



Postal Service Tracking System

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ABSTRACT

This research presents a web-based Postal Service Tracking System for an efficient and effective Postal Service Delivery. The software will help keep track of freight or parcel as they are being delivered from one place to the other. Most times the delivery of packages involves transporting them across long distances with several stops that may lead to the mix-up or possible misplacement of the packages enroute. The advent of Barcode or Quick Response (QR) has greatly assisted these efforts, to track mail from the time it arrives in the mail room to the time it is delivered to its intended location for pickup or delivery. In this research a Barcodes and QR identification techniques were used in the system to help identify and track packages. The system was implemented using Bootstrap for the front end, PHP for the business logic and MYSQL for the backend on an Apache server.

Keywords: Post, Postal, Postal Service, Tracking System, QR Code, Barcode

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INTRODUCTION

A postal service is a company which offers special deliveries of packages, money, documents or information. Postal services usually boast faster delivery times than any alternative method of transporting documents, and many services in the modern world rely on it. In the modern age of international business, postal service has become a keystone of enterprise, even as emerging technologies such as the fax machine and Internet have rendered them less useful in some areas.

A problem faced by Postal Services especially in developing countries like Nigeria is the inability to keep records of parcels and tracking them as they move from the point of origin to the right destination. Often, packages are misplaced or mixed up because of the manual way parcels and packages are handled in most developing countries. These problems and more are the case experienced by the Nigerian Postal Services (NIPOST); hence, this research focuses on the design and implementation of a web-based postal service tracking system to help mitigate the problems cited earlier and to help clients keep track of the whereabouts of their packages from the point of origin to the intended destination.

LITERATURE REVIEW

POSTAL SERVICES

The first known use of the word Postal Service can be traced back to the year 1885[1]. Most recently, it is sometimes referred to as post or mail. A postal service is a system that physically transports postcards, letters, and parcels from one place to the other and it can be either private or public [2]. The postal service has advanced over the years from crude ways of delivering parcels to a more modernized and technology driven postal service. Postal Services in developed countries like the UK, US and the EU have advanced and mastered the art of package delivery. This is in clear contrast with developing countries like Nigeria and Somalia who are still grappling with postal service inefficiencies. In

Nigeria for instance the Nigerian Postal Service (NIPOST) was created in 1985 [3] and are only most recently improving their services with technology due to competition coming from new players like EMS, DHL and UPS which are highly advanced in efficient delivery.

Problems Faced by Postal Services

Like earlier mentioned, there are several problems that Postal services still face especially in developing countries with poor road networks, semi-computerized system of record keeping or a complete lack of it, an inefficient transport system and poor addressing systems. In Nigeria, NIPOST is faced with inefficient management and obsolete infrastructure and an occasional loss and violation of items meant for delivery[4]. If NIPOST is to meet competing demands these areas must be as a matter of urgency be improved. In developed countries the challenges faced are not infrastructural problems but technological problems that seeks to replace the otherwise traditional system of sending and receiving mails. For example, letters are now mostly sent via emails and social media platforms. In a recent research study carried out across 20 developed countries[5], it was found that the pursuit of economic efficiency within a very tightly regulated environment was making life extremely difficult for the United States Postal Service. The research report also suggests that "despite the rise of cheap, immediate interpersonal communications on the internet, postal services will still expand along with the needs of developing economies." This shows that the frontiers of postal service growth are focused on developing economies like Nigeria where the threshold of technological and infrastructural advancements have not been reached. However, management issues are still faced by Postal Services in the developed economies. A report by the US General Accounting Office (GAO) cited management issues are a major problem in the US Postal Services[6].

Barcodes

Barcode also known as Automatic Identification

(Auto ID) was invented in the early 1970s [7]. It is an optical machine-readable representation of data and the data usually describes something about the object that carries the barcode[8]. Barcodes are used to identify almost every retail item, receiving shipping operations, manufacturing operations, Asset management, office and customer service applications; and warehousing. Fig. 1 shows how a barcode looks like. The benefits of barcoding include:

- i. **Data Accuracy:** It is the biggest benefit of barcode, it ensures data is accurately represented.
- ii. **Efficiency:** it helps users work faster
- iii. **Consistency:** It helps to maintain company standards by making sure suppliers use are certain type of barcode placed in a certain way for uniformity.












Fig 1: Sample Barcode

There are two categories of barcodes, the one-dimensional or linear barcode and the two-dimensional barcode. Based on these categories there are different types of barcodes that are used for specific purposes. Table 1 shows a few of the popular types of barcodes by category. The 2D barcodes hold more data than the 1D ones. The Universal Product Code (UPC) is the most common barcode found on retail items and it is obtained by manufacturers who desire to use barcodes on their products from the Uniform Code Council (UCC).

The Quick Response Code popularly known as QR Code is the most common of all 2D barcodes. In our research we used the UPC and QR code readers.

Table 1: Types of Barcode and their Uses

<i>1 Dimensional or Linear Barcodes</i>		
#	Barcode	Sample
1.	Universal Product code (UPC)	 e1 23456 78901 2
2.	Code 39	 1234567890125
3.	Code 128	 123456789012
4.	IMB	 12 345 678901 234567890
5.	DataBar	 (01)00123456789012
<i>2-Dimensional Barcodes</i>		
5.	Data Matrix	
6.	PDF412	
7.	QR Code	
8.	Aztec	

Tracking System

Simply put, a tracking system is a system that helps to efficiently keep track of an item as it moves from one place to another. Wikipedia encyclopedia defines a tracking system as a system that is used for the observing of persons or objects on the move and supplying a timely ordered sequence of location data for further processing[9]. The reason for tracking is basically to secure the item and knowing precisely where an item is per time is an information that will help decision making. An encyclopedia for energy and gas industry cited the following benefits [10] of a tracking system:

- i. Tracking saves money.
- ii. Tracking provides admirable customer service.
- iii. Tracking helps in efficiency and productivity.
- iv. Tracking improves safety measures.
- v. Tracking offers real-time visibility.

We can therefore say that a tracking system is relevant, and its use is not just limited to just an area of application but a vast one. In this research we focus on a tracking system for use in Postal Services to track parcels and achieve proper record keeping of packages.

Postal Tracking Systems

Several tracking systems exist that are mostly used in developed economies. Some are highly sophisticated while others are not. Postal service companies like DHL, UPS, Track and Trace, 1 and 1, USPS, EMS etc which operate globally employ one form of tracking system or the other. Perhaps due to funding, localized Postal Service organizations like NIPOST do not employ advanced forms of tracking systems in their operations. G2 Crowd a software reviewer provides a list of the best tracking software[11] based on some certain criteria that was met. The criteria suggest that the software must be able to:

- a. log the status of delivered packages
- b. Send out notifications about the status of delivered packages.
- c. Provide inventory tracking capabilities.
- d. Accept digital signatures.
- e. Store packages or client data relevant to transaction or signature history
- f. Remain separate from courier delivery management or supply chain management.

Some of the softwares included in this category include: Notifii Track, QTrak, SendSuite, PackageLog, ParcelAlert, Envoy Deliveries, EZTrackIt, GigaTrak, IMayl, IntelliTrack Package Tracking, iOffice Mail Module etc.

In the tracking system designed in this research we combined the management and tracking capabilities in a single web-based application to cater for the need of localized postal service organizations.

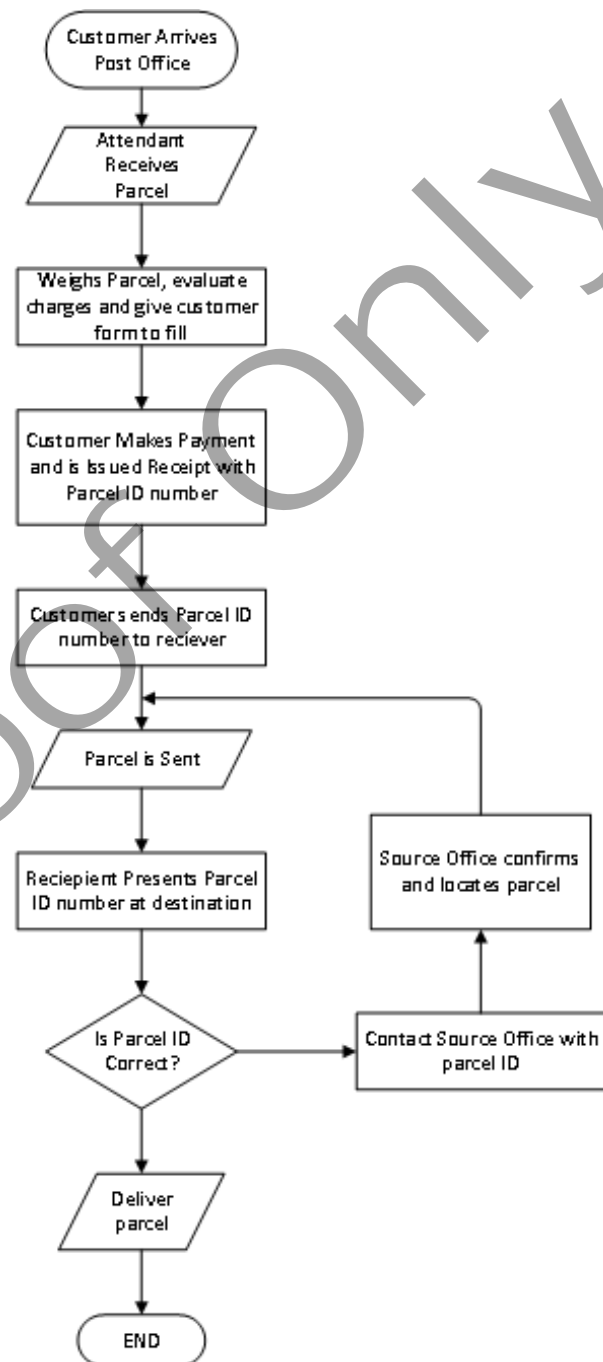


Fig 2: Process Flow Diagram of Existing System

Methodology

ANALYSIS OF EXISTING SYSTEM

In the current system records are mostly written on paper and stored in deliver record booklets. The sender of the package pays for the delivery

of the package and is issued a parcel identification number which will be used by the recipient of the delivery to identify the package. This information is written and recorded in duplicates with a copy kept by the source postal office branch and the other given to the driver of the delivery vehicle. When the delivery has reached its destination, the sender will notify the recipient of the package that the delivery has reached its destination. The recipient then goes to the destination postal office branch with the delivery identification number, to claim the package. Fig 2 shows the process flow of the existing system.

The design of the existing postal service tracking system is essentially manual. The manual system is based on the following concept:

- i. File storage of customer data collection, making the system to be much with paper work.
- ii. There is delay ranging from one to two weeks before customers can determine if

their package has reached its destination or not which leads to lack of trust on the system and potential loss of revenue.

- iii. Lack of system integrity which permits careless handing of packages and misplacement and database protection

Design of New System

The new system is built to work as a web-based platform. It will be accessible to users via any system connected to the Internet. Being web based, users will access the new system via the use of web browsers. The information will be store in digital format and organized in relational database tables. User authentication will be implemented in the new system to allow only authorized access to the system.

The system will be designed to be used primarily for two users; the delivery recipients who will monitor the progress of their package and the administrators who will submit and update the delivery.

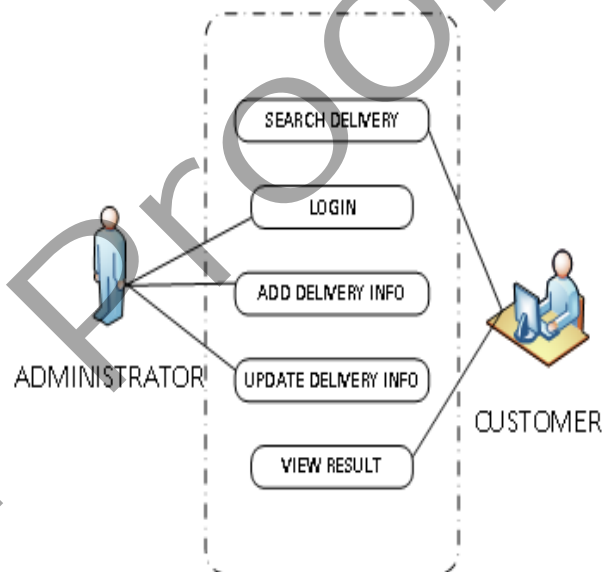


Fig 3: Use Case Diagram

Fig 3 shows the use case diagram of the new system with the various functions performed.

Process Flow of New System

The new system designed completely digitize parcel data by printing barcodes for each parcel whose data has been captured through the filling of an online form. The printed barcode is then affixed to the parcel before it is ready for transportation. Delivery trucks often have several

stops at postal service offices along the way to deliver parcels for those locations before proceeding to the final destination of the the parcel in question. At each stop the postal service registers that the parcel has indeed passed through that location on the system by using a barcode reader to capture the details of the parcel. A customer can login to the system to see the progress made in delivery. Fig 4 shows the process flow of the new system.

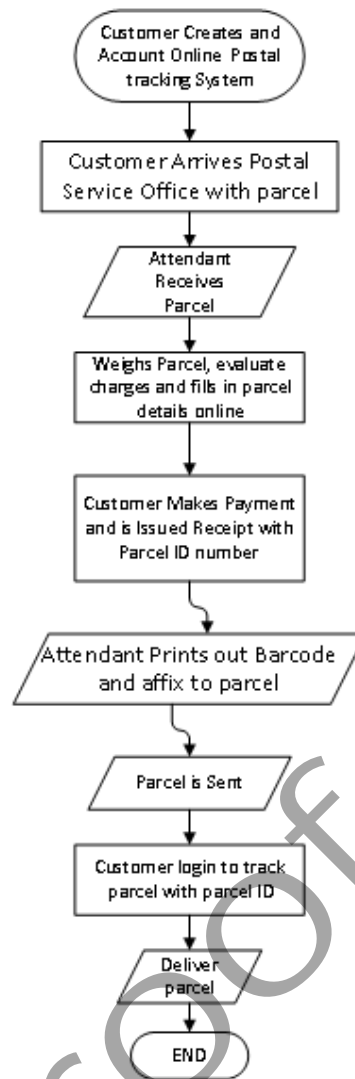


Fig 4: Process Flow of New System

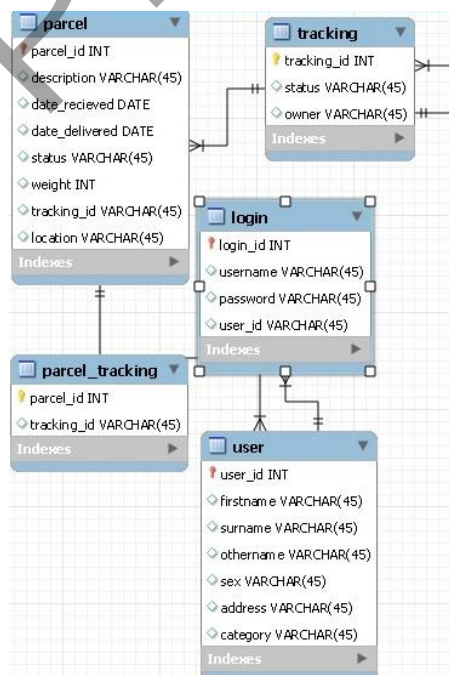


Fig 4: Entity Relation Diagram

Database Design

A relational database was designed using MySQL for storage of package data and user data. Fig 4 presents the E-R diagram of the design.

IMPLEMENTATION

Hardware Specification

The hardware specification used in designing the system is as shown in Table 2.

Table 2: Hardware Specification

PROPERTY	CONFIGURATION
Make	Toshiba
OS	Windows 10
Processor	Intel(R) Core(TM) i7-4700MQ CPU @ 2.40GHz 2.40GHz
Installed Memory	8.00GB
System Type	64 bits OS

Software Specification

The software specification used in implementing the software is presented in Table 3.

Table 3: Software Specification

SOFTWARE	TYPE
IDE	Dreamweaver
OS	Windows 10
Server	WAMP
Front End	Bootstrap 4.0
Database	MySQL
Logic	PHP

Interfaces

Fig. 6 Presents the home interface of the Postal Tracking System that was implemented.

Fig. 6. GUI of Postal Tracking System

CONCLUSION

The System designed and implemented in this research if adopted by postal service

organizations will benefit them in no small measure by increasing their efficiency, consistency,



and data accuracy. It would also increase customer confidence because customers can track their packages themselves at the comfort of their homes. This system can be further enriched with other technologies like GPS that will give precise coordinates of where packages are per time and will also add to their security.

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