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Web-based Fright Forwarding Information System for Logistics Management in East Africa

Siama Mary[1], Shubi Felix Kaijage[2], Maranya Mayengo[3]

[1]Research Student, School of Computation and Communication Science and Engineering, Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania
[2]Associate Professor, School of Computation and Communication Science and Engineering, Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania
[3]Doctor, School of Computation and Communication Science and Engineering, Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania

Abstract

Freight forwarding is the process of offering logistical services on behalf of shippers in delivering goods from point of origin and moving to the final destination using single or multiple carriers. The rising of universal e-commerce is stimulating change and innovation in the freight forwarding industry and the current generation of digital devices such as smartphones, and tablets and the availability of the internet has enabled the freight forwarding industry to thrive in facilitating both local and international services. Therefore, the freight forwarding sector in East Africa is moving from manual handling of freights to electronic-freights because of the ever-changing needs of technologies.The study aimed to develop freight forwarding web-based information system for logistics management that will streamline the customer experience and improve logistics services resulting to cost reduction and increase productivity. The author used mixed methods to gather the data and Extreme Programming (XP) system development model was used. Unit testing, integrated testing, and system testing were used to test and evaluate the developed system. The system was validated by structuring a survey questionnaire and distributed to the end users. According to the results, the system met the requirements and the users were satisfied because the system was easy to use and very interactive. With the development of this system, work overload and costs of operations are reduced, errors are minimized and the goods are expected to be delivered timely. For further studies, the author recommends the use of mobile app and Geographical Positioning Service (GPS) for real-time tracking.

Keywords: Freight Forwarding, Information Technology, Logistics Management

1. Introduction

Freight Forwarding (FF) is the process of offering logistical services on behalf of shippers in delivering imports, exports, transits or other goods from a specific location and move them to final destination using a single or multiple carriers [1]. On behalf of local or international shippers, they offer services such as air, ocean or inland freights, freight rate negotiations, cargo tracking, customs documentation, customs clearance, warehousing and distribution, cargo insurance, among other tasks. Effective logistics management in an organization and in the supply chain, can greatly assist in cost reduction and service improvement. As a result, organizations are pressured to look for other means of creating value and pass it to their prospective customers. For successful logistics within and across international borders requires prospective freight forwarders who have good knowledge of domestic and international trade law,

customs services and procedures, and solid understanding of shipping methods and insurance, as well as a good grasp of overseas markets and regulations [2]. The freight forwarding often involves several parties such as the local and international forwarders, shippers, consignees, carriers, co-loaders, insurers among others. For the supply chain to be benefited from the freight industry, it must execute with efficiency as a result, the forwarders are compelled to search for cost savings strategies by investing in and adopting information technology in order to achieve efficiency and effectiveness to stand competition in today's global logistics [3].

According to [4], there is global market opportunity with 57 billion of dollars for all sizes of freight forwarders. The rising of the international e-commerce is stimulating change and innovation in the freight forwarding industry and the current generation of digital devices such as smart phones, tablets among others and availability of the internet has enabled the freight forwarding industry to thrive in the era of e-commerce in facilitating both local and international transport. With the fastest growing market of the FF industry, there is more opportunities if players can embrace technologies in order to increase sales and efficiency of their business operations. Having a strong global network is very advantageous to the companies for competitive advantage and huge transformation hence improving customer experience.

The East Africa is part of the sub-Saharan Africa comprising of the following countries; Kenya, Tanzania, Uganda, Somali, Djibouti, Ethiopia, Burundi, Rwanda, Eritrea, Mozambique, Madagascar, Malawi, Zambia, Zimbabwe, Comoros, South Sudan, Mauritius, Seychelles, Reunion and Mayotte [5]. The region is connected to the global market through the busiest ports of Mombasa in Kenya, port of Dar es salaam in Tanzania, Port of Beira in Mozambique and the port of Djibouti in Djibouti, and it is accessed through two major corridors of the Northern Road Corridor and Central Road Corridor both for road and rail transport. Although there has been progress in specific countries of the East Africa, the region still faces challenges in applying Information and Communication Technology (ICT) services in the freight forwarding sector. The FF sector operates with high efficiency which guarantee quick submission and timely delivery and high-quality services. This requires a well-functioning ICT hub which provides reliable and quick information for handling imports and exports [6]. Most of the freight forwarding operators in the region use manual processes which are prone to errors, consumes more time, loss of documents, lengthy and cumbersome leading to low productivity and offering poor quality services to customers. The developed application used web technologies consisting of both frontend for data entry and backend for data storage and access, having four major users of the shipper, forwarder, Administrator and the consignee.

1.1.Problem Statement

Most freight forwarders in East Africa use paper-based system in handling their daily transactions. for instance, offline quotations and booking processes are lengthy and cumbersome, document filling and document conveying is tedious, time consuming, prone to errors and there is high risk of tare and deterioration, documents mismatch and misplace leading to delay in custom clearing process, loss of documents leading to high operational costs and custom penalties, generally, the paper-based processes are less efficient [7]. Additionally, due to increase in the use of e-commerce, customers have exhibited high expectations of faster delivery of goods in a flexible manner and at a low cost which in reality may not be the case. Another problem is the existing of yet tradition ways of communication such as the use

of personal massagers, telegram, telephones, telex and telefax which has triggered traditions and habit. With automated technology that captures information, accelerate its flow and enables sharing has a vital influence on the shipping process. Much as there are already existed customized information and management systems provided by Application Service Providers (ASPs), most of this off-the-shelf software are usually not suitable to freight forwarders' purpose, because they are originally constructed for multipurpose. For that reason, some of these have malfunctions, unnecessary functions, and bad interfaces. Therefore, the developed system aimed at automating business processes and digitalizing its booking, communication, document sharing, and providing online access to information. With the development of this system, work overload and costs of operations are reduced, errors are minimized and the goods are expected to be delivered timely.

1.2.Objective of the Study

To develop freight forwarding application for logistics management in East Africa that will streamline customer experience and improve logistics services resulting to cost reduction, secure movement of cargo, increase employee productivity, and improve quality of service.

1.3.Significance of the Study

- The proposed system will shall provide freight forwarding stakeholders with understanding of best practices and mechanism on how the freight forwarding business operates.
- The stakeholders will be able to draw lessons on the criteria for the freight forwarding business process.
- The study will help the companies to understand the best way to collaborate with the different stake-holders involved in the business process.

2. Literature Review

The application of web-based information systems has advanced in the recent years and has been applied in freight forwarding industry to streamline customer experience and increase profits and lower cost of business operations. This chapter reviews the related works in the use of freight forwarding information system for logistics management as follows;

In order to provide e-booking, shipping orders, container selection and cargo allocation, [8] developed an e-logistics for sea freight forwarding. XML-based information format for data entry and exchanged was used to develop the application. The application provided platform to interact and exchange of information between the shipper and the forwarder, however, the developed system provided one leg of transport mode leaving the shippers without options to choose from it.

According to [9], information systems have become a common place for freight forwarders increasing efficiencies hence improving logistics handling. With the use of RIA technology, there is improved accessibility, lowers maintenance, balanced resource sharing, asynchronous communication and reduced traffic. However, the use RIA technology is not well known and agencies are not used to it.

[10] from China developed a Freight Forwarders' Cloud-Based Platform with Usability to solve the problem of Legacy freight forwarding systems. In this research, the author used a cloud-based digital freight forwarder' platform (C-DFP) model design which examined 5 digital freight forwarders'

platform features based on existing framework with 30 features. According to the results, data integration and services from transport suppliers will enable digital forwarders to provide and control high-end contents on the system. The concept of cloud-based platform provided competitive advantages over the legacy shipping process. The author recommends future work on designing system features which involve the shippers and validate the features using a prototype by illustrating practical usage and applicability findings.

[11] from Indonesia proposed the development of information system of freight forwarding with agile SDLC. The method of the research included the use of the software development life cycle which includes; requirements gatherings, analysis. design. coding and testing. The system consists of three actors; the consignee, the freight forwarder and carrier. The SDLC method was used during the research in order to produce high-quality software capable of meeting the customer expectation, and completes within time and cost. According to the outcome of the research, the developed system achieved real-time overall business process, reduction in time for data acquisition and order automation and increased quality of information and service. However, user credentials were visible on browser.

[12] developed a system that uses real-time technology to update the location and status of trucks and cargo. The major aim of the proposed system is removing the use of paper documents and providing data exchange across the system making the entire transport cycle transparent and accurate, it reduces the use of carbon footprint which is not environment-friendly and cost-effective. The challenge with this system is that is manages only documents and considered only single mode of transport.

3. Materials and Methods

3.1 Case Study and Scope

The project was carried out at Trueline Africa limited located in Kampala, Uganda. Trueline Africa limited provides both forwarding and clearing services to its customers. The case study was chosen because the company has experienced managers and staff who fully understand the business model of the freight forwarding and its processes, having well experienced and expertise in both local and international trade, trade regulations, in-depth analysis and requirements can be elicited.

3.2 Research Method

The study used qualitative and quantitativefor collecting the data through in-depth interview, survey questionnaire and documents reviews were used to better get the understanding of the logistics industry in the region and some inspirations for the design of the system to be developed.

3.3 The System Development Approach

The study used agile model of development with Extreme Programming (XP) approach in particular. This approach was used because it encourages interactions over processes and tools, customer collaboration over contract negotiation, and responding to change over following a plan [13].

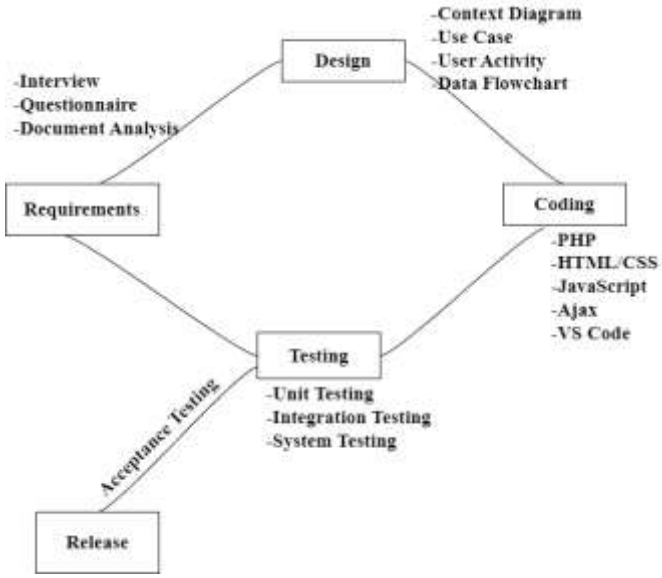

Figure 1:Extreme Programming Lifecycle

4. System Development Tools

The software requirements of the developed system include the programming languages and other software requirements that make the development of the system a success. The software components necessary for the development of the freight forwarding information system for logistics management are as follows;

- **Hypertext Preprocessor (**PHP): it is a free-source scripting language suitable for web design and development in a fast, flexible and pragmatic way and it is normally embedded into HTML. The PHP was used to execute codes in the server which then are turned to HTML file for the client to view/access.
- **Hypertext Markup Language (**HTML): It is a mark-up language used in formatting and organizing of structure of a web page and display its content. The pages are created and structured into sections, paragraphs and links using the building blocks such as tags and attributes. It is widely used, flexible and it's an open source.
- **Cascading Styling Sheet (**CSS): CSS is a simple design language that enables developers to describe the format and look of web page content. It normally presents how a document is styled and laid out by converting it into a form usable by the audience. With the use of CSS, the system used it as a tool used to control the layout of a webpage for better performance and easier maintenance.
- **JavaScript**: it is a Programming language that allows implementation of complex features on a web page is very important in software development because it is very fast to run immediately within the client-side browser, it is popular language and can be used everywhere on the web.
- **Ajax**: It supported dynamic creation of the web pages.
- **Bootstrap**: It's a front-end framework with features that support the interface of the forms and is comprised of HTML and CSS templates, buttons, JavaScript extensions, navigation and other design components.
- **My Structured Query Language MySQL**: This is a free-to-use source database that facilitates effective management of databases by connecting them to the software. It is a stable, reliable and po-

werful solution with advanced features. In this project, we used it specifically for the following reasons, it provides data security and reliability for database management system.

5. Result

5.1 The Requirements of the web-based freight forwarding Information System

The requirements of the web application were identified as based on the Freight Forwarding process flow during transactions. From the data collected from interview and Questionnaire, the respondents were well aware of the process/stages/steps of the freight forwarding. The requirements were developed using the stage-activity process model as explained by [14]. Table 1 shows the user requirements of the application.

Table 1: The Application Requirements

Functional Requirements	Description
Document	Users shall create/generate, upload and download documents in different format.
Communication	Users shall be able to communicate both within the company and outsiders using email, social media.
Order placement	Customers shall be able to place shipment order.
Automate Quotation	Customers shall be able to make quote through the widget and the company shall receive instantly.
Reports	Users shall be able to view, download reports in pdf, excel or csv form.
Monitor and track shipments	Users shall be able to monitor and track shipment using maps
Notifications/pre-alerts	Users shall receive notifications regarding the shipment.
Shipment pick-up schedule	The system shall schedule for shipment pick-up.
Payment automation	The system shallautomate payment for shipments.
Print	The system shall direct documents for print, save and download

5.2 The Architectural Diagram

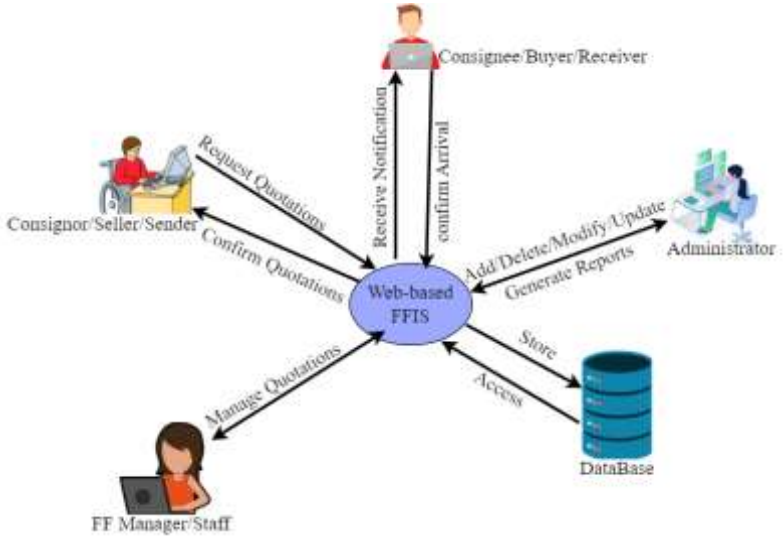

Figure 2:The Architecture of the Application

5.3 The Developed web Application

The web-based was developed to be accessed using the browser and its source codes and database files are stored in the central server which are utilized using the internet. The application is comprised of four categories of users having different functionalities, namely; the administrator,FF Manager, shipper (Sender) and the consignee (Receiver). The application is interactive and responsive hence it is easy to use without prior knowledge. The following figures below show output of the web application based on its functionalities;

i. The Dashboard of the Manager Portal

The dashboard is the first page. In this page, it displays the various menus and it quantifies the total number of customers, users, transaction, freight and emails.

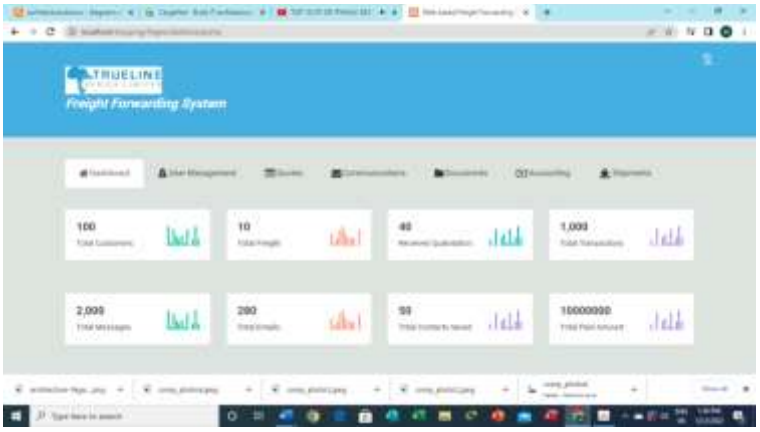

Figure 3: The Freight Forwarder's Dashboard

ii. The Consignee Portal

The Consignee is the receiver of the goods. s/he receives the details of the shipment and s/he could use the system to view, enquire and receive notification regarding the status of the shipments.

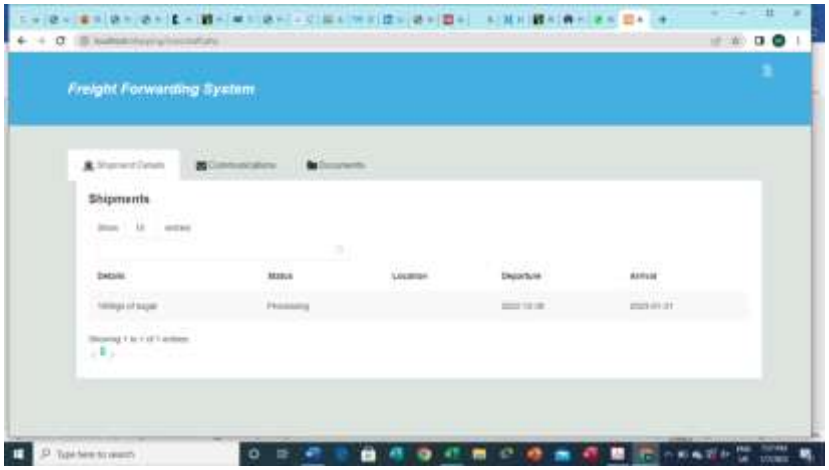

Figure 4: Depicts the Consignee Portal

iii. The Shipper's Portal

The Shipper referred to the sender of the goods and s/he is responsible in requesting quotes from the Freight forwarder and make all the necessary requirements in moving the goods as shown in Fig 23 below.

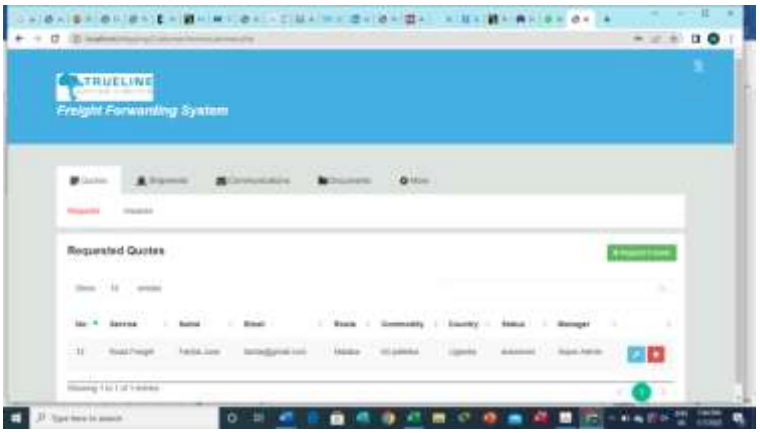

Figure 5: Depicts the Shipper Portal

5.4. Discussion

The role of freight forwarding both in the international and local market has drawn attention. Moreso, the rapid and faster use of computers is widely available. Hence the use of information systems has become rampant and a commonplace to the freight forwarding sector.

From the study, it is found out that the freight forwarding has thrived well through having quick delivery services. The major objective of a freight forwarder is to work out the most efficient way of shipping in order to meet the customer delivery requirements and ensuring that cargo arrives on time, at the right place and for the right costs [15]. According to the president of the Federation of the East Africa freight forwarder Association, freight forwarders in the East Africa region mostly comprised of small and medium sized enterprises who are operating on paper-based coupled with an unprofessionalism. These companies are being outcompeted by their big players who are operating as multinationals with robust systems hence they attract businesses from their associates in the region and they offer valued added services of which the small operators are not able to compete.

In this study, we have developed a web-based application with simplified processes which offers real time quoting, document sharing, end-to-end communication, shipment status updates and notifications, online payment and the system implemented all air, sea and road/rail freight operations. The objective was to eliminate paper, increase responsiveness and to operate more efficiently. we used both qualitative and quantitative to collect the requirements. The model for the system implementation was extreme programming. The system was tested for usability by the end users through setting a structured questionnaire and according to the results, 85% of the users supported the system and it was concluded that the project has met its objectives.

6. Conclusion and Recommendations

6.1. Conclusion

The major aim of the project was to develop a web-based freight forwarding information system for logistics management in East Africa. The contributions of the system are the automation of the system' services such as quote requests, online payment, storage of information collected from the various users of the system, shipment notification, access to reports, instant communication and document upload and download. These are delivered using web-based application which allows interaction between the management of TrueLine Africa and its customers. The developed system was implemented and evaluated and is believed that it has fulfilled its objective and it has the potential to be used as an independent application for managing logistics. The developed system is user friendly and very interactive with general good performance.

6.2. Recommendation

6.2.1. To the policymakers

The application bridges the gap between practice and education by enhancing user's competencies and personal qualification in order to ensure them that they are ready to meet the demand of their future profession. The application helps policy makers to identify effective policies and steps to successfully implement it in the freight forwarding industries at both national and regional level.

6.2.2. To the Practitioners

The freight forwarding industry can benefit from this application through offering online quotation and storage of documents for the different purpose for fast access hence improving service delivery. In addition, providing the users instant notification regarding their shipment gives the customer the hope of receiving their goods on time and are not scared of the loss of their goods.

6.2.3. Future Work

The future work is connecting the application with that of the customs clearing system for early declarations of goods for faster clearing. Furthermore, automating the rates based on the different locations such that the shipper has options to choose from the different carriers. In addition, improving the security of the application by introducing a two-factor authentication as an added advantage for better security.

6.3. Limitation of the study

- The rates from the different carriers vary and we did not have rights to use their APIs, the administrator must enter the rates on daily bases.
- The notifications sent to both the shipper and the receiver of the cargo vary in terms of time yet it is the same message.

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