**MINISTRY OF EDUCATION AND TRAINING**

**FPT UNIVERSITY**

Capstone Project Document

**Green Bus Ticket System**

|  |  |
| --- | --- |
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| **Ext. Supervisor** | N/A |
| **Capstone Project code** | GBTS |

- Ho Chi Minh city, September 5th 2016 -

Table of Contents

[List of Tables 4](#_Toc461376920)

[List of Figures 5](#_Toc461376921)

[Definitions, Acronyms, and Abbreviations 6](#_Toc461376922)

[A. Report No. 1 Introduction 7](#_Toc461376923)

[1. Project Information 7](#_Toc461376924)

[2. Introduction 7](#_Toc461376925)

[3. Current Situation 7](#_Toc461376926)

[4. Problem Definition xxx 7](#_Toc461376927)

[5. Proposed Solution 8](#_Toc461376928)

[5.1 Feature functions 8](#_Toc461376929)

[5.2 Advantages and disadvantages 8](#_Toc461376930)

[6. Functional Requirements 9](#_Toc461376931)

[7. Role and Responsibility 9](#_Toc461376932)

[B. Report No.2 Software Project Management Plan 10](#_Toc461376933)

[1. Problem Definition 10](#_Toc461376934)

[1.1. Name of this Capstone Project 10](#_Toc461376935)

[1.2. Problem Abstract 10](#_Toc461376936)

[1.3. Project Overview 10](#_Toc461376937)

[2. Project organization 13](#_Toc461376938)

[2.1. Software Process Model 13](#_Toc461376941)

[2.2. Roles and responsibilities 14](#_Toc461376942)

[2.3. Tools and Techniques 14](#_Toc461376943)

[3. Project Management Plan 16](#_Toc461376944)

[3.1. Software development life cycle 16](#_Toc461376946)

[3.2. Phase Detail 18](#_Toc461376947)

[3.3. All Meeting Minutes 19](#_Toc461376948)

[4. Coding Convention 19](#_Toc461376949)

## List of Tables

[Table 1 : Roles and Responsibilities 9](#_Toc461376950)

[Table 2 : Hardware Requirement for Server 12](#_Toc461376951)

[Table 3 : Hardware Requirement for Mobile 12](#_Toc461376952)

[Table 4 : Software requirements 13](#_Toc461376953)

[Table 5 : Roles and responsibilities 14](#_Toc461376954)

[Table 6: Tools List 15](#_Toc461376955)

[Table 7: Technique List 15](#_Toc461376956)

[Table 8: Software Development Life Cycle Detail 17](#_Toc461376957)

[Table 9: Phase 1: Infrastructure 18](#_Toc461376958)

[Table 10: Phase 2: System & Web app 19](#_Toc461376959)

[Table 11: Phase 3: Web service 19](#_Toc461376960)

[Table 12: Phase 4: Mobile app 19](#_Toc461376961)

## List of Figures

[Figure 1 : Scrum model 13](#_Toc461376962)

# Definitions, Acronyms, and Abbreviations

|  |  |
| --- | --- |
| **Name** | **Definition** |
| GBTS | Green Bus Ticket System |
| NFC | Near Field Communication |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# Report No. 1 Introduction

## Project Information

* Project name: **Green Bus Ticket System**
* Abbreviation: **GBTS**
* Product Type: **Web app & Mobile app**
* Start Date: **September 5th 2016**
* End Date: **December 2016**

## Introduction

Nowadays, bus is the most popular public transportation, buses are very safe, time efficient and cheap. In Vietnam, many people daily travel in these local buses from their house to their offices, schools and other places. For traveling by bus, people have to buy a paper bus ticket on a bus. The bus sometimes is crowded, buying ticket is not comfortable and inefficient. Moreover, the ticket is thrown anywhere after had used. The cost is spent very large and the ticket is created to garbage that cause wasting of wood resource. Based on researches and analysis, we proposed a solution for bus managers, passengers in Vietnam.

We build a system, which help bus managers, passengers to solve their current problems. In the process of analysis, we believe that NFC technology is suitable to resolve the problem by using NFC card to save passenger’s account information, so these NFC cards will be electronic bus tickets. NFC cards are cheap, small, convenient to bring with and easy to perform checking or validating. NFC cards are very durable, no-battery required and easy to rewrite information which is suitable to resuse. Beside of that, we also provide a system to help passengers manage their account, NFC cards and find buses based on their starting point and destination. Moreover, this system can help bus company manage their buses and tickets for income report.

## Current Situation

* For using bus, the passengers have to buy a paper bus ticket on a bus and pay cash for the driver assistant.
* Some buses route has already provided the buy ticket machine but the driver must take a cash, then must pay cash in return.

## Problem Definition

Research the current buying bus ticket process, we found that the traditional process has many advantages and disavantages below:

* Advantages:
  + Easy for anyone to use the bus, they need to bring cash along and pay for the paper ticket.
  + No technical skills needed.
  + No need to bring NFC card along.
* Disadvantages:
  + Buying a paper bus ticket on a bus which sometimes is crowded is not comfortable and inefficient.
  + The ticket is thrown anywhere after had used is wasting of money and wood resource.
  + The ticket sets (monthy or annually) are easily being lost or fray. Besides, the driver assistance has not good behavior with those passengers.
  + Some buses route has already provided the buy ticket machine but the driver must take cash, then ~~must~~ pay cash in return. It is not comfortable and inefficient both passenger and driver.

## Proposed Solution

Our solution is a new system, which will cover the whole bus ticket buy and sell process combine with NFC technology for buying bus ticket easy and efficient. In addition, our solution is also help passengers find buses route.

GBTS includes a web app and a mobile app, with the following features.

### Feature functions

* + Using NFC technology for storing passenger’s account information. The passengers can buy NFC card from bus companies or via online obly one time for using many times. The passengers use this NFC card as an electronic ticket each time they use bus.
  + There is an emulator on each bus which directly communicate with NFC card to access passenger account information. The emulator then sends information to the system to process. Next, the system check, minus credit on related account and notify tiket details to passenger’s mobile phone (if they have already installed mobile application).
  + With web application, passengers can manage their account and outcome report. In the other hand, bus managers can manage their buses, tickets, passengers and income report. They can also notify or suggest the promotion campaign to passengers.
  + With mobile application, passengers can receive ticket details or promotion notification, manage their account and outcome report. The mobile application can also help them to find buses route.
  + In the other hand, bus companies also issue anonymous NFC cards with fixed balance. Passengers who forget their card can buy these anonymous cards for temporary using.

### Advantages and disadvantages

* Advantages:
  + - NFC card is cheaper and very durable, no-battery requied, small and easy to bring with.
    - The system can replace the traditional way which always need paper bus tickets. We try to reduce garbages and save wood resource.
    - The system provides a new way to accost passengers with promotion or advertisement.
    - Standardize the process and make them available to more and more transportation services.
  + Disadvantages:
    - Each passenger must have at least one primary NFC card to use the system and up to three additional NFC cards.
    - Cost of buying each bus an emulator in order to communicate with NFC card.

## Functional Requirements

Passenger component:

* + Activate for a new account.
  + Get NFC cards.
  + Add credit to card.
  + Get outcome report.
  + Find bus.
  + View promotions & offers.

Bus manager component:

* + Manage their buses.
  + Manage credit plans.
  + Edit passengers.
  + Manage NFC cards.
  + Get income report.
  + Create promotions and offers.

Admin component:

* + Manage all accounts.

Emulator component:

* + Read & write NFC card.
  + Send information to server.

Scheduler component:

* + Suggest promotions and offers

## Role and Responsibility

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Full Name** | **Role** | **Position** | **Contact** |
| 1 | Kiều Trọng Khánh | Project Manager | Supervisor | [khanhkt@fpt.edu.vn](mailto:khanhkt@fpt.edu.vn) |
| 2 | Đỗ Ngọc Hoàng | Developer | Leader | [hoangdnse61246@fpt.edu.vn](mailto:hoangdnse61246@fpt.edu.vn) |
| 3 | Trần Quang Trường | Developer | Member | truongtqse61129@fpt.edu.vn |
| 4 | Đoàn Minh Đức | Developer | Member | ducdmse61486@fpt.edu.vn |

Table 1 : Roles and Responsibilities

# Report No.2 Software Project Management Plan

## Problem Definition

### Name of this Capstone Project

* **Official name**: Green Bus Ticket System
* **Vietnamese name**: Hệ thống bán vé xe buýt tiện lợi
* **Abbreviation**: GBTS

### Problem Abstract

For the goal of improving current bus system, especially the buying ticket process. We provide the solution for both passengers in buying, using bus ticket and the bus managers in managing efficiently. But there are many kinds of passengers may use our system, some of them don’t have any information technology skills like the old people. So we have to find the best convenient way to make our system simplest and easy to use for anyone.

Our system use NFC technology, this technology is quite new, so we may need times to research and integrate NFC to our system. Currently, only Android and Window Phone are supporting NFC technology, so we need knowledges on these operating systems for implementation.

### Project Overview

#### Current Situation

Below are the problems encountered in this project:

* **NFC security**: working with NFC, there are some problems may happen, any device support NFC like smartphone can read and write to this, so it can be counterfeited, attacked during data transmission caused data loss, data, corruption.
* **Emulator’s problem:** using emulator on bus in order to validate and process NFC cards is sometime not work or damaged.
* **Passengers’s habitat**: passengers are used to buying paper ticket with cash, so deploy the system in real life may take long time.
* **Account information secutiry**: the system allow passenger to buy ticket credits, this function may becom tatget for hacking and cheating.

#### The Proposed System

* After doing many researches on technology for saving information, we choose NFC technology as this technology is very capable of resolve the current situations in selling bus tikets. The basic idea is to use a NFC tag that each NFC card contain a unique card ID as a ticket that can be reused instead of using paper.
* In task assignment, we assign to member using vertical model to make sure if any member in this problem cannot continue to work in our team there will be the least harmful to the project processes.
* Our system includes three subsystems:
  + An online web application for passengers, bus managers and administrator.
  + A mobile application for passengers.
  + A mobile application for emulator.

##### ***Web Application***

Web application consists of three main parts:

* For passengers:
  + Activate for a new account.
  + Manage their account.
  + View outcome report.
  + Find buses route.
  + View promotions & offers.
  + Buy NFC card online.
* For bus managers:
  + Manage thier buses.
  + Manage ticket credit plans.
  + Manage their passengers.
  + Manage NFC cards.
  + View income report.
  + Send promotions and offers to their passengers.
* For administrator:
  + Manage all accounts.
  + Configure the system

Besides, website application also provides an API interface for two mobile applications to retrieve, update data from mobile applications.

##### ***Mobile Application***

There will be 2 applications which will be used by passengers and emulator. The mobile applications included functions as below:

* For passengers:
  + Activate for a new account.
  + Manage their account.
  + View outcome report.
  + Find buses route.
  + View promotions & offers.
  + Buy NFC card online.
* For emulator:
  + Read and write NFC card’s information.
  + Send information to server.

#### Boundaries of the System

* The system is mostly built based on real processes of bus ticket in Ho Chi Minh City. Our main target is improving the current process and makes it more convenient and efficient in Ho Chi Minh City.
* Any bus system which deployed this system must set up devices to operate, includes:
  + Emulator can read a NFC Card, with internet connection.
  + NFC cards with account information.
* The completed product includes:
  + Website application
  + Android mobile application for passengers and for emulator.

#### Future Plans

With further research and development, the system can apply the following features:

* Bus companies can place many emulators at bus stop with an assistant for helping the passengers recharge their NFC card credit without using mobile app or website. It is suitable for any passenger who lack of knowledge in information technology.
* Allow passengers add credit to their account. The system will minus credit on their account automatically while buying ticket in case of their cards is out of credit.

#### Development Environment

##### ***Hardware requirements***

* **For web application server**

|  |  |  |
| --- | --- | --- |
| Windows | Minimum Requirements | Recommended |
| Internet Connection | Cable, Wi-Fi (4 Mbps) | Cable, Wi-Fi (8 Mbps) |
| Operating System | Window Server 2008 R2 | Window Server 2012 R2 |
| Computer Processor | Intel® Xeon ® 1.4GHz | Intel® Xeon ® Quad Core |
| Computer Memory | 2GB of RAM | 4GB of RAM or more |

Table 2 : Hardware Requirement for Server

* **For Mobile**

|  |  |  |
| --- | --- | --- |
| Android | Minimum | Recommended |
| Internet Connection | Wi-Fi or 3G (1 Mbps) | Wi-Fi or 3G (8 Mbps) |
| Operating System | Android 4.4.2 | Android 6.0.0 |
| Mobile Processor | Cortex-A7 Dual-Core 1.3GHz | Cortex-A7 Dual-Core 1.3GHz |
| Mobile Memory | 1GB of RAM | 2GB of RAM or more |

Table 3 : Hardware Requirement for Mobile

##### ***Software requirements***

|  |  |  |
| --- | --- | --- |
| Software | Name / Version | Description |
| Operating system | Window Server 2012 R2 | Operating system and platform for development |
| Environment | .NET Framework 4.5 | Specification for developing web application |
| IDE | Visual Studio 2015, Android Studio v2.1 | Used for implement website and Android Mobile App. |
| Design Model tool | StartUML v2.5.1 | Used for creating modal and diagrams. |
| DBMS | Microsoft SQL Server 2014 | Used to create & manage the database for system |
| Document storage | Google Drive | Used for storing document |
| Store and manage source code | Team Foundation Server | Used to store all source code |

Table 4 : Software requirements

## Project organization



### Software Process Model

The project is developed under scrum model. Scrum model is capable with current situation in our team. We choose this model because the following reasons:

* The bus ticket problem not fully defined and the bus business in company cannot be fully understood. The users of our system are vary, so we may have many changes during development process to adapt the requirements.
* This project use NFC technology, which is a new technology that may need many times to research and implement.
* Scrum adopts an empirical approach, accepting that the problem is not fully understood or defined, focusing instead on maximizing the team's ability to deliver quickly, to respond to emerging requirements and to adapt to evolving technologies and changes in market conditions.



Figure 1 : Scrum model

Reference: <http://skytechnovation.com/scrum-development-model/>

### Roles and responsibilities

|  |  |  |  |
| --- | --- | --- | --- |
| No | Full name | Role in Group | Responsibilities |
| 1 | Kiều Trọng Khánh | Supervisor, Project Manager | * Specify user requirements * Control the development process * Give out technique and business analysis support |
| 2 | Đỗ Ngọc Hoàng | Team leader, B.A, Developer, Tester | * Managing process * Designing database * Clarifying requirements * Prepare documents * GUI design * Create test plan * Coding * Testing |
| 3 | Trần Quang Trường | Team member,  B.A, Developer,  Tester | * Designing database * Clarifying requirements * Prepare documents * GUI design * Create test plan * Coding * Test |
| 4 | Đoàn Minh Đức | Team member,  B.A, Developer,  Tester | * Designing database * Clarifying requirements * Prepare documents * Create test plan * Coding * Test |

Table 5 : Roles and responsibilities

### Tools and Techniques

|  |  |
| --- | --- |
| Tool | Name / version |
| Web server | IIS |
| Development tool | Visual Studio, Android Studio |
| DBMS | SQL Server 2014 |
| Source control | Team Foundation Server |
| Modeling tool | StarUML v5.0.1 |
| Document tool | Microsoft Word 2010 |

Table 6: Tools List

|  |  |
| --- | --- |
| Technique | Name / version |
| Frontend | HTML5, CSS, JavaScript, jQuery |
| Backend | ASP.Net, Android, NFC |

Table 7: Technique List

## Project Management Plan



### Software development life cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Phase | Description | Deliverables | Resource needed | Dependencies and Constrains | Risks |
| Infrastructure | - Identify and clarify overall requirements.  - Determine the system architecture.  - Build infrastructure for the project. | - Database design.  - System main structure. | 20 man-days |  | - Unclear project scope.  - Lack of member share of understand. |
| System  &  Web app | - Identify software and hardware requirements.  - Implements all web app modules.  - Design the web UI  - Build the web app | - Complete web app for all roles of the system. | 60 man-days | - Depends on “Infrastructure” | - Unclear project scope.  - Lack of experience. |
| Web services | - Identify requirements for mobile app.  - Build required API for mobile app. | - API for mobile app. | 20 man-days | - Depends on “Web app & System” | - Lack of experience. |
| Mobile apps | - Design the mobile UI  - Build mobile apps for end users and emulator. | - Complete Android Apps | 20 man-days | - Depends on “Web services” | - Lack of experience.  - Lack of NFC knowledge |

Table 8: Software Development Life Cycle Detail

### Phase Detail

#### Phase 1: Infrastructure

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Assessment | - Determine requirements.  - Create product backlog. | * HoangDN * DucDM * TruongTQ |
| 2. Selection | - Determine system architecture: ASP .NET MVC.  - Determine software design pattern: Repository & Service.  - Determind all core functions. | * HoangDN * DucDM * TruongTQ |
| 3. Development | - Create the main structure of project. | * HoangDN * DucDM * TruongTQ |
| 4. Review | - Review all completed works and presentation.  - Create sprint backlog. | * HoangDN * DucDM * TruongTQ |

Table 9: Phase 1: Infrastructure

#### Phase 2: System & Web app

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Assessment | - Determine requirements for System and Web app.  - Update product backlog. | * HoangDN * DucDM * TruongTQ |
| 2. Selection | - Determind all functions according to requirements of System and Web app. | * HoangDN * DucDM * TruongTQ |
| 3. Development | - Design and build prototype for web UI  - Create conceptual diagram  - Design class diagram  - Design database  - Implement all the web UI: layouts, detail pages, etc.  - Implement all the functions in controllers.  - Build needed utility classes | * HoangDN * DucDM * TruongTQ |
| 4. Review | - Review all completed works and presentation.  - Create sprint backlog. | * HoangDN * DucDM * TruongTQ |

Table 10: Phase 2: System & Web app

#### Phase 3: Web service

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Assessment | - Determine requirements for Web service.  - Update product backlog. | * HoangDN * DucDM * TruongTQ |
| 2. Selection | - Determind all functions according to requirements of Web service. | * HoangDN * DucDM * TruongTQ |
| 3. Development | - Create API for mobile app based on functions on the web app. | * HoangDN * DucDM * TruongTQ |
| 4. Review | - Review all completed works and presentation.  - Create sprint backlog. | * HoangDN * DucDM * TruongTQ |

Table 11: Phase 3: Web service

#### Phase 4: Mobile app

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Assessment | - Determine requirements for System and Mobile app.  - Update product backlog. | * HoangDN * DucDM * TruongTQ |
| 2. Selection | - Determind all functions according to requirements of Mobile app. | * HoangDN * DucDM * TruongTQ |
| 3. Development | - Implement all the functions based on the designed UI and the provided API. | * HoangDN * DucDM * TruongTQ |
| 4. Review | - Review all completed works and presentation.  - Create sprint backlog. | * HoangDN * DucDM * TruongTQ |

Table 12: Phase 4: Mobile app

### All Meeting Minutes

Meeting minutes are contained in folder “Meeting minutes” in the attached CD.

## Coding Convention

**C#:** Using to develop website and web service.

Summary:

* Naming Convention:
  + For variable’s name, use camel case. Eg: minValue, maxValue…
  + For function name, class name, use Pascal case. Eg: AddIncome, AddExpense…
* Layout Convention:
  + Indent continuation one tab stop (four spaces).
  + Add at least one blank line between method definitions and property definitions.
  + Use parentheses to make clauses in an expression apparent.

**Android:** Using to develop mobile application

Summary:

* Naming Convention:
  + For variable’s name, use camel case. Eg: minValue, maxValue…
  + For function name, class name, use Pascal case. Eg: AddIncome, AddExpense…
  + For resource file names are written in lowercase\_underscore. Eg: my\_name
  + Declarations Convention:
    - One declaration per line is recommended.
  + Using C# Code Convention from:
    - <https://msdn.microsoft.com/en-us/library/ff926074.aspx>
  + Using Android Code Convention from
    - <https://source.android.com/source/code-style.html>

# Report No.3 Software Requirement Specification

* 1. Software System Attribute
     1. Usability
* To use the web application, user must have knowledge about business process. The system requires 1 day for training.
* The Android application for emulator requires 10 minutes training for staff.
* The Android application for passenger will take 10-30 minutes to get used to the mobile system completely.
  + 1. Reliability
* The number of sending notification failure are 1 time per 100 notifications.
* Timer tasks run at configured time with 100% execution rate.
  + 1. Availability
* System should take at most 6 hours per month for backup or repairing.
  + 1. Security
* Privacy: Each role of user has a specific permission to interact with system.
* System requires SMS verification for all users.
* System always checks authorization and authenticated before doing anything.
* Only admin can grant permission to other roles.
  + 1. Maintainability
* The system is divided into separated modules.
* The code is easy to maintain and upgrade.
  + 1. Portability
* The web application is running on Windows 7 or above.
* Mobile application for passenger and emulator runs on Android API greater than 4.1
* Providing easy installation.
  + 1. Performance
* Web appication handles the task within 10 seconds.
* System response time of SMS message depend on telecomunications infrastructurs and server.
* Emulator reads data from NFC card in less than 5 second within the distance between 0 centimeter and 1 centimeter in the condition with no obstacle.