FALL INTERNSHIP REPORT

Submitted to the Department of Computer Science at Wayne State University in Fulfillment of the Requirements for the Completion of Industrial Training (CSC 6995)

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Introduction

This report describes the activities performed during a 3.5-month fulltime internship as a software engineer in Inovision, Inc. This document includes information of the company and responsibilities I took throughout the period from September 5 to December 20, 2018.

This report consists of the following sections: The first section is an overview of Inovision, Inc. The second section is a description of my responsibilities and duties during the internship. Then, I will give details of major tasks and projects I carried out. Finally, the report wraps up with thoughts and lessons I get from this experience.

Where I worked: Inovision Inc.

Inovision Inc. was founded in 1992. It offers products for closed loop fluid delivery and motion control. The services include software development, systems planning, design, maintenance and installation. Inovision Inc. also offers services to improve existing systems to make them updated and extend capital investment.

Inovision Inc. offers Turn-key Robotic Systems Integration, controls and software engineering services, robot programming and process engineering services, robotic system modular build and system testing, automation readiness audit (ARA) service. Some of the ongoing products include quality verification systems, smartsurface finishing, smartmix fluid delivery, medical equipment software. It collaborates with a lot of companies, like Ford, FCA, Zeiss, BMW, Toyota, GM, FANUC Robotics, etc.

Duties and responsibilities in the fall internship program

My title in the company is software engineer intern. My mentor is Jacob Allen, the senior software engineer in Inovision Inc.

My responsibilities include:

Develop code to add new features and/or fix bugs within internal business management systems;

Modify existing SQL Server database architecture and/or stored procedures;

Utilize technologies such as C#, MVC5, Entity FrameWork Code First, HTML&CSS, Bootstrap CSS, Javascript, and JQuery.

ASP.NET MVC

In this summer training program, the major platform I worked with is ASP.NET MVC on Visual Studio.

MVC is an HTML development environment. MVC stands for “Model”, “View”, “Controller”. The design of MVC separates the website into three layers, which results in increasing our control on the web application.

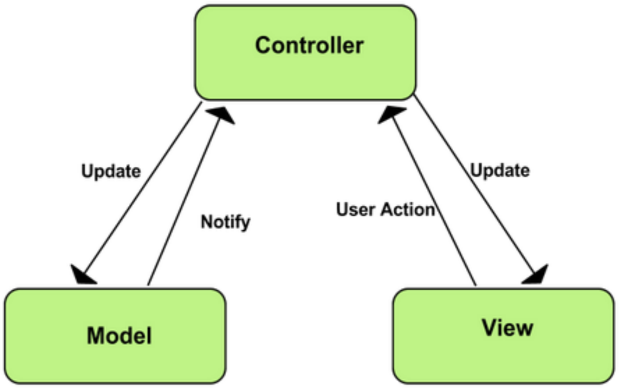


Figure 1. The scheme of MVC architecture

Model (M): Model is business logic and data. Model communicates with database. It can retrieve and store data in the database.

View (V): View is a user interface and displays data to the user. It is a set of user controls and web pages. The separation between the controller and view makes the application testable.

Controller (C): This is the logic layer which handles the user request. Typically, a URL request will be raised when a user interacts with View. A controller will handle the request and render an appropriate view. Controller plays a role as a coordinator between the View and the Model.

As MVC is divided into three layers, it is a loosely coupled development framework. The loose coupling has the advantage of reducing the complexity of the application and increasing the testability of the web applications.

Visual Studio

Visual Studio (VS) is an Integrated Development Environment developed by Microsoft. People use VS to develop web sites, web apps, computer programs, mobile apps and web services. VS produces native code and managed code as well. It uses Microsoft software development platforms including Windows Forms, WPF, Microsoft Silverlight, Windows API, and etc.

Intranet of Inovision, Inc

My main job is to maintain and improve the performance of the internal website of Inovision Inc. Via intranet, people within the company can easily share information. In intranet of Inovision, there are multiple functional sections, including daily log, time cards, purchase orders, contacts, jobs, organizations, travel, expense reports, etc. Employees can achieve almost all the tasks on this platform. For example, a purchaser can easily search for a purchase order using the order number or vendor name, and then get all the information of the purchase order details. And using searching by contact allows an administrator to easily obtain the daily log information, time card, expense reports attached to that person.

Main tasks I worked on

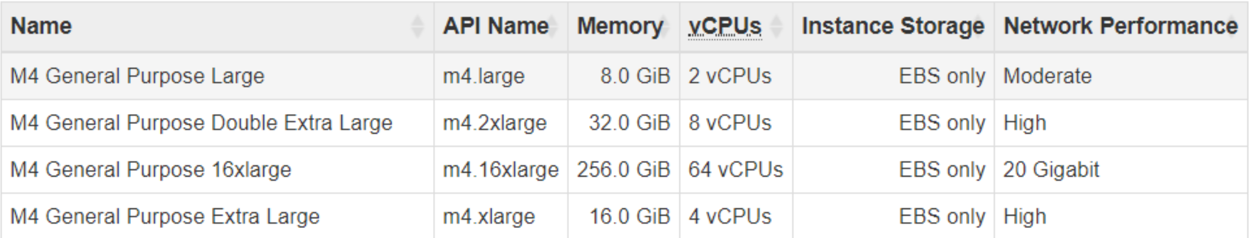
Task 1.

Problem defined: The goal of this task is to improve the performance of company website. It has been found that some web pages take a long time to load. For example, home page of accountant and administrator can take one minute to load. Another page with extremely long loading time is daily log page.

Approach: After investigating into this problem, I found that the slow loading of different pages has different reasons: for the accountant’s and administrator’s main pages, the loading time is long due to the reason that our current EC2 instance doesn’t have enough storage, while to improve slow loading of daily log page, I have to do code optimization.

Part 1.

Amazon EC2 is a web service providing resizable and secure computer capacity in the cloud. Its benefits include elastic web-scale computing, completely controlled, flexible cloud hosting services, integrated, reliable, secure, inexpensive, and easy to start. The current EC2 instance our company uses is m4.large. Fig. 2 displays a comparison among different M4 instances. Considering cost of each instance, m4.xlarge is a good choice. By transferring from m4.large to m4.xlarge, memory increases from 8.0 GiB to 16.0 GiB, and vCPUs increases from 2 to 4.



Name	API Name	Memory	vCPUs	Instance Storage	Network Performance
M4 General Purpose Large	m4.large	8.0 GiB	2 vCPUs	EBS only	Moderate
M4 General Purpose Double Extra Large	m4.2xlarge	32.0 GiB	8 vCPUs	EBS only	High
M4 General Purpose 16xlarge	m4.16xlarge	256.0 GiB	64 vCPUs	EBS only	20 Gigabit
M4 General Purpose Extra Large	m4.xlarge	16.0 GiB	4 vCPUs	EBS only	High

Figure 2. Comparison between m4-related EC2 instances

In order to test the new instance before applying it to the real website, I copied our current EC2 image and release it, so that our current website has an image website. I increased cache memory size for entities including ExpenseEntry, Assignment, TimeEntry, GoodsReceivedDetail, etc. Then I changed instance type of the image website from m4.large to m4.xlarge. It works well. Next, the instance type of the real website was converted from m4.large to m4.xlarge. Finally, the loading time of accountant/administrator pages was improved from ~40 seconds to ~2 seconds.

Part 2.

In order to figure out which function is the bottleneck causing the slowness. I used two methods: one is performance profiler, the other is to insert "stop watch" before and after the function we want to test.

Visual Studio provides many profiling tools to help people diagnose different performance issues. So as to measure performance of certain functions, I choose "performance profiler". In visual studio, from "Debug", choose "performance profiler", then start performance wizard, choose instrumentation, next choose the projects you try to measure, then finish. After this, the performance wizard starts a new IE window. In this window, open the pages you want to measure. After it's done, stop the wizard. At this point, a performance measurement report will be created for you. From this dynamic report, choose "functions". Then we can order the functions by the average elapsed inclusive time, and find functions which take most of the time, which is the "bottleneck" we are seeking for. Then I double checked with the function "stopwatch()", the results obtained from both methods agree with each other.

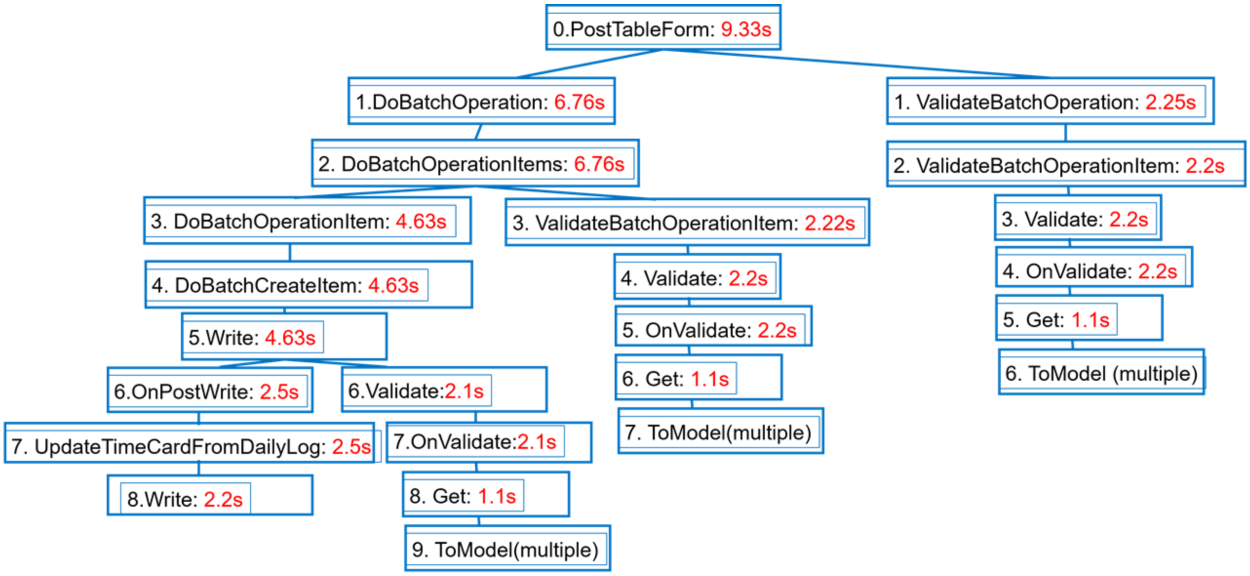


Figure 3. Function tree of daily log entry saving page

Based on the analysis report, I plotted tree structure of the functions with elapsed time labeled. As shown in Fig. 3, Get() calls function ToModel(). After more careful examination of performance profiling results, I find that ToModel() calls GetProjectManagerToString() takes majority of time as shown in Fig. 4. At the same time, GetProjectManagerToString() doesn't have much usage. Thus, I delete this function. This change dramatically improved the performance of daily log page loading. The loading time dropped from ~24 seconds to ~5 seconds.

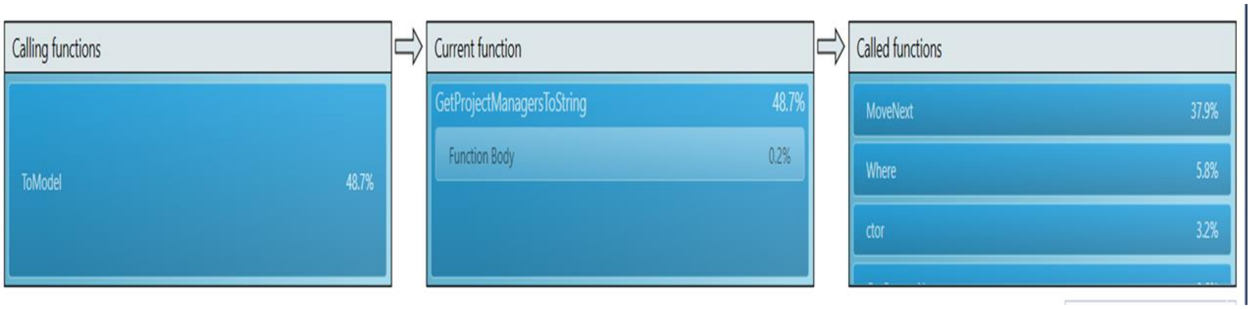
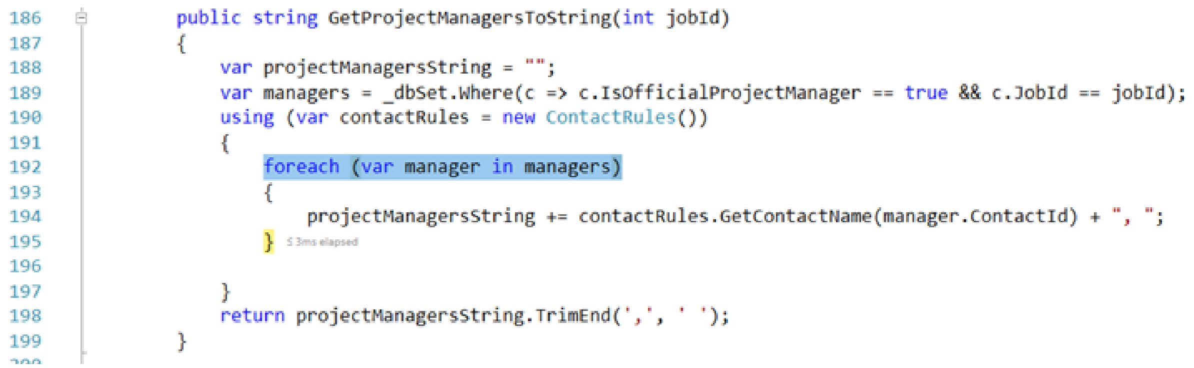


Figure 4. Called functions of ToModel()



```
public string GetProjectManagersToString(int jobId)
{
    var projectManagersString = "";
    var managers = _dbSet.Where(c => c.IsOfficialProjectManager == true && c.JobId == jobId);
    using (var contactRules = new ContactRules())
    {
        foreach (var manager in managers)
        {
            projectManagersString += contactRules.GetContactName(manager.ContactId) + ", ";
        } ≤ 3ms elapsed

    }
    return projectManagersString.TrimEnd(',', ' ');
}
```

Figure 5. Code of GetProjectManagerToString()

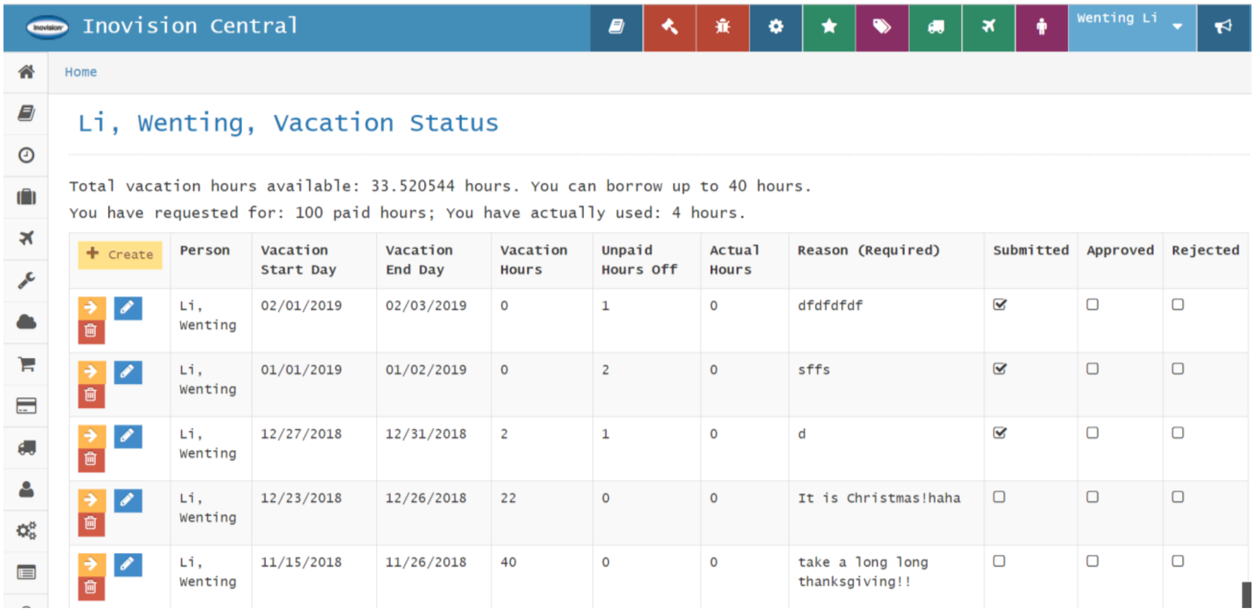
From this task, we can see that if we want to improve the loading time performance of web pages, we can investigate into whether the cache storage can be enlarged and whether the code and some sql queries can be optimized.

Task 2.

Problem defined: Currently, the company doesn't have vacation module in the intranet. When employees apply for vacation, they have to contact the manager and accountant to check whether they have enough vacation time available. The accountant has to perform all of these processes manually. Thus, it will be great if we can implement vacation module in our website, which will benefit both employees and employers.

Approach: The first step is to create scaffolding pages for the vacation related tables so that we can Create, Edit, and Delete the records. Follow the same pattern we use for creating, editing, and deleting from the Parts table. After this is done, we are able to view and edit records using the website. In this step, we don't need to worry too much about details, these may not be permanent pages, they are just to get started and we can make them more perfect later.

In the second step, I started to write business rules into codes. Of all the functions, his CalculateVacationTime() function is probably the most difficult part of the vacation time module, because it has to be correct for many possible variations. Also, this function should work retroactively. So, if I call it using the date of '1-20-18' it should give the correct result of what my vacation time was on that day from several months ago. Then, if I call it again using today's date, it should give me the correct result for today's date. So, the CalculateVacationTime method is central to the vacation time module.



Li, Wenting, Vacation Status

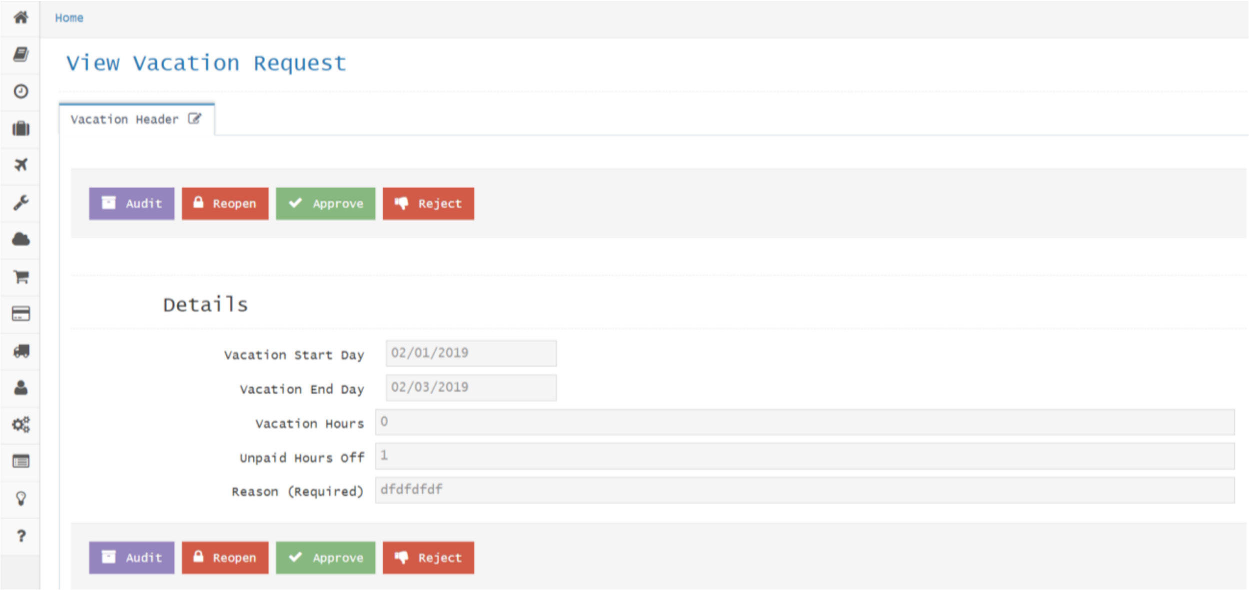
Total vacation hours available: 33.520544 hours. You can borrow up to 40 hours.
You have requested for: 100 paid hours; You have actually used: 4 hours.

+ Create	Person	Vacation Start Day	Vacation End Day	Vacation Hours	Unpaid Hours Off	Actual Hours	Reason (Required)	Submitted	Approved	Rejected
	Li, Wenting	02/01/2019	02/03/2019	0	1	0	dfdfdfdf	☑	□	□
	Li, Wenting	01/01/2019	01/02/2019	0	2	0	sffs	☑	□	□
	Li, Wenting	12/27/2018	12/31/2018	2	1	0	d	☑	□	□
	Li, Wenting	12/23/2018	12/26/2018	22	0	0	It is Christmas!haha	□	□	□
	Li, Wenting	11/15/2018	11/26/2018	40	0	0	take a long long thanksgiving!!	□	□	□

Figure 6. Vacation Status Page

The vacation rules include: After ninety days from start date, regular full-time employees begin accruing eighty hours of paid vacation time annually; After five years of employment, employees are eligible for 120 hours of vacation time; After ten years of employment, employees are eligible for 160 hours of vacation time; After fifteen years of employment, employees are eligible for 200 hours of vacation time. At the end of each year employees will have the option to carry over their unused vacation time into the following year or receive pay for the unused vacation time. If the vacation time is carried over to the next year it must be used prior to June 30th or it will be lost. Inovision allows employees to borrow up to forty hours against their unaccrued vacation time. If you borrow the maximum forty hours, you cannot take any paid vacation until you have accrued additional time. Any time taken off prior to you earning additional vacation time wil need to be taken as a non-paid day off. If the employment with inovision is terminated for any reason your final pay check will be adjusted for any accrued vacation time. If the accrued vacation time is negative you will be responsible for reimbursing inovision for that time. Part-time employees and independent contractors are not eligible for vacation time.

I managed to implement approximately fifty functions to achieve the expectations above. The final vacation request page, vacation adjustment page, and vacation rate page are shown is Fig. 7 – Fig. 9.

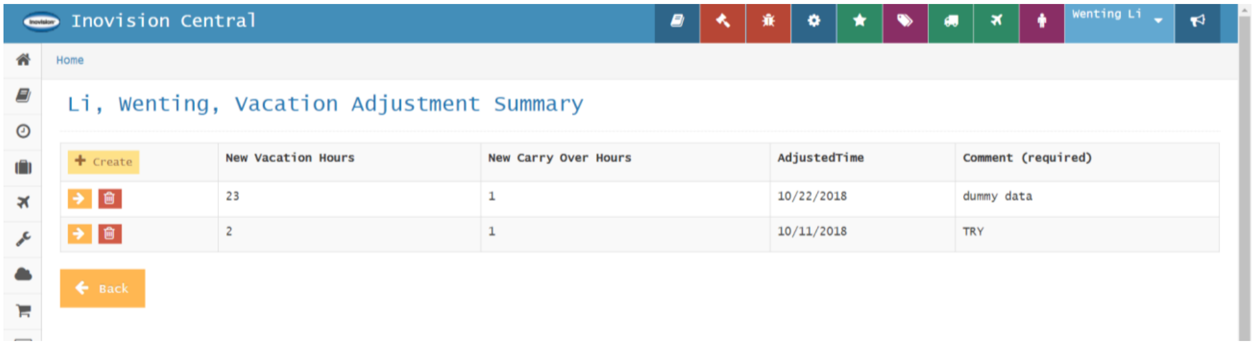


View Vacation Request

Details

Vacation Start Day	02/01/2019
Vacation End Day	02/03/2019
Vacation Hours	0
Unpaid Hours off	1
Reason (Required)	dfdfdfdf

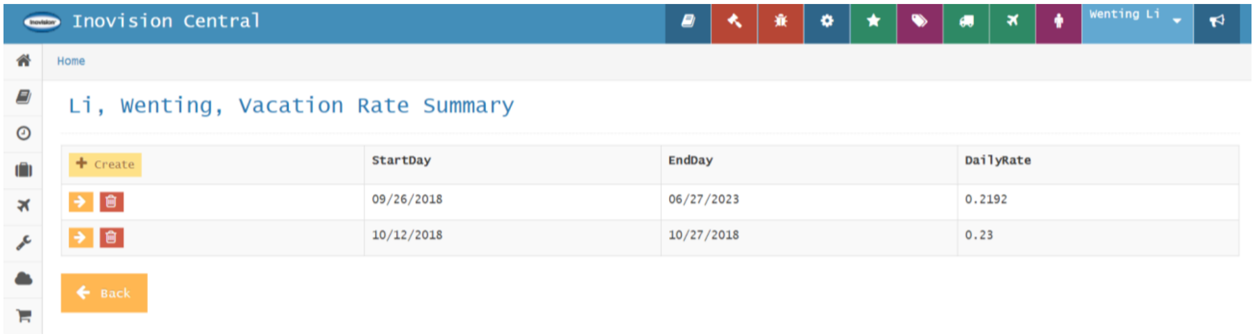
Figure 7. Vacation Request Page



Li, Wenting, Vacation Adjustment Summary

	New Vacation Hours	New Carry Over Hours	AdjustedTime	Comment (required)
	23	1	10/22/2018	dummy data
	2	1	10/11/2018	TRY

Figure 8. Vacation Adjustment Page

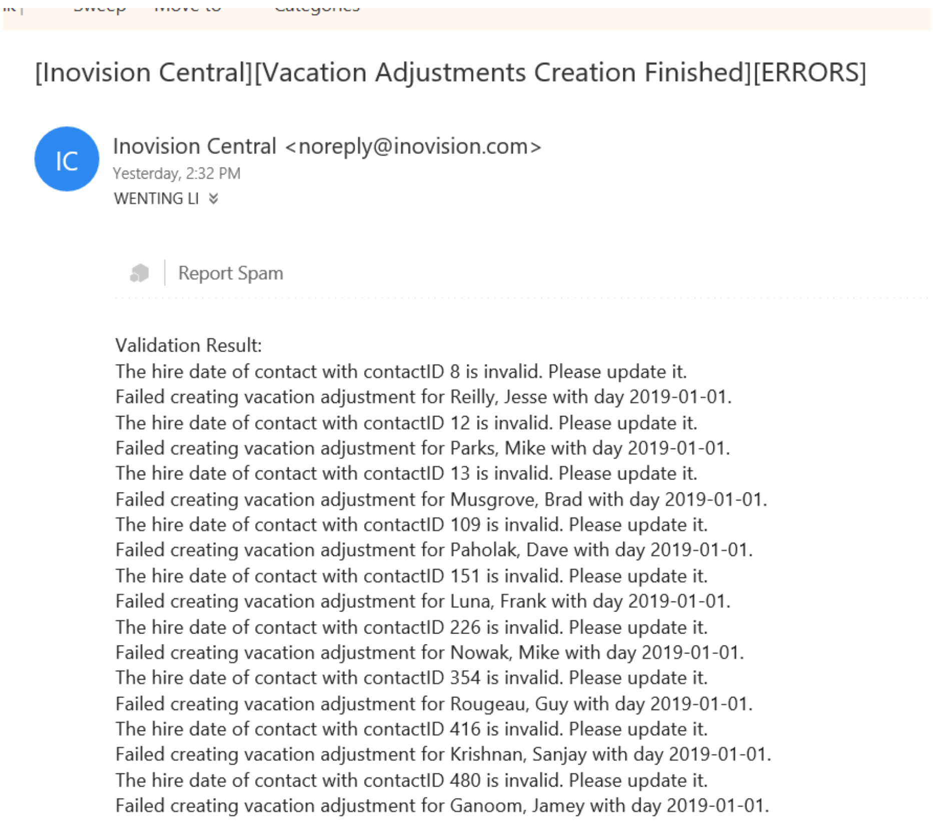


Li, Wenting, Vacation Rate Summary

+ Create	StartDay	EndDay	DailyRate
	09/26/2018	06/27/2023	0.2192
	10/12/2018	10/27/2018	0.23

Figure 9. Vacation Adjustment Page

In addition, I created batch vacation adjustments which occur at the end of year. BackgroundMailer.ProcessVacationAdjustmentEndofYear() was used for this purpose. My design is: On 12/31/18, for each person, the system calculates vacation hours available, and creates a new vacation adjustment for 01/01/2019. If the value of vacation hours is positive, the value is added to "new carry over hours" of vacation adjustment; otherwise, the negative value will be added to "new hours" of vacation adjustment. I tested the function with TestController. The error report was sent to my mailbox as shown in Fig. 10. The vacation adjustment failures in the email are all due to the problematic hire dates of these users. For users with normal hire dates, the process works fine.



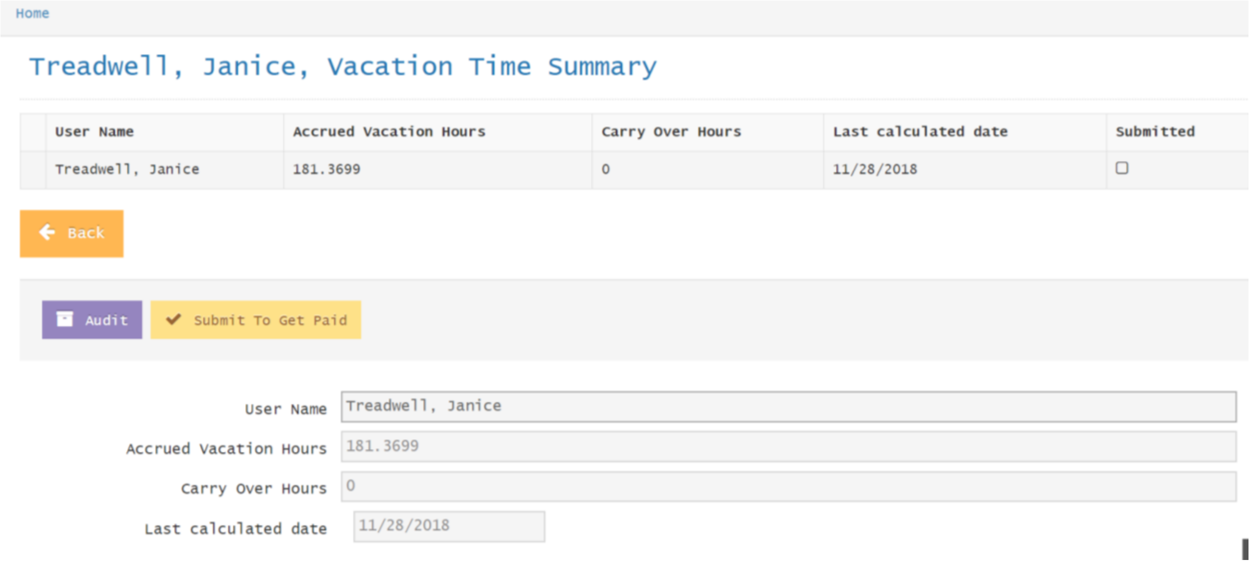
[Inovision Central][Vacation Adjustments Creation Finished][ERRORS]

Inovision Central <noreply@inovision.com>
Yesterday, 2:32 PM
WENTING LI

```
Validation Result:
The hire date of contact with contactID 8 is invalid. Please update it.
Failed creating vacation adjustment for Reilly, Jesse with day 2019-01-01.
The hire date of contact with contactID 12 is invalid. Please update it.
Failed creating vacation adjustment for Parks, Mike with day 2019-01-01.
The hire date of contact with contactID 13 is invalid. Please update it.
Failed creating vacation adjustment for Musgrove, Brad with day 2019-01-01.
The hire date of contact with contactID 109 is invalid. Please update it.
Failed creating vacation adjustment for Paholak, Dave with day 2019-01-01.
The hire date of contact with contactID 151 is invalid. Please update it.
Failed creating vacation adjustment for Luna, Frank with day 2019-01-01.
The hire date of contact with contactID 226 is invalid. Please update it.
Failed creating vacation adjustment for Nowak, Mike with day 2019-01-01.
The hire date of contact with contactID 354 is invalid. Please update it.
Failed creating vacation adjustment for Rougeau, Guy with day 2019-01-01.
The hire date of contact with contactID 416 is invalid. Please update it.
Failed creating vacation adjustment for Krishnan, Sanjay with day 2019-01-01.
The hire date of contact with contactID 480 is invalid. Please update it.
Failed creating vacation adjustment for Ganoom, Jamey with day 2019-01-01.
```

Figure 10. Sample Vacation Update Error Report

I also added functions to allow people to get paid for unused vacation hours. In order to keep track of the submission status, I added two fields “SubmittedById” and “SubmittedTime” to “VacationTimes” table. Before submission, the screen is shown in Fig. 11; After submission, the screen is like Fig. 12. Besides, I added audit button to vacation related pages, taken holiday into consideration when calculating vacation time, solved back button problem, and fixed some other bugs.

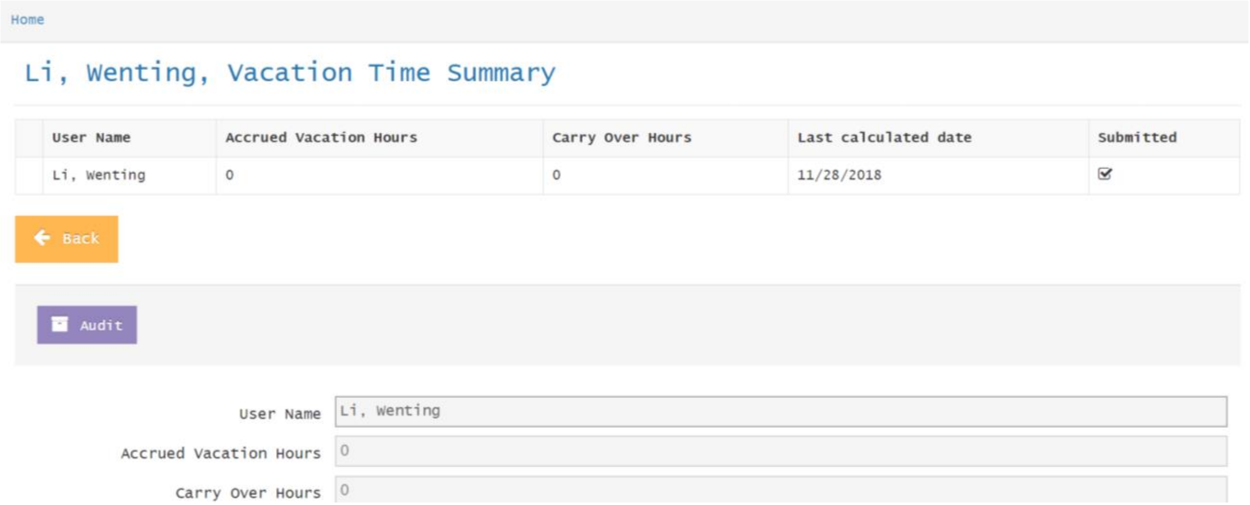


Treadwell, Janice, Vacation Time Summary

User Name	Accrued Vacation Hours	Carry Over Hours	Last calculated date	Submitted
Treadwell, Janice	181.3699	0	11/28/2018	□

User Name	Treadwell, Janice
Accrued Vacation Hours	181.3699
Carry Over Hours	0
Last calculated date	11/28/2018

Figure 11. Unused Vacation Screen Before Submission



Li, Wenting, Vacation Time Summary

User Name	Accrued Vacation Hours	Carry Over Hours	Last calculated date	Submitted
Li, Wenting	0	0	11/28/2018	☑

User Name	Li, Wenting
Accrued Vacation Hours	0
Carry Over Hours	0

Figure 12. Unused Vacation Screen After Submission

Conclusion and Reflection

Using knowledge and skills learnt from school

Working on the website of the company requires a solid knowledge background of web development, database management, algorithms design and analysis, etc. The knowledge used in the company is closely related to what I learnt from the courses taught at Wayne State University, including but not limited to CSC6580, CSC6710, CSC5850. The internship is a precious opportunity for me to apply the knowledge I learnt from school to industry.

Learning techniques and skills used in industry

What I benefited most from the internship is to have close look at advanced technology that the companies are using nowadays. After this 3.5-month internship, I became proficient in coding with C#, HTML, Javascript, Jquery, etc. The techniques used in companies are similar to what I used to practice at school, but way more complicated. Trouble shooting and making website run smoothly can be time-consuming. But nothing can match the satisfaction of solving problems and making things work. With my efforts, now the intranet has improved significantly and become more user-friendly. I also added a bunch of useful functions to the intranet, like adding the function for showing different color for different status in goods received page, add job configuration tab to job, etc. I also improved a lot myself compared to the beginning of the internship. At the beginning, it took me several days to finish one small task; now I can finish several tasks in one day.

Enhancing communication skills

My communication skills also improved a lot owing to the internship. In order to get work done and done well, it’s important to convey your message to the others as well as understand others. By discussing with my supervisor and coworkers, I learnt a lot about how to talk more efficient. One skill I learnt is to summarize the thoughts before talking. In this way, communication can be very efficient.

In conclusion, I have improved a lot thanks to the precious internship opportunity. The internship experience has allowed me to gain practical experience and given me an insight into the industry world. I sincerely believe the experience is helpful for my career in the future.