

ASHESI UNIVERSITY COLLEGE

**KAYAYO, AN E-COMMERCE SITE WITH RECOMMENDATIONS
AND
TEXT MESSAGING**

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Applied Project

ASHESI UNIVERSITY COLLEGE

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AND
TEXT MESSAGING**

By

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Declaration

I hereby declare that this Applied Project Report is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:.....

Candidate's Name:.....

Date:.....

I hereby declare that the preparation and presentation of the Applied Project Report were supervised in accordance with the guidelines on supervision of Applied Projects laid down by Ashesi University College.

Supervisor's Signature:.....

Supervisor's Name:.....

Date:.....

Acknowledgement

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Abstract

E-commerce, as a means of transacting business, is increasingly providing Ghanaians abroad and at home with a new and more convenient way to do their shopping. Sites such as makola.com and myebayghana.com are providing retailers with a means to exhibit their products to enable them expand their reach. However, many e-commerce sites do not fully address the shopping needs of the average Ghanaian shopper, which are, a quick, easy, reliable and more contextual way to shop for products and have them delivered to their doorsteps. This project therefore proposes a convenient, intuitive and contextually relevant e-shopping system. The system uses recommendation algorithms and SMS messaging as a major means of interaction.

Table of Contents

Declaration	iii
Acknowledgement.....	iv
Abstract.....	v
1. Introduction.....	1
1.1. Problem	1
1.2. Objective.....	2
1.3. Motivation	2
1.4. Overview of Report.....	3
2. Previous Work.....	4
2.1. E-shopping Sites: A Comparative Study.....	4
2.2. The relevance and benefits of electronic commerce systems to today's consumer.....	5
2.3. E-commerce Sites and Recommender Systems.....	6
3. Requirements and Design	9
3.1. System Requirements Specification.....	9
3.1.1. Functional Requirements.....	9
3.1.2. Non-Functional Requirements	12
3.2. Design	13
3.2.1. System Design	13
3.2.2. Database Design.....	15
3.2.3. Interface Design	16
3.2.3.1. Using Twitter Bootstrap	17

3.2.3.2. Customers and Retailers	18
3.2.3.2.1. Guests and Registered Customers	
18	
3.2.3.2.2. Retailers	
21	
3.2.3.3. Administrators.....	22
4. Implementation.....	26
4.1. Tools and Approach	26
4.1.1. HTML5	26
4.1.2. JavaScript.....	26
4.1.3. PHP	27
4.1.4. CSS	27
4.1.6. Apache Server (XAMPP).....	27
4.1.7. FrontlineSMS.....	28
4.1.8. MytxtBox Pro (SMS Gateway)	28
4.2. Implementing Kayayo’s Collaborative Filtering Algorithm	28
4.3. Implementing Kayayo’s SMS Functionality	30
4.4. Implementing Kayayo’s Mobile Web	31
4.5. Testing	31
4.5.1. Component Testing	31
4.5.2. Requirement Testing	31
4.5.3. User Testing.....	32
5. Challenges, Conclusion and Further Work	33
5.1. Challenges.....	33

5.2. Conclusion.....	34
5.3. Further Work	35
Bibliography	36
6. Appendix.....	37
6.1. Appendix 1 – Pen Drawn Prototypes.....	37
6.2. Appendix 2 – Customer View Screenshots.....	40
6.3. Appendix 3 – Administrator View Screenshots	42
6.4. Appendix 4 – Retailer View Screenshots	43
6.5. Appendix 5 – Questionnaire	45
6.6. Appendix 6 – System, Documentation and Database Dump	47

1. Introduction

1.1. Problem

Shopping in Ghana's major markets has always been a tedious and almost impossible process for many working individuals who work from 8am to 5pm daily. Goods and services are often scattered across the market and therefore consumers are faced with the task of walking from stall to stall in search of the products they desire. Other possible inconveniences include falling prey to pickpockets and bag snatchers or buying from an unreliable source. Furthermore, there are travel time and cost overheads that come with shopping from the market centers. These are inconveniences a person on a busy schedule cannot afford.

A system is needed that will allow individuals on a busy schedule to search for, purchase and receive products conveniently and remotely at an affordable price. This system is what this project seeks to build. Popularly known as e-commerce or e-shopping systems, they are quickly becoming the conventional means for the exchange of goods and services. However, e-commerce sites that do not employ data mining or recommendation algorithms are as useful as visiting the major markets and often require that customers perform a search for products they desire.

1.2. Objective

This project's objective is to develop an interactive and intuitive e-commerce portal that would enable individuals on a busy schedule to shop and stay productive on the go. This would alter how Ghanaians shop from major markets such as Makola. Aside, the e-commerce site allowing consumers to shop will also employ data mining, recommender system techniques and will provide a text-messaging platform to ensure that consumers don't only shop but that consumers shop faster and more efficiently. Furthermore, a mobile web version of the system would be created to enable delivery personnel send SMS receipts and notify the system on completion of a delivery.

1.3. Motivation

This project's motivation emanates from the personal experiences of the author with regards to shopping from the major markets in Ghana. The frustration of walking around for minutes and sometimes hours in search of a product you may never find spurred the thought of an easier way of shopping from these major markets or retailers. This realization was even more evident with working folk such as bankers, lawyers, professors, individuals on a tight schedule who are unable to make time to pickup a few groceries or food items for the house. This spurred on the notion that bringing the market to the consumer, in the comfort of their office or home, would help ease the task of shopping. To carry out that task, the web was identified as a means to reach people from all backgrounds and at all places and thus was chosen as the platform suitable for building the solution.

For the target web application highlighted in the objective section, all a consumer needs is a computer with Internet access. For people who find shopping from the market center frustrating or are on a busy schedule and so do not have the time to shop, this system will do away with the inconveniences associated with major market shopping and will lead to a larger customer base for the retailers or market sellers.

1.4. Overview of Report

The paper begins in chapter 2 with a literature review of the advantages of e-commerce systems and how recommender systems are redefining shopping. Chapter 3 contains a detailed system requirements specification of the application. Also, it contains information pertaining to the database structure and user interface designs of the system. Chapter 4 describes the implementation, tools and recommendation algorithm used. It also covers the testing of the system. Chapter 5 contains information concerning the challenges faced, the conclusion and the way forward for the system.

2. Previous Work

2.1. E-shopping Sites: A Comparative Study

Today, one of the essential points in the design of e-commerce or e-shopping system is the definition of the user-system interaction. In most e-commerce systems, a higher level of user interaction is achieved by providing relevant product recommendation to users and by providing additional functionalities such as, coupons and deals. In Africa, very little attention has been paid to more interactive ways of e shopping such as recommender algorithms. SchoolChopBox.com and Makola.com, both noteworthy e-shopping sites in Ghana, do not use recommender systems and thus customers are burdened with the task of choosing from hundreds to thousands of products; a gap Kayayo – an e-commerce site with recommendations and SMS interaction seeks to fill.

Another essential point is providing an alternative means of accessing the system. Notable e-shopping sites such as Amazon.com and Ebay.com provide mobile applications for shoppers who own smartphones and thus prefer to shop on the go from their phones. This means that the system's patronage increases as more users download the smart phone applications. Moreover, African startups such as M-Pesa by Safaricom – an SMS based mobile payment system, have proved that the market for SMS based e-commerce exists in Africa.

2.2. The relevance and benefits of electronic commerce systems to today's consumer

The quick growth and success of e-commerce sites such as Amazon.com and EBay.com is proof of the relevance of electronic shopping in today's consumer-driven society.

DHOLAKIA and UUSITALO [1] studied the shift from physical stores to electronic stores and the shopping benefits as perceived by individuals of upscale US household. On the basis of the empirical study, the authors proposed that the analysis be done at two levels. The first, a shift between formats (from physical stores to catalog and online sales), which represents a shift in retail evolution and suggests that catalog and internet shopping is increasingly gaining momentum in becoming a means of shopping for "time-compressed consumers" i.e. those in the working class of society who earn relatively high incomes and those who are in search of ways of shopping that require little or no labor. The second level looks at shifts within the home and pertains to shifting from catalog, TV and direct mail shopping to computer or online shopping and requires relatively fewer variations in a consumer's shopping behavior. Their study showed that consumers who use online shopping or e-commerce benefit in three dimensions or areas – utilitarian, hedonic and stress related [1]. Utilitarian benefits denote the fulfillment consumer's gain from shopping efficiently and conveniently. This refers to the growing numbers of "time-poor", "money-rich" consumers worldwide who dedicate less time to performing unpleasant tasks. Hedonic benefits refer to

benefits that induce a sense of amusement and fun. These include, "captivation, escapism and spontaneity". The stress related benefits denote the fact that consumers dislike shopping when stress is present and will try evading shopping completely or in some cases will try to get it done with minimum exertion. Thus in an era where the working class have little or no time to shop, e-commerce or online shopping proves its relevance and superior convenience by presenting consumers who use online catalogs or shopping sites with a range of benefits, making it a clear choice over conventional "brick and mortar" shopping methods.

2.3. E-commerce Sites and Recommender Systems

In a report by Bardrul Sawar, George Karypis et al., they examine several techniques for analyzing acquisition and preference data for the purpose of making significant recommendations to customers of e-commerce sites. They stated that recommender systems emerged as a solution to the challenge of consumers having to choose from the millions of products e-commerce sites have to offer. In the paper, they describe one of the first and most popular recommender system – collaborative filtering. Collaborative filtering employs statistical and data mining techniques to procure a set of customers with similar purchasing preferences and uses the generated information to suggest items the customer might like [2]. The results of the study shows that collaborative filtering systems that scale the scope of the obtained filtering matrices are more likely to allow collaborative filtering algorithms to prune large data sets and thus provide more appropriate recommendations to customers.

In a study by Hiralall, he reinforces the necessity of recommendation systems by explaining that the disadvantage of online shopping is the large number of products a customer has to search through to find the products they are looking for [3]. He states that with the implementation of recommender systems, e-commerce sites are able to provide personalized recommendations to customers. However, he expresses the weaknesses of recommender systems as a lack of personalization and accurate recommendations. Thus, his study scrutinizes the algorithms of six recommender systems to ascertain the best one for an e-shop – Non-personalized, demographic-based, collaborative-filtering, content-based, knowledge-based and the hybrid system. This was done by weighing the pros and cons of each algorithm. The general results of the study show that retailers must investigate and study their business in order to determine the data they require from the customer. This allow them ascertain the method they will employ for recommender systems [3].

Kayayo seeks to bridge the gap noticed by the lack of recommender systems on SchoolChopBox.com and Makola.com and the advantage realized by systems like M-Pesa, thus, creating an application that harnesses the benefits of using recommender algorithms and the importance of providing alternate means of interaction. Nonetheless, to substantiate the existence of this gap, a study will be conducted. See Appendix – 5 for Questions used in study.

However, to succeed in bridging this gap, Kayayo must also be aesthetically beautiful, lightweight and attractive. This can be done by using a number of existing front-end frameworks. However, for their beauty and simplicity only two were considered, namely, Kube and Twitter Bootstrap. Twitter Bootstrap and Kube are frameworks that consist of a library of CSS, JavaScript and JQuery files for fast and easy web-development. However, for the purposes of beauty and in the name of making shopping via Kayayo fun, Twitter Bootstrap was chosen for its colourful schemes and html elements. Nonetheless, using any of the two frameworks is an improvement over the conventional building from scratch approach of web-development and allows more time to be allocated to building the functionality of the system.

3. Requirements and Design

Empirical data was collected through an e-mail survey of working individuals to ascertain the feasibility of the system and to obtain the e shopping needs of individuals within the working class. The focus was on whether or not these individuals will patronize the system if it were available and the functionalities they would want the system to provide. From the study, the following functional and non-functional requirements were drawn as a basis for the creation of the functionalities each user possesses. This allowed for a vivid outline for designing the system.

3.1. System Requirements Specification

Kayayo's design will support four main types of users – retailers, customers, administrators and delivery personnel. However, individuals that fall within the customer class or type may be guests or registered customers. Furthermore, administrators may be delivery personnel. The delivery personnel members of administration interact with the system via a mobile web application designed to manage orders.

3.1.1. Functional Requirements

The following are the functional system requirements of Kayayo:

- **Guests of Kayayo shall be able to**
 - Add a new item to cart
 - View product details and comments
 - View shopping cart
 - Browse catalog

- View recommended products

- **Customers of Kayayo shall be able to:**
 - Authenticate user account during login
 - Add a new item to cart
 - View product details
 - View product comments and leave comments
 - View order history
 - Generate simple order history report
 - Repeat a previous purchase
 - Manage Account details
 - Change password
 - Cancel an order
 - Browse catalog and view recommended products
 - Receive SMS notification on checkout
 - Send SMS query to track order progress
 - Specify delivery location
 - Home
 - Office
 - Pickup Point

- **Retailers using Kayayo shall be able to:**
 - Authenticate retailer account during login
 - Add a new product to catalog

- Edit and delete existing products
 - Enable/Disable Products
 - Update product stock: In stock or Out of Stock
 - View comments pertaining to products
 - View orders
 - View order history
 - Generate simple order history reports
 - Send SMS query to update product stock
-
- **Administrators of Kayayo shall be able to:**
 - Authenticate administrator account during login
 - Add, Edit and Delete
 - Retailers
 - Customers
 - Products
 - Categories
 - Cities
 - Pickup points
 - Carousel Images
 - These images appear on the guest and customer index pages and advertise featured products
 - Enable
 - Products

- Retailers
- Customers
- Generate
 - Simple order history reports
- Notify
 - Customer after packaging is complete
 - Customer after shipping is complete

3.1.2. Non-Functional Requirements

The following are the non-functional system requirements of Kayayo:

- The system shall be:
 - Intuitive
 - Aesthetically beautiful
 - Easy to use and interactive
 - Convenient
- The system must be robust
- The system should be able to provide fast and reliable product recommendations to users
- The system should be scalable – It should support a large number of customers, retailers and administrators without degrading performance.
- The system shall be responsive – response time for each page shall be less than 20 seconds
- The system shall be secure

3.2. Design

The most essential points considered in the design of Kayayo were its power, portability, intuitiveness, aesthetic beauty and user-interaction. On most e-shopping systems in Ghana, user-system interaction is still very user oriented, since all the shopping decisions are made by the user with no assistance what so ever in terms of recommendations. Kayayo's design centers on achieving a more interactive approach by helping users find products via a range of relevant recommendations. However, Kayayo also extends its services to another dominant form of interaction in Africa – SMS. Additionally, the mobile web component for delivery personnel would allow them to interact with the system in the field, to send SMS notifications to customers when packaging or shipping is complete.

3.2.1. System Design

The web and mobile web applications implement a layered architecture approach.

Kayayo consists of three major layers. This includes a web user interface (front-end), the application and a database (back-end).

The Kayayo web user interface deals with all user-system interactions. It allows communication with the application via a web browser, thus, permitting the system to be used conveniently with any web browser (desktop or mobile). The user interface comprises of views built using Twitter Bootstrap – a tool mentioned in the previous work section of this documentation and further explained in the tools and approach section.

The application layer features several PHP and JavaScript scripts that communicate the actions of the user to the database layer and is responsible for the e-store logic such as adding, updating and removing cart items. Other duties include performing more complex logical operations such as providing recommendations to shoppers using a collaborative-filtering and a non-personalized recommendation algorithm. Furthermore, the application layer is responsible for receiving SMS queries and sending SMS notifications. Customers of Kayayo are notified via SMS when orders are placed from their accounts. They also have the option to delete an order and check order progress by sending a short code via SMS to a modem connected to an instance of FrontlineSMS. All requests are replied and the status of the request – successful or fail made known to the customer. Retailers using Kayayo are also notified via FrontlineSMS when a stock status update is successful or fails. These operations are supported by a web server deployment responsible for receiving and processing requests sent by clients (web browsers).

The database layer features a MySQL setup that handles data management processes. Fig. 3.1. Is a diagram of the architecture of Kayayo.

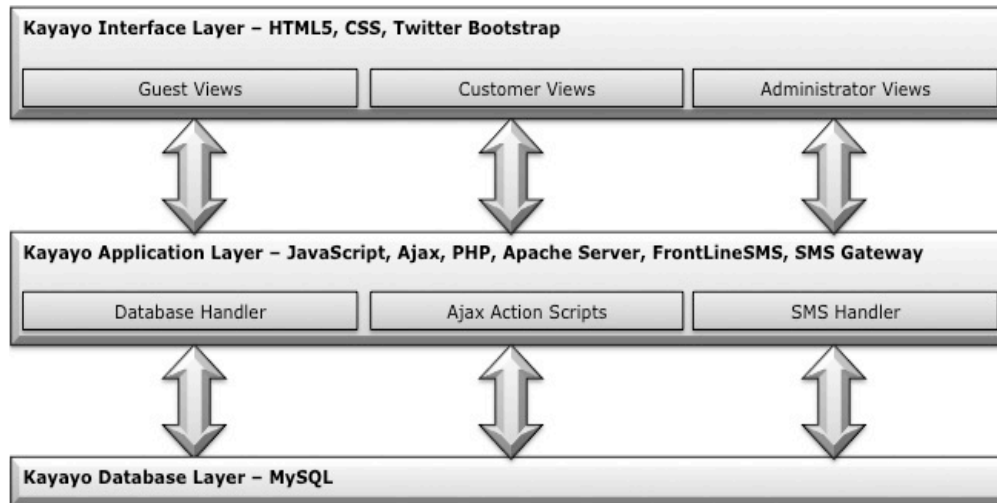


Figure 3.1 - Kayayo System Architecture

3.2.2. Database Design

In the preliminary stages of development, a database model was created as an abstraction of the requirements deduced from the distributed questionnaires and the study of e-commerce deployments in chapter 2. Defining the data needs of the application in that manner led to an unambiguous and more refined database schema. Additionally, it depicted the relationships that exist amongst the intended users of the application. Fig. 3.2 is a screenshot of the model created using the MySQL Workbench EER Data Modeling tools.

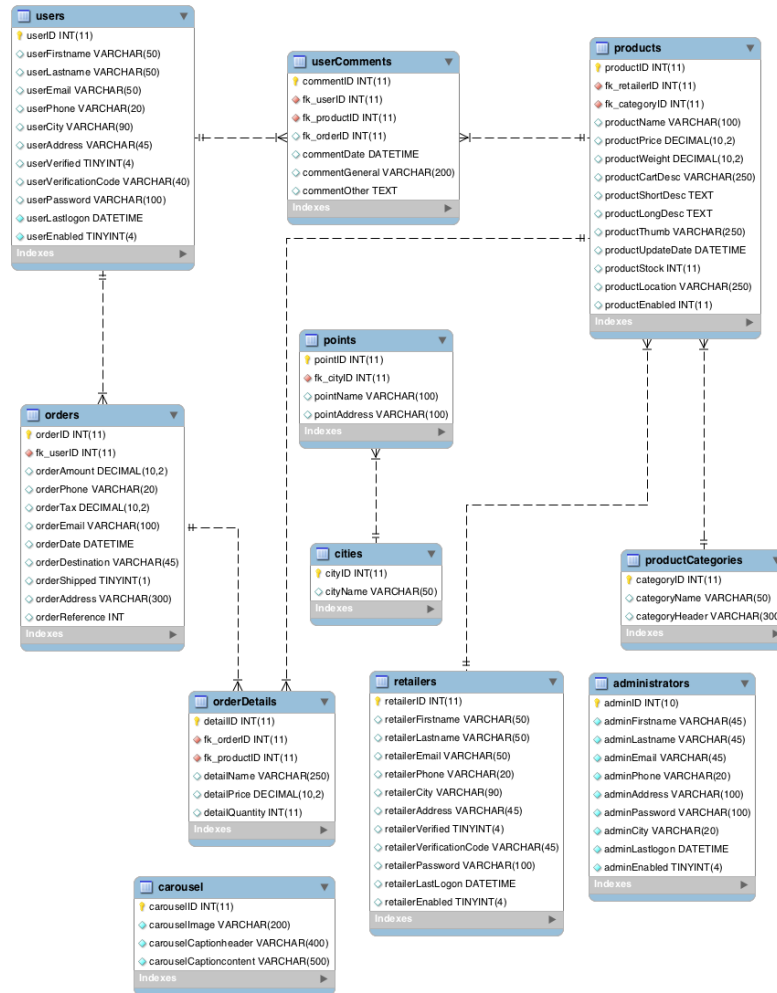


Figure 3.2 - EER Diagram of Kayayo Schema

3.2.3. Interface Design

For the purposes of developing a clean and simple interface, pen drawn prototypes of the interfaces were created (see Appendix 1 for photographs of pen drawn prototypes). These prototypes acted as blueprints during the rest of the interface design process. The core design of the system is adapted from a framework known as Twitter Bootstrap – developed by the creators of Twitter. The framework constitutes of predefined CSS classes, JQuery

functions and JavaScript functions that played an instrumental role in the creation of the fun, fluid interface of Kayayo.

3.2.3.1. Using Twitter Bootstrap

Twitter Bootstrap is a collection of tools for creating websites and web applications. Bootstrap includes HTML, CSS and JavaScript design templates for HTML objects.

To make the web pages aesthetically beautiful, intuitive, streamlined and interactive, it is necessary that the pages be structured in a uniform manner – a general theme be applied. To allow this, Twitter Bootstrap has cascading style sheets that define how elements on HTML documents appear. To implement the framework, a developer must include the Bootstrap CSS files in each HTML document using the link tag. However, to allow additional Bootstrap functionality such as carousels, dropdowns and popups, a JQuery script and Bootstrap's JavaScript files must be added as scripts. The snippet of code below shows how the framework is added to speed up and ease web development.

```
<link type="text/css" rel="stylesheet" href="css/bootstrap.css"/>
```

```
<link type="text/css" rel="stylesheet" href="css/kayayo.css"/>
```

```
<link type="text/css" rel="stylesheet" href="FontAwesome/css/font-awesome.min.css"/>
```

```
<script src="js/bootstrap.js"></script>
```

Subsequently, HTML element tags that need to conform to the style specified in the CSS documents need class attributes. The snippet of code below shows how the class attribute is used.

```
<div id="pending_orders" class="well">  
<form action="admin_index.php" method="post">  
<div class="page-header">
```

This example shows a div with the class attribute "well". This provides the div – pending orders, with a border and a background color specified in the Twitter Bootstrap style sheet. However, having a prototype or design idea is crucial to developing using Bootstrap.

3.2.3.2. Customers and Retailers

The customer and retailer page designs demonstrate just a few of the ways in which the Bootstrap effectively improves the general appearance of a web application.

3.2.3.2.1. Guests and Registered Customers

Guests and registered customers interact with three main interfaces to shop for goods. The first interface displays the available goods per category with their prices and product recommendations (see Figure 3.3). This allows customers to sort items via category, showing them what they want to see when they want to see it. Additionally, a non-personalized recommendations approach is used on the home screen to recommend products with the highest number of purchases.

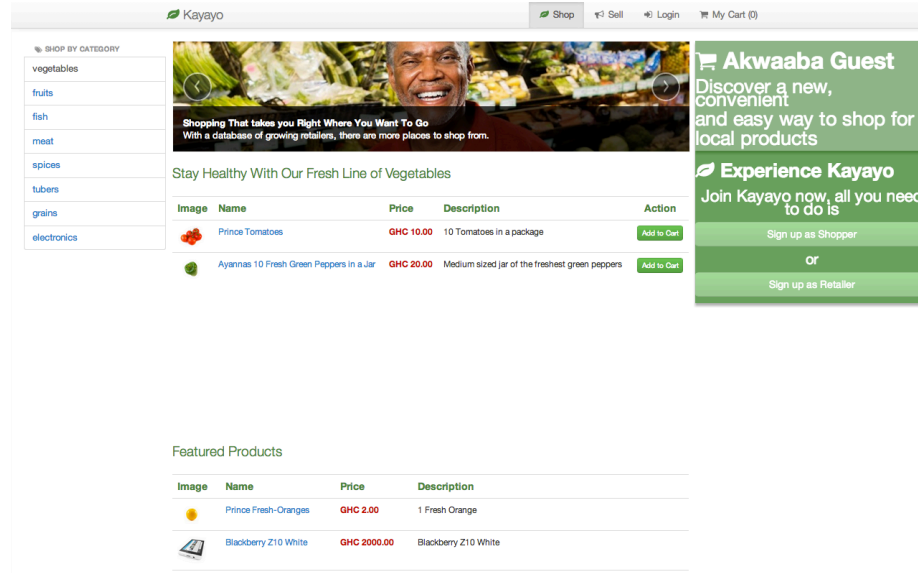


Figure 3.3 – Guests Home Page

The product name of each item is clickable and provides a link to a view product page that presents the shopper with more information pertaining to that product. This is equivalent to picking an item of the shelf and reading the general information on the label, thus, giving the customer the full shopping experience. Additionally, customers are presented with recommendations below the product information. Allowing them to see the other products available even when their focus is on one. This page can be seen in figure 3.4.

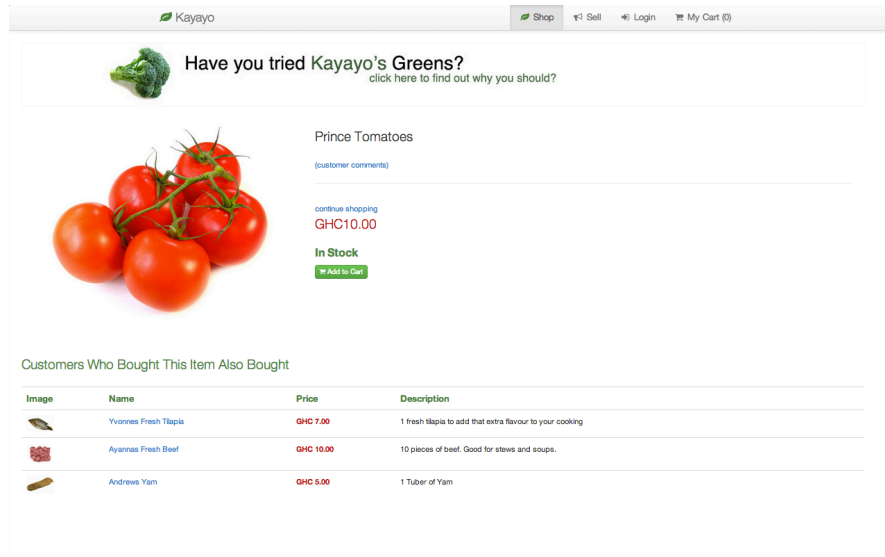


Figure 3.4 - View Product Page

Once the guest or customer adds an item to the cart, they have the option to view the items in the cart or proceed to checkout. On selecting to view items in the cart, the shopping cart is displayed. In shopping cart view, a customer's functionalities include updating cart items, removing cart items or proceeding to checkout. The "proceed to checkout" button's visibility depends on the availability of items in your cart; an empty cart has nothing and thus a checkout cannot occur. This can be seen in Figure 3.5.

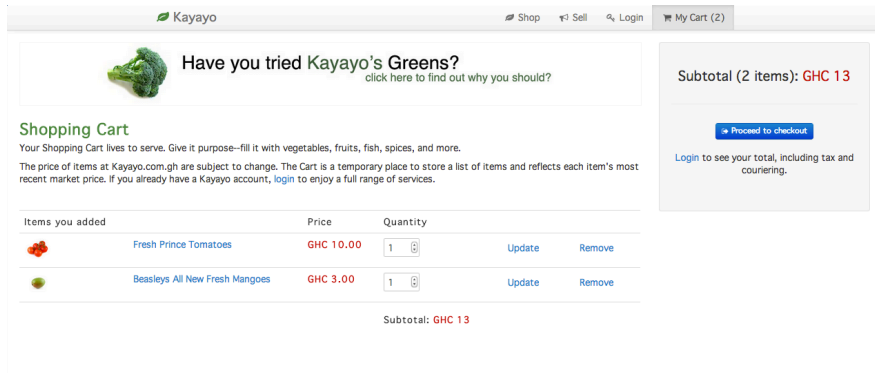


Figure 3.5 – Guests: Shopping Cart

3.2.3.2.2. Retailers

To avoid the running and upkeep of Kayayo being solely dependent on the administrator group, retailer pages were designed to allow a retailer add items to Kayayo’s catalog and view customer comments pertaining to their products. To do that, it is necessary that these retailers create accounts.

Subsequent to the account creation process, retailers have the option to add, edit or delete products. These products represent the goods available in their physical stores. All changes effected on this page reflect on the product catalog of Kayayo. Thus, products disabled by the retailer will not be visible to customers who use the site. The Manage products view of the retailer pages can be seen in Fig 3.6. See Appendix – 4 for screenshots of the remaining retailer pages.

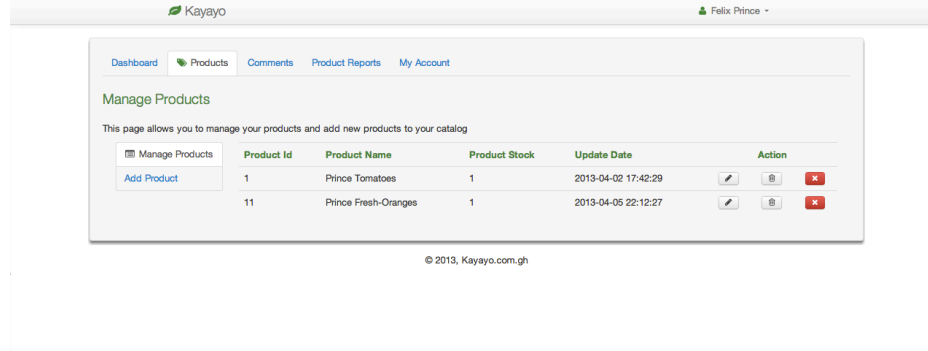


Figure 3.6 – Retailer: Manage Products

3.2.3.3. Administrators

Administrators have the ability to add, edit, delete and enable or disable products, customers, retailers and other administrators.

This is to ensure that customers receive the best in customer service; the administrator view is packed with functionality. Additionally, delivery personnel on delivery trips can still access order information from a cell phone. Trying to access the admin pages will show them the mobile web version of the admin page specifically designed for them. The dashboard gives the administrator the option to manage customers, products, orders and retailers and administrator accounts all at the click of a button, while the mobile dashboard manages pending orders. (Refer to Figure 3.6 for the desktop version and figure 3.7 for the mobile version of the admin dashboard).

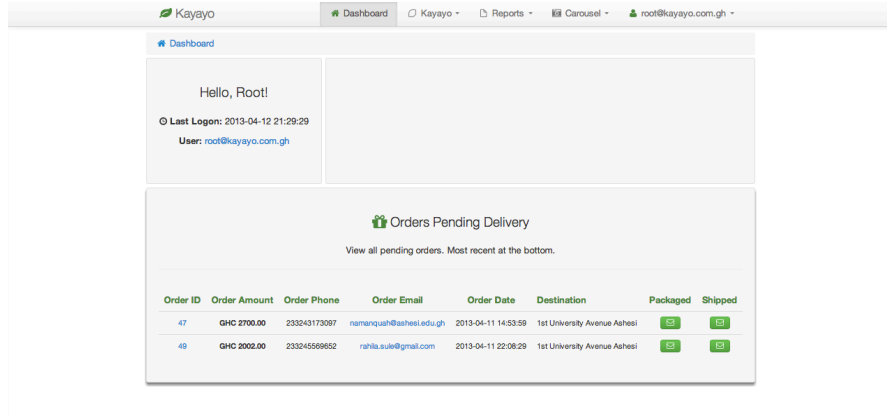


Figure 3.7 – Dashboard



Figure 3.8 – Mobile Dashboard

The functionalities an administrator has pertaining to categories, products, retailers, customers, cities and points can be seen in Fig. 3.8. In this figure, the actions an administrator can perform are located on the right of the corresponding categories. These actions include, editing and deleting and in the cases of products, retailers, consumers, cities and points, enabling and disabling. These functionalities extend to the categories mentioned above.

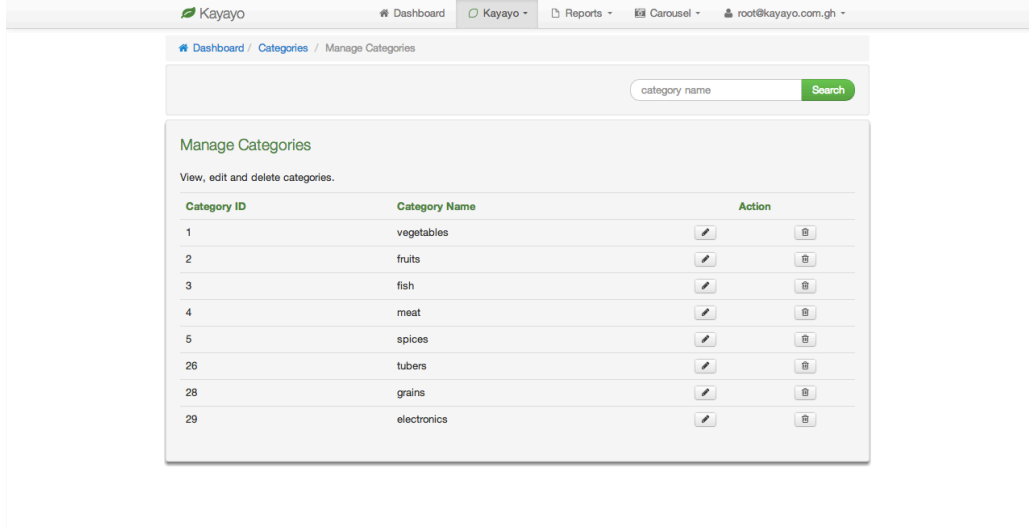


Figure 3.8 - Manage categories

Fig. 3.9 shows a site map showing the pages that are accessible from the landing page. In this figure all who access Kayayo as guests, see the landing page, which allows them to create a new account, view products, add items to cart, view shopping cart or login as a retailer or customer.

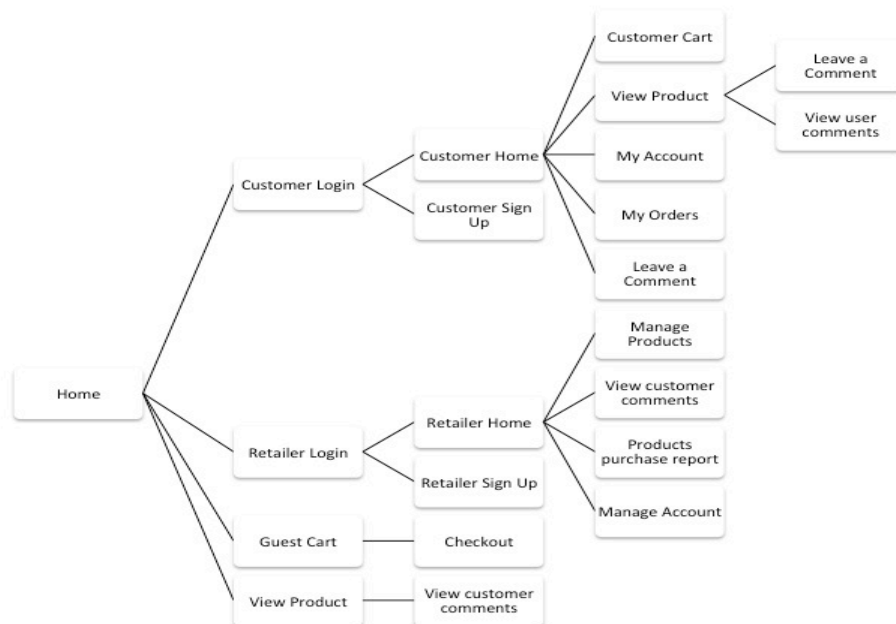


Figure 3.9 - Kayayo Customer and Retailer Site Map

To facilitate a more secure system, administrators and retailers access Kayayo differently and thus use a different site map. In Fig. 3.10, we can see the site map for administrators.

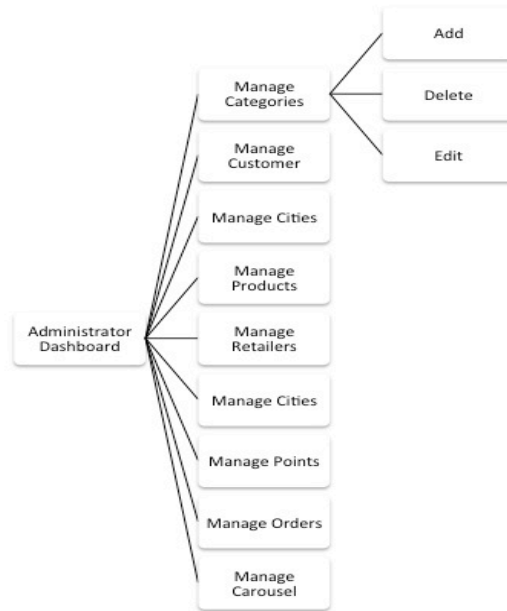


Figure 3.10 - Kayayo Administrator Site Map

The pages that are accessible from the manage categories page are also accessible from the remaining pages. Thus, an administrator can add, delete and edit, categories, customers, cities, products, retailers, points and orders. These site maps further outlined the system and eased the implementation process.

4. Implementation

4.1. Tools and Approach

In building Kayayo's mobile and mobile web application, various tools and frameworks were used. The following is a list of the various tools employed and their purpose.

4.1.1. HTML5

Hypertext Markup Language 5 provided a means to describe the structure of text-based information in a document and to supplement that text with interactive forms, embedded images and multimedia. Some of its many functionalities include client side storage and limited validation of input objects. Moreover, In order to ensure Kayayo is cross browser compatible, HTML was chosen as a markup language due to it being supported by all the major browsers.

4.1.2. JavaScript

JavaScript is a client-side scripting language. JavaScript was used to provide the interactive and intuitiveness of Kayayo. Since it works on the client-side pages do not require reloading when adding items to cart or removing items from the cart.

4.1.3. PHP

Hypertext Preprocessor is a web development sever-side scripting language. Provides dynamic web page creation support. PHP was employed to handle MySQL database connections and was used mainly due its efficiency in creating these connections and the tremendous amount of documentation available online.

4.1.4. CSS

Cascading Style Sheets is a style sheet language used to describe the look and formatting of a document written in a markup language such as HTML. CSS was used in addition to HTML to define the structure of the elements on the pages and to create a general theme for Kayayo. The look and feel of the web interface is as a result of Twitter Bootstrap's cascading style sheets.

4.1.5. MySQL

MySQL is a relational database system that runs as a server and is capable of catering to a large number of users.

4.1.6. Apache Server (XAMPP)

XAMPP is an open-source web server, which consists of an Apache HTTP Server, MySQL database and an interpreter for PHP scripts.

4.1.7. FrontlineSMS

FrontlineSMS [4] is an open-source application used by organizations to receive and send information via SMS. Frontline SMS was used to create the Kayayo's autoreply component and uses a PHP script to perform various actions based on commands received via SMS. An instance of this request is the product stock update request retailers can send by phone to notify the system when stock levels drop.

4.1.8. MytxtBox Pro (SMS Gateway)

MytxtBox Pro [5] is an SMSgh application that uses an SMS Gateway to send SMS messages to mobile phones. To allow Kayayo send SMS notifications to customers, SMSgh has a number of API's clients can interface with. Kayayo employs the standard HTTP API that allows clients with standard HTTP frameworks to send messages via their SMS gateway. Moreover, the API provides a cheap alternative for sending SMS messages to customers and retailers.

4.2. Implementing Kayayo's Collaborative Filtering Algorithm

The collaborative filtering algorithm or query of Kayayo is similar to that of the e-commerce giants – Amazon and Ebay. The algorithm takes the item you are currently viewing, searches for the item in a bunch of previous orders and returns recommendations based on the similarities in customer preferences. Thus, if a customer adds milo to his or her cart and

any other users had previously placed an order and the order included milo then you receive the other items that constitute the order as product recommendations. This means a guest or customer may have more or less in common with the orders participating in the collaborative filtering. To view recommended products, a user – guest or customer, merely needs to click on the name of an item on the catalog or home screen, this will take the user to the view item page and generate a collaborative group of orders that matches the item the user is currently viewing and display other items the user may be interested in. To implement the algorithm, a query was created. The code snippet below shows the query:

```
select count(orderDetails.detailName) as  
popularity,orderDetails.fk_productID,orderDetails.detailName from orderDetails as  
ItemTbl join orderDetails where ItemTbl.fk_orderID=orderDetails.fk_orderID and  
ItemTbl.fk_productID='1' and orderDetails.fk_productID!='1' Group by  
orderDetails.detailName order by popularity desc;
```

The query counts the number of times an item appears and aliases that as popularity, then creates a table from the result of a query that fetches the the viewed item's order id from previous orders and aliases it as ItemTbl. Subsequently, a join between ItemTbl and orderDetails on the orderID will reveal other products purchased by customers who bought the product the user is currently viewing.

4.3. Implementing Kayayo's SMS Functionality

Kayayo's SMS functionality is in two parts; the auto-reply functionality afforded by FrontlineSMS and the auto-forwarding functionality afforded by SMSgh's gateway API. These SMS applications allow Kayayo to interact with customers and retailers via SMS. To allow these two classes of users interact with the system, an sms handler script was created in the form of a php actions page. Thus, depending on the content of a text message and the phone number of the sender, a user could perform a range of actions. These actions include updating stock availability – retailers, cancelling an order – customers. Also customers can track the progress of their orders by texting their order ID to the system via the FrontlineSMS application. The can be seen in the table below.

Action	Message Content	Purpose
1	1:OrderID	Allows a customer to cancel an order they did not place
2	2:OrderID	Allows a customer to check the progress of an order. Packaged, shipped or both.
3	3:ProductID	Allows a retailer to update stock status. If out of stock status is updated to in stock and vice versa.

Table 4.1 – Table of SMS Actions

4.4. Implementing Kayayo's Mobile Web

As stated in chapter 1, delivery personnel will use the mobile web application. To send a receipt or notify the system of a successful packaging or delivery, the delivery personnel will be required to simply select the order from a list of orders and tap the button associated with the action he or she want to perform. These actions include sending an SMS notification when packaging is done and sending an SMS notification in the form of a receipt once the order is delivered.

4.5. Testing

The system was tested using the following testing techniques.

4.5.1. Component Testing

This testing technique was instrumental during the development process. Each function was tested in a piece-wise manner to ascertain their effectiveness. This was done by passing values to the functions and noting and comparing the results with the desired results of the system.

4.5.2. Requirement Testing

Requirement testing was employed to ensure that all the system requirements stated in chapter 3 had been met by the system. This meant checking off the system requirements as the system met them.

4.5.3. User Testing

User testing was used to ensure that user requirements of the system had been met. This was done by randomly selecting 3 individuals to try the customer, administrator and retailer views of the web site. This meant allowing them to browse Kayayo over the network through my XAMPP setup. All users agreed that the site was fun and easy to use. Additionally, they were all able to perform their desired tasks via the web views. However, the individual doing retailer page testing was not sure about what to click if he wanted to edit a product he had just added. This was quickly fixed and a button with a pencil icon was added to the actions per product.

5. Challenges, Conclusion and Further Work

5.1. Challenges

One of the major difficulties associated with the design of e-shopping sites is implementing an appropriate recommendation algorithm. Furthermore, there is also the challenge of there being a time delay associated with recommender algorithms. For instance, when using collaborative filtering as a recommendation algorithm, recommendations do not begin until the shopper adds an item to the cart, rates an item in the catalog or views one item by clicking on the name. It also means that the success of the recommendation algorithm relies heavily on the patronage of the site or service due to the fact that collaborative filtering uses the history of orders.

Some of the Kayayo specific challenges include formulating a query that efficiently generates relevant recommendations to the user. Another challenge that arose was creating the repeating order function. Due to data the desire to maintain data integrity I could not just duplicate the previous order record with each reorder, thus, I had to create a way of connecting the previous transaction to the present one. I solved this problem by creating an additional column in the orders table. This column – reference, would refer delivery personnel and administrators viewing the transaction to the orderDetails of the previous order.

5.2. Conclusion

This paper presented an e-shopping system, which does not only enable customers to shop online and have it delivered to their doorsteps, but also lets retailers and customers interact with the system via SMS messages, in accordance with the shopping needs of 9 respondents of the feasibility study. This is made possible by an administrator portal, a retailer dashboard and a mobile web application that allows delivery personnel to efficiently track and monitor goods while keeping an eye on database activities to ensure that the system runs efficiently.

The results of the study conducted to ascertain the feasibility of the system indicated that 9 out of 10 respondents would use an online shopping system if it were available. This represents the relevance and feasibility of the system to the working individuals of Ghana.

Furthermore, The results of the testing phase of the system development process indicate that the system meets all its stated functional and non-functional requirements.

Individuals who used the e-shopping site found it very useful, due to the fact that it simplifies the job of the shopper by providing a catalog that is sorted, thus, making it easier to find products. Moreover, using an e-shopping site that is accessible online from any internet capable device can be considered as a good alternative for working class individuals who do not have the time or energy to shop.

5.3. Further Work

Future efforts can focus on the design of a more advanced way of providing recommendations (e.g., hybrid recommendation algorithm), as well as improvements in the SMS sending module for retailers and customers. Additionally, some work could be done to create an Android application for customers to shop from the site. This will imply even more convenience for Kayayo customers and will lead to a more interactive system that allows not only people with web access but also people with mobile access to shop on the go and have items delivered to them, or a destination of their choice. Furthermore, some work could be done to provide a map for delivery personnel to allow them find the most convenient route to customers using the Google Maps API. Also, to facilitate payments online, an e-commerce platform such as DreamOval's iWallet or Visa could be incorporated to allow customers pay online.

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6. Appendix

6.1. Appendix 1 – Pen Drawn Prototypes

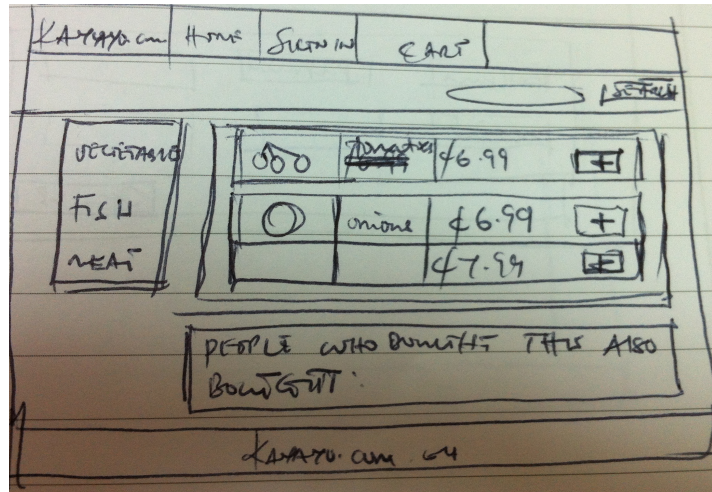


Figure 6.1 – Guest Home Prototype

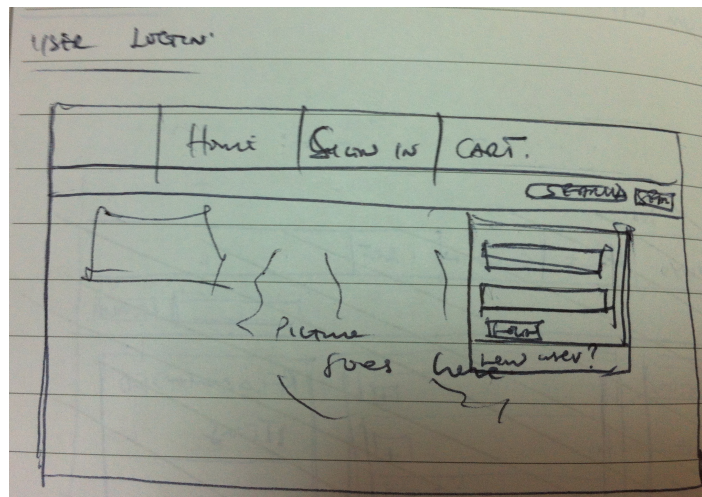


Figure 6.2 – User Login Prototype

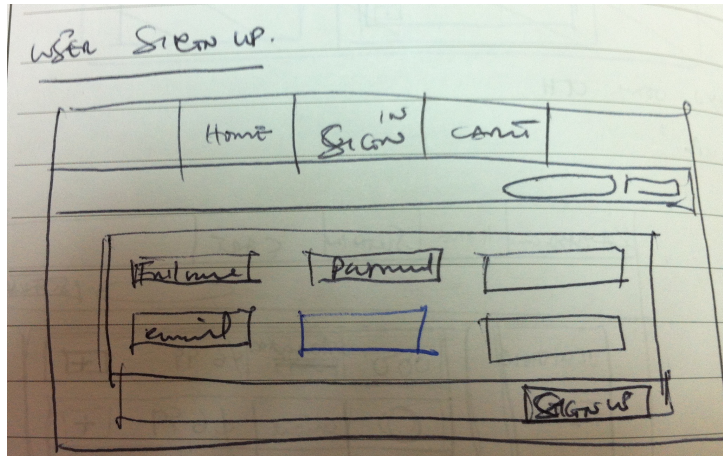


Figure 6.3 – User Sign Up Prototype

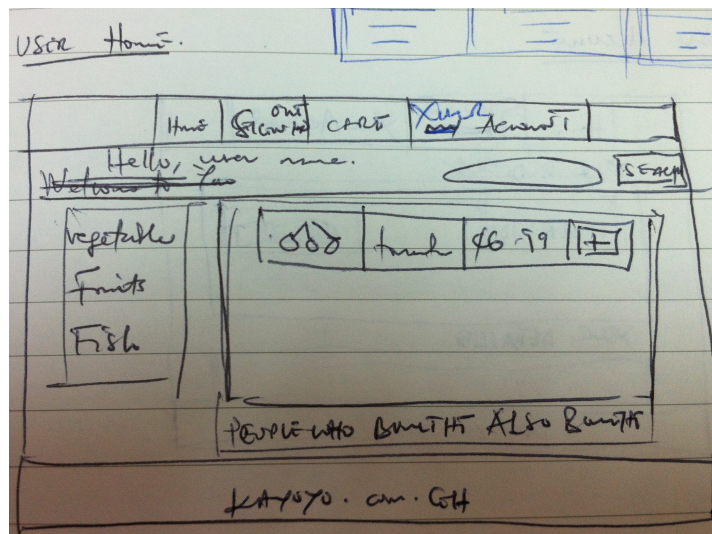


Figure 6.4 – Customer Home Prototype

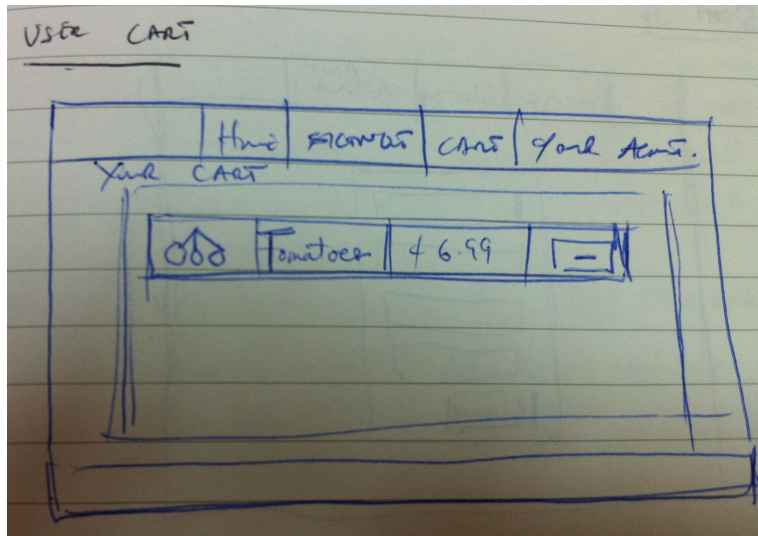


Figure 6.5 – Customer Cart Prototype

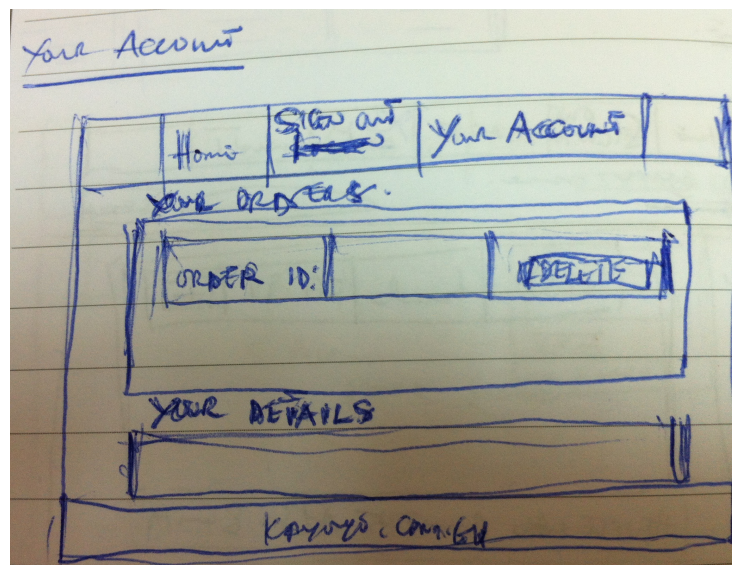


Figure 6.6 – Customer Modify Account Prototype

6.2. Appendix 2 – Customer View Screenshots

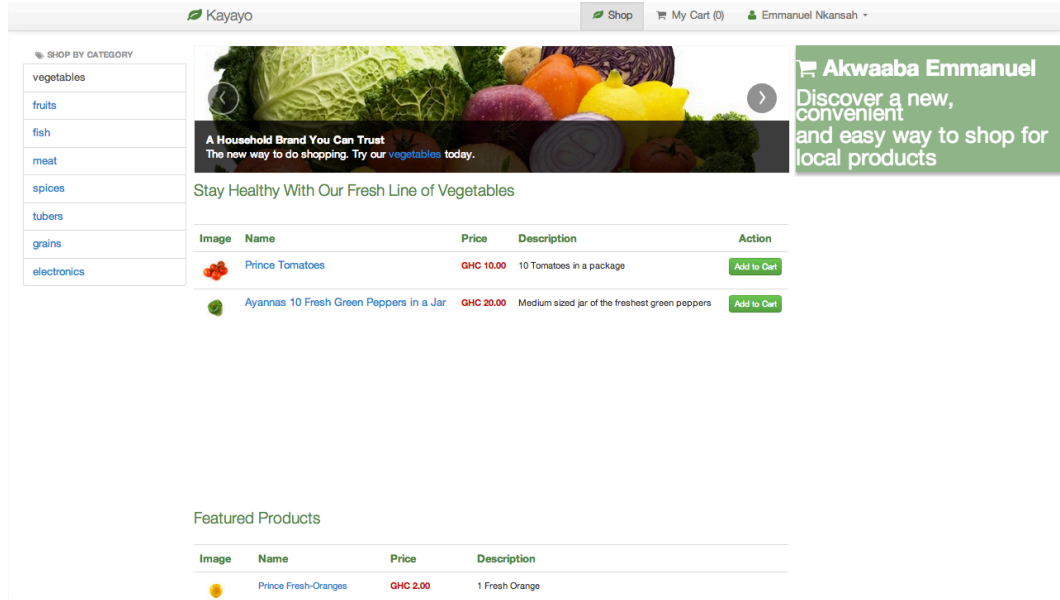


Figure 6.7 – Customer Home View

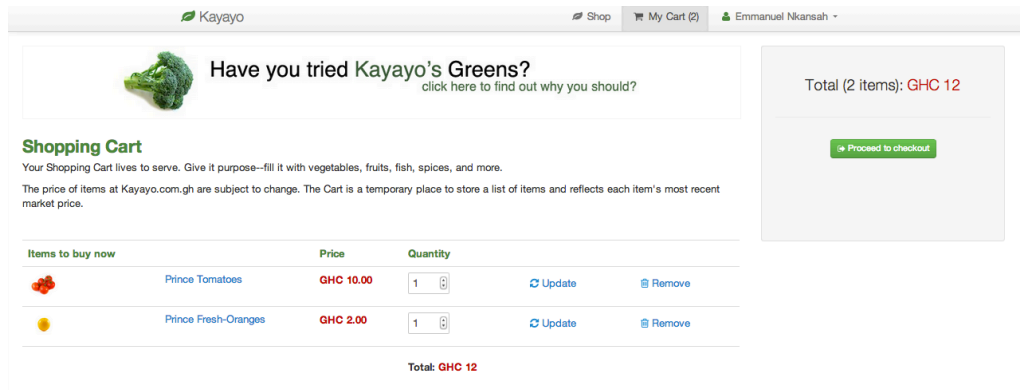


Figure 6.8 – Customer Cart View

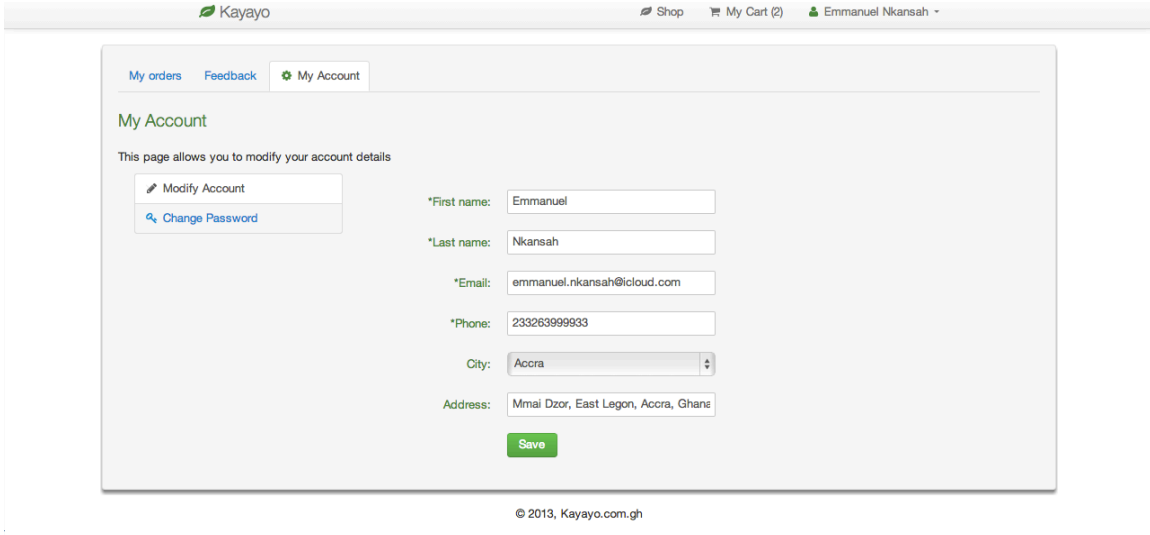


Figure 6.9 – Customer Manage Account

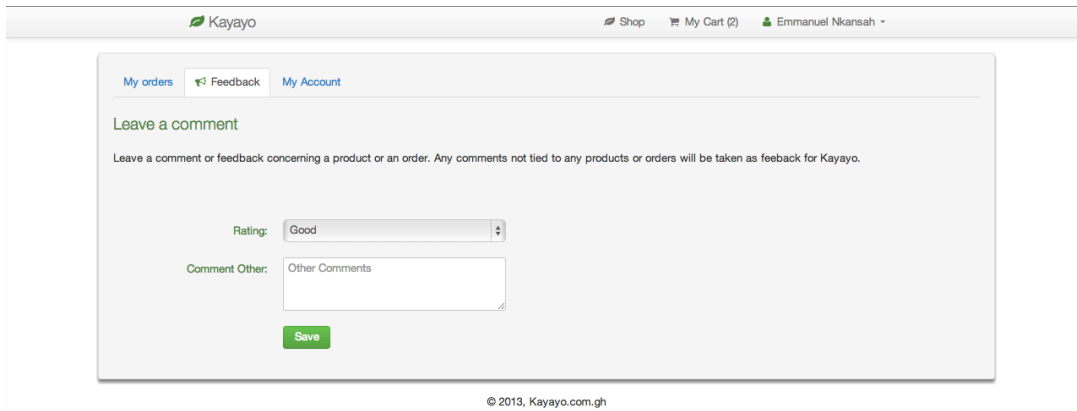


Figure 6.10 – Customer Leave Comment

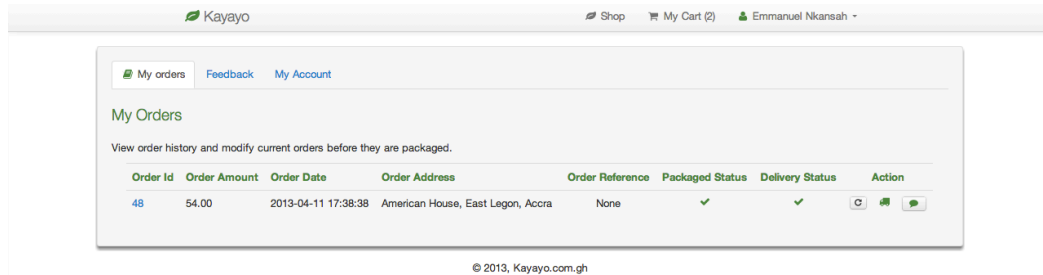


Figure 6.11 – Customer Order History

6.3. Appendix 3 – Administrator View Screenshots

Simple Report

[Print](#)

View a log of all purchases from all retailer catalogs.

Date	Customer	Product	Quantity
2013-04-11 22:08:29	rahila.sule@gmail.com	Prince Fresh-Oranges	1
2013-04-11 22:08:29	rahila.sule@gmail.com	Blackberry Z10 White	1
2013-04-11 17:38:38	emmanuel.nkansah@icloud.com	Prince Tomatoes	1
2013-04-11 17:38:38	emmanuel.nkansah@icloud.com	Ayannas Fresh Beef	2
2013-04-11 17:38:38	emmanuel.nkansah@icloud.com	Andrews Yam	2
2013-04-11 17:38:38	emmanuel.nkansah@icloud.com	Yvones Fresh Tilapia	2

Figure 6.12 – Administrator Simple Report



Kayayo Delivery Personnel

Order Details

rahila.sule@gmail.com
1st University Avenue Ashesi
233245569652
GHC2002.00

Items

1 Prince Fresh-Oranges
1 Blackberry Z10 White

[Packaged](#)

[Shipped](#)

[Pending orders](#)

[Log out](#)

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Figure 6.13 – Delivery Personnel View Order Details

6.4. Appendix 4 – Retailer View Screenshots

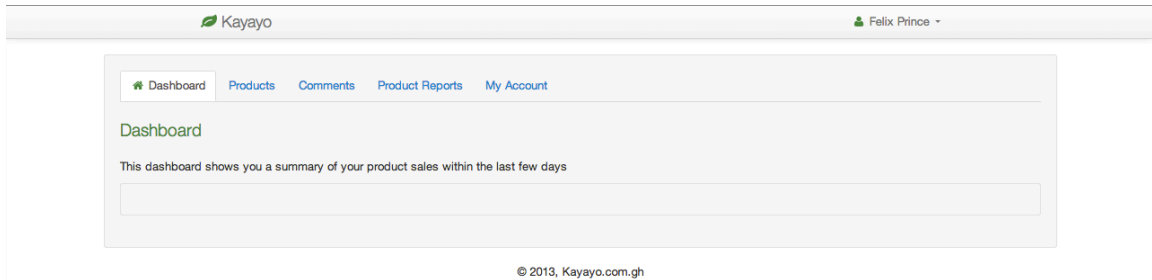


Figure 6.14 – Retailer Home

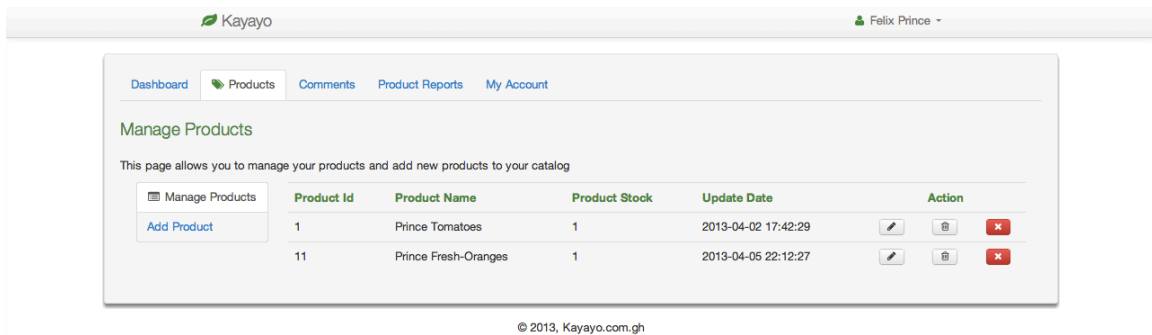


Figure 6.15 – Retailer Manage Products

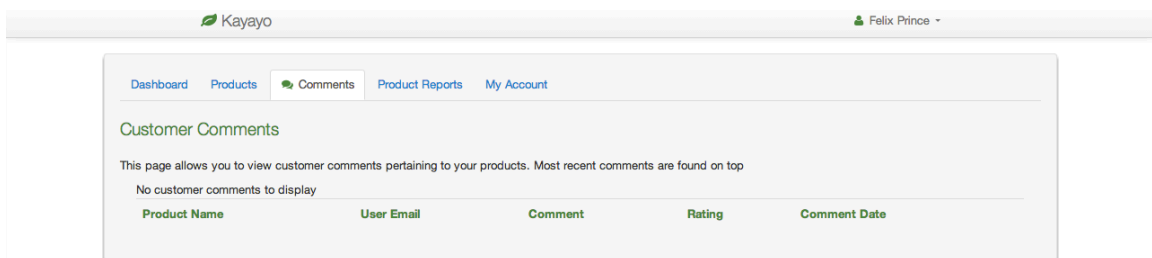


Figure 6.16 – Retailer View Comments

[Dashboard](#) [Products](#) [Comments](#) [Products Report](#) [My Account](#)

Products Report

[Print](#)

View a log of purchases from your catalog.

Date	Customer	Product	Quantity
2013-04-11 22:08:29	rahila.sule@gmail.com	Prince Fresh-Oranges	1
2013-04-11 17:38:38	emmanuel.nkansah@icloud.com	Prince Tomatoes	1

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Figure 6.17 – Retailer Products Report

6.5. Appendix 5 – Questionnaire

I am a final-year student of Ashesi University College. I am conducting a study on e-commerce in Ghana. I would appreciate your feedback.

Confidentiality clause: Your individual privacy and confidentiality of the information you provide will be maintained in all published and written data analysis resulting from the study. The study is strictly anonymous. Please tick and fill where spaces have been provided. Thank you

1. Gender
 - a. Male
 - b. Female
2. Marital Status
 - a. Married
 - b. Single
 - c. Divorced
 - d. I'd rather not say
3. Number of dependents?
 - a. 1-3
 - b. 4-6
 - c. 7-10
4. What is your occupation?
5. Where do you work?
 - a. Labone-Labadi
 - b. Ridge-Circle
 - c. Circle-Accra central
 - d. Cantonments-Osu
 - e. Burma Camp-Teshie Nungua
 - f. Spintex-Tema
 - g. East Legon-West Lands
 - h. Dzorwulu-Achimota
 - i. Nima-Pig Farm
 - j. Atomic-Berekuso
 - k. Other (please specify).....
6. Approximately, how many hours do you work on weekdays?
 - a. 5-7
 - b. 6-9
 - c. 10-11
7. Approximately, how many hours do you work on weekends?
 - a. 5-7
 - b. 6-9
 - c. 10-11
 - d. Don't work on weekends
8. Approximately, how many times do you shop for your household?
 - a. Multiple times a week
 - b. Weekly
 - c. Monthly
 - d. Semi-monthly
 - e. Every 2 months
 - f. Quarterly
9. Who does the shopping in your household?

- a. Yourself ()
 - b. Spouse(if married) ()
 - c. House help ()
10. If you could shop online, would you?
- a. Yes, definitely ()
 - b. Maybe ()
 - c. No ()
11. If you could shop online, what category of goods/products would you like to buy? (you may choose more than one category)
- a. Beverages ()
 - b. Electronics ()
 - c. Dairy Products ()
 - d. Health and Beauty Products ()
 - e. Baby care products ()
 - f. Soaps and Detergents ()
 - g. Fresh Fruits ()
 - h. Fresh Vegetables ()
 - i. Fresh/frozen fish, meat, etc ()
 - j. Assorted Canned, Boxed or Bottled Drinks ()
 - k. Other.....
12. If yes, where would you have the items delivered?
- a. Home ()
 - b. Office ()
 - c. Pickup point
 - i. Near your home ()
 - ii. En route your home ()
 - iii. Near your office ()
 - iv. En route your office ()
13. How quickly do you expect deliveries to be made?
- a. Same day ()
 - b. Next day ()
 - c. By end of Week ()
14. What days would you like deliveries to be made?
- a. Weekdays ()
 - b. Weekends ()
 - c. Other (specify day/s).....
15. If you could shop online, what would your preferred payment method?
- a. Cash(on delivery) ()
 - b. Visa card ()
 - c. Mobile Money ()
 - d. Cheque ()
 - e. Cash (deposited beforehand)
 - f. Bank transfer ()
 - g. Other (please specify) ()
16. You expect payment for delivery of goods and services to be:
- a. Percentage of total order ()
 - b. Fixed cost ()
 - c. Fixed basic cost + variable depending on volume/weight ()

17. How much will you be willing to pay for delivered goods/products?
- a. Ghc 5-10 ()
 - b. Ghc 10-15 ()
 - c. Ghc 15-20 ()
 - d. Ghc 20-25 ()
 - e. Ghc 25-30 ()
 - f. Ghc 30-35 ()
 - g. Above 35 ()
 - h. Other (please specify).....

18. What concerns or recommendations do you have?
-
-
-
-
-

Contact Information:
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emmanuel.nkansah@me.com

6.6. Appendix 6 – System, Documentation and Database Dump

A copy of Kayayo, its documentation and a database dump can be found on the CD submitted with this document.