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Title

AN EFFICIENT MODEL TO IMPROVE SOFTWARE DEVELOPMENT PROCESS AND QUALITY ASSURANCE

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Abstract:

Software Process Improvement is a systematic approach and continuous improvement of software development organization's ability to produce and deliver quality software within time and budget constraints. This paper work concentrates on improvement in process as well as in organization so as to assure a quality product. The paper covers assessment, software process improvement, factors that influence the software process improvement. The aim is to develop a model which would be useful in practice for software development companies. It describes how this model can be used to guide software organizations in process improvement in a way to find out the problems in current process and then also give solution to the problem which can give guarantee of quality. We can say that this technique is the replacement of existed standards like CMM, Ideal model, etc which work is just to give a stamp but not to solve.

Keywords

Software process improvement, software quality assurance, improvement model.

Introduction:

Software development describes a way, most commonly a sequence of phases or major events and activities that has been found to lead to success in some endeavor. Each software development project has to go through at least the following stages: Software development (Requirement gathering, Writing functional specifications, Creating architecture and design documents, Implementation and coding), Testing and quality assurance, etc. There are various development models such as waterfall model, spiral model, etc. But there are some crises attached with projects. The cause of the software crises are linked to the overall complexity of the software process and the relative immaturity of software engineering as a profession. The crises can be described in several ways: Project running over budget, Project running over time, Software was low quality; Software often did not meet requirements. Then it was found that if some activities are following then good quality software could be developed. During the 1990s there has been a movement towards the improvement of the software process as a means to improve the quality of software. Existing models such as the Capability Maturity Model, Six

sigma model, ISO 9000, SPICE model, Boot Strap, etc have been criticized, particularly in relation to the small company, as being cumbersome, expensive and failing to present a comprehensive improvement strategy.

So the idea in this paper is to develop such a technique that can be used to help a company to improve their software process in an affordable manner keeping business goals in focus.

Previous Work:

In November 1986 the software engineering institute (SEI), with assistant from the MITRE Corporation, began developing a process maturity framework that would help organizations improve their software process [1]. In September 1987 the SEI released a brief description of process maturity framework and a maturity questionnaire. Several specific approaches to process improvement have become popular in the software industry i.e. Capability Maturity Model, Six Sigma, ISO standard series, Total quality management, Ideal model, etc. Brief overview of some of these models as given:

CMM: CMM is developed by software engineering institute (SEI) in 1987. CMM helps organizations to select improvement strategies based on current process maturity status and to identify critical issues in quality and process improvement [2]. It consists of five maturity levels: Initial, Repeatable, Defined, Manage, and Optimizing. Each level has been divided into certain key process areas. For a company to achieve a certain maturity level it must fulfill all the key process areas of the desired maturity level [3].

Six Sigma: Six sigma strategies were developed by Motorola in the early 1990s [4]. It is based on statistical approach which does the improvement by historical data and by calculation of mathematical formulas. It has six stages and reduces the defect step by step. It is usually related to the magic number of 3.4 defects per million opportunities.

International Organization for Standardization (ISO): ISO is a standard of quality management system. ISO certification is necessary to improve the organization. The ISO 9000 series consists of three standards: *1. ISO 9000:2000*, Quality management systems, Fundamentals and vocabulary *2. ISO 9001:2000* Quality management systems – Requirements *3. ISO 9004:2000* Quality management systems - Guidelines for performance improvements [6].

Total Quality Management (TQM): TQM looks for a continuous improvement [7]. TQM is made by the combination of three alphabetical letters. Total (involving the entire organization, supply chain, or product life cycle), Quality (the literal definition of quality), Management (the system of managing with steps like plan, organization, control etc.)[8].

Ideal Model: This model consists of five phases: Initiating, Diagnosing, Establishing, Acting and Learning**.** Every phase has its own functionality. [9]

Many more such kind of improvement models are there which work for quality of software product.

Motivational & Problem Formation:

The software process improvement is an open question. During the review process it is observed that a lot of models are existing (e.g. CMM, SIX SIGMA, IDEAL Model, etc.), these models have some limitations. So we explore the limitations of the models which motivates us to give some another standard strategy to solve the quality problems.

Limitations of existing models:

- The main limitation of CMM is that describes "what to do" but does not prescribe how to do".
- CMM is a goal. Being used just as stamp of approval.
- Ideal model is also a continuous model. It works on study, plan, do, act basis. But it is a full method such that there is no recovery. Means either it is success or fail.
- Six Sigma focuses on prioritizing and solving specific problems which are selected based on the strategic priorities of the company and the problems which are causing the most defects.
- Another downfall of Six Sigma is the idea behind what constitutes a defect. If a defect or mistake is not well defined, it is hard to determine if one has occurred or not. Although many companies have had success with Six Sigma, some companies have not been so fortunate.

- It usually takes four to five years to see any benefits of Six Sigma once an initial commitment has been made.
- Often it is very difficult for small companies to take employees away from their regular duties in order to be trained in Six Sigma. If employees are not available to give their services, the company loses money due to a reduction in productivity.
- TQM involves all the individuals for quality management issues whether they are not involving in the development team.

Proposed Model:

The proposed model is a methodology which removes all the pitfalls of existing standard models and solves every kind of process related problems responsible for reduction in the quality and thus gives the assurance of quality product with in time and less effort.

Steps of this model:

1. Define current development process
2. Define problems in process
3. Assessment team formation
4. Assessment & recommendation
5. Plan to solve the problems
6. Inspection of plan
7. Implementation of plan
8. Inspection of product after implementation of plan
9. Approval of quality
10. Configuration management
11. Documentation

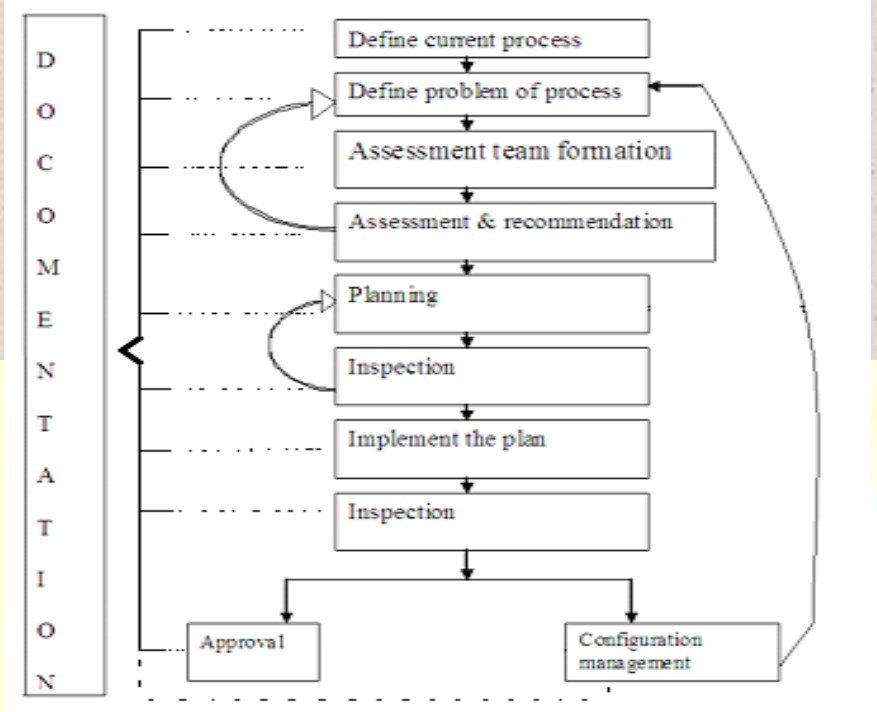

Fig 1. Proposed model

Working of Proposed model:

The work presented in the paper provides a maturity model. This model is an iterative model. The main objective of this model is to do software process improvement by stepwise.

First understand the current process which process is used for product development. Then identify the problems associated with that process which are the causes of unsuccessful project. Unsuccessful project means either they have no good quality or they have no completion with in time and budget. First clear the problem then next step is make an assessment team for improvement according to the size of project. Then this team is assessing its feasibility whether it have such individuals who can improve the process. If no then we take a back step to problem definition to find the reason why this team is not feasible to improve. If yes then this team is recommended by the higher authorities and next stage comes. Team starts the work on the process improvement. They make planning for process improvement at which area improvements are needed or changes are required. When they make a plan then their plan is viewed by the senior management. Then they give a presentation to the senior authorities and

convince them for the improvement. If plan doesn't seems to achieve goal then again planning is asked to make. If plan seems ok then next stage comes. This plan is given to development team and implemented as suggested.

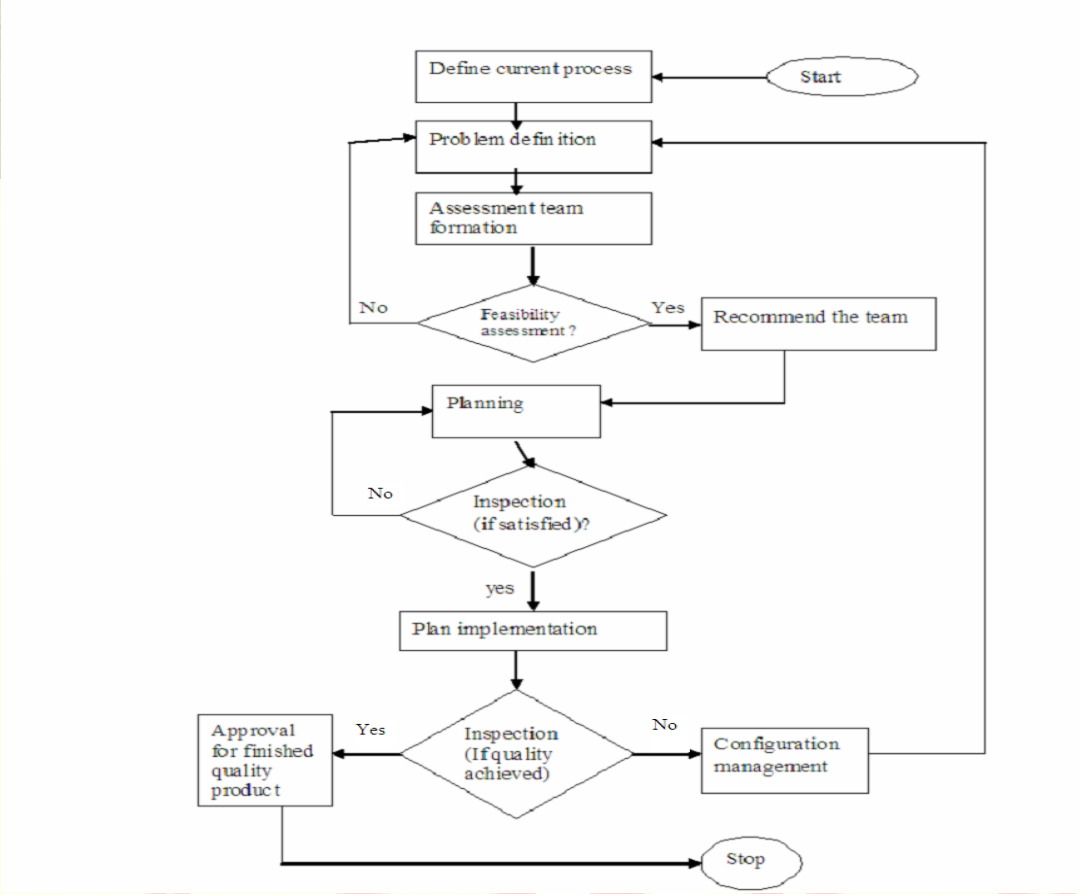

Fig2. Flow chart

After implementing the plan next phase come inspection. It is a formal meeting in which member of inspection team have taken interview of the assessment team. If they find the accurate results after plan implementation, then give the clean chit for quality. If still they find problems, then they call configuration management which identify where the changes are need and step goes back to problem definition where the changes made are defined again as new problem. And the whole cycle begins again and works until it give a better output rather then the normal process. In this model documentation is an umbrella activity. That is useful for reuse and further future work.

Implementation:

In this, we have to achieve a quality project using some development process and then its quality is assessed using existing maturity standard i.e. with CMM. We find that CMM disapprove the quality of project thus developed. Then, instead of putting all headaches to development team, we assess the problems with the proposed model. Fig1 shows the all steps of proposed model. After recognizing problem with existing process we make a plan to solve the problem and then implementation comes. The plan gives some changes in design and coding. So new design modules thus we obtain using above model is shown in figures 3 to 6.

The design of the application is shown in terms of class diagrams. The class diagram shows classes that make up the application in terms of the relevant methods that those classes expose and the variables that point to data.

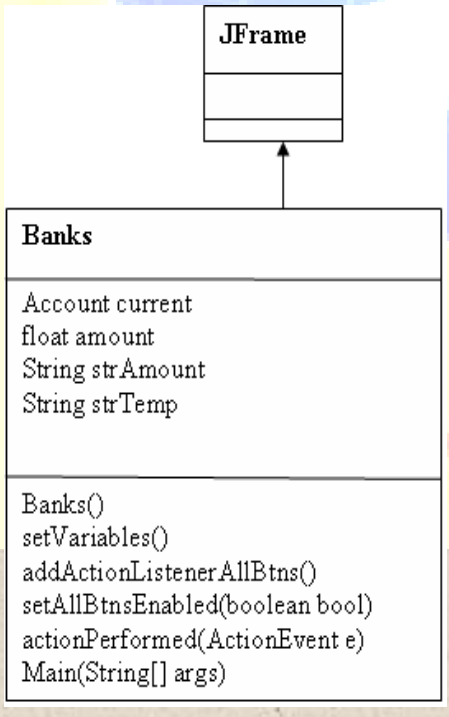

Fig3. Current account

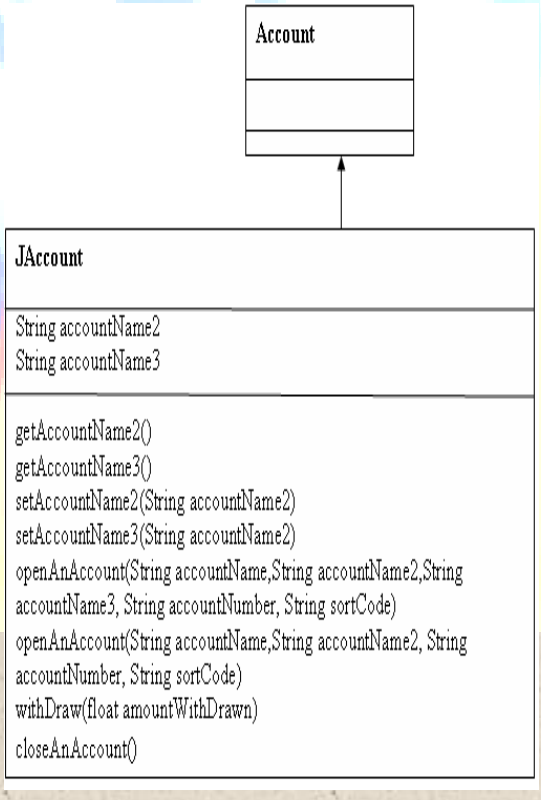

Fig4. Joint account

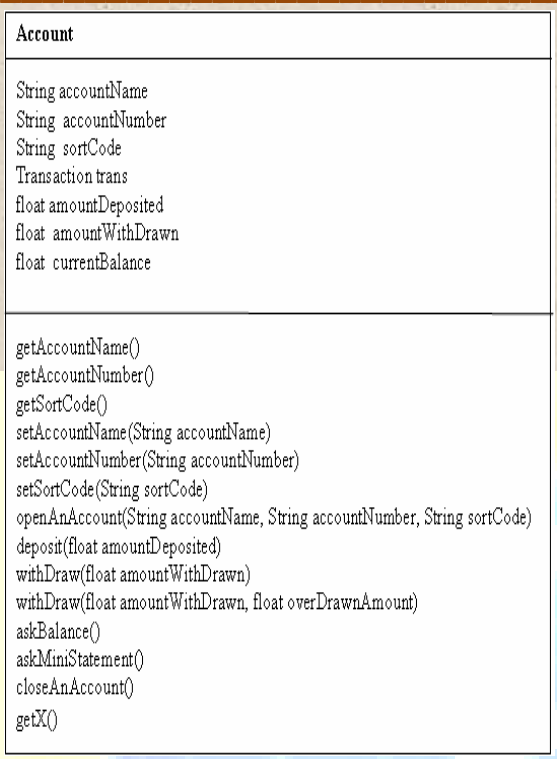

Fig5.Account info.

Fig6. Transaction

Results:

The above design modules given by new plan is now coded and we get our complete project. Some snapshots of project are as given below:

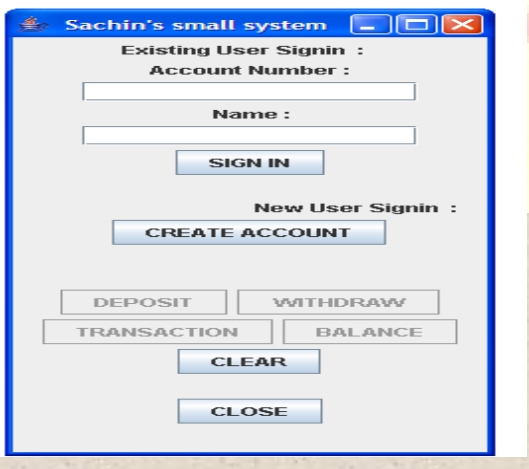

Fig7. Run time window

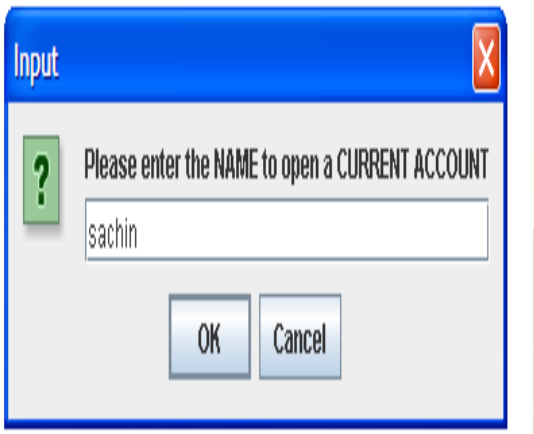

Fig8. Account holder's name

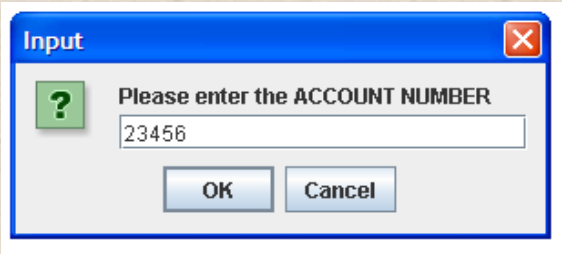

Fig9. Account holder's number

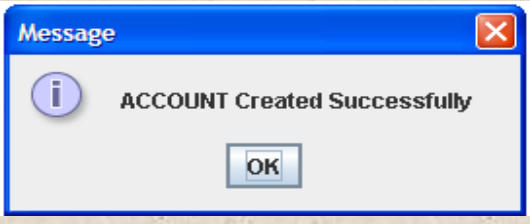

Fig10. Notification window

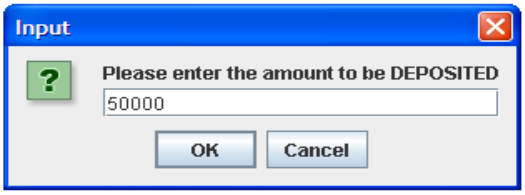

Fig11. Amount deposit

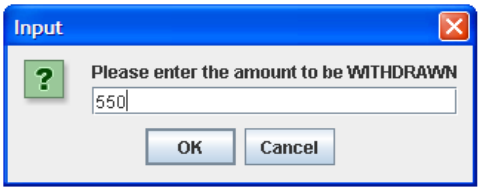

Fig12. Amount Withdraw

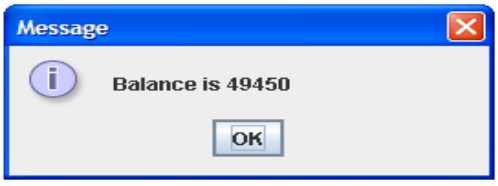

Fig13. Balance available

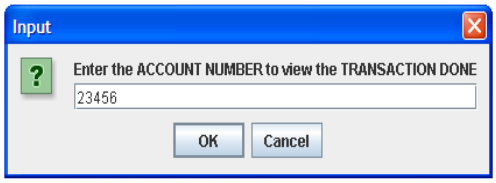

Fig14. Transaction view

Above are the screen shots of the program at run time.

Fig7: The screen appears at rum time and user has to press the "Create account" button to open an account.Fig8: The user has to enter the Account Holders Name. Fig9: The user has to enter the Account Number. Fig10: The screen shows the notification that account is created. Fig11. The screen shows the space to enter amount to deposit. Fig12. The screen shows the space to enter amount to withdraw. Fig13. The appearing screen shows available balance in account. Fig14. This window allows checking the transactions performed in account.

Major achievements:

The result thus we obtained using new methodology shows the quality of product in terms of user satisfaction, time, etc. Some major achievements can be shown by comparing existing models with this new one as:

S.N.	Existing models	Proposed model
1.	CMM does not specify the implementation.	In this model, implementation is defined and a proper document is prepared for every process.
2.	CMM works on software.	This model works on software and organization.
3.	CMM is a goal. Being used just as stamp of approval.	This model is a method.
4.	CMM work is only a repeating task.	But its work is not only repeating task but also whole. If problem is still there, then this model works due to a cyclic nature.
5.	Ideal model is also a continuous model. But it is a full method such that there is no recovery. Means either it is success or fail.	Proposed model is a cyclic model. So if any problem face then it will work until improvement has not completed.
6.	SIX SIGMA is iterative methodology reduced the defect one by one.	Proposed model is a cyclic and iterative model that improves the process one by one step. After completion of last step if further improvement is needed the cycle start again.
7.	Six Sigma focuses on prioritizing and solving specific problems which are selected based on the strategic priorities of the company and the problems which are causing the most defects.	Proposed model does not focus on prioritizing and solving problems. It solves all types of problems.

Future Scope:

This proposed model in the future can be implemented after finding out the Key Process Areas, then creating the templates and forms, after conducting exhaustive survey. Success of this model

depends on the depth of the survey. The key process areas and capability area of this model can also be defined and extended in future.

The proposed model reduces the risk as much as possible but it has also some limitations. It takes so much time in presentation and conduct the meeting. In the further work a lot of work can be done to remove the timing problem of this model.

Conclusion:

The Model proposed in this paper improves the process dynamically and simultaneously the proposed model is iterative also. This model does the process improvement in a stepwise way to covers the user requirements, software quality assurance, and organization point of view. Many of the factors can be identifying in the organization by using this model (like management commitment and teamwork were strengthened). This model covers some limitations of existing model (CMM, SIX SIGMA, and IDEAL). For example, the main limitation of CMM is that it describes "what to do" but does not prescribe "how to do". The proposed model describes the implementation and prescribes how to do.

This model does not necessary to work for the repeatable task. When the new problems come it will work for that also. It is a flexible model. If there is a change in the process, it covers all the aspect of the changing of process as being cyclic model.

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