Design Software Configuration Management Support System

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Abstract

In the era of Information Technology, there are tremendous needs for software and hardware to be utilized by private and public organizations. Software development is increasing but the success of development process can not be guaranteed. Each process of software development plays key roles in software quality. In this study, the software development supporting system named Software Configuration Management Support System (SCMSS) is proposed. The design of SCMSS is based on the best practice of CMM (Capability Maturity Model) and CPM (Critical Path Method). SCMSS provides facilities for software developers in order to best perform, follow the objective of developing the software and fulfill user requirements.

Key Words: CMM, SCM, CPM, Software Development

1. Introduction

The evaluation in technology nowadays is playing the important role in working system [9] and so famous that the software industries become more popular and affect to earn a lot of income in many countries.

Software industry is the growing industry which develops software and services to serve the needed of business and government enterprises in Information Technology. It appears that today, there are barrier in software development. For example, Reel reported that 26% of all software projects fail, and another 46% encounter cost and schedule overruns or significantly decreased functionality [7], and Charette [8] explains that many project with unrealistic and overly optimistic schedules and describes estimation as much of an art as it is a science. Thus, there are needed to control the quality and efficiency of software development to reach the customer satisfactions and meet all requirements.

The CMM (The Capability Maturity Model) standard is the standard that assessed, acceptably, and famous in international level [2] proposed by Carnegie Melon University. This standard is grantee the quality of the software development process in each software developer company by combining the advantages of the TQM (Total Quality Management) standard especially for developing software. So, it is a good pattern for measuring the quality of software developing process.

In the program development, there always be modification of processes which directed by the changing of the customer requirements and the company itself and also can not avoid [1]. The development of software in SCM (Software Configuration Management) process is an agreement to manage and control the changing of evaluation of the software department.

SCM process is the one of CMM process in the second level. It's provided as a beginning part of project development to accommodate the company. The company will use the policy to manage the software structure to assign the working process to develop software. Since most of software development has similar process, so it is necessary to control the developed software.

The objective of this study is to propose the prototype for designing the software development supporting system named Software Configuration Management Support System (SCMSS). The system functionalities are based on SCM process in CMM level 2 and Critical Path Method (CPM).

2. CMM standard with software development

Standard CMM is a model of ability status or a model of the measurement of ability to work which named as SW-CMM (The Capability Maturity Model for Software). This was established by SEI (Software Engineering Institute), USA. [2] At the beginning, it was developed for the US State of Ministry for being

a standard which set for measuring the quality and granting the process of developing the software. They bring the advantages of the TQM (Total Quality Management) standard to use specifically with the software development.

CMM standard has set the famous standard about software aiming the companies who are a software developer can use it as the course to improve the software processing [3]. CMM standard is classifying the ability to develop software of company in to five levels as follow.

Level 1: Initial Level, is the basic level which is a one way developing. That is the level which the software developer require only the ability of the personnel. Its character is informal. Moreover, it's not good command and not planed. So it cannot be assess the quality of produce which good or not. Beside, almost of developed software is aim to be finished with out doing any improvement. Since the company is in level which not stable enough to develop software itself.

Level 2: Repeatable Level, is the basic management process. The company in this level is started to bring the policy of the software management and assign the process of policy to use in the office. The management of new project is experiencing from the similar project. The ability of process is run as the process of the basic management, cautious planed, controlling document set, training, assess, be verified, and can be improved. The software developer company who reach this level will be able to develop software in each project to be success as the well done former project.

Level 3: Defined Level, is the level which clearly set. This level is the improved form the Repeatable Level. The software developer companies needed to be assign the properly method for providing document and the standard of working process in both project management and software development. The organization has to use the same standard, that is the organization who are the developer will have their own methods and standard themselves.

Level 4: Managed Level, is the level which improved from Defined Level. The characteristic of the level 4 company is combined the information of working process in statistics record form, so that the company can analyses the data, measure the process, and make a good prediction on the trend of the qualitative software. Furthermore, the company can control the software processing in case they face the hard project.

Level 5: Optimizing Level is the most proper developed level. This level emphasizes the development of process at all the time. So it is on going develop every step of the processing. Moreover company use the process improvement continues

policy to prevent any mistake that will lead to the high improvement. In addition, the software developer is enabled to assimilate to the changing of sort of technology [2].

3. Software Configuration Management

SCM is one of the main processes of CMM in level 2 which is the main gold to use in the world.

SCM is a formation and upkeep the correctness of wrote products in software project, that running along the time of developing software process. SCM is a working part of system which collects both document part and source code of the developed program, if there any changing in process. SCM can systemically control.

The function of SCM needed to be assigned version of software and documents by the source code must be the latest version. The alignment of company's documents which named as library system and source code needed to be same standard.

SCM is about the software development system which shows the period of working, control the process changing, upkeep the work structure to continue working all the period of developing the software. The software output is under the process of SCM system.

The goal of SCM

The first goal, SCM must be the chart of software processing. Likewise, the alignment activity needed to be planed.

The second goal, the adoption of any output in software project needed to be defined, controlled and able to use.

The third goal is the changing of output in software project

The forth goal, person or user who affected the disorder of process is being able to know the status and information of processing.[6]

4. Critical Path Method

Critical Path Method (CPM) is the technique used to manage the project. It was invented in year 1957 by Du Pont Co.Ltd and Remaining Rand Co.Ltd. for forming the most effective way to manage project. The overall image of the project management is to write the activities of project in form of relation network and calculate the time in both beginning and the end of activities to get the project done [4].

For this system, the CPM technique is used to calculate the longest way of working in the project. So that, the company can use the output of the technique to check status of the project in the system. Then, the project administrator will adjudicate the output of project process and improve the

performances of the activities which assigned in the project.

CPM processing
There are four steps in CPM processing [4].
1. Writing the relation network of all activities in the project. This model show all activities which are conducted in the project, so that we can see the characteristics of data coherence.

2. Calculate the period of processing in one activity. This is includes Earliest Start (ES), Earliest Finish (EF), Latest Start (LS) and Latest Finish (LF).

3. Find the critical job, this is means to start at the most important job and done immediately as assigned, if the job is grinded on, the project period will be delayed.

4. Find the critical Path, this is means about the job in network which can not postpone since it will affect to the period of ending of project.

The example of using CPM in managing the project
The software developer wants to make a bidding for software development project. The project is aimed to finish in one month. The company needs this job but it is uncertainty that it has ability to do the assigned job. So he uses the project management technique to help this out. They start with study the specification and the period they need for this job including the data of activity and time of processes as in table1. The process is divided into 9 activities (Activity A-I). Each activity has already been assessed the period of processing, and we can use the detail of activity to write the relation network which shows the step of activity that the program follow the first step of CPM technique as picture, Figure1.

Table1. Activity process's detail

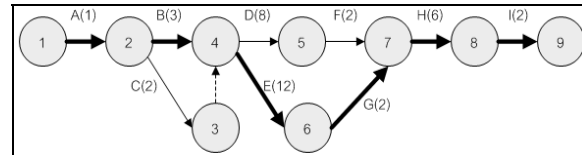| Activity	Predecessors	Duration: Days
A = receive system's requirement	-	1
B = process flow's planning	A	3
C = design process flow	A	2
D = develop front end	B,C	8
E = develop back end	B,C	12
F = check front end's quality	D	2
G = check back end's quality	E	2
H = overall checking	F,G	6
I = setup	H	2

Figure1. Shows activity's relation network

From Figure 1, it shows the relation network of activities which writing the relation by using circle as the starting and ending of the activities. The length of arrow is not related with the time used in activities. The letters is replacing the code of activities and number is replacing the period of activities. The dashed line is a connection which shows the relative between activities (supposed activity)

From the relation network, it can be explained that activity A is the first activity and Activity B, C can be done after Activity A is finished. Step 2 of CPM is the calculation of time which used in each activity as the data network shown in Table2.

Table2. Activity's calculation of time

Node	ES	EF	LS	LF	Critical Activity
A	0	1	0	1	A
B	1	4	1	4	B
C	1	3	2	4	-
D	4	12	8	16	-
E	4	16	4	16	E
F	12	14	16	18	-
G	16	18	16	18	G
H	18	24	18	24	H
I	24	26	24	26	I

From the table 2, we can see that activity A can earliest start, so it be 0 moreover activity A need 1 day to done, thus the activity will earliest finish on the first day. Then, Activities B and C will start after activity a done then Activity B can earliest start at the first day. Activity B needs 3 days and Activity C needs 2 days. The activities earliest finish on the forth day and third day in order.

For activity D will start when Activity B, C finished. So activity D earliest starts on forth day and need 8 days to be done. The earliest finish of activity D will be on 12th day. Next, calculate the earliest start and the earliest finish in order for each activity, then we'll record the data as shown in table.

Next, calculate the latest finish and latest start which not affect to the entry project time by starting at the last activity to the first one. For example, the

earliest finish is 26 days, so the latest finish should be 26 days. Activity I spend 2 days working, so Activity I should start on 24th day. Then Activity H should be finish on 24th day. Activity H spends 6 day, so Activity H should start at 18th day. Next Activity F and G should finish on day 18th. Activity F and G spend 2 day in working, so the latest start should be on 10th. Then we continue calculation until getting the latest finish and the latest start which do not affect the entry project periods of every activity.

Finally, we got the result as shown on table 1 of CPM activity

The table of CPM process enables us to know the earliest start will be equal to latest start, which do not affect the entry project time. Moreover, the earliest finish will be equal to latest finish which not affect the entry project time. So, the critical part will be activities A B E G H I in order, and take 26 days for the project. Finally, company can make a bid for the job since they can spend the time under 1 month as it assigned.
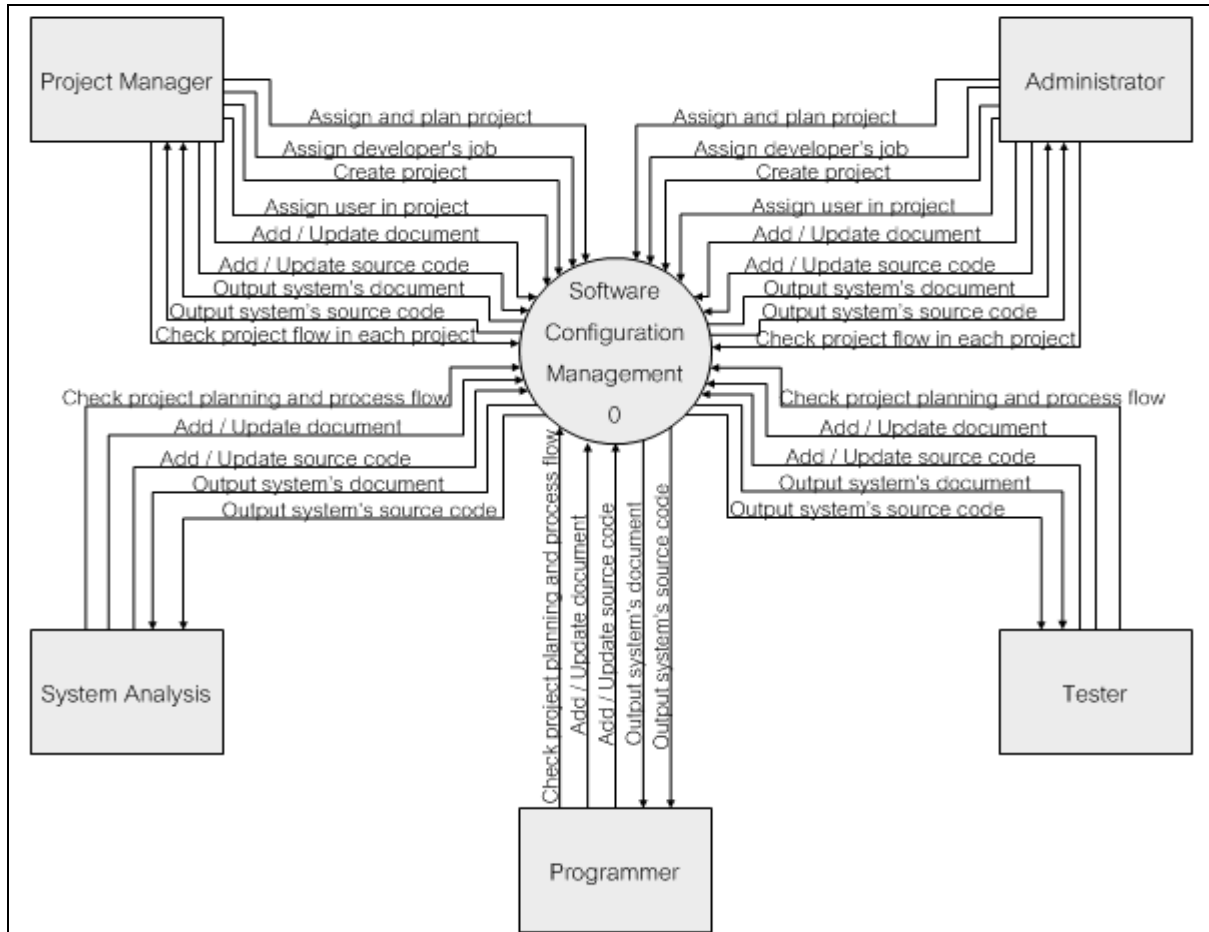

Figure 2. Context Diagram

5. Methodology

System analysis and design focus on supporting the software development project. The project development team includes project manager and staff. Since there are many staff in the project, there should be a system to facilitate the development process. In this study SCMSS is proposed, SCMSS will provide the stock services, user requirement documents, and provide the other document such as system planer. This is for supporting the communication between project manager and staff.

Moreover, it offers the source code which provides for searching facilities. The period of working in each activity can be controlled. So that, project manager can plan and assign the tasks to be done or manage the period of working in each activity.

The SCMSS was established for managing the software development follow the principles of CMM. For the software development part aims to arouse the developer companies to bring about the system to use in controlling the making and developing software. The system is not only being as a department-specific

system, but also the follow up system which follow the step of developing software to be the best effective. Context Diagram of system on picture 2

The SCMSS is based on the SCM policy and management techniques. Further, the technique CPM will be use for tracking the process of software development in the system and using for calculating the longest working period.

SCMSS has been divided into three parts by using three tires architecture to support the system structure, as shown in figure 3. This working part includes:

1). Client Terminal, is a section which user working through browser in his computer to run the system.

2). Web Server, is a part of program providing for user to run the system

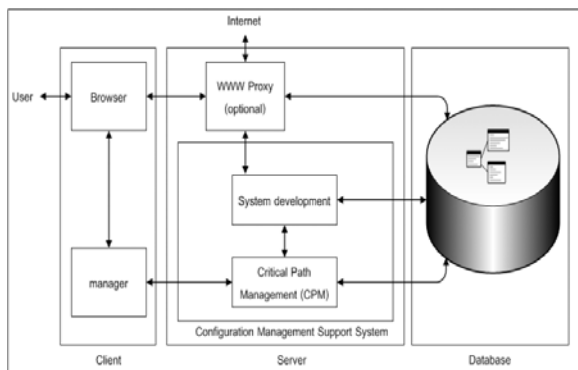3). Database Server, is a part of document of working process of user in database.

Figure 3. Architecture of SCMSS

User Level

There are five user levels in system which is designed for internal network working.

1. Project Manager (PM): PM manages the project and develops system to be effectively and completely.

2. System Analysis (SA): SA designs the workflow of each project based on the customer requirements in each project. Also, being a leader who controls the workflow as its assign.

3. Programmer (PG): PG works as a system developer, controls the workflow follow the line of SA. PG is the important person who forces the project to reach its success.

4. Tester (TE): TE is the person who tests the system of each developed project whether it's correct as it should be or not.

5. Administrator (AD): AD is the system controller who can work on every part of system.

Ability to work of each user in system will be in line with the position in project.

The steps of developing the project need the document data. The document in the system including

1. Customer requirement document, is a document provided for customer to fill up their requirements.

2. The project policy document, is the document used for deciding the policy of each project. It has been used as the main policy for controlling the effective of work.

3. Customer Appointment, is the document which PM uses for contacting with customer.

4. The follow up document, used for following the result of developing system.

5. Project Planer Document, is the document which used for deciding the project workflow.

6. Minor department, is a document which shows the data of minor working system.

7. Project deliver document, is provided for deliver work to customer.

8. Agenda, is the list of project matters to be discussed.

9. Project tester document, is document used for test run the system of the project.

10. General Document, is a document that defines a specification of user in system.

Different types of user are allowed to access the system differently as show in table 3. The right of users include the right to produce the project document, the right to read the documents, the right to edit the documents, and the right to delete the project document.

Table 3. Permission of user to access project documents

Document type	User in system																			
	PM				SA				PG				TE				AD			
	C	R	U	D	C	R	U	D	C	R	U	D	C	R	U	D	C	R	U	D
1. Customer requirement document	Y	Y	Y	Y	Y	Y	-	-	-	Y	-	-	-	Y	-	-	Y	Y	Y	Y
2. The project policy document	Y	Y	Y	Y	Y	Y	-	-	-	Y	-	-	-	Y	-	-	Y	Y	Y	Y
3. Customer Appointment	Y	Y	Y	Y	-	Y	-	-	-	Y	-	-	-	Y	-	-	Y	Y	Y	Y
4. The follow up document	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5. Project Planer Document	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	-	-	-	Y	-	-	Y	Y	Y	Y
6. Minor department	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7. Project deliver document	Y	Y	Y	Y	-	Y	-	-	-	Y	-	-	-	Y	-	-	Y	Y	Y	Y
8. Agenda	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	-	-	-	Y	-	-	Y	Y	Y	Y
9. Project tester document	Y	Y	Y	Y	Y	Y	-	-	-	Y	-	-	Y	Y	Y	-	Y	Y	Y	Y
10. General Document	Y	Y	Y	Y	Y	Y	Y	-	Y	Y	Y	-	Y	Y	Y	-	Y	Y	Y	Y

PM = Project Manager, SA = System Analysis, PG = Programmer, TE = Tester, AD = Administrator,

C = Create document, R = Read document, U = Update document, D = Delete document, Y = Yes and " - " = No

The workflow of system follows the structure of the main fourteen processes including (figure 4)

1). Assign the personnel in system
2). Assign the project
3). Assign the personnel in project
4). Assign and plan project
5). Document control
6). Testing Plan

7). Version Controller
8). Data access checking
9). Project document input
10). Project code input
11). Project document input
12). Project code output
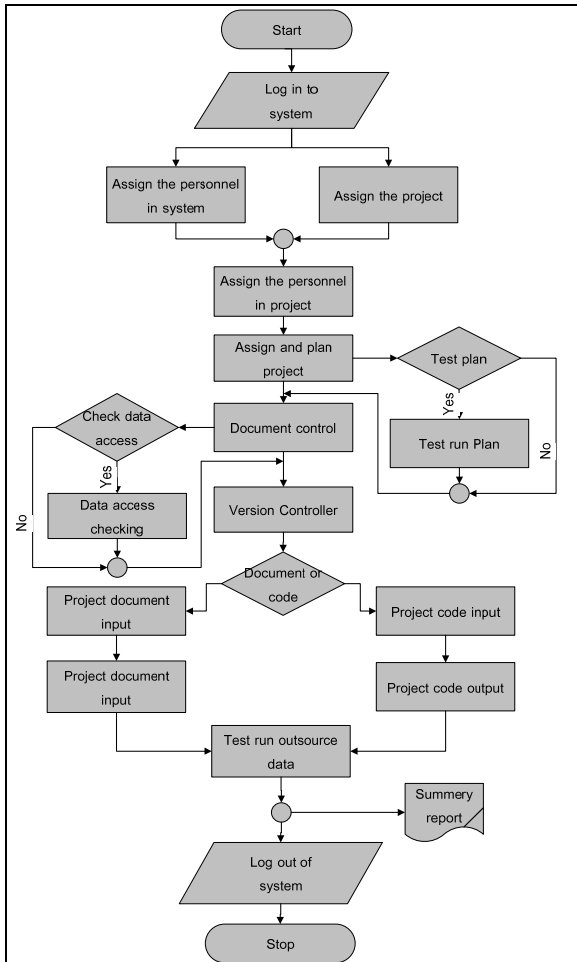13). Testing outsource data
14). Summary report

Figure 4. Logical flow of the system.

6. Conclusion

This document aims to propose the idea of developing the software support system (SCMSS) by using SCM theory which is a part of standard CMM process to adapt with CPM technique. Further, it is used for building the center storage to back up the software data, keep source code and documents for software development plan, and follow up the effect of developing software. It can be useful for developing system more effectively and efficiently.

Moreover, the companies can develop the software to reach their successes with the same standard of SCM. SCMSS will also be used as a prototype for the company or organization willing to develop their own support system for SCM in the future. Software development might bring SCMSS to use in their companies to gain the successful of developing the software.

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