**MINISTRY OF EDUCATION AND TRAINING**

**FPT UNIVERSITY**

Capstone Project Document

**Green Bus Ticket System**

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

- Ho Chi Minh city, September 5th 2016 -

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# Definitions, Acronyms, and Abbreviations

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

* 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 tickets are easily being lost or fray. Besides, the driver assistance has not good behavior with passengers.
* Some buses route has already provided the buy ticket machine but the driver must take a cash, then must pay cash in return. It is not comfortable and inefficient both passenger and driver.
* The passengers must always have cash if they want to use bus.

## 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 **once**. 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. **In addition, they can buy online ticket in case of forgetting NFC card**. The mobile application can also help them to find buses route.

### 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:
    - Every passenger need to buy new NFC card. (al least 1 – map 3)
    - Cost of buying each bus an emulator in order to communicate with NFC card.
    - **Training for using the new system may required.**

## Functional Requirements

Passenger component:

* + **Register** for a new account. (activate)
  + Manage their account.
  + **Manage their NFC card.**
  + View outcome report.
  + Find buses route.
  + View promotions & offers.
  + Buy ticket online.

Bus manager component:

* + Manage thier buses.
  + Manage their ticket credits.
  + Manage their passengers.
  + **Manage NFC card.**
  + View income report.
  + Send promotions and offers to their passengers.

Admin component:

* + Manage all accounts.
  + Configure the system

Emulator component:

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

## 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 : 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

Public transportation like bus is one of the best solution for most big cities. But in Vietnam, the demain of using bus is decreasing for many problems. The big one is the bus is usually crowed, buying ticket is not comfortable and inefficient. In addtition, current bus system is using paper ticket which create more garbages and wasting resource. Some bus route has already provided the buy ticket machine but the driver must take a cash, then must pay cash in return. It is not comfortable and inefficient both passenger and driver. Passengers sometime forget or lost their money/wallet, there are no way to use bus.

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 in efficiently and the bus managers in managing the ticket outcome, providing the best service to their passenger, improving their services.

### 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 contains a unique card ID as a ticket that can be reused instead of using paper.
* We also add ticket buying online as an alternative way in case of forgetting or lost NFC card.
* **We build a highly available web server to maintain the main system to work 24/7 and make sure that if mobile applications need access to the information there will be always available.**
* 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:
  + Register for a new account.
  + Manage their account.
  + Manage their NFC card.
  + View outcome report.
  + Find buses route.
  + View promotions & offers.
  + Buy ticket online.
* For bus managers:
  + Manage their buses.
  + Manage their ticket credits.
  + Manage their passengers.
  + 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:
  + Register for a new account.
  + Manage their account.
  + Manage their NFC card.
  + View outcome report.
  + Find buses route.
  + View promotions & offers.
  + Buy ticket online.
* For emulator:
  + Read NFC card’s information.
  + Send information to server.

#### Boundaries of the System

Pham vi he thong, va gioi han vat u choi trach nhiem

* **The language of this system is Vietnamese.**
* The system is mostly built based on real processes of bus ticket in Vietnam. Our main target is improving the current process and make it more convenient and efficient.
* 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

Propose for future plan: current system is only support selling tickets for bus in Vietnam as we call Isolated Single Service Model. We design the system it easy to scale to the model:

* **Isolated Multiple Service Model: system can be deployed to one company which provide multiple stransportation services such as air transport, rail transport, etc.**

#### 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 : 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 : 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 : Software requirements

## Project organization



### Software Process Model

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

* This model is very simple to understand and use. The waterfall model illustrates the software development process in a linear sequential flow. In waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases.
* The requirements are very well-known and clear and fixed.
* Product is stable and rarely change.
* Easy to manage.



Figure : Waterfall model

Reference: Page 30, chapter 2, Software process model, SOFTWARE ENGINEERING 9th Edition, by Ian Sommerville.

### 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 : 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 : Tools List

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

Table : Technique List

## Project Management Plan



### Software development life cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Phase | Description | Deliverables | Resource needed | Dependencies and Constrains | Risks |
| Requirement Analysis | - Identify and clarify overall requirements. | - Report No.1 - Introduction | 10 man-days | - N/A | - Unclear project scope.  - Lack of member share of understands.  - Missing requirement |
| System and Software Design | - Identify software and hardware requirements.  - Decide software architect and software detail design.  - Design database. | - Report No.2 – Software project management plan.  - Report No.3 – Software requirement specification.  - Report No.4 – Software design description. | 20 man-days | - Depends on “requirements definition” | - Unclear project scope.  - Lack of knowledge and experience for design.  - Lack of experience. |
| Implementation and Unit testing | - Implements all functions in requirement of system.  - Create test plan.  - Perform unit testing. | - Software package. | 60 man-days | - Base on “software requirement specification” and “software design description” | - Members do not performs code & unit test.  - Lack of practical experience. |
| Integration and System testing | - Perform integration test and system test. | - Report No.5 – System implementation & test | 20 man-days | - Implementation phase and Unit testing must be finish. | - Lack of testing experience.  - Not enough time for perform testing. |
| Operation and Maintenance | - Deploy system on real environment.  - Create user manual. | - Report No.6 – Software user’s manual. | 10 man-days | - Integration and System testing” must be finish. | - User manual may be difficult for user to understand and follow. |

Table : Software Development Life Cycle Detail

### Phase Detail

#### Phase 1: Requirement Analysis

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Collect requirements | - Find which systems currently provide similar service, their strengths and weakness. | * DucDM * TruongTQ |
| 2. Identify and clarify main functions. | - Define which main functions system should provide. | * HoangDN * DucDM * TruongTQ |
| 3. System Introduction | - Complete Introduction Report. | * HoangDN |
| 4. Identify software and hardware requirements | - Find out the suitable hardware and software for the system, include minimum and recommend requirements. | * DucDM * TruongTQ |
| 5. Software Project  Management Plan. | - Prepare Project Management Plan. | * HoangDN |

Table : Phase 1: Requirement analysis

#### Phase 2: System and Software design

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Decide software architect and software detail design | - Define the major software components and interfaces.  - Draw core flow diagram, use case diagram, …  - Review and improve in group meeting. | * HoangDN * DucDM * TruongTQ |
| 2. Design database | - Design database for the system  - Review and improve in group meeting. | * HoangDN * DucDM * TruongTQ |
| 3. Technology research | - Android, NFC. | * HoangDN * DucDM * TruongTQ |
| 4. Design Document | - Create software design document | * HoangDN * DucDM * TruongTQ |

Table : Phase 2: System and Software design

#### Phase 3: Implementation and Unit testing

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Implement all web function in requirement of system | - Coding all components for web application. | * HoangDN |
| 2. Implement all mobile function in requirement of system | - Coding all components for mobile application. | * DucDM * TruongTQ |
| 3. Create test plan | - Planning for unit test.  -Review and improve in group meeting. | * HoangDN * DucDM * TruongTQ |
| 4. Perform unit testing | - Write Unit test cases.  - Implement Unit tests. | * HoangDN * DucDM * TruongTQ |

Table : Phase 3: Implementation and Unit testing

#### Phase 4: Integration and System testing

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Perform integration test and system test | - Test groups of related modules  - Test whole the system. | * HoangDN * DucDM * TruongTQ |

Table : Phase 4: Integration and System testing

#### Phase 5: Operation and Maintenance

|  |  |  |
| --- | --- | --- |
| Task | Description | Author |
| 1. Deploy system on real environment | - Deploy the system on client environment. | * HoangDN * DucDM * TruongTQ |
| 2. Create user manual | - Create guideline for system using. | * HoangDN * DucDM * TruongTQ |
| 3. Perform maintenance activities | - Do periodic maintenance activities for client system. | * HoangDN * DucDM * TruongTQ |

Table : Phase 5: Operation and Maintenance

### 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.
* Commenting Convention:
  + - Begin comment text with an uppercase letter.
    - End comment text with a period.
    - Insert one space between the comment delimiter (//) and the comment text.
    - Do not create formatted blocks of asterisks around comments.

**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
* Commenting Convention:
  + - Begin comment text with an uppercase letter.
    - End comment text with a period.
    - Insert one space between the comment delimiter (//) and the comment text.
    - Do not create formatted blocks of asterisks around comments.
  + 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>