

Administration and Scheduling -

- a web development comparison



LUND UNIVERSITY

Campus Helsingborg

LTH School of Engineering at Campus Helsingborg
Department of Computer Science

Bachelor thesis:
Oscar Kollert

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LTH School of Engineering
Lund University
Box 882
SE-251 08 Helsingborg
Sweden

LTH Ingenjörshögskolan vid Campus Helsingborg
Lunds universitet
Box 882
251 08 Helsingborg

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Abstract

This thesis delves into small business administration and scheduling through interviews with two different types of businesses within the service sector. A nightclub and an inn. As part of the project, a prototype with the basic functionalities has been developed. An analysis is made of the strengths and weaknesses of different administration and scheduling techniques and an explanation is given of why these businesses would benefit from the software being developed in this project.

The solution is an administration and scheduling web application. It utilizes ASP.NET MVC 5 framework to create a working environment for small businesses to administrate their needs. The result became the groundwork for the final solution which is intended for future development.

The website result became a web application with user authentication through login. When a user is authenticated he will have access to the administrative tools and the scheduling system. When a new user is registered he will not have access to the systems till he has been authorized by an administrator or moderator. The scheduling system utilizes a JavaScript based calendar called fullcalendar and modals to handle user input. The tools provides a means to schedule users in a calendar, duplicate chosen days/weeks for a set amount of weeks forward. These features make managing employees easier by giving managers tools to effectivize scheduling as well as help keep track of who is employed.

A comparison is made between different web development frameworks and languages. It delves into the different strengths between: ASP.NET MVC, ASP.NET Webforms and PHP.

All methods listed have strengths and weaknesses or aspects they lack. ASP.NET MVC ideal for systems that can make use of a higher standard of organization of code. It segregates the different aspects into model-view-controller making the organization easier and logical. Webforms has the advantage of state based coding. Letting session keep track of information client side. This allows for some interesting web application usage. PHP is a coding language specialized for web development. The best part is its versatility. It is possible to find a framework that specifically caters to your needs in your project and allows development in whatever OS you want (Windows, Mac OSX, Linux, Unix.). It also is completely free to develop using PHP. No royalties or paid hosting to set up a working website.

Key words: Web development, PHP, ASP.NET MVC, ASP.NET Webforms, Comparison, Administration, Scheduling.

Sammanfattning

Detta examensarbete fördjupar sig i tekniker för administration och schemaläggning för små bolag genom intervjuer med två olika typer av bolag inom service sektorn. En nattklubb och ett värdshus. En analys av styrkorna och svagheter och en förklaring av varför mjukvaran som utvecklas i detta projekt är förmånligt för bolagen.

Lösningen är en administrations och schemaläggnings webapplikation. Den använder ASP.NET MVC 5 framework för att skapa en arbetsmiljö för små bolag att lösa sina administrationsbehov i. Resultatet blev en prototyp till slutgiltiga lösningen som ska utvecklas vidare i framtiden.

Webside resultatet blev en enkel web applikation med inloggning. När användaren authenticeras kommer användaren åt administrations verktyg samt schema systemet. När en ny användare registreras har de inte åtkomst till schema systemet tills de har godkänts av administrator eller moderator. Schema systemet använder en JavaScript baserad calender fullcalendar och modals för att hantera input från användaren. Verktygen tillåter att schemalägga användare till dagar i en kalender, duplicera valda dagar/veckor antal veckor framåt. Dessa funktioner gör att hantering av anställda lättare genom att ge chefer verktyg som effektiviserar schemaläggning samt hjälper hålla koll på vem de har som anställda.

En jämförelse görs mellan olika web utvecklingsframeworks och språk. Den diskuterar de olika styrkorna mellan: ASP.NET MVC, ASP.NET Webforms och PHP.

Alla metoder har sina styrkor och svagheter eller fördelar de saknar. ASP.NET MVC är ideal för system som kan ta sig till nytta av högre standard av organiserad kod. Den segregerar de olika funktioner i model-view-controller vilket tillåter organiseringen av kod enklare. Webforms har styrkan att den använder state baserad coding. Det tillåter sessioner hålla koll på information på klienten. Detta tillåter för några intressanta web applicationer. PHP är en kodnings språk som specialiserar på web utveckling. Det bästa är des versatilitet, man kan hitta en framework för specifikt det man behöver och tillåter att man utvecklar i valfri OS (Windows, Mac OSX, Linux, Unix.). Det är också helt gratis att utveckla i PHP.

Nyckelord: Web development, PHP, ASP.NET MVC, ASP.NET Webforms, Comparison, Administration, Scheduling.

Foreword

The development process of the thesis solution is not a complete project. It is the groundwork for the product, and currently has limited functionality which may change in development at a later date.

I would like to thank and express my gratitude to Ola Flodin, Peter Kollert, Alex Cronhamn and Tina Kjellberg for their contributions to this thesis.

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1 Introduction

Work experience of the author within the service sector, be it restaurants, nightclubs or event galleries, showed that there was always a distinct lack of software and digital oversight, or a struggle to acquiring and implementing one as mentioned in the article (Patrick Y.K.Chau, 1995). Everything was managed through a single person on site. Said person had to be informed of every change of schedule, he/she had to be apprised and handle missing personnel without any tools aiding in his/her decisions. This bachelor thesis focuses on the development of a web application prototype that has the further development goal to become a product for these businesses. The aim is to assist the managers with their employee management and scheduling.

1.1. Background

This thesis is undertaken as the sole proprietorship of the company under the name Oscar Kollert. The company was created to broaden the possibility of consultation work with companies globally. The consultation work has consisted of varying IT solutions with companies outside of Sweden, varying from normal data deciphering to development of simple software.

This thesis can have relations to all administration and scheduling systems, web development using the Model-View-Controller (MVC) structure. MVC is used to separate code into different categories. Model defines the data that the controller has access to. The View defines all visual aspects making use of controllers to interact with the user. The controller passes the model over to the view and defines how the view interacts with the users and the databases if available. More on MVC can be found in chapter 3.2.

The software development project that is a part of this thesis is a version catered to smaller businesses, focusing on effectivizing and giving the tools for employers and employees to ease the management of their duties within their business area.

What this thesis enables is a comparison of different web development tools for these kinds of solutions. It gives an overview of modern web development with its benefits and downsides in comparison to other alternative languages and frameworks.

1.2. Aim and goal

In this thesis an understanding of web development and the different options available will be analysed, compared and the benefits and cons compared to one another will be disclosed. It also delves into current small business practices of administration and schedule handling.

The goal is to have a prototype ready using Asp.NET MVC development as a structure. The prototype will contain some of the functionality found in the documentation "Requirement Specification" found in Appendix A. The current state of the prototype can be found in chapter 4, Results.

1.3. Problem definition

The thesis has a large focus on the technical aspect of the development. Whilst attempting to get a decent picture of the need and use of administrative software. These questions are thereby focused on the benefits of the current development choices and comparisons to the alternatives. The administrative area are focused on experience of interviewees and what software currently exists on the market that benefit small businesses.

Which methods are currently being used by small businesses within the service sector to fill their administrative and schedule-handling needs?

1. Which methods are currently being used by small businesses within the service sector to fill their administrative and schedule-handling needs?
2. Are there any other products that effectivize or automate these methods above? Are they affordable and directed towards small businesses?
3. What can be done to streamline the methods pertaining to administration and scheduling of employees?
4. What benefits does MVC structure give developers compared to other established structures?

1.4. Limitations

There are too many different web development frameworks and languages to encompass in a comparison in any constructive manner. Comparisons will focus on ASP.NET MVC, ASP.NET Webforms and a overview of PHP web development.

The Requirement Specification goes beyond the scope of the thesis, since it is written as a first iteration of a final product not a prototype. The prototype will have a more limited set of functions. The idea is to have the groundwork of the final product ready as a prototype.

2. Methodology

The thesis is divided into two different parts. A practical implementation of a prototype of an administration and scheduling web application and an analysis and conjecture of used practices of small businesses. The analysis has an effect on the implementation, since it provides a baseline of the needs small businesses require.

The implementation aspect revolves around planning in a Kanban project method as described in (Howard Lei. Farnaz Ganjeizadeh. Pradeep Kumar Jayachandran. Pinar Ozcan, 2017), chosen for its freedom of changing the content of the development cycle.

Kanban allows for focus on one selected task at a time. Taking it through several stages: Idea, Working On, Functional, Testing and Done. Requirements would be listed in the Idea, divided into different tasks and separated and worked on through the different stages.

The basic principles of Kanban:

- Limiting Work in Process (WIP).
- Pulling value through the development process.
- Making the development process visible.
- Increasing throughput.
- Using a fixed backlog.
- Embedding quality.

In this project WIP is by default limited since there is only one developer working on one task at a time. This is also a reason why the choice was made to work with Kanban. In the article (Howard Lei. Farnaz Ganjeizadeh. Pradeep Kumar Jayachandran. Pinar Ozcan, 2017) it states that Kanban is great to visualize what needs to be done and keep track of where one is in the development. This is done in this thesis through tables consisting of: Todo, Working on, Done Not Tested, Done Tested. A task would start in Todo then work its way to Done Tested through each other table. When managing several tasks, this helps keep track of what is under development.

2.1. Project Method

The development process started with a research and design phase, where interviews and design questions (which framework, layout of webpage) were created and analysed. Next step was to define the requirement specifications using ideas from previous work experience and suggestions from colleagues. The Requirement Specification [Appendix A] goes beyond the scope of the thesis, but is still used as the source for the tasks for the prototype. This is due to the fact that the Requirement Specification was created as a frame for a finished functional product. It contains functionality that would not be feasible to be functional within one month of development. The Requirement Specification with this in mind, was then used to create the foundation for further development.

Tasks from the Requirement Specification used Kanban as a practical way to organize what needs to be done in specific segments of the prototype. Tracking the tasks in the chrome addon Todoist to keep track what needs to be done through each iteration and what has been completed and when.

The Requirement Specification was used to create the tasks in Todoist. When a task is created it is also estimated how much time is required to complete. If a task is too large or encompasses a complex system it is divided into several subtasks. Once each subtask is complete then the larger task can move ahead into the next phase. If a task was found to have its time estimated incorrectly, it was labelled and the planning modified to accommodate the change.

Often during development literature studies is needed to be done to comprehend different aspects of ASP.NET MVC development when getting stuck. Making use of discussion forums such as StackOverflow where other experts answer questions about different solutions to different abstract problems. The best answers are voted by fellow developers leading to quality and detailed solutions and answers to problems making it easier to see if answers are reliable.

For the research phase of the thesis focused on administration and scheduling methods, interviews were conducted to get an image of how small businesses conduct administration and scheduling. Flexibility was the emphasis during the interviews.

There were 3 main questions asked at the interview:

- How do you administrate your workforce?
- How do you schedule your workforce?
- How much time does administration and scheduling take up?

Then after presenting these questions, the thesis solution is then presented to the interviewee.

From there the interviews goes beyond its needs with follow up questions based on the answers and reactions. The input from presenting the solution of the product would show if there is an interest or not in the participants.

2.1.1. Interviews

Interviews were seperated into two categories, scheduled interviews with a set time and spontaneous inquiries to local businesses and their staffs. Two scheduled interviews were made and 5 establishments were selected for the spontaneous inquiries. All interviews were done face to face. The plan was for more planned and spontaneous interviews, but not many wanted to answer questions.

The only difference between the planned and spontaneous visits was the possibility of presenting the product and the amount of time taken to discuss the thesis. Where the planned interviews had more time than the spontaneous ones.

Tina Kjellberg

Tina owns Kullagårdens Wårdshus in Mölle. It is a restaurant and inn/hotel. She manages all forms of administration for the business.

To start with, the software and the implemented and planned functionalities were presented to Tina. This came in the form of a presentation using Google Slides.

Subsequently a comparison was made with her current business model, which was the classical use of pen & paper for both scheduling, time keeping and administration. Discussions were held to the advantages and disadvantages between the software and her current solution. She argued that her current system is working well for her, but after some further discussion she concluded that although her current might work and she is more comfortable using it, she could consider trying out the software because of the potential time saving and traceability it could offer.

She had a booklet to keep track of employees and posted a new schedule every month on a wall. All this done manually by hand. Employees wrote in a booklet when they arrive and leave for the day.

Management of leave and reporting of illness all handled through phone calls directly to her. She hired an accountant to handle pay management for the employees.

Following the discussions between pros and cons of the software, inquiries were made about other companies around her. According to her most small businesses in the area around Mölle utilize the same technique as well as keeping track using excel or other digital support like google docs.

Alex Cronhamn

Alex works at Etage, a nightclub situated in Stortorget in Malmö. He has responsibility over everyone except the bartenders and the manager. The manager handles events and overview.

During the interview it was established that all schedules and employee management was handled through Excel. The only thing handled in a booklet was employees reporting in and out of work. Illness reporting and leave of absence requesting is done through direct phone call to the manager. After showing him the system in its current form, he expressed interest in the end product. He concluded that they would have much use for such a system, since that would give them an alternative when the manager is unreachable.

Employees from restaurants and bars across Möllevångstorget in Malmö

Whilst attempting to get interviews with people in management positions at bars and restaurants around Möllevångstorget wasn't fruitful, most declining whilst others were difficult or impossible to get a hold of. Instead, interviews were conducted with staff during low business intensive hours.

All of the establishments either used excel or pen and paper to handle scheduling and administration. None of them used any form of digital overhead. After showing the employees a list of features the project would provide was met with approval and positive reflections. The software could potentially give a better schedule overview and accessibility as well as giving a more efficient handling of schedule changes.

Notes were taken where it was possible. Often notes were taken after the interviews.

Establishments visited with interview of staff: Restaurang Nyhavn Bar & Pub, BOB's Bar & Restaurang, Ölkaféet: Restaurang -sportbar & Cafe , Sara Restaurang och Pizzeria, Häng Bar.

2.1.2. Result of Interviews

The result that stands out the most of the interviews is the lack of digital oversight for administration within small businesses such as restaurants, nightclubs and inn/hotels. Within a business that has a very small employee pool such as Kullagårdens Wårdshus the software seemed excessive from their point of view. But for a business like Etage or the restaurants and bars around Möllevångstorget, where they have a very flexible employee pool from day to day, the software would shore up issues with handling employees and save time in making the schedules.

2.1.3. Complications

Due to unforeseen issues the interviews were delayed and/or cancelled, forcing the planning to go into the next phase without the required interviews for analysis and complementation of the Requirement Specification. Due to this issue, assumptions were used to create viable requirements in the Requirement Specification that were then modified when the interviews were held.

Due to the inability to find any survey or article about digital tools used within administration or scheduling for smaller businesses, the analysis relies on the interviews.

2.2. Criticism of the Sources

Many sources have been from discussion forums, where experts discuss different advantages between different approaches of web development.

1: Chau, P.Y.K., Factors used in the selection of packaged software in small businesses: views of owners and managers

An article that goes through the different views between owners and managers. Makes mentions about how small businesses try to find or implement software into their business practice. Reliable due to thoroughness.

2: Lei Howard, Ganjeizadeh Farnaz, Jayachandran Pradeep, Kumar Ozcan, Pinar, A statistical analysis of the effects of Scrum and Kanban on software development projects.

An article that goes through the principles of Kanban and its effects. Coincides with textbook Kanban.

3: Biggest advantage to using ASP.Net MVC vs web forms - Stack Overflow., 2008

A discussion between professionals where a voting system defines the best answer to the question. In this case it is a discussion between the pros and cons of using MVC over webforms. This session has been going since 2008 and the voting has been elaborate enough to select two choices, one more brief and abstract, the other detailed. One can follow the discussions underneath each question for more in-depth view of what people inquired about. This article is valid since it is a documented discussion between experts. Where they put forward their experiences in the use of the different methods. Reliable since it is an open discussion on a mostly professional forum.

4: Liu Peng, Li Zhizhong, Human Error Data Collection and Comparison with Predictions by SPAR-H.

A reference to human error. Thorough study of human error.

5: Tina Kjellberg, Kullagårdens Wårdshus

Interviews with Tina Kjellberg.

6: Ted French, What is Microsoft Excel and What Would I Use it for?

Simple explanation to what exactly Excel is and what to use it for.

7: Schedules and Planners

A reference to templates in excel specialized for scheduling. Official website.

8: Quinyx Staff Management Software: Full Feature List, 2016

Official website of Quinyx, contains a full feature list of their software.

9: Trygve, Trygve/MVC, 2016

A website made by the creator of MVC. He delves into the original idea behind MVC before it was changed to what it has become today. Reliable since it is made by the inventor himself.

10: ScottGu, ScottGu's Blog - ASP.NET MVC Framework, 2014

A website promoting MVC development. Goes into detail on the key benefits developers will be able to utilize. Reliable since content correlates with reliable references.

11: DoFactory, Why should we use MVC vs normal ASP.NET? , 2016

A good summary of the benefits of MVC. I have not used doFactory.com much for open discussions, but these summarized points are supported by other references.

12: When to favor ASP.NET WebForms over MVC, 2016

A discussion in favour of ASP.NET Webforms. It provides arguments on both sides of the spectrum. Bringing clear advantages in specific situations. Reliable since it is an open discussion on a mostly professional forum.

13: 10 Advantages of PHP over other languages, 2013

A listed advantages of PHP. May be biased.

14: Kazi Manzur Rashid, Kazi Manzur Rashid's Blog - ASP.NET MVC Best Practices (Part 1), 2014

A guide on how to simplify coding for ASP.NET MVC projects. It has been very insightful with tips and tricks on how to structure the code for efficiency and ease of use. A two part

segment, but have only taken excerpts out of the first segment. Reliable since the techniques described are detailed and effective.

15: Stephen Walther, Top 10 Changes in ASP.NET 5 and MVC 6, 2015

Used to provide feedback about Microsoft stop supporting Webform since ASP.NET 5.

3. Analysis

3.1. Administrations and Scheduling

3.1.1. Methods used by smaller businesses

After interviewing small businesses within the service sector around Skåne it was obvious that they have, for the most part, been using paper and pen approaches to handle all administrative and employee scheduling needs. This has some disadvantages and can consume the administrators time immensely. The fact of the matter is that people, no matter how talented or motivated, make mistakes. It is completely human, nobody is infallible. Without a form of oversight, mistakes are left undiscovered and may cause the business harm or inconveniences. Due to the lack of documentation and corrective measures, errors also tend to be repeated over and over which is discussed in the article about human error in (Liu, P. and Li, Z. 2014).

Administration:

Administration in this thesis is defined as the focus of managing and keeping track of employees.

Within administration of employees, the most common method is paper and pen for business owners of the late generations. They have been using it for decades and tend to trust themselves more than any system that currently exists. This is in small part due to them not being accustomed to technology as opposed to the younger generations that have partially grown up with digital tools. This does however does not mean they are completely averse towards the advantages a system backing them up would provide. Newer businesses and businesses owned by younger generations tend to be attracted to digital tools, if by the sole reason that they are used to using digital software to solve their needs, this taken from the interviews by (Oscar Kollert 2016).

Paper and pen has the advantage that everything is personally made, hand written. It demands the user of the technique to put more time and effort into it, thereby making them personally remember it better. The disadvantage is that it takes time. And considering its nature of changing as employees leave and enter their employment, it can get cluttered. Of course, this is only a minor issue for administration of small businesses, the important fact is as their businesses grow, more and more time will have to be put on this specific method. Furthermore, having multiple people handle administration is impossible, since there is only one physical original.

Excel is a electronic spreadsheet software. Data is stored in tables organized in rows and columns. It is a tool to store data in spreadsheets (Ted French, 2016). It is commonly used by many to both share and have a frame for every month that comes up. There are many

advantages in using excel for administration. Wage handling is easily modified, checked and can be used to calculate the exact amount the employee has earned each month. Searching for specific employees is simple. But again, as with paper and pen, there lacks any automated form of oversight. Human error is still a factor.

Various administrative software, such as QUINYX, is also used by a very small minority. Some of the interviewees remarked that companies they knew of that have used administrative software even reverted back to either excel or pen and paper method. Reasons for this vary, some do not find that the software used gives any advantages and restricts them unnecessarily. Examples would be small businesses getting a software that larger businesses use. They pay a hefty fee and only use a small aspect of the software. Now they are stuck with software that go way beyond their needs, and are obliged to keep using the software since they have invested in the package.

Scheduling:

As with administration of employees, scheduling of employees has various methods to keep track of employees schedules. Tools to help keep track and editing said schedule vary from writing by hand, using excel or using software specifically developed for the purpose.

Pen and paper is not as prevalent since it has to be redone, by hand, every month and have access to a scanner to make copies or to digitize it. This consumes quite some time, since the administrator has to keep track of who is available, what positions they have and who they do or don't work well with. Editing it has to be done to all copies, it can get cluttered if too much many changes are made.

WEEKLY ASSIGNMENT SCHEDULE						
WEEK OF 2/2/2015						
PROJECT	MON	TUE	WED	THU	FRI	SAT/SUN
[Project A]	[write notes]					
[Project B]	[write notes]					
[Project C]	[write notes]					
[Project D]	[write notes]					
[Project E]	[write notes]					

Excel is an excellent tool to keep track of every day of every month (Schedules and Planners). It solves the issue of clutter since changes can easily be made. The issue still is that there is no oversight, and you still have to keep track of every employee.

Other scheduling software is not used by smaller businesses. This has been noted through interviews that; many cannot afford the systems big businesses use, they often restrict and have many more functions than what they actually need.

3.1.2. Existing Solutions

Excel and Manual bookkeeping

Whether administrators keep track of employees and schedules by hand or using excel the model mostly look the same. To keep track of employees, business owners keep track either

in a booklet or in an excel file. There they store contact info, bank account numbers, wages and personal notes. Then to keep track of which days employees have worked they have a booklet on site where each employee signs with date and time of when they start and end. The manager then has to manually cross reference the booklet to the schedule to make sure there is nothing wrong.

Schedules have the same look about them, be they weekly or monthly. Usually a copy is sent to the employee's email.

QUINYX

The QUINYX software, as found and described in (Quinix, 2016), encompasses this project and more. The major difference between QUINYX and what this project aims to be is that this one is web based whilst QUINYX is an installable client. There are pros and cons for both, but the accessibility of schedules outside of the client is what this project's comparative strength would be.

Quinyx contains:

A scheduling and administration of employee system with a report feature to summarize desired information. This is available for employees to access via an app on their phones. The employees have access to swap shifts with coworkers, apply for leave, book future shifts and are able to register arrival and departure from work.

A task management feature. Able to get a graphical overview of workflows and processes to better help keep track of company processes. Easy sharing of documentation to employees. Employees app variant are able to track and manage tasks from their phones.

A timestamp feature. Allowing employees to punch in and out of work. This allows for salary files to be generated automatically on demand.

A budget feature. This allows the administrator or manager to keep track of the businesses annual or monthly budget.

A forecast feature. This enables employee scheduling depending on bookings if the business allows. For example restaurants can use this feature to plan the amount of employees working each day based on the standard and with the current bookings for the day.

A communication feature. Allows simple messages via sms, e-mail or Qmail. Employees are able to utilize this feature as well.

Overall Quinyx is what this project aims to be if observed solely through its features. The difference is its execution. Quinyx is a client based software whilst this thesis is web based, where the advantages of accessibility regardless of which PC you use may make this project more attractive.

3.2. ASP.NET MVC development

MVC has been around since its invention by Trygve Reenskaug in 1978 (Trygve, 2016). Since then there have been many different frameworks that utilize and enforce the method. In its core, it is about segmenting different aspects into different sections. There are 3 main

sections: The model, the view and the controller. Each handle different aspects. Figure 2 displays the interaction of each aspect.

The model contains the state of the application, stored in a table of a database. In this thesis's solution this would be all the data for the users, the different events in the schedule, each user role and the administrative settings.

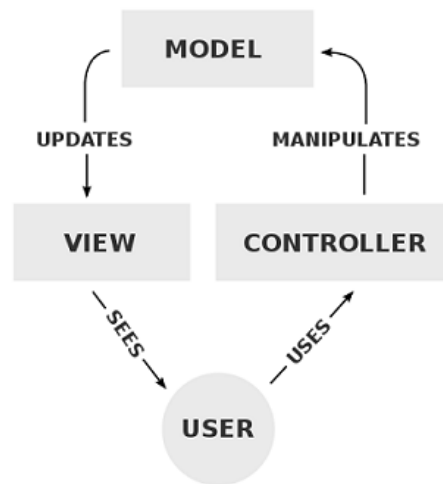


Figure 2 - MVC model

The view handles aspects that have to do with the user interface. All visuals can be safely put into the view. This would be where all html code will be stored.

The controller is where all interaction and rules the end user utilizes exist. For example, in the solution presented there are different forms and input labels. In the controller, the rules of what is acceptable input as well as what should happen when the form is submitted is defined. Essentially all logic behind the user interaction is handled here (ScottGu, 2007).

3.3. Benefits

One of the first aspects anyone starting out using MVC is the separation of concerns (SoC). From a developer's standpoint, the organization of code is efficiently structured and minimalistic. This helps the developer to scale the web application's functionality. It also makes designing web apps in the ASP.NET MVC environment logical and structured.

Client side tools such as jQuery are easily integrated into your development. This is a great advantage since usage of these tools are increasingly common within web development as discussed in public forums in (Stack Overflow Community, 2008).

URL's are RESTful (i.e. mywebapplication.com/users/ 1 - retrieve user with an ID of 1 vs mywebapplication/users/getuser.aspx (id passed in session)). This makes the application search engine optimized (SEO). The web application is also stateless, which helps prevent issues of users causing session collision (opening multiple windows of the same session causing problems for the server). MVC follows the stateless web protocol. Thus removing viewstate that webforms relies upon.

Developers who need full control over the design of the web application will enjoy that compared to web forms. They have complete control over what is rendered in the HTML.

Something to consider is that compared to web forms, the HTML forms are much smaller than the web forms variant. This can give quite some performance boosts.

One of the selling points for developers who love test driven development (TDD) is that ASP.NET MVC you can base entire projects over TDD. MVC has an easier time creating tests for the web aspect. Making having additional layer of tests to catch unexpected behaviour found in (Stack Overflow Community, 2008) and (Rajesh Pillai, 2016).

The ability to have more than one form per page is a giant seller for developers of web applications. Webforms lacks this versatility which is argued in the public forum (Stack Overflow Community, 2016)

3.4. Disadvantages

The learning curve of MVC development can be quite a hurdle for developers used to webform development. From experience, learning the structure and actually understanding it practically took some getting used to. But once you understand how the connection between Models, Views and Controllers behave it becomes a simple matter of navigating files and implementing functionality within each aspect.

3.5. Web development alternatives with advantages

3.5.1. ASP.NET Webforms

In (Stack Overflow Community, 2008) it is argues that the web application supports state, which is used to give a user experience as if the application knows what the user has been doing. Webforms eases the complexity of this for the developer.

Webforms supports Rapid Application Development (RAD). This is essentially the ability for quickly and easily creating prototype webforms applications. Essentially it highlights a lighter learning curve for new developers.

Webforms has an integrated toolbox that offers premade controls for easy setup. This however leaves less control over the visual aspect.

3.5.2. PHP

In the webarticle (*10 Advantages of PHP over other languages*, 2013) it is discussed that PHP has been a long-standing alternative to web development. The code used is specifically created to handle web development projects.

Today it is one of the major languages people use for web development as pointed out in (Yoshitaka Shiotsu, 2014). Facebook and Wordpress both utilize PHP making the language a credible choice when deciding what language to develop in.

PHP is easy to learn. It has similarities to C and Java making picking up the language swift if you have experience with the use of these languages. Even if you are a beginner coder, it is clear and easy to understand.

Considering its popularity, it has a great source of support that can easily be found simply by searching for your problem. The advantage of having such a huge user base makes that the

problem you are encountering, or any questions you might have can mostly be found on the internet. If you aren't able to find a solution you can always ask on one of the popular developer forums available.

One advantage PHP has over ASP.NET Webforms and MVC is that it has much more freedom in the form of choice of editor and framework. You do not require a specific OS or a quirky fix to make it run on your Non windows based OS. PHP works on: Windows, Mac OSX, Linux, Unix.

The best part here is that we are only talking about the language. Not the tools available to PHP development. There are many alternative frameworks to use depending on your development needs and preferences. There are no costs for developing with PHP. No royalties or paid hosting requirements.

4. Result

The result of the thesis is the actual work put into developing the groundwork of a product that will be useful for small businesses. This chapter will go through exactly what functionality exists, the structure of the code and notes on benefits as well as issues.

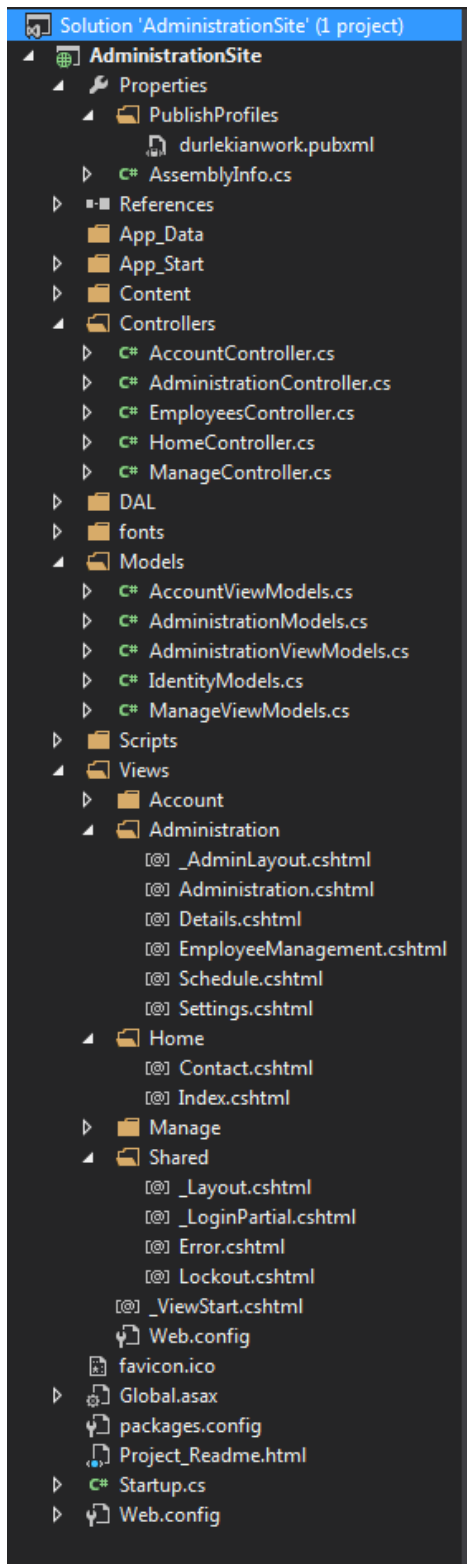


Figure 1 - Solution Explorer

Small Businesses would benefit greatly from a low-price software that could make their administration and scheduling more reliable, traceable and less time consuming. The solution presented as a prototype here is an ASP.NET MVC 5 web application. It features a website with user authentication, schedule and employee management. The great thing about ASP.NET MVC is that it has an automated feature to generate a page with user authentication and simple user management tools. This sets up a good base to work with. Using this as a base, and incorporating a visual JavaScript based calendar called fullcalendar, the system visualizes the content of the database to handle a scheduling system.

On an interactive level of end users, the website utilizes modals to interact with the user. The decision to use modals instead of individual pages for every event is derived from the experience of always having to move back and forth between pages when handling different systems. With modals, you stay on the same page you are on whilst opening up a modal with the different aspects shown.

Modals are used in both the administration and scheduling systems. The reasoning behind this is that it is unnecessary to go to a new page when it can be handled on the same page. Essentially, it can be considered as having pages within a page. Where the modal is its own “page” with different options that reaches other modals.

The structure follows MVC pattern of Models, Views and Controllers. In figure 1 we can see the different files associated in each view. As is displayed, all HTML code is collected into View. The View has access to the Model in which it is defined which model it will have access to. The controller passes any data to the model when it initializes.

This prototype has segregated controllers within their own sections. For example: All controls that handle

employees is in EmployeeController.cs. When a user makes a change to a work session or other users in the schedule, it will use the methods within the controller. All rules on the view are applied here. Every call to the database is handled here.

Models are divided into two segments: The model and viewmodel. Model is how the database is structured. One of the advantages of using ASP.NET MVC is that it is able to smoothly define data that shall be stored in a database. In this solution it contains two tables: Employees and Work Sessions.

The viewmodel contain the models with the data that the View will need access to. The controller for the view will create an instance of a selected model, fill it with its required data from the database and hand it over to the view.

Views contain all HTML and JavaScript calls. It will use the controllers to create the interactions in the form of buttons and inputs. The calendar is a javascript class that is initialized and handled within the view. The calendar is purely visual and does not handle any database calls, only controllers do this.

Something to note behind the design within the HTML files is that the use of partial HTML files to render standard layouts. For example the _ViewStart.cshtml file contains what all HTML files will run. In this case it solely consists of setting the Layout of each page. If for example I would have had several different layout this would have to be done individually on each page. Or alternatively have one layout as default and if any other page deviates from the norm then set a new layout at the start of the page.

A discovery late in the development cycle expressed methods to simplify the HTML code through the use of creating your own HTML helper classes. The sole reason behind this is to simplify the pathing to files in the solution as expressed in the webarticle (Kazi Manzur Rashid, 2014).

Example result:

```
<a href="<%= Url.Dashboard() %>">Dashboard</a>
```

```
<a href="<%= Url.Profile() %>">Profile</a>
```

Compared to:

```
<%= Html.ActionLink("Dashboard", "Dashboard", "Story") %>
```

```
<a href="<%= Url.RouteUrl("Profile")%>">Profile</a>
```

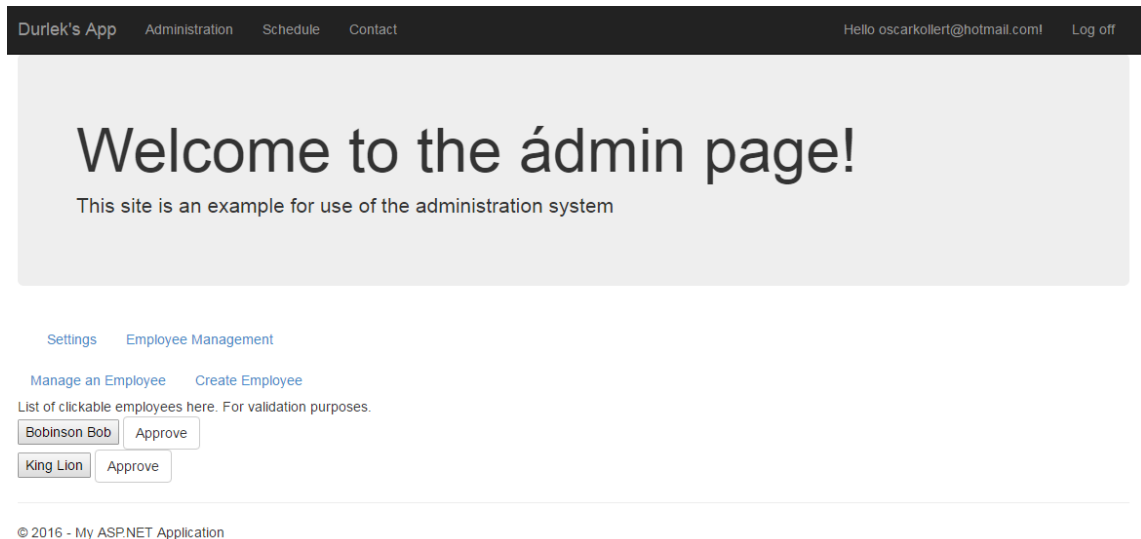
There is some code behind the scenes here where you define Url.Dashboard and Profile. But the end result is what matters. It is cleaner and simpler to use. Less prone to mistakes since it is defined in a class once then called upon. Instead of continuously type the name of the ActionLink and RouteUrl in the second comparison.

The JavaScript done within the views handle specific events such as what happens after a controller has been called to handle submissions to lists and schedules. For example JavaScript will be used to edit the schedule without having to reload the page as well as prevent repetitive calls for information from the database through controllers when a page is reloaded or redirected unnecessarily.

4.1. Administration

Administration is simply the management, creation and modification of settings and employees. It is a page the administrators or those with the manager roles are able to

access. It is a simple page with two options to select from: Settings and Employee management. This leads to two separate pages handling their respective functionality.



4.2. Employee Management

This page contains features for managing employees. Such as: Creating employees, modifying employees and approving/rejecting/revoking employees.

The approval segment is used to approve of users registering on the web application. Instead of the manager creating accounts for every single employee, the employee is able to create their own account and fill in their own information to be approved by the manager. This allows the manager to easily navigate and approve of employees.

Once an account is approved, the owner of said account will be able to access the schedule page.

4.2.1. Settings

Currently, the settings page has no functionality. It is a placeholder for the dynamic creation of settings the managers can set. It will handle: Warning settings, standard work day minimum employee threshold and role management.

4.3. Scheduling

The scheduling solution utilizes the JavaScript based calendar fullcalendar. It is a visual JavaScript entity that handles lists of "events" to display. It also has functionality to detect mouse clicks which I make use of to initialize menus in the form of modals depending on what is clicked.

Using this tool and combining it with controllers within the ASP.NET MVC framework, the solution is able to display work sessions from the database onto the calendar. If later in development we decide to replace fullcalendar this can easily be accomplished.

Clicking on a day will bring up a menu of different option available. The only option is to add employees to said day. Adding an employee lists all available employees that have been approved by the managers. Selecting them will add them to the schedule. Adding employees

uses default values for start and end times. This will be able to be manipulated in the Administration Settings page.

Durlek's App Administration Schedule Contact Hello oscarkollert@hotmail.com! Log off

Schedule

Your application description page.

< > today May 2016 month week day

W	Sun	Mon	Tue	Wed	Thu	Fri	Sat
19	1	2	3	4	5	6 6a Bob Bobinsor	7 6a Bob Bobinsor
20	8 6a Bob Bobinsor	9 6a Bob Bobinsor	10 6a Bob Bobinsor	11 6a Bob Bobinsor	12 6a Bob Bobinsor	13 6a Bob Bobinsor	14 6a Bob Bobinsor
21	15 6a Bob Bobinsor	16 6a Bob Bobinsor	17 6a Bob Bobinsor	18 6a Bob Bobinsor	19 6a Bob Bobinsor	20 6a Bob Bobinsor	21 6a Bob Bobinsor
22	22	23	24	25	26	27	28
23	29	30	31	1	2	3	4
24	5	6	7	8	9	10	11

Use this area to provide additional information.

© 2016 - My ASP.NET Application

Clicking on a specific day and dragging will select multiple days. A menu will show with specific options. Currently it will ask if you wish to duplicate selection for a set number of weeks ahead or to remove all selected work sessions.

Currently, the schedule page is solely for the administrators. The functionality for the employees to request swap days, reporting illness and vacation is not implemented functionally.

4.4. Issues and Failings

The biggest issue within the current project solution is its inefficient database handling. At its current stage, it has two separate databases handling user authentication, employees and work sessions. This is mainly due to the fact that during development of the project, there too much time focused in integrating and adding to the database, so the solution to the problem to continue developing the rest of the project by including another database. Inefficient, but functional.

The project is not complete when comparing to the Requirement Specification. It lacks certain functionalities such as the employee schedule and settings page not being implemented.

There is a clear issue with the modals visually. They are not supposed to be completely transparent. It has been an issue in the development from the beginning and no solution to

the problem has been found. Suspicion has been directed to the bootstrap css, and creating and handling an internal css stylesheet may solve the problem.

The project does not follow “Best Practices” principles as described in (Kazi Manzur Rashid, 2014). This will be done at a later stage, past the scope of the thesis when the functionality of the product is operating properly.

5. Conclusion

- What benefits does MVC structure give developers compared to other established structures?

When researching for the optimal framework to develop the web application there have been many discussions used as references to form a viewpoint. Many coincide in their opinions. But the further one deviates from similarities (for example programming language) the more of a rift of opinion appears. Nothing within the discussions lead to a conclusive result that would put an end to a debate, they simply have their own advantages and design style.

From the arguments it was deduced that much of the web development community uses the tools they are most proficient with. PHP is widespread and has a very large community, so finding developers for this language is a simple affair.

ASP.NET MVC is excellent when planning from the ground up. If you already have a web application using PHP or ASP.NET Webforms it might not be optimal to switch midway and have certain pages of your website in either. The advantage you get from organized segmentation of coding from MVC is lost. Many that have worked with both MVC and Webforms argue that if you are starting a new project, that has a larger scope in both functionality and complexity, it is better to use ASP.NET MVC.

ASP.NET MVC does not replace ASP.NET Webforms. Webforms will only be supported by .NET 4.6 and below according to (Stephen Walther, 2015). This is due to their newer variants catering to the MVC structure. They are both great frameworks and have their own strengths. Webforms utilize viewstates which help the website feel like a windows application. The disadvantage here is that it can cause performance issues due to large viewstate overhead, and has nothing that promotes organized design of the web app. MVC does not use states, this makes the website faster and the controller scheme allows the server to handle all of the commands.

MVC is logical and has a clear structure. After reading the webarticle and guide (Kazi Manzur Rashid, 2014), it was made clear how the MVC structure helps development speed. It gives insight and tips on how to smooth out development even further without complicating the matter. It may have taken a new developer a while to get used to the logic, since past experience within web development have followed completely different forms, that were much more simplistic and handled most of the visual aspect automatically.

- Which methods are currently being used by small businesses within the service sector to fill their administrative and schedule-handling needs?

On the topic of research of administration and scheduling for small businesses within the service sector, difficulty was found to be had to organize meeting with business owners.

There was an unwillingness to diverge from their already established methods. They see the benefits of the features, it is just the hassle of diverging to a new system and “learning” it that makes them wary. The two interviews that were held consisted of a nightclub and an inn.

Interviewing a staff member of the Nightclub “Etagé”, Alex Cronhamn, who’s handled scheduling personally attained results. They utilize excel for everything. Keeping track of employees and their contact information and making of schedules. For wage handling they had a paper booklet for employees to sign in and out of. They are most interested in this system, especially if it can handle employee signing in and out. The feature of employees being able to handle switching of work sessions themselves without involving the manager apart from informing them seemed to be in high demand.

From the interview with the owner of the inn “Kullagårdens Wårdshus”, Tina Kjellberg, we found a little difference in management style. The inn handled everything through paper and pen. The owner has been in business for several decades with the established system, making convincing that the benefits outweigh the hassle of changing systems and “learning” it difficult. She was receptive at being able to try out the software beforehand, before making a decision to convert.

Asking either of the interviewees if they have every used or considered using software that already exists is that it is out of their price ranges. Since most of the software is aimed at larger businesses. This makes the product this thesis has focus on part of their possible solution. By the end of the development process there should be a viable alternative that is within small business administration and scheduling.

Through the interactions with the interviewees, the conclusion is that when the solution is complete, there will be ample businesses eager to get their hands on a simple administration and scheduling software. One that cater to their needs in a simple and minimalistic solution.

- What can be done to streamline the methods pertaining to administration and scheduling of employees?

From the interviews it was established that there is a need for digital oversight. To have software that assists in keeping track whom the employers have available on a given day. Software that assists in contacting employees that are available simply. To give employees the tools and possibility of being able to easily switch work hours with each other without directly involving management.

- Are there any other products that effectivize or automate these methods above? Are they affordable and directed towards small businesses?

While searching for products that would assist in small businesses, Quinyx came up that seemed to do most of what this thesis wishes to accomplish. The major difference being that Quinyx is client and hardware based compared to this thesis prototype that is a web based solution. It does a lot more than what this thesis prototype scope encompasses, but at the same time seems to be focusing on larger businesses with the possibility for small businesses to use their product. The products would be competitors, the difference is just on what the focus is on.

6. Future Development

Further development of the software is possible. Continued improvement and added features can easily be added with the MVC structure. By utilizing the layout of the previous pages minimal effort needs to be applied. A developer can easily look at the current code and mimic for ease of use further features in the mode and controller.

If the software becomes a product, further development within the mobile app sector is an option. For simple features such as signing in and out of work as well as switching shifts for employees. Notifications can be made using the apps, or through a built in automatic sms feature.

Adding automated scheduling is an option. Automatic handling of wages could also be applied if the businesses completely rely on the software for employee signing in and out of work. Automatically generated statistical reports can also be a possibility in the future.

There are quite some lofty goals for this software that can become a reality. It all depends on if the software can remain focused on small businesses if too much work is put into it. A lot of consideration needs to be made on what is needed and what is “nice to have” as to not make the product too complex.

7. Terminology

- Administration - Management of Employees, be it adding, modifying, removing or wage management.
- App – Application
- Controller - All rules for user interaction and database interaction.
- Modal - A window that is a child to the parent window used within html5.
- Model - Defines database and the data the views will be able to choose from.
- MVC – Model-View-Controller
- Project – The software development process of the web application prototype.
- View - All visual aspects of a project, html code.

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