

A Systematic Literature Review on Software Reliability Estimation Model for Measuring the Effectiveness of Object Oriented Design

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Abstract: Software Reliability is one of the most important quality indicator for software development life cycle process. It is perfectly measured and support to increase the development process. Somewhere the software quality depends upon the reliable measurement. A number of software reliability theories have been published in different types of journals by researcher and practitioners. On the other hand reliability is a always big questions in complex system. This research paper shows the outcomes of a systematic literature review conducted on software reliability of object oriented design.

Keywords: Software Reliability, Software Reliability estimation model, Object Oriented design, Industrial Perspective.

I. INTRODUCTION

Software reliability is an important factor to estimate software quality. Software reliability is a probably that software will not cause the failure of a system for a specified time under specified condition. According to the ISO/IEC 25010:2011 product quality model defines reliability as the degree to which a system, component or product performs specified functions under specified conditions for a specified period of time.

Software Reliability is a one of the key factor among the eight functional characteristics of quality model that contributes to the efficiency of the software system which was further divided into sub-characteristics which are maturity, availability, fault tolerance and availability. Just like hardware, the reliability of software can be measured and evaluated [2].

II. SOFTWARE RELIABILITY

According to the **IEEE-Std 729-1991** "Software Reliability is defined as the probability of failure - free operations for a specified period of time in a specified background."

According to the **ISO9126**: "Reliability is the capacity of the software product to continue a particular level of performance when used under specific situation."

Following figure 1. (a) shows the relation between error, faults and failures. In terms of software reliability, error is a computer programmer action or hops that result in a fault.

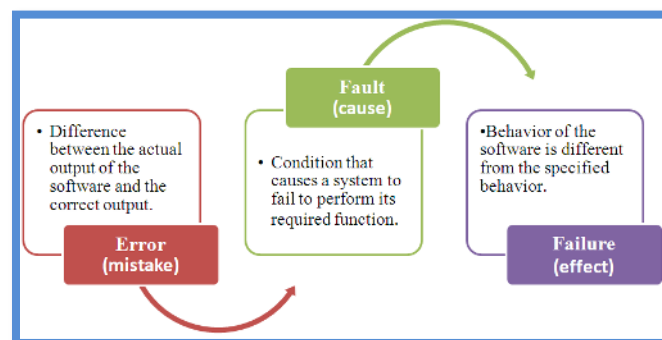


Fig.1 Life Cycle of Software Failure



A fault is a software defect that causes failure. A failure is the inability of a system or component to perform a required function according to its specification. Reliability Metrics are used to know the possibility of failure or failure rate of software where system error are occurs.

Software failures occur if the behavior of the software differs from the specified behavior of the software. A failure in the software design makes the system difficult to understand and increases the complexity [1].

III. OBJECT ORIENTED METRICS

The object-oriented technology is more trustworthy to design the software in order to make available the product of higher quality. The recognition of the object-oriented approach is credible to produce improved and cheaper software [4]. Three important concepts formulate a distinction the object-oriented approach from conventional software engineering: Coupling, Encapsulation, Cohesion and Inheritance & Polymorphism [4].

The object oriented design metrics used for evaluating object oriented design and selecting an optimal design among alternatives with respect to reliability. Object Oriented design and metrics give out results for the measurement for a system element for a software measurement then these Object Oriented reliability metrics are used for finding out the ranking of software reliability .

The following software reliability metric are identified during the whole research work :-

- Inherited Complexity Metric
- Cohension Complexity Metric
- Encapsulation Complexity Metric
- Coupling Metric

IV. SOFTWARE RELIABILITY MODELS

According to the Software Engineering Concepts, Software Reliability is divided in two types of software named as the prediction models and estimation models.

Table 1:- Comparison Between Prediction and Estimation Model

Issues	Predication Model	Estimation Model
Data Reference	In this Model Historical Data are used in predication model	The Data from current software development is used in estimation model.
At the time of use in the development cycle	Generally it is used in testing phase.	This type of reliability model is used in development Phase and Design phase.
Time Frame	The reliability can be predicated at the same future time	The reliability can be estimate at either future or present time

V. RESEARCH OBJECTIVE

The main objective is to develop a consolidated framework to software reliability model at the development phase of the software development life cycle The Primary objective of this research is to remove all the faults which was critical to both software and hardware growth. The secondary research objective is to remove all the faults which was encountered often by the users

VI. REVIEW METHODOLOGY

A systematic literature review for recognize, estimate and to understand the existing research to a particular area of research .The research study is categorized into 2 way i.e. primary and secondary data source. Primary study is done by individually and secondary research done systematic review of other research paper which is related to research area and topic. The important research papers review in detail is to determine its effectiveness with respect to the literature review. Out of 85 papers 50 papers were extracted from the journals, transactions and conference etc to optimize the objectives of the research.

In this paper study the systematic review is used to find out the reliability factors and measurement taken in software engineering which help to proposed new software reliability estimation model for reliable system.



Several models have been developed and proposed since 1970 however some are similar in work principle and some are different. One of the earliest model was the Rome Laboratory TR-92-52. It was developed in 1987 and then updated in year 1992 and was generated for avionics systems. Some of other models are Shortcut model, Full-scale model, and Neufelder assessment model. Some of the software prediction models include Musa's Execution Time Model, Putnam's Model. and Rome Laboratory models TR-92-51 and TR-92-52, etc.

Using software reliability prediction models, software reliability can be predicted early in the development phase and enhancements can be initiated to improve the reliability. Some of the software reliability estimation models include exponential distribution models, Weibull distribution model, Thompson and Chelson's model, etc. Exponential models and Weibull distribution model are usually named as classical fault count/fault rate estimation models, while Thompson and Chelson's model belong to Bayesian fault rate estimation models.

A complete comparative study of existing Software reliability Models Consider by Various researchers and Expert has been done in Table2.

Table 2 A Systematic Literature Reviews of Software Reliability Models Proposed by Various Researchers

Year	Author (s)	Methodology	Model
2002	M.M.T Thwin & T.S. Quah	Object Oriented metrics for reliability and maintainability	Multiple Regression Model and Neural Network Model
2007	N.R.Kiran & V.Ravi	Software Reliability predication model	BPNN , DEFNIS , MARS & MLR
2009	K.Khataneh & T.Mustafa	Exploration Software Reliability Model	Fuzzy Logic Model
2010	N.F.Scheid Wind	Use of UML Diagram for design process	Object Oriented Design
2011	S.A.Hudli & A.V.Hudli	Estimate the addressing of reliability of object Oriented Design	Reliability Metrics
2012	Y.Wu & R.Yang	Reliability Predication Model	General Regression Neural Network
2012	B. Kotaiah and R.A. Khan	Survey on software reliability assessment	ANN, fuzzy network, genetic algorithm, SVM, Bayesian classification
2013	G. Agarwal & V.K. Gupta	Reliability of Software Modules	Neural network approach
2013	M.Arora & S. Chaudhary	Predication Software Reliability Model	Neural network approach
2013	A. Pandey & A.Ahlawat	To predict the software reliability and maintainability using object oriented metrics	Back Propagation Neural Network approach
2014	N. Sharma & P. Bano	Reliability Estimation Model	Survey Questionnaire
2015	N. Gupta & R. Kumar	Measurement of reliability in object oriented design	Systematic review
2016	A. Mishra & S.K. Dubey	reliability of object oriented software using fuzzy approach	ISO/IEC 9126 model and CK Metrics

VII. CONCLUSION AND FUTURE WORK

Most of the software reliability techniques are reviewed and still difficult to apply in applications. A lot of Reliability work has been proposed in the existing literature review for evaluating software reliability. A review of literature shows that the most work has been done at the phase of software development life cycle especially at coding and testing level. For that reason the evolution of software reliability to make reliable system still unsolved and the customer of system are still unsatisfied. Software complexity is one of the drawbacks from the growth of the reliable systems. In future research paper the new consolidated framework for Software Reliability Estimation Model has been proposed so that the quality and complexity well maintained

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