Courier Service Tracking System: NIPOST Adamawa State Nigeria

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Abstract - All courier companies today have some kind of courier management software(s) installed for a superior service. This study developed a software platform that will help a Courier Service Tracking System to determine the current position of vehicles, freight or parcel with a navigation system installed, this facilitates, among other things, efficient allocation of pick-up and delivery of goods, increased equipment utilization, effective maintenance scheduling, improved parcel security, decreased asset losses, and rapid assistance for vehicle in need of help or repair. The advent of Global Positioning System (GPS) has greatly assisted these efforts, as geographic location can now be pinpointed within a number of meters allowing the position of vehicle to be accurately determined. A GPS-based tracking system can provide this kind of centralized tracking and management that fleet owners need. The system was implemented using HTML and PHP programming language for frontend with MySQL as the backend.

Keywords - Courier service; GPS; GIS; NIPOST; Tracking system; System

I. INTRODUCTION

There are over seven thousand companies all over the world whose sole function and responsibilities are to provide delivery services to their customers. known These services, which can sometimes be same-day delivery services, or in other instances next day delivery services are also as courier services. Courier service agents include DHL,TNT, Express Delivery, Speed Post, United Parcel Services-UPS, FedEx, Bax, NIPOST and others too numerous to mention. The core responsibilities of these courier service agents are to transfer goods from one region or location to another in order to meet up with our day-to-day economy and to also ensure security of these goods.

Along the line of transportation of these goods, unforeseen events could sometimes occur which could lead to the determent of business transactions and to the vehicle transporting the goods or there could be an attempt to stealing, or violation of the transported items. This raises serious issues of concern for a way to monitor the transition of vehicles, trunks, ships and airplane carrying freight from the courier service providers to their destination in good and save condition, and to avoid these aforementioned uncertainties. Also, there has to be a way to track down freight, and even trucks or vessels carrying goods for delivery in any particular location on the earth. To this end, a monitoring and tracking system needs to be developed in a more sophisticated way to handle these routines.

This paper focuses on such a system that can be used to monitor and track down courier services facilities like trucks, vehicles as well as the freight that are being transported. The essence of this research work is to develop a suitable tracking system for NIPOST, Yola, using a Global Position System (GPS) and Geographical Information System (GIS) to monitor the current position of their vehicles or vessels at any point in time and to track the location of these vehicles or vessels. Whether a vehicle fleet operates regionally, nationally, in Europe or internationally, a modern vehicle tracking service system which provide pin-point location, snail trail facilities and a communication platform is one complete solution, while improve performance, reduce costs can give a real competitive advantage in the market place.

II. PROBLEM STATEMENT

Considering a courier service agent such as NIPOST; when they want to sent a large number of parcels around the world, the logistics can become a nightmare and very tiring. Even in this modern day and age, human error and paperwork can make a parcel to vanish into thin air, even when the parcel is perfectly safe on its journey. Before resent technology advancement, when customers ask their courier agents about transaction status of their specific item, the courier service provider will rummage through pages and pages of information, or sometimes it may be impossible to ascertain actual position of freight and notify their customers, even with extended time frame. There is also no proper documentation of client's details or backup of the database in case of unforeseen circumstances. These problems and more others are the case experienced by the Nigerian Postal Services (NIPOST) Yola; hence, this study is expected to offer a lasting solution through the design and implementation of a tracking system for the courier service agent.

III. DEFINITION OF TERMS

The following terms will be defined for the purpose of this study.

GPS: it stands for Global Positioning System. This is a satellite network that was developed in the nineteen seventies by the USA as part of their defense program. Later, under President Bill Clinton, it was make public for civilian.

SYSTEM: a system is an object or a collection of objects or set of detailed methods, procedures and routines created to carry out a specific activity, perform a duty, or solve a problem.

Track Systems: this is a package application, which incorporates the GPS and GIS technology for ease of application into business environments. According to material from [1], there are 24 satellites in operation and 3 extra stand-by ones, so 27 satellites in all. They allow you to track objects or vehicles by providing you with information about the exact position – by giving you the altitude, longitude, and latitude – of the object or vehicles being tracked.

Courier: couriers are basically a service for sending money or goods at some extra cost. It involves a person or a company engaged in transporting, dispatching and distributing letters, parcels and mails. A courier is much faster, safer and secured than ordinary mail. It is a specialized service with authenticated signatures. Dedicated timely delivery is its primary hallmark.

Freight: this can be defined as goods or cargo carried by a commercial means of transportation. Also, freight can simply be defined as a load burden.

GSM: Global System Module, it is used to transmit the data obtained using GPS to the server.

IV. LITERETURE REVIEW

After Second World War, different types of courier companies have been launched worldwide. A Courier company is primarily concerned in delivery of goods and mails to any place in the world. The services offered by them are accessible almost all the time. There are large numbers of courier companies here in Nigeria of which NIPOST is one of them. It can be segmented into organized, semi-organized and unorganized categories. The organized sector players are quit large in magnitude; these players often have best of speed and reliability. As the competition is heating up, companies are offering specialized services including online tracking of the goods [2]. In this service, customers can check the route via on which there goods are being delivered and the exact location of their freight in specific time. The major players in Nigeria courier industry are DHL, TNT, UPS and NIPOST, out of these players DHL courier defiantly has an edge over the competitors since it has 68% acquisition of another big player UPS. DHL is a huge brand name in courier industry not only in Nigeria context but also worldwide. It is right there on the top in services such as air, shipment, worldwide express and overland transport, its expertise lies in providing customized solutions to the customers. They have a very potent combination of global reach and local knowledge. Whether, its express document shipping managed through its wide-range network or entire aspect of supply chain management; it has managed to carve its own inch in the courier and logistic industry. According to the material from [3] Courier service companies have numerous systems to provide continuous tracking of freight, this courier-tracking system typically include a satellite-based data messaging system, they also use cellular based system for communication and data messaging. These systems are generally only effective in urban areas or along highways having cellular telephone coverage.

A. Courier Service Operations

Whether customers desire same day service, overnight service or time sensitive route delivery, the courier operations team works to ensure that the best possible routing structure is developed to meet their customer's requirement. Accordingly, courier service agents undertake the following operations, to mention but a few:

- **Dispatch:** dispatchers are on duty 24 hours a day, 365 days a year coordinating routes, monitoring daily activities, accommodating special request and managing emergencies.
- **Supervision:** A Supervisor is assigned for every route, they are the most experienced courier staff that have exceptional knowledge of their geographic areas and who have demonstrated the ability to train, schedule, and directly supervise personnel. A supervisor is responsible for reporting route emergencies to the Customer service Department and for recovering route efficiently. A customer service representative will immediately contact the service center and advise its staff of any anticipated delays.
- **Drivers:** drivers must meet some of the most stringent standards in the courier industry. Each applicant is tested for area knowledge and map reading ability.
- **Emergency Recovery:** while it is nearly impossible to plan for every contingency, courier service has implemented a Route Recovery System for dealing with traffic accidents, mechanical breakdowns and inclement weather delays.

B. Tracking and Recovery System

Tracking and recovery system provide accurate location of freight via radio, satellite and cellular technologies. Gardner, Morrow and Wyers [4] revealed that, there were only two broad forms of tracking device available, these being radio frequency (RF) transmitters and Global Position System (GPS) satellite systems. A more recent development utilizes the (Mobile Phone) Global System for Mobile Communications (GSM) location facility. Device which combine GSM and RF location are proving exceptionally effective.

Radio Frequency Transmitters: When activated, the Radio Frequency (RF) transmitter emits radio frequency pulse that can be detected by tracking system providers (i.e. that are within the vicinity of a courier vehicle with an RF transmitter fitted to it). **Global Positioning System (GPS):** Is a global Navigation Satellite System (GNSS) developed by the United States Department of Defense. It is the only fully functional GNSS in the world. It uses a constellation of between 24 and 32 Medium Earth Orbit Satellite that transmit precise microwave signals, which enables GPS receivers to determine their current location, the time and their velocity (including direction). Its official name is **NAVSTAR-GPS.** Although

NAVSTAR-GPS is not an acronym, the GPS satellite constellation is managed by the United State Air Force 50th space wing. GPS is often used by civilians as a navigation system. Similar satellite navigation systems include the Russian GLONASS (incomplete as of 2009), the upcoming European Galileo positioning system, the proposed COMPASS navigation system of china, IRNSS of India and DORIS of France. [3].

GPS Satellite System: These system offers real time location of courier package, fitted with this kind of device, upon activation, the monitoring company can determine the courier's location and this can be updated every few seconds to therefore track courier(s) in transit.

GSM Location systems: GSM location system are benefiting from the increased accuracy required by directives such as E9116. GSM location also have advantage over GPS in that, the tracking device can be detected even when hidden undercover or hidden inside a steel container. When considering a recovery device, the aspect of transferability is also worthy of some consideration. Many tracking system cannot be transferred and in effective be 'written off' when the asset they are affixed is changed or replaced.

C. Courier Tracking Technology

One of the primary reasons that the quality of the courier service has flowed, is the utilization of the courier tracking technology. Courier companies that do not implement the means of technology advance to communicate with their courier drivers and track individuals are not able to provide the reliability and high quality service that is demanded by today's demanding customers. Courier tracking technology keeps a steady record of all the delivery activities as they occur in process, which is then recorded as data and can be accessed from a back-end. Through the years, technology has revolutionized and tracking database is able to manage extremely large numbers of records, making tracking your package more manageable than ever before.

V. SYSTEM ANALYSIS AND DESIGN

System Analysis is a problem solving techniques that decomposes a system into its component pieces for the purpose of studying how well those components parts work and interact to accomplish their purpose (Jeffrey, 2001). The current system is properly analyzed during analysis to discover problem area affecting its efficiency and sent for re-designing to improved performance and proper functioning of proposed new system.

VI. ANALYSIS OF EXISTING SYSTEM

Courier service tracking system presently in some branches of NIPOST is based on real time processing technique, which involves a real time locating system-a combination of wireless hardware and real-time software is used to continuously determine and provide the real time position of assets and resources equipped with device designed to operate with the system. The design of the existing courier service tracking system NIPOST Yola is manual. The manual system is based on the following concept;

- File storage of customer data collection**,** making the system to be much with paper work
- There is delay ranging from one to two weeks before customers can determine if there package has reached its destination or not which leads to lack of trust on the system and potential loss of revenue.
- Lack of system integrity which permits careless handling of packages and misplacement and database protection.

A. Feasibility Study

At this stage the current system was examined and the need for improved system was established. The following were established during feasibility study.

- The cost nature of implementing the new system
- Outlined step-by-step solutions to the new system
- Security assurance of the new improved system through the use of new technology.
- The economic aspect of the new system in terms of cost effectiveness, customer satisfactions and efficiency.

The re-designed and improved system will take care of vital issues like: Cumbersomeness, tedious processes and tracking protocol in order for the customer to be able to track their parcels with ease. During analysis and design of the existing system, the researcher discovered that to track a single parcel, it takes times, false information are sometimes given to customers, there is a need to design a portable, easy to use for courier service tracking system in a way as to provide quick and easy solution to anyone who wishes to track his/her freight is the basis for which the new system.

B. Benefit of the New System to user and NIPOST

- With your unique tracking number it possible to find out exactly where the package is on its route.
- Peace of mind, knowing that your parcel hasn't been lost in the mysterious void of shipping but is instead safely in the hands of professionals.
- You will be sure that the parcel gets to its destination and you can quite easily get a copy of the Proof of Delivery paper for your records.
- Sufficiency is maintained by the courier company.
- Trusting relationship with your clientele with regards to competence of service
- The best and most up-to-date system available in the courier industry.

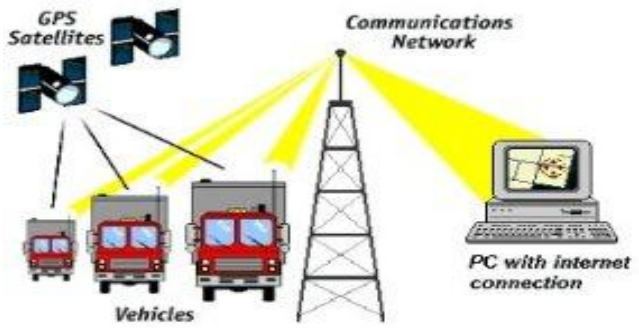

Figure 1 Vehicle tracking unit consists of a built-in GPS receiver, GSM modem

C. How Tracking Technology Works

With a GPS and GIS Tracking System, NIPOST server Administrator can obtain detailed and current information about the vehicle or object that is being tracked through communication with satellite. Also using GPS and GSM real time tracking can be achieved. It is called 'Real Time' because you are getting information as it happens, as opposed to 'Passive' systems where you get to check the information afterwards. According to [5], there are 27 Satellite that circles the globe 12,000miles making two complete rotation every day on earth and sends out distance signals converted from time, and GPS being an accurate Worldwide Navigation and Survey facility, has it reception of signals from this array of Orbiting Satellites then determines latitude and longitude of a receiver on earth by computing the time difference for signals. It does the mathematic with TRILATERATION.

When the driver picks up your parcel, each parcel is given a unique, bar-coded tracking number which is physically attached to the parcel. At each point on the journey of each parcel, the tracking number of every package that it comes into contact with is recorded. In the modern world this is a ridiculously easy step; digital barcode scanners read the number on each package as the label passes; customers are given the tracking numbers too as that will enable them to track their parcels right from their comforts by simply logging into the courier website, and without unnecessarily rummaging through page and pages of information. When a customer log into the courier agent website, type the unique number into a form that will appear with other necessary information for security purpose, the exact location of their parcel will simply appear before them on their screen, and even when they phone for information, the precise details are readily available to all the staff at the customer care at the touch of a button.

GPS systems use communication with satellite positioning to pinpoint the location in latitude and longitude mapping co-ordinates of the GPS transponder to within square meter. The Geographical Information System or GIS provides the relevance to the co-ordinates that GPS system provide, but also extend beyond the typical street maps to handle layers of data such as buildings, routes, territories onto terrestrial maps. Incorporating GPS and GIS solution means that real time positioning data of truck or courier can be mapped along with optimum route to pick-up or delivery addresses, storage temperature and driver speeds.

D. GPS and GSM Location

Another type of courier tracking concept employs both a combination of GSM and GPS Tracking to locate company vehicles in real-time anywhere in the world. Individual vehicle locations are plotted against a visual map displaying geographical location of each vehicle in relation to each other.

E. Use case diaagramme for tracking

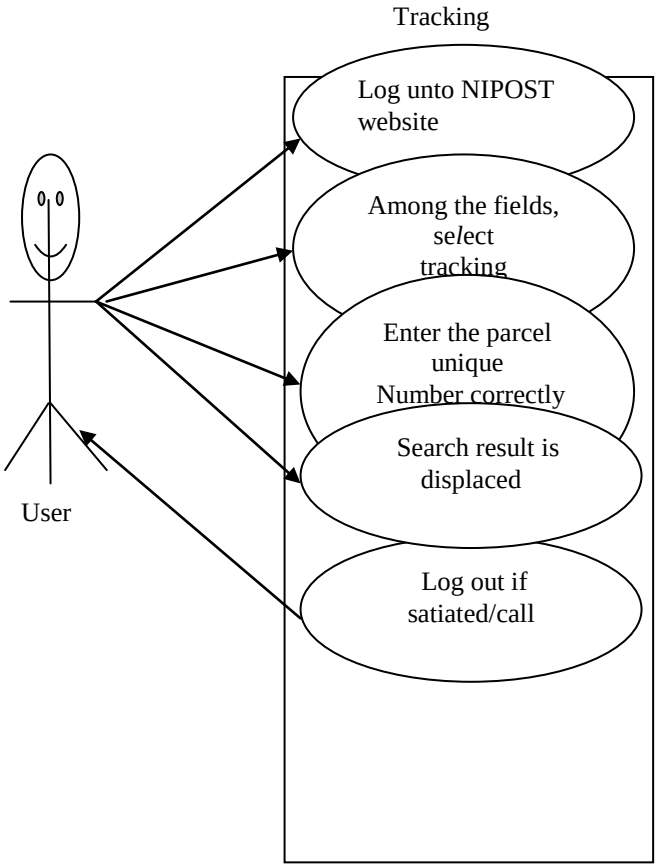

Fig 2: Use Case Diagram

VII. DESIGN OF THE NEW SYSTEM

The new system is a Tracking platform for NIPOST Yola; the system design is made up of a Tracking System-packaged, which incorporate the GPS and GIS and maybe GIS technologies for ease of application into business environments. The most advanced option with Real Time Locating System (RTLS) is to track objects and thereby collecting information about the last appearance there of.

Typically they consist of:

The GPS Receiver: it fits into the vehicle and captures the GPS location information apart from other vehicle information at regular intervals to central Server. With the 27 earth

orbiting Satellites (24 in operation and three in case one fails). The GPS receiver locates four or more of these satellites.

GIS Server: the Geographical Information System is a tracking server that has a dual responsibility, one of receiving data from the GPS tracking unit and securely storing it. And the other is serving this information on demand to user(s).

GSM: an integrated communication device to send and receive data via a cellular network.

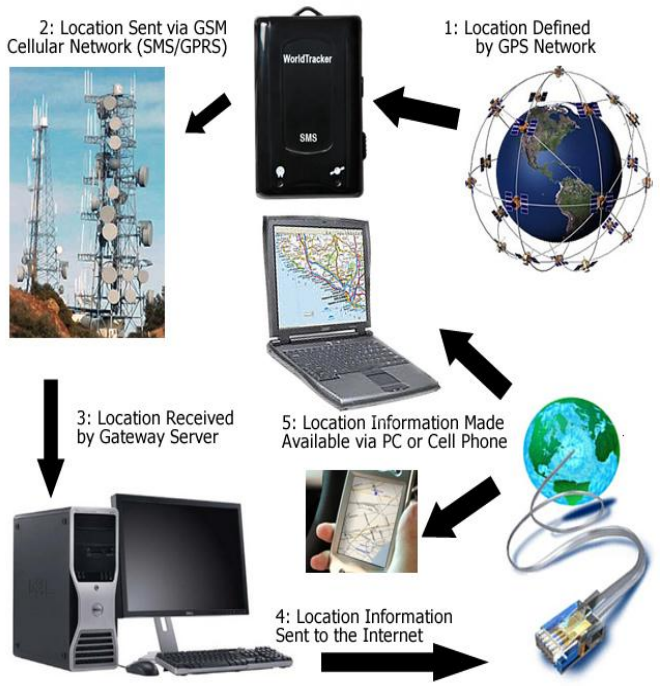

Fig 3: example of an integrated Supply Chain Tracking System for the new system

A. Program Algorithm

This refers to the sequence of actions to be taken and the order in which to execute them, in order for the new system design to become a reality. Algorithm can be seen as the step-by-step method of implementing the system using the ordinary or simple language [6] [7]. The new courier service tracking system is designed based on the following algorithm, using Pseudo code:

- Begin
- Design of the MySQL Module
- Design of html and php Module and links
- Create a web-domain for the courier company - link all modules together
- Design the home page of the site
- Introduce radio buttons and assign functions to each
- Request login ID and password
- Create tracking menus and submenus with links
- Create result display area
- Hyperlink all necessary items
- Stop

B. Database Design

Database is a collection of structured data, the structure of data being independent of any particular application, by [8]. The rational database model was used in the design of the database for this Courier Tracking system. According to [9], "The basic idea behind the relational model is that a database consists of a series of unordered tables (or relations), it is flexible, to reduce ambiguity the total information used in the system have been divided into appropriate sets of normalized tables. The benefits of a database that has been designed according to the relational model are:

- Data entry, updates and deletions will be efficient.
- Data retrieval, summarization and reporting will also be efficient.
- Since the database follows a well-formulated model, it behaves predictably.
- Since much of the information is stored in the database rather than in the application, the database is somewhat self-documenting.
- Changes to the database schema are easy to make.

C. Implementation and Documentation

The design of a new system or package is incomplete until it has been tested, implemented and documented. Implementation, testing and documentation are the final and the most vital stages in the design of a new system, which provide the needed assistance for the efficient uses of the system or package. System implementation and testing is to ensure an appropriate metamorphosis from the old system to the new one and the efficient and effectiveness of the system to users. In this study, implementation is designed in such a way that it involves coordination of the efforts of the user department and the data processing department in getting the new system into operation.

D. Computer System Requirements

The new courier service tracking system is designed to run on a computer system with the following hardware and software requirements:

i. Hardware Requirements:

- Desktops or notebooks computer system
- AMD-K2 or Athlon, Intel Celeron, Pentium II/ III plus
- LAN/WLAN card (10/100MHz) transmission band card
- Minimum of 512MB of Random Access Memory (RAM)
- Minimum of 20GB Hard Disk Capacity
- Super Video Graphics Adapter (SUGA) display unit
- GPS receiver /transponders
- A Server System with GIS chips incorporated.

ii. Software Requirements:

- Windows Operating System Platform (Win2000, WinXP, WinVista and Windows7)
- PHP Setup Software
- My SQL Setup-e.g. WAMPSERVER Setup
- Netscape Navigator, Mozilla Firefox, Opera or Internet Explorer 6.0
- Microsoft Access (Database Management System)
- Internet Domain (Website).

E. Choice of Programming Language

According to [6] MySQL as database (backend), html and PHP programming languages as the web page platform are the most appropriate programming language used for the implementation of this software system. PHP runs in different platforms (Windows, Linux, Unix etc) and compatible with all servers used today (by IT Developers-ITD, [10]). Other software design tools or programming language are employed at the GIS and GPS console level of design, which is beyond the scope of this research work.

David [11], opined that the PHP language makes possible the development of web-based software which is designed with sequence of hyperlinks to the GIS server, having the GPS docket number of the parcel, freight or vehicle for delivery. This programming language also support animation as well as objects and is a powerful communication tool for the internet protocols.

F. System Testing Strategies

The testing of the system implemented is done based on two strategies. First, each module or program was tested independently to ascertain its functionality and the performance of the task defined in its structure. This testing is known as ***unit test.*** Since the system is made up of a collection of different modules (classes), all existing in hierarchy and tied together to actualize the task of courier service tracking system, the next level of testing involves putting all the modules together and testing them all at once. This interestingly was achieved with the hypertext reference (href) function in the php source module; this method of testing is called ***integrating testing.*** Integration testing is done in terms of interface testing, function calls, input/output operation as well as storage. To this effect, integration gives a true picture of the system, how it works and the overall appraisal of the system should be done here by the users [7].

G. System Documentation

Documentation is an important aspect of any system development, this so because it gives a detailed description of how the system works; the interface, the input/output, storage etc. The courier service tracking system software as designed for research is built with MySQL, html and php programming language as explained earlier in the choice of implementation language. Note that for efficient use of the fully functional system, some vital issues must be known.

i. The courier company must have equipped its vehicle, parcel or freight with GPS hardware transceiver which has a unique ID. Each of these vehicles, parcel or freight as the case may be, are to be installed a ***GPS chip*** so as to make possible for tracking when they are on transit for delivery.

ii. It is also important that the courier company be equipped with wireless software device knows as a fleet pro server should also find its place in the company's installation setup.

iii. Another important documentation is on the software, and it follows that users log on to the URL-Uniform Resource Locator of the NIPOST Adamawa i.e. http://www,adamawanipost.com. This will take the users to the NIPOST home page where series of operations and information's can be obtained, including tracking.

iv. To search for a single job, click on "***User***" and enter the docket number that was given to you by your courier agent.

VIII. CONCLUSION

All courier companies today have some kind of courier management software(s) installed for a superior service. There are a few key elements for proper software, some of which are a barcode scanning system, proof of delivery documents, freight management system, a proper billing system and of course a tracking system so that both company and client can be fully aware of the exact location of the packages. Thus, with a good software system a company as NIPOST ADAMAWA would be able to minimize its losses and optimize management to run more smoothly, improve quality of service rendered to customers, increase revenue and get better result from drivers and increase deliveries. The fact that ***Computers*** has been found to be accurate and reliable in handling of categories of data processing operations, hence there can be no better method for handling courier service tracking system than the use of computer and computing. The software for tracking system is strongly recommended to the management of NIPOST, Adamawa. This system is designed to be integrated into all Windows Operating System platforms and using a well-known and avoidable backend as Access and SQL booking program. The more user-friendly your courier software is, the more time and money you save when installing, followed by a smoother running operating courier company system.

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