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Web Based Project Collaboration, Monitoring and Management System

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Abstract— **The software project is a highly people intensive effort that spans over period of time, with the fundamental implications on work and performance of many different teams. The success of a project is heavily relying on timely transfer of information among the parties involved such as project managers, team leaders, developers, designers and clients. In present scenario most of the software companies works on multiple projects simultaneously, therefore there need to be an efficient project management procedure in term of resource allocation and project planning. Web Based Project Collaboration, Monitoring and Management System provides a solution by automating project management functionalities which covers all the aspects of project management process including document management, resource management and team collaboration. The system addresses the functionalities such as assessment of actual progress, team collaboration, update feedback with email and short messages , server login manager, customer portfolio manager, invoices with online payment option and the important aspect is that it provides management reports, which will lead to effective decision making.**

Keywords—**Project Management**
Project Monitoring
Project Collaboration

I. INTRODUCTION

Project Management is the term increasingly used to refer to the process of planning, organizing, leading, monitoring and controlling project resources within an organization. Project Management has a much broader scope on effective utilization of resources as well as its progress monitoring to benefit both organization and the client.The complex project environments need appropriate project management standard to monitor requirements from stakeholders and monitor overall project progress. The lack of consistent project management procedures results in the duplication of efforts that ultimately affect the project goals as well as organization's goals as a whole. [1]

The definition of project management software varies widely and highly depends on the company, the team and project management practices. The challenge is to identify a software project management tool which matches to company project management policies and practices. Such a software solution will increase the success of a project, and this is what Project Management is all about, making projects and organizations successful.As a foundation for innovation, companies focuses more towardstoprovide easy access to information, create effective business process with customers and enhance team collaboration. In order to increase operational efficiency and productivity, most companies rely on information technology.[2]

Web Based Project Collaboration, Monitoring and Management System is also titled as WebPCMM and is a web based project management system which allows developers to share project status, collaborate with their supervisors and team members. The system facilitates project managers to monitor overall project progress. The WebPCMM system provides a dashboard interface to clients which allow project progress monitoring. The system also integrates customizable payment gateway module facilitating online payment option to project clients.

Ultimate objective of the project is automating existing system to provide reliable, user friendly project tracking system, which enable project managers, clients and developers to easily collaborate and track project status in an efficient and effective manner. Following are some of the main objectives for the system.

- Improve efficiency by automating and implementing Project Collaboration, Monitoring and Management System.
- Improve decision making capabilities of Project Manager and Team Leaders.
- Provide reliable and user friendly Project Collaboration, Monitoring and Management System.
- Provide a meaningful way of tracking project progress and individual task progress.
- Improve invoice management functionalities by facilitating online and offline payments with multiple payment options.

II. BACKGROUND

A project is collections of activities that have define beginning and end. The outcome of every project is a unique product, service or a result. There can be many uncertainties about the outcomes due to the unique nature

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of the projects. Thereby projects planning need to be done in care prior to beginning of the project.

The project management is an art of organizing the components and resources together and defining methods of achieving goals and objectives. The project management can be considered as a combination of planning, controlling, leading, motivating, decision making and communication among group of people and managing available resources to achieve specified goals or objectives. [3]

Project management in software projects, is a vital activity to be successful in any development project. Since entire software development life cycle is highly depended on project members, project team management plays major role in successful project completion. These days most of the software project teams are virtual; meaning that members are located in geographically separated locations. Hence project managers face more critical situations in team collaborations and therefore all information need to store in central location where it can be accessible from any location without any geographical barriers. As a reason most development firms are converting their traditional project management solutions to online management tools allowing project managers, team leaders and team members to gain access to project information, while providing them a virtual environment to collaborate, regardless of actual geographical location.

Use of internet has grown and spread during recent decades. Therefore most of the companies change over from their traditional systems to rapidly growing new software technologies. Software development firms, try to gain competitive advantage by providing quick responses to their clients. Therefore currently most companies go for online project management solutions allowing their clients to check project status more quickly than traditional systems.

Project management in software project development plays a major role in entire development hence project managers need highly automated, manageable system to provide their best to serve the company.

III. DEVELOPMENT METHODOLOGY

A. Requirement Analysis

Requirement analysis is the complete evaluation of end user requirement in order to identify system needs. The main objective of the requirement analysis is to identify end user business requirements and discover expectation of the new system. Fact gathering is most important part of the analysis phase. The whole project will become meaningless if the client's requirements are not gathered and defined accurately, since it will then not reflect what client actually wants from the system. Most projects fail because there is no clear understanding of the system requirements. To find out correct user requirements the analysis must choose appropriate fact gathering techniques based on problem domain. The benefits of proper requirement analysis includes improved user satisfaction, increased productivity of team, enhanced quality of work, reductions in user training costs.[4] The fact finding technique used can be outline as follows [5]

- *Observation:* One of the fact finding method used is observation of current system and get involved with system users. Since the author works for the client's company, it would be easy to gather requirements through observation.

- *Review Existing System Documents:* Learn from existing system documents and email system. Existing project documents and organizational team structure has been analyzed to identify reporting and communication path within the organization.

- *Meetings and Interviews:* Main strategy used for fact finding is interviewing, many different levels of users including project manager, team leader and developer, have been interviewed to identify user requirements and verify gathered requirements. Both formal and informal interviews have been carried out to find and verify requirements. Initial storyboards were design using Adobe Photoshop in order to identify user interface requirements and user dashboard design.

The main business functionalities identified during requirement gathering phase, can be drawn in a top level use case diagram. The project manager carries out most of the project management functions. The search function provides compressive search option for all projects, phases, tasks and support tickets. The main functionalities related to project manager role is shown in Fig.1.The team leader and team member handles functions related to authorizeprojectphasesand tickets assigned. The project client is capable of creating support tickets and pay invoices via payment gateway.

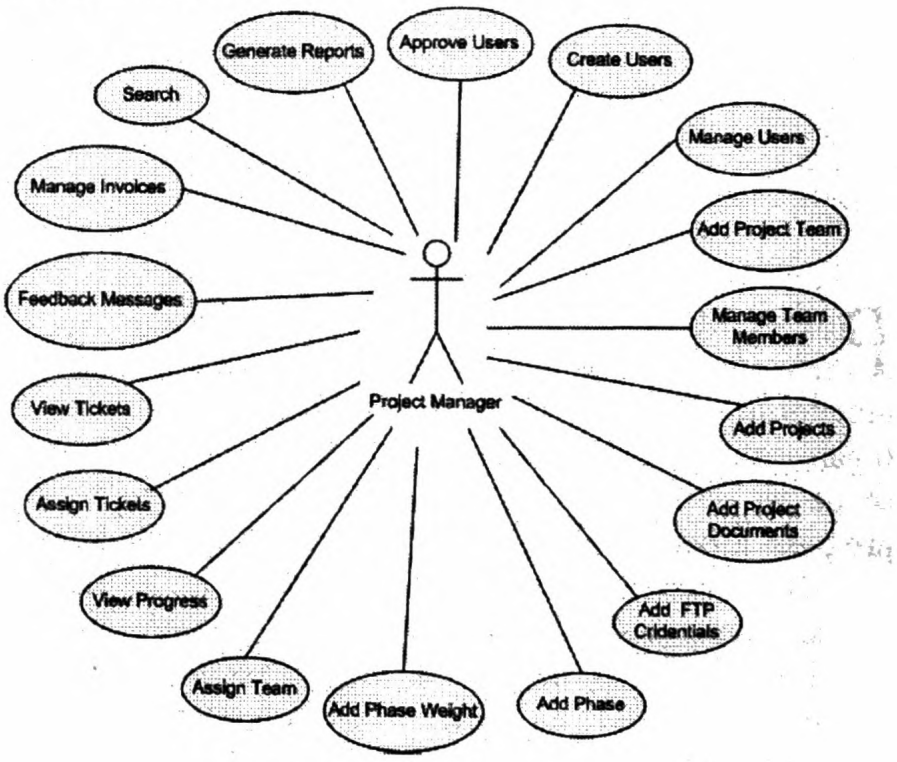

Fig.1-Project manager use cases

B. Design of the System

The users of the system had different viewpoints of the system at the inception of the project, which made evolutionary prototyping methodology is the best way to convince the user about functionalities of the system they get. This reason inclined the author to decide on using

evolutionary prototyping methodology when developing WebPCMM system based on requirements and time schedule.

At the early stage of the requirement gathering, the author had used throwaway prototyping in order to gather basic system requirements. Then system development moves towards the evolutionary prototyping methodology as is to act as a demonstration tool where the end user can observe the system interfaces and can express their ideas more effectively.Selection of Evolutionary Prototyping is beneficial in number of ways to reduce development time of the project. In addition, it helps to verify user requirements throughout the development as users can effectively provide feedback.

The system is developed gradually, each new prototype adding additional functionaries compared to previous prototype, until the system is evolved to be the final system.

Structured design methodologies are used to design the system initial context diagram was drawn for WebPCMM to identify overview of the system and environmental interaction of the system. Detaildesign of the system will be drawn based on context diagram by adding detailed data flows among various processors and data stores of the system.Fig.2 outlines overview of the system and environmental interaction of the system with data flows between sub systems and external environment. [6]

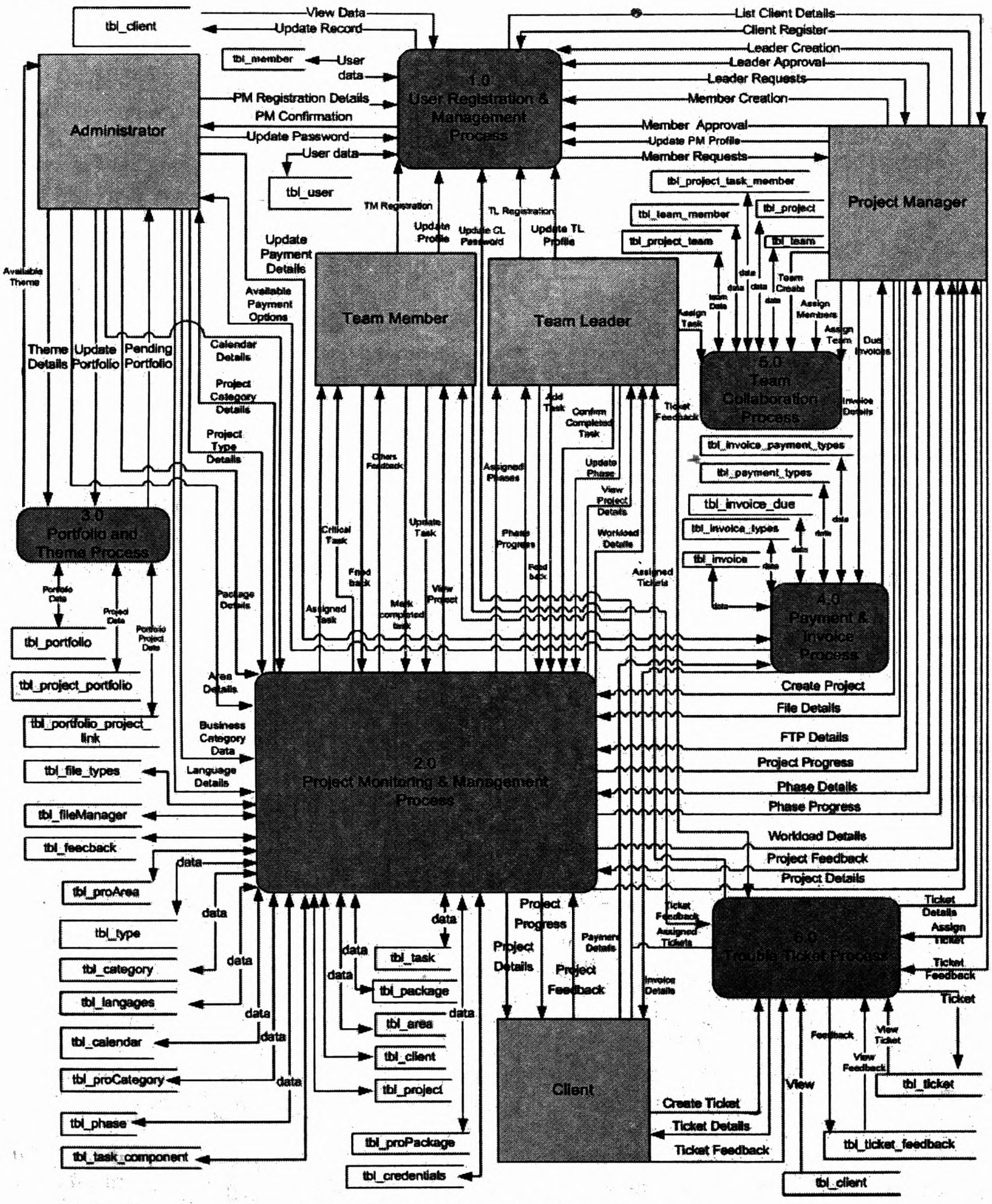

Fig.2 –Data in flow and out flow of the system

Entity relationship diagrams were used as a means of obtaining logical view of the system and used as a major data modeling tool [7]. This will help organize the data in the project into entities and define the relationship between the entities. This process has proved to enable the analyst to produce a good database structure so that the data can be stored and retrieved in the most efficient manner. Please refer Fig. 3 for Entity Relationship Diagram of the system

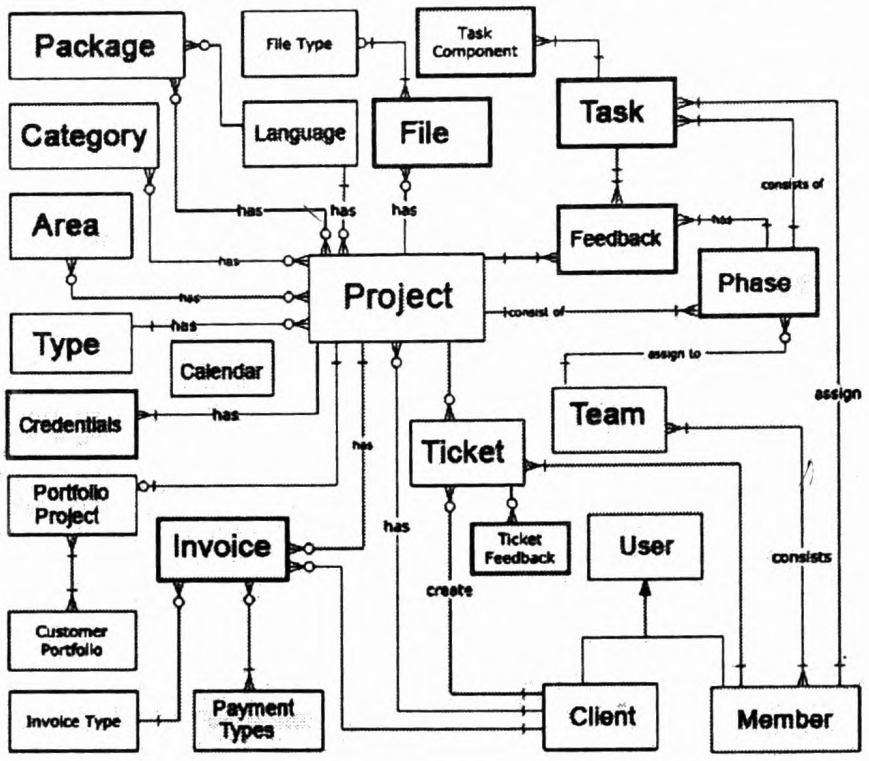

Fig.3 –Entity Relationship Diagram

IV. TESTING OF THE SYSTEM

The software testing is the process of evaluation of the program to verify that it satisfies its requirements and to detect errors. Software testing is the most vital phase in any software development project as the developer can identify and correct potential errors before the product is released to the customer. During and after implementation, the software being implemented must be tested to ensure that defined input test data will produce expected results. Therefore software testing was done in order to validate and verify software system, which ultimately used to assess quality of the system.[8]

The errors identified during testing were traced to the root and the necessary modifications were done to fix errors. The modified components have been re-tested to ensure the quality of the system. The testing phase was done according to the test plan and all test cases have been documented for future references.

A. Test Plan

Test plan give overall picture of the system testing process and has to be carefully planned in order to set out the standard for the entire testing process. The preparation of test plan was begun when the system requirements were formulated and it was developed in detail according to the design plan. Following are the main testing methods carried out: [8]

- *Black box testing:* Black Box testing approach assumes the software system without any understanding of the internal structure where it aims to test the WebPCMM against the system requirements. Since the system logic is not concerns in this approach it can be considered as a data driven testing method. System testing has been carried out with Black Box testing criteria.

- *White box testing:* White box testing can be considered as a logic driven testing method. It concerns about internal code structure and algorithms used. Unit testing has been carried out as a White Box testing and functional flows have been tested according to the implementation logic.

B. Testing Process

White box testing method is used to identify number of test cases and test data after analyzing the structure of software components. Testing process was done based on the following levels:

- *Unit Testing:* Unit testing was carried out at the early development stage when the individual programs are developed. Each unit of thesystem is tested withan aim of verifying detail software design with implemented unit. White Box test strategyhas been used with unit testing and all functional branches have been tested with the implemented logic.

- *IntegrationTesting:* Software moduleshas been integrated into one system and tested with an intention of identifying defect in the system interfaces.Progressively tested components were integrated and tested until the software work a system.

- *System Testing:* Completely integrated system was tested in order to identify errors, which results from unexpected interaction between sub systems. The functionality of the WebPCMM has tested as a complete system to verify that it meets its functional and non-functional requirements.

- *Acceptance Testing:* Acceptance testing was carried out to ensure that the developed system meet with business requirements. The project client had formally accepted the system prior to deploying the system at the client site.

C. Result of Testing

Test cases were developed with a wide range of test data to ensure all the sub systems of the system has been tested. Test data are the inputs, whichhave been devised to test the system. Test cases have been developed based on the system specifications produced in the design phase of the project.The test datashould be selected very carefully, because these are the mean of validating the system properly. Test data were generated based on company's historical project data provided by the client.

The system has been tested throughout and after the implementation process according to the test plan established earlier in the system development process. The overall testing process has been successful and proven that

the system has been well designed, implemented and confirms to the defined user requirements.

IV. OUTCOME

Most of the companies have a common set of requirements where they can fulfill by generic software. Some companies have extended set of project management functionalities which focuses more on client specific requirements. These special domain areas need careful analysis of requirement which results in developing more specific software systems.

As a result of analysis of the system domain, the solution, WebPCMM is been developed with web based project management capability. The system consists of five types of basic users named as System administrator, Project manager, Team leader, Team member and Client. There is only one Project manager within this project scope. The system consists of five sub systems and scope of each sub system can be outlined as follows:

A. Project Collaboration, Management and Monitoring Sub system

This is the main sub system tackle within the project scope. The system will consist of software project categorization module which is based on business, type, project area and development languages.

The project manager is capable of creating team leaders and team members of the system providing username and password. Create project teams and assigning members to project team will be project manager's responsibility. Project client details need to be added to the system by project manager. The project manager will be able to add new projects including project time, budget and client. Each project will consist of one or more phases, which are also known as milestones within this system scope. Project manager will add phases to each project including timeline.

Each phase will assign to a project team and team leader will be notified about new projects via email. Each project have its own dashboard interface which gathers required functionalities in project level such as Project progress monitoring, Milestones, Project team management, File manager, Invoices, Project Message board and Project Reports. The Fig.4, illustrate dashboard interface of a project.

Fig.4 - Project Dashboard

The project manager can add new projects and phases to the system. Each project consists of one or more project phases. The project manager can define weight percentage for each project phase and progress calculation is done based on given weight percentage.

Example: Assume Project A, consists of two phases Phase X and Phase Y. The weight percentage for Phase X is 30%. Meaning that, scope of Phase X is equal to 30% from Project A. In addition, Phase Y should be 70%, thereby total percentage for parent project is equal to 100%. Phase weight calculation form is shown in Fig.5. Each project phase can be assigned to a team and the team leader will be notified via email at the time of allocating phase to the team.

PHASE	PHASE WEIGHT	
Requirement Analysis		10 % of the project
Template Design		10 % of the project
Design CMS		25 % of the project
Develop CMS		35 % of the project
System Testing		10 % of the project
Document and Handover		10 % of the project
TOTAL PROJECT		100 %

Fig.5 - Phase weight calculation

Progress of a project is calculated based on weight given for phases. Similarly progress of a phase is calculated based on task associated with the phase. Following formulas were used to calculate project progress.

$$\text{Project Progress} = \sum_{n=1}^{n=w} PnWn$$

Pn : Completed percentage of n^{th} phase
Wn: Weight of n^{th} phase

Team leaders can add project tasks to projects with timeline and he/she can assign activities to relevant team members within his/her team. Each project task will consist of sub components, which guide developer to progress with the allocated task.

Team member can add a feedback on his/her task assigned to them and can be marked as "COMPLETED" when the given activity is completed. Team leader will be able to review his team member's feedback and will be ableto confirm activities.

Project manager will be able to review team leader's feedback on the project and will be able to give a feedback to the client via his dashboard. Fig.6 illustrates dashboard

interface with notifications of critical tasks and projects. The client will be able to login to the system and will be able to add feedback. Project manager will be able to review client's feedback and can inform team leader if necessary. Team leader will be able to check project comments and can assign to developers.

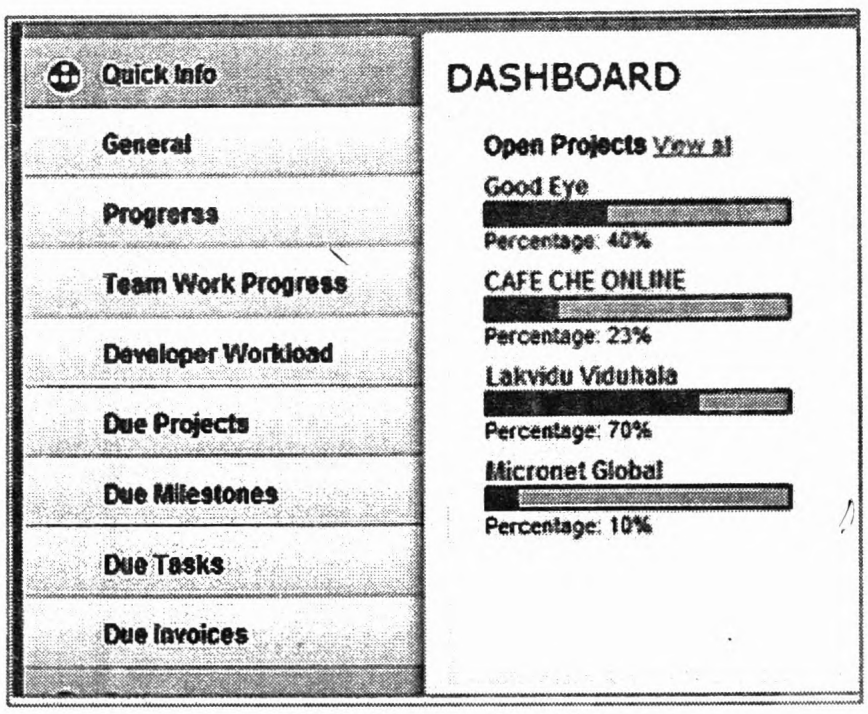

Fig.6- Dashboard Interface

B. Payment and Invoice Management Sub System

Payment and Invoice Management sub system is one of the unique features offered through the system. The system will be integrated with AUTHORIZE.NET and PAYPAL Standard payment gateways which can be customize from the administrative panel.

The payment gateway is an infrastructure usually integrated as a third party service, which authenticate and manages credit card transactions on behalf of the merchant through a secure channel. During the analysis stage of the project, it has been decided to integrate a payment module with the system thereby project client's can settle invoice payments directly through the client portal. After comprehensive analysis of the wide variety of payment options available, the system has implemented to accept credit cards with AUTHORIZE.NET [9] payment gateway.

AUTHORIZE.NET is one of a leading provider for payment gateway services. AUTHORIZE.NET enables merchants to accept, authorize, capture and manage credit card transaction via merchant's web site, retail stores, mail order/telephone order call centers and mobile devices. Prior to starting with application program interface integration, the merchant need to sign up with the AUTHORIZE.NET and need to set up a merchant account with merchant's bank. AUTHORIZE.NET provides a number of methods to process transactions through web sites, ranging from simple 'Buy Now' button to advanced API integration techniques.

The system, WebPCMM has been implemented using advanced integration method, which is highly suitable accepting credit card within the site itself, without navigation to AUTHORIZE.NET payment page. The security of the transaction assured through the SSL connection between the system and the Authrorize.net processor.Fig.7 illustrates steps involve during card processing handlesthroughAUTHORIZE.NET payment gateway.

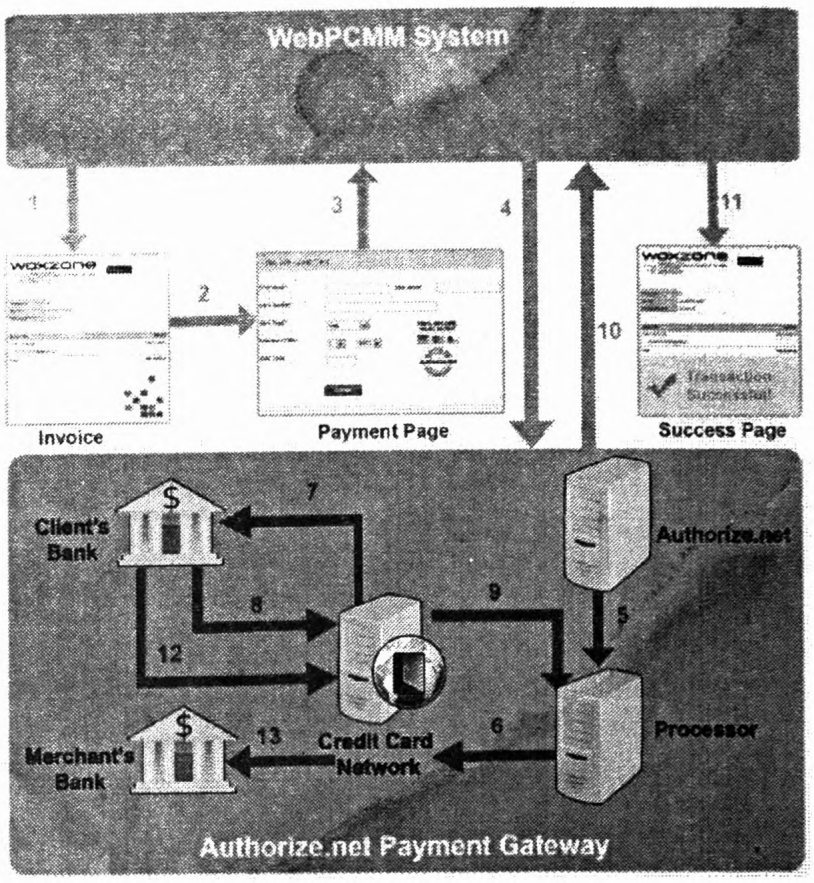

Fig.7 - Credit card process

•Step 1: Logged into the client portal and view Invoice
- Step 2: Select Authroize.net as payment method
- Step3: Client submits his/her credit card details for payment
- Step 4: The system sends card details to Authroize.net as an API request.
- Step 5: Authroize.net sends secure transaction details to merchant's bank processor.
- Step 6: Authroize.net submits transaction details to credit card networks like Visa, Master
- Step 7: Credit card network routes the transaction to the bank that issued the card.
- Step 8: Issuing bank approves or decline transaction based on customer's available funds and return response to Credit card network.
- Step 9: Credit card network sends response to AUTHORIZE.NET processor.
- Step 10: Authroze.net sends response back to merchant's web site.
- Step 11: WebPCMM confirms transaction and sends email to the customer.
- Step 12: Issuing bank sends requested funds to the Credit card network
- Step 13: Credit card network passes the funds to the merchant's bank. At the end of the transaction bank deposits the funds into the merchant's bank account.

PAYPAL[10] is a globally accepted payment service that enables to pay or accept payments online. Apart from local clients from Sri Lanka, the system has registered foreign client base. Therefore, PAYPAL Standard payment option has been integrated with the system as an alternative payment method. PAYPAL Standard application program

interface required few variables to be submitted to the PAYPAL interface. Once the user selects PAYPAL as the payment option, the system redirects users to PAYPAL website and returned once payment is completed.

The system administrator is capable of adding offline payment options such as bank account details via administrative panel. The project manager will create invoices under each project and the client will get an email notification about due invoice from the system. Each invoice can have one or more payment options, which can be configured from invoice management panel. The project client will be able to pay invoice by selecting one of the available payment option.

C. *Trouble Ticket Management Sub System*

Trouble Ticket Management System can be considered as one of the main modules developed within this project scope. This sub system handles customer issues in more systematic way. The project clients can create support tickets via his/her dashboard which relates to their projects.

The project manager will be able to notify about new trouble tickets through email and the project manager can assign reported issues to one of his team Leader/developer if required. Apart from this, clients will be able to check status about trouble tickets via client's dashboard.

D. *Customer Portfolio and Theme Management Sub System*

Customer Portfolio and Theme Management System is one of the special functional area covered within the scope of this project. The system administrator will be able to create customer portfolio and customize front-end interface. This can be done either by defining new rules in front-end style sheet file or by selecting pre-existing themes. The customer portfolio is a collection of completed software systems that presents with the company profile.

E. *Report Generation Sub System*

The system also consists of customized report generation component where project managers can generate reports related to projects, team members and support tickets. Examples of customized report includes List of past projects, List of ongoing projects, Project history, Client history report, List of assigned work to each member, List of open tickets.

V. CONCLUSION

Throughout the course of work, the author has achieved many goals and learnt new technologies as the result of developing the WebPCMM system. The project provided an opportunity to apply theoretical concept and knowledge gained during academic studies into practical aspects.

Software development is not only analyzing, designing, coding and testing; it is all about satisfying users at fullest extent within the boundaries of time, cost and requirements. Ultimately it is pleasure to indicate that the author has been able to complete, Project Collaboration, Monitoring and Management system successfully.

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