Towards Adaptive and Responsive Web Design: A Systematic Literature Review

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ABSTRACT

In today's age, the World Wide Web is a utility used everywhere on everything portable or immobile. All these devices can be accessed and communicate with each other even if the only common thing is their platform, this has created a variety of design issues against consistency of layouts and data mismatch. Detailed analysis of Responsive Web Design (RWD) and Adaptive Web Design (AWD) in terms of usage. A Systematic Literature Review (SLR) has been used to identify 58 research works, published during 2009-2017. We identify 6 models and 9 implementation approaches for AWD and RWD. We analyze which web design is better and what types of websites can be built efficiently through these web designs. Adaptive Web Design answers the research questions proposed in the manner to claim being the most efficient, workable web design in terms of usage as compared to Responsive Web Design.

Keywords
Web design, AWD, RWD, Adaptivity, Responsiveness, Web apps.

1. INTRODUCTION
The World Wide Web (WWW) has met a great success in better communication and spreading knowledge. Ever since its birth, WWW has been central in providing insight into the digital world for all. The opportunities that this new age provided have led to many other branches of information along with the forever evolution from one software to another, one hardware to another. In short, everything is connected and the easiest connection in the past decade is the wide usage of screens, any interface with screen at its bane. This further led to advancement in the multiple types, all sorts of variations to accommodate different styles because one is never enough in this world of constant evolution. This gave birth to the demand for more of everything interface related and encouraged developers to advance into the world. Most of which can be centered upon web designers, web engineers. Directly getting into the detail of it, the latest in this look-and-feel advancement are web designs. Namely; Adaptive Web Design (AWD) and Responsive Web Design (RWD). AWD is a relatively new approach for progressive enhancement of websites that focuses on accessibility, external style-sheet, scripting technologies and view of the site against the patriarchic RWD. This allows for a uniform representation of the site over any intended medium, and platform with an improved version of pages that is also detailed to those with specifically advanced mediums for viewing and accessing functionality of basic content. Therefore, it has made quite advancement in designing as compared to previous technologies used in this field of design. Whereas RWD, a relatively old approach aimed towards fashioning variety of sites to ultimately provide the optimal interaction and viewing experience, more specifically; advanced navigation and easy reading with a minimum of panning, resizing and scrolling and interacting over a multitude of different devices to enhance accessibility, ease of use and general adaptation of crossing limitations to providing better interface.

Keeping in view the stated situation, our goal is to select latest research studies available on AWD and RWD in our proposed Systematic Literature Review (SLR). Thus, we have developed following research questions for this systematic literature review:

Research Question 1: What models and approaches have been introduced for adaptive or responsive design since 2009 to 2017?

Research Question 2: Does adaptive design wins over responsive web design?

Research Question 3: Which web design is better for what type of websites?

This SLR will provide answers of the research questions stated above.

2. RESEARCH METHODOLOGY
We have followed Kitchenham [59] in order to develop research methodology of our SLR. The research methodology has two main stages including category definition and review protocol development.

2.1 Category definition
We have organized our research into three major categories (General, AWD and RWD) for classification of each selected research which provided us ease in answering our research questions.

2.2 Review protocol
We have developed the review protocol for the study, based on the readily defined Systematic Literature Review [59]. In rejection and selection criteria we have only selected five major publication databases (i.e. IEEE, Elsevier, ACM, Tylor & Francis and Springer). We have selected research studies which lie under publication year "*2009–2017*". The search terms included were (e.g. Adaptive web design, Responsive web design, Web adaptivity, Web responsiveness, Adaptive vs responsive web and Traditional web). Details of search terms can be found on [60]. Finally, after the data extraction,

we conducted a comprehensive analysis on comparison of the two web designs we worked on i.e. AWD and RWD. Details of selected researches is given in Table 1.

Table 1: Research Works and Database Details

Database	Type	Selected Research Works	No. of Researches
IEEE	J	[12][36][49][50][51][56]	6
	C	[5][6][7][8][15][16][21][22][23][24][30][31][32][37][39][45][46][47][48][52][53][54][57][58]	24
ELSEVIER	J	[3][4][18][28][35][41][42][43][44]	9
	C	[13][38][40]	3
ACM	J	[1][17][19][20][26][34]	6
	C	[14][29]	2
T&F	J	[2][9][11][25][27][33]	6
SPRINGER	J	[10][55]	2

3. RESULTS AND ANALYSIS

3.1 Models and Approaches identification

Different models and approaches are being used to build adaptive and responsive websites. A model is the abstract representation of software process which represents specific view of the tasks to be done for software development while an approach is a specific way of conducting software project in which we define when and how artifacts are produced. One of the most used model is SOA (Service oriented architecture). Table 2 sums up all the models whereas Table 3 summarizes the approaches used for adaptive and responsive web design in use since 2009 to 2017.

Table 2: Models Identification for AWD and RWD

Web Design	Models identified	Number of researches	Research Identification
AWD	Event-driven Execution model	1	[36]
	Adaptive Modeling Language	1	[40]
	MoDAR	1	[41]
	OWL (Ontology Web Language) and all variations	2	[3] [18]
	Hypermedia driven models.	1	[19]
RWD	OpenCV	1	[46]

Table 3: Approach Identification for AWD and RWD

Web Design	Approaches identified	Number of researches	Research Identification
AWD	NSGA-II, NSGA-III (Non-dominated Sorting Genetic Algorithm)	1	[34]
	SOA	3	[39] [36] [49]
	BDI(Believe-Decision-Intention)	1	[39]
	ITS (Intelligent Tutoring System)	1	[35]
	Classification algorithm using decision trees and data mining.	1	[7]
	UCMA	1	[25]
	WCAG (Web Content Accessibility Guidelines)	1	[38]
RWD	WCAG 2.0	1	[2]
	WAI-ARIA	1	[2]

3.2 Better web design identification

Both responsive and web have their advantages and disadvantages but in context of this paper we will prefer Adaptive web. The reason being despite fact that it requires very large lines of codes to support different device and as number of devices increases thus the lines of code. The advantage it has over responsive web is that large amount of work is already done on this platform moreover it gives the opportunity to web scientist to learn about the user needs and requirements. Anything that can be done on traditional and responsive web can be done on adaptive too. Table 4 provides the comparisons extracted from our research studies.

Table 4: Better Web Design

Better web design	Number of researches	Research Identification
Adaptive web design	26	[16] [17] [18] [19] [20] [21] [22] [25] [26] [30] [31] [33] [34] [35] [36] [37] [38] [39] [41] [42] [43] [44] [45] [48] [49] [51]
Responsive web design	15	[2] [8] [9] [11] [13] [14] [23] [24] [27] [28] [29] [32] [40] [48] [52]

Out of 41 researches on adaptive web design, 26 of them explicitly mentioned that adaptive web design is better than responsive as well as traditional web design whereas 15 out of 17 researches based on responsive web design mentioned that responsive web design is better than other designs.

3.3 Website types identified

Table 5 highlights the prominent website types that are better with Adaptive web design rather than traditional or any other web design. On a bird's eye view, for any type of E-Learning System Adaptive Web Design are the most appropriate. Moreover, adaptive web design includes a wide range of benefits for developers for creating Self-Adaptive Management systems, dynamic websites, information systems as well as general websites.

Table 5: Types of Websites Using AWD

Sr. no.	Types of websites using AWD	Number of researches	Research Identification
1	Learning System	14	[4] [5] [6] [12] [16] [15] [21] [22] [25] [31] [35] [42] [51] [54]
2	Management System	1	[7]
3	Social Media websites	2	[1] [10]
4	Mobile Applications	2	[1] [45]
5	Utility Websites	3	[30] [44] [47]
6	Augmented and Mixed reality applications	1	[19]

Some of the types identified by our research studies are:

- **Learning system i.e. educational and e-commerce websites:** Adaptive design introduces the concept of individual student profile. The source of learning is also different for different user hence, there's a concept of Adaptive Learning styles.
- **Management systems:** With adaptive design arrangement-frameworks adopt a self-adaptive concept.
- **Social websites:** Individuals share their data with friends and family on social networks like Facebook or Twitter but they are unaware of the consequences in case there's a security breach. To create a balance, adaptive web design along with Semantic web applications is proposed where there's a privacy and administration that considers the interests of both the user and the application.
- **Mobile applications:** Because different applications are accessed by using different devices like cell phones, tablets, etc. and Adaptive design works better with different screen resolutions as it has different designs for each device type.
- **Utility websites:** Because Adaptive web design takes shorter time for page-load, also that dimension and areas of Ad-spaces can be settled, along these lines keeping any breaking of a page's design.
- **Augmented and mixed reality applications:** Since most of the augmented reality applications utilize a smart phone as a core component, Adaptive design is best suited for them.

4. ANSWERS TO THE RESEARCH QUESTIONS

Research Question 1: What models and approaches have been introduced for adaptive or responsive design since 2009 to 2017?

Answer: Use of 15 models and approaches has been identified by our research. As shown in Table 2 and Table 3, respectively. Mostly most used model and approach is SOA (Service Oriented Architecture) as it provides flexibility, loose coupling, scalability, reusability and easier testing. The discovered approaches were found to be more in-tune, compatible with the overall purpose of the research; adaptability, compatibility and user-friendliness.

Research Question 2: Does adaptive design wins over responsive web design?

Answer: Unlike RWD, AWD doesn't utilize liquid frameworks to convey adaptable substance over any gadget. Rather, it physically makes separate designs for predefined screen sizes and shows the suitable choice. Its outline keeps everybody on the same URL while permitting you to give a focused on, streamlined experience to portable clients. The Adaptive design assists with:

- Taking into account the requirements of various gatherings of clients concocting gadget advanced site highlights, menus, pictures, writings, and so forth.
- Conforming the site speed and page weight to suit clients on shifting network and information arranges

Analysis of second part of RQ2 gave unpredictable results. Fig 1 shows that adaptive web design still wins over responsive despite the fact that adaptive web design costs more and is high maintenance.
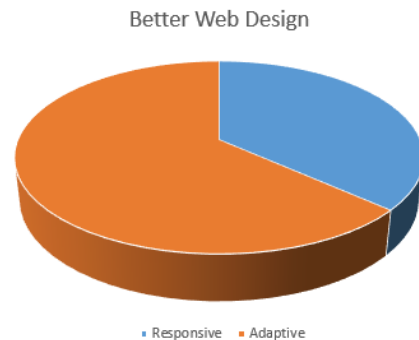

Fig 1: Better Web Design identification

Research Question 3: Which web design is better for what type of websites?

Answer: When it comes to choosing a web design for your website, key is to consider the audience first. But according to our research (Table 5) AWD is most suitable for audiences of the following websites:

- Learning system i.e. educational and e-commerce websites
- Management systems
- Social Media websites
- Mobile applications
- Utility websites
- Augmented and mixed reality applications

Reason to use AWD for these websites is that it provides good user experience and transfer the information necessary for the user intent. Moreover, it provides clarity of user need and requirement to the developer/coder as well as it provide ability to build upon the existing website.

4.1 Limitations

We tried to follow SLR guidelines [59] but still there ought to be some limitations in our work. We have identified a limited set of search terms but there is a chance that we missed some key words. We have used filter 2009-17 for selection of research studies, we might have missed some important publications out of this year bound. Similarly, we have only selected five major databases for our research selection, we might have missed some researches from other scientific database engines.

5. CONCLUSION

This SLR examines the detailed analysis of Adaptive Web Design (AWD) and Responsive Web Design (RWD) for modern age web applications, accessible via different types of devices. To accomplish this goal, our SLR has identified 58 research studies published during the year 2009-2017. We have identified a total of 15 models and approaches used for the both web designs, models (6) and approaches (9). Thus, both AWD and RWD have been researched and compiled together in order to analyze each one extensively. The SLR exhibits that AWD wins over RWD even though adaptive design costs more and is complicated. This will help researchers, developers and practitioners in selection of right design and best suitable models and approaches for it to develop their web applications according to the requirements.

6. REFERENCES

[1] Roberto V. (2012), AML: a modeling language for designing adaptive web applications, Journal of Personal and Ubiquitous Computing, Vol. 16, No. 5, pp. 527-541.

[2] Stewart C. B. (2014), Making It Work for Everyone HTML5 and CSS Level3 for Responsive Accessible Design on Your Library website. Journal of Library & Information Services in Distance Learning, Vol. 8, No. 3-4, pp. 118-136.

[3] Changbo K. and Zhiqiu H. (2012), Self-adaptive Semantic Web Service Matching Method, Journal of Knowledge-Based Systems, Vol. 35, pp. 41-48.

[4] Jia-Jiunn L.,Ya-Chen C. and Shiou-Wen Y. (2012), Designing an adaptive web-based learning system based on students' cognitive styles identified online, Journal of Computers and Education, Vol. 59, No. 1, pp. 209-222.

[5] Zhenlong L. and Binghua C. (2012), The Design of Adaptive Web-Learning System Base on Learning Behavior Monitoring, Proceedings of 7th International Conference on Computer Science & Education (ICCSE), IEEE.

[6] Manvi, Ashutosh D. and Komal K. B. (2013), Design of an Ontology Based Adaptive Crawler for Hidden Web, International Conference in Communication Systems and Network Technologies (CSNT) 2013, IEEE.

[7] Carlos G., Carlos J. and Ramon P. (2011), Improving Web Cache Performance via Adaptive Content Fragmentation Design, 10th IEEE International Symposium on Network Computing and Applications (NCA) 2011, IEEE.

[8] Bin Z. (2013), Responsive Design e-Learning Site Transformation, 4th International Conference on Networking and Distributed Computing (ICNDC) 2013, IEEE.

[9] Bijan B G. (2010), Culturally Responsive Educational Web Sites, Journal of Educational Media International, Vol. 37, No. 3, pp. 185-195.

[10] Luca L. (2012), Formalising human mental workload as non-monotonic concept for adaptive and personalised web-design, International Conference on User Modeling, Adaptation, and Personalization (UMAP) 2012, LNCS, Vol. 7379, pp 369-373

[11] Nancy R. G. and Phil S. (2014), One Site Fits All: Responsive Web Design, Journal of Electronic Resources in Medical Libraries, Vol. 11, No.2, pp. 78-90.

[12] Ioannis M., Stavros D. and Anastasios K. (2011), Adaptive and Intelligent Systems for Collaborative Learning Support: A Review of the Field, IEEE Transactions on Learning Technologies, Vol. 4, No.1, pp. 5-20.

[13] S. Mohorovičić. (2013), Implementing Responsive Web Design for Enhanced Web Presence, 36th International Convention on Information & Communication Technology Electronics & Microelectronics (MIPRO) 2013, IEEE.

[14] Jari-Pekka V., Jaakko S. and Tommi M. (2015), On the Design of a Responsive User Interface for a Multi-Device Web Service, 2nd ACM International Conference on Mobile Software Engineering and Systems (MOBILEsoft) 2015, ACM.

[15] Mohammed S., Mohammed R. and Mostafa B. (2013), Towards Minimizing Author's Effort during Designing the Domain Model of Adaptive Web-based Educational System, 8th International Conference on Intelligent Systems: Theories and Applications (SITA), 2013, IEEE.

[16] Gu W. and Liu J. (2010), Web-based Adaptive Intelligent Learning System Design and Implementation (ICINA) 2010, International Conference on Information, Networking and Automation (ICINA), IEEE.

[17] Aqueasha M. H., Abdullah A., Catherine H. and Amy K. H. (2015), Understanding design considerations for adaptive user interfaces for accessible pointing with older and younger adults, Proceedings of the 12th Web for All Conference (W4A'15), ACM.

[18] Ramón H. and José B. (2011), Towards the ubiquitous visualization: Adaptive user-interfaces based on the Semantic Web, Journal of Interacting with Computers, Vol. 23, pp. 40-56.

[19] Vlad S. and Yu Y. (2012), Experiences designing hypermedia-driven and self-adaptive web-based AR authoring tools, Proceedings of the Third International Workshop on RESTful Design (WS-REST'12), ACM.

[20] Federica C., Antonina D., Pasquale L. and Julita V. (2013), Perspectives in Semantic Adaptive Social Web, ACM Transactions on Intelligent Systems and Technology (TIST), Vol. 4, No. 4.

[21] Bilal L. B., Gede P. and Halizah B. B. (2013), ULUL-ILM The Design of Web-Based Adaptive Educational Hypermedia System Based on Learning Style, 13th International Conference on Intelligent Systems Design and Applications (ISDA) 2013, IEEE.

Circulation in Computer Science
International Conference on Engineering, Computing & Information Technology (ICECIT 2017), pp:55-60
www.ccsarchive.org

[22] Liu X. and Han H. (2010), The Design and Realization of Web-based Adaptive Learning System, 2nd International Conference on Networking and Digital Society (ICNDS) 2010, IEEE.

[23] Wei J., Meng Z., Bin Z., Yujian J. and Yingwei Z. (2014), Responsive Web Design Mode and Application, IEEE Workshop on Advanced Research and Technology in Industry Applications (WARTIA) 2014, IEEE.

[24] Jeonghyun L., Imsu L., Iseul K., Hyejin Y., Jongwon L., Mansung J., Hyenki K. (2015), Responsive Web Design According to the Resolution, 8th International Conference on u- and e-Service, Science and Technology (UNESST) 2015, IEEE.

[25] Jacob D., Bert V. and Tele T. (2014), Enhancing accessibility to web mapping systems with technology aligned adaptive profiles, International Journal of Digital Earth Taylor & Francis Group, Vol. 7, No. 4, pp. 256-278.

[26] Fabio P. and Christian S. (2011), Model-Based Customizable Adaptation of Web Applications for Vocal Browsing, Proceedings of the 29th ACM international conference on Design of communication (SIGDOC '11), 83-90, ACM.

[27] Anne S. (2015), Responsive web design for libraries A LITA guide, Journal of Hospital Librarianship, Vol. 64, No.2, pp. 159-160.

[28] Eva H., Paul K., Steven L. and Norbert S. (2011), Responsive web design, Elsevier.

[29] Ezwan S. A. M., Zulkefli M., Norfadillah K. (2015), Adaptation of Usability Principles in Responsive Web Design Technique for E-Commerce Development, 5th International Conference on Electrical Engineering and Informatics (ICEEI) 2015, IEEE.

[30] Wang H. and Liu X. (2009), Adaptive Site Design Based on Web Mining and Topology, World Congress on Computer Science and Information Engineering WRI 2009, IEEE.

[31] Katerina P. and Stephanos M. (2012), Developing adaptive e-Learning systems based on Web 2.0, International Conference on Information Society (i-Society) 2012, IEEE.

[32] Guo L., Hua Q. Y., Wang P., Yu K., Wang K. and Xu J. (2015), A Model-Based Responsive Web User Interface, 6th International Conference on Software Engineering and Service Science (ICSESS) 2015, IEEE.

[33] Evgeny K., Paul D. B. and Mykola P. (2009), AH 12 years later: a comprehensive survey of adaptive hypermedia methods and techniques, Journal of New Review of Hypermedia and Multimedia, Vol. 15, No. 1, pp. 5-38.

[34] Yoann B., Marianne H. and Michel M. (2015), Reconciling user and designer preferences in adapting web pages for people with low vision, Proceedings of the 12th Web for All Conference (W4A'15), ACM.

[35] Kunyanuth K., Pubet K. and Pattarapan R. (2015), Developing an Adaptive Web-Based Intelligent Tutoring System using Mastery Learning Technique, Procedia-Social and Behavioral Sciences, Vol. 191, pp. 686-691.

[36] Quan Z. S., Boualem B., Zakaria M. and Anne H. N. (2009), Configurable Composition and Adaptive Provisioning of Web Services, IEEE Transactions on Services Computing, Vol. 2, No. 1, pp. 34-49.

[37] Ja´n A. (2014), Beyond Adaptive Web Design, IEEE.

[38] Bujar R., Mexhid F., Xhemal Z., Jaumin A. and Florije I. (2015), Methods and Techniques of Adaptive Web Accessibility for the Blind and Visually Impaired, Procedia Social and Behavioral Sciences, Vol. 195, pp. 1999-2007.

[39] Bo M., Bin C., Xiaoying B. and Junfei H. (2010), Design of BDI Agent for Adaptive Performance Testing of Web Services, Proceedings of 10th International Conference on Quality Software, IEEE.

[40] Meltem H. B. and Murat B. (2013), Responsive web design-a new type of design for web-based instructional content, Procedia Social and Behavioral Sciences, Vol. 106, pp. 2275-2279.

[41] JianY., Quan Z. S., Joshua K.Y. S., JunHan, ChengfeiLiu and Talal H.N. (2015), Model-driven development of adaptive web service processes with aspects and rules, Journal of Computer and System Sciences, Vol. 81, pp. 533-552.

[42] Cristóbal R., Sebastián V., Amelia Z. and Paul de B. (2009), Applying Web usage mining for personalizing hyperlinks in Web-based adaptive educational systems, Journal of Computers and Education Elsevier, Vol. 53, pp. 828-840.

[43] Nicolas P., Toni M., Josep L. B., Ricard G. and Jordi T. (2009), Self-adaptive utility-based web session management, Journal of Computer Networks, Vol. 53, pp. 1712-1721.

[44] Evangelos S., Antoniou D., Poulia A. and Athanasios T. (2010), A web personalizing technique using adaptive data structures: The case of bursts in web visits, The Journal of Systems and Software, Vol. 83, No. 11, pp. 2200-2210.

[45] Quang-Dung V., Danh-Viet V., Ha-Thanh N. P. B., Viet-Ha N. and Nobuyasu N. (2014), Adaptive Web page layout for mobile devices, International Conference on Computing, Management and Telecommunications (ComManTel) 2014, IEEE.

[46] Sowmya S., Ravitheja T. and Joy B. (2014), Rendering on Browsers Responsive to User Head, Annual India Conference (INDICON) 2014, IEEE.

[47] Shengbo C., Huaikou M., Bo S. and Yihai C. (2010), Towards Practical Modeling of Web Applications and Generating Tests, IEEE 4th International Symposium on Theoretical Aspects of Software Engineering (TASE) 2010, IEEE.

[48] Sowmya S., Ravitheja T. and Joy B. (2014), Responsive, adaptive and user personalized rendering on mobile browsers, International Conference on Advances in Computing, Communications and Informatics (ICACCI) 2014, IEEE.

[49] Stephen S. Y., Nong Y., Hessam S. S., Dazhi H., Auttawut R., Mustafa G. B. and Mohammed A. M. (2009), Toward Development of Adaptive Service-Based

Circulation in Computer Science
International Conference on Engineering, Computing & Information Technology (ICECIT 2017), pp:55-60
www.ccsarchive.org

Software Systems, IEEE Transactions on Services Computing, Vol. 2, No. 3, pp. 247 – 260.

[50] Tiago C. N., Deller J. F., Sérgio T. C. and Luciana O. B. (2017), Evaluating Responsive Web Design's Impact on Blind Users, IEEE MultiMedia, Vol. 24, No. 2, pp. 86 – 95.

[51] Maryam A. A., John H. C., Carla B. Z. and Dimitrios P. (2017), An Adaptive Educational Web Application for Engineering Students, IEEE Access, Vol. 5, pp. 359 – 365.

[52] Wenhui P. and Yaling Z. (2015), The Design and Research of Responsive Web Supporting Mobile Learning Devices, International Symposium on Educational Technology (ISET) 2015, IEEE.

[53] Jeonghyun L., Imsu L., Iseul K., Hyejin Y., Jongwon L., Mansung J. and Hyenki K. (2015), Responsive Web Design According to the Resolution, 8th International Conference on u- and e- Service, Science and Technology (UNESST) 2015, IEEE.

[54] Yahya M. T., Majd S., Manar F., Walaa S. and Mohammad A. A. (2017), Adaptive e-learning web-based English tutor using data mining techniques and Jackson's learning styles, 8th International Conference on Information and Communication Systems (ICICS) 2017, IEEE.

[55] Yingzi L., Jeffrey B., Mura I. and David S. (2017), An Adaptive Interface Design (AID) for enhanced computer accessibility and rehabilitation, International Journal of Human-Computer Studies, Vol. 98, No. C, pp. 14-23.

[56] Xuan-zhe L., Mengwei X., Teng T., Gang H. and Hong M. (2016), MUIT: A Domain-Specific Language and its Middleware for Adaptive Mobile Web-based User Interfaces in WS-BPEL, IEEE Transactions on Services Computing, Vol. PP, No. 99.

[57] Azlan Y., Moamin A. M. and Mohd S. A. (2016), A Conceptual Multi-Agent Semantic Web Model of a self-adaptive website for intelligent strategic marketing in learning institutions, 2nd International Symposium on Agent, Multi-Agent Systems and Robotics (ISAMSR) 2016, IEEE.

[58] Tilman D. and Ted S. (2016), On the Importance of Spatial Perception for the Design of Adaptive User Interfaces, IEEE 10th International Conference on Self-Adaptive and Self-Organizing Systems (SASO) 2016, IEEE.

[59] Kitchenham, B. (2004), Procedures for Performing Systematic Reviews, Keele University TR/SE-0401/NICTA, Technical Report 0400011T

[60] Search Process - Search terms http://ceme.nust.edu.pk/ISEGROUP/Resources/slra/slr.html