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Development of Web Based Reports for Time and Attendance in Agile Environment

Vivasvan V. Chebolu

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Development of Web Based Reports for Time and Attendance in Agile Environment

by

Vivasvan Chebolu

A Starred Paper

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Starred Paper Committee:

Hiral Shah, Chairperson

Ben Baliga

Balasubramanian Kasi

Abstract

Technology has taken over the world at a rapid pace and has replaced regular work with faster and more efficient solutions. More so, the World Wide Web has, to a greater extent, played a pivotal role in globalization. A majority of the companies now have their own websites which showcase their work, products, their missions and goals and other information related to the company. Employees too, are a critical resource for organizations as they are the primary expense. Human Resources and labor management are very crucial for the growth of the company. This project involves the development of web-based reports for employee time and attendance using agile methodology.

The objective of this project was to develop Web Based Employee Time and Attendance Reports in an agile environment. This enables the employees to be able to login from anywhere in the world and be able to log-in and log-out of their work, manage their schedules, etc. while on the other hand it makes it easier for the management to analyze the productivity of its workforce and make appropriate decisions.

The Project was carried out using SCRUM, an agile methodology used for software application development. The project further describes how SCRUM is useful in managing software development.

Acknowledgments

I owe a great many thanks to great many people who helped and supported me during the project. I would like to express my deepest gratitude to my mentors Dr. Hiral Shah, Dr. Ben Baliga, and Prof. Gary Nierengarten for all their support and encouragement at every step throughout my course of study at St. Cloud State University.

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Chapter I: Introduction

Introduction

Employee time and attendance is a vital part of the workplace as it allows for better workforce management. Time and attendance management facilitates Human Resources to better understand employee attendance, and are necessary for collecting information for payroll (Time Well Scheduled, n.d.). It is important for companies to assemble, categorize, and utilize workforce data, which will allow them to make critical decisions (Data Management Services, Inc., n.d.).

In this ever evolving and technologically savvy century, companies are often forced to adapt to the needs and requirements of the market. Companies prefer portability, flexibility and access to applications they use from anywhere and across all platforms, so that work and management become easier and less complex.

Agile methodology is the most widely used project management technique by several organizations for their software development projects. This methodology works great in environments where requirements change rapidly throughout the project scope and has been proven to achieve high project success rate for many organization (Battagiri, 2015). There are several software development techniques within the agile methodology. This project demonstrates the use of agile methodology to create web-based reports for employee Time and Attendance.

Problem Statement

ABC application is currently a *desktop application* which facilitates clients to use the software on the local system where the *server* is located. This is a drawback

since the client cannot access the application on a remote device. Clients now require flexibility to use the application from across any platform and any device without having to personally be present at the location and the local system where the Application is hosted. This can significantly reduce time and effort and increase the productivity of the workforce.

Nature and Significance of the Problem

For any company, it is necessary to manage its time and attendance and the work schedules of the employees who are the number one capital expense. Improper scheduling and attendance management can lead to a host of issues, including overscheduling a shift, costly overtime pay, and even litigation (Data Management Services, Inc., n.d.).

With the change in dynamics of the work environment in the present day world, employees have the option to work from remote locations. A lot of companies allow their employees to work from remote locations and to manage their time and attendance, it becomes an arduous task to keep track of the Human resources, which can lead to billing issues and corrections which can become costly.

Currently, ABC company TC-1 software is only limited to systems that have the database running on their *servers*. If employees of any of the clients are required to work from a remote location, or if the manager wants to access employee information, payroll, scheduling, they have to be physically present at their workstation where this application is hosted. An effective solution which can provide access to the application on any device would help the management in accurately

tracking employee work time and also reduce managerial time spent on timekeeping and payroll tasks.

Objective of the Project

1. To identify the tools and technologies required for the development of this application and create a web enabled application that interfaces with the *server* on the backend and presents a browser-based client interface to the user in an agile environment.
2. Identify the core areas of business and implement them in phases and release for production.

Project Questions

After successfully accomplishing the project, the following questions were answered based on the results obtained from the project:

1. What current drawbacks of the *desktop application have been resolved in the Web based application and up to what extent?*
2. How was Scrum agile methodology useful in developing this project?
3. How effective would the proposed solution of bringing in a web based interface help in resolving the clients' needs?
4. What are the factors of Scrum which were helpful in identifying any threats in this project?
5. Can new changes and modifications be made during the implementation of the web-application?

Limitations of the Project

This web application development project was conducted using specific software development tools and under its own environment. So the following were identified as the limitations of the project:

- a) TCServer is built on a socketed, session oriented architecture. The web is built upon HTTP, which is a stateless protocol. This means that each web request is processed independently from each other. For a client-server socket-based application, the client establishes a connection to the server and for the duration of the session communicates using that socket. Once the connection is closed or broken, the session ends. The web client needs to keep track of the connections as well as know how to communicate with TCServer.
- b) The project was implemented for web based reports only. Hence, the methodology followed was a simple Scrum based agile methodology.

Definition of Terms

The following are the key terms discussed in the project:

- a) **Software development methodology:** It is a framework used in software engineering structure, plan, and control the software development process. (Wikipedia, n.d.)
- b) **Agile methodology:** It is a set of principles for software development in which requirements and solutions evolve through collaboration between self-organizing, cross-functional teams. It promotes adaptive planning,

evolutionary development, early delivery, and continuous improvement, and it encourages rapid and flexible response to change (Wikipedia, n.d.).

- c) **Scrum methodology:** Scrum is a management and control process that cuts through complexity to focus on building software that meets business needs. Management and teams are able to get their hands around the requirements and technologies, never let go, and deliver working software, incrementally and empirically (Scrum.org, n.d.).
- d) **Socket Programming:** Sockets provide the communication mechanism between two computers using TCP. A client program creates a socket on its end of the communication and attempts to connect that socket to a server. When the connection is made, the server creates a socket object on its end of the communication (Tutorialspoint.com, n.d.).
- e) **Server:** A server is a computer program or a machine capable of accepting requests from clients and responding to them. Their purpose may be to share data or hardware and software resources among clients (Quizlet.com, n.d.).
- f) **Web Application:** A Web application (Web app) is an application program that is stored on a remote server and delivered over the Internet through a browser interface (Jdsofttech.com, n.d.).
- g) **Desktop Application:** A desktop application is a self-contained program that performs a defined set of tasks under the user control. Desktop applications run from a local drive and do not require a network or

connectivity to operate or function properly, though if attached to a network desktop application might use the resources of the network (Socmedtech, 2014).

- f) The **Software Development Life Cycle (SDLC)** is the process of developing or modifying software systems by following software development methodologies. People, process and technology play a vital role in success of the software development lifecycle (Battagiri, 2015).
- g) **Pair programming** is an agile software development technique, where two or more programmers work together on a software development task. One, the **driver**, develops the code while the other, the **observer**, reviews the code developed by the driver. The driver and the observer switch roles to achieve better results (Battagiri, 2015).
- h) **Best practices** are the set of rules followed in **software development** which can help in developing software which is effective as well as efficient and within the budget. A combination of best practices can be used to best fit a specific software development environment. The core agile software programming practices (versionone.com) are the following:
 - i. Iterative development,
 - ii. Test driven development,
 - iii. Quality testing,
 - iv. Requirement change management,
 - v. Following standard coding practices,

- vi. Software version control.
- vii. **Project management best practices** help us successfully initiate, plan, execute, monitor, control and close our projects. Best practices represent the practical application of the concepts, processes, and tools defined in the project (Battagiri, 2015).

Summary

This chapter introduces the problem statement and objective of the project. The nature and significance of the project are discussed. Limitations of this project implementation are also addressed. Important terms and keywords are briefly explained, which are necessary to understand the project. The next chapter discusses the framework and research methodologies used to conduct the project in detail.

Chapter II: Background and Review of Literature

Introduction

This chapter will explain the background related to the project and research area where the project is conducted. Literature related to project problem and literature related to methodologies used to conduct the project is discussed in detail. This chapter will provide a complete and broader aspect of the project.

Background Related to the Problem

ABC company is a leading provider of automated time and attendance, human resource, and payroll systems. For almost 50 years, ABC company contributed to the Time and Attendance industry by providing software and services that assist management in becoming more efficient and better manage workforce productivity and control costs.

Their clients include a myriad of businesses in the service, airline, healthcare, manufacturing, retail and insurance industry.

With the rapid and day-by-day evolution of the Information Technology industry, companies are forced to meet the needs of the ever-growing demand for automation, tools and technologies for easier access of information. In this case, ABC software has been functioning as a standalone application running on systems that have the TC-server database on them. The company has been seeing a lot of demand for a web-based application that can simplify the Human Resources' job for their clients. This enables them to easily access and maintain the workforce data and to simplify its labor management.

The Web Application development project was conducted under agile methodology where day-to-day activity had been monitored and reviewed as a part of this project.

Literature Related to the Problem

In this section, the concepts related to the project's research area are explained in detail, in order to achieve a clear understanding of the project.

The objective of the project was to create a web-enabled client for TC-1. The web client interfaces with TCServer on the backend and presents a browser-based client interface to the user.

Design challenges: TCServer is built on a socketed, session oriented architecture. The web is built upon HTTP, which is a stateless protocol. This means that each web request is processed independently from each other. For a client-server socket-based application, the client establishes a connection to the server and for the duration of the session communicates using that socket. Once the connection is closed or broken, the session ends. The web client needs to keep track of the connections as well as know how to communicate with TCServer.

Design components: The web client will be running under Microsoft's IIS web server using the ASP.NET MVC 5.1 framework. The design challenge necessitates a connector layer that will handle the communication to and from TCServer. The connector will contain various modules handling the processing of data from TCServer such as employees, timesheets, etc. (Figure 1).

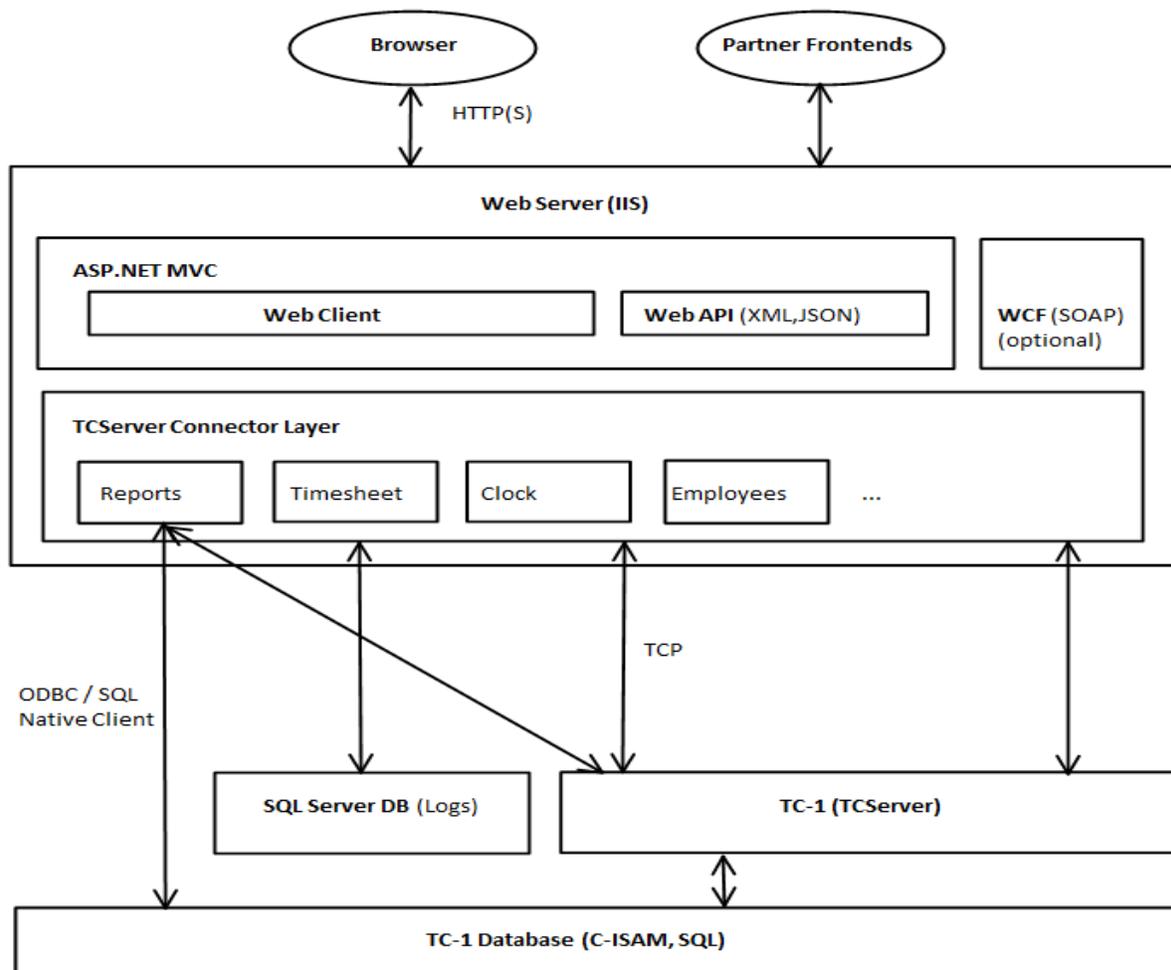


Figure 1: Web Client System Architecture

ASP.NET MVC 5.1: In addition to providing the framework for building the web client, MVC 5.1 also provides an interface for accessing data via an API. For instance, a browser or any other applications pointing to the location http://www.sampleserver.com/api/server_time can receive the current server time in JSON format. The current trend for web services is moving away from SOAP based services to web APIs serving XML or JSON encoded messages. SOAP is powerful, but complex and heavy, requiring more computation power and bandwidth to serve

the messages. (Most applications do not need the full power of SOAP, thus Web APIs were created.) If a customer or partner absolutely requires SOAP messages, a WCF (Windows Communication Foundation–Microsoft’s framework for serving/ consuming SOAP messages) component can be added to meet that need.

The software development life cycle. The most effective way to protect information and information systems is to integrate security into every step of the system development process, from the initiation of a project to develop a system to its disposition. The multistep process that starts with the initiation, analysis, design, and implementation, and continues through the maintenance and disposal of the system, is called the System Development Life Cycle (SDLC) (Radack, 2009).

Figure 2 shows the default phases of SDLC and they are explained below in detail (Gamasutra.com, n.d.).

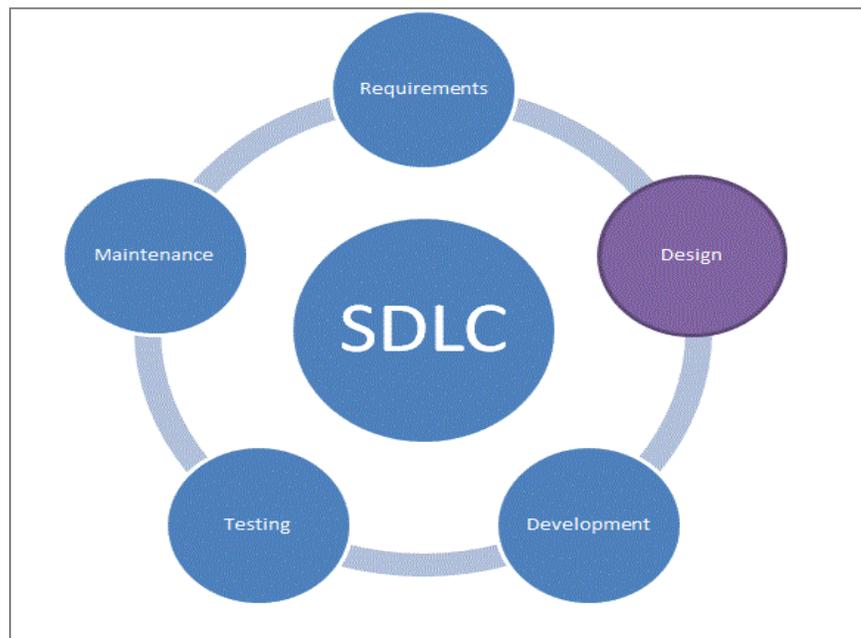


Figure 2: Software Development Life Cycle Phase

- a) Requirements gathering/analysis:** This is the first and critical phase of the project. When gathering the requirements, the analyst needs to speak with the end user, development and the business in order to ensure that all needs are met. The user will provide nontechnical requirements and expectations of the project. Development will provide the technical design requirements necessary to build the project.
- b) Design:** In the design phase, the technical design requirements are prepared by lead development staff which may include architects and lead developers.
- c) Development:** This phase is the actual implementation of the design using code. This is normally the longest phase of the SDLC. The finished product here is input to the Testing phase.
- d) Testing:** Once the coding is done, all the code is migrated to the test environment where different kinds of testing will be done. After the successful completion of the testing phase and if code looks good to be on the whole system, it is sent to deployment.
- e) Deployment/maintenance:** The Deployment phase of the project is where; all the code that has been written and tested is delivered and installed to the end user/customer system or deployed on to the server.

Different types of software development methodologies. Software engineering researchers have provided several software development methodologies

that fit for various industry software solutions. Following are some of the software development methodologies:

- Waterfall (also known as Traditional)
- Incremental Development
- Spiral Development
- Prototyping Methodology
- Agile Methodologies
- Rapid Application Development
- Joint Application Development

Traditionally for several years most of the organizations have been using Waterfall approach for their software development processes. Waterfall approach is a linear, sequential and structured software development model which suits best for small-sized projects where all requirements and specifications of the project are known beforehand. Any changes in the project requirements cannot be incorporated in projects that follow Waterfall approach. Consequently, the projects fail. To overcome these problems, organizations have tried to adopt agile software development methodologies that are highly embrace changes throughout the development process. Agile methodology is an iterative and incremental approach of software development (Battagiri, 2015).

There are several agile software development methodologies such as Scrum, Extreme Programming (XP), Lean and Kanban development, Crystal, Feature-Driven Development (FDD) and Dynamics Systems Development Method (DSDM). Among

these agile methodologies, Scrum and XP are the most widely used development techniques (Clutterbuck, Rowlands, & Seamons, 2009).

Different types of Agile methodologies. Following are the different types of Agile methodologies with their framework description.

a) Scrum: The Scrum process is essentially an evolutionary, incremental framework. It is a team based software development approach, which uses a time-boxed adaptive artifact termed a Sprint. Scrum takes an “iterative approach to software development.” In Scrum, the team is responsive to its environment throughout the development. The developers are accorded unlimited flexibility and creativity during the development iterations. The Scrum Master is responsible for the team process, helping the team to achieve success and use Scrum correctly. The team consists of cross-functional developers who between them possess all off the expertise necessary to deliver a potentially shippable increment of the product (O’Connell, 2014).

b) Lean and Kanban software development. Lean Software Development focuses on delivering valuable and efficient product to the customer. Following are the important principles of Lean framework:

1. Eliminating Waste
2. Amplifying Learning
3. Deciding as Late as Possible
4. Delivering as Fast as Possible

5. Empowering the Team

6. Building Integrity In

7. Seeing the Whole

The following are the three main principles of Kanban:

- Visualize the workflow
- Limit the amount of work in progress (WIP)
- Enhance the work flow

c) Extreme Programming (XP). Extreme Programming (XP) is the most widely recognized agile method (Boehm & Turner, 2004). XP has been pioneered by Kent Beck and is described in (Beck, 2000) as “a light-weight methodology for small-to medium-sized teams developing software in the face of vague or rapidly-changing requirements”. The main principles of XP are

- Simplicity
- Communication
- Feedback
- Courage

d) Crystal. Cockburn (2000 and 2002) describe a framework of related methods that address the variability of the environment and the specific characteristics of projects. The term “Crystal” is used as a metaphor to describe the “color” and “hardness” or “heaviness” of each method. The appropriate Crystal method is selected according to development team

size and project criticality. Crystal methods share two fundamental values: the appropriate level of effective communication and a high tolerance of change within the project (Clutterbuck et al., 2009).

- e) Dynamic Systems Development Method (DSDM).** DSDM Consortium (1997) and Stapleton (1997) describe more of a framework for developing software rather than a particular method. The five-phase DSDM life cycle provides for project management activities and risk management. Abrahamsson (2002) states that: “The fundamental idea behind DSDM is that instead of fixing the amount of functionality in a product, and then adjusting time and resources to reach that functionality, it is preferred to fix time and resources, and then adjust the amount of functionality accordingly.” DSDM is consistently described as the first truly agile software development method (cited in Clutterbuck et al., 2009).
- f) Feature-Driven Development (FDD).** FDD (Palmer, 2002) focuses on simple process, efficient modeling, and short, iterative cycles. Boehm and Turner (2004) describes how “FDD depends heavily on good people for domain knowledge, design, and development. A central goal is to have the process in the background to support rather than drive the team.” FDD does not assign collective ownership of project tasks (including code base) unlike other agile methods including Extreme Programming. Boehm and Turner (2004) state that the FDD focus on architecture and “getting it right the first time” is very much the “antithesis of XP’s collective ownership” and

that “this makes FDD strong for more stable systems with predictable evolution, more vulnerable to nonpredictable ‘architecture-breaker’ changes” cited in Clutterbuck et al., 2009).

Web application development using agile methodology with SCRUM. The following will be the different steps to develop the Web Application project using agile methodology with scrum. Figure 3 shows the different events/phases involved in Scrum framework (Expert Program Management, n.d.):

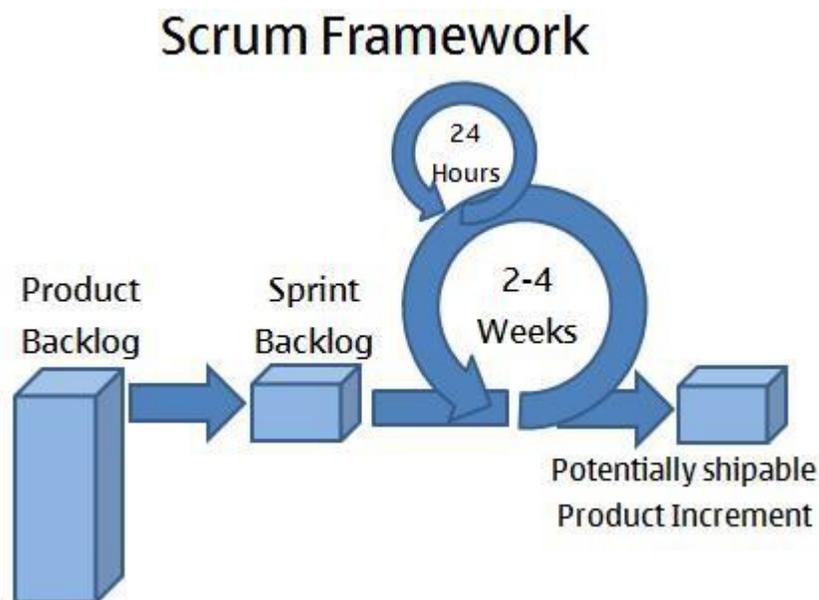


Figure 3: Scrum Framework

The diagram above can be described as follows:

- The Product Owner builds the product backlog and they prioritize it.
- The team then looks at this backlog and they pull work from it. It is a pull system just like Toyota’s Lean Manufacturing operation. If you have managers getting involved at this stage (pushing) then it slows things

down. This is why the team decides how much stuff they can take into the scrum and what they can deliver in a cycle (the sprint backlog).

- A Sprint cycle is no more than 4 weeks. Usually a Sprint will last between 2-4 weeks.
- Inside the cycle the team must have a daily meeting. This is used to synchronize everyone within the team.
- At the end of the cycle the team have to produce working software, and potentially shippable working software.

This is a very basic introduction to the Scrum framework. Below are some definitions to further clarify the basic components of Scrum.

Product backlog: This is a document containing high-level descriptions of all features to be developed in business priority order. This document is owned by the Product Owner. Typically, each item on the list will contain a rough estimate of both business value and development effort.

Sprint backlog: This is simply the list of things (again in priority order) that the team thinks they can do in the current Sprint. This is chosen by the team (pull) not by managers (push).

Sprint planning: This happens on day 1 of the Sprint and is where the team members create the Sprint Backlog.

Daily scrum meeting: These are used to synchronize the work of the team. The meeting should last no more than 15 minutes. Each team member discusses

what they worked on yesterday, what they are working on today, and any blockers they're facing.

Sprint retrospective: (aka Sprint Review) This occurs at the end of the Sprint and gives the entire team the opportunity to examine the Sprint just completed and identify improvement opportunities for the next Sprint.

Product owner: Owns the Product Backlog. Essentially the Product Owner directs the team to ensure they are working on the right requirements.

Scrum master: This role does not direct the team like a Project Manager and allocate tasks, instead they shield the team from outside distractions and remove blockers to enable the team to work as quickly as possible.

Summary

This chapter provided in depth explanation of concepts related to the project problem and methodology. The next chapter will discuss the methodology used to conduct the project research in detail.

Chapter III: Methodology

Introduction

This chapter discusses the methodology used to implement this project. The most suitable research method was applied to the project. The reasons behind selecting this research method are explained. The framework applied to the project and data collection processes are discussed in detail. Various tools and technologies used to analyze the data collected are also discussed. The budget and timeline involved to conduct this entire project are also specified.

Design of the Study

The main objective of the project was to develop a web-based application using the framework from an existing Standalone Application. The project is aimed at creating web-based reports for the clients.

For this purpose, a team was formed with two developers, one tester, a Program Manager and a Project Manager from the Client's end. A basic Scrum based methodology was followed for the implementation of the project. The project was divided into the following phases which are implemented in sequential order as follows:

a) **Project planning and initiation.** In this phase, regular meetings were conducted to discuss the action plan and define the architecture. Feedback from all the members of the team were taken into consideration to identify drawbacks from the current architecture & environment and discussed about the possible changes that

can be implemented to avoid them and also encouraged suggestions from the team members to improve the performance.

b) **Gathering and analyzing requirements.** During this stage, all team members worked together to get functional, business and technical requirements essential for the project. The requirements were analyzed and changed according to the team members' suggestions. Additional resources were identified and assigned according to the budget. Project time line was developed to complete on time.

c) **Defining sprints and identifying tasks.** The Program manager who was also the Scrum master developed a scrum timeline and defined sprints and its goals. The tasks were identified accordingly and appropriate resources were allocated. Before every sprint, story points were created for team members based on their weightage of tasks. During the sprints, every day stand up meetings were conducted for 15-30 minutes to discuss about the previous day's work, any blockers if exist and the following day's work of every team member. Blockers were identified and resolved after serious brainstorming sessions. During this meeting, the progress is tracked on daily basis and tasks were adjusted accordingly.

d) **Design and build each environment.** In this phase, the new environment is built right from the scratch. The best possible combination of configuration and system resources are identified after several iterations. Once an environment was successfully built, it was tested and the same was repeated for all the other environments.

e) **Test the environment.** Once the environment was ready, wide variety of

regression testing was performed on each server for each project with maximum possible load to see how effective new environment was. The new environment was compared to the existing environment at project level to see if there were any inconsistencies and the appropriate action was taken accordingly.

f) **Go live.** After successful testing and validation, the new environments went live. For a certain time, both the environments were available for use and once the satisfaction is achieved, the old environment was decommissioned. A message was communicated to developers, testers and business users about the changes that were taken place and the important information and process steps were documented and distributed.

During the project, business requirements were changed at times, which were discussed in daily stand up meetings and the corrective action was taken from the next sprint. Project manager tracked all the activities of the individuals to make sure that the project was moving smoothly and on time. The blockers were identified, their cause and solution steps were documented to prevent the same from future occurrence. After the successful completion of project, the effectiveness of new changes was evaluated and will be discussed in next chapter.

Data Collection

The data was obtained from the pre-existing TC-Server database. ABC company has about 18 major clients who use TC software for their labor resources management. For 50 years, ABC company has been in the Time and Attendance

industry. Since the objective of this project is to develop the already existing desktop application into a web application, the design of the middleware is most crucial.

The following are the tools and technologies used:

1. .Net Visual Studio 2012
2. Repository: Team Foundation Server
3. Backend: TC-Server data accessed through web service.

Data Analysis

The data that was called through web services is displayed through various reports in the web application. These reports are displayed as drilldown tables and can be downloaded as PDF documents and excel sheets. The data for some reports had been also depicted in the form of Pie Charts and Graphs.

Budget

The major part of the budget had been the billing for the employees. A lot of prior planning had gone into the complete scope and requirements for the project. Hence, the budget was as pre-planned without any extensions.

Timeline

The following is the timeline to complete this project:

Project Idea Formulation and Research	August 2015
Project Proposal Write-up.....	September 2015
Gathering the requirements.....	September 2015
Analyzing the requirements	September 2015
Design and Development of the code	October 2015

Development of the code.....	October 2015 to February 2016
Testing the developed code.....	February 2016
Deploying the tested code.....	March 1st 2016
Project Write-up.....	March 2016
Final Defense.....	April 2016

Summary

This chapter introduced how the project was conducted and the reasons for selecting the research method used for this project. The framework applied to the project, tools and technologies required for the project, the budget and timelines for the project and how this data was analyzed to evaluate the efficiency of the Scrum methodology.

Chapter IV: Data Presentation and Analysis

Introduction

This chapter will discuss how the reports were developed by the development team members and presents the reports in detail which makes the analysis of the data easier. Data presentation provides a clear understanding of the data collected. Data analysis techniques are also discussed in detail.

Data Presentation

Desktop application vs web based application. Desktop Applications are generally used for conventional standalone applications where the user has access to the application on one particular system. Unlike the desktop application, the web based application can be run on any system from anywhere via a connection through the web and access the database by calling the API's. The web-based application provides more ease of access as it is being developed after the standard and framework for the application has been set by the desktop application. Modifications and changes if any to better suit the individual needs of the management and employees can be made here. The reports have been modified to be able to be exported into PDF, XLS, and XLSX documents in the web application. Any changes to the application can be done at the client's end without affecting the individual users.

The scrum methodology was followed to implement this project. A brief summary about the Scrum framework is given below.

The Scrum framework. The project was kicked off after the requirements had been discussed with the Clients. The requirements were discussed internally within the team before beginning the development for the implementation of the project. The whole project was divided into sprints with each sprint having some tasks to finish. The following section describes what was accomplished in each stage. Figure 4 show the Scrum development process (maxxor.com, n.d.).

Product backlog: Product backlog is merely the list of all things that needs to be completed as part of the project. All the ideas were converted into user stories representing the user functionality but not implementation details. The stories were estimated, prioritized and ordered accordingly. Each and every story in the list adds value for the customer. Product backlog was flexible enough to add new stories to the list and modify or delete existing stories as appropriate. The scrum master was responsible and made sure that the product backlog is in good shape.

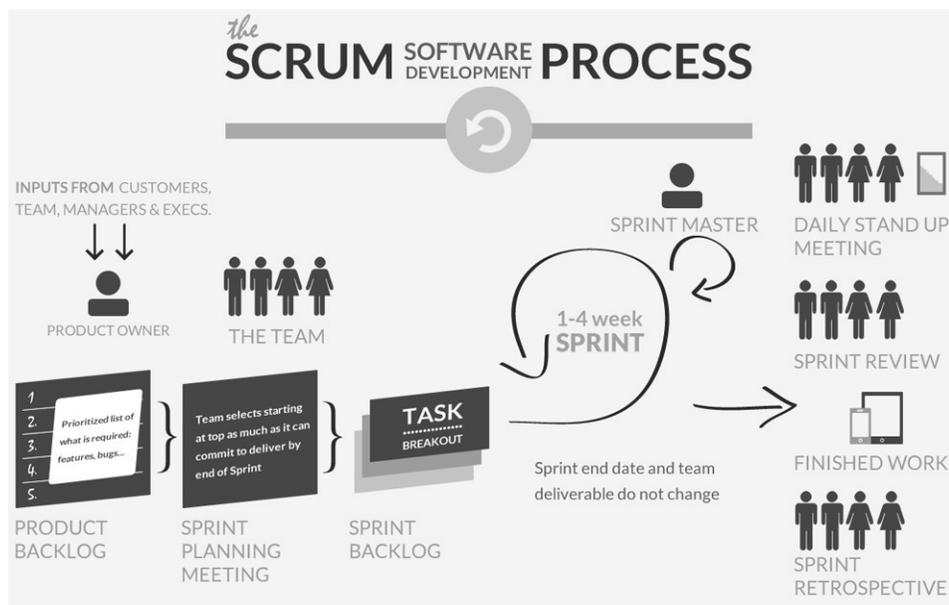


Figure 4: Scrum Framework

Sprint planning meeting: The main agenda of this meeting is to sprint goal and sprint backlog. In first sprint planning meeting, the whole project was divided into 8 sprints and high prioritized stories are added to to-do list for first sprint. The scrum master discusses with the team about the plans to achieve during the sprint. Each sprint was for two weeks and story points were assigned to each story. Each story point represents 8 hours of work. Big stories are divided into sub tasks.

Sprint backlog: Sprint backlog represents the list of stories that needs to be completed in that sprint. Each story is assigned to respective team member. Estimated remaining work was updated daily and the sprint backlog can be changed every day when necessary. During every sprint, newly discovered stories were added and existing ones were modified accordingly.

Daily standups: Daily stand up meetings were conducted throughout the sprint lasting for 15 minutes to discuss briefly about each team member's what was accomplished the previous day, what will be covered that day and also if there are any impediments or blockers hat needs to be discussed. Blockers were identified and appropriate action was taken to eliminate them.

Sprint review: Sprint review meetings are held typically after the end of every sprint to assess project progress against sprint goals. These meetings contributed to development of team's morale. Sprint review meetings were attended by project owner, scrum master and team members to discuss about the completed stories. Product owner reviews the work done by team members in that sprint.

Sprint retrospective: Sprint retrospective meetings were after every sprint held between product owner, scrum master and team members constantly looking for improvement opportunities. They analyzed how they are doing and discussed about the ways to improve. The meeting was mainly focused on following details:

- What went well during the last sprint?
- What went wrong during last sprint?
- How could we do differently to improve?

Data Analysis

The following reports have been developed in the project. The following are the screenshots of the various web based reports developed having the server on the backend and presenting a web based interface for the client.

- **Employee Contact Info Report**

The Employee contact info report gives the complete details such as ID, Last Name, First Name, Phone, work email, emergency phone number etc. of all the employees in the organization. This gives a complete information of the employees' details which is very helpful for the Human Resources department to run payroll, benefits etc. Figure 5 shows a screenshot of the employee contact info report.

AD3i Company R. Kevin Heinle 5:11 AM (EDT) Log Out

Time Card Time Off Requests **Reports** Settings

Employee Reports > Employee Contacts

Export to: [PDF] [CSV] [Excel]

Employee Contacts

Enter text to search...

Drag a column header here to group by that column

Employee ID	Last Name	First Name	MI	Phone	Cell	Emergency Name	Emergency Phone	Work Email	Home Email
23	Eska	Ken		(000) 000-0000	(000) 000-0000		(000) 000-0000	jlin@datamaticsinc.cor	
25	Embry	Raymond	P	(000) 000-0000	(000) 000-0000		(000) 000-0000		
101	Heinle	R. Kevin		(000) 000-0000	(000) 000-0000		(000) 000-0000		
103	Heinle, Jr.	Norman	C	(000) 000-0000	(000) 000-0000		(000) 000-0000	nch1@datamaticsinc.c	
123	Aaa	PTO		(000) 000-0000	(000) 000-0000		(000) 000-0000		
244	Heinle	Robert		(000) 000-0000	(000) 000-0000		(000) 000-0000		
325	Nelson	Laura		(000) 000-0000	(000) 000-0000		(000) 000-0000	jlin@datamaticsinc.cor	
578	Heinle	Hilary		(000) 000-0000	(000) 000-0000		(000) 000-0000		
720	Nelson	Debra		(000) 000-0000	(000) 000-0000		(000) 000-0000	debbie@TC-1.com	
957	Bonica	Louis		(000) 000-0000	(000) 000-0000		(000) 000-0000		

Page 1 of 4 (34 contacts) Page size: 10

Figure 5: The Employee Contact Info Report

- **Detailed Hours Report**

The Detailed Hours report is a drill down report of all the total hours of each employee by day, by shift, by week and by the benefits obtained. Once the initial list of employees' hours is populated, by on-click of any particular record the employee's detailed hours which also include the reason for the leave, or number of hours worked in a week on a particular day of the week will be populated through a drill-down menu. This increases the efficiency and transparency for each employee as well as the Human resources to better manage the work schedules and benefits of is employees. Figure 6 shows a screenshot of the Detailed hours report which has the bar chart and the benefit details of an employee.

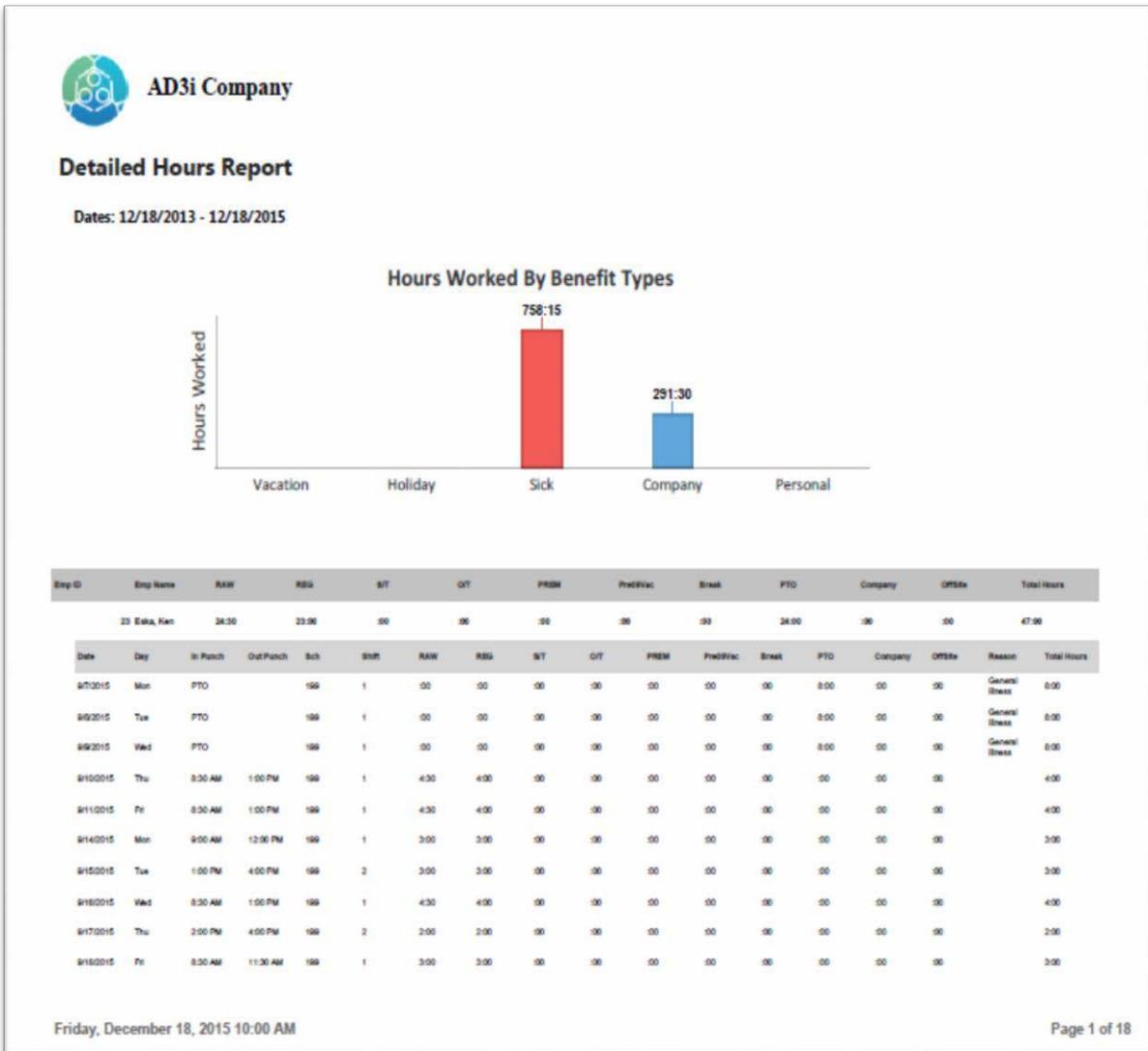


Figure 6: Detailed Hours Report

- **Available Benefit Day Report**

The Available benefit day report provides a detail of the benefit days and leaves available for an employee for a calendar month/ year. Figure 7 shows the sample Available benefit day report.



AD3i Company

Available Benefit Day Report

Full Name	Benefit Type	Hrs Authoriz Current Year	SoH Hrs Current year	Hrs Used Current Year	Hrs Remaining
Eska, Ken	PTO	176:00	24:00	24:00	152:00
Embry, Raymond P	PTO	176:00	0:00	0:00	176:00
Heinie, R. Kevin	PTO	88:00	0:00	0:00	88:00
Heinie, Jr., Norman C	PTO	160:00	0:00	0:00	160:00
Aaa, PTO	PTO	160:00	0:00	0:00	160:00
Heinie, Robert	PTO	208:00	0:00	0:00	208:00
Nelson, Laura	PTO	36:32	0:00	0:00	36:32
Heinie, Hilary	PTO	168:00	0:00	0:00	168:00
Nelson, Debra	PTO	11:00	0:00	0:00	11:00
Bonica, Louis	PTO	:00	0:00	0:00	:00
Izzi, Janet	PTO	48:00	0:00	0:00	48:00
Test, Password	PTO	-56:00	0:00	0:00	-56:00
Amontis, Dina	PTO	-304:42	0:00	0:00	-304:42
Thompson, Misty	PTO	40:00	0:00	0:00	40:00
Lin, Jonah	PTO	-40:00	0:00	0:00	-40:00
Moscariello, Mark J	PTO	104:00	0:00	0:00	104:00
Markert, Joseph	PTO	:00	0:00	0:00	:00
Heinie, Noah C	PTO	104:00	0:00	0:00	104:00
Lee, Susan	PTO	1:38	0:00	0:00	1:38
McKenzie, Dominic	PTO	-4:00	0:00	0:00	-4:00
Heinie, Heather	PTO	27:00	0:00	0:00	27:00
Friedman, Olga	PTO	-19:23	0:00	0:00	-19:23
Jefferiss, Somer V	PTO	-8:00	0:00	0:00	-8:00

Figure 7: Available Benefit Days Report

- **Paid Records Report**

The Paid Records report contains data of the individual days and hours the employee has worked in a particular week of the month and whether the employee has been paid for that particular day in the event of a holiday taken due to some reason. (Sick, Unpaid Leave, etc.). This helps for improved transparency in the payment of wages. (see Figure 8).



Jonah Demo

Paid Records Report

Dates: 12/8/2015 - 12/8/2015

Employee ID	Full Name	Date	Day	Record	Hours	U	Reason Code	Prepaid Date	Paid
Employee ID: 25									
25	Embry, Raymond P	11/12/2012	Mon	PTO	00800	U			True
25	Embry, Raymond P	11/13/2012	Tue	PTO	00800	U			True
25	Embry, Raymond P	11/14/2012	Wed	PTO	00800	U			True
25	Embry, Raymond P	11/15/2012	Thu	PTO	00800	U			True
25	Embry, Raymond P	11/16/2012	Fri	PTO	00800	U			True
Employee ID: 103									
103	Heinie, Jr., Norman C	11/5/2012	Mon	PTO	00800	U	Heart trouble		True
103	Heinie, Jr., Norman C	11/6/2012	Tue	PTO	00800	U	Heart trouble		True
103	Heinie, Jr., Norman C	11/7/2012	Wed	PTO	00800	U	Heart trouble		True
103	Heinie, Jr., Norman C	11/8/2012	Thu	PTO	00800	U	Heart trouble		True
103	Heinie, Jr., Norman C	11/9/2012	Fri	PTO	00800	U	Heart trouble		True
Employee ID: 325									
325	Nelson, Laura	9/17/2012	Mon	PTO	00700	U			True
325	Nelson, Laura	9/25/2012	Tue	PTO	00635	U	Sick called in		True
325	Nelson, Laura	9/26/2012	Wed	PTO	00700	U			True
Employee ID: 720									
720	Nelson, Debra	9/7/2012	Fri	PTO	00475	U			True
720	Nelson, Debra	9/11/2012	Tue	PTO	00375	U			True
720	Nelson, Debra	9/20/2012	Thu	PTO	00800	U			True

Figure 8: Paid Records Report

- **Time Card Report**

The Time Card report provides all the details such as time in and time out, hours worked, etc. which are automatically generated based on the employees' work hours and presents a printable report for signature and authorization for individual / official use.

Bonica, Louis (ID# 997)

Date	Day	Sh	Shift	RC	Time In	Time Out	Hours	REG	S/T	O/T	PREM	OVR	Sh To Work
9/21/2015	Mon	001	1	0	Absent	Unpaid	:00	:00	:00	:00	:00		Yes
9/22/2015	Tue	001	1	0	Absent	Unpaid	:00	:00	:00	:00	:00		Yes
9/23/2015	Wed	001	1	0	Absent	Unpaid	:00	:00	:00	:00	:00		Yes
9/24/2015	Thu	001	1	0	Absent	Unpaid	:00	:00	:00	:00	:00		Yes

Period: RAW :00 REG :00 S/T :00 O/T :00 PREM :00

Time Off Balances

<u>PTO</u>	<u>Pre09Vac</u>	<u>Company</u>	<u>OffSite</u>	<u>Break</u>	<u>Military Leave</u>
:00	:00	No Limit	No Limit	No Limit	

I agree by signing below that I have reviewed my timesheet and the information is complete and accurate.
 I understand and agree that I will not sign below if the information reported on my timesheet is not complete and accurate.
 By signing this form I also certify:

- 1) I have taken my required 30 minute meal break each day and the meal breaks I took were not interrupted by work-related activities.
- 2) If I was unable to take an uninterrupted 30 minute meal break on any day, I notified my supervisor in advance on the same day.
- 3) No one has instructed me to inaccurately report my hours worked, meal periods or absences from work.
- 4) I will contact my supervisor or Human Resources immediately if my timesheet or paycheck is not correct or if anyone instructs me to submit incomplete, inaccurate or false payroll information.

Date __/__/____ Employee Signature _____
 Supervisor Signature _____

Figure 9: Time Card Report

Summary

This chapter presented the reports collected from the development team. It also discussed the Scrum framework which was followed by the team to effectively implement the project in the planned timeframe. The next chapter will discuss in detail the results of this project research and come up with future work recommendations.

Chapter V: Results, Conclusion, and Recommendations

Introduction

This chapter will discuss the results of the Scrum methodology evaluation assessed on a case study of web application development project. The answers for all the project questions will be provided. Conclusions and recommendations will also be discussed based on the results obtained from the evaluation.

Results

This project evaluated Scrum methodology on a Web Application development project which was used as a case study. The efficiencies and risks of the Scrum framework were explored. All the tasks and phases of Scrum that were implemented during the course of the project played a vital role in the effective completion the project.

The following are the questions identified during the initial stage of capstone project research. The answers for these questions are addressed below:

Q) What current drawbacks of the desktop application have been resolved in the Web based application and up to what extent?

- A.** A Desktop application usually runs only on the system where the application has been hosted and cannot be accessed remotely. This makes it difficult for the Human Resources to effectively manage the work schedules, payroll, leaves, etc. of its employees and also it is easier for the employees who are working from remote locations to easily access their records and submit a request if they find any

discrepancy. The web-based application has made it possible to access the application from remote machines including tablets and has been through the UAT phase successfully.

Q) How was Scrum agile methodology useful in developing this software project?

A. Scrum methodology was very adaptable to this project. There were situations where the functional requirements would change or some modifications had to be re-implemented like deleting the existing code and adding the new lines of code. The adaptability, flexibility and iterative nature of Scrum made these changes very easy.

Q) How effective would the proposed solution of bringing in a web based interface help in resolving the clients' needs?

A. The web based interface makes it easier to access the application from any system just through an internet connection. It achieves this through an http based connection with the client and having a remote connection to the server. The connection is dynamic and ends as soon the session ends. It is easier for the client to access the application across platforms and devices via the web without having to worry about the application being hosted on the device.

Q) What are the factors of Scrum which were helpful in identifying any threats in this project?

A. Threats were easily resolved at the initial stages of this project using

scrum methodology. Product Backlog, Sprint Planning Meetings and Daily Scrum Meetings are the main assessment factors in identifying the threats in this project development.

Q) What steps will be taken to design the web-application such that it has high usability and ease of access?

A. HTML5 with JavaScript and CSS3 were used to design the web pages and implement high usability and ease of access for the reports and implement the drilldown. The advantage of using HTML5 with CSS3 is that the web pages can be viewed across platforms such as windows, Mac, Android without having to alter the code for each platform.

Q) Can new changes and modifications be made during the implementation of the web application?

A. A lot of modifications were made during the development of this project. Many functionalities which weren't part of the desktop application were added to the web reports. These included adding the Time Card report and the drill-down options for the reports and selection options.

Conclusion

- Generic Scrum Framework is applicable to most software development projects and has been the optimum way to run this project.
- Agile methodology is the way to go for development projects where the outcome of the project is time-frame bound.

- For the web based reports project, it has been observed that SCRUM framework can be tailor made and adaptable to the nature of the project.
- All the tasks and phases of Scrum Framework are very helpful and quite straight forward to follow.
- The project has been successful in implementing the web reports and it has been very effective in being able to access the application from remote devices.

Recommendations

This capstone project results are explorative in nature. They are valid for developments projects that are similar to the project used in the case study. The results cannot be generalized for all kinds of development projects. These project results can be used as a guidance/ framework to similar development environments. Agile methodologies help management take better decisions and better implement projects that are time bound.

References

- Battagiri, L. K. (2015). *Applying agile methodology to manage web application development in oil and gas industry*. Unpublished starred paper. St. Cloud State University, St. Cloud, MN.
- Beck, K. (2000). *Extreme programming explained: Embrace change*. Reading, MA: Addison-Wesley.
- Boehm, B., & Turner, R. (2004) *Balancing agility and discipline*. Pearson Education, Inc.
- Clutterbuck, P., Rowlands, T., & Seamons, T. (2009). A case study of SME web application development effectiveness via agile methods. *The Electronic Journal Information Systems Evaluation*. Retrieved from <http://www.ejise.com/issue/download.html?idarticle=631>.
- Data Management Services, Inc. (n.d.). *Time and attendance software-employee attendance systems*. Retrieved from www.datamaticinc.com.
- Expert Program Management. (n.d.). The SCRUM process | SCRUM framework. Retrieved May 24, 2016, <http://www.expertprogrammanagement.com/2010/08/the-scrum-process/>.
- Gamasutra.com–The Art and Business of Making Games. (n.d.). *Software development life cycle overview*. Retrieved from http://www.gamasutra.com/blogs/StanleyHandschuh/20130929/201241/Software_Development_Life_Cycle_Overview_Part_1_of_6.php.

- Jdsofttech.com. (n.d.). *Web application development*. Retrieved from <http://www.jdsofttech.com/web-application-development.php>.
- Maxxor.com. (n.d.). *SCRUM software development process*. Retrieved from <https://www.maxxor.com/software-development-process>.
- O'Connell, T. (2014). An analysis of the implementation of agile software development practice in Irish industry. *International Journal on Advances in Software*, 7(3), 4th ser., 486-502.
- Quizlet.com. (n.d.) *Simple tools that let you study anything*. Retrieved from <https://quizlet.com/>.
- Radack, S. M. (2009). The system development life cycle (SDLC). *NIST Special Publication 800-64 (Rev. 2)*. Gaithersburg, MD: National Institute of Science Technology.
- Scrum.org. (n.d.). *Improving the profession of software development*. Retrieved from <https://www.scrum.org/>.
- Socmedtech-Web Design & Development Company. (2014). *Design application*. Retrieved May 24, 2016, from <http://socmedtech.com/desktop-application/>.
- Time Well Scheduled. (n.d.). *Time and attendance*. Retrieved May 24, 2016, from <https://timewellscheduled.com/time-and-attendance/>.
- Tutorialspoint.com. (n.d.). *Simply easy learning*. Retrieved from <http://www.tutorialspoint.com/>.
- Wikipedia. (n.d.). *Agile software development*. Retrieved May 24, 2016, from https://en.wikipedia.org/wiki/Agile_software_development