A Review of various Software Project Scheduling techniques

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Abstract- Software project scheduling is one of the most important scheduling areas faced by software project management team. For a successful project, both software engineering and software management are very necessary. To complete the software project within a specified time limit, allocate a start and end date that determine the milestones and outcomes of the tasks, determine which tasks are depend on another task to complete its operation, save time, build consistency, enhance visibility scheduling is very essential. There are several software project management resources and schedule estimation methods have been developed. In this paper, we will make a review of some of these software project scheduling techniques which are used recently and are helpful in handling the various type of scheduling used in software projects.

Key Words: Project Scheduling, Multi-agent method, Genetic Algorithm, Planning, Controlling.

1. INTRODUCTION

Software project management is "The process of planning, staffing, monitoring, organizing, controlling and leading a software project". Software project managers are responsible for planning and scheduling of software project development. Software project manager leads the development team and is the interface with initiator, suppliers and senior management. The software project manager's job is to ensure that the software project its constraints and delivers software in time. Software project management is a method of organizing all activities related to a project and its parts. According to project management institute, It consists of five stages: Proposal writing, project planning, project scheduling, project tracking, personal selection and evaluation and project report writing .Project management can be applied to all types of project but it is widely used to control the complex processes of software developments projects. It is an application of knowledge, skills and techniques to execute projects effectively and efficiently. We need software project management because professional software engineering is always subject to organizational budget and schedule constraints. The following are the major activities in software project management.
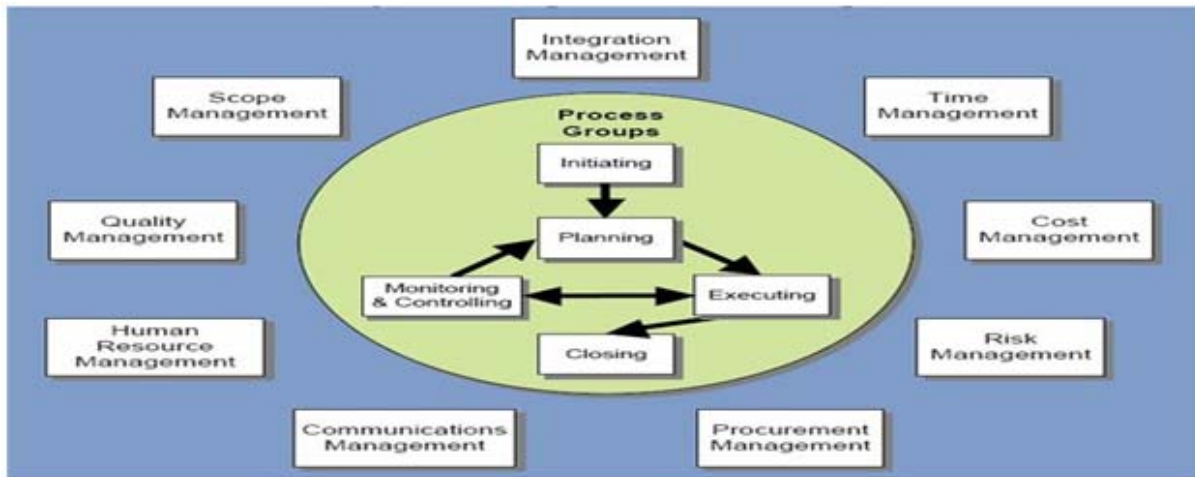
Figure 1. Software Project Management Activities.

software project scheduling is one of the most demanding tasks for software managers. It is an activity that distributes estimated effort across the planned project duration by allocating the effort to specific engineering tasks. In other words, Project scheduling involves separating the total work involved in a project into separating activities and judging the time required to complete these activities. Managers must also estimate the resources needed to complete each task. Software project scheduling consists of many benefits like: Uncover problems, save time, build consistency, enhance visibility, fix problem etc. The project scheduling is usually represented as a set of charts showing the work breakdown structure, activities dependencies and staff allocation. There are many software project scheduling techniques which are given below:

- Work Breakdown Structure
- Activity Charts
- Project Evaluation Review Technique (PERT)
- Gantt Chart
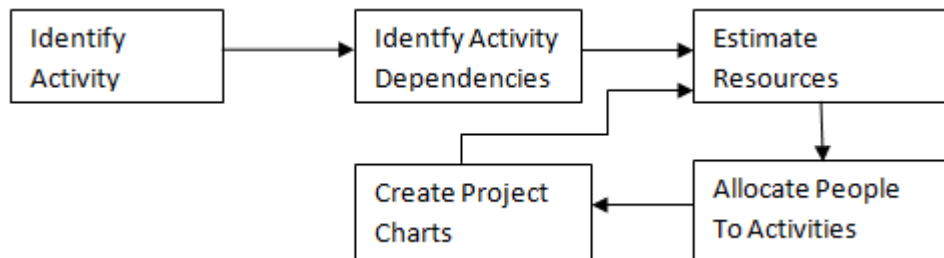- Critical Path method (CPM)

Figure 2. Project Scheduling Process

1. Identify Activity:-   Identifying the specific activities that must be performed to produce the various project deliverables.
2. Identify Activity Dependencies:- Identifying and documenting interactivity dependencies .
3. Allocate Resources:- Resources are allocated and   estimating the number of work periods which will be needed to complete individual activities.
4. Create Project Charts: Project activity charts are created to analyzing activity sequences, activity durations, and resource requirements to create the project schedule.
5. Allocate People To Activities:- According to different activities people are allocated to that activities.

II.LITERATURE REVIEW

A. "A Survey of project management tools, techniques and methodologies used in Mauritius: The current status Barnard (2004)"-A Eloff, M.M. and Van der poll, J.A [1]- Growing countries are often faced many problems such as lack of skilled staff, weak political institutions, difficult social and economic conditions that have a great impact on development in various discipline. This paper analysis the situation of software project management Mauritius. For statistical analysis data sets was collected using two questionnaires. One is used to collect the information from development organization and another one targeting users of computer software. For assessment the use of project management tools and techniques considered as important. Client questionnaire analyzed the user satisfaction criteria. Based on the results of the surveys, it was discovered that there are many

improvements related to software project management in Mauritius. The developed methodologies of western countries may not be suitable for growing countries.

B. "Project Scheduling: Imposed Approach to Incorporate Uncertainty using Bayesian Networks (2007)"-Vahid Khodakarami, Norman Fenton, Martin Neil [2]- Project scheduling involves uncertainty the basic inputs are affected by many sources of uncertainty. There is a random relationship between project parameters and uncertainty sources. This paper presents Bayesian Network modeling approach, which intercommunicate both casuality and uncertainty in project scheduling. Bayesian networks approach has been broadly used as decision-support applications. The model presented the Critical Path Method (CPM) to handle uncertainty and also provides analysis to manage and represent many sources of uncertainty in project planning.

C. "Time-line based model for software project scheduling with genetic algorithms (2008)"-Carl K.Chang, Hsin-Yi Jiang, Yu Di, Dan Zhu, Yujia Ge [3]- Effective management of large software projects based on the ability to solve complex problems. Most studies on software project management do not pay attention to critical problems like employee-to-task assignment which require an optimal schedules and proper use of resources. Commercial tools, like Microsoft project consider that managers are responsible for assigning tasks to employees to achieve the efficiency of resource utilization. This paper extends that work, introducing new model that is capable of simulating real world situations. The new model is described along with GA to produce optimal or near optimal schedule. The simulation results of this model enhance the ability of GA based approaches, while providing decision support under some conditions.

D. "Multi-Agent Real Time Scheduling System for Taxi Companies (2009)"-Andrey Glaschenko, Anton Ivaschenko George Rzevski, Petr Skobelev [4]- This paper gives an overview regarding multi-agent scheduling solution for Taxi companies. It describes Multi-Agent approach to real-time scheduling, outlines the system architecture and provides performance metrics .It also discussed the key design decisions. Re-Schedule Taxi service before confirming order acceptance to the client and the system ability to update schedules in intervals between two events is one of the most important achievements. In this paper the Multi-Agent approach is applicable to optimization and Real-Time scheduling of a broad business and social system.

E. "Application of Project Scheduling in Agriculture (Case study: Grape Garden Stabilization)(2009)"-S.M.Fahimifard, A.A.Kehkha [5]-Some activities of project are critical that delay in their commencement and overall project completion time. Scheduling and management of project is inexorable. In this paper, project scheduling in agriculture field for stabilizing 300 hectares grape garden. In agriculture center of Zabol , is accomplish by PERT (Program Evaluation Review Technique) and CPM (Critical Path Method)scheduling techniques. The results of this study prove that by using PERT method the minimum completion time of this project is 390 day and 364.67 day. The results attain by using CPM method the project completion time to 365 day.

F. "Complex Project Scheduling using Multi-Agent methods: A case study for research Projects (2010)"-Constanta, Ileana, Augustin [6]-The impact of economy dynamics on the project constraints, incrementing their complexity. The project could be examined as Complex Adaptive Systems (CAS) in that case. When projects are seen as CAS, the paper addresses the project scheduling optimization problem. There are two different approaches for project scheduling optimization. RCPSP (Resource-Constrained Project Scheduling, and TCPSP (Time-Constrained Project Scheduling). This paper is based on the TCSP with a Multi-Agent approach provides better optimization results than deterministic methods, so this approach is selected. The paper includes the comparison between two Multi-Agent methods Ant Colony Optimization (ACO) and Genetic Algorithm (GA).

G. "Operation research and Dynamics Project Scheduling: When research meets Practice (2012)"-Mario Vanhoucke [7]-An overview of recent developments in the dynamic project scheduling literature is given in this study. Project risk analysis and Resource-Constrained Project Scheduling have been broadly investigated in the academic literature. The academic results in a novel software tool will be explained from a dynamic scheduling point of view. The software tool makes use state-of -the –art algorithms for both academic, commercial purposes. The implemented algorithms are focused on state-of-the-art research result and will be straightly improved by new research results. The tool will also be used as a research engine to stimulate future researchers to develop algorithms for project scheduling. Focused on the knowledge fetched from different research projects explained in this paper

COMPARISON TABLE 1.

Sr. No	Paper Name	Techniques Used	Advantages	Disadvantages	Results/Conclusion
1.	A survey of project management tools, techniques and methodologies used on Mauritius: The current status barnard.	Questionnaire method.	1. Practical. 2. Large amount of information can be collected. 3. Carried out by researcher with limited affects to its validity and reliability.	1. No way to tell how truthful a respond's being. 2. No way of telling how much thoughts a respondent has put.	Need to encourage the the emergence of project management methodologies of a certain indigenous nature, which can cope with the actual status countries and stand a better chance of survival.
2.	Project scheduling imposed approach to incorporate uncertainly using Bayesian Network	Bayesian network approach	1. Handle incomplete data set. 2. Use a variety of input data. 3. Visual decision support tool. 4. Can handle missing observation.	1. Difficult reaching agreement on the BN structure with experts. 2.No feedback loops. 3. Continuous data representation. 4. Spatical and temporal dynamics.	Bayesian network model can be generated from a project's CPM network. Part of this process is automatic and part involves identifying specific risks and resource indicators.
3.	Time-Line based model for software project scheduling with genetic algorithm	Genetic Algorithm	1. It can solve optimization problem. 2. Solve problem with multiple solutions. 3. Solve the solution structure and solution problem. 4. Easy to understand	1. Certain optimization problems can not be solved. 2. No absolute assurance that a genetic algorithm will find a global optimum.	Genetic algorithm to find optimal and near –optimal solutions compared to the efforts by project management experts, using GA appeard to be a viable tool to help guide project managers in their daily routine.
4.	Multi-Agent real time scheduling system for taxi companies	Muti-Agent approach	1. Distributes computational resources and capabilities across a network. 2. Allow for the interconnection and interoperation of multiple existing legacy system 3. An MAS efficiency retrieves, filters and globally coordinates information from sources that are spatially distributed.	1. The architecture depends on all layers and is not fault tolerant.	Improvement of service levels for the customers urgent order average response time is now 9 minutes, high priority orders the response time greater than 5-7 minutes
5.	Application of project scheduling in agriculture case study:Grape garden	PERT, CPM	PERT- 1. Large project planning. 2. Visibal critical path.	PERT- 1.Compalicated tasks. 2. Prediction inaccuracies.	Minimum completion time of the project based on PERT was 390 days and 364.67 days and the result of

	stabilization		CPM- 1 .Make dependencies visibal. 2. Organize large and complex project. 3. Increase visibility of impact of schedule revision 4. Enable the project manager to optimize efficiency.	CPM- 1. Difficult in predicting activity ending times. 2. For a large and complex projects, there will be thousand of activities and dependencies relationships.	the CPM method showed that the cost of reducing the project completion time is 365 days.
6.	Complex project scheduling using Multi-Agent methods:A case study of research project.	Multi-Agent method and ACO	1. Objectivity is brought to be case of patents. 2. Goals and objectives are defined and made mandatory.	1. Complexity of payment unclear regulations delayed payments.	TCSP problem would be to apply multi agent methods as Genetic algorithm and Ant Colony optimization. TCSP has acceptable and similar solution both GA and ACO approaches.
7.	Operation research and dynamics project scheduling: When research meets practice.	State-Of-The-Art Algorithm	1. Improve system capacity. 2. Efficient resource allocation.	1.Energy is wasted by flooding in route discovery	Overview of the academics endeavors is given that have lead to publications in the domain of project management and dynamic scheduling and their specific use and relevance during the development of a new commercial software tool.

III.CONCLUSION

Software Project Scheduling is one of the most important tasks for Software Project management team. Project scheduling refers to the planning and scheduling of the projects. Project scheduling consists of many activities. Some activities of the project are very critical that delay the overall project completion time. When team do not schedule the software completion time they leave the projects vulnerable to factors that cause major rework or project failure. But adopting any software project scheduling technique is the step every software project manager can take to more effectively manage software development initiatives of work have been done and still continue in different fields of software Project Scheduling to make it relevant. In this paper, a review of some of these software project scheduling techniques is done using various research papers in this field. In this paper, we compare various type of scheduling techniques which are used in software projects. This review of various techniques will be helpful for better study and inventing new ideas for even better scheduling techniques.

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