

# SOFTWARE ENGINEERING RESEARCH GROUP



SERG@UPM

# OVERVIEW

Software engineering related research activities in Universiti Putra Malaysia are conducted by the Software Engineering Research Group (SERG). SERG is one of the most prolific research groups under the Department of Software Engineering and Information Systems, Faculty of Computer Science and Information Technology.

Software engineering is an engineering discipline that is concerned with every aspect of software production from early stages of software requirements through maintaining the software after it has gone into use. This area covers systematic, disciplined, quantifiable techniques and methods in designing, developing, implementing, and maintenance of quality software. Issues related to **theoretical and formal aspects** of software engineering, software **architecture**, software **web services**, software **modeling**, software **quality**, software engineering **management**, **enterprise** software engineering and integration, **green** software engineering, **component-based** software engineering, **search-based** software engineering, software **measurement, estimation and metrics** are among popular topics in this research. This area also addresses emerging trends such as software engineering for artificial intelligence (**SE4AI**), the **industrial revolution**, and **big data** software engineering. Additionally, research is also carried out in the area of special-purpose embedded software engineering which involves multidisciplinary research disciplines such as **educational** study, **agricultural** science, and **health** science.



# SERG GROUP MEMBERS

## Principle Researchers



## Students

- 30 PhD students
- 6 MSc Students





# List of Current Research Grant

Project Title	Researcher	Grant	Amount (RM)
Enhanced Random Selection by Employing Q-Learning Algorithm for Intelligently Selecting Action in Automated GUI Testing	SALMI BINTI BAHAROM	FRGS - FUNDAMENTAL RESEARCH GRANT SCHEME	64200
A framework for assessing the metamodel quality towards its standardization in healthcare systems environment.	NORHAYATI BINTI MOHD ALI	FRGS - FUNDAMENTAL RESEARCH GRANT SCHEME	58600
Tangible User Interface Design Model to Embodied Learning Amongst Dyslexic Students	NOVIA INDIATY ADMODISASTRO	FRGS - FUNDAMENTAL RESEARCH GRANT SCHEME	89200
An Integrated User Stories Prioritization Approach in Agile-Scrum Software Development to Produce High-Quality and Sustainable Software	HAZURA BINTI ZULZALIL	FRGS - FUNDAMENTAL RESEARCH GRANT SCHEME	76400
Security Testing of Web Applications for Detecting and Removing Second-order SQL injection vulnerabilities	ABU BAKAR BIN MD SULTAN	FRGS - FUNDAMENTAL RESEARCH GRANT SCHEME	85200
A Modelling Approach to Predict Emergent Properties for Software Resiliency in Intricate Computing Environment	SA'ADAH BINTI HASSAN	FRGS - FUNDAMENTAL RESEARCH GRANT SCHEME	69200
Multicriteria Optimization Decision Model to Improve Operational Efficiency of Social Welfare Case Management	KOH TIENG WEI	FRGS - FUNDAMENTAL RESEARCH GRANT SCHEME	89200
DisleksiaBelajar: Mobile App (Fono-Eja-Baca-Tulis) for Dyslexic Children to Learn the Malay Language	NOVIA INDIATY ADMODISASTRO	GERAN INNOHUB	30000
Formulating a crime hotspot prediction model using enhanced density-based clustering and auto regressive integrated moving averages techniques for improving prediction accuracy of resident burglary crime.	KOH TIENG WEI	GERAN KOLABORASI	114450
Improving Language Learners' Communication Skills in Online Learning through Feedback and Learning Analytics	KOH TIENG WEI	GERAN KOLABORASI	51000
Framework of Student Engagement in Online Learning through Learning Analytics for Enhancing Students' Learning Performance	KOH TIENG WEI	GERAN KOLABORASI	65850
The Development Of An Evidence-based Project Reporting Solution Using Imaging Processing And Artificial Intelligence	NG KENG YAP	GERAN SWASTA/ ANTARABANGSA	55000
Research And Development Of An Ai-based Smart Cradle	NG KENG YAP	GERAN SWASTA/ ANTARABANGSA	30000
Semantic-Based with Machine Learning Support in Dynamic Service Adaptation Framework for Context-Aware Mobile Cloud Learning	MUHAMAD SUFRI BIN MUHAMMAD	GP-IPM - GERAN PUTRA INISIATIF PUTRA MUDA	20000
A Quality-Driven Service Decomposition Framework for Legacy to Cloud Architecture Migration.	MOHD HAFEEZ BIN OSMAN	GP-IPM - GERAN PUTRA INISIATIF PUTRA MUDA	25700
Specification And Verification Of IOV User Data Privacy Preservation And Security In Event-B	MAR YAH @ MEK YAH BINTI SAID	GP-IPS - GERAN PUTRA INISIATIF SISWAZAH	11500

# LIST OF PUBLICATION

## Journal (ISI Indexed, Scopus)

1. Sara Qahtan, **Khaironi Yatim**, AA Zaidan, HA Alsattar, OS Albahri, BB Zaidan, AH Alamoodi, H Zulzalil, MH Osman, RT Mohammed, 2022. Novel Multi Security and Privacy Benchmarking Framework for Blockchain-Based IoT Healthcare Industry 4.0 Systems, *IEEE Transactions on Industrial Informatics*, 18(9), pp. 6415-6423.
2. **Saadah Hassan**, Aidi Ahmi, 2022. Mapping the State of the Art of Scientific Production on Requirements Engineering Research: A Bibliometric Analysis. *International Journal of Information Technologies and Systems Approach (IJITSA)*, 15(1), 1-23.
3. M Dashti, TJ Gandomani, DH Adeh, **H Zulzalil**, ABM Sultan, 2022. LEMABE: a novel framework to improve analogy-based software cost estimation using learnable evolution model, *PeerJ Computer Science*, vol. 7, e800.
4. Sharaf Addin, E. H., **Admodisastro, N.**, Mohd Ashri, S. N. S., Kamaruddin, A., & Chong, C. Y. (2022). Customer Mobile Behavioral Segmentation and Analysis in Telecom using Machine Learning. *Applied Artificial Intelligence*. Taylor & Francis, Q4. <https://doi.org/10.1080/08839514.2021.2009223>
5. **Muhammad, S.**, Admodisastro, N., Osman, H., & Ali, N. M. (2022). Semantic-Based Dynamic Service Adaptation in Context-Aware Mobile Cloud Learning, *Cybernetics And Information Technologies*, Volume 22, No 3, Bulgarian Academy of Sciences, eISSN: 1314-4081.
6. Emyreema Ja'afara, **Sa'adah Hassan**, Salmi Baharom, Johanna Ahmad, 2021. Test Case Prioritization Approach for Sequence of Events Using Complexity Factor, *International Journal on Advanced Science, Engineering and Information Technology*, vol.11(1), pp.400-407.
7. A. Baabad, **H.B. Zulzalil**, S.Hassan and S.B. Baharom, Characterizing the Architectural Erosion Metrics: A Systematic Mapping Study, 2022, vol.10, *IEEE Access*, pp. 22915-22940.
8. Butt UM, Letchmunan S, Hassan FH, **Koh TW** (2022), Hybrid of deep learning and exponential smoothing for enhancing crime forecasting accuracy. *PLoS ONE* 17(9): e0274172.
9. Saadon, M., and **N. Admodisastro**, *Self-Configured Workflow Platform for MapReduce Job Execution In Cloud Environment*, in the Proc. of the Applied Informatics International Conference (AiIC), IEEE, 2022.
10. A. Baabad, **H.B. Zulzalil**, S.Hassan and S.B. Baharom, 2022. A survey on characterizing the empirical analysis, proposed approaches, and research trends for architectural decay, *International journal of software innovation*, 1(1), pp. 1-18.
11. G Duraisamy, **AA Abd Ghani**, H Zulzalil, A Abdullah, 2022. Model-based testing of access control requirement in multi-tenant application: an extensive life cycle, *Recent advances in electrical and electronic engineering and computer science*, pp.11-24.
12. MA Khairuddin, **AA Abd Ghani**, H Zulzalil, S Hassan, 2022. Catalogue-based guideline for misuse case, *Journal of theoretical and applied information technology*, 100(1), pp.38-51.
13. Noor Hazlini Borhan, **Hazura Zulzalil**, Sa'adah Hassan, Norhayati Mohd Ali, 2021. A Prioritization approach upon non-functional and functional user stories in agile-scrum software development (i-USPA): a preliminary results, *International journal of multidisciplinary sciences and advanced technology*, 2(6), pp. 62-76.
14. Ali, AQ, **Sultan, ABM**, Ghani, AAA, Zulzalil, H., 2021. An Empirical investigation of software customization and its impact on the quality of software as a service: perspectives from software professionals, *Applied sciences*, 11(4), pp.1-18.
15. KA Dawood, **KY Sharif, A.**, AA Ghani, H zulzalil, AA Zaidan, BB Zaidan, 2021. Towards a unified criteria model for usability evaluation in the context of open source software based on a fuzzy Delphi method, *Information and software technology*, 106453, pp. 1-15.
16. **S. Hassan**, R. Shuib, 2021. Collaborative Feedback Approach for Improving Customer Engagement and Product Increment in Agile Software Development, *IT in Industry*, 9(1), pp.16-23.
17. Muhammad Ehsan Rana, Eddy Khonica, **Wan Nurhayati Wan Ab Rahman**, Masrah Azrifah Azmi Murad, Rodziah Atan, 2021, Impact of design principles and patterns on software flexibility: an experimental evaluation using flexible point (FXP), *Journal of computer science*, 17(7), pp.624-638.
18. KA Dawood, **KY Sharif, A.**, AA Ghani, H zulzalil, AA Zaidan, BB Zaidan, 2021. Novel multi perspective usability evaluation framework for selection of open source software based on BWM and group VIKOR techniques, 2021. *International Journal of information technology and decision making*.
19. **Samat, P. A.**, Azwarrudin, M. A., Ali, N. M., & Admodisastro, N. (2021). Verifying the Correctness of UML Statechart Outpatient Clinic Based on Common Modeling Language and SMV. *International Journal of Integrated Engineering (IJIE)*, 13(5), 137-145.
20. **Ali, N. M.**, Admodisastro, N., Rahmat, R. W. O., Allaudin, M. A. M., & Dimon, M. Z. (2021). The Use of Metamodel-based Approach for Designing Healthcare Applications. *International Journal of Integrated Engineering (IJIE)*, 13(5), 178-186.
21. Umair M.B., Sukumar L., Fadratul H.H., Mubashir A., Anees B., **Koh, T.W.**, Hafiz, H.R.S. (2021), "Spatio-Temporal Crime Predictions by Leveraging Artificial Intelligence for Citizens Security in Smart Cities," in *IEEE Access*, Vol. 9, pp. 47516-47529, 2021
22. **N. Admodisastro**, K.F. Chan and S.S. Abdul Hamid, Evaluation of DisleksiaBelajar Mobile App for Assisting Dyslexia Junior School Students to Learn the Malay Language, *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(3):2230-2235, April 2021. <https://doi.org/10.17762/turcomat.v12i3.1172>.

# RESEARCH PUBLICATIONS

## Journal (ISI Indexed, Scopus) – cont.

23. **S. Hassan**, R. Shuib, 2021. Towards Adopting Software Quality Assurance in Agile Development Methodology, *Turkish Journal of Computer and Mathematics Education*, 12(3), pp.2152-2157.
24. **Muhammad, S.**, Admodisastro, N., Osman, H., & Ali, N. M. (2021). The Correctness of Service in Runtime Adaptation for Context-Aware Mobile Cloud Learning, *Turkish Journal of Computer and Mathematics Education*, e-ISSN 1309-4653,
25. Nuh, J.A., **Koh, T.W.**, Baharom, S., Osman, M.H., Kew, S.N (2021). Performance Evaluation Metrics for Multi-Objective Evolutionary Algorithms in Search Based Software Engineering: Systematic Literature Review. *Journal of Applied Sciences*, Vol. 11, Issue 7, 3117.
26. **S. Muhammad**, N. Admodisastro, N. Mohd. Ali and H. Osman. An Experimental Evaluation of The Dynamic Service Adaptation Framework in Mobile Cloud Learning, *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(3):2236-2241, April 2021, doi:10.17762/turcomat.v12i3.1173.
27. Kew, S. N., **Koh, T.W.**, Liew, Z. W. and Y. M. Aldheleai (2021). Japanese Students' English Language Experience through Computer Game-Based Student Response Systems. *Turkish Journal of Computer and Mathematics Education*, 12(3), 1993-1998.
28. I. Hydera, **A.B. Md Sultan**, H. Zulzalil and N. Admodisastro, The Limitations Of Cross-Site Scripting Vulnerabilities Detection and Removal Techniques, *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(3):1975-1980, April 2021. <https://doi.org/10.17762/turcomat.v12i3.1033>
29. Ali, AQ, **Sultan, ABM**, Ghani AAA, Zulzalil, H., 2020. Development of a valid and reliable software customization model for SaaS quality through iterative method: perspectives from academia, *PeerJ Computer Science*, vol. 6, pp. 1-34.
30. Fadhil, J. A., **Wei, K. T.** & Na, K. S. (2020). Artificial Intelligence for Software Engineering: An Initial Review on Software Bug Detection and Prediction. *Journal of Computer Science*, 16(12), 1709-1717.
31. R.D. Abdul Mutalib, **S. Hassan**, C.Y. Chong, N. Admodisastro and S. Baharom, Graph-Powered Recommendation Engine in Movie Recommender System, *Journal of Critical Reviews*, 7(8), 2020.
32. Ahmed Baabad, **Hazura Zulzalil**, Sa'adah Hassan, Salmi Baharom, 2020. Software architecture degradation in open source software: a systematic literature review, *IEEE Access*, vol. 8, pp. 117109-117121.
33. A. M.A. Al-Hakimi, **A. B. Md. Sultan**, A.A.A. Ghani, N. M. Ali & N. Admodisastro, Hybrid Obfuscation Technique to Protect Source Code From Prohibited Software Reverse Engineering. *IEEE Access*, 8, 187326-187342, 2020
34. Gandomani, TJ, Tavakoli Z, **Zulzalil H**, Farsani HK, 2020. The role of project manager in agile software teams: a systematic literature review, *IEEE Access*, vol. 7, pp. 88196-88217.
35. **Ab Rahman, WNW**, Zulzalil H., Ishak, I., Selamat, AW., 2020. Quality model for massive open online course (MOOC) web content, *International journal on advanced science, engineering and information technology*, 1, pp.24-33.
36. Saharudin, S. N., **Wei, K. T.** & Na, K. S. (2020). Machine Learning Techniques for Software Bug Prediction: A Systematic Review. *Journal of Computer Science*, 16(11), 1558-1569.
37. **Ab Rahman, WNW**, Zulzalil H., Ishak, I., Selamat, AW., 2020. Analysis of web content quality factors for massive open online course using the rasch model, *International journal of advanced computer science and applications*, 11(3), pp. 578-587.
38. Ahmad, J., **Baharom, S.**, Ghani, AAA, Zulzalil, H, Din, J, 2020. Towards prioritize event sequence test cases using machine learning approach, *Journal of advanced research in dynamical and control systems*, 12(7), pp.1642-1647.
39. Mohammed Bashir Ribadu, **Wan Nurhayati Wan Ab Rahman**, Abdul Azim Abd Ghani, Azrina Kamaruddin, Mohd Sukki Othman, 2020. Sharia compliance requirements framework for e-commerce systems: an exploratory study, *Journal of theoretical and applied information technology*, 98(6), pp.994-1008.
40. Musabayli, M., **Osman, M.H.**, and Dirix, M. (2020). "Classification Model for predictive Maintenance of Small Steam Sterilizers," *IET Collaborative Intelligent Manufacturing*.
41. Ibrahim Hassan Hussein, **Jamilah Din**, Salmi Baharom, Muhammed Basheer Jasser, (2020), An Approach for Selecting the Suitable Requirement Elicitation Technique;, *Journal of Computer and Mathematics Education (TURCOMAT)* 12(3):2083-2087
42. Norshaharizan Binti Puteh, **Jamilah Din**, Salmi Baharom, Delaila Abdullah, (2020), Identifying Social Commerce Features Towards Improving a Social Commerce Website, *Journal of Computer and Mathematics Education (TURCOMAT)* 12(3):2021.



# RESEARCH PUBLICATIONS

## Book, Book Chapter

- Wong S.V., Nur Aira A. R., Tan C. Y., **Koh T.W.**, Zamir A. Z., Mohamad Khair A. M. S., Rosmaria O., Ahmad Azran R., “A study on the Improvement of NOSS Development Method and the Suitability of Its Structure in the New Era of New-Collar Job”. UPM Consultancy Services (UPMCS) Sdn Bhd, 2022. ISBN 978-629-97236-0-8
- **Wan Nurhayati Wan Ab. Rahman**, 2022. Editor: Mohannad Fauzy bin Tambi, Kaedah Pengkomersialan Melalui Usahawan Tekno, Syarikat Terbitan – Pemula & Usaha Sama, Kolokium Pengkomersialan R&D 2021.
- **Wan Nurhayati Wan Ab. Rahman**, Azrizam Esam, Nor Azizah Ismail, Mohamed Thariq, Hameed Sultan, 2021. Editor: Mohd Izani Mohd Zain, Inovasi Bendung Covid-19, Impak Covid-19 dan Prakarsa UPM.
- Kew Si Na, **Koh Tieng Wei**, Shahrizal Sunar, “Leading Higher Institution. Leadership Traits, Dreams and Achievements - Case Study 3: Leadership in Action: Founder of CEO@Faculty”, UMK Entrepreneurship Institute (UMKEI), 2021. ISBN 978-967-2912-86-6
- Noris, N, **Muhammad, S.**, Hizmawati, M., Azrul, H.J, & Rusli, A. (2021). Chapter “Mereka bentuk Antaramuka (Interface) Sistem bagi Keperluan Orang Kelainan Upaya Penglihatan Bersama Malaysian Association for the Blind” oleh Kumpulan Pelajar Kursus SSE3202 Interaksi ManusiaKomputer”, Inovasi Pengajaran dan Pembelajaran, SULAM di UPM, e-ISBN 978-967-19652-3- 8, pp. 162-173, CADe UPM

## Proceeding/Conference

- Aisha Kurmangali, Muhammmad Ehsan Rana, **Wan Nurhayati Wan Ab. Rahman**, 2022. Impact of Abstract Factory and Decorator design patterns on software maintainability: Empirical Evaluation using CK Metrics, in International Conference on Decision Aid Sciences and Application (DASA) 2022, IEEE, Chiangrai, Thailand, 23-25 March 2022, pp. 517-522.
- C.E., Tan, **N. Admodisastro** and S. Mohd Sidik, *Informing the Design of An E-Health System for Provision of Information Support to Childhood Cancer Parents*, National Symposium on Human-Computer Interaction (FUSION2022), myHCI-UX, 2022.
- **S. Hassan**, N. Admodisastro, H. Zulzalil, H. Osman, 2022. The Perspectives on Developing a Conceptual Model for Exploring Emergent Behaviour in Complex Systems, In the 9th International Conference on Computational Science and Technology (ICCST2022)
- Mohamad KAM, Wong SV, **Koh TW**, Zamir AZ, Nur Aira AR, Rosmaria O, Tan CY, Mohd Azran R. Saidi Z. & Hafiz S., “Benchmarking Analysis of Occupational Standards for the Malaysia’s National Occupational Skills Standard (NOSS) Approach Towards New-Collar Jobs Era”, 3 rd Kuala Lumpur International Conference on Management, Education & Technology (KLIMET 2022). 27 August 2022.
- M.A., Mohammad Allaudin, **N. Mohd. Ali**, N. Admodisastro, and R.W.O.K. Rahmat, *MC4MD: A Metamodel Critic Tool for Checking Metamodel Design*, in Proc. of the 9th International Symposium on Applied Engineering and Sciences 2021 (SAES2021), Virtual Conference UPM, Malaysia, 2021.
- Jasvina Mae Ealn Davan, **Tieng Wei Koh**, Dong Ling Tong, Kwan Lee Tseu, 2021. Anticipation of Parking Vacancy During Peak/Non- peak Hours using Convolutional Neural Network – YOLOv3 in University Campus”, Proceedings of 2021 International Conference on Green Energy, Computing and Sustainable Technology (GECOST), Curtin University, Miri Sarawak Malaysia, 7-9 July 2021.
- **S. Muhammad**, N. Admodisastro, H. Osman and N. Mohd. Ali, *Mudahnya BM: A Context Aware Learning Application using Semantic-Based Approach*, in Proc. of the 7<sup>th</sup> Int. Conf. Visual Informatics Conference, *Lecture Notes in Computer Science (LNCS) 13051*, Springer-Verlag, pp. 227-238, 2021.
- Ahmad Wiraputra Selamat, **Wan Nurhayati Wan Ab Rahman**, Hazura Zulzalil, Iskandar Ishak, 2020. MOOC Content Quality Assessment Tool (MOCQAT): A Case Study, in. The 14 th International Technology, Education and Development Conference (INTED2020), Valencia, Spain, 2-4 March 2020, pp.2073-2082.
- S N Kew, **T W Koh**, Z Tasir, N F Jumaat, N D Abd Halim, 2020. A Systematic Review on Internet of Things in Language Practice, Proceedings of the 5th International Conference on Advanced Technology and Applied Sciences 2020 ICATAS 2020 in conjunction with the 6th Malaysia-Japan Joint International Conference 2020 MJJIC 2020 (ICATAS-MJJIC 2020) 7th -9th October, Kuala Lumpur, IOP Conference Series: Materials Science and Engineering, Vol. 1051.

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