**HOUSE BUILDING COST ESTIMATION WEB SYSTEM**

**CASE OF NICKJOY BUILDING AND CONSTRUCTION**

**COMPANY**

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A project report submitted to the department of information technology in the school of computing in partial fulfillment of the requirement for the award of the Degree of Bachelor of science in Information Technology of Jomo Kenyatta University of Science and Technology.

**APRIL 2022**

# 

# **DECLARATION**

This project is my original work and has not been presented for a degree in any other University

…………………. …………………

Signature Date

This project has been submitted for examination with my approval as University Supervisor

……………… ……………….

Signature Date

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# **ABSTRACT**

Many people have tried to come up with many house plans majorly for shelter and aesthetic value as well as one of the good measures of people’s prosperity level. Due to this, the plans that some people have been trying to come up with contains many complexities in terms of resource consumption like money for the purchase of building materials. This has made many owners of buildings to invest a lot in such projects because they lack adequate knowledge of the best house plans, the total quantity of materials required to complete the project and also, they don’t have adequate information on where to buy building materials at an affordable price.

The house designers together with constructors have been trying to dupe the owners of building and construction projects and establishment of these plans by failing to tell them the truth about the quantity of the materials to be used in the said projects.

In respect to the challenges identified on this matter, this project is aimed at making an online house architecture analysis known as one storey building to help Nickjoy building and construction company get enough breakdown information on the exact quantity of the materials to be consumed during establishment of the house plans, to compute the total cost of the proposed building and also to show the place where one can acquire building materials at an affordable price.

The system has incorporated incremental methodology which is based on developing an initial implementation and exposing it to the user thereby creating several versions developed based on users’ feedback.

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# **CHAPTER ONE****: INTRODUCTION**

## **Background**

Nickjoy building and construction company is a private construction company that is registered under the company’s act and its staff are registered with the engineering board

Nickjoy building and construction company deals on construction of various house plans which include bungalows, Victorian style, and prairie style just to mention a few

This company has been using manual system to estimate the cost of building houses for its clients throughout the country which have led to exaggeration of cost of buildings and theft of some of building materials by the company staff

## **Problem Definition**

Nickjoy building and Construction Company in its delivery of its core mandate that is building of houses for its clients encounters some challenges in estimating the cost of the clients house/building. In the cost estimation the contractor has to take the design of the house and its dimensions and then comes up with the bill of quantity in order to estimate the materials and cost of the building

This manual estimation of building cost is tedious and also has negative implication to the owners of the building because some contractors can exaggerate the cost of building thus leading to raise of building cost

Also some staff of the company may steal some of the building materials and sell them thus leading to building of substandard houses and hence tainting the image of the building company and this may also lead to cancellation of the license of the company by the government

## **Proposed Solution**

The researcher decided to develop a web system that will help to solve the aforementioned problems

The research has covered the foundation of the building, the wall, the lintel and the roof. The user therefore will enter the dimensions of the stated parts of the house above in their respective tables in the database and be able to calculate the bill of quantity that is the cost of the material and the quantity of the material to be used for the entire plan. This will help the building company and owner of the house to know exactly the cost of the house prior to the implementation.

This project has singled out on One storey building only.

It also challenges the constructors to learn and understand the details of the Storey house and exact materials to be used in construction and building so as to help them have the proper mastering of the concept of the Storey house architecture.

## **1.4 Objectives**

### **1.4.1 Main Objective**

To implement efficiency in house building cost estimation web system

To come up with a web application system that will help nickjoy building and construction company to analyze the architecture of the Storey house and estimate the building cost

### **1.4.2 Specific Objectives**

1. To design a house building cost estimation system
2. To improve efficiency in building cost estimation
3. To conduct analyses of the architecture of one storey house
4. To compute bill of quantity.
5. To document the project

## **1.5 Research Questions/Hypothesis**

1. Which are the steps to be implemented to build house cost estimation web system?
2. How does the house cost estimation system work?
3. How will the architecture/structural design for the building analyzed?
4. How will the bill of quantity computed?
5. Which method will be used to document the project?

## **1.6 Justification**

The system will help Nickjoy building and construction company and its clients to save the resources as they will be able to know the exact quantity of materials required for the building and construction activity as opposed to the manual system where the amount of materials and the cost of the materials are exaggerated leading to high cost of building.

The web application is able to carry out analysis faster and easier and compute the cost of the building as compared to the current manual system which takes a lot of time and also is cumbersome.

It also challenges the constructors to learn and understand the details of the Storey house and exact materials to be used in construction and building so as to help them have the proper mastering of the concept of the Storey house architecture.

## **1.7 Research and System Methodologies**

### **1.7.1 Incremental Methodology**

The system uses incremental methodology which is based on developing an initial implementation, which is exposed to the user and several versions created or developed based on user’s response

The incremental methodology has the following advantages:

1. Customer’s feedback on the development work can be achieved easily. Customers can comment on demonstrations of the software and see how much have been implemented. Customers find it difficult to judge progress from software design documents.
2. Delivery is more rapid and useful software can possibly be deployed to the customer, even without including all the functionalities. Customers can also use software earlier enough and gain value from the same software earlier than when waterfall model is used.

iii.The cost of changing customers’ requirements analysis and documentation is less

Build 1

Design and development

**Implementation**

Erosion

**Testing**

Erosion

Build 2

Design and development

**Implementation**

Version

**Testing**

Build N

Implementation

Version

Testing

Design and development5

Figure 2:Incremental model

## **1.8 Scope**

The study focused on development of house building cost estimation web system that will be used by Nickjoy building and construction company in estimating cost of buildings for their clients

The system will bring efficiency in estimating the cost of building and it will eliminate exaggeration of building cost that was brought through the use of manual system

The system will cover estimation of cost of one storey building but it will not cover other designs as the developer is a student, and the project might go beyond his capability in terms of both time and finances

# 

# **CHAPTER TWO****: LITERATURE REVIEW**

## **2.1 Introduction**

House construction in Kenya is among the major practice that highly contributes not only to economic growth through landlordism and tenancy but also in providing shelter as the basic life need for the republic. Through various forum, the Kenyan government has primarily made a lot of effort in encouraging people, professionals such as non-squatters or any other capable parties/individuals to have desires for a transformation in the traditional practices and history of houses architectures in the state to bring up a situation where the economy gets compressed positively for development of the nation (The Government of Kenya, 2018).

IT experts have thus taken a step to modernize the building and construction sectors in Kenya. This has been done through the development of software systems for various platforms ranging from desktop applications, website services and Android applications. These have been used to implement computerization for various practices in building and construction; knowledge systems to educate architects and expert systems to provide advice for both architects and employers (Julia & Adrian, 2017).

## **2.2 Theoretical Review**

Majority of house owners in Kenya as a country have majored into development of these storey house architectures both for the shelter as their homes and for commercial purpose through renting. Their colleagues in other developed countries do the same house architecture development projects not just as a mere traditional practice but rather as a professional area deserving sufficient attention both by provision of professionally trained labor but also investing in research for improving every aspect of the work. This project therefore addresses the gap between these two groups of house designers doing the same activity but rather in different dimensions. Several designs have been proposed as shown below:

## **2.2.1 Similar Systems in Existence.**

Various applications have been developed to provide a digital approach to house plan and construction practices and techniques in the recent past. These include the following discussed systems.

### **2.2.2 FINALCAD App**

Is a mobile application that offers portable building software and prediction of analysis which helps building and construction investors forestall and rectify problems or issues likely to be found in the process of construction (Latif , 2019). It aims at increasing superiority and reducing the price while making it accessible to all individuals. From 2011, FINALCAD has been in a position to help many projects, and has been advancing the ordinal evolution of the building and construction sectors.

The application therefore focuses on bringing together the constructors of the sites (buildings) for marketing and advertisements of the finished house architectures. The system has achieved its intended purpose to some extent. The application has been developed using Java for the Android platform (it’s therefore an android application). The connection is made possible by use of mobile network technologies; wireless fidelity (Wi-Fi) and virtual private networks.

However, this application does not consider a way to address to the employers the amount of the building and construction assets needed to come up with the intended house plan architecture. There is a need to equip the employers of means to calculate and come up with the specific approximation of quantities of the materials required in the building and construction process so that the employers can achieve better utilization of resources to minimize wastage. These are major gaps that I have noticed which are supposed to be addressed in which the proposed system addressed them.

### **2.2.3 Zoho Creator**

Is an application that is aimed to deliver quality project to the client and within the budget. In addition, it also turns easily a profit for the stakeholders. It can be used to manage all the stages of construction projects. It achieves the drag and drop mechanism that helps an addition of the new features even after the apps have been launched (Shabdar, 2017). It can easily be customized for the web Android and iPhone and iPad as well.

(kumar , et al., 2018)The pricing for Zoho Creatorbegins from as low as $10.00 on a monthly basis per each user and in addition, the Zoho versions available offers freetrials.

The application has well served in building and construction thus, I believe if we extend the application to bridge the remaining gap of analysis of building and construction process will help employers in all the building and construction sectors in the country in diversity, in such a way that everyone will be at a position to consume the knowledge that this nice application has provided.

### **2.2.4 Autocad Mobile**

Is an application that is used in drawing and designing which enables us to observe, produce, edit, and share drawings on mobile devices (Modlo & Semerikov, 2019) . It’s an extension that fits to the AutoCAD desktop and enables you to share the building plans across multiple programs in the DWG format. Using this app, helps you forget to bring drawings to the site because it can be used instead of adjusting measurements.

This app has an ability to access drawings from the mobile device either in the field or outside an office. It also supports multiple layers so that more details and contextual information can be observed compared to when paper drawings are used. It sets your location and the entire walk inside the drawing as well as updating drawings with coworkers and clients.

### **2.2.5 Archi Snapper**

(Konomi, et al., 2019)This is a simple app that helps you to come up with reports that have photos, annotations, observations, and locations on the floor designs. The reports and to-do lists are available from the cloud account (on your desktop) after synchronizing to aid further proofreading and supply. This app when used it aids in overcoming struggle that are present while working with Word or Microsoft Excel to make field reports hence saving on time. It has features like Collection of data, making sketches on photos, assigning items, and marking up blueprints on-site as well as formatting the layouts of the PDF reports.

### **2.2.6 Magic Plan App**

(Froehlich, et al., 2017)This is an app that is mainly used for scanning the room and it uses input from either the smartphone or tablet to design complete floor plans. It has an augmented reality which is a technology that helps this app enable the user to create the floor plan in seconds. This app is able to turn the corners of the room into measurements and can be fine-tuned in the 2D overview. It can as well scan the multiple rooms so as to complete floor plans of the whole buildings and it can even add furniture. It is a wonderful app but it requires a lot of time to familiarize with it. Once the user is familiar with it, it’s an awesome tool.

The below picture shows how it works by showing the position of the door, the corners and the wall.

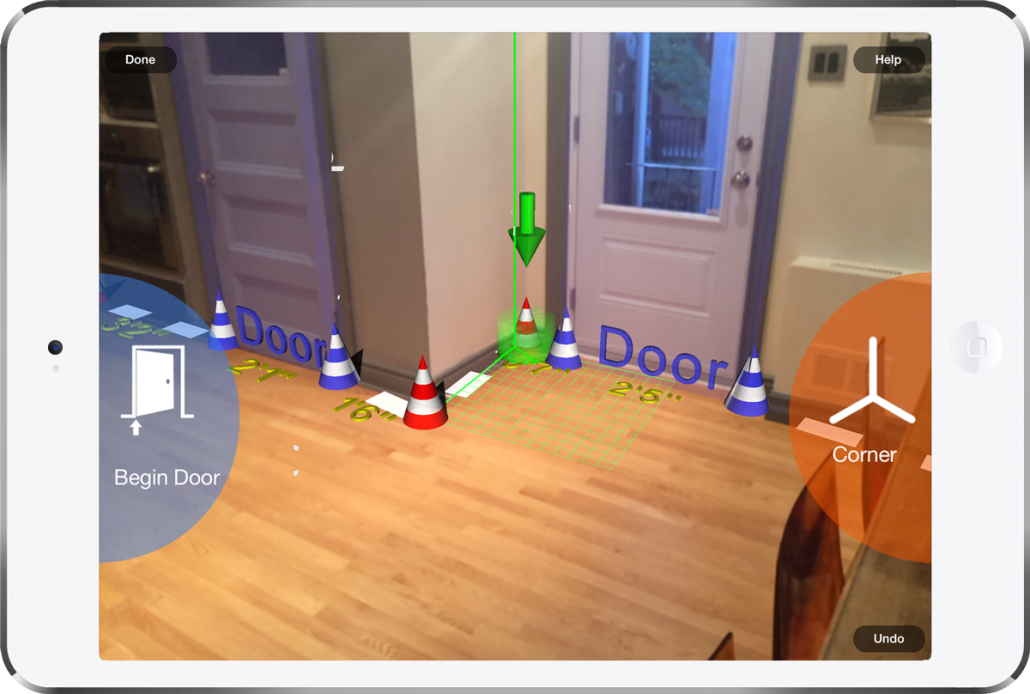
[](https://blog.archisnapper.com/wp-content/uploads/magic-plan-ipadair_mockup_1-1030x694.png)

Figure 3:Magic Plan App

### **2.2.7 Morpholio Trace**

(Maider, et al., 2018)This is a wonderful sketching application for the house contractors and it is used with an iPad and Apple Pencil. It allows users to draw on top of imported images instantly, or background templates, layering ideas to come up with the immediate sketches that are easily circulated based on the reviews, it is an app that is mostly loved by the users.

### **2.2.8 Tsheets**

This application allows you to perform the tasks using the mobile phone. It is a very simple and easy to use unlike other applications and it uses technology known as facial recognition to prevent buddy punching. In addition to this, it has got a wall-mounted time clock application known as TSheets Kiosk which is ideal for job sites as well. It has the capacity to add or attach photos to timesheets.

### **2.2.9 Shapr3d**

This is a 3D CAD application that runs on the iPad and also the Apple Pencil (Fischer & Al-Janabi, 2019). It helps constructors to design sketches in a quicker and easier way before converting them into 3D shapes. This amazing app can also be used in conjunction with other CAD soft wares. It was made for the purpose of solid modeling in a precise way and it runs on the similar engine as most of the desktop CADs, Para-solid. It can also be used to come up with the 3D sketches in a faster way than when the traditional 3D CAD is used. The features are as follows: It loads models like STEP, XT, SHAPR, and IGES and begins importing images as a reference or handling these models. It draws the sketches in a much quicker way, and makes their definition well done with the constraint tools that are very powerful.

## **2.3 Critiques**

### **2.3.1 Tsheets**

This application is amazing because of its simplicity nature to be used; however, it does not employ the technology whereby the employer can log in and analyze the design or architecture to calculate the total cost of the material to be used. The developed system will be filing this gap.

### **2.3.2 Morpholio Trace**

It only makes use of the imported images hence not able to do the analysis of the house to determine the aggregate material as this system does.

### **2.3.3 Magic Plan App**

One limitation that this app has is that it requires some level of expertise in its usage hence making it difficult for many people to use it. The developed system bridges this gap as it does not need user experience. There is also lack of ability to analyze the proposed house architecture making it difficult for an employee to calculate the average cost of the material for the entire building architecture bridging this gap. The developed system solved this.

### **2.3.4 Archi Snapper**

It lacks the mechanism to ensure trustworthy amongst the employees as well as lacking mechanism to calculate aggregate materials required for the complete house layout the features that this developed system included.

### **2.3.5 Autocad Mobile**

Despite all these amazing features, it lacks the technology whereby the employers can analyze the construction material. Therefore, it is not easy to measure the trust amongst the constructors. The developed system helped solved this issue.

## **2.4 Summary**

Being centered on the earlier survey of the existing system there exist a place that has not yet been explored, which this developed system tries to address. The system gap opens to everyone and not a category of people. Satisfying the gaps like that of trustworthiness and usability, which have not yet been solved by some of the systems mentioned above.

# **CHAPTER THREE: SYSTEM ANALYSIS AND DESIGN**

## **3.1 Introduction**

This chapter focuses on the system methodology used, the research methodologies, system specifications as well as the logical and physical design of the system. The methodologies used ensured that the project objective was met accomplishing an interactive web system for Nickjoy building and construction company in terms of estimating the cost of houses for their clients.

## **3.2 Development Approach**

A software development methodology in software engineering is a framework that is used to structure, plan, and control the process of developing an information system.

### **3.2.1 Incremental Methodology**

The system is developed as a series of versions (increments) with each version adding functionalities to the previous one.

Incremental model is based on developing an initial implementation, which is exposed to the user and several versions created or developed based on user’s response. Specification, development, and validation activities are enclosed rather than separate, with rapid feedback across activities. Each increment or version of the system includes some of the functionalities that are needed by the user. The early stages increments of the system contain the most urgently required functionality meaning that the customer can evaluate the system at a relatively early stage in the development to see if it delivers what is required. If not, then only the current increment must be changed and, new functionality outlined for later increments. (Alshamrani & Bahattab, 2015)

## **3.3 Feasibility Study**

Projects can be feasible if the resources were unlimited and time was infinite. Unfortunately, the development of the student house building cost estimation web system was faced by scarcity of resources and development time.

The study was carried out in three sections;

### **3.3.1. Technical Feasibility**

Nickjoy building and construction company requires a computerized system to aid in cost estimation of houses as they engage in their construction work in kenya. The organization have installed the developed web system in their computers and laptops and it’s only one more computer that was bought. Secondly, the software required for proper running of the software was identified (XAMPP and visual studio code) and was installed in the organization’s computers. It is therefore easy to run the system.

### **3.3.2. Economic Feasibility**

Cost/benefit analysis was carried out and the operational costs of the proposed system obtained as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Description | QTY | Amount (Kshs) |
| 1 | Computer (Intel(R)Core i5 (TM)@2.30 GHZ, 4GB RAM, 1TB HDD) | 1 | 40,500 |
| 2 | Flash disk | 1 | 800 |
| 3 | Windows 10 operating system |  | 10000 |
| 4 | Microsoft office 2019 |  | 1000 |
| 7 | Hp desk Jet printer | 1 | 4000 |
| 8 | Internet fee |  | 1000 |
| 9 | Stationeries |  | 1000 |
| 12 | Miscellaneous |  | 1000 |
| 13 | Labor | 2 | 30000 |
|  | Total |  | 89,300 |

Table 2:Budget for the new system

## 

|  |  |  |
| --- | --- | --- |
| Item | Description | Amount (Kshs) |
| 1 | Labor | 90000 |
| 2 | Materials used | 20000 |
| 3 | Miscellaneous | 10000 |
|  | Total | 120000 |

Table 3:Budget for the current system

#### Costs:

The new computerized system developed reduced the costs of operation. This was mainly through reducing paperwork for example the money used in purchasing record books, writing materials as well as ink was reduced. The estimated operational cost projected for the next five years was less than if the old manual system was to be used.

### Cost Benefit Analysis

**Benefit Analysis:** Is obtained through comparison of the new system and the existing system.

There was a lot of savings obtained due to introduction of computerized system. The development of the new system is thus beneficial and will greatly cut the costs of process.

### **3.3.3. Operational Feasibility**

1. The group required to operate the system, have the required skills to operate the system.
2. No reorganization of the organization will be required to accommodate the proposed system.
3. It reduces the time taken to carry out all operations.

### 

### Benefits of the new system.

The system has the following merits:

1. Saves time during data entry and estimation of the cost for a building.
2. Reduces paperwork which is costly and tedious.
3. Accuracy is ensured during cost estimation of the house.
4. Has a user-friendly interface.
5. Uses passwords making it secure.

## **3.4 Requirement Elicitation**

## Data collection procedures

The data used in this approach came from both primary and secondary sources.

### **3.4.1 Primary Sources**

The primary data that was collected for this approach provided an opportunity to inspect the related opinion to the data partaking in the real estate area. Three methods were used to obtain the information. The methods were observations, interviews and questionnaires. Interviews were considered to be useful in situations where respondents did not have enough time and patience to fill the questionnaires. The observation was used largely in places where the interviews and questionnaires methodologies failed to provide results.

### **3.4.2 Secondary Sources**

Secondary data were gathered in the course of the study which contained the collected as well as the analyzed past data from both printed and unprinted resources that were utilized to indicate the existence of an event from previous times and offer support to the data from primary sources. Secondary sources contained former hypotheses newspapers, journals, books, periodicals and government and local government publications.

### **3.4.3 Data Collection Instruments**

### **3.4.4 Interviews**

Interviews were conducted to obtain comprehensive facts about matters that were either too complex or delicate to include in the questionnaires. Engineers and architectures were interviewed on how the bill of quantity is being done using the current system and the challenges encountered while using the current system.

### **3.4.****5 Observation**

Observation is a simple method that allows the researcher to physically observe information that cannot be covered in the interview session or others. The researcher observed the staff of Nickjoy building and construction company as they executed their duties and he got the required data.

### **3.4.6** **Questionnaires**

Published questions were given to the respondents/staff of the company to be answered in either yes or no format. The respondents who in this case were the architects and quantity surveyors and engineers provided the necessary guidance by providing the best information which helped the project achieve the goal.

## **3.5 Data and System Analysis**

Data analysis is the process of examining, cleaning, converting and displaying data with the aim of determining valuable information, to make conclusions and to support decision-making. Upon collection of data, it is checked if it is complete and made ready for analysis. The data from the field is coded in accordance to the subjects under study.

|  |  |  |  |
| --- | --- | --- | --- |
| Staff Category | Approximate Time taken to analyses materials required (Hours) | Approximate Time taken to estimate cost of the building (Hours) | Total |
| A | 24 | 20 | 44 |
| B | 22 | 18 | 40 |
| C | 25 | 22 | 47 |

Table 4:Time taken to estimate cost of a house

The table above clearly shows that the staff who are mandated with the task of analyzing the materials required to construct the house and estimating the cost of the building are taking a lot of time because the process is tedious when done manually

## **3.6 System Specification**

After analysis of the collected data, the following system specifications were realized.

### System administrator requirements

1. An effective way to view all users
2. An effective way to manage users accounts
3. An easier way to manage house materials
4. An effective way to manage house costs

### Users requirements

1. An efficient way to create a new account
2. An effective way to analyze the house
3. An easier way to view the cost

### Functional Requirement.

The new system should be able :

1. To Create a log in account
2. To enter the dimensions of the building
3. To analyze the quantity of the material required based on the dimensions entered
4. To compute bill of quantity.
5. To show the place where the materials can be purchased at an affordable price

### Non-functional Requirement

1. The system should be simple and easy to learn
2. The system should allow upgradability as per the organization needs
3. The system should improve performance in estimating the house building cost and authenticating authorized users

### **3.6.1 Software Requirement**

a) Windows operating System – The platform on which the system will execute on.

b) Microsoft Office suite 2019 – For report writing.

c) Laravel a PHP framework for coding.

d) Networking component such as modem for the internet connection.

## **3.6.2 Hardware Requirement**

1. Pentium IV processor 2.1GHz or more.
2. 160 GB Hard disks or more.
3. 2GB RAM or more.
4. CD-ROM / USB drive.
5. 15” color monitors low power consumption.

## Others

1. Internet fee
2. Stationery –writing materials to be used in writing rough copy of proposal and report

## **3.7 Summary**

The chapter describes the development methodology that was used to develop performance review system. It discussed the overall research approach for the study and presented the research design that was deemed appropriate to address the research questions for the study. The topics covered in this chapter include: development approach, data collection procedures, data collection instrument, data analysis and development project requirements.

## **3.8 System Design**

This section provides both physical and logical designs of the system

### **3.8.1 Logical Design**

The main function of the new system is to assist in automating the estimation of house building cost

The system flowchart below illustrates how the new system works

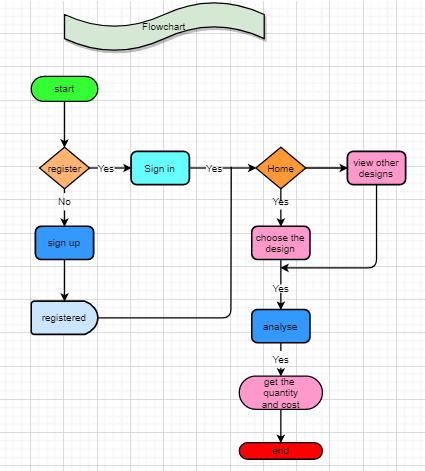


Figure 4:Flowchart

The figure above shows how the new system will operate. When the user attempts to login in to the system, the system will verify whether the user is registered, if the user isn’t registered, he/she will first be required to sign up using a valid email address and a password

In case one is a registered user, the person can login to the system using an email and password, choose the design, carry out analysis of the building and then get the estimated cost of the building

## **3.9 Physical Design**

### **3.9.1 Database Design**

The system database will contain the following tables:

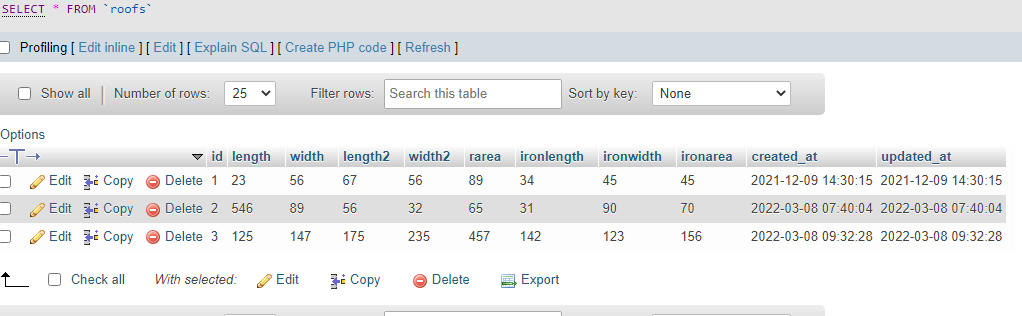


Table 5:Roof table

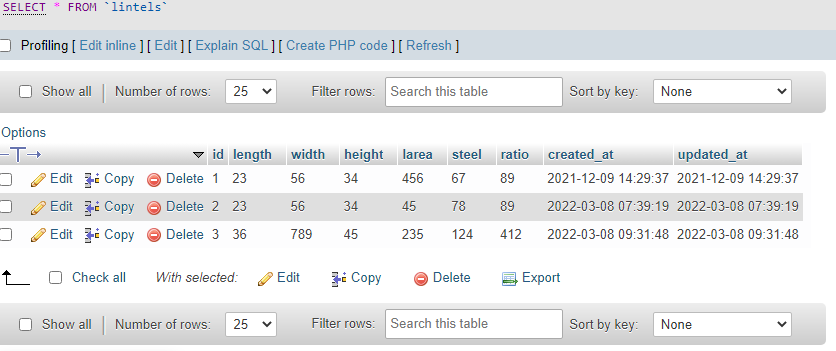


Table 6:Lintel table

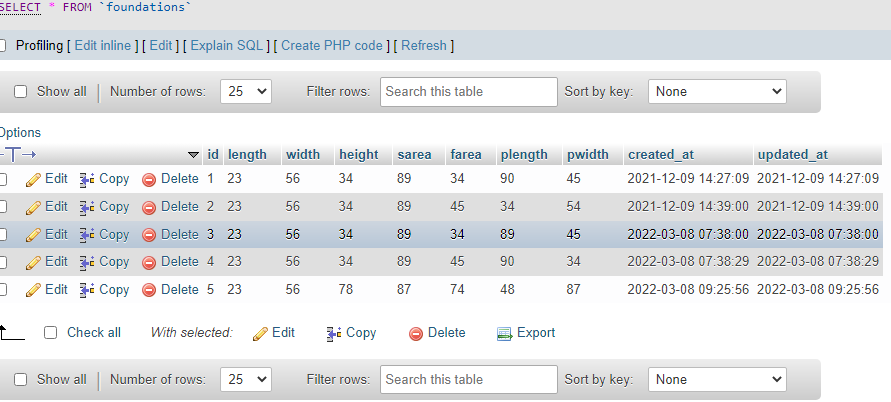


Table 7:Foundation table

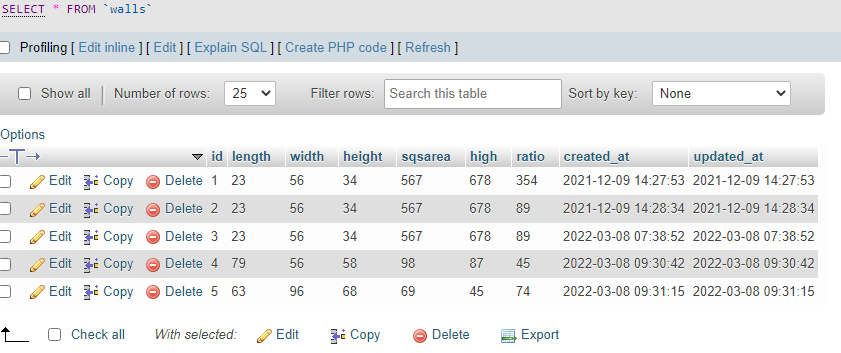


Table 8:Walls table

### **3.9.2 System Architecture**

### Conceptual Database schema

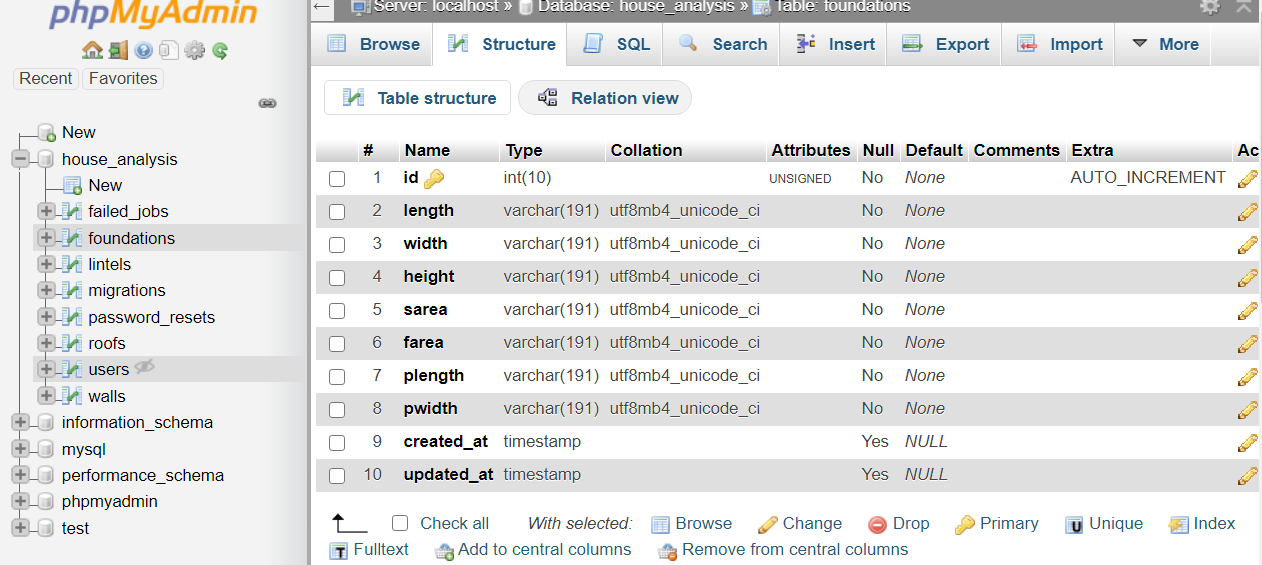


Table 9:Conceptual Database schema

### **3.9.3 User Interface Design**

User interface design (UI), also known as user interface engineering, is the design of user interfaces for machines and software, such as computers, appliances for home, mobile devices, and other electronic devices, with the focus on increasing the user experience. User Interface (UI) Design focuses on forestalling what users might need to do thereby ensuring that the interface has elements that are easy to access, understand, and use to facilitate those actions. UI makes concepts from interaction design come together, visual design and information architecture. The user interface design type here was graphical user. The register, login allows the user to access the system with full rights.

The register interface enables the user to register into the system with their name, email address and password as well as the password confirmation. The register details are then submitted to the user table of the database to enable the user to effectively login to the system using the login interface as shown.

|  |  |
| --- | --- |
| Figure 5:Register user interface | Figure 6:Login user interface |

|  |  |
| --- | --- |
| Figure 7:House selection interface | Figure 8:Foundation interface |
|  |  |

## **3.10 Requirement Analysis**

Requirement analysis defined the needs of customer and objectives in the context of planned customer use, environments and identified system attributes to ensure determination of requirements for the proper functioning of the system.

### **3.10.1 User Requirements**

It contained user involvement and reports of facts and assumptions that explain the expectations of the system in regard to objectives, constraints, environment, mission and measures of suitability and effectiveness. Essentially, the users are interested in:

1. A system that is flexible, safe and convenient
2. A system that is easy to learn and use.
3. A system that improves on the efficiency of information storage and retrieval.
4. A system that is fast in processing transactions

### **3.10.2 Functional Requirements**

It is an essential task or action that was accomplished. The proposed system can do the following:

1. Allow user to create an account and login to the system.
2. Allow the user choose the storey house design to analyze.
3. Prompt users to enter the dimensions of the foundation, wall, lintel and the roof of the storey house.
4. Allow users to post the dimensions of the foundation, wall, lintel and the roof to their respective databases.
5. Calculate the quantity of the materials and the cost and returns required materials and the total cost plus the places where the users can purchase the materials at the fair price.

### **3.10.3 Hardware Requirements**

1. Processor 2.0 GHz processor speed.
2. Memory 4GB RAM.
3. Visual Display Unit 800\*600 colors.

### **3.10.4 Software Requirements**

1. Operating System- windows 10.
2. Microsoft Office Power point- Used during presentation.
3. Laravel a PHP framework for coding.

## **3.11 Suggested Minimum Requirements**

Diagramming tools are used to help users of the system understand the flow of data for all operations carried out.

## Use Case diagrams

Below is the general use case that shows the system users and their assigned privileges. The administrator can execute every process in the system; while a standard user is only limited to a few roles as shown.

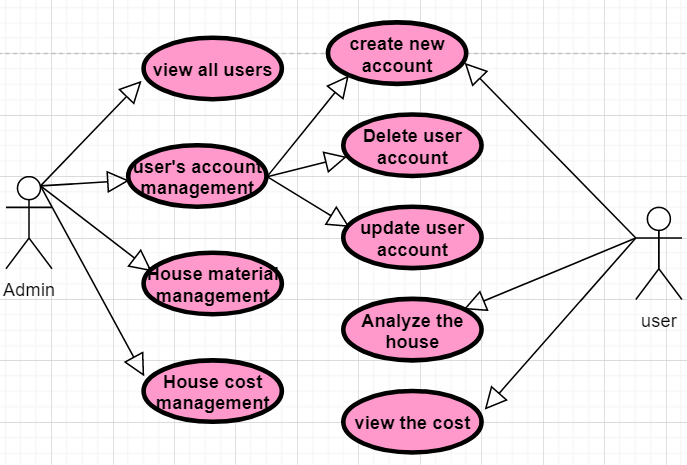


Figure 9:Use case diagram

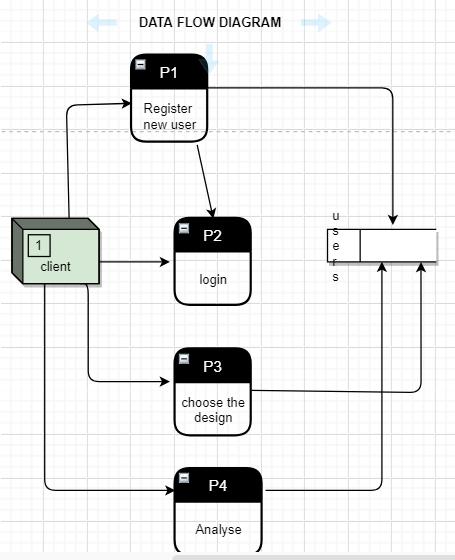


Figure 10:DFD

# **CHAPTER 4: IMPLEMENTATION AND TESTING**

## **4.1 Introduction**

This chapter describes how the system requirements formulated during analysis were translated into a functional system

## **4.2 Implementation**

During system development the following tools were used;

### **4.2.1 Laravel, HTML and CSS**

Backend modules i.e. database panel and users’ panel was developed using Laravel a php framework. Frontend is developed using HTML and CSS. The following are some of the specific tools used for coding the system.

### **4.2.2 Composer**

Composer is a tool for dependency management in PHP. It allows you to declare the libraries your project depends on and it will manage (install/update) them for you.

### **4.2.3 Visual Studio Code**

Visual Studio Code is an editor for PHP development. It provides features like syntax highlighting and bracket matching, IntelliSense (code completion), and snippets out of the box and you can add more functionality through community-created VS Code extensions.

### **4.2.4 Xammp**

XAMPP is a cross-platform web servers, it helps developers to create and test their programs on a local webserver

With the help of the above tools, different components were integrated to create a fully functional system.

## **4.3 System Code Generation**

This section shows a sample code that have been used to implement several elements of house building cost estimation web system

Partial welcome code

<html>

    <head>

    <title>LET US GO HOUSE</title>

    <link rel="stylesheet" href="style.css">

    <link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css">

    <link href="https://fonts.googleapis.com/css?family=poppins" rel="stylesheet">

    <link rel="stylesheet" href=https://stackpath.bootstrapcdn.com/font-awesome/4.7.0/css/font-awesome.min.css>

    <script src="https://code.jquery.com/jquery-3.3.1.slim.min.js"></script>

    <script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.14.7/umd/popper.min.js"></script>

    <script src="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/js/bootstrap.min.js"></script>

    <link href="https://fonts.googleapis.com/css?family=Lato&display=swap" rel="stylesheet">

    <style type="text/css">

    .navbar-brand img

    {

    height: 50px;

    padding left: 30px;

    }

    h

    {

    padding-left: 110px;

    font-size: 25px;

    font-family: cursive;

    font-weight: 1000;

    }

    #nav-bar

    {

    position: sticky;

    top: 0;

    z-index: 20;

    font-family: monospace;

    background-color:white;

    }

    #footer {

    height: 50px;

    background-color: black;

    }

    .nav-link::after{

    content: '';

    display: block;

    width: 0;

    height: 2px;

    background: #fff;

    transition: width .2s;

    }

    .nav-link:hover::after{

    width: 100%;

    transition: width .2s;

    }

    .navbar-nav li

    {

    padding: 0 10px;

    display:inline-block;

    }

    .nav-link

    {

    color: black!important;

    font-size: 16px;

    font-family: 'Lato', sans-serif;

    font-weight: 700;

    }

Partial Home Code

@extends('layouts.app')

@section('content')

<div> </li>

  <li class="nav-item" style="color: magenta;text-decoration:none;text-align:left; border-radius: 5px;background-color: orange">

  <li class="nav-item" style="color: magenta;text-decoration:none;text-align:left; border-radius: 10px;background-color: green">

  </div>

<div class="container">

    <div class="row justify-content-center">

        </div>

        <div class="col-md-10">

            <div class="card">

                <div class="card-header" style=" text-align:center;font-family:algerian;">welcome <span style="color:red;"> {{ Auth::user()->name }}!</span> click on the house architecture you want to analyze bellow</div>

                <div class="card-body">

                    @if (session('status'))

                        <div class="alert alert-success" role="alert">

                            {{ session('status') }}

                        </div>

                    @endif

                    <h2 style="color: magenta;text-decoration:none;text-align:center; border-radius: 20px;background-color: #8a0f0f">KARIBU SANA</h2>

                        <head>

                            <meta name="viewport" content="width=device-width, initial-scale=1.0">

                            <style>

                            \* {

                              box-sizing: border-box;

                            }

                            body {

                              margin: 0;

                              font-family: Arial, Helvetica, sans-serif;

                            }

                            .header {

                              text-align: center;

                              padding: 32px;

                            }

                            .row {

                              display: -ms-flexbox; /\* IE 10 \*/

                              display: flex;

                              -ms-flex-wrap: wrap; /\* IE 10 \*/

                              flex-wrap: wrap;

                              padding: 0 4px;

                            }

Partial Login code

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml">

<head id="Head1"><title>

MERU University: Login

</title><link href="Content/bootstrap.min.css" rel="stylesheet" /><link href="Content/bootstrap.css" rel="stylesheet" /><link href="Content/bootstrap-theme.css" rel="stylesheet" /><link href="Content/font-awesome.css" rel="stylesheet" />

<Style type="text/css">

html,body{

height: 100%

}

</Style>

<link rel="shortcut icon" href="App\_Images/app.ico" />

</head>

<body>

<form method="post" action="./Default.aspx" id="Form1">

<div class="aspNetHidden">

<input type="hidden" name="\_\_LASTFOCUS" id="\_\_LASTFOCUS" value="" />

<input type="hidden" name="\_\_VIEWSTATE" id="\_\_VIEWSTATE" value="/wEPDwUJMjk0MTIzMzk2ZGSiC8nuDQs7J+gjO6CFaFelGWUYP23PsMw4+m/x1V5P0Q==" />

</div>

<script type="text/javascript">

//<![CDATA[

var theForm = document.forms['Form1'];

if (!theForm) {

theForm = document.Form1;

}

function \_\_doPostBack(eventTarget, eventArgument) {

if (!theForm.onsubmit || (theForm.onsubmit() != false)) {

theForm.\_\_EVENTTARGET.value = eventTarget;

theForm.\_\_EVENTARGUMENT.value = eventArgument;

theForm.submit();

}

}

//]]>

</script>

<script src="/WebResource.axd?d=8fqErm9j\_zfSy3ikLMoqTmIA98d-rLhlV-iNyARjfWLdOyBld2toYXYTe9pDjg4yEA1Ud9Ms3nHkqXtML75v3\_vOAS-PMWqRHh8p37U5IUM1&amp;t=637100914445053551" type="text/javascript"></script>

<script src="/WebResource.axd?d=vQ3ZwsAvsAMRx-fsN\_apuxwpwArRPy4QoDfmCorTTdwoAS5Ke5K6pNIyaH0UJPXcDydQL0ecTuJoLjIarsCHBrZkoKovZcaMqnUDn3AQXUM1&amp;t=637100914445053551" type="text/javascript"></script>

<div class="aspNetHidden">

<input type="hidden" name="\_\_VIEWSTATEGENERATOR" id="\_\_VIEWSTATEGENERATOR" value="CA0B0334" />

<input type="hidden" name="\_\_EVENTTARGET" id="\_\_EVENTTARGET" value="" />

<input type="hidden" name="\_\_EVENTARGUMENT" id="\_\_EVENTARGUMENT" value="" />

<input type="hidden" name="\_\_EVENTVALIDATION" id="\_\_EVENTVALIDATION" value="/wEdAAVjrVCmI4uiv+K1P6ZoqJExwocmOXm74xStVph5IU2fp/5t6U+/r0b2hLwxd2HhT+zM+1/ZHDRbvJtZiB27/+/n4omRnkGka8bJujh3dpYqu7UD0+T9Dbb3GT3DgPbTTrJaaPPZEtgPrGPdpZkLJ1hr" />

</div>

<div class="container">

<div class="row" style="height: 100px;"></div>

<div class="row">

<div class="col-md-4"></div>

<div class="col-md-4">

<div class="row">

<div class="col-md-3"></div>

<div class="col-md-6"> <img src="App\_Images/logo.png" /></div>

<div class="col-md-3"></div>

Partial wall code

@extends('layouts.app')

@section('content')

<div class="container">

    <div class="row justify-content-center">

        <div class="col-md-12">

            <table class="table table-dark">

                <thead>

                    <tr>

                    <th scope="col">ID</th>

                    <th scope="col">Length</th>

                    <th scope="col">Width</th>

                    <th scope="col">Height</th>

                    <th scope="col">area of stone</th>

                    <th scope="col">height of stone</th>

                    <th scope="col">sand cement and ballast ratio</th>

                    <th scope="row">Total</th>

                    <th scope="row">wall Cost</th>

                    </tr>

                </thead>

                <tbody>

                    @foreach($walls as $wall)

                        <tr>

                        <th scope="row">{{$wall->id}}</th>

                        <td>{{$wall->length}}</td>

                        <td>{{$wall->width}}</td>

                        <td>{{$wall->height}}</td>

                        <td>{{$wall->sqsarea}}</td>

                        <td>{{$wall->high}}</td>

                        <td>{{$wall->ratio}}</td>

                        <td>{{$wall->length +$wall->width + $wall->height  + $wall->sqsarea + $wall->high + $wall->ratio}}m</td>

                        <td>ksh{{(($wall->length \* $wall->width\* $wall->height)/$wall->sqsarea \*$wall->high)\*50}}</td>

                        </tr>

                    @endforeach

                </tbody>

            </table>

        </div>

    </div>

</div>

## **4.4 System Testing**

Testing is a process that was extensively done to ensure that the system met most of the specified requirements. The process of testing began immediately when the system development process started. A number of testing types were done and they included unit testing, integration testing and system testing. Unit testing was carried on every module completed to ensure that it performed as required. Whenever, two or more modules were integrated, integration testing was then performed to ensure that the involved modules communicated and performed as per the expectations. The final type of testing done was system testing in which, the fully integrated system was evaluated based on the expectations. It is in this testing that validation was done through supplying the system with both valid and invalid data and observations were made. Detected errors were rectified

## .

## **4.4.1 Testing Cases and Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test caseNumber**  **D** | **Task** | **Expected result** | **Actual result** | **Status** |
| **case 1** | Login= (blank)  Password=  (blank) | A window “please fill out this field” must be shown to the  user and access isnt granted  granted. | A window“please fill out this field” is shown to the user  and access is not granted. | **Pass** |
| **case 2** | Username= Incorrect  Password=correct | A window“credentials don’t match our record” must be  shown to the user and   access must not be granted | A window“credentialdon’t match our record”is showns to the user and access is not  granted. | **Pass** |
| **case 3** | Username= Correct  Password=Incorrect | A window“credentials don’t match our record” mustbe shown to the user and access is  denied. | A window  “credentials don’t match our record ” is  shown to the user  and access is denied | **Pass** |
| **case 4** | Username= Correct  Password=Correct | Access must be  granted to the user  and main screen displayed | Access is granted  to the user and  main screen displayed | **Pass** |

Table 10:Testing the Login function

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Case Number** | **Task** | **Expected result** | **Actual Result** | **Status** |
| **Case1** | Admin register a new user | The system opens up after successful registration of a user” | The system opens up after successful registration of a user | **Pass** |
| **Case 2** | Admin viewing the registered users report | The system generates registered  Users report | The system generates registered  users report | **Pass** |
| **Case 3** | Admin attempts to register a new user with an already used email | The system generates a message “The email has already been taken” | The system generates a message “The email has already been taken” | **Pass** |

Table 11:User registration Checks

**4.5** **Conclusion**

Despite the fact that a few challenges were experienced during the research and system development, the entire process proved interesting and beneficial. First, the research conducted under this study offered the researcher an understanding of how to evaluate the cost of a building and how house cost evaluation can be enhanced in a system. Secondly, the researcher got an opportunity to practice and explore different areas taught during his degree course. In particular, during the system development a lot of knowledge was gained in programming and database development, which left the researcher a more experienced individual.

## **Limitation**

All systems will always be exposed to one or more limitations spanning from data integrity, data security or high maintenance costs. The developed system will be faced by the following limitations

* The system cannot estimate the cost of doors, windows in its current state.
* One has to enter the dimensions of the house each at a time. ie. foundation, wall, lintel and roof. This process is tedious
* The system is applicable for cost estimation of one storey building and thus cannot be used to estimate cost of other types of buildings/houses

## **4.7 Recommendations**

A Well-developed software can take a number of years to be completed because it requires the software to go through series of research and tests. The researcher recommends for a further advancement in the development of the system where more features that can improve the house building cost estimation web system can be incorporated. For an effective deployment of the system, the developer also recommends that:

* Stakeholders in the company should be involved in the implementation of the software.
* Stakeholder should also make funds available to make implementation of the project possible.
* The system can be further developed to meet the limitations stated
* A more complex cost evaluation measure can be adopted for the system to meet the ever-changing technology.

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# **APPENDICES:**

## **Appendix 1: Sample Questionnaire for Nickjoy Company**

Introduction:

Ngahu Nicholas Kiragu has prepared this questionnaire for a research project. Kiragu is a final year student at Jomo Kenyatta university of Agriculture and Technology pursuing a Bachelor of Science in information Technology. The research project is to help the Nickjoy building and construction company management to estimate house building cost and document the estimated cost. Your feedback is important for the successful completion of this study. Kindly take some time and answer it by indication through ticking and giving detailed answers where possible.

**SECTION A: PERSONAL DETAILS**

1. Gender:

☐ Male

☐ Female

2. Building Experience in Years

☐ Below 2 ☐ 3-5 ☐ Above 5

3. Department:

* Overall engineer
* Quantity surveyor
* Architectural engineer
* Supervisor

**SECTION B: SYSTEM INFORMATION**

1. Do you evaluate house cost ☐ Yes ☐ No

2. If yes, which method do you use to evaluate the house building cost?

☐Drawing the house and from the dimensions i estimate the cost

☐ Estimate the cost from the dimensions given without drawing

Other\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. How many times do you evaluate house building cost in a week?

Once ☐

Twice ☐

More than twice☐

4. Is the method used to estimate house building cost accurate? ☐ Yes ☐ No

5. Would you like the current house building cost estimation method to be improved to use a web system? ☐ No ☐ Yes

6. What are the considerations when computing the house building cost? \_*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*\_

7. How do you rate your computer literacy skills?

☐ Poor

☐ Average

☐ Excellent

8. Should the proposed house building cost estimation system be adopted as a web application? ☐ Yes ☐ No

## **APPENDIX 2: Budget**

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Description | QTY | Amount (Kshs) |
| 1 | Computer (Intel(R)Core i5 (TM)@2.30 GHZ, 4GB RAM, 1TB HDD) | 1 | 40,500 |
| 2 | Flash disk | 1 | 800 |
| 3 | Windows 10 operating system |  | 10000 |
| 4 | Microsoft office 2019 |  | 1000 |
| 7 | Hp desk Jet printer | 1 | 4000 |
| 8 | Internet fee |  | 1000 |
| 9 | Stationeries |  | 1000 |
| 12 | Miscellaneous |  | 1000 |
|  | Total |  | 59,300 |

Table 12:Budget

## 

# **Appendix 5: Work Plan**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ACTIVITY** | **PERIODS IN WEEKS** | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **Proposal Writing** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Feasibility Study** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Fact Finding** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Requirement Specification** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Logical Design** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Physical Design** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **System Coding** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Testing** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Implementation** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Documentation** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Table 13:Gantt chart showing the Development of The System