

MINISTRY OF EDUCATION AND SCIENCE
OF THE RUSSIAN FEDERATION

Federal State State-Financed Educational Institution of High Professional Education
South Ural State University (National Research University)
Faculty of Computational Mathematics and Informatics
Department of System Programming

THESIS IS CHECKED

ACCEPTED FOR THE DEFENSE

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“10” *версия* 2016

“13” *версия* 2016

DEVELOPMENT OF A PAYROLL SYSTEM
APPLICATION BASED ON
EMPLOYEE PERFORMANCE INDICATORS FOR THE
VIETNAM URAL CONSTRUCTION MACHINERY CORPORATION
GRADUATE QUALIFICATION WORK
SUSU-02.04.02.2016.Member_of_student.GQW

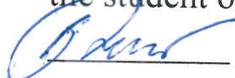
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“10” *версия* 2016

Chelyabinsk, 2016

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APPROVED

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13.2.2016 г.

TASK

Of the master graduate qualification work
for the student of the group VMI-216
NGO TRAN BAO DUONG
in master direction 02.04.02

“Fundamental Informatics and Information Technologies”
(Master program “Database Technologies”)

1. **The topic** (approved by the order of the rector from 15.04.2016 No. 661): Development of a Payroll system application based on employee performance indicators for the Vietnam Ural Construction Machinery Corporation.
2. **Thesis basic data**
 - 2.1. Makhija. Comparative Study of Project Tracking and Management Tools. – India: IJCSIT, 2014. – 6 p.
 - 2.2. Professional ASP.NET 4.5 in C# and VB. – USA: Gaylord, 2013. – 1440 p.
 - 2.3. The CSS Anthology: 101 Essential Tips, Tricks & Hacks. – USA: Andrew, 2009. – 388 p.
3. **The list of the development issues**
 - 3.1. Analysis of related works, web-application development platforms and competitor solutions,

- 3.2. Develop architecture for Payroll management system,
- 3.3. Develop and test Payroll management system using Microsoft Azure cloud computing platform.

Supervisor

Ph.D, Assoc. Prof.



G.I. Radchenko

The task is taken to perform



Ngo Tran Bao Duong

Student: Ngu Tran Bao Duong

Supervisor: G. I. Radehenko

Topic: Development of a payroll system application based on employee performance indicators for the Vietnam Ural Construction Machinery Corporation

**The calendar plan
of the execution of master graduate qualifying work (GQW)**

No	Phase	Duration	Deadline	Report	Actual date of execution	Supervisor's signature
1.	Introduction and literature review	1 month	February, 25 th	1. Task of the master graduate qualification work 2. Text of Introduction 3. References	25.02	
2.	Development of the model, design of the system	1 month	March, 15 th	1. Text of chapter 1 (theoretical part).	15.03	
3.	Implementation of a system	1 month	April, 15 th	1. Software system 2. Text of chapter 2 (implementation part).	15.04	
4.	Testing and debugging of the system, experiments	2 weeks	May, 1 st	1. Set of tests 2. Text of chapter 3 (experimental part).	1.05	
5.	Full text	2 weeks	May, 15 th	1. Full text of GQW	15.05	
6.	Validation of the text by supervisor	1 week	May, 22 nd	1. Electronic version of the GQW text checked by the supervisor	22.05	
7.	Normative control	3 days	May, 25 th	1. Twisted text of GQW signed by student, supervisor and normative controller	25.05	
8.	Proposal defense	1 week	May, 25 th – June, 1 st	1. Twisted text of GQW signed by student, supervisor and normative controller for the signature of the Head of the Department Head about accepting for the defense 2. A signed review of the supervisor 3. A review of the reviewer, signed and notarized at his place of work 4. Implementation act (if exists) 5. Presentation of the report in PowerPoint	01.06	

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INTRODUCTION

Information system is becoming increasingly important to the business environment in the age of information technology [1]. As globalization empowers international trades, it has created a fiercely competitive environment which forces organizations to either adopt changes and adjust or gradually fall behind. The application of information system in corporate's management is one of the most effective tools in creating a competitive edge over its competitors.

Vietnam Ural Construction Machinery Corporation (VU-TRAC) is currently a technology-transfer services corporation with business operations primarily based in Russia and Vietnam. Due to the nature of the company's tasks and objectives, the executives often have to travel on business trips. In order to ensure the interests and dutiful performance of its employees, the Board of Director has decided to implement a profit-sharing payroll information system.

There are many different payroll software systems on the market today. These systems provide capabilities which not only could easily capture the scope of payroll system's basic objectives, but also offer a lot more functionalities applicable to large enterprises managing thousands of workers. However, there are four primary predicaments associated with the use of commercial payroll applications:

- *Complexity* – the development of information system and computer technology in Vietnam is growing rapidly. However, the utilization of software and applications are very much limited among domestic firms. In addition, compared to countries, in which a majority of payroll applications is developed, Vietnam is still behind in terms of user's basic knowledge of computer and technology;

- *Cost* – in addition to high acquisition cost, there are also maintenance costs incurred when using big and complex commercial payroll software;

- *Objective* – payroll system in Vietnam is subject to constant and unpredictable changes of laws. Furthermore, the degree of complexity is high as many

companies have their own and differentiating view of applying company and legal rules. This will be the greatest flaw should VU-TRAC decides to utilize commercial payroll application;

– *Potential* – the development of this in-house application could mark the beginning of a potentially broader, more complete, and integrated information system with functionalities that support operations and managements across all departments in the organization. This opportunity is not presented with the use of outsourced commercial payroll applications.

For the development of the system, there are three primary objectives:

- 1) the system must be cost-effective;
- 2) the system must achieve its user requirements objectives while still simple enough to operate by basic computer user;
- 3) the system must be secured to ensure the confidentiality of the company and its workers' information.

The goal of this project is the development of a Payroll system application based on employee performance indicators for the Vietnam Ural Construction Machinery Corporation.

To reach the goal I should achieve the following objectives:

- 1) research between in-house and outsourcing development;
- 2) research on different cloud-computing services;
- 3) compare and contrast between different types of payroll systems
- 4) learn the Microsoft Azure cloud PaaS;
- 5) compare and contrast between different programming models
- 6) investigate Entity Modeling and compare between different approaches to data-accessing using EF framework.
- 7) develop architecture for Payroll management system
- 8) develop and test Payroll management system using Microsoft Azure cloud computing platform.

The rest of the report is organized as followed:

- 1) in chapter 1, I provided a review of other competitors' solutions and programming methods used in development of the system;
- 2) in chapter 2, I provided an overview of the system's requirement which includes a brief description of the system and its use case;
- 3) in chapter 3, I provided the architecture of the system and its databases as well as the profit-sharing calculation method;
- 4) in chapter 4, I provided descriptions and screenshots of the implemented system.

1. RELATED WORKS

1.1. In-house development vs. Outsourcing

Before starting any development process, we need to perform a thorough assessment of other available options on the market in order to provide the best payroll system solution to the client.

A rapidly growing business information system industry offers clients with many different services which include: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). They are all parts of the cloud computing solutions, a game-changing innovation in the world of technology. In addition to cost-reduction, scalability, flexibility, security, the cloud service might be able to solve the dilemma of whether to outsource our payroll system or develop it in-house. Payroll in the cloud eliminates the unnecessary IT resources arose from maintaining software and infrastructure while provides flexibility for us to design a system completely tailored to your organizational requirements. In addition, the risk of losing data is essential reduced to zero since everything is stored in the cloud instead of traditional physical hardware. This also means we can easily access our data and functionality from anywhere. Cloud-based payroll services allow a minimum upfront cost and fixed maintenance fees at the expense of not having to worry about maintenance, upgrades, and security of our system. Cloud scalability feature enable it to serve organizations of all sizes with ease.

Infrastructure as a Service (IaaS) provides virtual infrastructure which mimics traditional physical computer hardware, such as servers, storage arrays, and networking. The main purpose of IaaS is to deliver computing power and data centers required for applications to run. An example of IaaS is Amazon Elastic Cloud Compute (Amazon EC2) which allows us to management a number of instances (virtual servers), configure security and networking, and manage storage (see figure 1). It eliminates the need to invest in any hardware up front, so that we are able to develop and deploy applications faster. An example of an effective implementa-

tion of Amazon EC2 solution is the case with PIXNET Digital Media Corporation, a social network website, online photo gallery, and blog service provider in Taiwan. After developing its new face detection and recognition feature for its online photo gallery, instead of purchasing extra physical hardware to serve as data centers, PIXNET utilized Amazon EC2 to process all of the images on the company's website. With 50 Amazon EC2 instances, PIXNET was able to process approximately 10 million photographs every day. PIXNET's services running on AWS of Amazon EC2 was also able to communicate with its existing's physical infrastructure through a RESTful API [2].

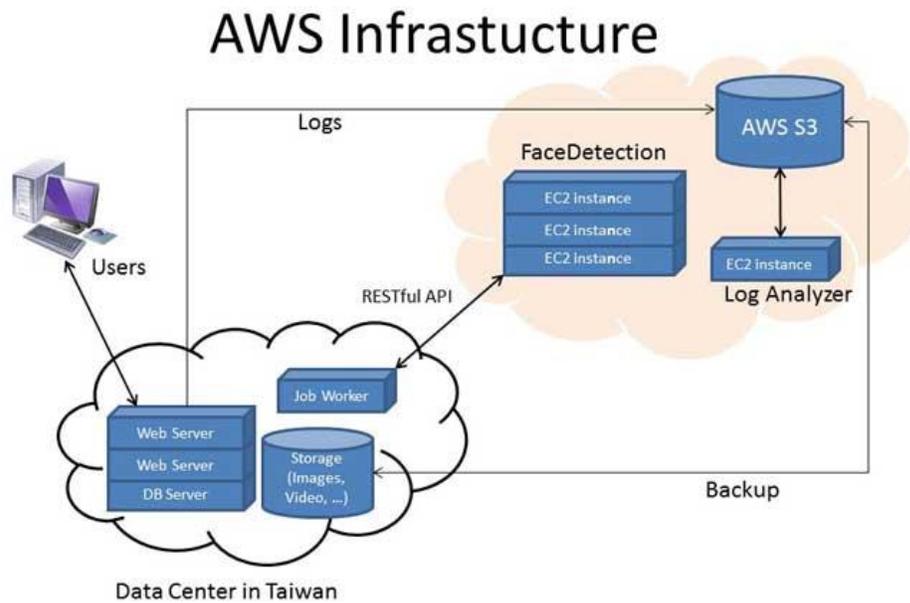


Fig. 1. Implementation of Amazon EC2 to process face recognition for clients

Platform as a Service (PaaS) is the platform that delivers a solution stack as a service (see figure 2). It supports in deployment of applications. It does not involve the cost and complexity of buying and management the underlying hardware and software and even provisioning hosting capabilities. Furthermore, it provides all the facilities that are required to support the complete life cycle of building and delivering web applications and services, which are completely accessible from the inter-

net. PaaS includes different categories ranging from application servers, ingestion brokers, databases and database management systems. It is further divided into two sub-categories: Application Platform as a Service (aPaaS) and Integration Platform As a Service (iPaaS). Google App Engine is an example of aPaaS products which provide cloud hosting services and development tools. iPaaS such as CloudHub on the other hand are designed to facilitate integration of applications across the enterprise, with partner enterprises, and other cloud services.

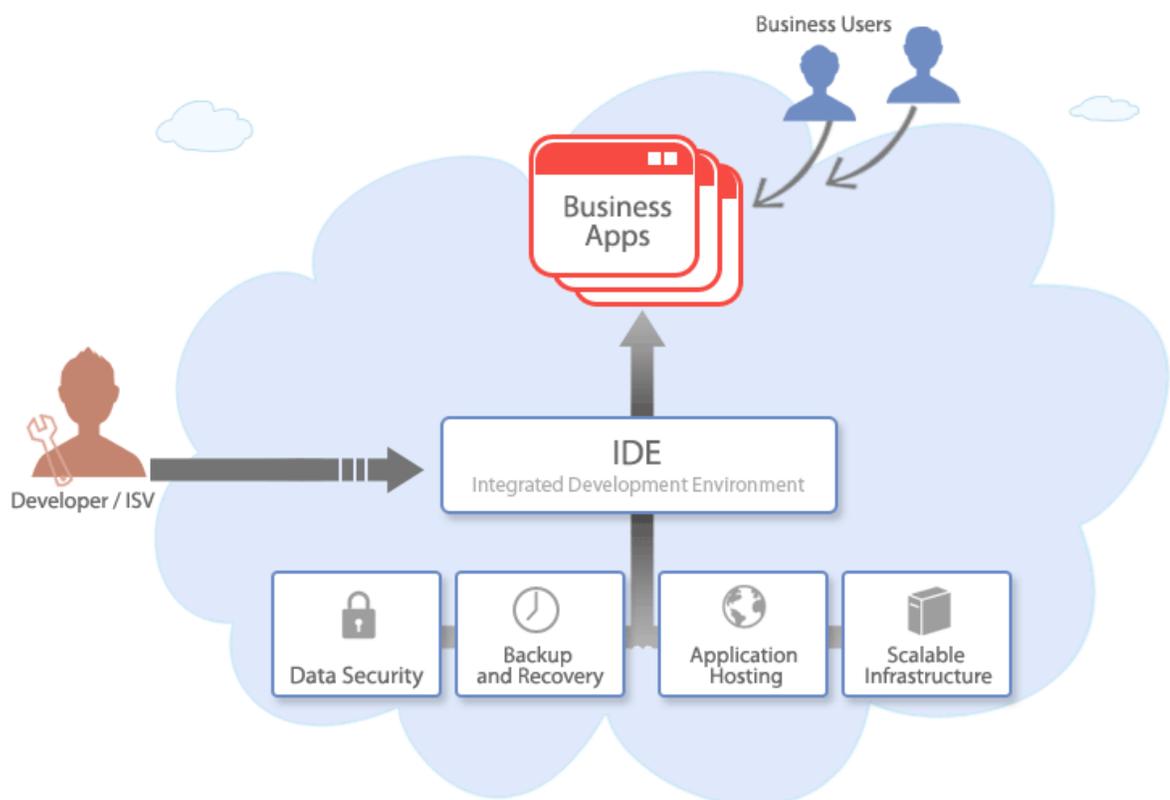


Fig. 2. Platform as a Service (PaaS) model

Platform as a Service (PaaS) is a good solution to utilize in our payroll system because it enables quick web application development without the cost and complexity of buying and managing the underlying software/hardware.

Software as a Service (SaaS) is the top-level solution of cloud computing which provides actual software for end-users. This solution is most widely utilized as it does not require any development, deployment, or maintenance. We can find instances of SaaS almost everywhere such as email, word processing, business CRM, etc. SaaS is typically charged on per-use and per-month basis [3]. In the case of payroll system, there are many different available commercial SaaS payroll systems on the market. Based on the scope and functionality of the system, they are categorized into either “big” commercial systems or applications for small businesses.

“Big” commercial systems: one of the most noticeable characteristics of big payroll systems is its ability to process huge amount of information, transactions to satisfy enterprises employing thousands of workers. Another attractive plus of big payroll systems is their scalability capability. This is extremely essential to corporations operating on the global scale in rapidly expanding sectors such as retailing, wholesaling, healthcare services, etc. OutSystems Platform is a notable example of “big” payroll systems which was able to perform excellently to serve the needs of large enterprise, in this case Randstad – “a global leader in the Human Resources industry, which in 2011 provided employment for over 576,000 people around the world.”. Randstad business objective concentrates on providing management over operations and administrative processes for medical placement in different healthcare units in Portugal [4]. The solution offered by OutSystems Platform was said to have automated the entire process of payrolling, business control including but not limited to scheduling, doctor’s databases, payments and invoicing, auditing. This means that the task of allocating over 3010 payment items among over 300 doctors every month is performed automatically utilizing Outsystems solution [4]. Furthermore, Outsystems allows integration with corporation central ERP system, providing analysis and reports to serve better decision making process. When con-

sidering public sector, big payroll system is undoubtedly beneficial in capturing and tracking the flow of public money to public workers.

Applications for small businesses: most of payroll applications for small businesses are designed to deliver the following benefits: cost-effective, ease of use, accounting program integration, and extra services in terms of tax filing, workers' compensation, retirement plans, etc. [5] These applications are often offered as free trials for users to have the opportunity of experiencing and familiarizing himself with their interfaces and functionalities. Using small payroll applications, businesses could completely outsource their payroll process and eliminate the need to maintain extra IT personnel. This is because these payroll applications are usually backed up by their own IT teams who offer top notch service and support to their customers.

For example, Gusto (formerly ZenPayroll) [6] is ranked as one of the best payroll services for small businesses [5]. If you are a user of Gusto application, its customer service's team would email you regularly to ask for your feedbacks on the software in order to make sure its product always satisfies customers. However, this does come at the cost of monthly fees.

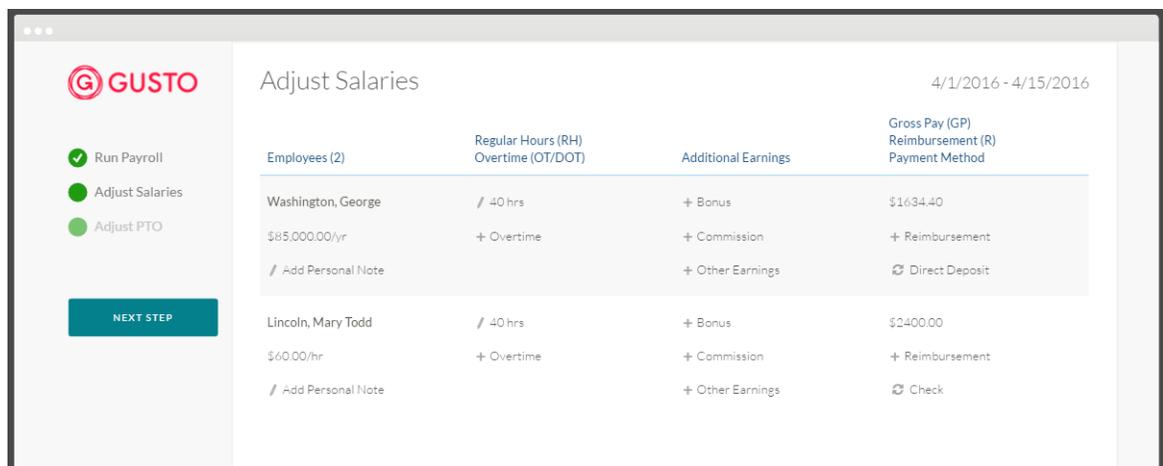


Fig. 3. Gusto payroll management interface

Another example of payroll software solution for small businesses (from 10-50 employees) is Patriot Payroll Software solution. Patriot provides fast, simple, and affordable accounting and payroll software to small businesses [7]. Their solutions range from basic payroll, time & attendance to integrated HR software with multiple functionalities to ensure automatic management of HR tasks. Patriot is hosted 100 % online in the cloud with secured data center protected by redundant firewalls and encryption techniques that banks use [7]. The interface of the software is user-friendly and simple for user to quickly get acquainted with (please see figure 4) Even though the cost of using Patriot software service is considered affordable compared to other available services on the market, it still charges as high as 56.92 \$/month for a company with the size of VU-TRAC (roughly 25 employees). The additional time & attendance and HR software services are provided at the cost of 28.28 \$/month and 27.28 \$/month consecutively. Thus, a decent PaaS payroll software may cost VU-TRAC around over 100 \$/month.

The screenshot shows the 'Pay Employees' interface with a progress bar at the top indicating three steps: 1. ENTER PAYROLL (active), 2. APPROVE PAYROLL, and 3. PRINT PAYCHECKS. Below the progress bar, there are several input fields: 'Pay Frequency' (set to Weekly), 'Pay Period' (with START* and END* fields and calendar icons), and 'Pay Date*' (with a calendar icon). To the right of these fields are buttons for 'Next Step', 'Save Entries', and 'Options'. Below the input fields is a table with columns for 'Hourly Employees', 'Regular Hours', 'Overtime Hours', and 'Hourly Rate'. The table contains one entry for 'Adams, John' with a 'Hourly Rate' of '\$10.00' and a link to 'Add Hours/Money'. At the bottom of the interface, there are buttons for 'Clear Entries', 'Save Entries', and another 'Next Step' button.

Fig. 4. Patriot payroll management interface

For Gusto, which is evaluated as the least expensive payroll service, the basic monthly fee is \$25/month or \$65/month for 10 employees. Another disadvantage that may arise from using small payroll applications is its simplicity. This means that if your corporation may create a different method of calculating employees' salary besides time-check cycle, these applications may not be able to fulfill your requirement. As mentioned above, the complexity of Vietnamese companies' organizational structures on top of ever-changing laws makes it essentially impossible for small payroll services to keep up.

After performing the assessment on available software system services, I believe that utilizing PaaS together with in-house application development will provide us with a system that best fits the objectives given by the Board of Directors.

Microsoft Azure cloud platform is well-known and widely used by software developers around the world. It is categorized as PaaS (Platform as a Service) cloud service used for developing, managing, and hosting applications off-site. Azure consists of the cloud operating system, SQL Azure, which provides database services in the cloud as well as other .NET services. As Azure is extremely user-friendly especially to those who are familiar with Window applications such as: Visual Basic, C++, C#,etc., this makes it easy for me to utilize Azure platform to develop my application. In addition, Azure is integrated with Visual Studio 2015, allowing users to easily connect and push their VB applications to Azure platform for hosting purposes after development. As far as security is concerned, Microsoft Azure utilizes Security Assertion Markup Language (SAML) tokens to identify and authenticate users.

1.2. Programming Model: MVC vs. Web Forms

ASP.Net is an open source server-side Web application framework designed for Web development to produce dynamic Web pages. There are three different programming models built on top of ASP.Net which developers can select from to

build web applications: Web Forms, MVC, and Web pages [8]. Each model creates and structures a web application using different approaches.

Web Form is an event-base programming model and very closely similar to Window Form. Its controls encapsulate HTML, JS and CSS which makes it easier for developer with minimal knowledge on markup languages to design the web page. In addition, there are rich UI controls associated with web form such as data grids, charts, AJAX. Please see figure 4 for a simple flow model of Web form (see figure 5). These enable rapid application development which saves a lot of time for developers as they are freed from lots of the background complexities.

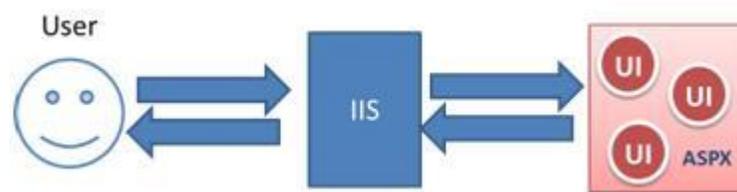


Fig. 5. Web form model

MVC is a model-view-controller framework which groups together the data and its processing (model) and isolates it from the manipulation (the controller) and presentation (the view) that has to be done on a user interface (see figure 6). It gives developers more control to HTML, JS, and CSS. It also supports Unit Testing which is essentially difficult to execute with Web Form.

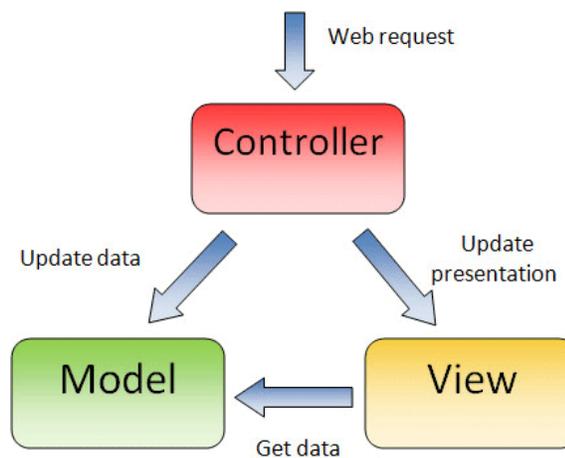


Fig. 6. MVC model

1.3. Entity Modeling

Entity Framework is an extended ORM which simplifies data access in our application by isolating the object model from the data model of the application [9]. These objects act as a medium to interact with database. There are three approaches to modeling entities using Entity Framework: Code First, Model First, and Database First (see figure 7).

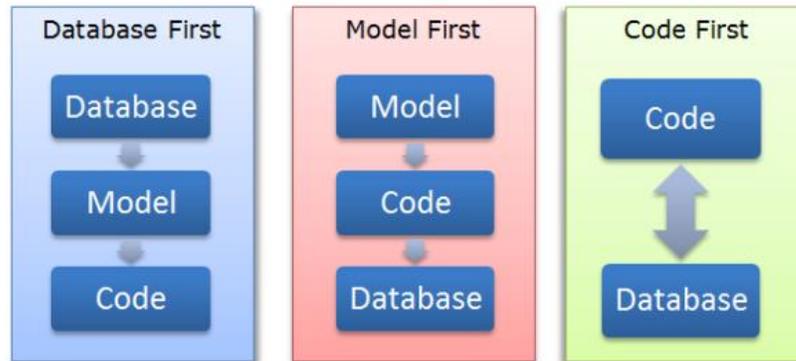


Fig. 7. Entity Framework approaches

With Code First approach, developers are able to exert better control over the code as the entities are defined and configured before hand-coded to the application to create the database.

This gives a lot more flexibility and control as there will be no auto generated code.

As for the Database First approach, the database is already designed and can be manipulated manually or by updating the Entity Data Model.

In the Model First approach, the EDM is created in order to generate the database from it. An empty EDM is typically created using Entity Data Model Wizard. Within, we can define the entities and their relationships, then generate the database from pre-defined model.

Since Code First approach gives me better control over my own codes together with simple, DDD entities, I consider it the best modeling approach in de-

signing my classes and database for the system. In addition, with the introduction of DB-migrations, it has solved its biggest problems of having to drop and recreate the database in the event of any change in the DB model.

2. SYSTEM REQUIREMENTS

2.1. System Description

The general idea is to design a payroll information system which manages its employee's payroll and corporate information. Some of the basic functionalities of the system are listed below:

- 1) providing a payroll account for every worker in the corporation;
- 2) providing worker with personal identifier to access and view his own payroll account;
- 3) manipulating payroll information such as: periodical salary, deductions, taxes, etc. (management ability);
- 4) manipulating account information such as: add, edit, remove worker's account information, etc. (management ability);
- 5) granting user roles and account security measures;
- 6) generating reports, money order, and other related forms, etc.

The system should be accessible to its users using any internet enabled devices.

2.2. Use-case model

The "Payroll system" use case diagram depicts the cloud level interactive view of the payroll system to be implemented at VU-TRAC. It also demonstrates the roles of different users and their interactions, activities within the system. Users of the system are expressed as different actors inside the use case diagrams (see figure 8).

Actors consist of:

- *Administrator*: responsible for managing all users' account, including: add, edit, delete user's account, and assign roles and privileges to different users of the system.
- *Timesheet manager*: provides timesheet on request of HR manager.

- *HR manager*: responsible for managing payroll information, including: add, edit employee’s record, import timesheet record, modify expenditure/accommodation expenses, modify benefits, dues, tax records, and generate payslip.
- *Director*: responsible for assessing employee’s performance periodically for profit-sharing salary calculation.
- *Employee*: able to view his payroll information and employee information.

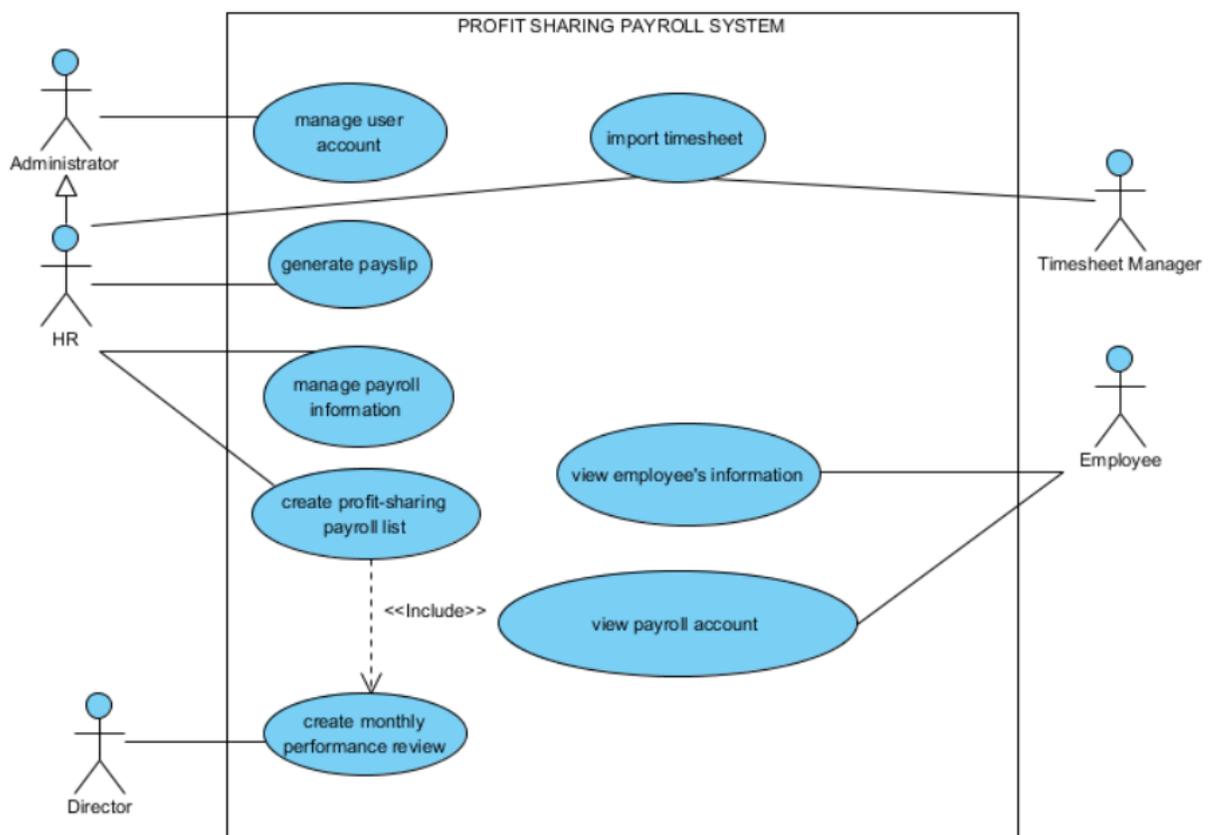


Fig. 8. Payroll system use case diagram

Use cases consist of:

- *manage user account*: create, edit, and delete unique identifier/account with login and password for every user of the system;

- *create profit-sharing payroll list*: create suggested list of payroll amounts to employees using two factors: corporation performance (earnings) and individual performance (includes use cases: “create monthly performance review”);
- *create monthly performance review*: rate employees based on built-in indexes;
- *view payroll account*: view information about individual’s payroll;
- *view employee information*: view information about individual in the company;
- *manage payroll information*: control and manage payroll records of all employees (including: “add employee”, “add employee’s record”, “modify expenditure/accommodation expenses”, “modify benefits/dues, tax records”);
- *generate payslip*: create payslip, payroll report quarterly, annually, etc.;
- *import employee timesheet*: import employee timesheet to the system.

3. SYSTEM ARCHITECTURE AND IMPLEMENTATION

3.1. Salary computation algorithm

VU-TRAC implements computation method of salary based on governmental regulation and the company's performance method. An employee's salary consists of two parts: base wage and performance wage (see figure 9).

$$\text{Wage computation algorithm:}$$
$$\text{Total wage} = \text{Base wage} + \text{Performance wage}$$

Fig. 9. Wage computation

When the company signs an employment contract with its worker, salary's weighted index is implemented according to government's regulation. It depends on the number of year of employment, employee's experience. In addition, some employees can receive additional index based on responsibility or current employment position. Thus, the algorithm for calculating base wage is described in figure 9 (see figure 10)

$$\text{Base wage computation algorithm:}$$
$$\text{Base wage} = (\text{Base wage index} + \text{position index} + \text{responsibility index}) * \text{Minimum wage}$$

Fig. 10. Base wage computation

In table 1, the distribution of employee's base wage calculation is provided.

Table 1. Base wage computation

Position	Base wage index	Position index	Minimum wage	Base wage
HEADQUARTER				
General Director	5	1.5	3,100,000	23,250,000
Chief Financial Officer	4	1.25	3,100,000	15,500,000
HR Manager	3	1.2	3,100,000	11,160,000
Commercial Director	3	1.2	3,100,000	11,160,000
Commercial Associate	1.25	1.1	3,100,000	4,262,500

Position	Base wage index	Position index	Minimum wage	Base wage
Radar Project Director	3	1.2	3,100,000	11,160,000
Radar Project Associate	1.5	1.1	3,100,000	5,115,000
Radar Engineer	2	1.2	3,100,000	7,440,000
Administrative Manager	1.5	1.1	3,100,000	5,115,000
Administrative Associate	1.25	1.05	3,100,000	4,068,750
Treasurer	1.5	1.05	3,100,000	4,882,500
Accountant	1.5	1.1	3,100,000	5,115,000
Driver	1	1.05	3,100,000	3,255,000
Security Guard	1	1.05	3,100,000	3,255,000
Office Maid	1	1.05	3,100,000	3,255,000
HANOI BRANCH				
Branch Director	4	1.5	3,100,000	18,600,000
Branch Vice Director	3.5	1.25	3,100,000	13,562,500
Accountant	1.5	1.1	3,100,000	5,115,000
Administrative Associate	1.25	1.05	3,100,000	4,068,750
Treasurer	1.5	1.05	3,100,000	4,882,500
Engineer	2	1.2	3,100,000	7,440,000
Driver	1	1.05	3,100,000	3,255,000

The second part of an employee's salary – performance wage is calculated based on two important factors: employee's performance report/record and company's reported net profit.

In other words, performance wage is profit-sharing sum which employee may or may not receive at the end of a fiscal year after all accounting reports have been filed and the firm's net profit is officially declared. The algorithm for calculating employee's performance wage or annual profit-sharing sum is described in figure 11 (see figure 11):

$$\text{Performance wage} = \text{Employee's performance index} * (\text{Net profit} * 5\% ***) / \text{Number of Employees}$$

Fig. 11. Employee's performance wage

***: The percentage may vary according to company's financial standing and well-being.

3.2. System Architecture

The Payroll System will be implemented using a three-tier architecture, which consists of: data layer, business layer, and presentation layer (see figure 12).

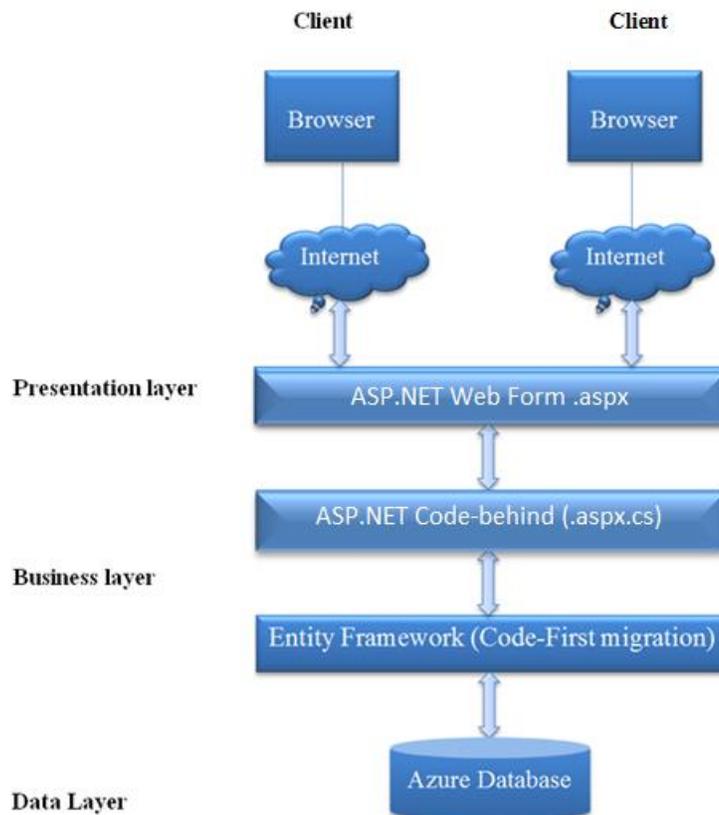


Figure 12. System Architectural Layer

For the data layer of the system, we will utilize Azure database because the system will be hosted in the cloud; and I have previously selected Microsoft Azure as my PaaS (Platform as a Service) to implement the system. The business layer consists of business logic, validations or calculations related to the data which will be coded in ASP.net Code-behind page (.aspx.cs). The data access layer Entity Framework is also labeled as part of the business layer. At the top-most level of the

system is the presentation layer, which contains pages like .aspx or Windows forms. The presentation layer is very important as it is essentially the user-interface. If the presentation layer is designed poorly, this gives the users a poor view of the system.

With the introduction of Entity Framework 4.3 or later, database access and initialization is executed using migration tool that automatically updates the database schema, when your model changes without losing any existing data or other database objects. Payroll information system will utilize migration tool. Its DAL architecture contains 6 following steps: 1/ models & mapping; 2/ connection strings; 3/ enable migrations; 4/ update database; 5/ push code + migrate server DB; 6/ process workflow (see figure 13).

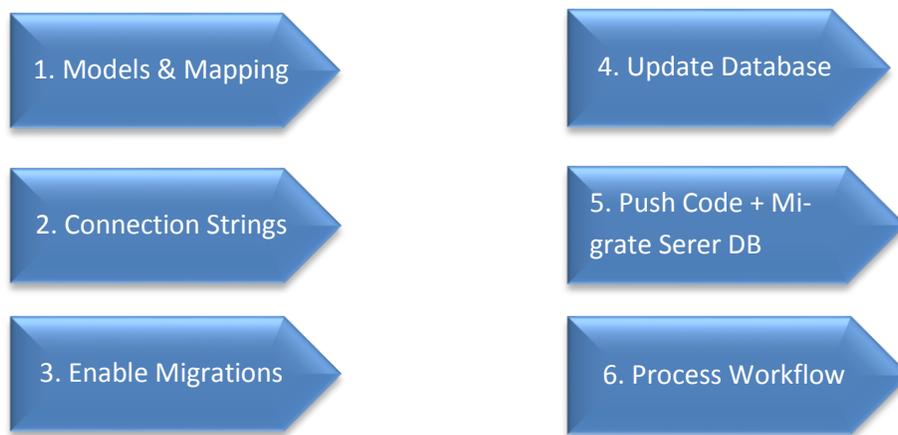


Figure 13. EF Code First Migration DAL architecture

3.3. *Database Architecture*

On figure 14 below, I present the database structure of the payroll system, which includes tables, fields, and their relationships to each other. I will also briefly present the data dictionaries of several important tables in the database.

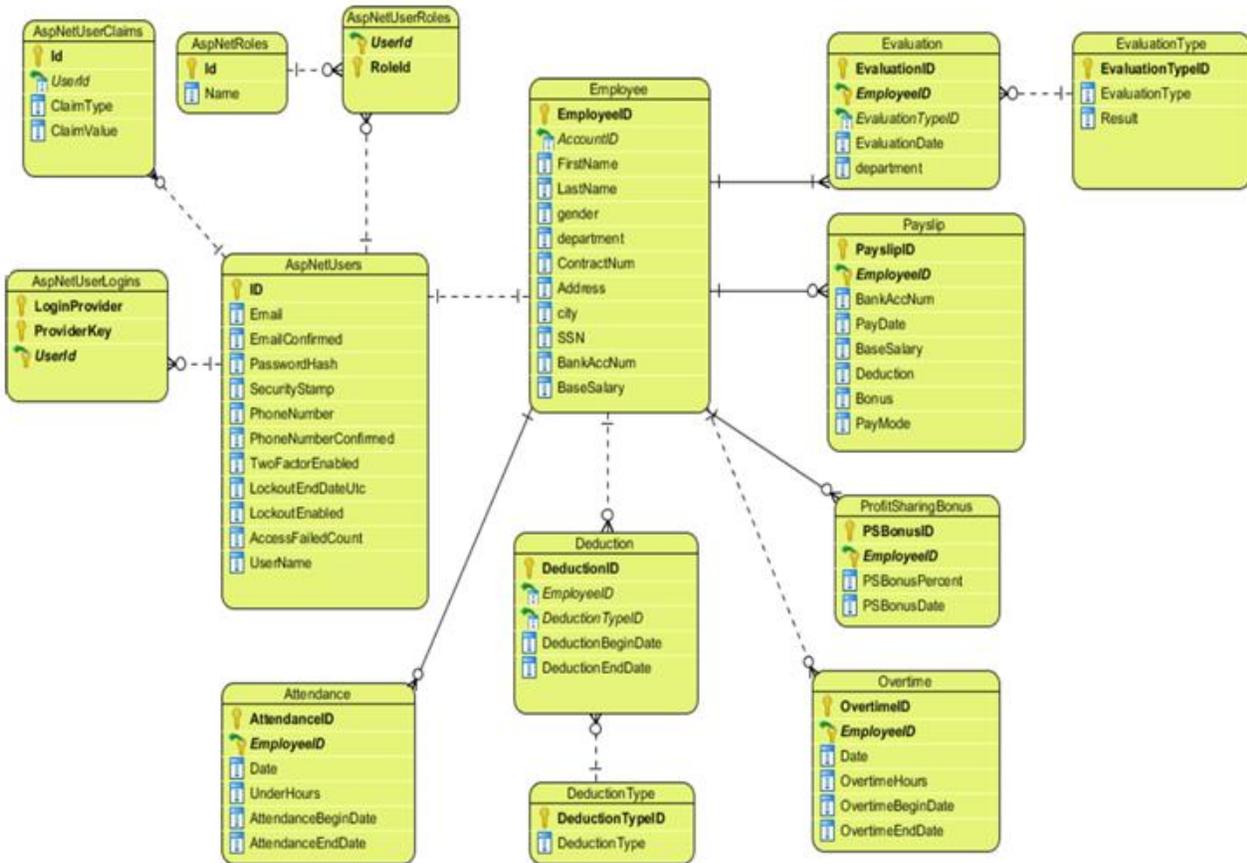


Figure 14. Payroll System ERD

Table employee contains information about employees in the company (see table 2).

Table 2. Employee Data Dictionary

Field Name	Data Type	Description
EmployeeID	int	Employee ID
FirstName	string	Employee first name
LastName	string	Employee last name
gender	Gender	Employee gender
department	Department	Employee department

Field Name	Data Type	Description
ContractNum	int	Employee contract number
Address	string	Employee address
city	enum	Employee city
SSN	integer	Employee social security number
BankAccNum	string	Employee bank account number
BaseSalary	double	Employee base salary

Table AspNetUsers contains credentials information about the user of the system (see table 3). This table is automatically generated when I select the Web-form template during development.

Table 3. AspNetUsers Data Dictionary

Field Name	Data Type	Description
ID	nvarchar	user unique identifier
Email	nvarchar	user email
EmailConfirmed	bit	user email confirmed
PasswordHash	nvarchar	user password hash
SecurityStamp	nvarchar	user security stamp
PhoneNumber	nvarchar	user phone number
PhoneNumberConfirmed	bit	user phone number confirmed
TwoFactorEnabled	bit	user two factor authentication login
LockoutEndDateUtc	datetime	user lockout end date
LockoutEnabled	bit	user lockout enabled
AccessFailedCount	int	user access failed count
UserName	nvarchar	username

Table Deduction contains information about employee's different mandatory deductions out of his paychecks such as: social security tax, personal tax, and insurance (see table 4).

Table 4. Deduction Data Dictionary

Field Name	Data Type	Description
DeductionID	int	employee deduction unique identifier
EmployeeID	int	employee unique identifier (foreign key)
DeductionTypeID	int	deduction type unique identifier (foreign key)
DeductionBeginDate	datetime	begin date of deduction calculation
DeductionEndDate	datetime	end date of deduction calculation

Table ProfitSharingBonus contains information about employee's profit sharing bonus such as the percentage of revenue which will be credited toward his paycheck and the date it is recorded (see table 5).

Table 5. ProfitSharingBonus table Data Dictionary

Field Name	Data Type	Description
PSBonusID	int	employee profit sharing bonus table unique identifier
EmployeeID	int	employee unique identifier (foreign key)
PSBonusPercent	smallint	profit sharing percentage of revenue
PSBonusDate	datatype	date of calculating employee's profit sharing bonus

Table Evaluation contains information about employee's performance review (see table 6). It is also the association table between Employee table and EvaluationType table in order to prevent their many-to-many relationships.

Table 6. Evaluation table Data Dictionary

Field Name	Data Type	Description
EvaluationID	int	employee evaluation table unique identifier
EmployeeID	int	employee unique identifier (foreign key)
EvaluationTypeID	int	employee evaluation type unique identifier (referenced)
EvaluationDate	datatype	date of evaluating employees
department	string	department of employees

Table Attendance contains information about employee work hours (see table 7). It contains the number of late hours of the employee in the date of work.

Table 7. Attendance table Data Dictionary

Field Name	Data Type	Description
AttendanceID	int	employee attendance unique identifier
EmployeeID	int	employee unique identifier (foreign key)
Date	datetime	date of attendance
UnderHours	int	number of hours late
AttendanceBeginDate	datetime	begin date of recording attendance
AttendanceEndDate	datetime	end date of recording attendance

Table Payslip contains information about employee payment order (see table 8). Employee can be paid by cash or transfer to account.

Table 8. Payslip table Data Dictionary

Field Name	Data Type	Description
PayslipID	int	employee pay slip unique identifier
EmployeeID	int	employee unique identifier (foreign key)
BankAccNum	string	employee bank account number
PayDate	datetime	employee pay date
BaseSalary	double	employee base salary
Bonus	double	employee total bonus
PayMode	string	employee pay mode

4. SYSTEM TESTING AND IMPLEMENTATION

4.1. *Technologies Used*

I developed the payroll system and implement in Microsoft Azure cloud platform using the following technologies:

- 1) Asp.NET Web form;
- 2) Windows Azure SQL Database;
- 3) EF migration;

4.2. *Site Map*

The site map of the system/website consists of the list of pages to provide an overview of the pages organized in hierarchical order (see figure 15).

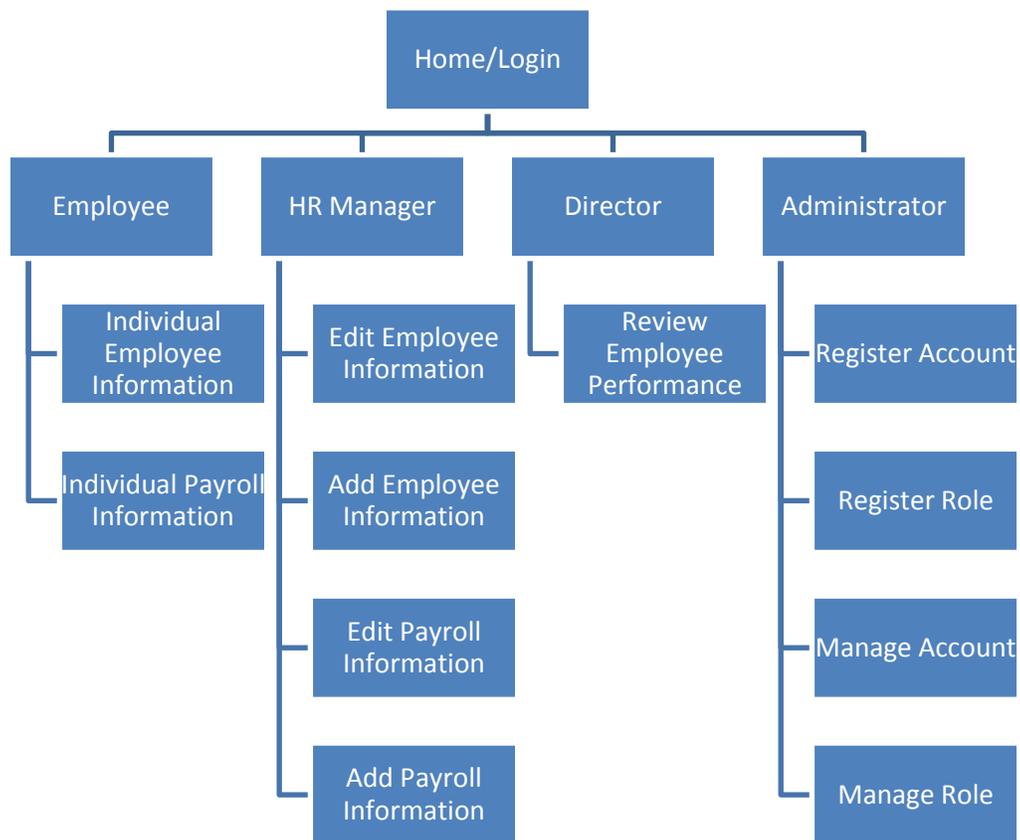


Figure 15. System site map

I designed the site map according to the roles of the users in the system as well as the actions they are able to perform in the system. In the process of devel-

opment, I created a site map in Visual Studio by adding an XML document. It can also be used as a data source to create my navigation panel for the page.

4.2.1. Web interface development

The web-interface of the system is developed using the Bootstrap library and CSS styling.

The Home Page of the system is the login page, where user will provide his username and password to access his account as shown in figure 16. On the left of the page is the navigation panel for the user. The links will be visible to users depending on their roles.

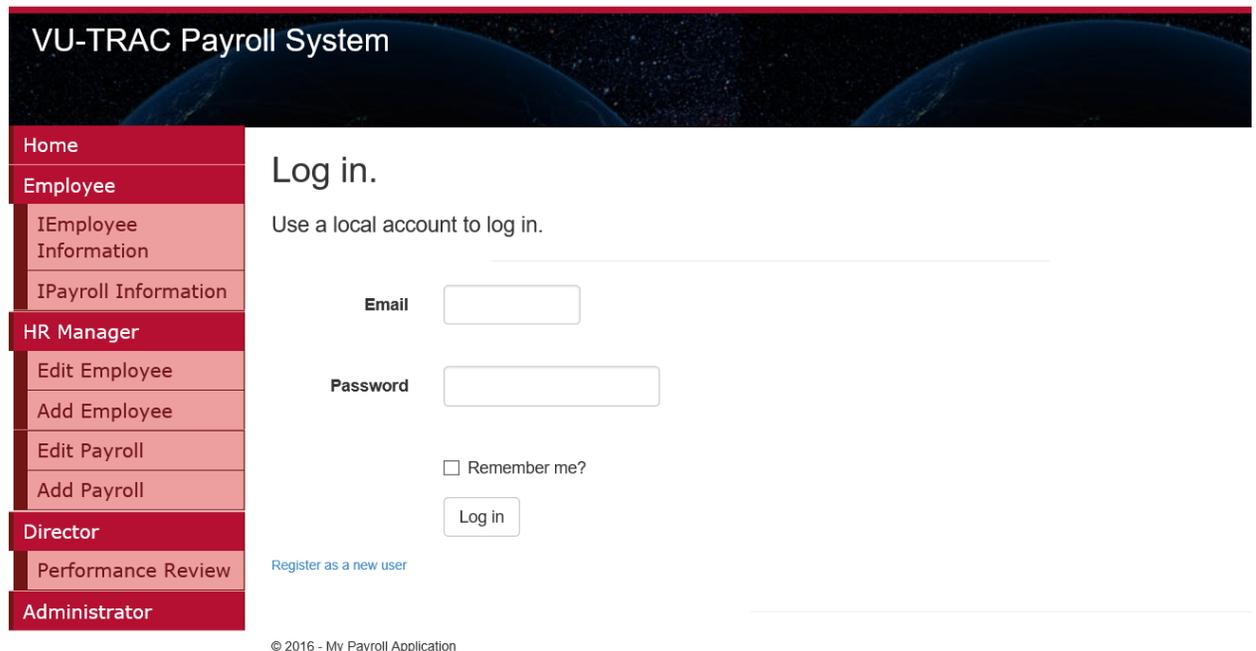


Figure 16. Home/Login page

If the user is assigned an Employee role, he can gain access to the following pages: Employee Information, Payroll Information. He can also perform the following actions:

- 1) view employee information;
- 2) view payroll information;

If the user is assigned and HR manager role, he can gain access to the following pages: Edit Employee, Add Employee, Edit Payroll, Add payroll.

He can also perform the following actions:

- 1) Edit Employee;
- 2) Add Employee;
- 3) Edit Payroll;
- 4) Add Payroll;

In the “Edit Employee” page, user can edit information about employee or delete record of the employee (see figure 17).

VU-TRAC Payroll System

Home

Employee

IEmployee Information

IPayroll Information

HR Manager

Edit Employee

Add Employee

Edit Payroll

Add Payroll

Director

Performance Review

Administrator

Add New Employee

	ID	First Name	Last Name	Gender	Social Security Number	Address	City	Contract Number
Правка Удалить	1	Duong	Ngo	Male	24942028	128 Phan Chu Trinh, P.2	Hochiminh	20
Правка Удалить	2	Trinh	Dau	Female	269383053	26BC Phan Van Tri, P.7...	Hochiminh	30
Правка Удалить	3	Tram	Nguyen	Female	238475813	152 Phan Chu Trinh, P.2	Hochiminh	10

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Figure 17. Edit employee record

There’s also a link “Add New Employee” for him to navigate to the page “Add Employee”, where user can add a new employee record by providing information in textboxes or select from dropdown list (see figure 18). After the user inserts a new employee record, he will be redirected to the “Edit Employ-

ee” page to check if the record is actually added to the entire employee record list.

VU-TRAC Payroll System

Home
Employee
Employee Information
IPayroll Information
HR Manager
Edit Employee
Add Employee
Edit Payroll
Add Payroll
Director
Performance Review
Administrator

First Name
Last Name
Gender
[Not Set] v
Department
[Not Set] v
Contract Number
Address
City
[Not Set] v
Social Security Number

Insert Cancel

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Figure 18. Add employee record

4.2.2. Security

The system is secured by using ASP.NET built-in security features. It provides a much more reliable authentication and authorization method for the system than simple self-made security. With HTTPS protocol, a request is sent to the server from a client in encryption. User password is hashed to ensure protection in the user account database. In addition, user is offered with two-factor authentication, which makes it much more difficult to hack into the account from another location.

5. CONCLUSION

I was able to define the database architecture using EF Code First approach for the entire project. I implemented the security aspects of the project using ASP.Net built-in features which is extremely reliable and guarantees the confidentiality of the information. I developed and tested the interfaces for system login, employees adding and editing information. I should be able to complete the remaining tasks of the project using the same logic. ASP.Net web-form technology and EF Code First approach allows me to rapidly develop the system and constantly check for errors and bugs during the implementation of the program.

6. IMPROVEMENT

In the future, I'm planning on completing the project by developing and testing all interfaces according to site map introduced in Section 4. I will also migrate the project and database to Microsoft Azure Cloud in order to implement the system as a web application.

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