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Some Observations on Maintainability Estimation Model for Object Oriented Software in requirement, Design, Coding and Testing Phases

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Abstract---In software development the maintenance is not considered as its part but its important role in the life of software product. The total cost of maintenance is greater than the development cost of software design. The object-oriented approaches for software development are fundamentally more popular because an object oriented systems permitting changes more easily. The important objectives of the development of object oriented software should be to produce software that is easily maintainable. Here we are going to design an automation tool and using estimated model that can help the developers to reduce maintenance cost of software project. Analysis of metrics in object oriented software system to improve software reliability and maintainability.

Keywords---software maintenance, object -oriented metrics, reusability and testability

I. INTRODUCTION

The requirements of the software increases day by day, the maintenance of the software is very necessary for developing good quality software. For this purpose, software engineering is required. To develop good quality software, a developer needs to adopt the concepts and strategies of software engineering. The most important thing in development process is requirement gathering requirement gathering and needs of the customer. If developer wants to develop good quality software, then the software must fulfill these needs. To develop software many new and fast technologies are comes into picture. Object oriented design is one of the technologies. It helps in developing the new modules in the software system. The object oriented design helps to identify the various requirements. The object oriented design is module based architecture. It also helps to increase the quality of the design. The object oriented design contains two types of modules, these modules are:

1) Static model for object oriented design
2) Dynamic model for object oriented design

These models are the main content in object oriented design. The state of the object and behavior of the object affects the object oriented design. The objects are use in a class diagrams

A. Object Oriented Metrics

The term metrics is frequently used to mean a set of specific measurements taken on a particular process. The object oriented metrics are used to evaluate and predict the quality of software. These metrics are used as an early indicator of externally visible attributes. The externally visible attributes could not be measures until too late in the software development process. Metrics to be a set of standards against which one can measure the effectiveness of object oriented analysis techniques in the design of a system. Object oriented metrics can be applied to analyze source code as an indicator of quality attributes. The source code could be any object oriented language. [2] On the basis of their requirements, object oriented metrics can be classified into two categories. :

1) Project based metrics
2) Design based metrics

B. MOOD Matrix

Mood matrix stands for maintainability of object oriented design. In the development of the software systems the object oriented developers are promises to reduce the maintenance effort. The object oriented development methods models the system components as the objects. These objects are helpful in allow the designer to separate the interface from the implementation. Earlier the maintainability can be defines in three different ways as,

C. Testability

Testability is the quality of the software design. It helps in the automated testing. Testability is extrinsic property that helps to find out the various kind of bugs presented in the system. It also helps in reduces the bugs for effectiveness of the system. A testable product is used for the complete execution of the test scripts. When the testability is take place in the system, the customers reports the minimum number of defects. The testable products are easy and the cost to maintain product also less. Testability is an important aspect for the maintainability of software product.

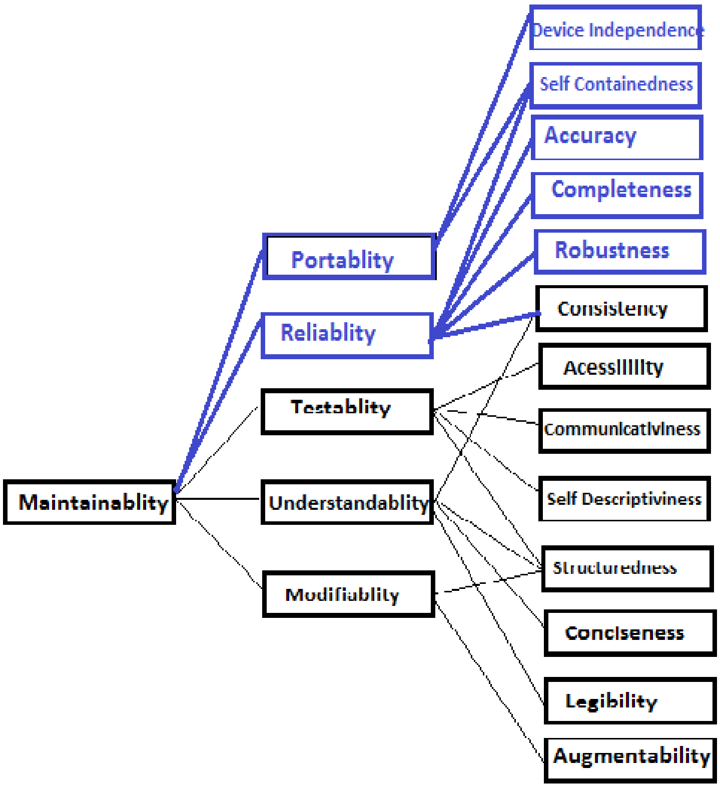

Fig 1 Proposed Maintainability Model

D. Understandability

Understandability of the software system defines as the attributes of the software that uses the user efforts to recognize the various logical concepts. Understandability of the software system defines the user requirements, state of their tasks.

E. Modifiability

Modifiability is defined as the changes occur in the system to increases the performance of the system. Whenever there is the need to change the properties of the system, the developers change the many features according to the demand of the developer.

F. Component-Based Approach

This approach is used to revolutionize the development and maintenance of software systems. In this the distributed system approach is used. Many companies today claim to be doing component based development. All this development is comes under the distributed system.

G. Component Based Software engineering

Component based software engineering is the branch of software engineering that emphasizes the separation of concerns. Component based software engineering assembles the software products from pre existing smaller products. These products are known as the components. A component model generally defines a concept of components and rules for their design time composition and is usually accompanied by one or more component technologies, implementing support for composition and interoperation. [4] This practice aims to bring about an equally wide ranging degree of benefits in both the short-term and the long-term for the software itself and for organizations that sponsor such software. Software engineers regard components as part of the starting platform for service orientation.

II. RELATED WORK

Maintainability Estimation Model for Object-Oriented Software in Design Phase (MEMOOD)S. W. A. Rizvi and R. A. Khan [2010]: In this paper, author discussed about the development of a multivariate linear model „Maintainability Estimation Model for Object Oriented software in Design phase. It's increasing maintainability by adding two new factors understandability and modifiability into it. This paper shows the models, the models use design level object oriented metrics. These models use the multiple linear regression techniques (5). The values of understandability, modifiability and maintainability are used in the software development process. These values help software designer to review the design and to take appropriate measures. The maintenance team uses the information to know that on what module to focus during maintenance.

A Maintainability Estimation Model and Tool, Alisara Hincheeranan and Wanchai Rivepiboon[2012]: In the given paper, author presents a multivariate linear regression to establish the maintainability estimation model. In this author add the two new factors, as: flexibility and extendibility. This tool helps in the software designer. It helps in improving the maintainability of class diagram during design phase. It also helps in reduces the increasing cost of software maintenance phase. The tool helps the software designer for evaluates maintainability of software system. These software development life cycles help a software designer to improve the maintainability of software system before delivering into the market for use.

Metrics Identification for Measuring Object Oriented Software Quality, Aman Kumar Sharma, Arvind Kalia, Hardeep Singh, [2012]: In this paper author discuss about the various quality metrics. In this paper author presents a review of quality metrics suites. The author used the various metrics like: MOOD, CK and Lorenz & Kid. In this paper process and product metrics are used, which are helpful in managing the activities, such as scheduling, costing, staffing and controlling. These metrics are also helpful for the different phases of the metric such as, analyzing, designing, coding, documentation and testing. (7) Software metrics is the measuring property which is used to measure the quality of a software object, which is related to software project of any size. The Object oriented metrics are useless if they are not mapped to software quality parameters.

Emergence of Component Based Software Engineering, Ardhendu Mandal, S. C. Pal,[2012]: In this paper author discuss about the need of component based software engineering. Now days with the help of Component Based Software Development (CBSD), the industry is moving into new direction. Most of the software that we used are not new, the software are built from the existing components. These days software systems are more complex as compared to those of early. [8] These complex, high quality software systems are built efficiently using component based approach in a shorter time. Component based systems are easier to assemble. Component Based Software Development aims to construct complex software systems by means of integrating reusable software components. This approach promises to alleviate the software crisis at great extents. The objective of this paper is to gain attention towards this new component based software development paradigm and to highlight the benefits and impact of the approach for making it a successful software development approach to the concerned community and industry.

A Maintainability Estimation Model and Metrics for Object-Oriented Design (MOOD) Kiranjit Kaur, Sami Anand[2013]: In this paper author discuss about the maintainability of MOOD metrics. Maintainability of any software in design phase helps a software designer to improve the maintainability of software before deliver to a customer. The maintainability is ease with which a software system or component can be modified to correct faults, improve performance. [9] Unified Modeling Language has been proposed as a standard language for expressing object oriented software designs which used in the development of any software system.UML provides the structural and behavioral aspects of software systems. Object oriented development use to reduce the maintenance effort that not based on reliable experimentation. In this paper, author discuss about the multivariate linear model. These metrics help a software designer for the purpose of improving the maintainability of a class diagram in the design phase, which are helpful in feature to reduce the increasing high cost of software maintenance phase.

III. EXPERIMENTAL OBSERVATION

In earlier time maintainability of object oriented design matrices contain Testability, Understandability, and Modifiability. These three factors are used to help in maintains of the software projects. The present work is about increasing the maintainability factors of the MOOD metrics. These factors help to increase the functionality of the software system. With the help of these factors the reliability, portability and maintainability of the software system become easy. Often component based software engineering with the help of object oriented model means it allows us to reuse the previous existing components into new projects. In the other hand we can use old existing components into new building projects. A organization had done a lots of projects in different languages. Every software project components like login component, file edit/update component, now consider the organization working on a new project and it needs file edit/update component for new project so according to component based software engineering it can reuse the existing file edit/update component into new project. But our base paper two new component are integrated in it. These factors enhance maintains of maintainability of object oriented design.

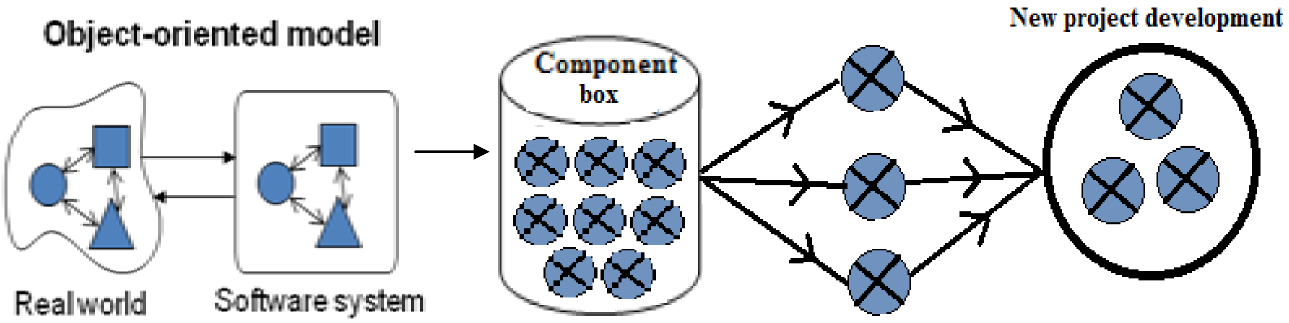

Fig 2 Object Oriented software development Model

In earlier time maintainability of object oriented design matrices contain Testability, Understandability and Modifiability. These three factors are used to help in maintains of the software projects.

The key factors of maintainability contain:

- Testability
- Understandability

- Modifiability
- Reusability

According to base paper the effect of these factors on maintains of software projects is given below:

- **Testability:** Accessibility-2.1%,Communicativeness-8.7%, Self Descriptiveness- 9.32%
- **Understandability:** Consistency-10.09%, Conciseness-4.21%, Legibility-9.27%
- **Modifiability:** Structrendness-10.51%, Augmentability-1.04%
- **Portability:** Device independence-7.87%, Self containdness-11.11%
- **Reliability:** Completness-7.34% .Robusrnesss3.25% .Accuracy5.21%

Although coding is a very important factor for the project in companies. A process obviously includes requirements, design coding and testing phases. The development cost for the different phases could be:

Table I S/w development process consists of phases

Requirements	10%
Designing	10%
Coding	30%
Testing	50%

From the above details it can be vary organization to organization and the nature of the process. The programming is the major activity. The secondary method can be classified the effort spent in programming is to study how programmers spend their time in a software organization. A study conducted in Bell labs to determine how programmers spend their time as given detailed:

Table II To study effort spent in programming

Writing programs	13%
Reading programs and manuals	16%
Job communication	32%
Other(including personal)	39%

From above data the programmers spend less than 20% of their time programming. The second observation from the data about effort distribution with phases is that testing consumes the most resources during development. The main objectives of the process to reduce the cost of maintenance with the help of component based software engineering.

IV. CONCLUSIONS AND FUTURE SCOPE

Maintainability and Reliability are two important characteristics of any software system. It is widely accepted fact that software maintenance is by far the most expensive phase of the software life cycle and therefore has the greatest impact on or more to encourage developers to focus on Reliability and Maintainability because Reliability and Maintainability is one of the key quality attributes in software development and one of the hardest attributes in software to measure.

ACKNOWLEGMENT

I reminded to myself to thank the cooperation of guide and institutes

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