SRS document in relation with consistency. So as the size of the requirements document increases the impact of consistency and correctness also must increases. Chao et al.[26] has used NLP technique that is cataloged extraction and organized description for identifying the integrity and inconsistency of requirements and used LMS for applying the proposed technique, the results stated the complexity of measuring the consistency of requirements. Constance L. Heitmeyer et al.[27] has automated the consistency issues of requirements documents for detection of errors like type errors, missing requirements, iterative definitions and non-determinism in requirements. Requirements are reviewed with the help of SCR[27],for measuring the scalability and utility of the model the proposed approach is applied on the application avionics. Patra et al.[28]prsents an approach wich objectively assess the SRS quality, it uses process valuation model as framework for identifying the quality of the requirements document. N prampoon et al.[29] assess the quality of the requirements including correctness and consistency based on the structure of the requirements document and contents of the requirements document. It[29] uses The quantity process model for developing the approach and measurement information approach is used developing the metrics. X. Liu et al[33] specifies that international standards are developed for measuring and evaluating the quality of requirements which includes assessing the correctness and consistency. M Sibisi et al[34] proposed a frame work to evaluate the quality of requirements and this framework helps in tailoring the generic model for assessing the quality of the specific project need.

3. METHODOLOGY

This section describes the approach that is developed for assessing the correctness and consistency of requirements stated in the SRS document. The assessment in this approach is mainly based on the definition of good characteristics of SRS document of IEEE standard 830(1993) [1]. First the given SRS document is restructured by converting from standard format to new format which contains different sub sections which includes the requirements represented in natural language and formal language [13]. This will help to categorize requirements that aids in understanding so that correctness and consistency [1] of the each requirement can be properly assessed.

Things that are considered for measuring the correctness of a requirement are:

- Based on the information given in the input source documents.
- Based on the validity of the requirement.
- Based on the universally accepted standards related to that particular requirement.
- Based on customer/client/user feedback.
- Based on the comparison with objectives/goals of the project.
- Based on the comparison with domain of the project.
- Based on the scope and realizability of the requirements.
- Based on the traceability matrix of requirements.

Things that are considered for measuring the Internal consistency are:

- Based on conflicts between/among terminology.
- Based on temporal conflict between two or more requirements.
- Based on logical conflicts among the requirements.
- Based on real world object conflicts with the requirements.
- Based on conflicts in output formats.

Things that are considered for measuring the External consistency are:

- Based on conflicts between source documents and SRS document
- Based on conflicts between user stories and requirements stated in SRS.
- Based on conflicts with quality standards.
- Based on conflicts with hardware performance.

In this paper, our focus is on Correctness and Consistency(C&C) of artificial intelligence [2] systems, so, both C&C are divided into sub factors.

Based on the definition of each sub factor, sub metrics are developed for measuring the same. Measurement of sub factors is based on the responses to the questionnaire given by the stake holders designated for the C&C assessment [11] of SRS document. Stake holder may be technical personnel having knowledge in requirements engineering domain or personnel having experience in handling software projects, or personnel having software development experience, or personnel having experience in Software quality assessment department or personnel having experience in software testing. Based on the availability and feasibility, stake holders are identified and used for C & C assessment of SRS document [8]. These sub metrics are used to calculate the final metrics of C & C [12].The final metric values are used in preparation of report indicating the correctness and consistency of the SRS document. This report also gives you the insight into the SRS document regarding the portions or parts of the document where the corrections or improvements needed. The following figure 3.1 represents the process that has been followed in this approach.

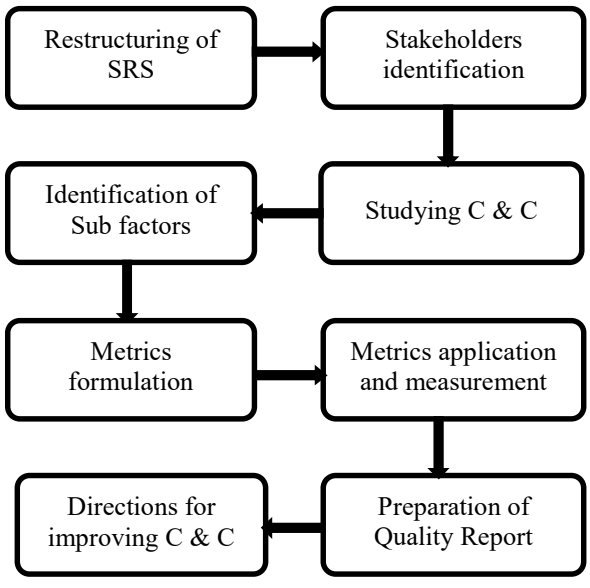

Figure 3.1: Model for C & C measurement of Requirements document

4. METRICS FOR CORRECTNESS AND CONSISTENCY

4.1 Correctness (SRS_{crt}): Requirements stated in the SRS document are said to be correct [1] if each individual requirements contributes something in achieving the success of the project. Correctness metric [8][13] is subdivided in to following metrics:

- **User Stories (Crt_{us}):** If a requirement is reflecting the user story then it is correct.
- **Equivalence (Crt_{eq}):** If a requirement stated in the SRS document is matched/equivalent with its related or input source documents used for preparation of SRS, then it is correct.
- **Restraints (Crt_{re}):** If the SRS document reflects all the conditions or limitations that must be met by each individual requirement, then it is correct.

$$SRS_{Crt}=\forall_{k=1}^{R_r}[\sum_{k=1}^{q} Crt_{us}*q^{-1}+\sum_{k=1}^{q} Crt_{eq}*q^{-1}+\sum_{k=1}^{q} Crt_{re}*q^{-1}] * [N_{sf} * R_r]^{-1} \quad ....eq(1)$$

Where, R_r: Total no. of Requirements, N_{sf}: No. of Sub Factors and q:Questions for each sub factor

4.2 Consistency(Con_r): Metrics for measuring the consistency[1][13] is based on the two sub factors internal consistency and external consistency. Internal consistency describes the conflicts among the requirements stated in the SRS document [11] and external consistency describes with the conflicts between the requirements stated in SRS and the different documents or different sources used to prepare the SRS document.

$$SRS_{Con}= \forall_{k=1}^{R_r}[\sum_{k=1}^{q} Con_i*q^{-1}+\sum_{k=1}^{q} Con_e*q^{-1}] * [N_{sf} * R_r]^{-1} \quad .....eq(2)$$

Where, R_r: Total no. of Requirements, N_{sf}: No. of Sub Factors and q:Questions for each sub factor.

5. APPLICATION OF METRICS AND EXPERIMENTAL STUDY:

Navigation and Maps is the most important application nowadays without which one cannot reach their destination. It has become a part of life and at the same time it has to be hundred percent accurate, or else we can lead to wrong directions. We have taken one SRS document (AI based Navigation and maps application) from Natural Language requirements dataset [19], in that there are totally fifty requirements. Few requirements are: Accepting the input from the user, analyzing the route, collecting different alternative paths form

the source, calculating the distance from source to destination, identifying the shortest path, identifying path based on the type of the vehicle driving, identifying obstacles if any in the path from source to destination, displaying the path on the screen, efficiency of audio and visual aids etc.

$$\mathbf{SRS_{Crt}} = \forall_{k=1}^{R_r}[\sum_{k=1}^{q} \mathbf{Crt_{us}}*\mathbf{q^{-1}} + \sum_{k=1}^{q} \mathbf{Crt_{eq}}*\mathbf{q^{-1}} + \sum_{k=1}^{q} \mathbf{Crt_{re}}*\mathbf{q^{-1}}] * [\mathbf{N_{sf}} * \mathbf{R_r}]^{-1}$$

$$SCR_{crt} = [48+47+48]*[3*50]^{-1}=.95$$

$$\mathbf{SRS_{Con}} = \forall_{k=1}^{R_r}[\sum_{k=1}^{q} \mathbf{Con_i}*\mathbf{q^{-1}} + \sum_{k=1}^{q} \mathbf{Con_e}*\mathbf{q^{-1}}] * [\mathbf{N_{sf}} * \mathbf{R_r}]^{-1}$$

$$SRS_{Con} = [47+48]*[2*50]^{-1}=0.95$$

These metrics value indicates the correctness and consistency of requirements specified for AI based application of Navigation and Maps. The value 1 is the ideal value i.e if the metric Value is 1, then 100% correctness and consistency is achieved. After applying the metrics, 95% of correctness and consistency is observed in the SRS document. This indicates still there is a scope for improvement. So requirements document has to be revised once again to achieve the ideal value one. The metric measure and its corresponding indication is given in the table 5,1.The values for metric measure will give you the indication and that indication provides the insight in to the document. That insight will direct us which parts/portions of the SRS document need to be reconsidered and improved.

Metric measure	Indication
1	Having Good quality
[0.9,1)	Having quality with few changes
[0.8,0.9)	Few parts of SRS needs to be rechecked
[0.7,0.8)	Major parts of SRS needs to be rechecked
[0.0,0.7)	Reevaluate the entire SRS for C and C

Table 5.1 Metric measure and indication

Confusion matrix concept is used to compare the efficiency and performance of different models with the help of predefined metrics precision, accuracy, specificity, F-measure and etc. In this paper we have used confusion matrix to compare our proposed model with the existing model. Our proposed approach is compared with C&C SRS [6].The following Figurers 5.1,5.2,5.3 and 5.4 represents the Precision, Accuracy, Specificity and F-measure of projected model C&CRAIS and existing model C&CSRS. The results of the metrics are better and optimal when compared with C&C SRS model.

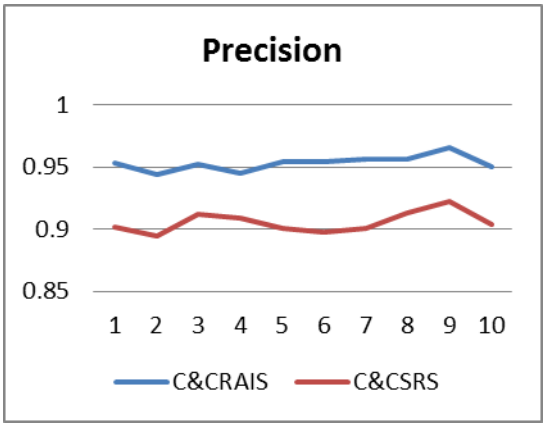

Fig.5.1 Precision of C&CRAIS over CCSRS

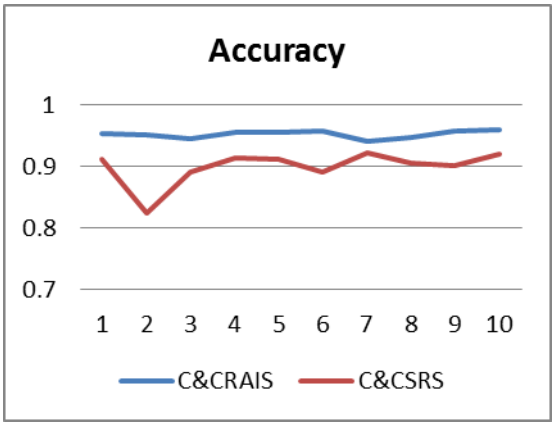

Fig.5.2 Accuracy of C&CRAIS over CCSRS

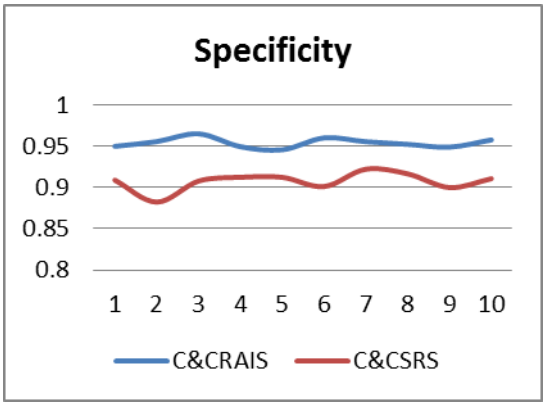

Fig.5.3 Specificity of C&CRAIS over CCSRS

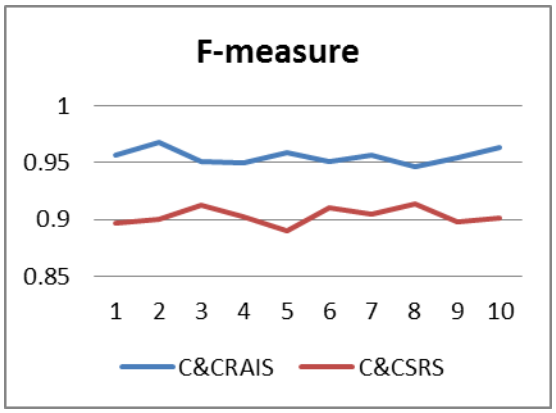

Fig.5.4 F-measure of C&CRAIS over CCSRS

6. CONCLUSION:

So far the work on finding the quality of SRS document is very less, when come to the work on finding the correctness and consistency of requirements documents it is very nominal. But these two factors will play a vital role in achieving the quality of the entire project and also decides the success or failure of the project. Specific to the Artificial intelligence based systems the work done in the past on finding the quality of SRS document is almost zero. With this motivation this work concentrates on measuring the factors correctness and consistency of SRS document designed for AI based systems. This paper explores the new ways of measuring the correctness and consistency of requirements specification document for AI based systems. The proposed approach is developed based on the IEEE standard 830.After restructuring the given SRS document for measuring the required factors, the factors correctness and consistency are divided into sub factors, then metrics are developed for sub factors, after application of metrics on the SRS, the values of these sub metrics are combined to measure the final metric for both correctness and consistency. Along with assessing the C and C of SRS document these metrics also provides the insight into the SRS that leads to rechecking and improvement of the quality of SRS document. The developed metrics were applied on AI based Navigation and Maps system and also the proposed approach is compared with existing model and the results are promising. In this paper the focus is to measure the only two factors i.e consistency and correctness out of eight quality factors given by IEEE standard 830.In future as an enhancement to this work left over six factors need to be measured to find the quality of entire SRS document designated for AI based systems.

REFERENCES

[1] IEEE Recommended practice for software requirements specifications, Software Engineering standards, IEEE Computer Society, December 2, 1993.

[2] A. Gjorgjevikj, K. Mishev, L. Antovski and D. Trajanov, "Requirements Engineering in Machine Learning Projects," in *IEEE Access*, vol. 11, pp. 72186-72208, 2023, doi: 10.1109/ACCESS.2023.3294840.

[3] J. Horkoff, "Keynote - Requirements Engineering for Machine Learning: Non-functional Requirements as Core Functions," *2022 IEEE 30th International Requirements Engineering Conference Workshops (REW),* Melbourne, Australia, 2022, pp. 141-141, doi: 10.1109/REW56159.2022.00034.

[4] U. -E. Habiba, J. Bogner and S. Wagner, "Can Requirements Engineering Support Explainable Artificial Intelligence? Towards a User-Centric Approach for Explainability Requirements," *2022 IEEE 30th International Requirements Engineering Conference Workshops (REW),* Melbourne, Australia, 2022, pp. 162-165, doi: 10.1109/REW56159.2022.00038

[5] L. Yu, S. Su, S. Luo and Y. Su, "Completeness and Consistency Analysis on Requirements of Distributed Event-Driven Systems," *2008 2nd IFIP/IEEE International Symposium on Theoretical Aspects of Software Engineering*, Nanjing, China, 2008, pp. 241-244, doi: 10.1109/TASE.2008.46.

[6] F. T. Sheldon, Hye Yeon Kim and Zhihe Zhou, "A case study: validation of guidance control software requirements for completeness, consistency and fault tolerance," *Proceedings 2001 Pacific Rim International Symposium on Dependable Computing*, Seoul, Korea (South), 2001, pp. 311-318, doi: 10.1109/PRDC.2001.992714.

[7] M. S. Jaffe and N. G. Leveson, "Completeness, Robustness, And Safety In Real-time Software Requirements Specification," *11th International Conference on Software Engineering*, Pittsburgh, PA, USA, 1989, pp. 302-311, doi: 10.1109/ICSE.1989.714438.

[8] Shaoying Liu, "Capturing complete and accurate requirements by refinement," *Eighth IEEE International Conference on Engineering of Complex Computer Systems, 2002. Proceedings.*, Greenbelt, MD, USA, 2002, pp. 57-67, doi:

10.1109/ICECCS.2002.1181498.

[9] W. Liu, Chengwan He and Kui Zhang, "Service-based domain requirements completeness analysis," *2009 Asia-Pacific Conference on Computational Intelligence and Industrial Applications (PACIIA)*, Wuhan, China, 2009, pp. 110-115, doi: 10.1109/PACIIA.2009.5406481.

[10] R. S. Kenett, "Software specifications metrics: a quantitative approach to assess the quality of documents," *Proceedings of 19th Convention of Electrical and Electronics Engineers in Israel*, Jerusalem, Israel, 1996, pp. 166-169, doi: 10.1109/EEIS.1996.566920.

[11] C. Heitmeyer, B. Labaw and D. Kiskis, "Consistency checking of SCR-style requirements specifications," *Proceedings of 1995 IEEE International Symposium on Requirements Engineering (RE'95)*, York, UK, 1995, pp. 56-63, doi: 10.1109/ISRE.1995.512546.

[12] Satyajit Acharya, Hrushikesha Mohanty and C. George, "Domain consistency in requirements specification," *Fifth International Conference on Quality Software (QSIC'05)*, Melbourne, VIC, Australia, 2005, pp. 231-238, doi: 10.1109/QSIC.2005.24.

[13] M.R Rajaramesh, et al, Metrics for Software Requirements Specification Quality Quantification",International Journal of Computers and Electrical Engineering (IJCEE), ELSEVIER,Oct 2021.

[14] R Raja Ramesh Merugu, et al, Automated Cloud service based quality requirement classification for software requirement specification, Evolutionary Intelligence, Springer- Verlag GmbH Germany, SPRINGER, May 2019.

[15] M.R Raja Ramesh, et al. Activity based Quality Assessment Technique for Software Requirement Specification, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume 8 Issue-2S2, December, 2018.

[16] M.R Raja Ramesh, et al. .A Survey on Security Requirement Elicitation Methods: Classification, Merits and Demerits", International Journal of Applied Engineering Research, Volume 11, Number 1 (2016) pp 64-70.

[17] M.R Raja Ramesh,et al. Difficulties in Software Cost Estimation: A Survey, International Journal of Scientific Engineering and Technology, Volume No.5 Issue No.1, pp: 10-13.

[18] Prasad Devarasetty,et al. Ambiguity detection techniques of SRS: Classification, merits and demerits, Ijfans International Journal Of Food And Nutritional Sciences, Volume 11,Iss 12,2022

[19] https://ieee-dataport.org/documents/dataset-text-requirements-models.

[20] D. Ganesh, J. R Kumar, K. K Rao, Empirical Investigations to Find Illegal and its Equivalent Test Cases using RANDOM-DELPHI, IJSEA, Vol. No 11,pp 107-116, 2015.

[21]]Zowghi, Didar & Gervasi, Vincenzo. (2003). The Three Cs of Requirements: Consistency, Completeness, and Correctness. Proceedings of 8th International Workshop on Requirements Engineering: Foundation for Software Quality, (REFSQ'02).

[22] [22] Atish P. Sinha, Doug Popken,Completeness and consistency checking of system requirements: An expert agent approach,Expert Systems with Applications,Volume 11, Issue 3,1996,Pages 263-276,ISSN 0957-4174.

[23] Daoust, MK. The explanatory role of consistency requirements. *Synthese* 197, 4551–4569 (2020). https://doi.org/10.1007/s11229-018-01942-8.

[24] P. Nistala and P. Kumari, "An approach to carry out consistency analysis on requirements: Validating and tracking requirements through a configuration structure," *2013 21st IEEE International Requirements Engineering Conference (RE)*, Rio de Janeiro, Brazil, 2013, pp. 320-325, doi: 10.1109/RE.2013.6636737.

[25] Jaroslaw Kuchta,"Completeness and Consistency of the System Requirement Specification", Position Papers of the Federated Conference on Computer Science and Information Systems pp. 265–269, ACSIS, Vol. 9. ISSN 2300-5963,2016.

[26] Chao Wu, Zhong Hua Huang, Yu Ting Yang and Yue Liu," Requirement Consistency and Integrity Verification Method based on Natural Language Processing", DOI 10.1088/1742-6596/1756/1/012002.

[27] Constance L. Heitmeyer , Ralph D. Jeffords, Bruce G. Labaw, "Automated consistency checking of requirements specifications",ACM Transactions on Software Engineering and Methodology,Volume 5,Issue 3,pp 231–261,https://doi.org/10.1145.

[28] P. Thitisathienkul and N. Prompoon,

"Quality Assessment Method for Software Requirements Specifications Based on Document Characteristics and Its Structure," *2015 Second International Conference on Trustworthy Systems and Their Applications*, Hualien, Taiwan, 2015, pp. 51-60, doi: 10.1109/TSA.2015.19.

[29] P. Thitisathienkul and N. Prompoon, "Quality assessment method for software development process document based on software document characteristics metric," *Ninth International Conference on Digital Information Management (ICDIM 2014)*, Phitsanulok, Thailand, 2014, pp. 182-188, doi: 10.1109/ICDIM.2014.6991412.

[30] P. Shen, X. Ding, W. Ren and C. Yang, "Research on Software Quality Assurance Based on Software Quality Standards and Technology Management," *2018 19th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD)*, Busan, Korea (South), 2018, pp. 385-390, doi: 10.1109/SNPD.2018.8441142

[31] T. E. Vollman, "Software quality assessment and standards," in *Computer*, vol. 26, no. 6, pp. 118-120, June 1993, doi: 10.1109/2.214463.

[32] Y. Zhao, Y. Hu and J. Gong, "Research on International Standardization of Software Quality and Software Testing," *2021 IEEE/ACIS 20th International Fall Conference on Computer and Information Science (ICIS Fall)*, Xi'an, China, 2021, pp. 56-62, doi: 10.1109/ICISFall51598.2021.9627426

[33] Y. Zhang, X. Liu, Z. Liu and W. Li, "Development and Reconstitution of Software Quality Measurement and Evaluation Standards," *2018 19th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD)*, Busan, Korea (South), 2018, pp. 380-384, doi: 10.1109/SNPD.2018.8441040.

[34] Mbusi Sibisi and C. C. van Waveren, "A process framework for customising software quality models," *AFRICON 2007*, Windhoek, South Africa, 2007, pp. 1-8, doi: 10.1109/AFRCON.2007.4401495.

[35] Kilsup Lee and Sung Jong Lee, "A quantitative software quality evaluation model for the artifacts of component based development," *Sixth International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing and First ACIS International Workshop on Self-Assembling Wireless Network*, Towson, MD, USA, 2005, pp. 20-25, doi: 10.1109/SNPD-SAWN.2005.7.

[36] A. Rossanez and A. M. B. R. Carvalho, "Semi-Automatic Checklist Quality Assessment of Natural Language Requirements for Space Applications," *2016 Seventh Latin-American Symposium on Dependable Computing (LADC)*, Cali, Colombia, 2016, pp. 123-126, doi: 10.1109/LADC.2016.26.

[37] P. Shen, X. Ding, W. Ren and C. Yang, "Research on Software Quality Assurance Based on Software Quality Standards and Technology Management," *2018 19th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD)*, Busan, Korea (South), 2018, pp. 385-390, doi: 10.1109/SNPD.2018.8441142.

[38] A. Fatwanto, "Software requirements specification analysis using natural language processing technique," *2013 International Conference on QiR*, Yogyakarta, Indonesia, 2013, pp. 105-110, doi: 10.1109/QiR.2013.6632546.

[39] W. X. Li, Z. Y. Gu, X. L. Yang and F. Tian, "The Design and Application of Software Measurement and Evaluation Model Based on Process Management," *2021 2nd international Conference on Big Data & Artificial Intelligence & Software Engineering (ICBASE)*, Zhuhai, China, 2021, pp. 649-653, doi: 10.1109/ICBASE53849.2021.00128.

[40] J. Tassone, S. Xu, C. Wang, J. Chen and W. Du, "Quality Assessment of Open Source Software: A Review," *2018 IEEE/ACIS 17th International Conference on Computer and Information Science (ICIS)*, Singapore, 2018, pp. 411-416, doi:10.1109/ICIS.2018.8466436.