R. Hamada (1981); Dynamic analysis of a beam under a moving force; a double Laplace transform Solution, Journal of Sound and Vibration 74 pg. 221 – 233.

S. Kukla, (1997); Application of Green function in frequency analysis of Timoshenko beams with oscillators, Journal of Sound and vibration 205 pg. 355 – 363.

S. Kukla, B. Posiadala (1994); Free vibration of beams with elasticity mounted masses, Journal of sound and vibration 175 pg. 557 – 564.

Sadiku S. and Leipholz H.E. (1987): On the dynamics of elastic systems with moving concentrated masses. IngenieurArchir 57, 223 – 224.

Seong-Min Kim, (2004): Vibration and Stability of axial loaded beams on elastic foundation under moving harmonic loads, Engineering Structures, 26, 5-105.

Siddiqui, S.A.Q., Golnaraghi, M.F. &Heppler (2003): Large free vibrations of beam carrying a moving mass. International journal of Nonlinear Mechanics 38, 1481-1493.

Stansic M.M. and Hardin J.C. (1969): On the response of beams to arbitrary number of concentrated moving masses. Journal of the Frankline Institute 287, 115 – 123.

T.H Broome Jr. (1989) ; Economical analysis of combined dynamical systems, American Society of Civil Engineers, Journal of Engineering Mechanics 115 pg. 2122 – 2135.

Thambiratnam, D.&Zhuge, Y. (1996): Dynamic analysis of beams on an elastic foundation subjected to moving loads, Journal of Sound and Vibration, 198, 49-169.

Timoshenko S. (1927): Vibration of bridges, Transactions of the American society of Mechanical Engineers. 53 – 61.

Ugural A.C. (1981): Stress in plates and shells. New York, McGraw – Hill.

UmianEssendemir (2009): Derivation of Equations for Flexure and Shear Deflections of Simply Supported Beams. Vol 6. 187 – 193.

GREEN COMPUTING THROUGH TELECOMMUTING

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ABSTRACT

Green computing is a technology that tends towards the sustainability of the environment, through energy efficiency, electronic waste reduction, virtualization, employing thin client, remote administration, green power administration and telecommuting. Commuting entails movement from one point to another, with the aim of satisfying individual needs. The population of people all around the world keeps growing exponentially and the major means of transportation is by road using specifically motor vehicles and sometime locomotive trains which exhaust is Carbon Monoxide (CO). CO has been categorized as a harmful substance to the surrounding, and thus creates more challenges to global warming. In lieu of this, telecommuting has been identified as a major weapon to control the challenge. This technology is a product of information communication technology, specifically the e-commerce. With this technology, the rate at which commuters travel is drastically reduced, thus the rate of deposition of CO to the environment is correspondingly reduced, and thus paving way for a greener environment. This concept termed telecommuting is embraced in this research by introducing e-commerce to a livestock production farm, and software engineering models were emplored to design a reliable on-line shopping for a farm. In the findings, the adoption of this technology by clients and farm workers in the livestock farm has reduced foot print on this axis through the technology of telecommuting. This in turn reduced the rate of deposition of CO to the atmosphere.

Key words: Green Computing, Telecommuting, Carbon Foot Print, Population.

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INTRODUCTION

As the world is constantly evolving, and there is an improvement in information technology industry, the electronic energy and machine usage will be something to reckon with in the coming years. In recent years, companies in the computer industry have come to realize that going green is in their best interest, both in terms of public relations and reduced costs . The deposition of carbon monoxide (CO) to the atmosphere from locomotive engine and other electronic items usage will the world tend towards an uncomfortable zone, and something to worry about. The deed or thought of how to reduce global warming and hot climate change caused by this machines increase has become impatient. Various machines at different specifications are built daily to tackle and reduce human stress and increase productivity in services rendered. This process requires a larger amount of energy (power)a and money for its effective functioning. It is amazing to know that these are forms of achievement from the ancient days when things are done manually, in the modern days, works are done quickly, everything is working effectively and there is less time to worry about low productivity because the improvement in this machine has aided productivity which is a good achievement. There is a neglect to acknowledge this type of achievement, and the effect it has on the general environment, what it has on the air (for respiration), the food (for consumption) which affects our life in one way or the other . The various chemical substances emitted by these machines i.e. cars, tractors used in farm or other machineries have negative reactions on lives and environment. Therefore there is a need to find for a new measure to curtail this, hence the approach of green computing technology.

Green computing also called green technology is

the environmental responsibility of the use of computer and related resources; such practice includes the implementation of energy efficient central processing unit (CPUs), servers and other peripherals to reduce resources consumption and proper disposal of electronic waste. Basically, green computing is the study and practice of using computing resources efficiently . The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings mainly reduction of Carbon Monoxide emission from cars and related gases, and releases by some computing devices to avoid global warming .

BACKGROUND AND MOTIVATION OF TELECOMMUTING

The term telecommuting was first used in a report from the University of Southern California and the National Science Foundation . Since then, there has been various means and research to understand the impacts on the future of telecommuting on the environment. Due to the need to eradicate or reduce global warming to the surrounding for better living of human. Telecommuting has led to a significant reduction in CO emissions even when increased home-based CO emissions are taken into account, in order to improve lives in many ways. For some, telecommuting is a worker's dream, working from home means not having to worry about catching the 8 o'clock train or getting dressed in uncomfortable business suits each day. It translates in many workers' minds to less pressure, more flexibility and increased productivity.

According to a 2008 study conducted by Telework Exchange, a company that aims to increase telecommuting options for workers, around 9.7 billion gallons of gas and $38.2 billion can be saved each year, if only 53 percent of all white-collar workers telecommute two days per week. The study also found that 84 percent of Americans depend on their own means of transportation to travel to and from work. On average, these workers spend $2,052 on gas and 264 hours of travel time a year just on commuting alone

Although the concepts of telecommuting and telework are closely related, there is still a difference between the two. All types of technology-assisted work conducted outside of a centrally located work space (including work undertaken in the home, outside calls, etc.)3 are regarded as telework. Telecommuters often maintain a traditional office and usually work from an alternative work site around 1 to 3 days a week. Telecommuting refers more specifically to work undertaken at a location that reduces commuting time. These locations can be inside the home or at some other remote workplace, which is facilitated through a broadband connection, computer or phone lines, or any other electronic media used to interact and communicate. Knowing how much Carbon vehicles and machines emit to the atmosphere and how difficult they are to reduce, and then one would also appreciate the idea of green computing through telecommuting. These days computer is of more importance than ever, and everybody should do his job to help keep the environment clean by reducing transport emissions and working from home.

MODEL OF TELEWORKING

Egbuta, Thomas, & Al-Hasan, 2014 researched on strategic green issues of teleworking in terms of the environment, transport, location, office space e.t.c. One of the advantages of teleworking technology is lower green gas emission related to travelling. A theoretical framework and model of teleworking was developed. The framework depicted in Fig. 1 shows the relationship between telework and transportation, office space, environment, location of work and resource use. The relationship which is an aspect of green computing i.e. green teleworking. The aspect of green teleworking that this research looked into is telework in transport or travel i.e. telecommuting.

Fig. 1: Teleworking model

There are seven known approaches to green computing:

1. Energy efficiency – This is where maximizing the power utilization of computing systems by reducing system usage during non-peak time periods.
2. Reducing electronic waste – Physical technology components (keyboards, monitors, CPUs, etc.) are often not biodegradable and highly toxic. The approach is to reduce or eradicate the disposure of these components to avoid the harm it causes to the surrounding.
3. Virtualization – By utilizing a single server to provide the virtual services that would otherwise need to be provided by multiple systems, hence overall power consumption is reduced.
4. Employing thin clients – These systems utilize only basic computing functionality (and are sometimes even diskless), utilizing remote systems to perform its primary processing activity.
5. Remote administration – Allowing administrators the ability to remotely access, monitor and repair systems significantly decreases the need for physical travel to remote offices and customer sites. As with telecommuting, this reduced travel eliminates unnecessary CO emissions.
6. Green power generation – Many businesses have chosen to implement clean, renewable energy sources, such as solar and wind, to partially or completely power their business.
7. Telecommuting – arrangement, where employees can work from their respective homes or remote offices. Telecommuting is a decentralized work. Telecommuting, remote work, or telework is a work arrangement in which employees do not commute to a central place of work. A person who telecommutes is known as a "telecommuter", "teleworker", and sometimes as a "home-sourced," or "work-at-home" employee. Many telecommuters work from home, while others sometimes called "nomad workers", use mobile telecommunications technology to work from coffee shops or other locations. Implementing green computing through telecommuting has various importance which are many; increased worker and customer satisfaction, reduction of greenhouse gas emissions related to travel, and increased profit margins as a result of lower overhead costs for office space, heat, lighting, etc.

Out all these approaches listed above, “telecommuting” developed strategies to reduce CO and ground level ozone levels. Rather than traveling great distances, in order to have a face-face meeting, it is now possible to teleconference with the use of the internet. Each member of the meeting, or party, can communicate via the internet, and can talk to themselves as if they were in the same room. This brings enormous time and cost benefits, as well as a reduced impact on the environment by lessening the need for travel.

With this approach the daily commute to a central place of work is replaced by telecommunication links. Many work from home, while others, occasionally also referred to as nomad workers or web commuters utilize mobile telecommunications technology to work from coffee shops or myriad other locations. A successful telecommuting program requires a management style which is based on results and not on close scrutiny of individual employees. This is referred to as management by objectives as opposed to management by observation.

METHODOLOGIES OF TELECOMMUTING

Telecommuting program can be implemented in many ways, all forms of telecommuting share two common characteristics:

1. Geographic distribution of an organization's workforce
2. Access to enterprise-based communications and applications

Following are descriptions of common telecommuting models:

1. **Partial telecommuting**: By far the most common form of telecommuting is that which involves an employee working both at home and in the office. For example, an employee may work two days per week in the office and three days per week elsewhere, such as at home or at a client location. Ideally, this model involves a "hot desk" or desk-sharing program in which an enterprise makes in-office work stations available to remote or mobile employees as needed.
2. **Pure telecommuting:** This model is gradually gaining popularity whereby an employee works almost exclusively from their home office and requires no in-office space. There are many instances when a pure telecommuting model makes both business and environmental sense, such as in sales and consulting organizations, or when an organization must expand its talent search beyond an immediate geographical location.
3. **Teleworking in the contact center:** As the world seemingly gets smaller and organizations increasingly offer "follow the sun," 24/7 customer service and support, more and more contact centres are staffed by remote, home-based agents.

Teleworking practicalities: In order for telecommuting to truly work – for the organization, its customers and its employees – the telecommuter needs full access to in-office applications and communications such as email, the company Intranet, a single business telephone number, voice mail, conferencing features, critical business applications and ideally video conferencing.

Teleworking infrastructure: One of the first considerations is to select the type of remote access technology. The choices range from slow, cumbersome dial-up to expensive, dedicated private circuits. For most telecommuting programs however, the best choice is the use of virtual private network (VPN) technologies over an inexpensive, broadband public Internet access service. Depending on whether the telecommuter is stationary or on the move, such services can be digital subscriber lines (DSL), cable modems, public Wi-Fi hotspots, 3G/4G cellular networks **.** (Ye, 2012)

RESEARCH AIM

The aim of this study is to design and implement a livestock farm inventory and good ordering system through green telecommuting with the aid of e-Commerce. This can be carried out by creating an e-commerce website platform where customers can place order for livestock by identifying the type of livestock and the breed they would like to purchase from the farm and payment would be made online.

RESEARCH QUESTIONS

1. How can green computing assist in checking the well known "Global warming"?
2. How can the usage of IT contribute to a sustainable environment?
3. How can the "Reduction of Carbon footprint of cars travels" be achieved through telecommuting.

RESEARCH METHODOLOGY

The existing system and the proposed system will be discussed in this session.

EXISTING SYSTEM

Business transactions between customers and livestock farm involves the transportation of the customer to farm and the physical presence of admin staffs and delivery department staffs on the farm in order to purchase livestock which entails stress and the emissions of Carbon Monoxide. This is harmful to the surrounding, thus, there should be a way to get this solved.

PROPOSED SYSTEM

An online solution for easy business transaction where customers can identify the livestock they would like to buy, add them to their cart and purchase them and all livestock bought would be transported to the destination of the buyer. This system will also enable farm workers like the *admin* staff, the delivery department staff, farm produce marketer and also the farm manager to telecommute. The model adopted by this research is partial telecommuting, this is because farm workers and clients can work both at work and from home.

CONCEPTS OF THE PROPOSED SYSTEM

The proposed system phases involve the investigation of the structure of current system, with the objective of identifying the problems and difficulties with the existing system. The major steps involved in this phase include defining the user requirements and studying the present system to verify the problem.

ARCHITECTURAL DESCRIPTION OF E-LIVE STOCK SYSTEM

An e-livestock system was designed to eradicate the draw backs in the manual livestock system which is hazardous to human health due to the rate of commuting by customers, this was achieved through an oral interview i.e one on one interaction with the farm worker and their clients, from which the requirement specification and system specification were gathered. More over on line research were also conducted to commensurate ideas gotten from farm experts and clients. Fig. 3 depicts the architectural frame work of the e-livestock system.

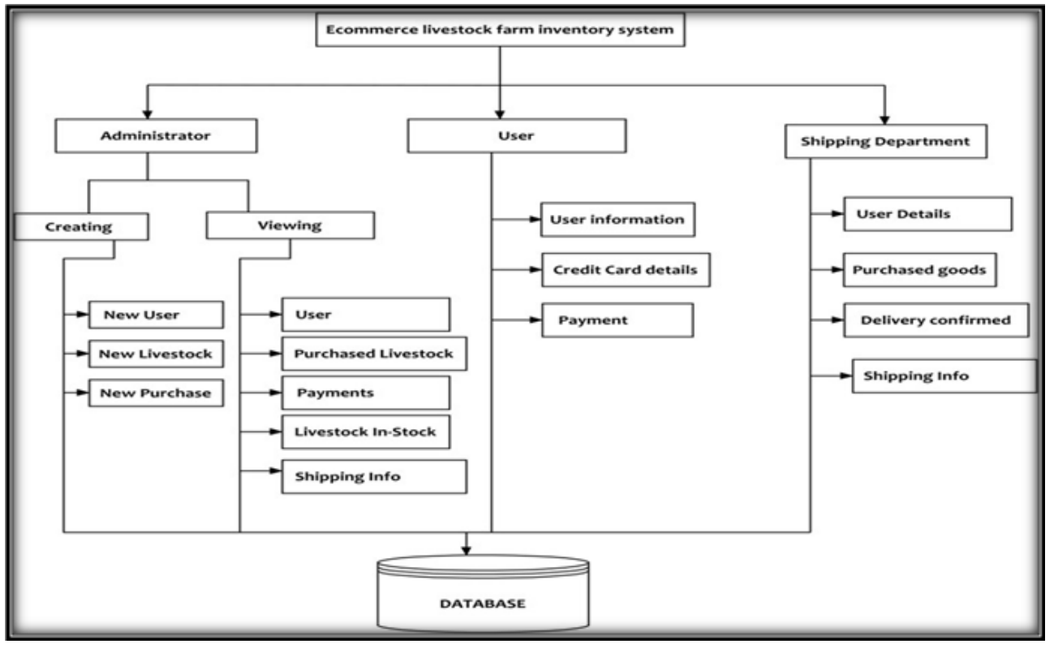

Fig 3: Architectural description of an e-livestock system

The admin keeps track of livestock by updating farm data on regular basis, users have access to the farm cart through which they can view the available livestock, species and sizes. Clients make order based on their choice, and make payment electronically. An enhanced feature of this design is that it has a shipping department, which is in charge of delivering farm products. It is ensured that delivery is done in batches based on the With this, twenty clients on the same axis can be serviced within the same time frame. This is contrary to the existing system where the individual clients will commute separately. This new approach reduces Carbon foot print. Thus, the success of IT has created a platform for a greener environment, through telecommuting.

Admin Login:

Administrator login with valid username and password to perform the following activities:

1. The administrator creates a database of all livestock that are available for sale online.
2. The administrator creates, updates, and deletes all databases of live stocks that are not available for sale.
3. The administrator also monitors all the business transactions of the end users
4. The administrator creates a database for all the users who registers with the farm e-commerce website.
5. The administrator monitors the system for every transaction done by the end users
6. The administrator makes available reference number for every stock on sale
7. The administrator provides secure transaction for the users.
8. The administrator checks for order placed by the customers.
9. The administrator helps to give the time that goods will be delivered to customer's destinations.

End Users/ Customers:

They login with valid username and password. They perform the following activities.

1. The user registers his/her credentials so that it can be acknowledged during the next transaction and proper documentation of every transaction done by the user on the website database
2. The user provides their credit card transaction details for buying of livestock
3. The user accesses every livestock that is available in stock for sale
4. The user identifies the kinds of livestock and what breeds they wants
5. The user makes new orders of livestock
6. The user checks for the status of their ordered goods and time of delivery

RESEARCH DESIGN AND SETTING

This research was conducted at FARMWEB Atan, Lagos State, Nigeria. The farm has been a very big farm which deals with clients from far and near in request for various farm produces. This actually adds to congestion along this axis and thus aggravates the issue of global warming, through the rate of deposition of CO to the atmosphere. To reduce this drastically, the information technological achievement e-Commerce is used, by designing an e-livestock system through which the farm and clients can telecommute which is an approach to green computing, to attain a greener environment.

To test the viability of this new system two sets of questionnaires were distributed to farm workers and clients through their mail box, workers filled the questionnaire and forwarded it back to the sender. This is to enquire if the system had actually reduced commuting and thus making the environment more sustainable.

4.0 Input and Output Design

Input and Output design will be explained using sequence diagram, due to its explicit descriptive nature.

4.0.1 Sequence diagram

Sequence diagram is an interaction diagram that shows how processes operate with one another and the order of interaction. It is a construct of a Message Sequence Chart. The sequence diagram shows object interactions arranged in time sequence, it depicts the objects and classes involved in the scenario and sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams has to do with the use of case realizations in the logical view of the system under development. Sequence diagram is also known as Event Diagrams or Event scenarios

A sequence diagram shows the following:

Lifelines:  A parallel vertical box connected by a vertical lines; Showing different processes and objects that live simultaneously.

Link:  An horizontal arrow, the message exchanged between them, in the order in which they occur.

Use Cases:  What the lifeline and arrow interact with, to show its processes

This allows the specification of simple runtime scenarios in a graphical manner. Sequence diagrams commonly contain the following:

- Objects
- Links
- Messages

Like all other diagrams, sequence diagrams may contain notes and constrains. Fig. 3 shows the sequence diagram for the user login.

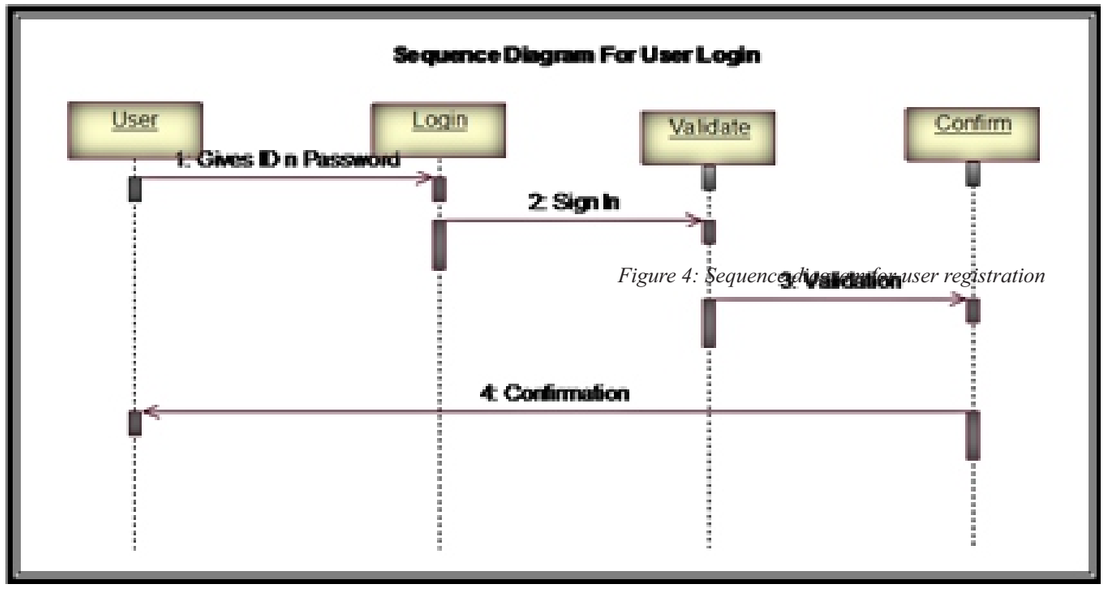

Figure 3: Sequence diagram for user login

Figure 4: Sequence diagram for user registration

Fig. 4 shows the sequence diagram for the user registration

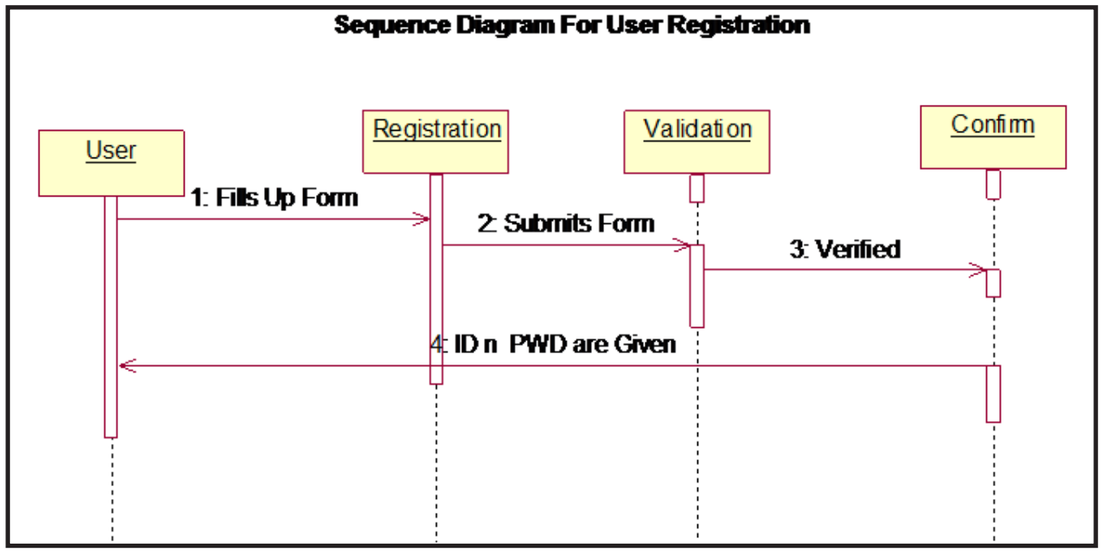

Figure 4: Sequence diagram for user registration

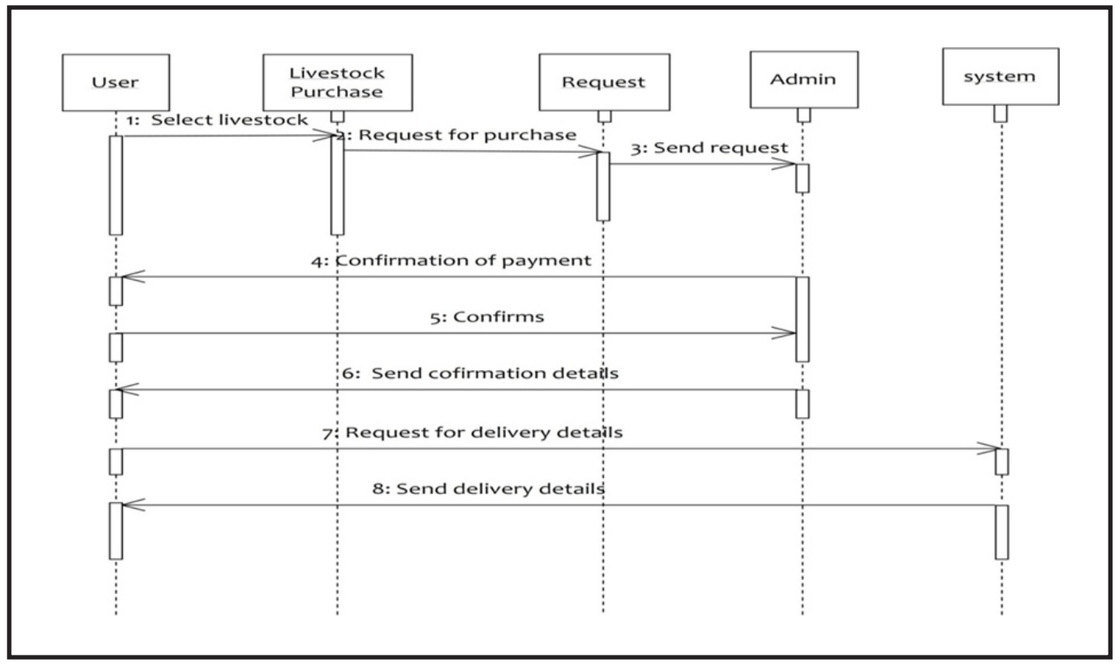

Fig. 5 depicts the input and output phase of the system

Fig. 6 shows the commercial channels for the farm.

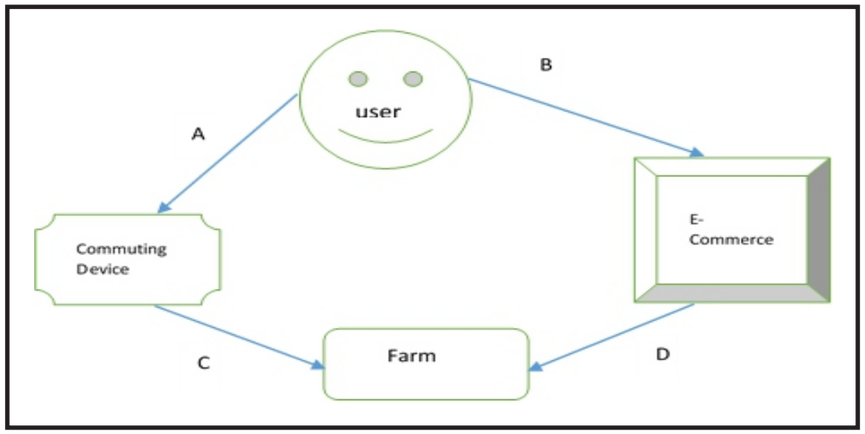

Figure 6: Commercial channels to Farm

In Figure 6 two paths are involved, paths AC and BD. AC deposits COto the atmosphere where BD makes the atmosphere greener, farmers are thus encouraged to adopt BD. Assuming that each client that takes channel AB deposits 20 Moles of CO to the atmosphere. Let X represent the number of clients that visit the farm, on day Y for D days in a week, thus the total number of CO deposited per week = X*D*20 Moles. This indicates that the higher the number of clients that patronize the farm per day, the higher the emitted CO2. From survey, it was observed that 50 to 100 clients patronizes the farm on daily basis, this in actual sense makes global warming alarming.

This research is proffering a solution to this through information technology whose product is e-Commerce, this can actually deliver a greener and more sustainable environment. Path BD is thus preferred.

5.0 DESCRIPTION OF IMPLEMENTATION

Figures 7, 8 and 9 depict of home page, registration page and ordering page. These figures show the specific e-commerce interface for each of the pages. This application gives users all the necessary support in terms of enquiry, booking and ordering. On the back end, it gives farm admin worker the opportunity to update farm record. The adoption of this e-commerce tool, reduces Carbon foot print in turn. This application enhances telecommuting, and thus promotes the greenness of the environment.

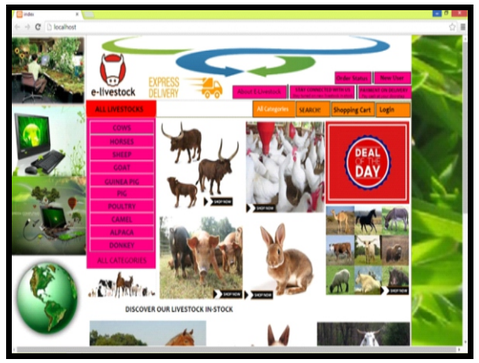

Fig. 7: Home page

Fig. 8: Registration page

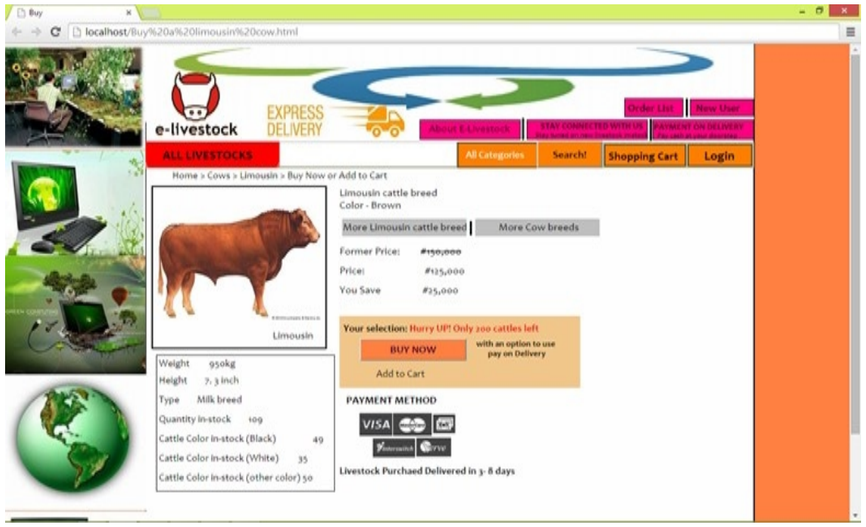

Fig. 9: Ordering page

SUMMARY AND CONCLUSION

Green computing involves reducing the rate of deposition of energy into the atmosphere, and also proper disposal of IT equipment. Telecommuting an aspect of green computing involves reducing Carbon foot print, and in turn reduces the rate of commuting workers and client. E-live stock is a designed website that enables staff and clients to interact, transact and work on-line from their respective homes.

Clients adopt pure telecommuting, because they make enquiry, order, and payment on-line. The admin staffs adopt partial telecommuting because they only have to be at work few days a week, like two or three days in a week to take inventory of stock. Other works can be done through telecommuting. The delivery department staff can also adopt partial telecommuting. This is because they only have to be on farm after affirming delivery details. The adoption of this approach will drastically reduce foot print of Carbon monoxide in the atmosphere, and thus contributing to a greener environment.

REFERENCES

Anwar, M., Qadri, S. F., & Sattar, A. R. (2013). Green Computing and Energy Consumption Issues in the Modern Age. IOSR Journal of Computer Engineering (IOSR-JCE), 12, 91-98.

Dookhitram, K., Narsoo, J., Sunhaloo, M., Sukhoo, A., & Soobron, M. (2012). Green computing: an awareness survey among university of technology, Mauritius students. Paper presented at the Conference Proceeding of International Conference on Higher Education and Economic Development, Mauritius.

Egbuta, I. C., Thomas, B., & Al-Hasan, S. (2014). The Contribution of Teleworking towards a Green Computing Environment Green Technology Applications for Enterprise and Academic Innovation (pp. 218-232): IGI Global.

Johnson, L. (2016). Predictors of job satisfaction among telecommuters. Walden University.

Mankoff, J., Fussell, S. R., Dillahunt, T., Glaves, R., Grevet, C., Johnson, M., et al. (2010). StepGreen. org: Increasing Energy Saving Behaviors via Social Networks. Paper presented at the ICWSM.

Nilles, J. M. (1974). Development of Policy on the Telecommunications-Transportation Tradeoff, Final Report.

Shinde, S., Nalawade, S., & Nalawade, A. (2013). Green computing: go green and save energy. International Journal of Advanced Research in Computer Science and Software Engineering, 3(7), 1033-1037.

Sperling, D., & Gordon, D. (2009). Two billion cars: driving toward sustainability: Oxford University Press.

Ye, L. R. (2012). Telecommuting: Implementation for success. International Journal of Business and Social Science, 3(15).