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Research Thesis Title: Utilizing a Deep Learning Model for Managing Institutions' Income and Expenses via a Web-Based Interface

By:

Adeline Yamfashije

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A research Thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science in the Internet of Things – ECS

2022

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AFRICAN CENTRE OF EXCELLENCE IN INTERNET OF THINGS

Research Thesis Title: **Utilizing a Deep Learning Model for Managing Institutions' Income and Expenses via a Web-Based Interface**

A dissertation submitted in partial fulfilment of the requirements for the award of masters of Science degree in internet of things: Embedded computing system

Submitted By

Adeline Yamfashije (REF.NO:221002734)

Supervised by:

Dr. Gerard Rushingabigwi

Prof. Ayalew Belay Habtie

2022

Declaration

I, Adeline Yamfashije a Master's student at the University of Rwanda, College of Science and Technology, African Center of Excellence in the Internet of Things Embedded Computing System (ACEIoT_ECS) with Registration Number: **221002734** hereby declare that this research Thesis is my original work and has never been submitted to any University or Institution for any award. The references used here from the journals or materials are indicated in the reference section.

Names: Adeline Yamfashije

Date:

Signature

Certification

This is to certify that the research project titled **" Utilizing a Deep Learning Model for Managing Institutions' Income and Expenses via a Web-Based Interface "** is a record of the original work completed by Adeline Yamfashije with registration number: 221002734 in partial fulfilment of the requirement for the award of a master's degree in the internet of things at the College of Science and Technology, University of Rwanda, during the academic year 2020–2022

This work has been submitted under the guidance of Dr. Gerard Rushingabigwi and Prof. Ayalew Belay Habtie

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Dedication

I dedicate this Thesis to,

The almighty God,

My family members,

All my Friends,

To ITEC LTD who provided me with an internship of two months.

Acknowledgments

First, I would like to thank God for all the blessings, guidance, and protection throughout my life, particularly during my studies. My special thanks are to my family for their incredible support. I would like to express my gratitude to all the people who helped me and guided me to this level of studies. I would like to thank the staff, lecturers, and all of my classmates in ACEIoT for their tremendous support in skills and guidance and the unlimited support they provided to me. I would also like to thank ITEC Ltd for allowing me to follow my internship in their company.

I am grateful for all of those who have patiently offered me all forms of assistance to complete my studies without forgetting Supervisors Dr. **Gerard Rushingabigwi and Prof. Ayalew Belay Habtie** of this research. They did their best to turn my research idea practically achievable.

May God bless you all!

Abstract

One of the reasons leading to poverty is less care to plan and know about income and expenses and carelessness about the expected result analysis. As a small institution, the families have not yet utilized the platform to supervise and manage their spending and income patterns. Instead, they manually carry out their financial transactions, which leads them to the loss of data, missing reports, and not being able to make self-control and analysis about their financial status. Income and expense system help to do the financial activities smartly where its users can be able to set their estimated budget, recoding their actual income and expenses, get the reports, and find the generated future budget. Hence, a deep learning-based income and expense model is developed to facilitate organizations, institutions, small businesses, cooperatives, families, and individuals in their finances. To conduct this study, Deep Neural Network (DNN) is a single model used to make predictions of future budget where we will have a website to facilitate users to insert their data in the database; from stored data, we will find a dataset that plays a role in deep learning Model training, testing and future budget prediction. A waterfall approach was used in the development of User interfaces to facilitate user model communication.

Tools used to conduct this research are Python, Tensor flow, and Keras however, the experimental techniques used are Machine learning with a deep learning algorithm, for data collection technics, and we use observation, interviews, and documentation. As result, the users are able to find all financial information, financial reports, and future budgets are well predicted and displayed to them.

Keywords**: Deep Learning Model, DNN, Income, Expense, institutions, budget, Web application**

List of Acronyms

ACEIoT: African Center of Excellent in the Internet of Things

ECS: Embedded Computing System

AI: Artificial Intelligence

IoT: Internet of things

ICT: Information Communication Technology

DL: Deep Learning

DBN: Deep Belief Networks

FNN: Feedforward Neural Network

CNN: Convolutional Neural Network

RBM: Restricted Boltzmann Machine

RNN: Recurrent Neural Network

RL: Reinforcement Learning

DNN: Deep Neural Network

USSD**:** Unstructured Supplementary Service Data

UML: Unified Modelling Language

PHP: Hypertext pre-processor

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Chapter 1: General Introduction

This chapter gives information about the main ideas behind the use of Deep Learning Models for tracking an Institution's income and expenses. Moreover, the problem statement, background, motivation, and study scope, both general and specific objectives of the study are discussed in this chapter.

1.1. Introduction

Internet of Things (IoT) is an advanced automation and analytics system that uses big data, artificial intelligence, networking, sensing, and sensing technology to give entire systems for a good or service [1]. Nowadays, e-financial which are the provision of financial services using electronic communication and computation Simply, E-finance is a financial services delivered through Internet [2]. Artificial intelligence is a tool that allows people to reconsider and analysis of data, integrate information, and then use these insights to make better decisions [3]. Artificial Intelligence is the study of computer programs that make an effort to simulate and use human intellect [4], It is widely used and it rapidly enables societies to produce more than traditional methods of managing institutions, homes, and other industries. This technology also contributes to the development of social, economic, administrative, and intellectual sectors and other areas like Transportation, Agriculture, and Health but now we are using it in financial sector [5]. The application of computer technology in financing can offer the possibilities of collecting the amount of data to make a transaction processing system and turning these data into managerial information for supporting decision-making. Financial management software can be used to execute the information technology integration of finance and business management [6]. using pulling technology from abroad to realize company information development System software and real-world experience can be used to achieve integration and complete management of the company's operations, marketing, and capital flow in order for the business to achieve its fundamental objective of cost containment and enhance its fundamental economic benefits [6]. However, as technology advances, institutions as families are trying to make the most of the operations they performed to become more and more dependent on computer data. Hence, the need for a reliable deep learning model for tracking institutions' income and expenses can solve the problem of recording financial transactions manually as well as the problem of doing unplanned transactions

as well as the development of institutions in economic life will be good based on the Internet of things.

We choose to develop a deep learning model for Income and expense management because many institutions like families, still record financial transactions manually and engage them in many risks. This method is time-consuming and uncontrollable and can push people into poverty.

1.2. Background and Motivation

Nowadays, financial services in the condition of being improved according to the rapid advancement of the Internet of Things which is widely used and rapidly enables societies to produce more than traditional ways of managing institutions. The two main contribution of IoT are safety and communication and enhancing the quality of life [7], IoT has been used in many areas that attempt to improve efficiency. Through its implementation also the development of social, economic, administrative, and intellectual sectors [7]. The application of computer technology offers possibilities of collecting the amount of data to make transaction-processing systems and turn these data into managerial information to support decision-making [8], the ways used to accomplish these complex activities cannot reach the development needed in these entire sectors especially economic sector. As technology advances, families are trying to make the most of the operations they perform to become more and more dependent on computer data [9]. The need for a reliable application is obvious and institution's economic life must be founded on information and communication technology (ICT) in order to accelerate its development. However, in many institutions such as families services are provided manually, which is time-consuming and uncontrollable, causing them to engage in unplanned activities, that motivated me to conduct this research in order to resolve the negative impacts such as data loss, missing reports, a lack of self-control and financial situation monitoring, as well as the existing system are the android applications which are not capable to predict the future budget therefore, this research thesis is to develop a deep learning model for Income and expense management.

1.3. Problem Statement

After observation and discussions made with different peoples and families, we find that they face a problem of managing their economic life because they do not have the best way of tracking their financial status and forecasting their economic status. Most people only track their expenses or incomes for a few weeks so that they can see how their incomes are spent. Other people only track

certain types of expenses, like where they spend a lot of money and after a few days, they stop writing down their financial data because they use handwriting on a little notebook or use a spreadsheet system, others use some platforms like mobile Applications, which cannot be capable to generate the future budget and others do not record anything. This is a crucial factor underlying some conflicts and poverty in different families and the losses in some institution.

Generally, many institutions, like families, record financial transactions manually as well as do unplanned transactions, which are time-Consuming, as well as uncontrollable methods, which can lead to the risk of poverty. They are other applications that may record, and store operations about financial. However, they do not have the capacity of generating a future budget. The specialty of this project is to use the stored information in computing balance, to display where they spend or receive much money, and to produce the future budget for the users. That is why this application is a powerful tool to overcome difficulties and misunderstandings in an institution's financial life management. For instance, the following mentioned difficulties are fixed

- Difficulty in knowing the exact income on daily basis.
- Difficulty to know the exact expenses on daily basis.
- Difficulty to identify expensive family operations.
- Difficulty to make a family budget.

However, this project deals with how can a deep learning model tracks institutions' income and expenses and generates a budget to follow in the future.

1.4. Research Objectives

The following goal will be the basis for this research

1.4.1. General Objective

The main objective of this research is to utilize a Deep Learning Model in Managing Institutions' Income and Expenses via a Web-Based Interface by considering the entered data for better prediction of future budget plans.

1.4.2. Specific Objectives

- To identify major institution's resources
- Gather income and expense data from users

- To develop a friendly user software tracking institution's income and expenses
- Develop deep learning model for Income and expense management
- Train and test the model
- Evaluate the performance and accuracy of the model
- Design and test the user interface(UI) for user-system interaction
- Validate the usability of the system
- Make public the software that can assist users to do their financial activities

1.5. Hypotheses

A deep learning model for income and expense management will be developed and enable to address the problems like amount of time lost in manually transactions recording and performing unexpected tasks would be reduced, to know their financial status. This project will friendly generate a future budget, time required to record the data is reduced, there is no loss of financial information, the self-control is made simple, the users will do the planned activities and smart financing for all will be in use.

1.6. Study Scope

In this research, I will do the following activities:

- Designing user interface
- Building database for dataset
- Preparing Dataset
- Building deep learning model
- Test and training of deep learning model.

1.7. Significance of the Study

This Project will help organizations, institutions, small businesses, cooperatives, families, and individuals to know their financial status to manage them and it will generate for them a budget for the future. It is a tool, which can help users to know exactly their incomes and expenses and provide for them the future budget, where they will able to find the reports they need and they will be able to receive a warning message when they spend more than they gain. This will change the spending habitude of the users.

We develop the deep learning model, which will help institutions to know their income and expenses and provide them with future budgets in a good way to avoid unwanted expenses, avoiding poverty, and institutions work smartly. This model will allow users to view the amount of income and expenses daily, weekly, monthly, and yearly. You can also view your transactions grouped by categories.

It is the easiest and fastest way to get an overview of the financial activities of users. Users will access it through the website and others on their Smartphones where they will complete the information required by entering every income and expense made a day in a real-time manner. This model will facilitate to compute the total amount of income and the total amount of expense will process the entered data, and then it will show them the exact spending scenario in a real-time manner. Not only that, deep learning models will use the computed result to predict the budget for the future.

1.8. Summary

The Project will assist groups of people, including families, small businesses, cooperatives, organizations, and institutions, in recording their financial transactions, obtaining financial reports, and creating future budgets. In addition, it will warn them when they begin to spend more money than they make. This will help the users to reduce the time for recording manually, reduce also loss of financial information, self-control will become simple, the users will do the planned activities and smart financing for all will be in use and resulting in expanding the thinking level of the users about their economic life.

The rest of this research work is organized into six chapters, arranged as follows:

- Chapter 1 deals with a general introduction.
- Chapter 2 is the Literature review.
- Chapter 3 describes the methodology and project analysis.
- Chapter 4 is about the System Analysis and Design.
- Chapter 5 focuses on Results Analysis.
- Chapter 6 consists of the Conclusion and Recommendations

Chapter 2: Literature review and related work

2.1. Introduction

A literature review is a compilation of other scholars' publications on a certain topic defined by being categorized, evaluated, and summarized for readability. It is usually a component of a research thesis, although it can also be a self-contained examination of the written works on a certain topic. In a literature review, it is important to consider each work's contribution to the subject under consideration and to explain how it relates to the others. It is also important to identify new approaches and to interpret earlier research while elaborating on any gaps, to resolve potential differences in past studies, to suggest future investigations, and to place a new piece of research in the context of earlier works [10].

2.2. Related work

The research talk about the most used deep learning models in finance and Banking, and these models are Feedforward Neural Networks (FNN), Convolutional Neural Networks (CNN), Restricted Boltzmann Machine (RBM), Recurrent Neural Networks (RNN), Reinforcement Learning (RL), Deep Convolution Model (DCM) and Generative Adversarial Network (GAN). The primary model for predicting exchange rates, prices, and economic factors, as well as banking default risk and credit, the FNN, LSTM, and FNN, are two kinds of popular models for stock market prediction. Regularly, RL and FNN are used when buying stocks. In an investment portfolio, FNN, RL, and simple RNN can be used. Deep learning has been made widely in computer vision, natural language processing, and audio-visual recognition/ the overwhelming success of deep learning as a data processing technique has sparked the interest of the research community. The uses of deep learning in finance and banking services have become prevalent. However, a detailed survey of the applications of deep learning in finance and banking is lacking in the existing literature [11]. The gap available is that even if these models are used are not used in predicting financial budgets where the researcher use one of them to predict financial budgets for institutions.

The study proposed the use of deep learning architectures for day-ahead electricity price forecasting over different periods in the Spanish Electricity Market. The main problem in the electricity market is that prediction is a difficult task due to a large number of factors involved,

non-linearity, non-seasonality, and price volatility over time. Deep learning models are effective at predicting electricity prices; although, the varied periods and their unique aspects have a direct influence on the models' results [12].

Machine learning for financial forecasting, plan, and analysis, recent developments and pitfalls the project article done by Helmut Wasserbacher and Martin Spindler and published on 17 November 2021 focused on forecasting (prediction). Discussion of particular care that must be taken to avoid the pitfalls of using them for planning and resource allocation but the research team did not focus on the family budget plan and forecast [13].

We believe these results are encouraging since average regional household income is an important input to a wide range of economic policies. In underdeveloped countries reliable statistics of income are often lacking, not frequently updated, and is rarely fine-grained to sub-regions of the country. Making income prediction simpler and more efficient can be of great help to policymakers and charity organizations – which will ultimately benefit the poor [14].

2.3. Gap available on the existing Application

As summary of considered above studies and most others that have contributed to the financial and banking field we have found that there is no work done using deep learning which can contribute to tracking income and cost and predicting budget and this is the available gap in the existing work done which we want to work on. Also we find that Deep Learning models are used in some finance and business (F&B) domains, which are: credit risk prediction, macroeconomic prediction, exchange rate prediction, stock market prediction, oil price prediction, portfolio management, and stock trading. The relationship between commonly used deep learning models for the finance and business (F&B) domains are summarized in the Figure 2.1 and on past papers [15]. In addition, we find that from using different approaches of unsupervised clustering such as K-means and hierarchical approach(Algorithms), it is possible for using customer transactional data to identify spending patterns among individuals that can be used to assess creditworthiness [16].This encourage us to work on deep learning model for Income and expense management where by considering inserted transactions, it is possible to predict the future budget.

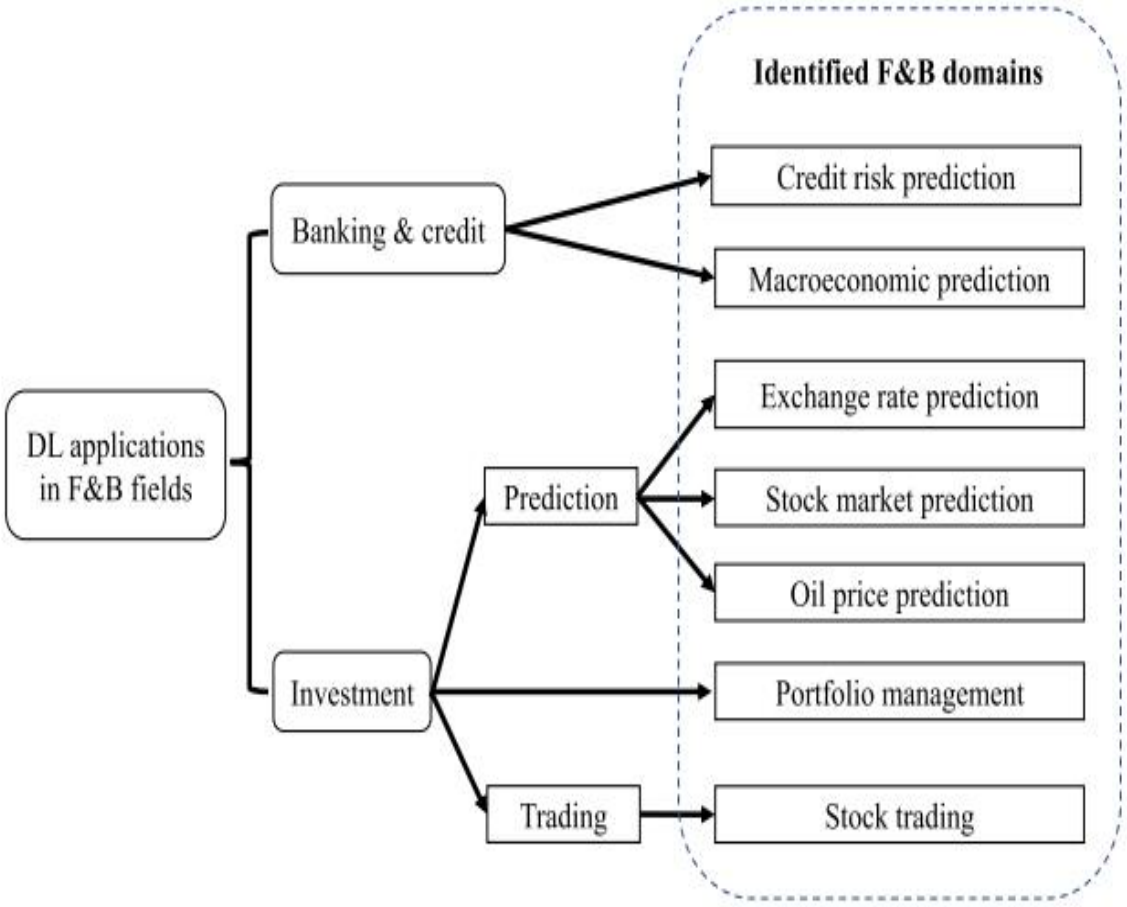

Figure 2. 1: DL Applications in Finance and Business Field

2.4. Summary

From recent literature, it is found that in each research, there is something to consider, but in the reviewed literature, the focus was put on the used deep learning model, the purpose of using it, and the domain applied which facilitated me to find that it is possible to use it. Also in our research, the relevant literature helped us to work on the design of study units, to gather ideas for the design while keeping an eye on the results, and reflect on the final product in order to make it better.

Chapter 3: Research Methodology

3.1. Introduction

This section describes the model used, technologies, methods, and materials used in the research. To conduct this study we will use a waterfall approach to the software development process. The main data collection techniques for system analysis and requirements engineering will be observation, interviews, and documentation. Utilizing UML modelling software, the information flow was created. To conduct this study, we will use a waterfall approach to the software development process, for the Design and implementation of a deep learning model for tracking institution's income and expenses, the requirements was gathered by interviewing the families, individuals and the persons who has small business. Interview, observations also have been used in this project, helped me to know what needed and what is done correctly in practical way.

3.2. Deep Neural Network (DNN)

Deep learning draws its influence from how the human brain filters information, Deep Neural Network (DNN) is a single model used to make prediction of something [17], But now it is used to predict the future budget. Its main objective is to facilitate human decision-making. Actually, it is composed with three layers, Input Layer which plays a role of initial data for the neural network, Hidden Layer which is intermediate layer between input and output layer and place where all the computation is done, and output layer, produce the result for given inputs. The Figure 3.1 illustrates the Deep Neural Network Model Representation.

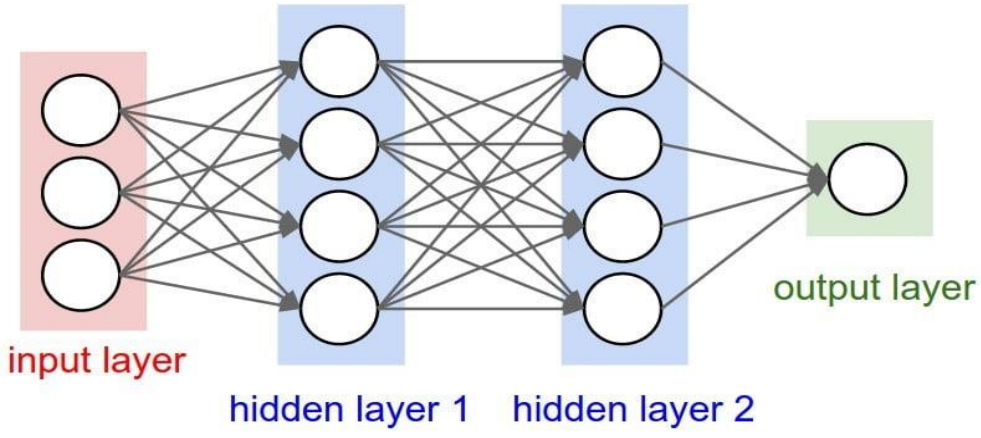

Figure 3. 1: Deep Neural Network

In general, in order to learn and gain accuracy over time, neural networks rely on training data. We can identify and cluster data quickly using these learning algorithms, though, once they have been improved for accuracy [18].

3.3. Software Development Life Cycle (SDLC) _ Waterfall model

Waterfall model The waterfall display is a sequential, downhill display frequently used in programming improvement forms [19]. The SDLC is done in the following stages: planning and requirement analysis, requirement definition, design of the software architecture, development, testing, deployment in the market, and maintenance. Simultaneous tasks, Flexibility and feedback, Minimal expenditure, and Deep review are SDLC characteristics [20]

The Figure 3.2 describe SDLC_Waterfall model [21]. All phases of Waterfall model helped us in the development process where during **Requirement gathering and analysis is** all potential system requirements are gathered and recorded in a requirement specification document [22]. **System design** aids in determining the design of the system as well as the hardware and system requirements [22]. **Implementation**: The system is first constructed in small programs known as units, which are then combined in the following phase, with input from the system design [22].**Unit testing** is the process of developing and evaluating each unit for functionality [22]. **Integration and testing**: Following the testing of every unit created during the implementation phase, the entire system is integrated. After integration, the complete system is tested for faults and failures [22]. **System deployment**: After functional and non-functional testing is complete, the product is deployed in the Users environment [22]. **Maintenance**: A few problems can occur in a client environment. Updates are made available to address those issues. Better versions of the product are also released in order to improve it. To provide these modifications to the consumer environment, maintenance is performed [22].

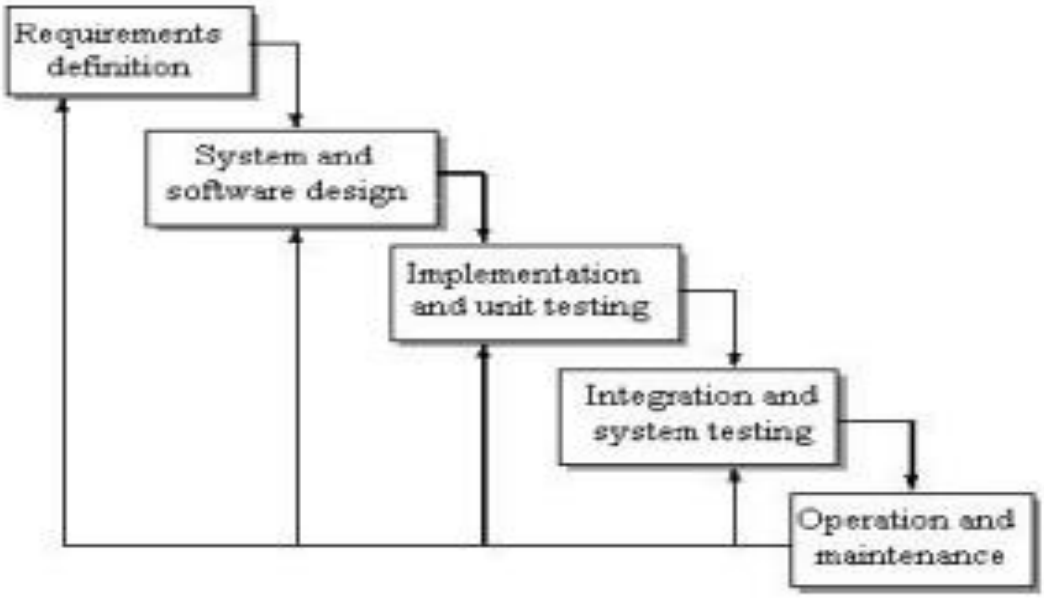

Figure 3. 2: SDLC _ Waterfall model

3.3. Used Methods

3.3.1. Observation

Observation is a technique for gathering information [23]. In this research, the observation method plays a big role in identifying financial management problems faced in institutions especially in families also in conducting the implementation of this project it will help us to know if the result we are finding is the one expected. It is used also in the testing phase where it is important to the extent to which the application is solving identified problems.

3.3.2. Interviews

Interviews are techniques used in research that relies on the collection of data with questions [23]. This research, the interview done with some families, helps me to know the existence of the problem and the solution needed them. It plays a big role also a big role in the Testing, deployment, and maintenance phase where the answers from the interviewer and the observation of what I have will show me directly what is needed.

3.3.3. Documentation

Documentation is composed of written materials that act as records of events or as proof of certain facts [23]. In this research, The Idea from the documentation made helped me to know clearly the

work done by others and the gap available, which helped me to take a decision of doing this Thesis work. All borrowed ideas from other researchers are referenced.

3.4. Technologies Used.

In general, development is based on financial management. This can be achieved and more effective to the users if electronic of all financial information is done. It is the reason why the deep learning model for tracking the institution's income and expenses which have capability of making a prediction of budget is implemented based on data acquisition and data communication technologies.

3.4.1. Data acquisition Technology

The data from users will be acquired using a very friendly user interfaces that will allow users to record their financial activities in simple way and after data will be stored to cloud Server where daily report is generated and prediction process are done for making a system to be a solution to community.

3.4.2. Data communication technology

Data communications is the process of transferring digital information between two or more points [24].The deep learning model for tracking institutions' income and expenses will use internet to perform its all operation and give the feedback to corresponding user in real-time data transmission.

3.5. Summary

For conducting this research, we prefer to use Deep Neural Network (DNN) because several layers make it possible for models to learn complicated features more quickly and to handle more demanding computational tasks, carry out more complex operations at once. As we will find its importance in the result, find on the predicted result analysis. We used have used also SDLC_ Waterfall model also in order to develop well the user interfaces required.

Chapter 4: System Design and Analysis

4.1. Introduction

The Figure 4.1 describes the model development and evaluation steps of this research. End users will use the website and that will store their data in database. Validation comes after training to evaluate the trained model is acceptable. If not accepted the training will continue, the testing and prediction is done on accepted model.Validation was done using mean squared error and mean absolute error where training steps was followed.

In general, to develop this model we followed the following steps:

- **Collect Data** is the first step where the quality and quantity of data you get are important since they will directly affect how well or poorly your model works.
- **Prepare the data** is a good time to analyse your data and see if there are any relationships between the various attributes that we obtained.
- **Choose models** to be used depending on the data you are going to process and as well as we will use numerical values our model is Logistic Regression.
- **Train the deep learning model** on this step we need to train the datasets in order for the prediction rate to improve rapidly.
- **Evaluation** on this step we must test the model we built to our evaluation data set, which comprises inputs that the model does not recognize, and test the precision of the trained model**.**
- **Parameter Tuning** at this step if you did not achieve good predictions during the evaluation and your precision was not the minimum intended, you may have overfitting or under fitting issues and must return to the training process before establishing a new configuration of parameters in our model.
- **Prediction or Inference** is the last step where You are prepared to apply your Machine Learning model to infer results in real-world scenarios [25]**.**

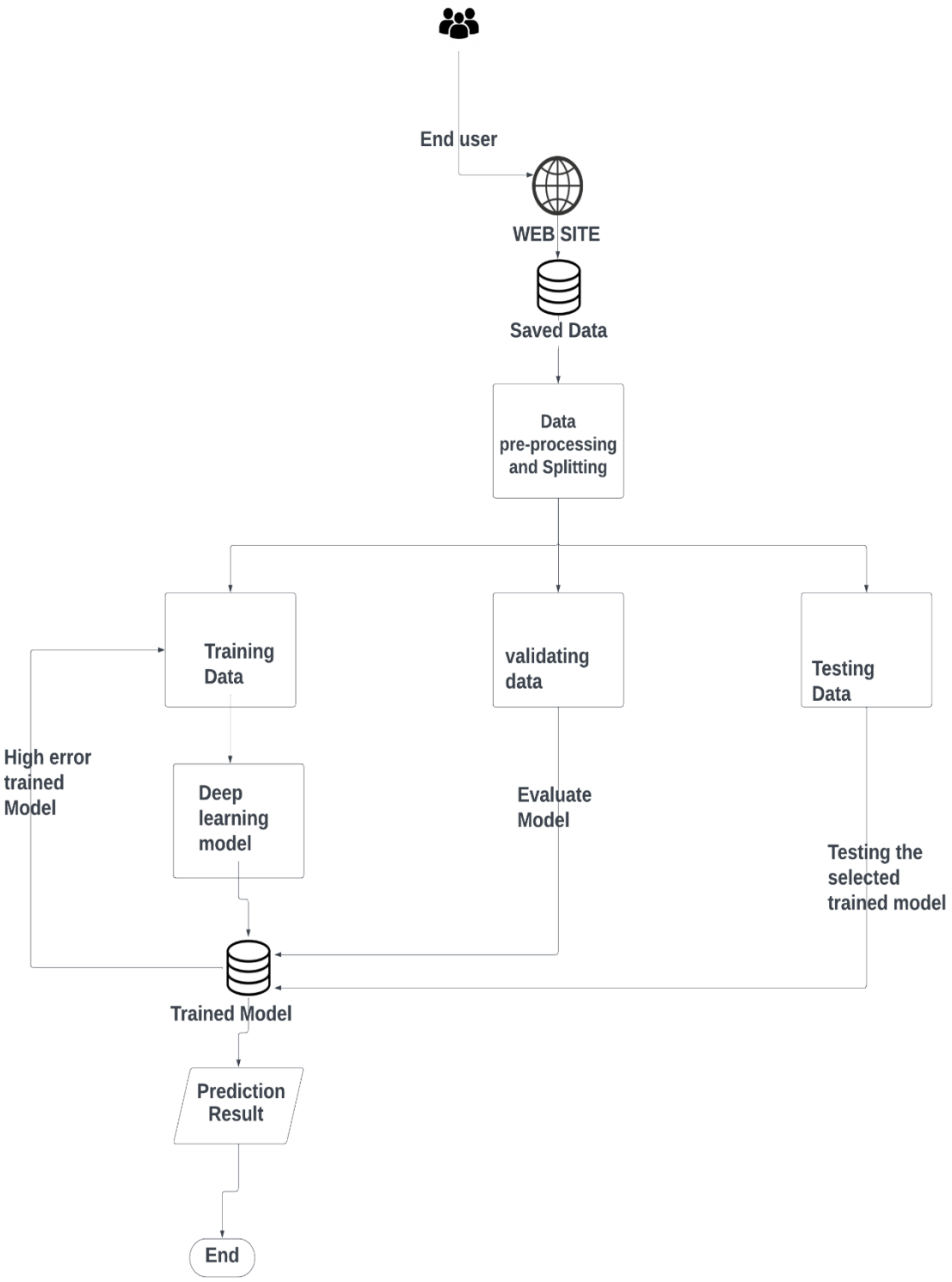

Figure 4. 1: Model process

4.2. Structure Design of the System

As shown on the Figure 4.2, users will fill required information in form available on the user interface and data will be stored on cloud server where analysis and prediction will take place to output the daily report and prediction of future budget.

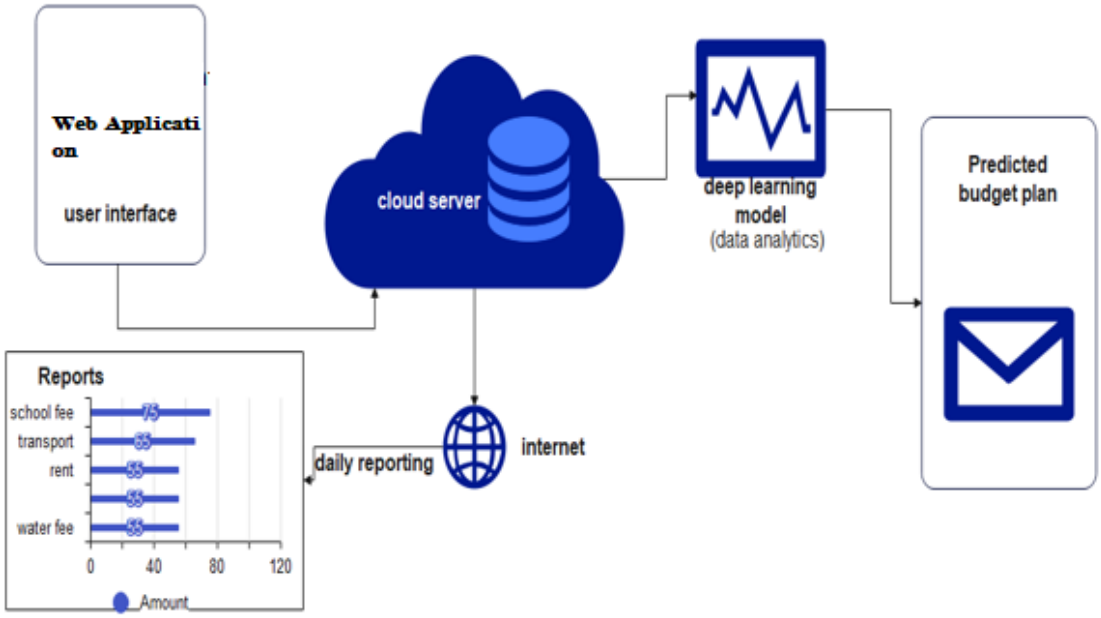

Figure 4. 2: Structure Design of the System

4.3.Hardware and Software Requirements

1. **Personal Computer:** having a laptop or desktop computer with not less than 12.45 GHz processor this will help user to access the best-introduced solution.
2. **Smartphone:** Smart phone current intelligent device that make it simple for a human being communicate, to plan and to access internet service from any location. As our application will run through a smart phone, that why it's better to use an Android Smart phone with not less than android 8 operating system.
3. **Internet:** Now days interface is life, the internet is the back bone of the technology that why we suggest the family member to set a good internet connection at their home.

4. **WampServer** is a Windows web development environment. It enables the development of web applications using a MySQL database, Apache 2, and PHP. Additionally, PhpMyAdmin makes it simple for you to administer your database.
5. **Visual Code studio** is a code editor that has been updated and improved for creating and debugging contemporary online and cloud applications.
6. **Python** is a popular computer programming language used to create software and websites, automate processes, and analyze data.
7. **Tensor flow** is a free and open-source machine learning and artificial intelligence software library used for a variety of applications, but it focuses on deep neural network training and inference.

4.4.Use Case Diagram of the Project

Use case modeling is a popular technique for defining a system's software requirements in moder n software development methodologies. It can be used to predict system representations at the same level of abstraction as well as additional representations at lower levels [26]. A deep learning model for tracking an institution’s income and expenses is an application that helps its users to write their financial activities for every day and then get a predicted budget. This use case is one of the functionality from the trained model; it has one part of users, one part of the admin, and a prediction model.

In this application, the users will enter his/her records and these records will be stored in a database. Even if these data will be stored in database users will have the right of viewing their own data, not for all users. The prediction Model will use the stored data to predict the future budget and display it to the users. It is an independent part, which is automated based on the entered data in order to provide real-time service to the users. The administrator will have the right of Admin where he can be able to reset the password of users and he will be able to view all records so that he will be able to make observations of data and the necessary time, he may support users. When the user wants to use this application, he will make registration to the system and then login in

order to obtain credentials. After finding credentials he may start to use, it by following the steps available in the flowchart am going to provide.

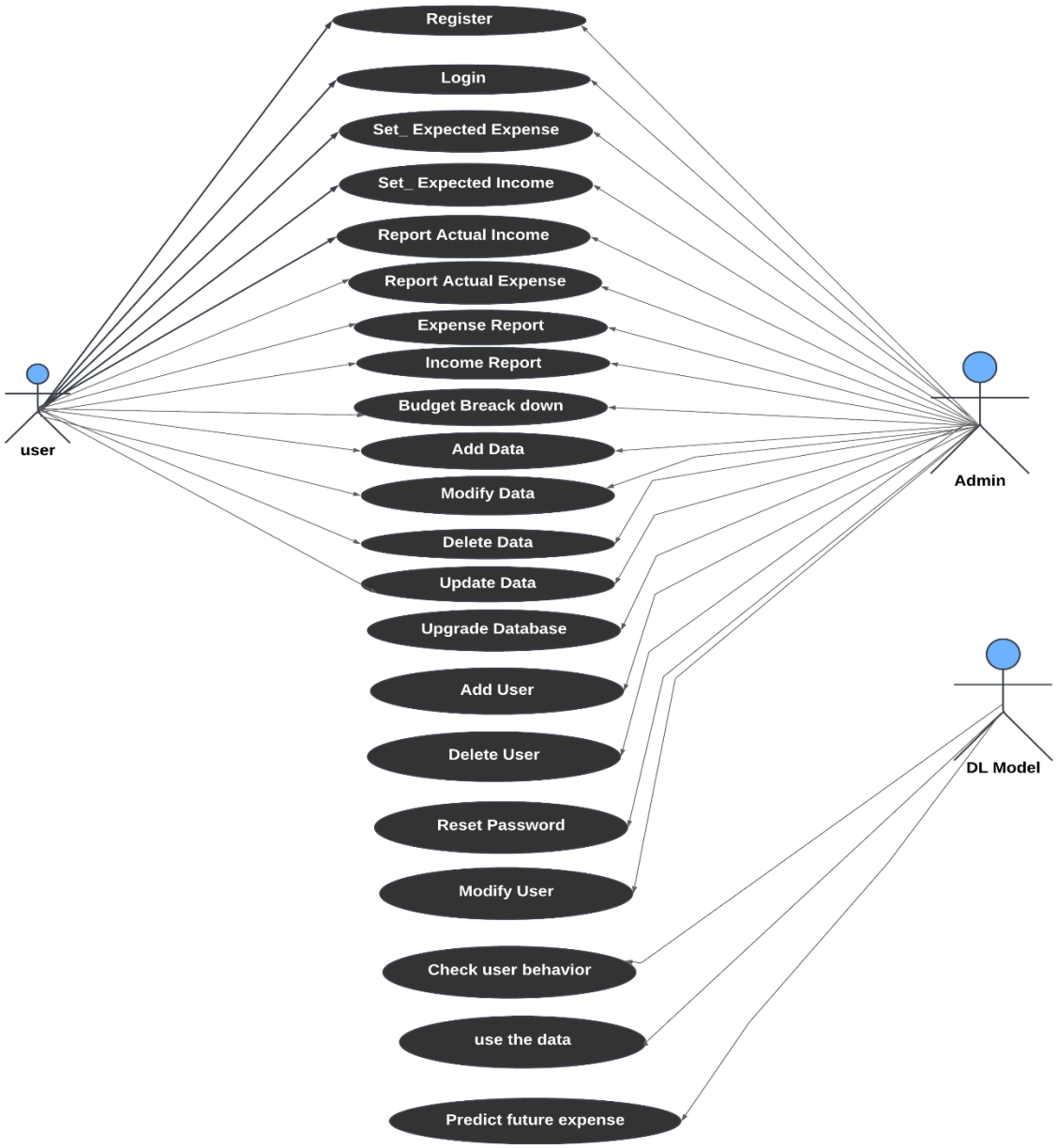

Figure 4. 3: Use Case Diagram

4.5. Role and responsibilities of each module

Table 4.1: Role and responsibilities of each module

Module	Role to view	Right to
Admin	➢ Expenses ➢ Income ➢ Budget	➢ Add New User ➢ Modify user ➢ Delete user ➢ Reset password ➢ Upgrade database ➢ Update data ➢ Delete data ➢ Add data ➢ View All data with in database ➢ Set _Estimated Expense ➢ Set _Estimated Income ➢ Report Actual Expenses ➢ Report Actual Income ➢ Expenses Report ➢ Report Actual Expenses ➢ Budget Breakdown
Users	➢ Expenses ➢ Income ➢ Budget	➢ Register ➢ Login ➢ Set _Estimated Expense ➢ Set _Estimated Income ➢ Report Actual Expenses ➢ Report Actual Income ➢ Expenses Report ➢ Expenses Report ➢ Budget Breakdown
Prediction Module	➢ View and use all Entered Data as Dataset.	➢ Generate Future budget to users.

4.6. Software (language) used:

Table 4.2: Software used

LANGUAGE	ROLE
python	Model development
Wampserver	Server side to connect to database
PHP	Creating interfaces and forms
CSS	Creating interfaces and forms
JavaScript	Creating interfaces and forms
HTML	Creating interfaces and forms

4.7. Flow chart of the project

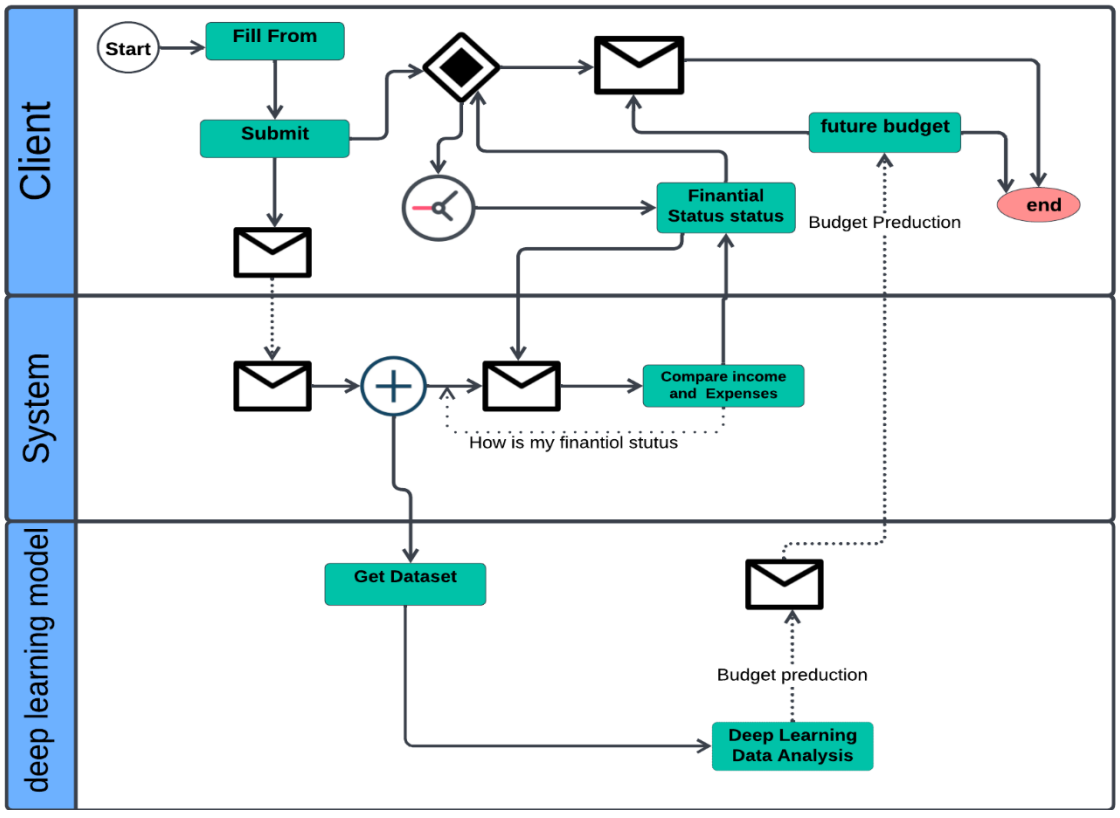

Figure 4. 4: Flow Chart diagram

On the Client level, the task was to design all required user interfaces and databases needed in order to make this application usable and friendly. On System Level, the task was to on make this application usable and generate reports to the users. On the Deep learning model Level, the task was the implementation of deep leaning algorithm, which facilitate the application to generate the budget and to send warning message to the users. This level will use the inserted data as Dataset for future prediction results.

4.8. Summary

In chapter of System Design and Analysis, we described, the model development structure in Figure 4.1, the structure design of the system in Figure 4.2 Hardware and Software Requirements, and the Use case diagram of the system in Figure 4.3**,** which explain, well the workability of the entire system and we describe the workability of overall system using flowchart, which is the Figure4.4**.** However, the working flow of the system is described in table of role and responsibilities of the User in table 4.1, also table 4.2**.** Available within this chapter, shows the languages use in designing this System.

Chapter 5: Results and Analysis

5.1. Introduction

A web-server relational database system serves as the foundation for the software system's structure. The web server database contains all user-related data as well as the users' own information. The system user's registration will be done by the user himself and be stored in the system. The interfaces are integrated with the database using the server-side open-source Wamp Server WAMPServer. MySQL was used to create and deploy the database. JavaScript is used to make various operations, such as the robust interactive process of transferring sensor-detected data to a database, live. Using PHP to make the system dynamic then model development was done using Python.

However, after doing all the tasks the result are described in two types of screenshots one for deep learning model results and other results are for website result.

Training, testing, and system evaluation

5.2. Deep learning model training and testing

5.2.1. Dataset

Actually, a dataset is a collection of data treated as a single unit by a computer. In our model the size of data recorded are one thousand within five columns. Then due to that, we cannot report overall dataset table here, the Figure 5.1 below is taken as a sample of five-recorded observation.

Our dataset consists of five columns, which are explained as follow:

- **House Members** this column is described by number of people related to Ind**_Comp categories.**
- **Ind_Comp** this column describe four categories of interviewed people grouped in Non-governmental organization (NGOs), association, Individual, companies. However, cooperatives, Industries and NGOs was considered as company.
- **Accommodation** this column describes the state of people grouped in Resident and non-resident
- **Income ($)** this column shows the total amount of income received

- **Expenses ($)** this column shows the total amount of expenses used

```
PATH_DATA = '/content/drive/MyDrive/Dataset/expenses_data.xls'
data=pd.read_excel(PATH_DATA)
data.head()
```

	HouseMembers	Ind_Comp	Accomodation	Income($)	Expenses($)
0	9	Individual	No Resident	1188	712
1	45	Association	Resident	23820	704
2	18	Company	Resident	50112	846
3	10	Individual	Resident	867	634
4	7	Individual	No Resident	124	72

Figure 5. 1: Dataset Sample

The Figure 5.2 shows the bar plot of dataset, it shows that Induviduals and companies have a great range level size in the dataset. Most of the times Induviduals and componies are the more range where people are able to get salary. which is the reason why from this generalization NGOs and Association's income is hard to analyse their income and expenses and we decide to keep Indidual and camponies as shown in Figure 5.3 the taken dataset structure.

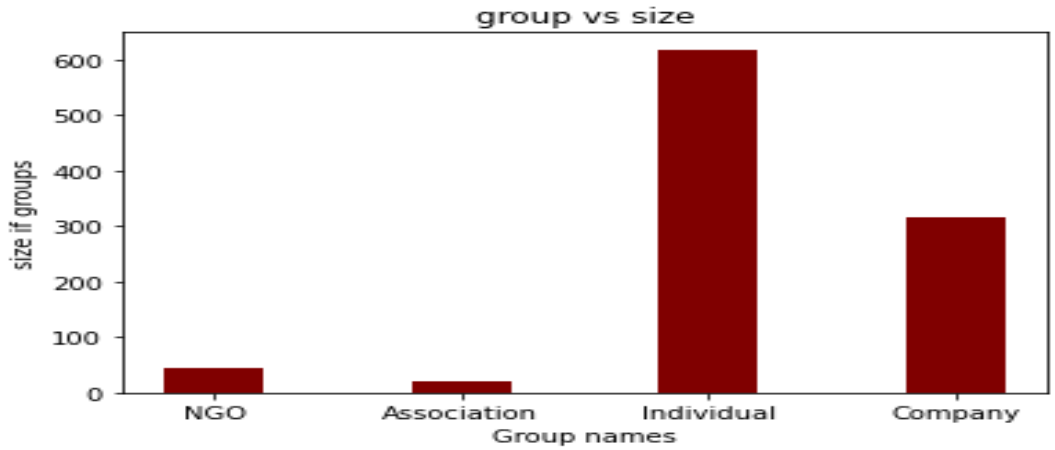

Figure 5. 2: Dataset bar plot

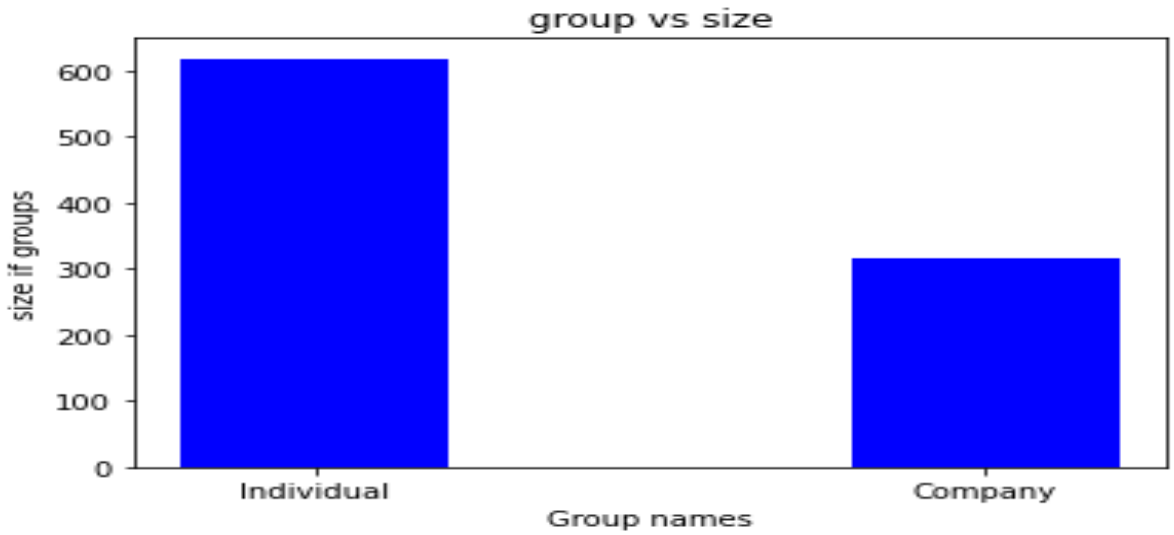

Figure 5. 3: Dataset bar plot with chosen groups

5.2.2. Training and Validation Loss

As shown on the Figure 5.4, between Epoch zero and epoch twenty, Training loss and validation loss are coming reduced. Within short time, errors associated with training and validation are decreasing, from Epoch 20 our model start to be stable on both training and testing but errors in training are higher than those from validation, there for since validation errors are less samples in training, it means that our model is working perfectly.

Red line shows Validation loss.

Yellow line shows Training loss.

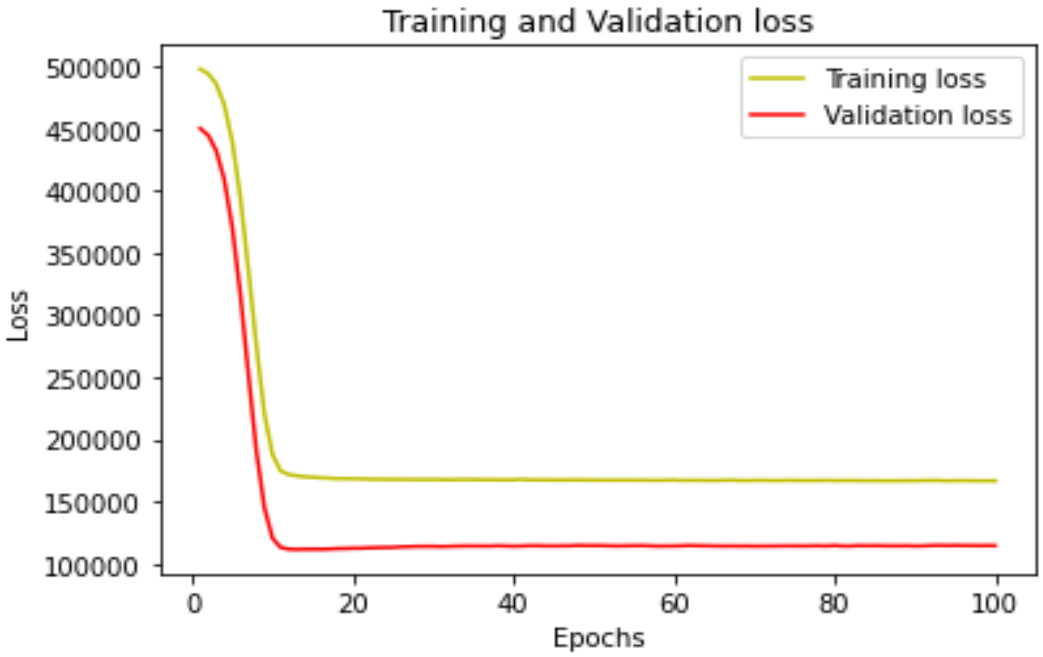

Figure 5. 4: Training loss and validation loss

The Figure 5.5 and Figure 5.6 show that the coloration between expense and income is not linear, There for using normal machine learning models like linear regression the errors could be too high that can lead to the power performance of the model, there for we used deep learning model that can learn this non-linear relationship between expenses and income together with other remaining variables.

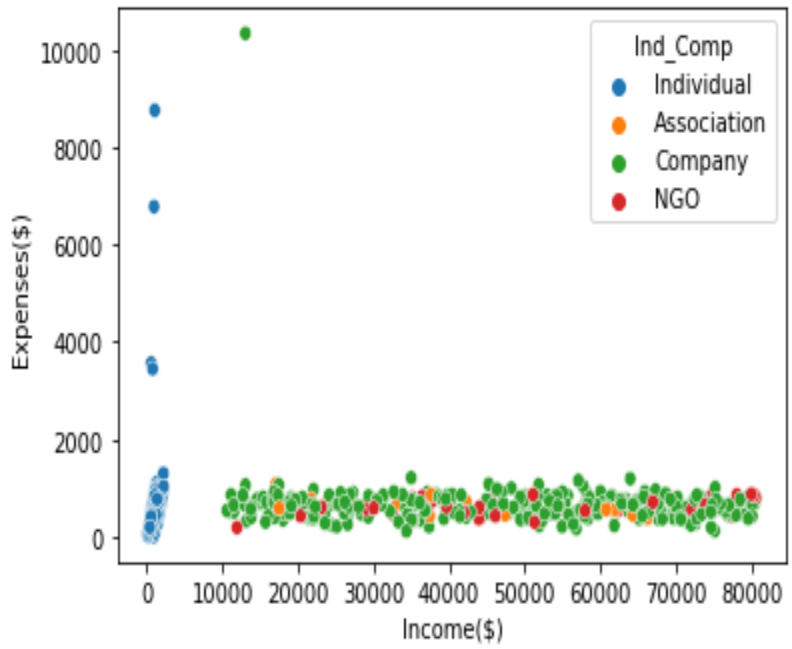

Figure 5. 5: Coloration between expense and income within ind_comp

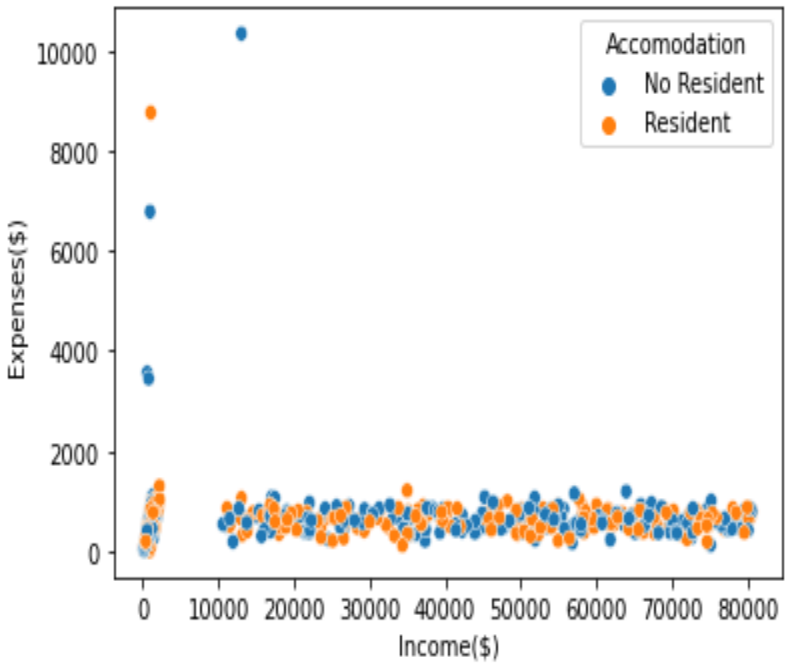

Figure 5. 6: Coloration between expense and income within Accommodation

5.2.3. Future expense prediction

```
[72] #PREDICTING FUTURE EXPENSES
     #df.columns
     my_val=[[
     #    'Company', 'Individual', 'No Resident', 'Resident', 'HouseMembers','Income($)'
           0, 1, 0, 1, 6,700
     ]]
     my_val=scaler.transform(my_val)
     print("_____________________________________________________")

     print("Predicted expenses on my values: ",model.predict(my_val))
     print("_____________________________________________________")

_____________________________________________________
1/1 [==============================] - 0s 20ms/step
Predicted expenses on my values:  [[590.7104]]
_____________________________________________________
/usr/local/lib/python3.8/dist-packages/sklearn/base.py:450: UserWarning: X does not have valid feature names, but MinMaxScaler was fitted with feature names
  warnings.warn(
```

Figure 5. 7: Future expense prediction

The Figure5.7 shows the expense prediction amount for an individual, who is resident with six house members and Seven hundred Dollars (700$). The result shows that his predicted expenses is 590.7104$

Prediction will be done by the model where it will look on different entered parameters such as Company, Individual, No Resident, 'Resident, House Members, Income ($) and then display the future expense amount.

5.3. Website result

5.3.1. Home Page

The Figure 5.8. Shows the home page of the project, where the user can be able to choose any menu according to what he/she want

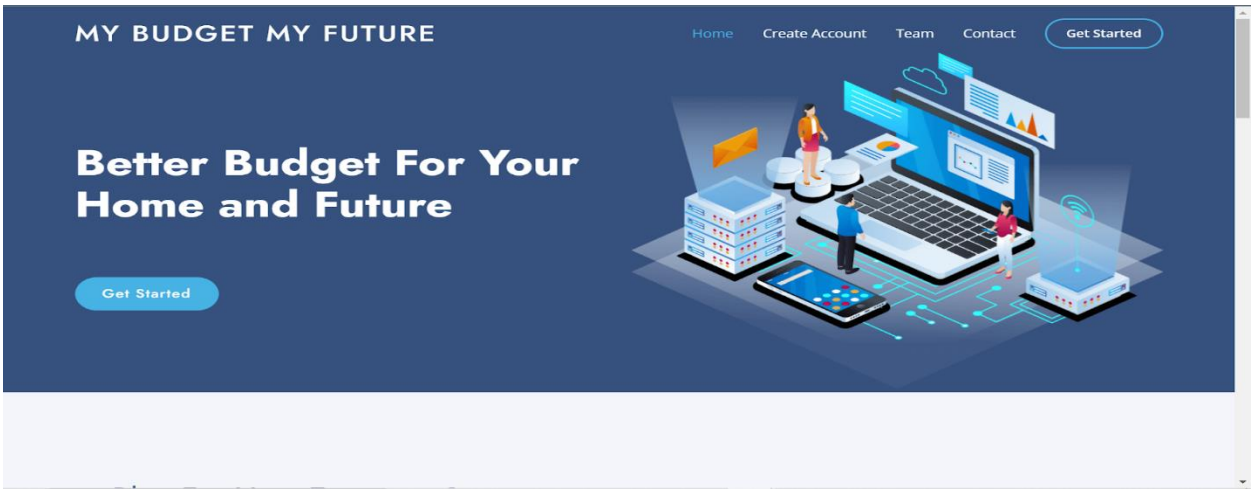

Figure 5. 8: Home page

5.3. 2. Register and Login Page

5.3.2.1. Login page

You may access this page by choosing to get started or create an account from Home page. From this page described by Figure 5.9, existing users can directly login in the system to access their data

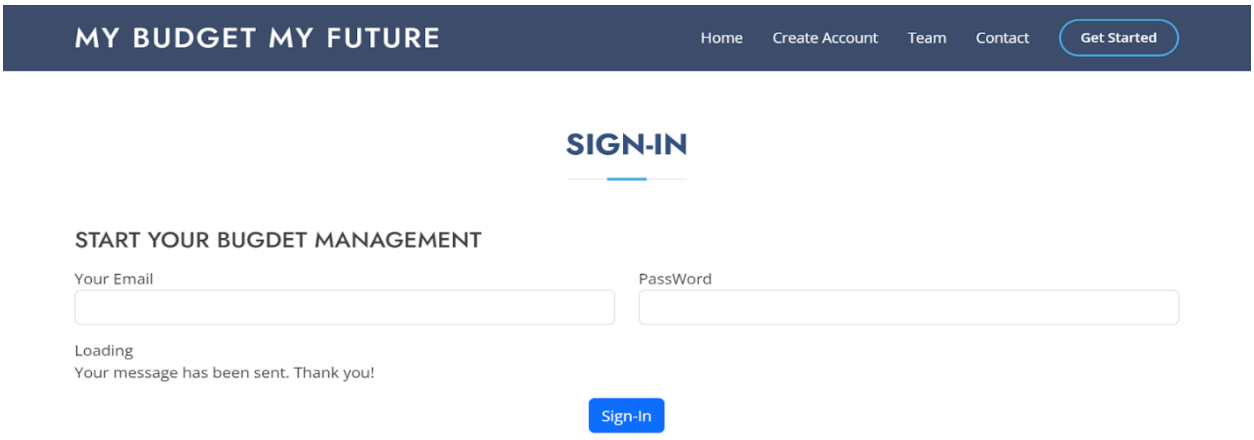

Figure 5. 9: Login Page

5.3.2.2. Account creation page

You may access this page by choosing get started or create an account from Home page.

From this page described by Figure 5.10, new users can directly create account in order to be able recorded in the system and getting the credentials for accessing the system.

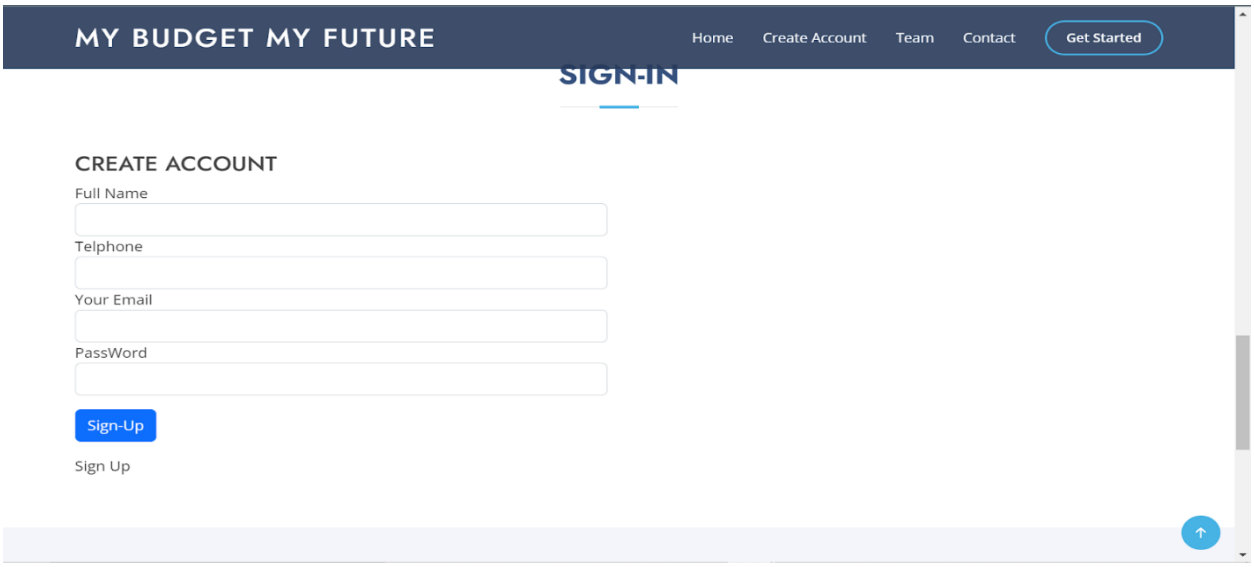

Figure 5. 10: Account Creation

5.3.3. Recording Page

On this page, the user can be able to choose the activity he/she wants according to the task he/she wants to do from Expense, income, and budget. When he chooses Expense, he will find the task set _Estimated expanse, Record actual expanse, and Income details. When he chooses Income he will find the task set _Estimated Income, Record Actual Income and Income details

We settled our expenses estimation for one month; it is displayed as shown in Figure 5.11, and it is the same manner of setting our estimated income

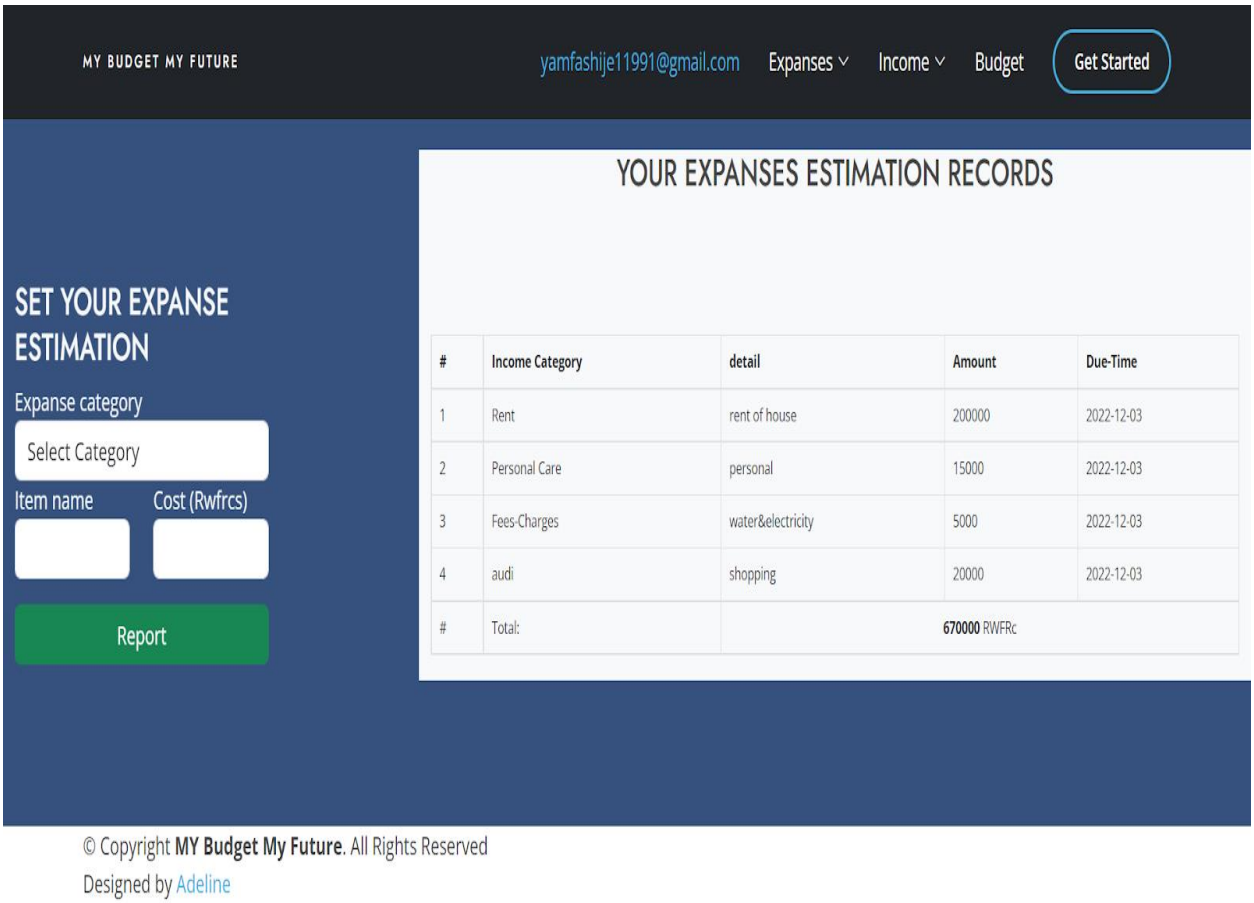

Figure 5. 11: Set estimated expense

5.3.4. Recording Actual income and Expenses

The page described by Figure 5.11 shows how the user can be able to report their actual expenses Income he/she may choose the activity he/she wants according to the task he/she wants to do from Expense, income, and budget. When he chooses Expense, he will find the task set _Estimated expanse, Record actual expanse, and expense details. When he chooses Income he will find the task set _Estimated Income, Record Actual Income and Income details

On the option of recording the actual income and expenses, we must select Expenses and choose Record Actual Expenses; it is displayed as shown in Figure 5.12 and it is the same manner as Recording Actual Income where we must select Income and choose Record the actual Income it is displayed as shown in Figure 5.13**.**

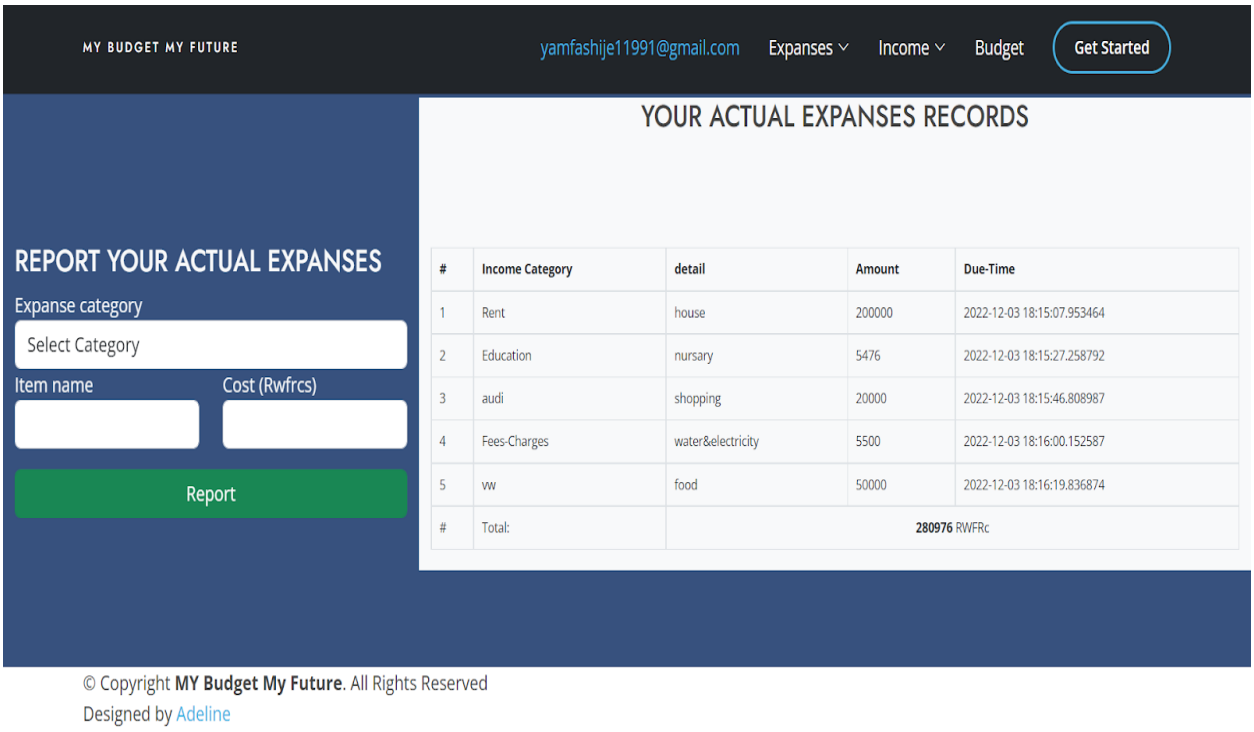

Figure 5. 12: Recoding Actual Expense

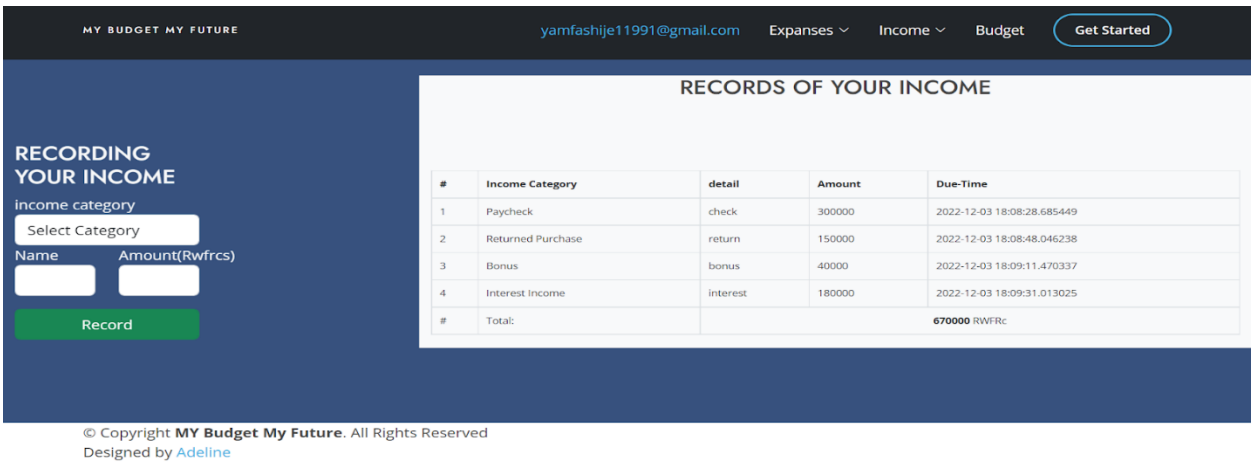

Figure 5. 13: Recoding Actual Income

5.3.5. View details of Expenses and Income reports.

The pages described by figures below shows how the user could check his/her reports. Actually, he have to choose Income or expense their actual expenses according to the task he/she wants to do from Expense, income, and budget. When he chooses Expense, he will find the task set

_Estimated expanse, Record actual expanse, and Expenses details. When he chooses Income he will find the task set _Estimated Income, Record Actual Income and Income details

On the option of Income details and expenses details, we must select Expenses and choose expenses details, it is displayed as shown in Figure 5.14 and it is the same manner as Income details where we must select Income and Income details it is displayed as shown in Figure 5.15 .The Figure 5.16 illustrate a detailed report of income; it combines both estimated income and actual income where by ticking on one level of income in the bar chart, you may know the exact amount and make a comparison to actual and estimated income amount directly.

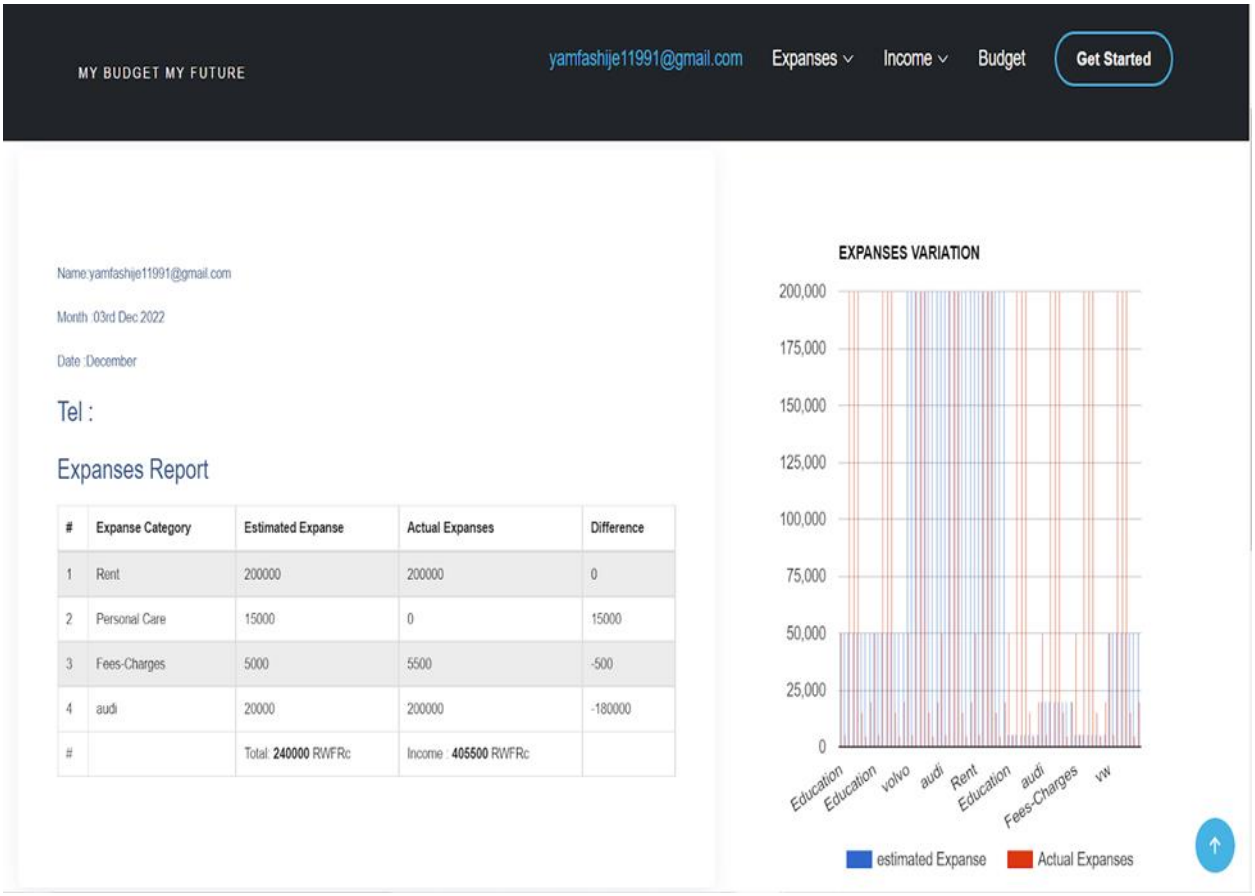

Figure 5. 14: Expense report

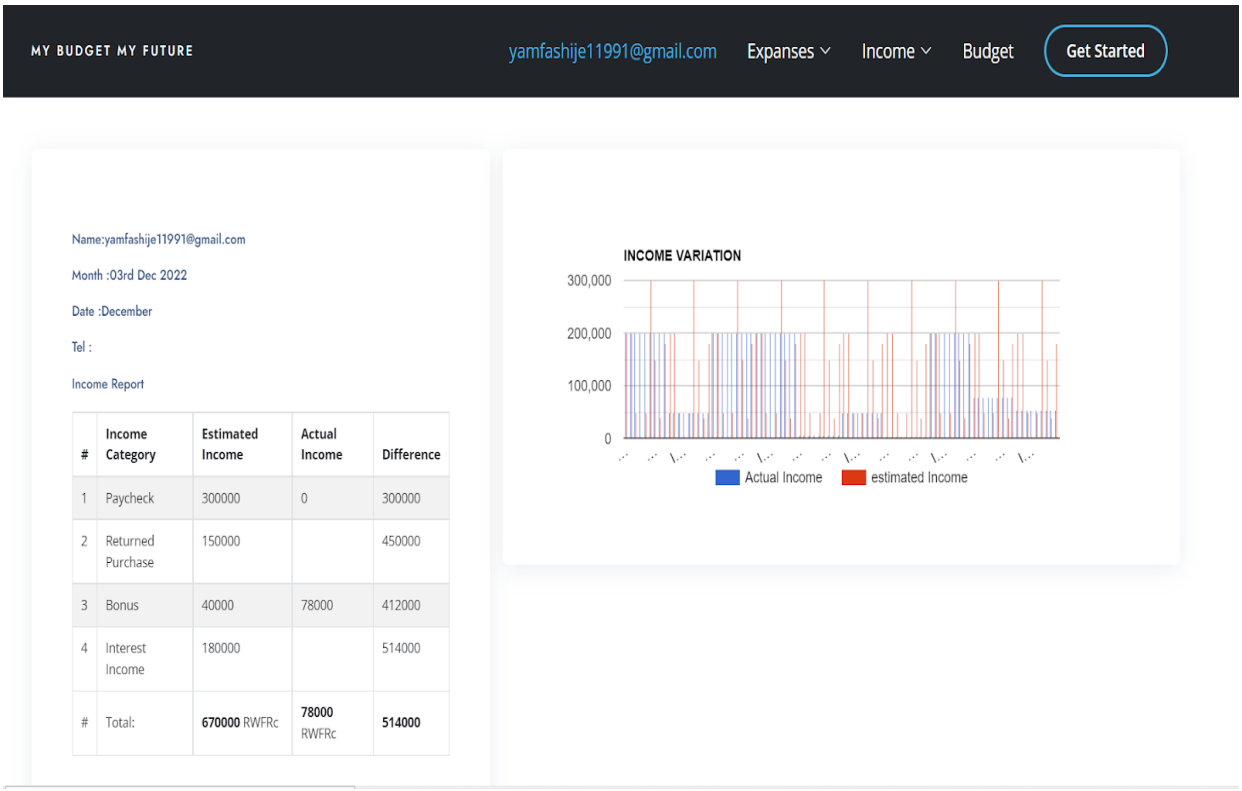

Figure 5. 15: Income Report

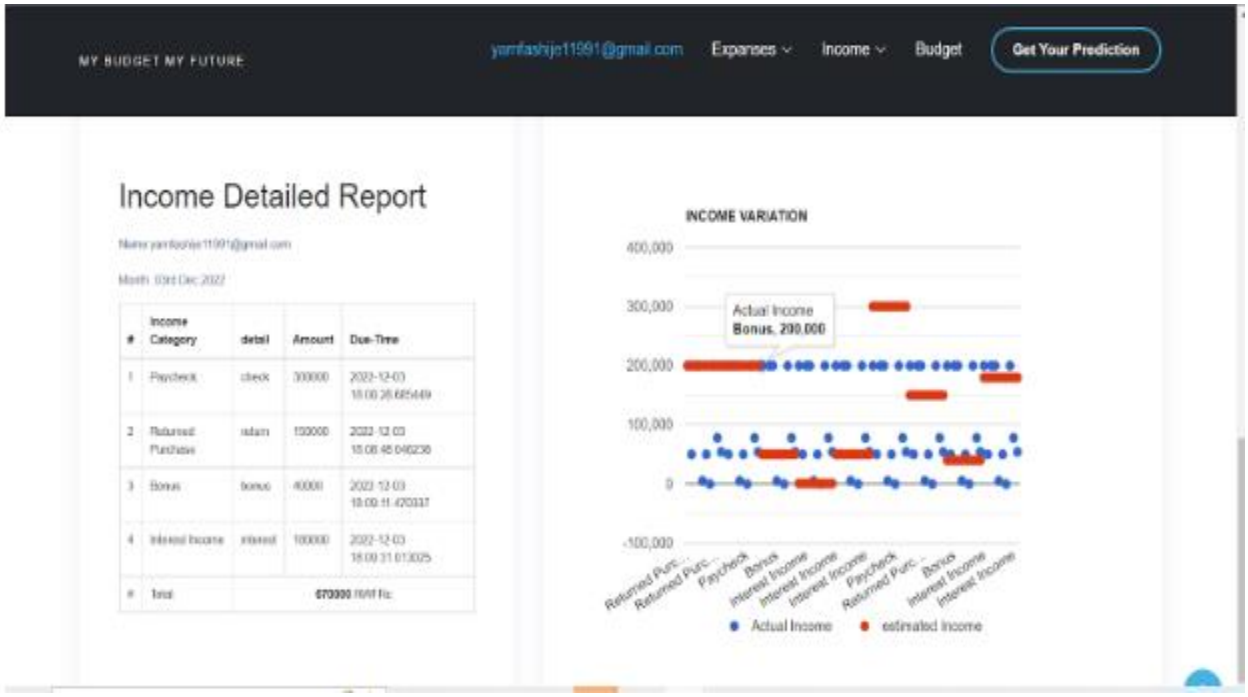

Figure 5. 16: Income detailed Report

5.3.6. Budget

5.3.6.1. Actual Budget

As described in the beginning of this Thesis, the main objective is to predict the future Budget. When the user start to use this she have to set his budget for one month and day to day he have to record his financial transaction accordingly. However, the system will use these data to generate for him the report in real-time manner.

The Figure 5.17 illustrate the Budget breakdown where we compare estimated expenses and actual expenses. When we say estimated expenses are the expenses we planned to use within one month where Actual Expenses are the used expenses, which recorded day to day.

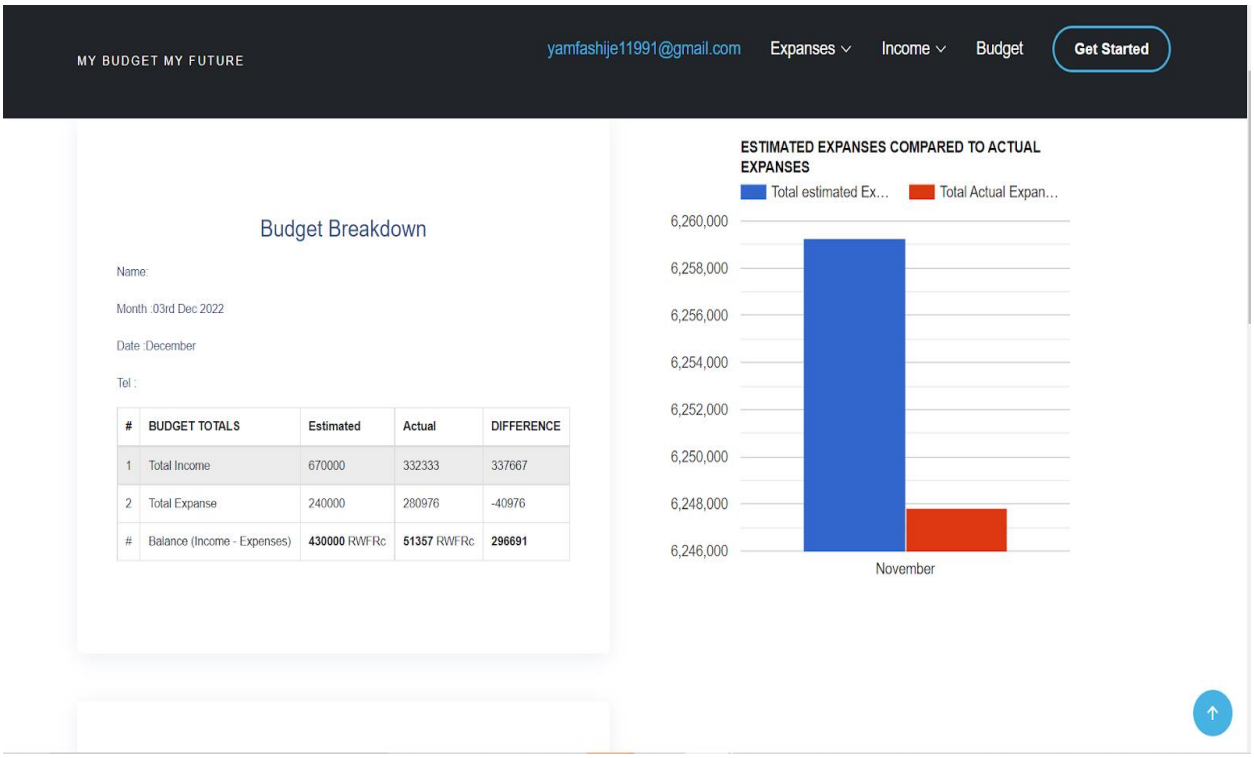

Figure 5. 17: Budget Breakdown

5.4. Summary

As existing applications like student expense tracking application, which is an android app designed to keep controls on a student's everyday spending. So, we created a project that will be very helpful to the users in order to create a better spending tracking system [27]. Expense Tracker helps to keep the record of daily expenses and monthly income of users from any place and bring

on a monthly report of the expenditure in pdf format, when compared to our project, it is limited on services. Expense tracker is another android-based application. This application allows the user to maintain a computerized diary [28].This is application allow user to enter their daily expenses and end of the day, they know their expenses in charts [28]. The speciality that our system offer is to facilitate users to go in deep by considering expected and actual income and expenses and give them ability to view the future budget in turn as well as to produce the waning massage to the users in time needed.

The result shows that our system is working as expected. Users are able to view their reports Income Report and expenses report, are able to set the expected income and expenses, They are able to record their daily income and expenses which is called record actual income or record actual expenses. From the system users are able to, they are also able to view the future budget and to receive the warning message while they start to spend more than they gain.

As a point of view, all expected objectives and difficulties are fixed and now the user are able:

- To identify major institution's resources
- Gather income and expense data from users
- To develop a friendly user software tracking institution's income and expenses
- Develop deep learning model for Income and expense management
- Train and test the model
- Evaluate the performance and accuracy of the model
- Design and test the user interface(UI) for user-system interaction
- Validate the usability of the system

.

Chapter 6: Conclusion and Recommendation

6.1. Conclusion

IoT is deployed in the financial sector because it allows for faster information flow. When the user wants to know their financial status or to record their transaction it is easy by using this application. This project provides the smart financial system, which could be, used for not only institution but also individual, Family, cooperatives and others private sectors to manage their financial activities in real life. Using the system, the users can be able to find their financial activities easily and are able to generalize easily according to the output displayed by the system. Through this application, financial information will never be lost and are available always when needed by its users as well as manual recording is closed and financing for all is in use. As the implementation of this project, the social impact will be positive on both the owner and the users, due to simplify the manual work.

6.2. Challenges

Actually, I planned to predict the future budget, which contain both Income and expense, but I find the prediction of expenses only due to expenses correspond to the income. Without money, you cannot do an expense transaction. This is the challenge faced in model development. Another challenge is related to the model deployment where I was planned to find the result of prediction in Web site, but the end the user will do all activities in the website and only the prediction of future expense is done by the model independently.

6.3. Recommendation

Future researchers, researcher would like to recommend them fix the challenges described above and they should expend this project so that the users will link Bank Account and Mobile Money with the system in order to make auto recording financial transaction either saving withdraw or pay by check or using ATM cards. Due to the users of this system must have Internet, personal computer or Smartphone researcher would like to recommend also the future researchers to integrate the use of Unstructured Supplementary Service Data (USSD) for the peoples who has no capabilities of getting Smartphone or personal computers and internet. This will real make this project be more friendly and useful to everyone according to his financial capacity.

List of References

[1] E. Malinowski *et al.*, "About the Tutorial Copyright & Disclaimer," *Data Vault 2.0*, no. January 1999, pp. 1–15, 2019, doi: 10.1007/978-3-322-94873-1.

[2] U. Nations and C. On, "E-FINANCE AND SMALL AND MEDIUM-SIZE ENTERPRISES (SMEs) IN DEVELOPING AND TRANSITION ECONOMIES," *Challenges*, no. October, 2001.

[3] Z. Mohammed, "Artificial Intelligence Definition, Ethics and Standards."

[4] S. Harvey and R. Harvey, "An introduction to artificial intelligence," *Appita J.*, vol. 51, no. 1, 1998, doi: 10.2514/6.1994-294.

[5] OECD Publishing, *Artificial Intelligence in Society*. 2019.

[6] J. Huang, "Development of Computer Technology Application in Financial Accounting," *J. Phys. Conf. Ser.*, vol. 1533, no. 2, 2020, doi: 10.1088/1742-6596/1533/2/022021.

[7] N. H. Marjumin *et al.*, "The challenges and contribution of internet of things (Iot) for smart living," *Int. J. Recent Technol. Eng.*, vol. 8, no. 1, pp. 162–166, 2019.

[8] M. Chui, M. Collins, and M. Patel, "The Internet of Things: Catching up to an accelerating opportunity," no. November, 2021, [Online]. Available: https://www.mckinsey.com/~/media/mckinsey/business functions/mckinsey digital/our insights/iot value set to accelerate through 2030 where and how to capture it/the-internet-of-things-catching-up-to-an-accelerating-opportunity-final.pdf?shouldIndex=false

[9] M. a. Hilgert, J. M. Hogarth, and S. G. Beverly, "Household Financial Management: The Connection between Knowledge and Behavior," *Fed. Reserv. Bull.*, vol. 106, no. November 1991, pp. 309–322, 2003.

[10] A. Pick, "A Literature Review I . What is a literature review ? II . Selecting the topic and the literature," pp. 1–4, [Online]. Available: https://web.pdx.edu/~wooster/EC_Writing/A Literature Review.pdf

[11] J. Huang, J. Chai, and S. Cho, "Deep learning in finance and banking: A literature review and classification," *Front. Bus. Res. China*, vol. 14, no. 1, 2020, doi: 10.1186/s11782-020-00082-6.

[12] B. Vega-Márquez, C. Rubio-Escudero, I. A. Nepomuceno-Chamorro, and Á. Arcos-Vargas, "Use of deep learning architectures for day-ahead electricity price forecasting over different time periods in the spanish electricity market," *Appl. Sci.*, vol. 11, no. 13, 2021, doi: 10.3390/app11136097.

[13] H. Wasserbacher and M. Spindler, "Machine learning for financial forecasting, planning and analysis: recent developments and pitfalls," *Digit. Financ.*, vol. 4, no. 1, pp. 63–88, 2022, doi: 10.1007/s42521-021-00046-2.

[14] S. Abis, "Detection of the spinodal point in an Al-Zn 40wt% alloy," *J. Mater. Sci. Lett.*, vol. 9, no. 1, pp. 119–121, 1990, doi: 10.1007/BF00722890.

[15] J. Huang and J. Chai, “Deep learning in finance and banking : A literature review and classification,” vol. 6, 2020.

[16] M. Holm, “DEGREE PROJECT IN THE FIELD OF TECHNOLOGY Machine learning and spending patterns A study on the possibility of identifying riskily spending behaviour Machine learning and spending patterns A study on the possibility of identifying riskily,” 2017.

[17] A. Neuron, “Neural Networks and Introduction to Deep Learning,” *WikiStat*, pp. 1–17, 2015, [Online]. Available: http://klab.tch.harvard.edu/academia/classes/BAI/pdfs/intro-deep-learning.pdf

[18] A. Shrestha and A. Mahmood, “Review of deep learning algorithms and architectures,” *IEEE Access*, vol. 7, no. c, pp. 53040–53065, 2019, doi: 10.1109/ACCESS.2019.2912200.

[19] Admin BWC, “Software Development Life Cycle (SDLC),” *Https://Bigwater.Consulting/2019/04/08/Software-Development-Life-Cycle-Sdlc/*, 2019, [Online]. Available: https://bigwater.consulting/2019/04/08/software-development-life-cycle-sdlc/

[20] R. Mokhtar and M. Khayyat, “A Comparative Case Study of Waterfall and Agile Management,” *SAR J. - Sci. Res.*, no. March, pp. 52–62, 2022, doi: 10.18421/sar51-07.

[21] S. Herawati, Y. D. P. Negara, H. F. Febriansyah, and D. A. Fatah, “Application of the Waterfall Method on a Web-Based Job Training Management Information System at Trunojoyo University Madura,” in *E3S Web of Conferences*, EDP Sciences, Dec. 2021. doi: 10.1051/e3sconf/202132804026.

[22] K. Petersen, C. Wohlin, and D. Baca, “The waterfall model in large-scale development,” *Lect. Notes Bus. Inf. Process.*, vol. 32 LNBIP, pp. 386–400, 2009, doi: 10.1007/978-3-642-02152-7_29.

[23] U. K. B. Dubey and D. P. Kothari, *Research Methodology*. 2022. doi: 10.1201/9781315167138.

[24] B. T. Iv and Y. I. Sem, “Lecture Notes Malla Reddy College of Engineering & Technology,” vol. 2, 2021.

[25] D. R. V. RODRIGUEZ, “Title: The 7 Key Steps To Build Your Machine Learning Model.” https://analyticsindiamag.com/the-7-key-steps-to-build-your-machine-learning-model/

[26] H. Gomaa and E. M. Olimpiew, “The role of use cases in requirements and analysis modeling,” *Work. Use Cases Model. Softw. Eng.*, pp. 1–15, 2005.

[27] S. Dubey, “STUDENT EXPENSE TRACKING APPLICATION,” no. 2, 2022.

[28] Velmurugan R and M. P. Usha, “Expense Tracker Application,” vol. 9, no. 4, pp. 5–9, 2021.

Appendices

Appendix 1: Interview guide

The questions below are used to realize the existence of the problem and justify the significance of the web and Mobile application for tracking institutions' income and expenses.

1. Are you an individual, a non-Government Organization (NGO), a company, Or an Association?
2. How many members are within your category?
3. Have you used software to track your financial activities?
4. Is it easy to you to identify major institution's resources?
5. Which tool are you using in recording your financial activities?
6. Is it easy to you to make a budget?
7. Is it easy to you to control your activities?
8. Is it easy to you to make a plan for the future?
9. Did you do a record of your own financial activities?
10. Do you need software that can provide you with the best way of tracking your financial status and forecasting your economic status?

The questions below are used in finding the right information for data use in our System.

11. Within your category, are you renting or a resident?
12. How much income in Rwandan Francs do you get within one month ……?
13. How much expenses in Rwandan Francs do you spend within one month……?

Appendix 2: Interview Responses

No	Are you an Individual, a non-Government Organization (NGO), a company, Or an Association?	How many members are within your category	Within your category, are you resident or a no resident	Have you used software in tracking your financial activities?	Is it easy to you to identify major income and expenses resources	Which tool are you using in recording your financial activities	Is it easy to you to make a budget?	Is it easy to you to control your past financial activities	Have you ever lost your financial data	What was the cause of losing data	Do you need software that can provide you with the best way of tracking your financial status and forecasting your economic status	How much income do you get within one month (FRW)	How much expenses do you spend within one months(FRW)
1	Individual	1	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	200000	192000
2	Individual	5	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	113000	90000
3	NGO	40	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	300000	150000
4	NGO	60	No Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	400000	250000
5	Individual	9	No Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	100000	60000
6	Individual	3	Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	600000	300000
7	Individual	4	Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	250000	200000
8	Individual	1	No Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	100000	200000

9	Individual	2	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	150000	135000
10	Individual	6	No Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	135000	150000
11	Individual	2	No Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	600000	300000
12	Individual	2	Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	600000	500000
13	Individual	7	Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	300000	150000
14	Individual	3	No Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	150000	100000
15	NGO	15	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	150000	100000
16	Individual	6	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	200000	100000
17	Individual	3	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	400000	120000
18	Individual	2	No Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	400000	200000
19	Individual	2	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	600000	200000
20	Individual	3	No Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	600000	3E+06
21	Individual	6	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	600000	400000
22	Individual	9	No Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	118800	712000
23	Association	45	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	2382000	70400
24	Company	18	Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	700000	500000
25	Individual	10	Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	107000	5E+07
26	Individual	7	No Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	124000	720000

27	Individual	4	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	140000	111800
28	Company	27	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	67653	363
29	Company	29	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	34391	232
30	Company	35	Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	42011	688
31	Individual	2	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	8630	387
32	Company	33	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	41145	498
33	Individual	1	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	9620	549
34	Individual	8	No Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	1208	671
35	Individual	8	No Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	62700	630
36	Company	39	No Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	68683	870
37	Company	47	Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	502200	600
38	Company	28	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	24158	642
39	Company	11	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	38982	731
40	Individual	7	No Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	8740	432
41	Individual	6	No Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	7690	503
42	Individual	7	No Resident	NO	NO	NO THING	Not Easy	Not easy	NO,I didn't record	I didn’t record any where	I need it	1541	492
43	Individual	4	No Resident	NO	NO	NO THING	Not Easy	Not easy	NO,I didn't record	I didn’t record any where	I need it	1000	847
44	Individual	1	No Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	718	657

45	Individual	7	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	1224	698
46	Company	47	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	60056	925
47	Company	31	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	77867	645
48	Individual	2	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	718	209
49	Individual	2	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	718	700
50	Company	44	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	58559	608
51	Company	7	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	51419	496
52	Company	21	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	22475	484
53	Company	10	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	61652	660
54	Individual	8	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	1507	595
55	Individual	4	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	528	450
56	Company	27	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	61579	843
57	Company	15	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	74671	678
58	Individual	1	Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	984	338
59	Company	23	No Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	19184	786
60	Individual	7	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	227	130
61	NGO	12	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	65994	886
62	Company	35	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	39573	565
63	Individual	7	No Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	120	63

64	Company	31	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	49026	515
65	Individual	5	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	565	333
66	Individual	3	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	1595	555
67	Individual	5	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	1489	565
68	Individual	2	No Resident	yes	some how	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	129	66
69	Individual	7	Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	1724	532
70	Company	24	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	79400	533
71	Individual	9	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	1430	696
72	Individual	3	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	774	356
73	Company	29	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	50698	810
74	Individual	9	No Resident	yes	some how	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	897	674
75	Individual	9	No Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	1198	785
76	Company	42	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	19055	802
77	NGO	25	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	35864	707
78	Individual	6	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	1125	884
79	Individual	9	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	1023	370
80	Individual	8	Resident	yes	some how	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	728	619
81	Individual	3	Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	1154	890
82	Individual	3	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	926	710

83	NGO	38	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	16987	605
84	Individual	2	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	988	456
85	Company	14	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	54913	905
86	Individual	6	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	857	543
87	Individual	3	No Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	1152	904
88	Individual	3	Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	957	600
89	Individual	8	Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	1758	932
90	Individual	4	No Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	1738	541
91	Individual	8	No Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	1259	469
92	Association	40	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	66237	374
93	Individual	4	No Resident	NO	NO	NOT BOOK	Not Easy	Not easy	YES	LACK OF CLEAR ACTION PLAN	YES	1395	738
94	Individual	2	No Resident	NO	No	Short notebook	Not Easy	Not easy	I Lost it	My notebook was broken	I need it	231	65
95	Individual	10	No Resident	NO	No	my mind	Not Easy	Not easy	I lost it	I forget it	I need it	843	502
96	Company	21	Resident	YES	NO	EXCEL	Not Easy	Not easy	I lost it	My computer was broken	I need it	39377	782
97	Company	25	Resident	no	no	Register(notebook)	Not Easy	Not easy	I lost it	My Notebook was broken	I need it	48254	997
98	Individual	7	Resident	yes	somehow	excel	Not Easy	Not easy	I lost it	problem of my device	I need it	666	225
99	Individual	6	No Resident	NO	NO	NO THING	Not Easy	Not easy	NO,I didn't record	I didn’t record any where	I need it	933	549
100	Individual	3	Resident	NO	NO	NO THING	Not Easy	Not easy	NO,I didn't record	I didn’t record any where	I need it	1270	970