AN INTEGRATED TAXI MANAGEMENT INFORMATION SYSTEM MODEL FOR KAMPALA TAXI OWNERS AND DRIVERS ASSOCIATION

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SEPTEMBER, 2018

ACCEPTENCE SHEET

This thesis entitled "**AN INTEGRATED TAXI MANAGEMENT INFORMATION SYSTEM MODEL FOR KAMPALA TAXI OWNERS AND DRIVERS ASSOCIATION.**", prepared and submitted by **BIZOZA KOMAYOMBI SERGE** in partial fulfillment of the requirement for a degree of **MASTER OF INFORMATION TECHNOLOGY (Information Systems)**, is hereby accepted.

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DECLARATION

I**, BIZOZA KOMAYOMBI SERGE,** hereby declare that this thesis titled "**AN INTEGRATED TAXI MANAGEMENT INFORMATION SYSTEM MODEL FOR KAMPALA TAXI OWNERS AND DRIVERS ASSOCIATION"** is original and a result of my own study and not been submitted for an award of degree in any other university of institute of higher learning.

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DEDICATION

This thesis is dedicated to all my lectures, my parents, Mr. KOMAYOMBI MUGWIZA Mamert and Mrs. TIMIZA MUGABO Henriette, and my dear sisters Laetitia Sine, Nadia Komayombi, Isabelle Mugwiza, Nancy Mugwiza, Agatha Mugwiza and my brothers Fernand Mugwiza Benjamin Mugwiza and Joseph Mugwiza, thank you so much for the love, supportive prayers and role in my life, May the lord continue to bless us all the time.

BIOGRAPHICAL SKETCH

The author of this thesis is Bizoza Komayombi Serge, born on 27th/07/1990 in Goma / Democratic Republic of Congo. He completed his primary school in 2002 in Complexe Scolaire KABUIS then joined ISIDORE BAKANJA Institute for his secondary school, which he completed in 2010.

In 2011, he joined Bugema University for his Bachelor's Degree in Computer Network and System Administration and graduated in 2014.

In 2014, he worked in INFOSET in the department of payment system. In August 2016, he applied for Master's Degree of Information Systems at Bugema University.

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TABLE OF CONTENTS

PAGE

LIST OF TABLES

TABLE

PAGE

LIST OF FIGURES

FIGURE PAGE

LIST OF APPENDICES

APPENDIX

PAGE

LIST OF ACRONYMS

KATODA: Kampala Taxi Owners and Drivers Association

ICT : Information Communication Technology

ERD : Entity Relationship Diagram

ABSTRACT

BIZOZA KOMAYOMBI SERGE, School of Graduate Studies, Bugema University, Kampala-Uganda, September 2018. "**AN INTEGRATED TAXI MANAGEMENT INFORMATION SYSTEM MODEL FOR KAMPALA TAXI OWNERS AND DRIVERS ASSOCIATION.**"

Supervisor: Samali V. Mlay, Ph.D.

The researcher conducted the study to develop an integrated taxi management information system model for Kampala taxi owners and drivers association (KATODA).

The main objective of this research was to design a model of an integrated taxi management information system model for Kampala taxi owners and drivers association. To fulfill that objective, the researcher carried out requirements gathering and analysis to obtain the functional and nonfunctional requirements for the system.

An interview method was used with the help of interview guides to gather data from the respondents and content analysis was used to analyze the qualitative data and requirements needed for the designing of the model where noted. The researcher designed the model using UML modeling tool (Microsoft Visio) and MySQL an open source Relational Database Management System. The integrated management information system model shows how the operators in the Kampala taxi owners and drivers association register taxis and taxi drivers for each vehicle. The operators also manage income and expenditure within the association.

CHAPTER ONE

INTRODUCTION

Background of the Study

All over the world, the popular mode of transportation is by use of taxis in most of the cities. The costs of owning a private vehicle are high and therefore, taxis serve an important and an alternative purpose in the transportation sector. Quality customer service requires fast and efficient means because the taxi industry is very competitive (Jing, et al., 2014). There are several taxi management systems including those that are satellite-based, to track taxis using Global Positioning System (GPS) technology. Taxi companies deploy currently such systems, mainly in the capital cities of developed countries. With these systems, taxi companies can track, locate, and dispatch taxis on the road network in real-time (Jing, et al., 2014).

Choudhary (2013) explains that, automating the taxi transportation is becoming more important because, automated systems provide accurate information about taxies such as registration, fare charges, road information, and taxi information. This information is from anywhere and at any time.

Furthermore, Choudhary (2013) adds that Information Management Systems are able to provide detailed information to commuters, taxi owners, and drivers. In addition, the systems efficiently and effectively manage the income and expenses for taxi owners and operators from the taxi companies.

In developing countries, taxis play numerous roles that are essential in development of the cities economically, much as they face severe challenges. Taxis can locate passengers at exact locations because they are flexible (Veloso et al., 2011). This

means that, the services taxis provide are flexible and easily accessible in terms or route operation, unlike other means of transport such as trains, buses, boats, and ships. Taxis have already become an essential part of our lives; particularly you are in hurry and in need of an urgent means of transport. During such emergencies, public transport is slow and inconvenient. More so, there are particular places where public means of transport do not fit because the roads are not main. In those areas, people may require walking long distances in order to reach the main roads and access the public means of transport, yet taxis can reach even in the feeder roads. Other factors hinder the usage of personal cars, such as insecurity to owners of the personal vehicles, lack of parking, traffic congestion and poorly constructed roads. A taxi offers a better option in all these situations on addition to other available means of transport (Rayle et al., 2014).

Much as taxis are vital and appropriate in the transportation sector for developing countries, associations responsible for managing their services operate in an informal and unorganized manner. According to Kisembo (2014), taxi associations in Uganda including Kampala Taxi Owners and Drivers Association (KATODA) maintain little records about taxi drivers, taxi owners, taxi fares, taxes, and income and expenditure within the association. Because of this poor management of taxi services, there are high response times while retrieving records, higher charges to taxi drivers, inaccurate accountability of income and expenses in the organization, hence lower earnings and losses.

It is against this background that the research purposes at developing an integrated taxi management information system for Kampala Taxi Owners and Drivers association. The researcher noted that KATODA could improve its managerial services in the

transportation industry if they deploy as system to automate and integrate their processes involved in various modules.

Statement of the Problem

Poor service delivery continues to escalate in the transportation sector in Uganda. Taxi governing bodies perform in an informal and unorganized manner leading to lower earnings and losses among the taxi drivers, taxi owners, and the governing bodies (Kayemba, 2013). Currently, Kampala Taxi Owners and Drivers association (KATODA) are using manual means to record the registration of taxis, taxi owners, and drivers, on paper. As a result, they face a challenge of retrieving the information in time and in an organized way, whenever required. In addition, KATODA has no formal way tracking the internal expenses and income, and hence finds challenges to deliver accurate reports to the governing authority, Kampala City Council Authority. Due to these inefficiencies and ineffectiveness, taxi owners and drivers are sometimes over charged and some income is miss used, hence the need to a system to address all the challenges.

General Objective

The general objective of the research is to develop an integrated taxi management information system model for Kampala Taxi Owners and Drivers Association to enable easy registration and recognition of all the taxi drivers, taxi owners, and their vehicles active in Kampala and for easy monitoring, managements of expenses and reporting.

Research Questions

1. What processes and specifications does the integrated taxi management information system for Kampala taxi owners and drivers association, require?
2. What modules and components does design for the integrated taxi management information system model for Kampala Taxi owners and drivers association, constitute?
3. How shall the integrated taxi management information system model for Kampala taxi owners and drivers, be tested, and validated?

Specific Objectives

The following specific objectives guide the research study:

1. To gather requirements necessary to design an integrated taxi management information system model for Kampala Taxi Owners and Drivers association and analyze them to obtain system specifications
2. To design an integrated taxi management information system model for Kampala Taxi Owners and Drivers association.
3. To develop an integrated taxi management information system for Kampala Taxi Owners and Drivers association, in order to test and validate the model.

Scope of the Study

This research focused on developing an integrated taxi management information system model for Kampala Taxi Owners and Drivers Association. The model has modules to register users, taxi owners, taxi drivers, and vehicles, manage the sittings of the system, manage KATODA income and expenditure, and generate reports. The model

called integrated because it connects all the distinct modules within KATODA into one system.

The researcher carried out the study within a period of five months, and developed a working prototype for an integrated taxi management information system model, to test and validate the model.

The researcher carried out the study in the central region of Uganda, Kampala. The Kampala Taxi Owners and Drivers Association (KATODA) own the integrated taxi management information system and are fully responsible to manage it if implemented.

Justification

The study was to expose the inherent situations of an integrated taxi management information system in Kampala, thus was an eye opener to the taxi owners, their vehicles and drivers how they were registered in different groups and to identify the ideal income and outcome per number of taxies active in the system,

The study pointed out the intensity of the gaps within the current practices thus assisting the key stakeholders to design the appropriate policies and measures towards addressing the problem.

Conceptual Design

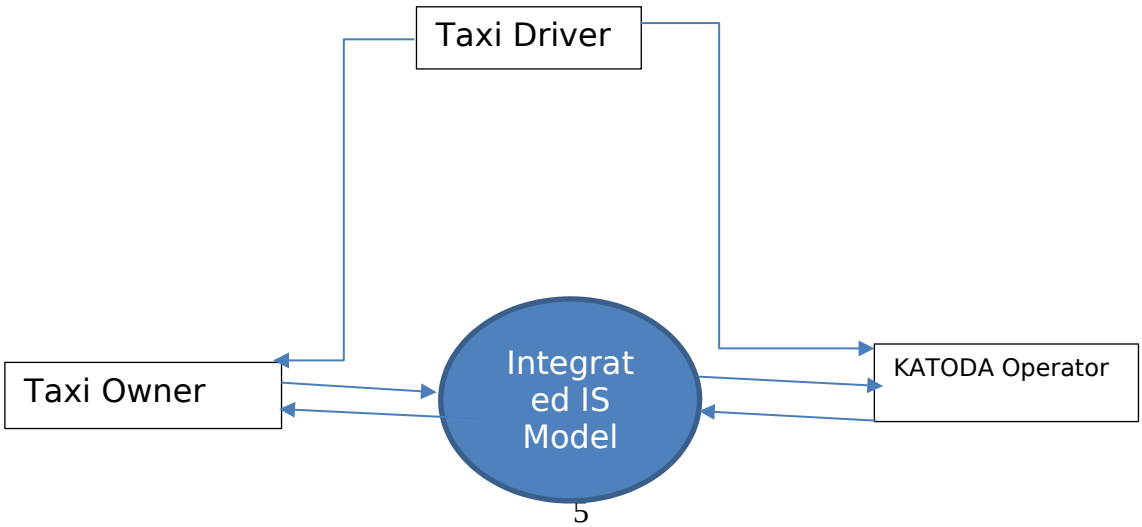

Figure 1: Conceptual Design

Operational Definition of Terms

Integrated Information system model: An information system is an organized system that captures, transmits, stores, retrieves, manipulates, or displays information, there by supporting people, organizations, or other software systems.

Taxi driver: This is the individual driving a taxi, he can be able to register himself in the system, and he is assigned to a particular vehicle and taxi owner.

Taxi owner: This individual owns a taxi vehicle registered in the integrated system. They can view the personal details can be viewed through the system by the taxi owners and drivers operators. He can also be able to register taxi drivers

Taxi drivers and owner's association: It is a group of many taxi drivers and owners of the taxis who share information in the system.

Model: A model is a working representation of a product or information system, usually built for demonstration purposes or as part of the development process

Integration: According to the study, integration is bringing related information together in one central point.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter outlines and discusses in details the related literature on taxi management systems and models by various authors who researched about this field of study. It includes research from books, journals, research papers, articles, websites and other sources found relevant. The literature investigates the role of information technology in the transportation sector, analysis, and design of taxi management systems, development and implementation of taxi management systems, related taxi management systems and models, and the summary of identified gaps.

The role of information technology in the transportation sector

Rayle, et al. (2014), explains that information and communication technologies (ICT) deliver intelligent solutions that play a great role in solving significant challenges that societies face in the transportation sector. Intelligent systems guide drivers to drive safely and avoid accidents, and even in case of a crush, these systems can call emergency services automatically. Intelligent systems in the transportation sector also reduce pollution.

According to Marin (2006), a taxi service is a thriving industry and therefore, the introduction of information technology would be advantageous. Cost effective, efficient, and compatible taxi management systems would have a high market potential. Therefore, this would help taxis to be safer hence improving the transportation sector as a whole.

According to Glaschenko, et al. (2009), the popularity of vehicle applications is increasing in western countries, and smartphone technology is increasingly penetrating

the industry. Several modern systems for transportation exist, such as dispatching systems most of which are hosted in a public cloud. In addition, companies that rent their taxis for commercial usage need advanced vehicle tracking systems on every vehicle. These systems help the companies to manage their whole business in an accurate and easy way. With such systems, companies are able to track their vehicles whenever they are sent for any booking. More so, they can monitor not only of the vehicles, but also the drivers and the passengers with the aid of the vehicle tracking systems (Gerdes & Schaper, 2015).

Furthermore, Glaschenko, et al. (2009) adds that in a fleet business, both the vehicles and the drivers are very important for the organization. Therefore, both of them must be taken good care of. Using the advanced Vehicle Tracking systems, the organization can do this with ease. It is easy to understand where the vehicle and the driver are. In case it is difficult for the company to communicate directly to the driver over the mobile phone, then you the location of the vehicle can be tracked. In so doing, the company is able to ensure the safety of both the vehicle and the driver, and can find them easily.

In addition, taxi management systems are good for diagnosis of the vehicles as well. They can help you to get sufficient information regarding fuel consumption along with the mileage of your vehicle. This helps to be aware of the efficiency of your cars if required, take the necessary steps as soon as possible to repair them (Idris et al., 2002).

Analysis and design of taxi management systems

Generally, all information systems, including taxi management information Systems are based on the conceptualization of the three fundamental iterative phases.

These include data input, data management, and data output. Data input is the phase that includes acquisition and verification of data. Data management or processing is the phase that includes retrieval and presentation of data (Tan, 2010).

Just like any information system, developing a taxi management information system is based on the analysis of the system. Analysis directly affects the database utility of the system. Database analysis is categorized into two parts. The first part is the analysis of conceptual model, the second part is analysis of the logical model **(**Feng & Liu, 2013).

Conceptual model is the generalization and abstraction of the real world. This model reflects the real world relations between things and to satisfy processing requirements of the user's data. The Entity Relationship diagram (ERD) is the powerful tool for designing the Conceptual model. Entity relationship model is problem-oriented conceptual model, and uses a graphical way to describe data of the real world. To establish the final system, the conceptual model has to be converted into a logical model and this completes the design of the database logical structure. The design of the database logic structure involves two steps: First step is to convert the entity relationship diagram to the entity-relationship model, and then optimize the entity-relationship model. Once the database model is designed, then system design can start (Feng &Liu, 2013).

Related taxi management systems and models

An agent-based simulation model was developed to ease taxi transportation in Lisbon, Portugal. In this model, there is a taxi, which acts in ‘sharing’ mode. This taxi offers lower prices to the passengers, if they accept to share the vehicle with other passengers who have harmonious trips or routes. The agent-based simulation model

focuses on reproducing a real time and typical working day in a city. Road network is the environment where the simulation takes place. In the roads, this is where taxis circulate and passengers are created according to trip generation indicators. A dispatcher system manages a centralized operation of assigning taxis to passengers. This system uses the following as its main information sources: location of shared taxi vehicles, current occupancy rate, and the location of clients. The model also contains the option of addressing a taxi on the street and going directly to a taxi stand (Martinez, 2015).

TRACC: Taxi Routing for Aircraft: Creation and Controlling with the departure management system is another taxi management system. This system works with CADEO: Controller Assistance for Departure Optimization system. TRACC was created to support Air Traffic Controllers to create optimized and conflict-free trajectories of taxis, and to detect conflict and resolution. TRACC features accurate prediction of taxi time, management of push-back, and target start-up times management (Gerdes & Schaper, 2015).

Another system is called Multi-Agent Real Time Scheduling System for Taxi Companies. This system has the ability of to re-schedule the service of the taxi before confirming order placed by the client. It also has the ability to update schedules in intervals between two events, in real time. The multi-agent approach in this system is appropriate for scheduling in real-time and a wide range of business and social system optimization (Glaschenko, 2009).

A Geo-Aware Taxi Carrying Management System was developed using location based services and zone queuing techniques on Internet of things. With this system, drivers are able to both hunt on the road and wait in a queuing zone. A queuing table is

used in the control center and neighbor tables are used in establishing zone queuing. Zone queuing management involves joining and leaving mechanisms. This system records the history of all taxi drivers and the taxi owners.

Summary of Identified Gaps

Even though several taxi management systems and models that exist, these solutions currently do not take into consider many transportation specifics for example identifying the actual location of each vehicle at any time. As a result, transportation companies only implement a limited range of operations because they either deal with old solutions, or delegate the transportation-scheduling task to highly qualified dispatchers (Glaschenko, 2009).

More so, Glaschenko (2009) shows that, Constraints of taxi management are changing, depending on the current situation and the location of the operating companies. For example, the registration details for taxis, taxi driver, and taxi owner vary depending on the country and the parameters used to capture them vary. Therefore, the researcher designed a model, to address specifically the situation of Uganda, mainly in Kampala.

In addition, all the related models focus on distinct modules such as tracking of vehicles, monitoring drivers, sharing cabs and scheduling appointments with clients. None of them integrates different modules to work together as one system. Therefore, the researcher developed and integrated model to even integrate the income and expenditure modules by the taxi operators, and generate reports timely and accurately, whenever required.

CHAPTER THREE

METHODOLOGY

In this chapter, the researcher elaborates the methodology used during the study. It shows the research design, locale of study, population, sample size, sampling procedure, requirements instruments, requirements analysis and design, and model design, testing and validation.

Research design

A qualitative approach with exploratory was used in gathering information to further understand the challenges faced by KATODA and to uncover a deeper understanding of how KATODA operates.

Local of the study

The researcher chose a case study of Kampala taxi owners and drivers association (KATODA) in Kampala, the central region of Uganda. This is because, in Kampala area, there is the highest number of taxis in the country and taxi activities are many.

Population and Sample Size

The population consisted of taxi drivers, taxi owners, KATODA officials, and passengers. The researcher chose a sample size of ten (10) respondents was to investigate the system requirements, basing on time and resources the researcher had, as suggested by (Glaser & Strauss, 1967; Cresswell, 2013).

Sampling Procedure

The researcher selected a sample of respondents using non-probability sampling technique because the population was homogenous. The researcher used purposive

sampling to choose specific respondents across experience, role, familiarity with the subject, and ability to give information willingly.

Research Instruments

The researcher used the interview guide to collect requirements of the system. The interviews were semi structured to allow opportunity for the researcher to ask additional questions and obtain clarification depending on the interviewee's response to the specific set of questions in the guide. The open-ended questions also allowed the interviewee to respond in any way that seemed appropriate.

Requirements Gathering Procedure

Following approval of the proposal by the supervisory committee, the researcher embarked on data collection. From the Dean Graduate School Bugema University and the researcher got a data collection letter that introduced him to the research area in Kampala taxi parks and in the Kampala Taxi Owners and Drivers association office. The letter was accepted and the researcher proceeds to the field to collect data. The researcher took a guide who introduced him to the respective respondents.

The researcher introduced himself to each of the respondents for the interviews during two days planned to collect data. While still in the field, observation was made on the existing manual system used by the Kampala Taxi Owner and Drivers Association.

While still in the field, the data collected was transcribed to make ready for analysis in line with the themes of the study.

Requirements Analysis

After the interviews, data gathered was analyzed using content analysis method. With content analysis, the researcher coded data to formulate themes that reduced large volumes of material into content categories. The researcher used field notes to collaborate with the interview scripts. Through this analysis, the researcher identified system specifications and constraints under which the system operates.

Designing the Integrated Taxi Management Information System Model for KATODA

The researcher presented the logical design of a system using Data flow diagrams (Level 0 and Level 1). These show how data flows among the processes and the respective data storages. The researcher presented the physical design using the Unified Modelling Language (UML) context diagram that helped to relate the actual input and output processes of the system. The researcher designed the data base model using Entity Relationship Diagram (ERD).

Development, Validation and Testing

To develop, validate, and test the integrated information taxi management information system model, the researcher developed a working prototype of the model, using MySQL Database Server to store the system configurations, and PHP Language that offers wonderful features and web site functionality and to secure the system model. The researcher hosted the integrated system model locally on the apache server using XAMPP Control Panel v3.2.2.

CHAPTER FOUR

ANALYSIS AND DESIGN OF ITMISM FOR KATODA

The study aimed at developing an integrated taxi management information system model (ITMISM) for taxi owners and drivers in Kampala. The specific objectives of the study were: to gather requirements necessary to design an integrated taxi management information system model for Kampala Taxi Owners and Drivers association, to develop an integrated taxi management information system model for Kampala Taxi Owners and Drivers association and finally to test an integrated taxi management information system model for Kampala Taxi Owners and Drivers association.

The results in this study have been presented in line with the objectives and the reviewed literature. The study research findings were qualitatively presented.

Analysis of Requirements

Concerning **research question one** which is about *the requirements for an integrated taxi management information system model, it* was discovered through interview from the Kampala Taxi Owners and Drivers Association that they should be able to register taxi drivers, taxi owners, the vehicles and to input daily income and expenses via a web-based information system.

Through the interviews with the administrators for Kampala Taxi Owners and Drivers Association, the officers proposed the integration strategy for developed the system in modular form in which the development would begin with the core functionalities and new features added with time. Furthermore, the administrators

proposed that the researcher should developed the system in an incremental format where new modules can come in afterwards.

Concerning **research question two** about *designing an integrated taxi management information system model for Kampala Taxi Owners and Drivers association,* the following components and modules emerged; account for taxi drivers, account for the taxi owners, account for taxis, searching mechanism for taxis and a drivers, generation of reports, and management of income and expenditure.

Concerning **research question three** about *testing and validating the integrated taxi management information system model for Kampala taxi owners and drivers association,* the researcher developed a working prototype of the model to validate all the process in the model and to test how all the actors work with the system.

Analysis of Results

From the requirements survey, the researcher asked respondents to identify the needs in terms of requirements they would need to be part of the system as presented in the table below.

Table 1: Proposed user requirements of the system model

Responses	**Frequency**	**Percentage (%)**
Search option	9	90
Ability to view report data	10	100
Dividing users into groups	9	90
Handle Administrative functions	8	80
User Account creation & Login	10	100

From the table 1 above, respondents indicated that there was need for the system to have search options to enable users search for data. Out of the 10 questionnaires issued out, 90% agreed while 10% disagreed to the search option.

Furthermore, respondents were asked whether the new model should be able to allow users to view reports to the management and out of the 10 questionnaires issued out, 100% agreed to the ability of the system to enable report generation and printing. By this response, the researcher considered it as a by the way that the functionality was not needed by the majority of the users.

In regards to dividing users into groups, 90% agreed while 10% disagreed to the dividing users into groups. Further, the respondents disagreed to the downward compatibility with 80% and lastly concerning the model allowing users to create accounts and log on onto the system, they all agreed that it was a necessity with 100%.

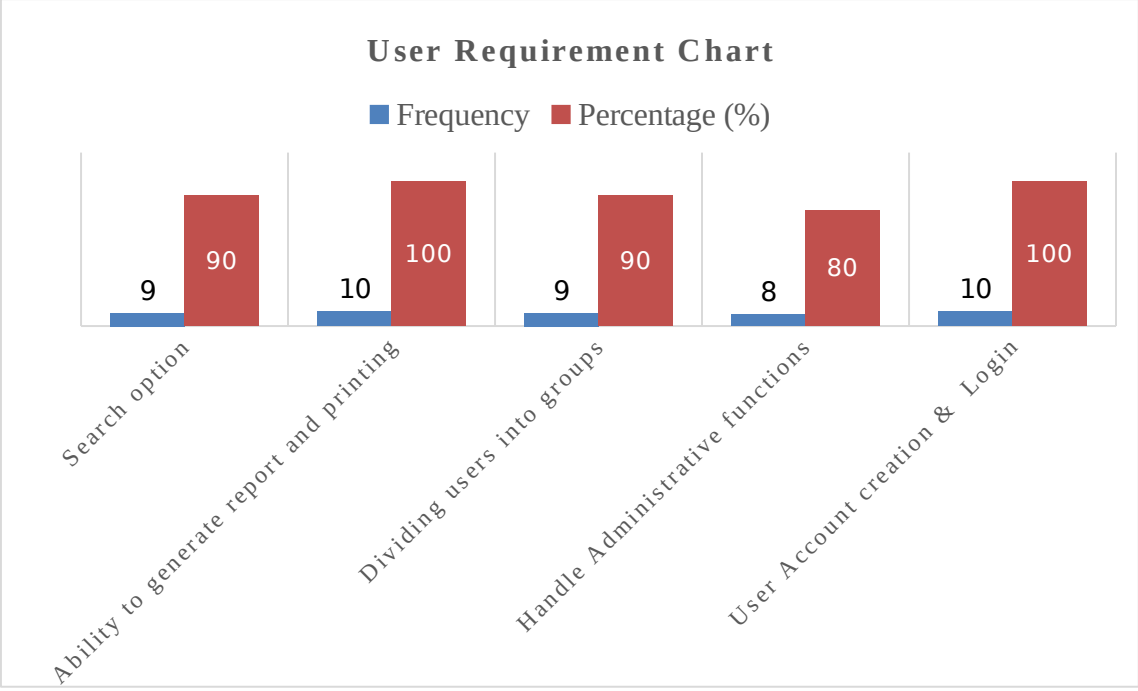

Figure 2: Graphical Representation of user Requirements

Requirements Specification

After the analysis, the functional and non-functional requirements were identified.

Functional requirements

The system should perform the following tasks:

- Creation of user accounts for both Kampala Taxi Owner and Drivers Association operators and taxi owner.
- Kampala Taxi Owners and Driver association staff has to be able to generate reports.
- Users should be able to view historical information of taxi owners and drivers association.
- The owner and staff members of KATODA a have to be able to search for vehicle and drivers using a search box on the system.

Non-functional requirements

- The system should be able to give different permissions to different users.
- The Performance to work on different web browsers.
- Reliable to run at the time when it needed.
- Serviceability is concerned for the system to deliver the authentic information.
- Security should be considered for keeping all the data safe.
- Data Integrity at the time the system gives the output expected.
- Usability when the user is able to interact with the system and all it features.

Design of the Models

The Integrated Taxi management information system model was designed using Unified Modeling Language (UML). The Data flow, use case, Entity relations and architectural diagrams were used in the modeling of the proposed system model.

Context Diagram (level 0)

The context diagram (figure 3), in chapter one was used to describe the system model as a whole and the external entities that interact with Taxi management information system model.

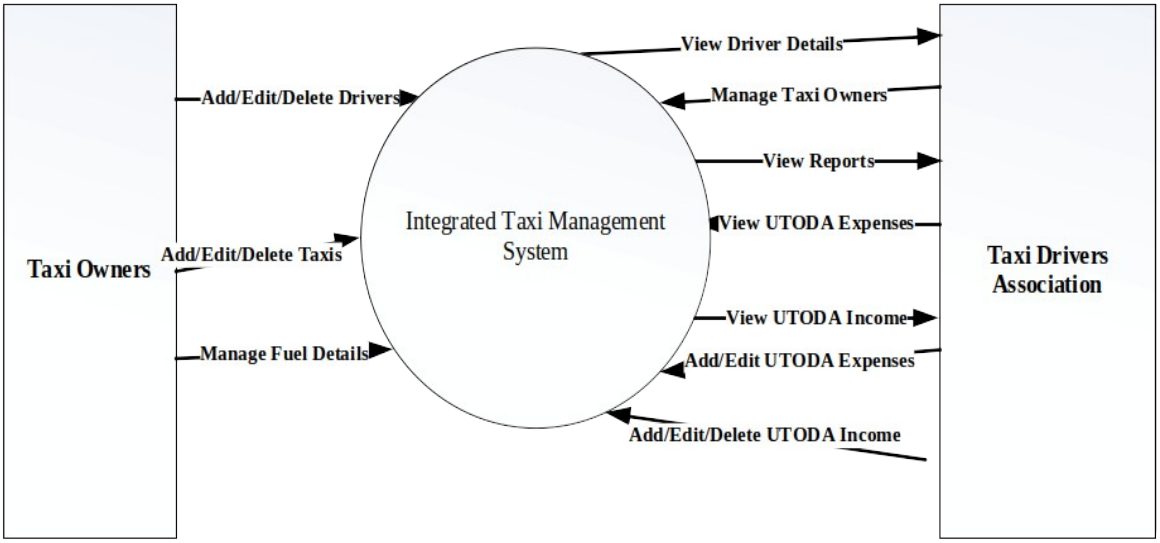

Figure 3: The Context Diagram

Use case diagram

The Use Case Diagram below in (figure 4) consists of two actors the Taxi owner and the KATODA operator. The Taxi owner has limited permission on the system to only add/edit/delete vehicle, add/edit/delete driver(s), and to manage fuel details. The KATODA operator has full permission to register taxi owners, add/edit/update/delete vehicles, to add/edit/update/delete taxi drivers, and to view/add expenses and to register Users.

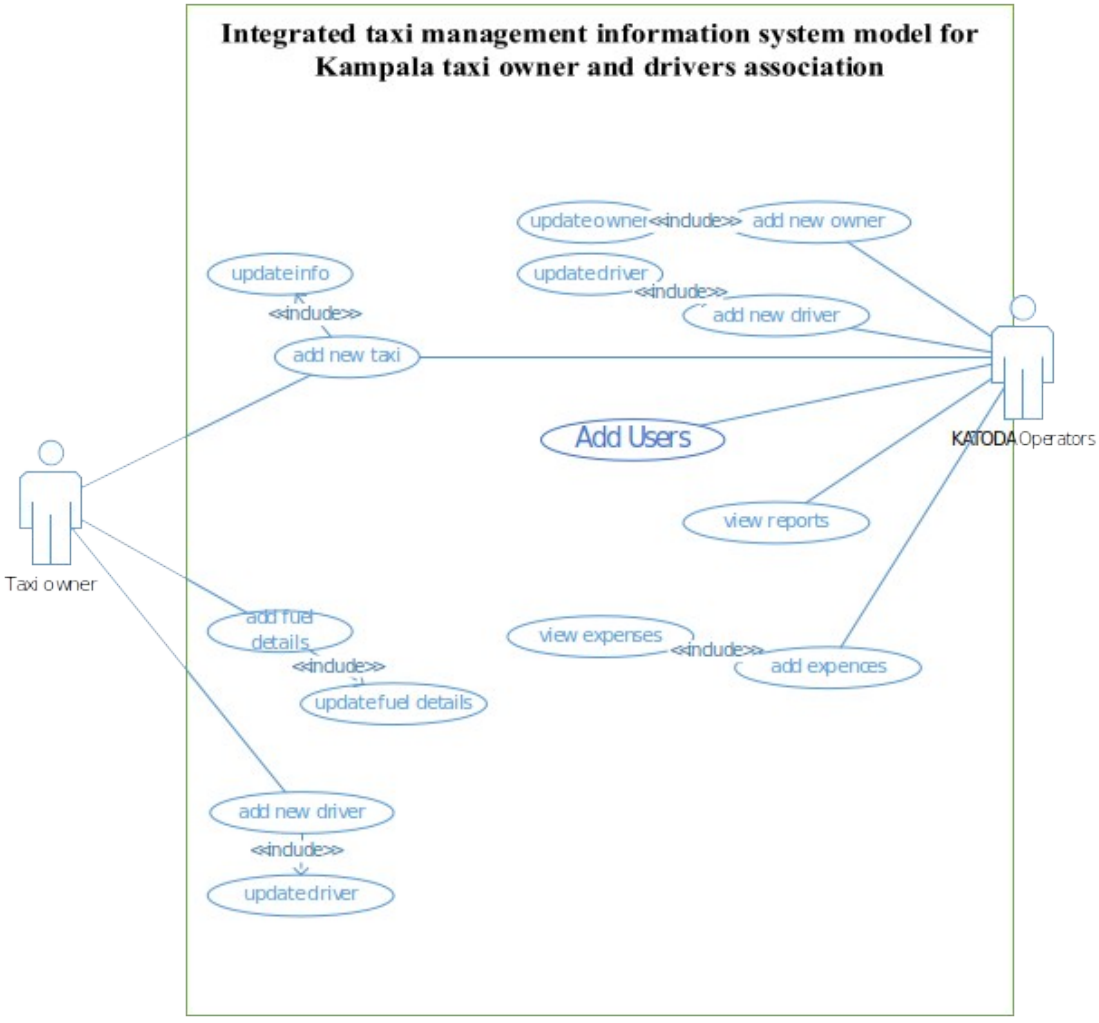

Figure 4: The use case diagram

Architectural diagram for the integrated taxi management information system model

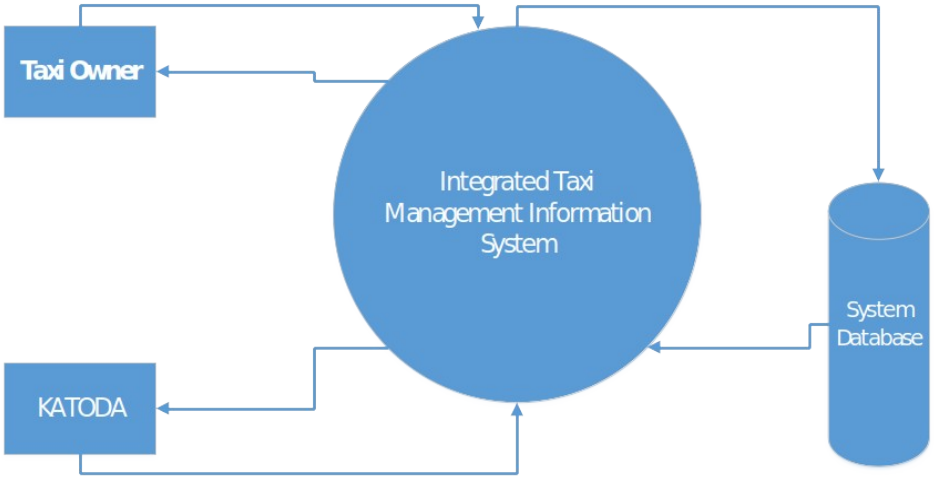

Figure 5: Architectural diagram

Data Flow Diagram (Level One)

The data flow diagram (figure 6) describes the flow of information within the information system. The entities that is the Kampala Taxi Owners and Drivers Association could access and update information. seven main processes are involved which include to register users, register taxies, drivers registration, taxi owner registration and viewing reports by the KATODA staff.

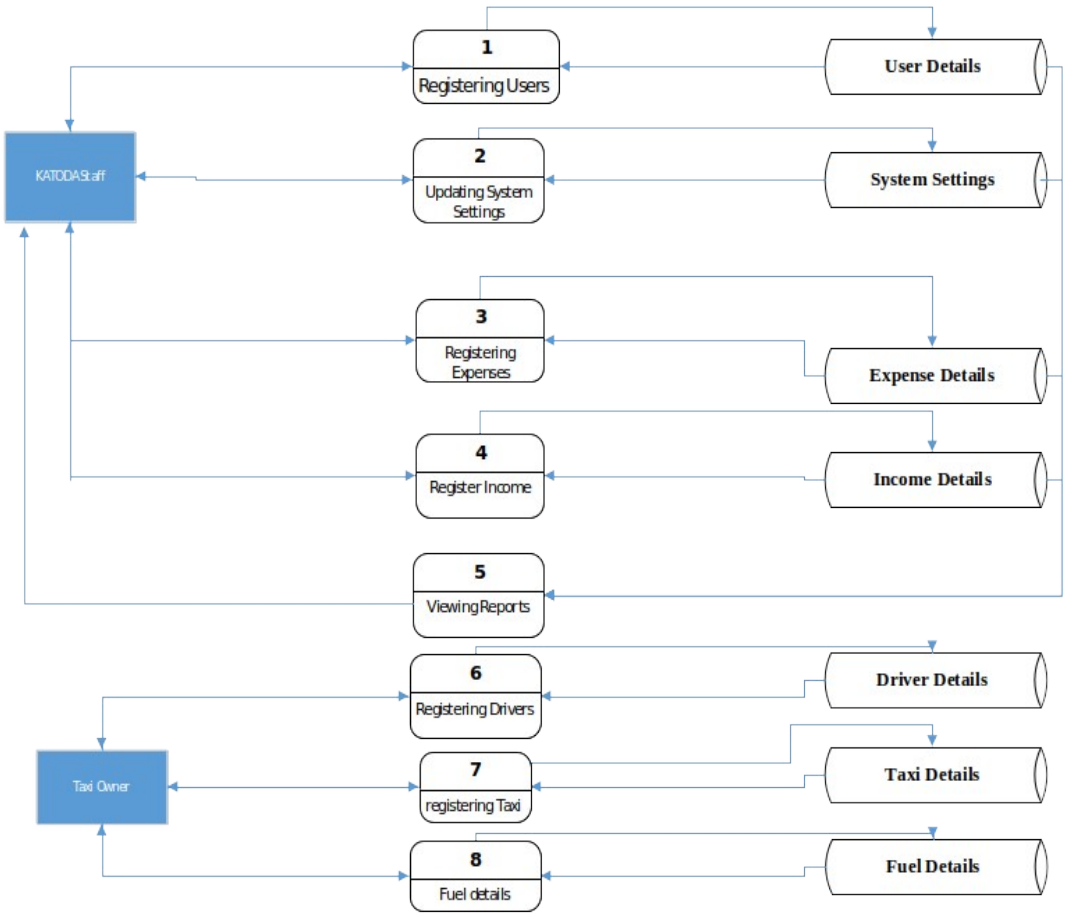

Figure 6: Data Flow Diagram

An Integrated taxi management information system model for Kampala taxi owners and drivers association

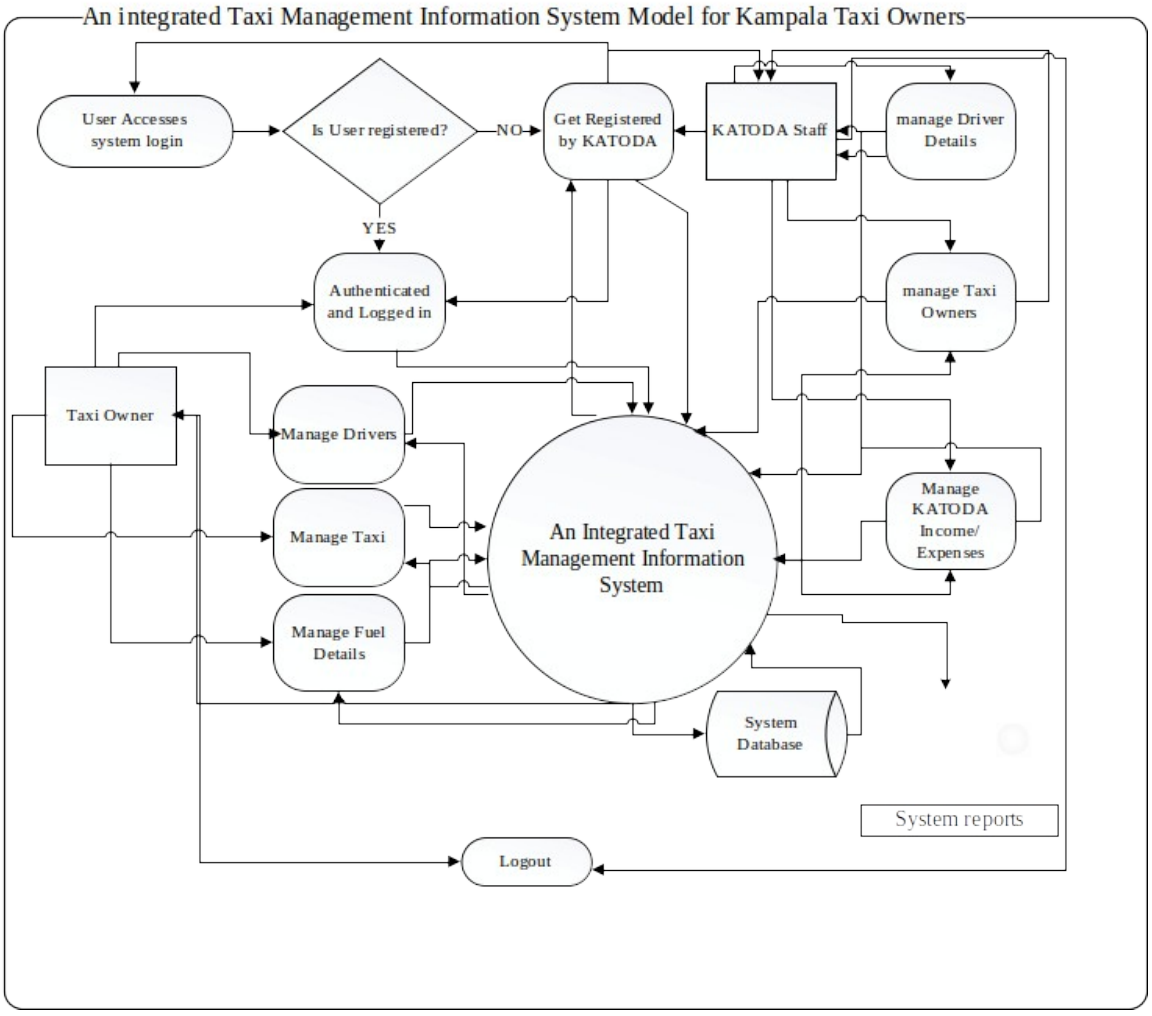

Figure 7: System model

Entity Relationship Diagram (ERD)

The Entity relational diagram describes the conceptual database design; it also describes the relationships among entities as shown by figure 8 below.

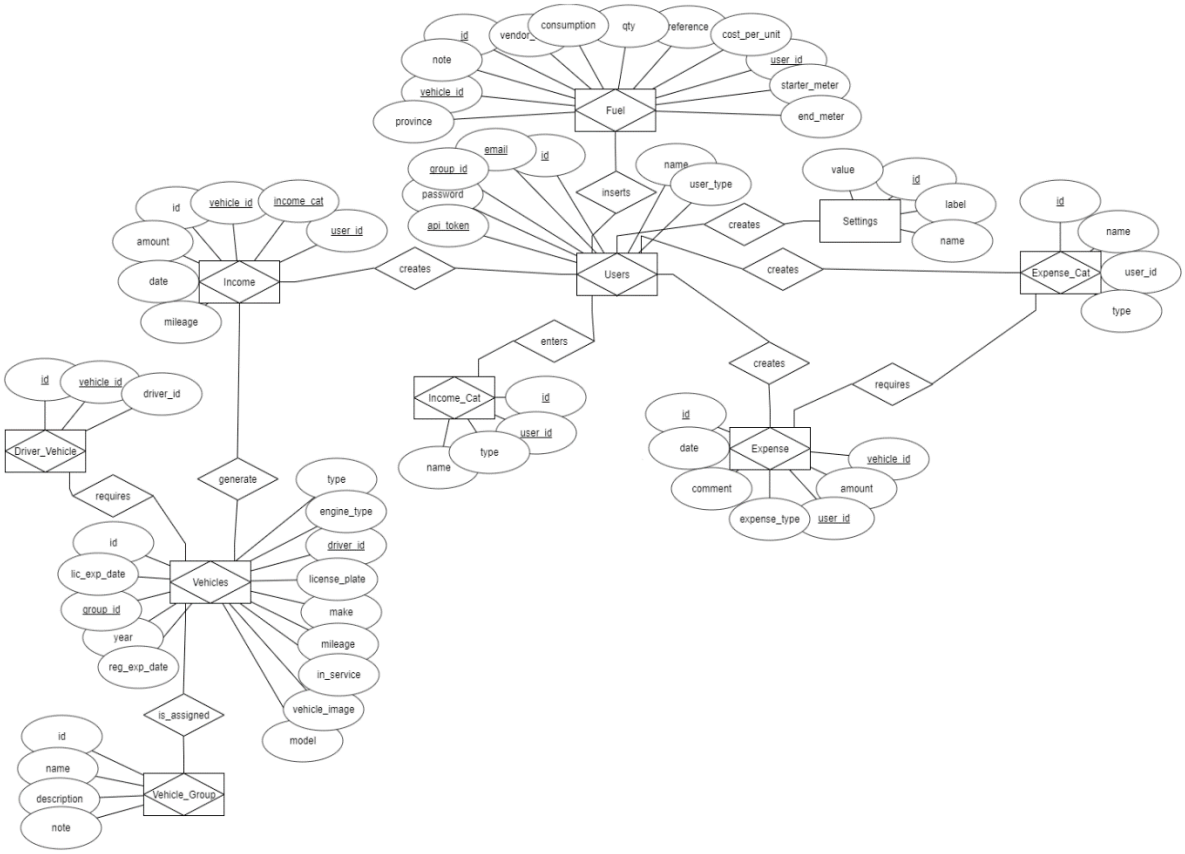

Figure 8: Entity Relationship Diagram

Sequential Diagram

The researcher used the UML Sequence Diagram are to show the details of the operations carried out.

Figure 9: Sequential Diagram

CHAPTER FIVE

WORKING PROTOTYPE OF THE SYSTEM

In this chapter, the researcher explains how he developed, validated, and tested the working prototype of the system, and presents the screen shots of several interfaces in the system.

Prototype Development

The researcher used the following tools to develop the integrated taxi management information system model prototype: MySQL to develop the database, PHP and HTML to create the system pages, and CSS to style the pages. The researcher hosted the system locally on the apache server using XAMPP server v3.2.2.

System Interfaces

The figures below shows some of the interfaces generated from the system.

The integrated taxi management Information system login page

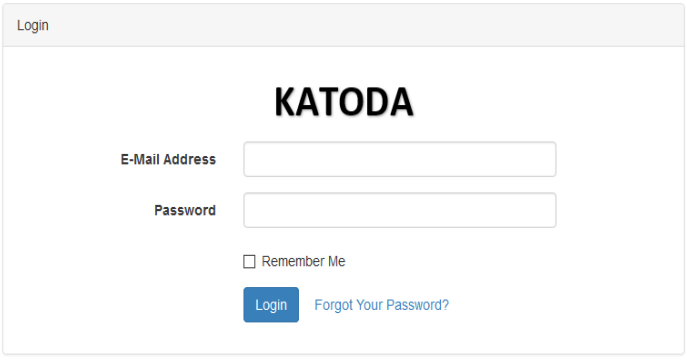

Figure 10: Prototype Login Page

The dashboard of the system

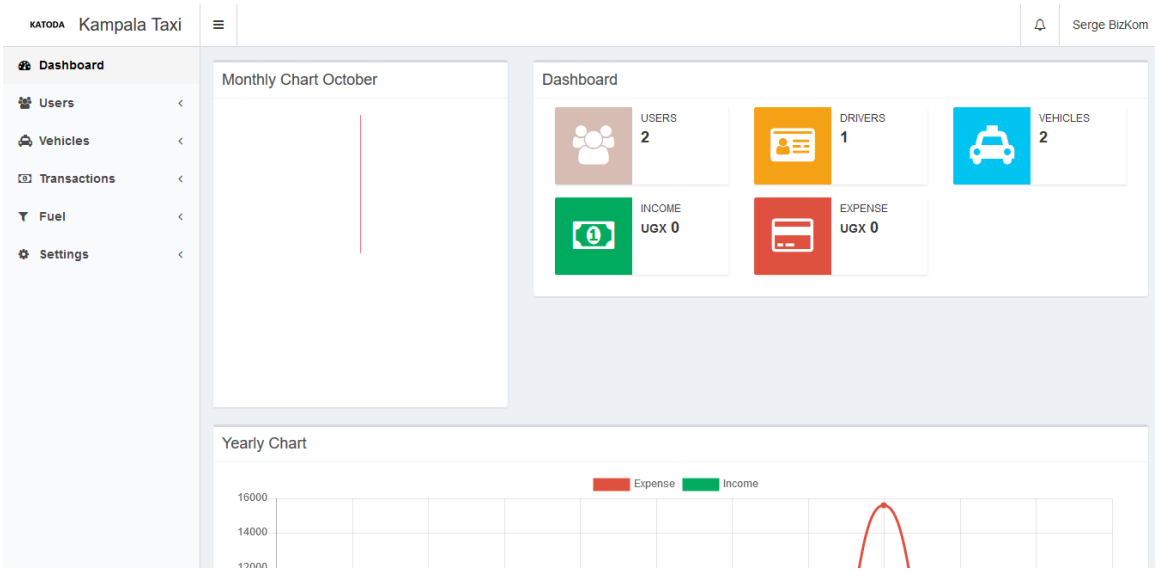

Figure 11: Prototype Dashboard

Manage users Module

The manage users module in the system displays all registered users in the system.

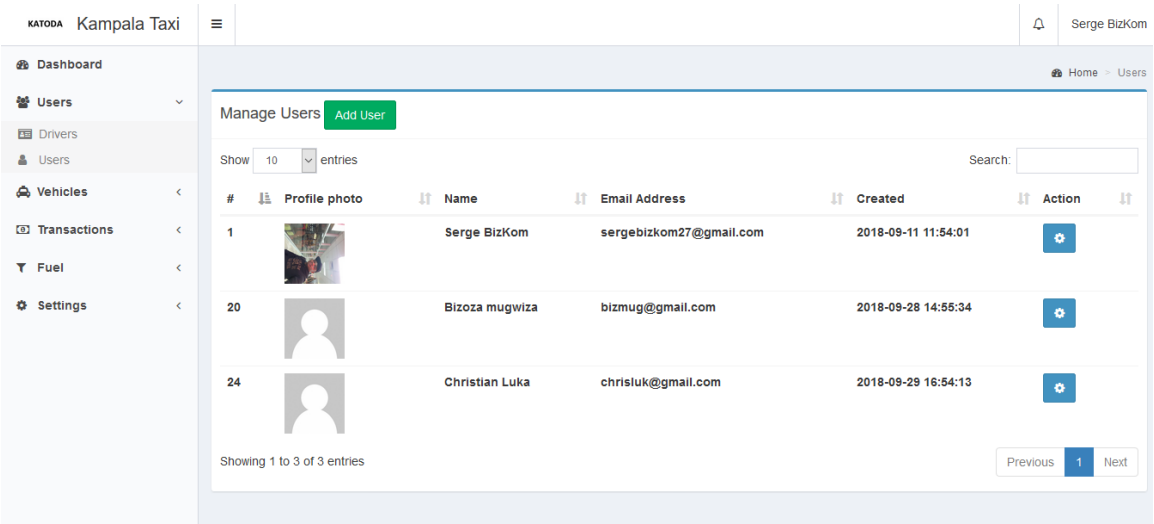

Figure 12: Manage Users Interface

Taxi Drivers Module

The drivers' module of the integrated taxi management system manages the capturing and storing of all taxi drivers details like first name, last name, email address, phone number and driver image in the system.

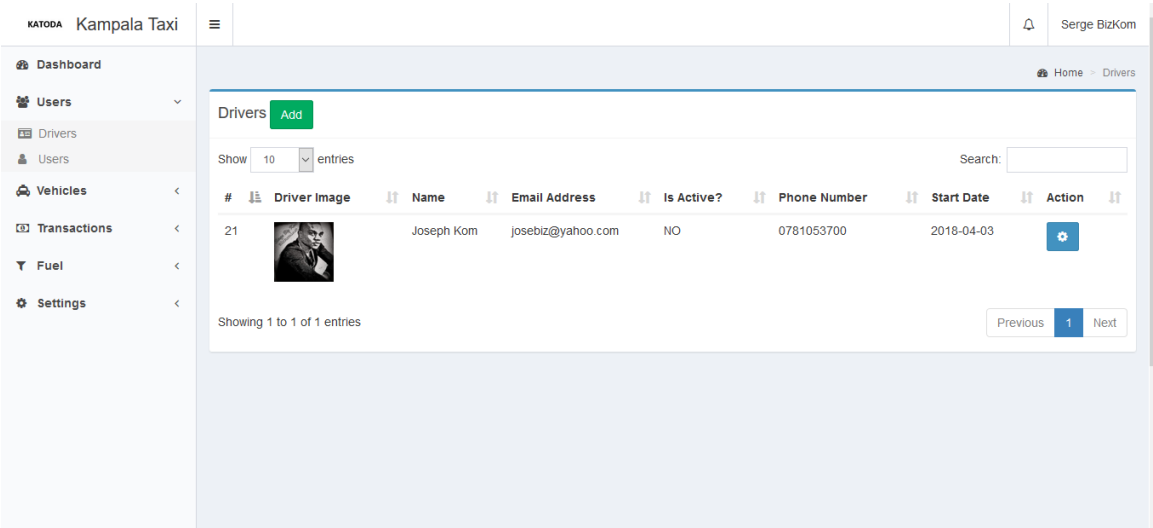

Figure 13: Drivers Module

The Vehicles/Taxi Module

The vehicles/taxi module of the integrated taxi management information system which manages capturing and storing of all vehicle details like vehicle image, taxi model, vehicle type, number plate in the system.

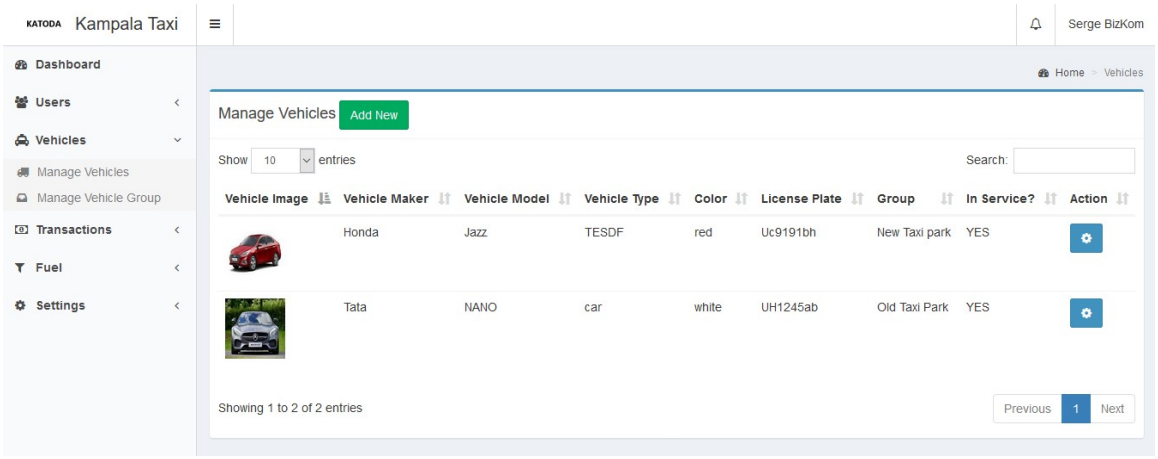

Figure 14: Vehicles / Taxi Module

Manage Expenses Module

The manage expenses module of the integrated taxi management information system which enables the Kampala Taxi Owners and Drivers Association (KATODA) to manage all expenses incurred into the system.

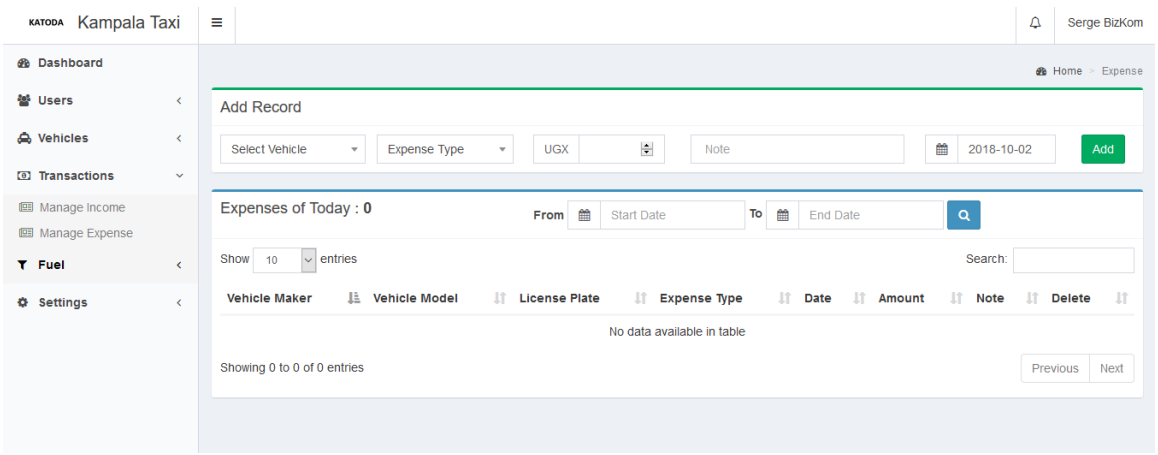

Figure 15: Manage Expenses Module

Manage Income Module

The manage income module of the integrated taxi management information system enables the taxi driver and owner to add and manage all incomes of the taxi.

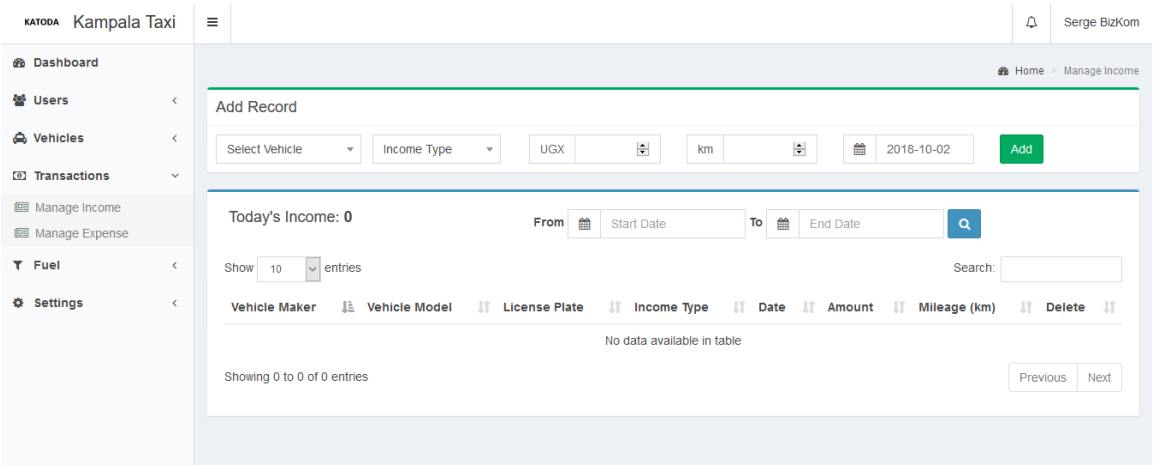

Figure 16: Manage Income Module

System Testing

The researcher tested the integrated taxi management information system prototype on different browsers using the following modes of testing:

- **Unit testing**

The researcher tested every module separately. The modules include the Users Module, the taxi drivers' module, the vehicle module, the expenses module, settings module, and fuel module.

- **Integration testing**

The researcher merged all the modules and tested them as a whole system.

Validation

The researcher validated the system to authenticate user logins, ensuring that only authorized users can log into the system. He did this by implementing password and username checks that returns a notification as shown in figure 17.

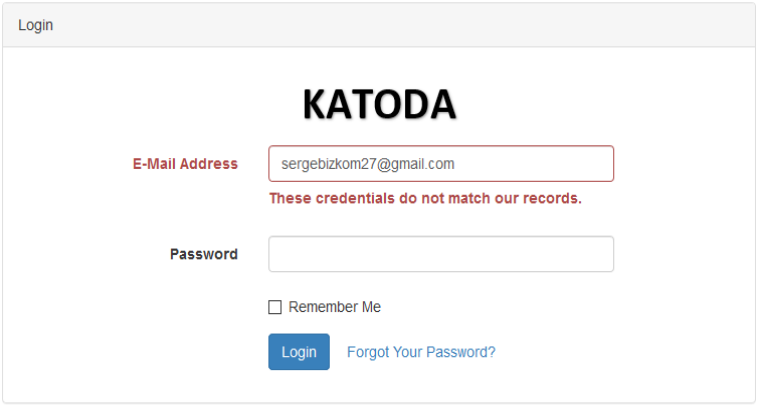

Figure 17: Login Authentication

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary, conclusions, and recommendations of the research.

Summary

In summary, the researcher successfully designed an integrated taxi management information system model for Kampala taxi owners and drivers association; hence, the research fulfilled the general objective, and met the specific objectives.

Research results

This integrated taxi management information system for Kampala taxi owners and drivers association was developed through interviewing different respondents who are the staff of Kampala Taxi Owners and Drivers Association and some taxi drivers and owners, which helped to gather requirements needed to design the model and also helped to fulfill objective one of the research.

The completion of objective two about design, the model was designed using UML modeling tools (Microsoft Visio 2016) to draw the Conceptual Diagram, the Use-Case Diagram, Data Flow Diagram, sequential diagram and the Entity Relationship Diagram.

To achieve objective three, the researcher used PHP framework and MySQL database server to develop the system prototype.

The researcher tested the working prototype of the on different web-browsers to achieve the objective four.

Limitations

The time or the period given to conduct the research was not enough according to several tasks that the researcher could attempt to complete the analysis after coming to the field and then to implement a system prototype for the users.

The researcher had some financial limitations while carrying out his research. On the field while collecting data, the communication with some respondents was fund as a big challenge with those who speaks and understand only Luganda, so the researcher needed an assistant to interpret the information needed during the interview. Some were busy for interviews and others not willing to give information needed.

The researcher got also some challenges with the respondents on the field because while collecting data they did not have enough time to respond all the time busy to do their tasks.

Conclusion

In conclusion after interviewing different respondents on the field, the researcher realized that there was a need for an integrated taxi management information system model for Kampala taxi owners and drivers association by reducing the manual work to register taxies, taxi drivers and taxi owners and drivers association.

Recommendation

The researcher designed the Integrated taxi management information system model that can be used to register taxi owners, drivers and vehicles but it can also helpful for the Uganda police or the KCCA authorities to consult the Kampala Taxi Owners and Drivers Association to easily track the information details about any drivers or taxi owners in case of any criminality.

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APPENDICES

Appendix 1: Interview Guide

INTERVIEW GUIDE FOR THE INTERVIEWERS TO THE MEMBERS OF KAMPALA TAXI OWNERS and DRIVERS ASSOCIATION

1. Do you have any existing information system model for taxi management?

   Yes ☐ No ☐

2. What problems do you face today that your current software solution cannot solve?

   ……..

   ……..

3. What problems would you like the software to solve?

   ……..

   ……..

4. Do you think there is need for the User to be able to send any report to management?

   Yes ☐ No ☐

5. Are there manual processes that you would like to automate?

   Yes ☐ No ☐

6. If Yes which one?

   ……..

7. What data do you expect to collect and report on?

   ……..

   ……..

8. Would you love a Search option given to users to search from various vehicles?

   Yes ☐ No ☐

9. What will make the software solution successful in your organization?

……

……

10. When it comes to Accessibility, what should the developer consider?

……

……

11. Would the organization require any Configuration document for the model?

Yes ☐ No ☐

12. Does the organization get any cloud Storage facility in place?

Yes ☐ No ☐

13. How would like the proposed model to handle the Security issue of the organization?

……..

……..

14. Are any specific Performance requirements that would be considered?

……...

……

15. Is there need for Users to be divided into groups and groups can be given separate rights?

Yes ☐ No ☐

Appendix 2: Approval letter for requirements collection

BUGEMA UNIVERSITY

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KAMPALA - UGANDA

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Between Total Petrol Station
& Makerere Yellow Primary Sch.
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Tel: +256 312 266 630
+256 312 266 631

SCHOOL OF POSTGRADUATE

June 13, 2018

To Whom It May Concern

RE: DATA COLLECTION

This is to certify that **Bizoza Komayombi Serge** is a student of Bugema University pursuing a Master's of Science in Information Systems.

The purpose of this letter is to request you permit him carry out data collection for his research entitled **"AN INTEGRATED TAXI MANAGEMENT INFORMATION SYSTEM MODEL FOR KAMPALA TAXI OWNERS & DRIVERS ASSOCIATION".**

The research will be based on utmost ethical considerations and the findings will be for academic purposes and of benefit to the Community.

Any assistance extended to him is highly appreciated.

Sincerely,

BUGEMA UNIVERSITY
P O BOX 6529, K'LA
★ 13 JUN 2018 ★
DEAN GRADUATE SCHOOL

Rosette Kabuye, PhD
Dean, School of Graduate Studies

Appendix 3: Login Codes

```
<?php

class Swift_Transport_Esmtp_Auth_LoginAuthenticatorTest extends \
SwiftMailerTestCase
{
    private $agent;

    protected function setUp()
    {
                                        $this->agent    =    $this-
>getMockery('Swift_Transport_SmtpAgent')->shouldIgnoreMissing();
    }

    public function testKeywordIsLogin()
    {
        $login = $this->getAuthenticator();
        $this->assertEquals('LOGIN', $login->getAuthKeyword());
    }

    public function testSuccessfulAuthentication()
    {
        $login = $this->getAuthenticator();

        $this->agent->shouldReceive('executeCommand')
             ->once()
             ->with("AUTH LOGIN\r\n", [334]);
        $this->agent->shouldReceive('executeCommand')
             ->once()
             ->with(base64_encode('jack')."\r\n", [334]);
        $this->agent->shouldReceive('executeCommand')
             ->once()
             ->with(base64_encode('pass')."\r\n", [235]);

             $this->assertTrue($login->authenticate($this->agent,
'jack', 'pass'),
            '%s: The buffer accepted all commands authentication
should succeed'
           );
    }

    /**
     * @expectedException \Swift_TransportException
     */
    public function testAuthenticationFailureSendRset()
    {
        $login = $this->getAuthenticator();

        $this->agent->shouldReceive('executeCommand')
             ->once()
             ->with("AUTH LOGIN\r\n", [334]);
        $this->agent->shouldReceive('executeCommand')
             ->once()
```

```
            ->with(base64_encode('jack')."\r\n", [334]);
        $this->agent->shouldReceive('executeCommand')
            ->once()
            ->with(base64_encode('pass')."\r\n", [235])
            ->andThrow(new Swift_TransportException(''));
        $this->agent->shouldReceive('executeCommand')
            ->once()
            ->with("RSET\r\n", [250]);

        $login->authenticate($this->agent, 'jack', 'pass');
    }

    private function getAuthenticator()
    {
                                                    return      new
Swift_Transport_Esmtp_Auth_LoginAuthenticator();
    }
}
```