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RESEARCH PAPER

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ASSESSMENT OF AVAILABILITY USING DESIGN METRICS

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Abstract: It has been a more appearance of the software development life cycle. Design stage is vital for software development. From that instant, the designers have accumulated much knowledge in the design and construction of object oriented system. However, at the present time various approaches are available to guide a design in a formal way. One important quality parameter is availability. Ethics authorize to us to analyze an easier way in which to introduce new design approach. Indirections provide availability to the pattern. In this paper, show that the concepts of availability are more significant with software and developed multiple liner equations.

Keywords: OOD Concept, Quality Factors, Design Metrics

I. INTRODUCTION

All Software availability is one of imperative ideas in design of software program and components. Building projects and components with great availability dependably rearranges test activities, lessens test cost, and builds software quality. As pointed out by Kuwaiti [12], there is an arrangement of program attributes that prompt software, including availability, integrity, dependability, fault tolerance much more. They pointed out that software availability analysis is valuable to inspect and assess the nature of software utilizing an empirical analysis approach. In the segment building worldview, software advancement of part based software; engineers have a few queries concerning segment availability. What is part software quality and related variables? How to check, measure, or assess the availability of software components? Instructions to design create accessible components to accomplish good availability. Anshul [2] et.al advocated that availability of a software can be image as a set of software artifacts (classes) relate with one another at design level. Inter-class associates are alleged to have greater manipulate on availability than intra-class associates. Software developers to evade availability violation at design level it is compulsory to establish a logical relation between the classes and entities.

II. SOFTWARE QUALITY

Availability is the property that the framework will be accessible for true blue utilize. Software Quality Attributes are the benchmarks that depict framework's planned conduct inside nature for which it was manufactured [4]. The quality attributes give the way to estimating the wellness and reasonableness of an item. Software architecture has a significant effect on most characteristics somehow, and software quality attributes influence architecture [9]. The availability of a framework is a measure of its status for utilization. Availability is dependably a worry while thinking about a framework's dependability, however to shifting degrees, contingent on the application. Availability is estimated as the point of confinement of the probability that the framework is working accurately at time t, as t approaches interminability. This is the unfaltering state availability of the framework. It might be computed as MTTF/ (MTTF + MTTR) where MTTF is the mean time to failure, and MTTR is the mean time to repair.

III. AVAILABILITY

Availability Availability is identified with an application's unwavering quality. On the off chance that an application isn't accessible for utilize when required, then it's probably not going to satisfy its useful prerequisites. Availability is generally simple to indicate and measure. Regarding determination, numerous IT applications must be accessible in any event amid typical business hours. Most Internet locales want 100% availability, as there are no customary business hours on the web. For a live framework, availability can be estimated by the extent of the required time it is useable. Failures in applications make them be inaccessible. Failures affect on an application's unwavering quality, which is normally estimated by the mean time between failures. The time allotment any time of unavailability endures is dictated by the measure of time it takes to recognize failure and restart the framework. Thusly, applications that require high availability limit or ideally kill single purposes of failure, and establishment mechanisms that automatically distinguish failure and restart the fizzled components. A number of experts in the area suggested that availability is an important quality factors and their view is summarized in table I.

Table I A Critical View of Quality Attributes

Experts	*Reliability*	*Maintainability*	*Completeness*	*Tracebility*	*Availability*	*Usability*	*Security*
Zunnon (2017) [13]	√		√	√	√		√
Anshul (2017) [14]	√	√	√	√	√	√	√
Nikhat (2015) [6]			√		√		√
Rajeev & S.A. Khan (2015) [5]	√		√	√	√		√
S.M.K Quadri (2012) [7]	√			√		√	
Kout (2011) [1]	√	√		√	√	√	√
Saha 2010 [3]	√	√	√		√	√	√
Briand 2009) [8]		√	√		√	√	√
M. Sharma (2009) [11]	√	√		√	√	√	
Zheng (2008) [10]	√		√	√	√	√	
Surabhi 2017 [15][16]	✓		√			✓	✓

IV RELATIONSHIP WITH SUITED METRICS

The figure1 portrays the evaluation procedure of availability display keeping in mind the end goal to establish a multivariate model for quality builds. The estimations of these metrics can be effortlessly recognized by class outline metrics. This metrics will assume the part of autonomous factors while availability will be taken as dependent variable.

Fig 1 Mapping between quality and design property

V MODEL ESTABLISHMENT

It is obvious from writing review that availability is not another term; rather it has been in discussion among the business experts at different gatherings. This model utilized the low level design metrics specifically Data Abstraction Values and Cohesion Value to depict a scope of estimation for software and characterized as far as design characteristic and additionally supportive for quantitative evaluation of degree to which framework, part or process hold a given quality. So as to establish a model for Availability, different direct relapse procedures have been utilized. The values have taken from [9, 14] for evaluation and model development and shown in table II. The evaluation process has done through SPSS in table III.

The proposed multivariate model takes the accompanying structure: In order to establish a model for availability to proposed multivariate model takes the following form:

$$Y=\alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \ldots\ldots \alpha_n X_n$$

Where

- Y is dependent variable
- X1, X2, X3 ... Xn are independent variables.
- $\alpha_1, \alpha_2, \ldots \alpha_n$ are the regression coefficient of the respective independent variable.
- α_0 is the regression intercept.

Table II Availability Calculated

Project	Known Index	MFA	LCOM
P_1	0.910	0.72500	0.88506
P_2	0.925	0.83516	0.00000
P_3	0.913	0.00000	0.71429
P_4	0.904	0.85859	0.77083
P_5	0.925	0.70000	0.88095
P_6	0.913	0.50000	0.00000
P_7	0.925	2.00000	0.96386
P_8	0.915	0.65833	0.58065

$$Y^{AVAILABILITY} = 0.914 + 0.00713 * LCOM - 0.00494 * MFA$$

Table III Data Calculated table

Project	MFA	LCOM	Calculated Index	Standard Index
P_1	2.000	.964	.923	.922
P_2	.658	.581	.916	.907
P_3	.333	.981	.912	.906
P_4	.594	.652	.915	.950
P_5	.583	.622	.914	.912
P_6	.500	.949	.913	.888
P_7	.794	.804	.916	.941
P_8	.879	.708	.917	.930
P_9	.813	.951	.915	.947
P_{10}	.696	.455	.917	.891

Table IV Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.996[a]	.991	.989	.000340

a. Predictors: (Constant) MFA, LCOM

Table V Descriptive Statistics

	Mean	Std. Deviation	N
Calculated	.91571	.003193	10
LCOM	.78505	.456106	10
MFA	.76664	.189319	10

VI EMPERICAL VALIDATION

During experiments, availability value of the projects has been calculated index sing the developed model, followed by the calculation of availability rating (table VI). These calculated ratings are then compared with the known rating given by experts with the help of Charles Spearman's Coefficient of Correlation

Table VI Index Table

Project	Calculated Index	Calculated Ranking	Known Index	Known Ranking
P_1	.923	7	.922	6
P_2	.916	5	.907	4
P_3	.912	1	.906	3
P_4	.915	4	.950	10
P_5	.914	3	.912	5
P_6	.913	2	.888	1
P_7	.916	5	.941	8
P_8	.917	6	.930	7
P_9	.915	4	.947	9
P_{10}	.917	6	.891	2

Table VII Validation Test

Project	Calculated Ranking	Known Ranking	$\sum d^2$	r_s	r_s > Value
P_1	7	6	1	0.89	√
P_2	5	4	1	0.89	√
P_3	1	3	4	0.975	√
P_4	4	10	36	0.78	√
P_5	3	5	4	0.97	√
P_6	2	1	1	0.89	√
P_7	5	8	9	0.94	√
P_8	6	7	1	0.89	√
P_9	4	9	25	0.840	√
P_{10}	6	2	16	0.90	√

Correlation values between availability through model and known ranking are shown in table above. Pairs of these values with correlation values are checked in table VII. Table IV, V have given the model summary about the established correlation and also complete statistical analysis of proposed model. As mentioned above, Charles Spearman's Coefficient of Correlation (rank relation) rs was used to check the significance of correlation between calculated values of availability using model and it's 'Known Values'. Rank correlation is the process of determining the degree of correlation between two variables. The 'rs' was calculated using the method given as under: Spearman's Coefficient of Correlation

$$1 - \frac{6\sum_{i=1}^{n} d_i^2}{n^3 - n}$$

Where

- **d_i = rank x_i – rank y_i**
- **R is to +1 or -1**

VII CONCLUSION

Availability is a standout amongst the most noteworthy factors for estimating quality of objects oriented software design. Concentrate created availability estimation demonstrate that establishes the relationship among availability, object oriented design properties and object oriented metrics. This paper demonstrates the noteworthiness of availability as a key factor of quality and its association with different object oriented design properties. Availability estimation demonstrate in design stage has been created and approved theoretically and also empirically utilizing trial experiment with. For trial approval a few extensive business ventures has been utilized. The connected approval on the availability display reasons that created demonstrate is exceptionally solid, up to standard.

REFERENCES

[1] Kout, A., Toure, F., & Badri, M. (2011). An empirical analysis of a testability model for object oriented programs. ACM SIGSOFT Software Engineering Notes, 36(4), 1.

[2] ISO 9001:2005, Quality management system Fundamentals and vocabulary; 2005.

[3] Singh, Y., & Saha, A. (2010). Improving the testability of object oriented software through software contracts. ACM SIGSOFT Software Engineering Notes, 35(1), 1.

[4] Mulo, E. "Design for Testability in Software Systems." Master's Thesis (2007).

[5] R. Kumar, S. A. Khan & R. A. Khan, "Revisiting Software Security: Durability Perspective", International Journal of Hybrid Information Technology, Vol. 8, No. 2, pp 311-312, 2015.

[6] Nikhat et. al. , "Model to Quantify Integrity at Requirement Phase", Indian Journal of Science and Technology, Vol 9(29), DOI: 10.17485/ijst/2016/v9i29/89280, August 2016.

[7] I. A. Mir & S.M.K Quadri, "Analysis and Evaluating Security of Component Based Software Development: A Security Metrics Framework", I. J. Computer Network and Information Security, pp 21-31,2012.

[8] Briand, L. C., Labiche, Y., & He, S. (2009). Automating regression test selection based on UML designs. Information and Software Technology, 51(1), 16–30.

[9] M. Jureczko and L. Madeyski, "Towards identifying software project clusters with regard to defect prediction", IEEE, 2010

[10] Zheng, W., & Bundell, G. (2008). Contract-Based Software Component Tes ting with UML Models. Computer Science and its Applications, 2008. CSA '08. International Symposium on, 978-0-7695(13 - 15 October 2008), 83–102.

[11] Sharma, M., & Mall, R. (2009). Automatic generation of test specifications for coverage of system state transitions. Information and Software Technology, 51(2), 418–432.

[12] Kuwaiti et. al. "A Comparative Analysis of Network Dependability, Fault Tolerance, Reliability and security", IEEE, 2010.

[13] Zunnon Khan, "Fault Criteria at Design issues", IJSRD, 2017.

[14] Anshul Mishra, D. Agarwal and M. H. Khan, "Availability Estimation Model: Fault Perspective", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 6, Issue 6, June 2017.

[15] Surabhi Saxena , Dr. Devendra Agarwal,. "A Systematic Literature Review on Software Reliability Estimation Model for Measuring the Effectiveness of Object Oriented Design", International Journal of Advanced Research in Computer and Communication Engineering, Volume 6 , Issue 6 , June 2017.

[16] Surabhi Saxena , Dr. Devendra Agarwal,. "A Systematic Literature Review and Implementation of Software Usability Estimation Model for Measuring the Effectiveness ", International Journal of Emerging Technology and Advanced Engineering, Volume 7 , Issue 7 , July 2017.

VIII. ACKNOWLEDGEMENT

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