# CHAPTER 4: DESIGN PHASE

## 4.1 Introduction

Having done the project analysis which was done in the previous chapter, chapter 3, the project moves on to the design phase where the designing of the automated fare collection system will be done. The design goal or the chapter goal is to answer the “how?” part of the development process. A context diagram and a dataflow diagram are the first tools the developer is going to implement to understand and help others understand the system. An architectural design, physical design, database design interface design and a program design shall also be carried out.

## 4.2 System design

Define

It involves detailing how a system meets the requirements from the analysis phase in the previous chapter.

### 4.2.1 Description of the proposed system

The proposed automatic fare collection will be comprised of a device, which records GPS coordinates of places where a passenger drops off or boards a bus. Passengers swipe an issued unique RFID card or get a journey token on boarding a minibus and the GPS coordinates at a point at which a customer boarded the minibus will be recorded. On dropping off a passenger will swipe the card again and an amount will be deducted from the customer account which will be deduced by the system from the pick-up point GPS coordinates and drop off point GPS coordinates.

### 4.2.2 Context diagram of the proposed system

Figure 4.1 Context diagram

### 4.2.3 Dataflow diagram for the proposed system

Figure 4.2 Dataflow diagram of the proposed system

## 4.3 Architectural design

Architectural design in software engineering is the modelling of the technical environment in which an information system works in. It outlines the software and hardware elements which are needed for the information system to function properly. The architecture for the system in this project is described below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Automatic Fare Collection Device |  | Web Server | Middleware | DBMS |
|  |  |  |  |  |
|  |  | Web browser |  |  |

Fig 4.3 Architectural design

From the diagram the AFC device communicates with the web server. The web server is the software used to access web pages. Apache will be the used web server in this project. The web server then feeds data into the Database Management System (DBMS) through a middleware. The DBMS stores and manages the data. There are different DBMS that can be used and this project makes use of the MySQL DBMS. The Middleware is the backend programming or scripting language that is used to manipulate operations sent by the web server. There are different web applications middleware that include Python, ASP.Net, ColdFusion, Ruby on Rails and PHP which is the middleware to be used in this project.

## 4.4 Physical design

Physical design is the network arrangement of an information system. It is mapped by the use of a network model, which is a diagram that depicts all nodes for a network. A client-server network model shall be used in this project where each vehicle with an AFC device acts as a node communicating with one central server. There will also be computers acting as nodes. These computers will be those being used by transport managers to view operations and get reports.

### Figure 4.4 Physical design

## 4.5 Database design

Database design refers to the definition of data elements to be employed by the software application. Three methods will be used to model the database design and these are database architecture, enhanced entity relationship modelling and the database tables.

### 4.5.1 Database Architecture

Database architecture is an abstract design for a database management system. The American National Standards Institute – Standards Planning and Requirements Committee (ANSI-SPARC) shall be used to describe the database architecture. The ANSI-SPARC architecture employs a three-level architecture and the objective for this is to separate the user’s view as it allows independent customised user views. Each user of the application access data from the same location but each user has a different customised view of the data.

Google me and draw me

Fig 4.5 Database Architecture

### 4.5.2 Enhanced Entity Relationship Model

Enhanced Entity Relationship (EER) model is a conceptual view of the existisitng relationships between the tables of a database. This is expressed through an EER diagram. An EER diagram identifies all the tables of a database and their respective unique keys. Relationships between them are also displayed.

Draw me

Fig 4.6 EER Diagram

### 4.5.3 Database Tables

Define database table

Draw all of them tables

## 4.6 Program Design

Define program design and explain it

### 4.6.1 Package Diagram of Model View Controller

Define package diagram

Draw

### 4.6.2 Class diagram

Define package diagram

Draw

### 4.6.3 Sequence diagram

Define package diagram

Draw

## 4.7 Interface design

An interface is the …

Interface design is therefore a very important stage of this project as the interface determines the user friendliness of an application.

### 4.7.1 Input Forms

These are forms that mainly take input from the user of the system.

#### 4.7.1.1 Login Form

This form allows users to login to the system and if a user tries to access the system with no user session, it will be the first form they encounter.

### 4.7.2 Output Forms

These are forms that mainly take input from the user of the system.

#### 4.7.1.2 Operation Report

This form allows management to have a relatime view of how operations are happening.

## 4.8 Pseudo Code

Define and expain

Write it

## 4.9 Security Design

Define and security in ISs

There are three different aspects to consider in security design and these are physical security, network security and operational security.

### 4.9.1 Physical Security

Physical security is the protection of hardware, software, networks and even personell from physical events or actions that causes damage or loss. These include theft, flooding, fires and vandalism. Personel shall be tasked to protect the AFC devices from an physical security threats and will be held accountable if any action or event lead to the damage or loss of a device.

### 4.9.2 Network Security

Network security refers to the identification of all threats that can attack the system network intentionally or unintentionally. Powerful coding mechanisms will be employed and robust code will be built to protect the system network.

## 4.10 Conclusion

The design phase outlined the construction of the proposed system in light of the analysis that had been carried out in chapter 3. Design elements that include system design, physical design, database design, interface design, program design and security design were covered and considered understandable. This gives a stepping stone into the implementation phase where the actual coding, testing, documentation and conversion of the project will take place.