Collaborative and Adaptive Framework for Telediagnosis and Prescriptions in Herbal Medicine

Ogirima, Sanni Abubakar Omuya, Afolabi, Adeolu Olabode, Baale, Abimbola Adebisi

Department of Computer Science & Engineering, Ladoke Akintola University of Technology,Ogbomoso, Nigeria

Abstract

Herbal medicine has been an age long tradition for the treatment and cure of diseases globally. Previous researches on telediagnosis and prescriptions in orthodox medicine studied applications of modern technological devices which could improve health care services. However, there is yet to be an exhaustive study on the audio-visual technological framework for telediagnosis and prescription in herbal medicine. Hence, the research developed a collaborative and adaptive framework for telediagnosis and prescriptions in herbal medicine. The framework and its system were developed consisting of multimedia features for videoconferencing; ability to record, capture and replay consultations; and capacity for editing, data compression and short message service amongst herbal tele-consultants. The system was experimented on Ladoke Akintola University of Technology hotspot network for a period of twenty one days in order to determine the system's average packet loss rate and packet transmitted with five herbal tele-consultant nodes (node-1, node2, node3, node4 and node5). All nodes were allotted Internet Protocol addresses through which the intending herbal tele-consultant(s) could be connected to the telediagnosis videoconference session. Three performance metrics, System Reliability Index (SRI), System Degree of Relevance (SDR), and System Ease of Usage (SEU) were used to carry out subject to the evaluation of the system by administering one hundred questionnaires herbal consultants to harvest users' perception of the system based on a Likert rating scale. The results obtained from telediagnosis session showed that the system recorded packet loss rates of 3.46, 3.13, 3.42, 3.61 and 3.36% at node1, node2, node3, node4 and node5, respectively. Also, the average packets of 3123.2, 5017.6, 5683.2, 4454.4 and 4249.6 bits were obtained at node1, node2, node3, node4 and node5, respectively. The summary of the subjected evaluation of the system indicate that the respondent's response means of 3.20, 2.88.and 3.42 were obtained for the SRI, SDR and SEU, respectively on a rating scale of 1 to 5.

Keywords: Collaborative, Adaptive, Telediagnosis, Prescription, Herbal medicine.

I. Introduction

Herbal medicine has been in existence for a long time for the treatment and cure of tropical diseases [1]. A Collaborative provision of healthcare service to individuals or a community at distance has help greatly through telemedicine approach [2]. It consists of the managements, practices, prescriptions, diagnosis and consultations for the purpose of curing and treatment of diseases [3]. Herbal medicine is an age long tradition used for the treatment of diseases especially in Nigeria. It is quite cheaper, accessible and close-to nature [4]. In recent times, herbal medicine has found its way as an alternative to compliment orthodox medicine. Therefore, herbal medicine is an alternative to orthodox medicine, otherwise known as traditional medicine in Africa [5]. Herbal medicine is being practiced all over the world, both developing and developed nations. Its medicine is made exclusively from plant. Virtually used in all societies and common to all cultures due to its affordability and is under validation by scientific investigation, which seeks to understand the active chemistry of the plant; many modern pharmaceuticals have been modelled after, or derived from chemicals found in plants [6]. Nevertheless, modern or orthodox medicine has its own disadvantages; the common ones are the issue of price and lack of means to afford the drugs. The present economic situation in Nigeria has made it difficult for people to afford the cost and therefore, this led to patronage of alternative medicine which people use for self-medication. Self-medication is the administration of ethical drugs by a lay-man without a health Practitioner's advice [7]. Collaborative telediagnosis refer to as the provision of media to facilitate the consulting procedures between physicians and the bed-site physician in rural or less-developed areas can consult more specialized or experienced physicians located at the remote site [3] and [8]. Remote physician can therefore examine the patient's medical images; medical documents, real time data from the device connected to the patient, provide

comments and findings to the bed-site physician [9]. Telediagnosis can be defined as the determination of nature of a disease at a site remote from the patient on the basis of telehealth procedures of transmitted data, the new technology for treatment of diseases using telecommunication media such as telephones, cell phones, PDA's, the Internet and videoconferencing has increase health care delivery [10]. However, telemedicine has successfully been applied in orthodox medicine, it can as well be imperative for study to be carried out on the application of modern technology on herbal medicine prescription [3]. Therefore, the application of this study in herbal medicine will support the integration of electronic healthcare services that will bring about collaborative health care delivery to the society in the distributed operating centers is imperative [3].

Review of Related Works

[11] designed a framework that could protect patient diagnostic medical imagery for a well secured telediagnosis. The framework shows a very significant improvement on the security of encrypting images. However, the research does not consider the physical appearance of patient rather stored and forward telemedicine and the developed system is less applicable in practice. The application adaptation determines the marks in the functioning properties used by specific devices [12]. The adaptation server determines and reports the best quality/capacity for data to meet the requirements of the devices. The research does not consider physical teleconsultation of patient but study was based on imagery. [13] presented web-based medical information to support telemedicine system; the idea is to find the suitable information and electronics solutions that could be used for the telemedicine application healthcare delivery. The approach was to manage the multimedia medical databases in a telemedicine system used to provide medical services to a rural healthcare center. The developed system is a Web portal application that functions as a database encapsulating medical information obtained during patient visits. The Web-based data structure can reduce the complexity of accessing medical information. This study, integrated multimedia patient information within the same database system and provide two kinds of user interfaces for different medical service purposes but the concept could not formulation of diagnostic behaviors and build a knowledge base to assist diagnosis and medical assistance to new practitioners. [14] presented Telemedicine: Current and Future Perspectives, that in developing nations, the rural population struggles to use the new amenities of modern healthcare. However, the research does not discuss the challenges and the impact of adopting telemedicine in both urban and rural communities in developing and developed countries. [15] presented a Wireless Emergency Telemedicine System for Patients Monitoring and Diagnosis, the study adopts a continuous collection and evaluation of multiple vital signs, long-term based healthcare, and a cellular connection to a medical center that could help in emergency case and it transfers all acquired data by the internet in normal case. However, the rstudy does not consider physical diagnosis to see the appearance of the patient. [16] presented Videoconferences Systematization and Experiments in Telemedicine. The paper described one of the different modalities of telemedicine, allowing real-time interaction that could enhance health care delivery. [17] developed a framework, Mobile telemedicine system application for telediagnosis using multimedia messaging service technology, the study model a multimedia to send messages to patient in remote areas that may not have access to medication to enhance the capability of MMS technology in message delivery. Nevertheless, the study suffers the ability of seeing the patient health status in appearance. The knowledge about herbal medicines in Nigeria are mainly observed, practiced and passed down from generation to generation verbally. In future, the knowledge on the practices of herbal medicine to treat illness is at risk of being deteriorated or lost. It happens when the practitioners do not have children to inherit their knowledge or the children have no interest in herbal medicine. The skill of practicing herbal medicine could also be imparted to selected people and if none could be found fit to inherit such a skill, the knowledge may likely be with the dead herbal practitioners [3].

There is serious need for exhaustive diagnosis and a prescription concerning a patient to have adequate prescription. Most of these researchers mainly worked on imageries as source of information. The reviewed works do not address African adaptation to herbal medicine and does not addressed the challenges faced by patient's access to a real time telediagnosis.

Therefore, it is necessary to have extensive study on the audio-visual technological framework to enhance herbal medication to provide a real-time platform where tele-herbal consultants could share information using technological devices for telediagnosis and prescriptions of herbal drugs to patient to improve herbal care services.

2. Materials and Method

This is the approach employed in conducting the research work. It first started with designing of an architectural framework, which is meant to factor in the collaborative and adaptive telediagnosis and prescription in herbal medine; the designed framework was implemented on Microsoft visual studio using C#; the performance of the designed system was evaluated on two standards (User's perspectives involve the design, distribution and evaluation of administered questionnaire on 5 point likert scale and System centred evaluation concerning the packet loss during transmission among the herbal tele-consultants); data obtained from the standard evaluations were analysed with aid of Microsoft excel tools; and finally the research considered the ethical issues where permission of the patients used were duly soughted and agreement was consolidated on protecting their privacy. The detail is depicted in Figure 1. The study was carried out in South Western Nigeria and part of North Central Nigeria. The location in which the field work was conducted in the Southwestern Nigeria includes Oyo, Ogun, Lagos, Ekiti, Ondo and Osun State while the North Central Nigeria comprises of Kwara and Kogi States as indicated in the Map (Figure 2).

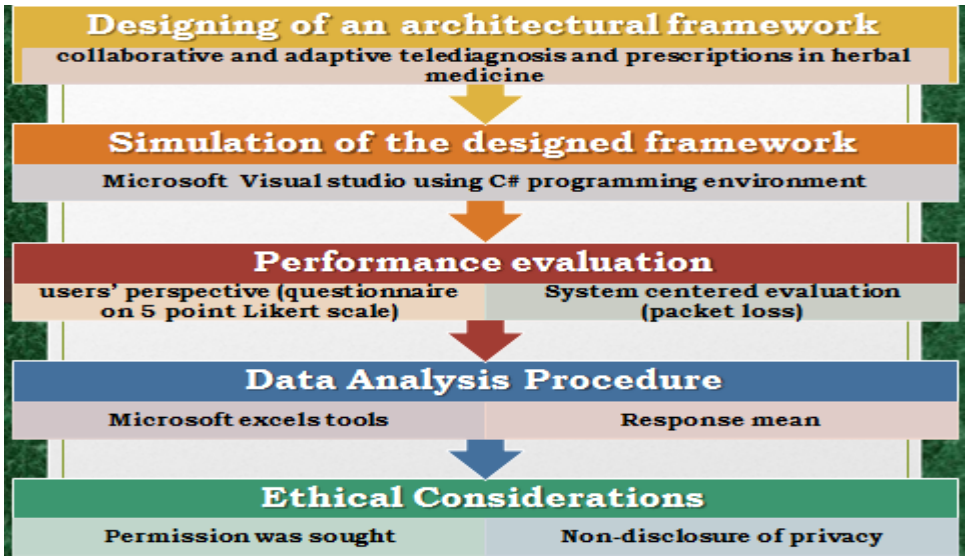

Figure 1: The working principle flow of the research method

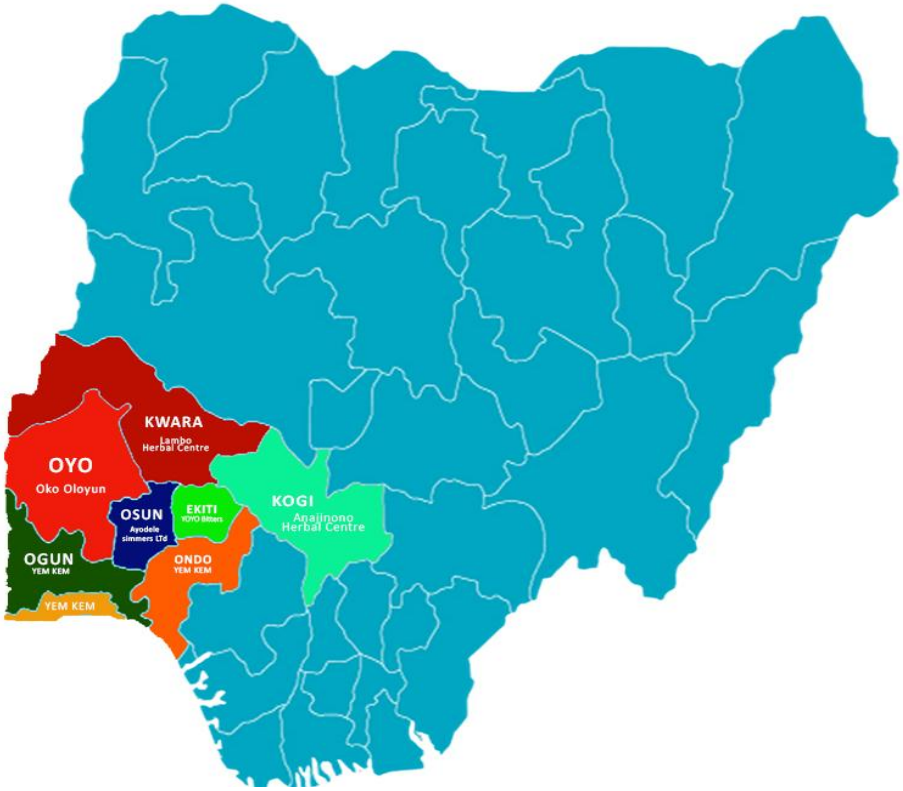

Figure 2: Map of Nigeria showing the study Areas (Vegetation map of Nigeria)

3.1 Working Principle

It is divided into three stages. They include the:

I. Designing

ii. implementation

IIi. Verification

3.1.1 Designing

An architectural framework, which is meant to factor in the collaborative and adaptive telediagnosis and prescription in herbal medicine, was designed to show the system and hardware requirements and specifications as shown in Figure 3.

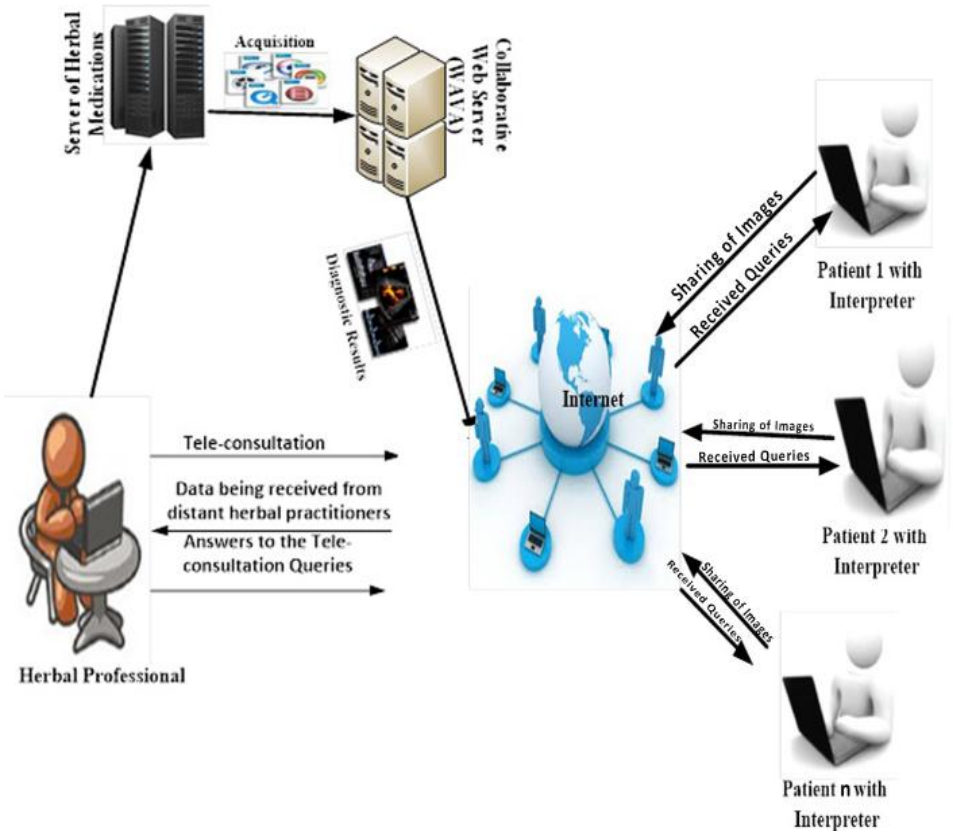

Figure 3: Arctectural framework for Collaborative and Adaptive telediagnosis and prescription

3.1.2 Implementation

The designed framework was implemented based on the flowcart shown on Figures 4 and 5. Figure 4 indicate how tele-herbal consultants to get access to the system with centre (Node) identification number for joint telediagnosis of patients. Figure 5 show the main full accesses to other consultants, in this process if a tele-herbal consultant could not be able to join the telediagnosis session after the fifth trial of connection links probably due to network. The tele-herbal consultant needs to change a channel of connection. Microsoft visual studio C# was used as software tools for the interface as shown in Figures 6 through to 9.

3.1.3 Verification

The system verifies the transmission flow of data during the telediagnosis to check the packet loss to conform with ITU regulations and the comparism of this research work with other reviewed related works. More details in the Results and Discussion.

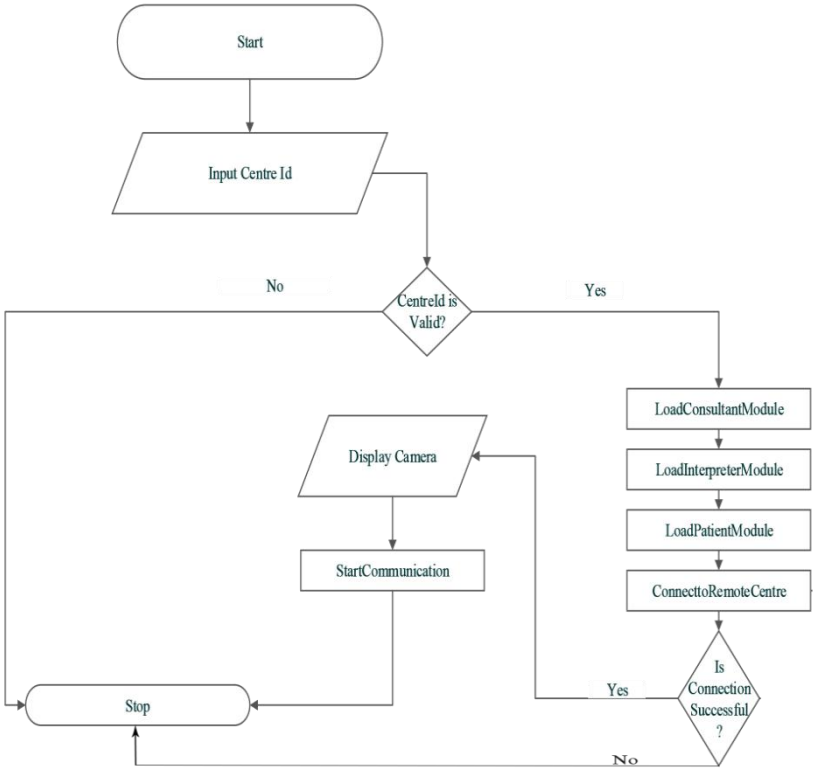

Figure 4: Flowchart for teleherbal consultant having access to other

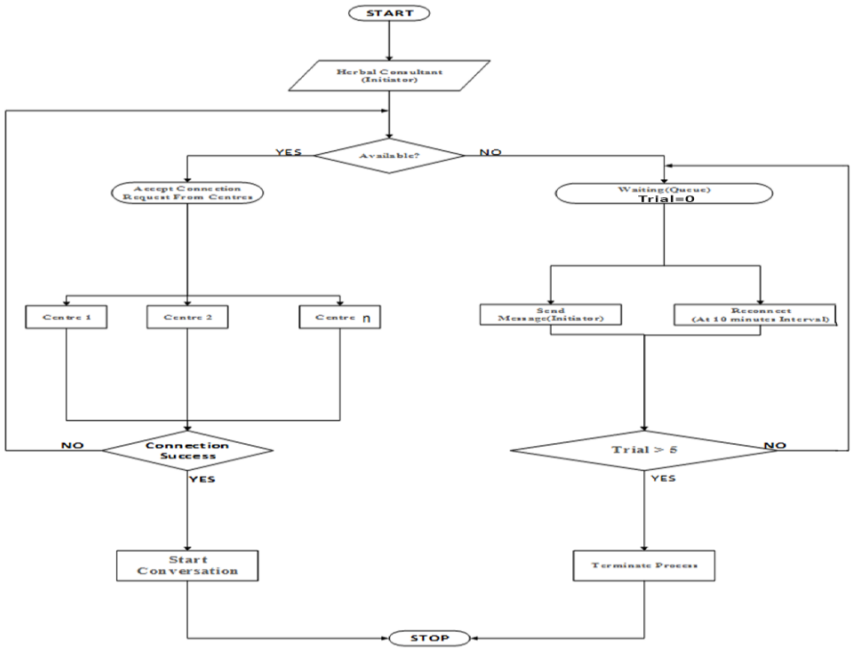

Figure 5: Flowchart for teleherbal consultant on joint telediagnosis session

3.2 Hardware Design of the System Requirement Specification

Basically, the following tools are needed for the integration of the system:

a. High-resolution video camera (polycam) or web camera. A polycam is a video conferencing tool accompanied by a voice transmission enabler. The polycam is connected to the ISDN

lines and to the TV both at the consultation center Microphone. This transmits voice to the speaker.

b. Personal Computer for the storing of information about medication.

c. The Speaker, that enhances the interpreter's and herbal teleconsultant's voice to other herbal practitioners in different location and Chief herbal consultant where the server reside.

d. Facsimile machine and a modem.

3.3 Software Requirement Specification

The needed software required to make the application system work effectively are Microsoft Visual Studio 2010 and above using C# integrated development environment creating, running and debugging programs and well link with internet connectivity.

Figure 6: Home page showing the available navigation

Figure 7: Herbal information

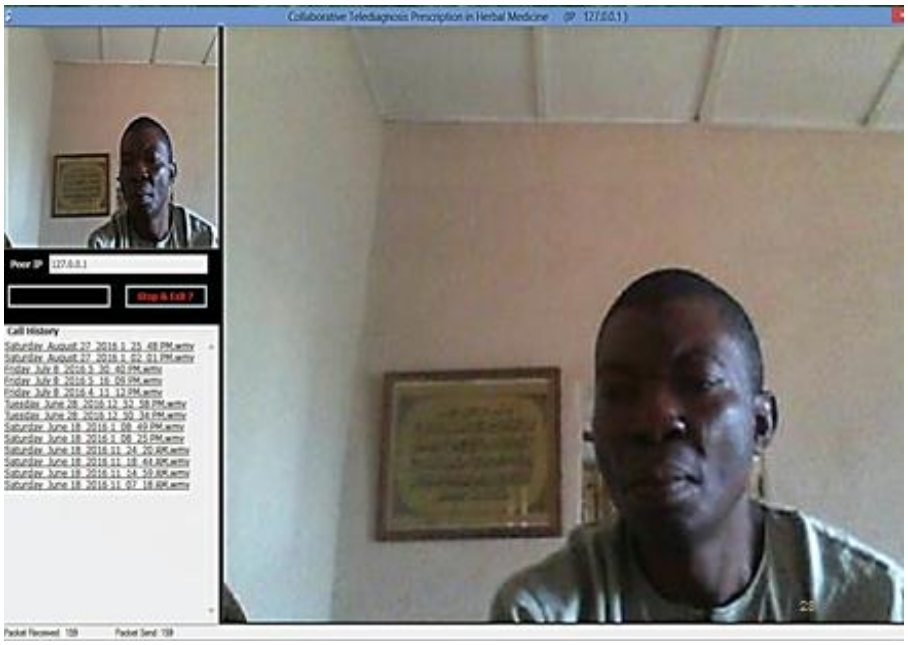

Figure 8: Showing Telediagnosis session

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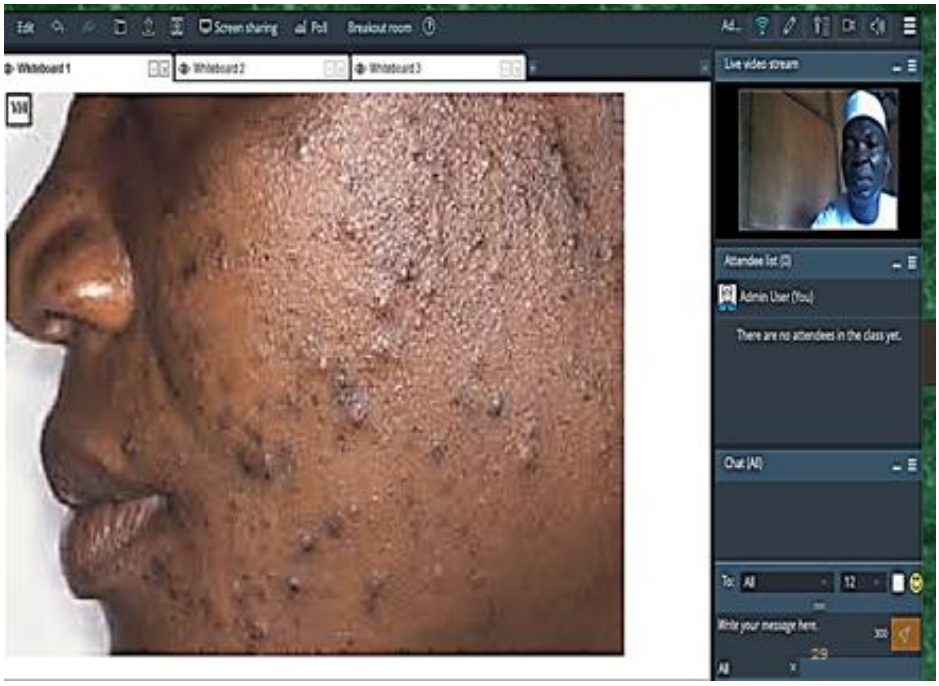

Figure 9: Showing Telediagnosis session

3. Results and Discussion

The results of the system performance was to check system reliability index, system degree of relevance and system ease of usage as performance matrix of the users' perspective from the generated administered questionnaire on 5 point Likert scale with one-hundred(100) understudy questionnaire. The understudies were designed, distributed and evaluated as shown in Figure 11. The system was tested among five tele-herbal centres (Nodes) to check the packet loss during telediagnosis session and the results were generated to conform with the ITU regulation for any data transmission for packet loss rate should not exceed 5% for bits loss in any transmission [18]. The packet loss analysis taken for the 5 centres (Nodes) in 21 days respectively to check the packet loss during telediagnosis session amongs the tele-herbal consultants from the five centres (Nodes) were shown in Figure 12 to Figures 16. The summary of the packet loss rate analysis for the 5 NODES (centres) in 21 days is shown in Figure 17. The total average packet loss rate in 21 days for the 5 NODES was 3.397% bits/seconds. This confirms the claims with [12] on the quality of the loss of precision on images during transmission. The research work also confirms the study of [8] that in a collaborative application user are allowed to share data, but if terminals and network are heterogeneous it is hard to guarantee that no data will be lost.

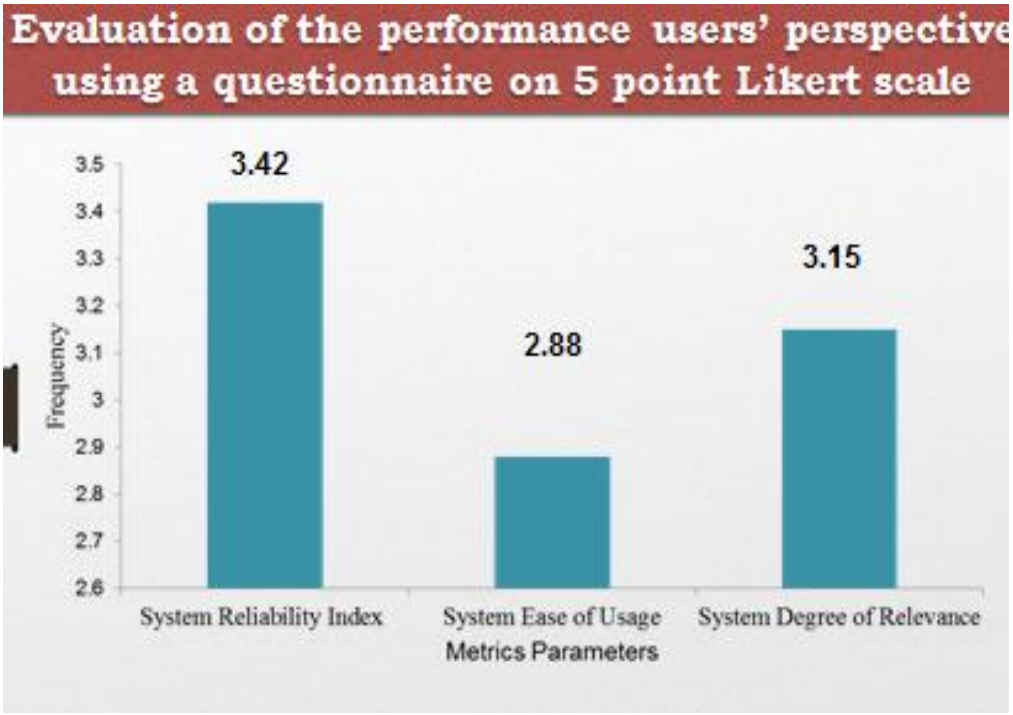

Figure 11: Users' Evaluation Metrics of the System

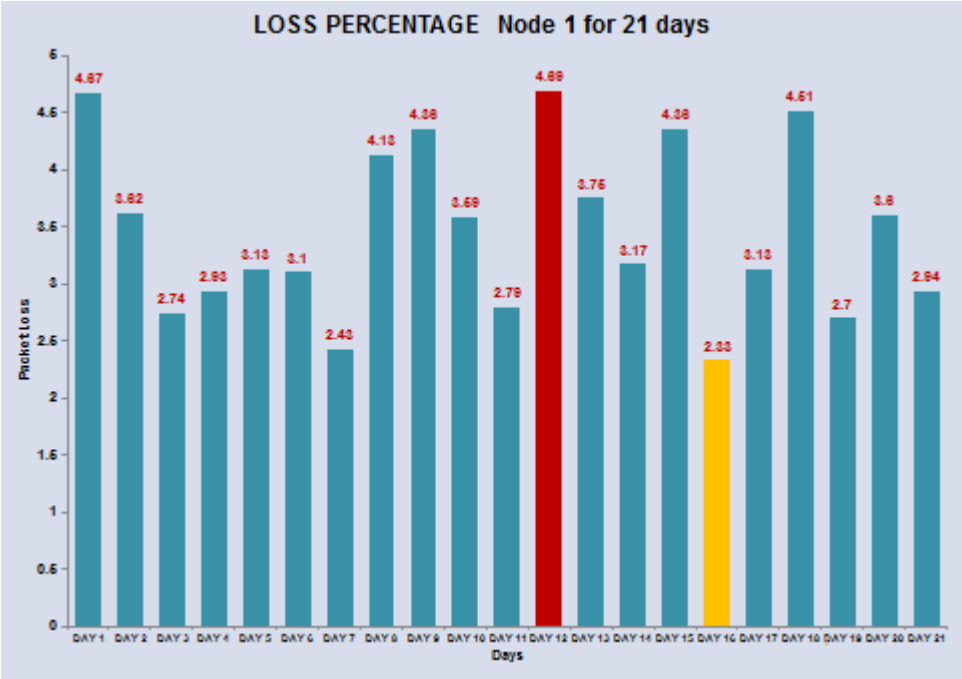

Figure 12: Bar Chart Packet loss analysis for Node 1 for 21 days

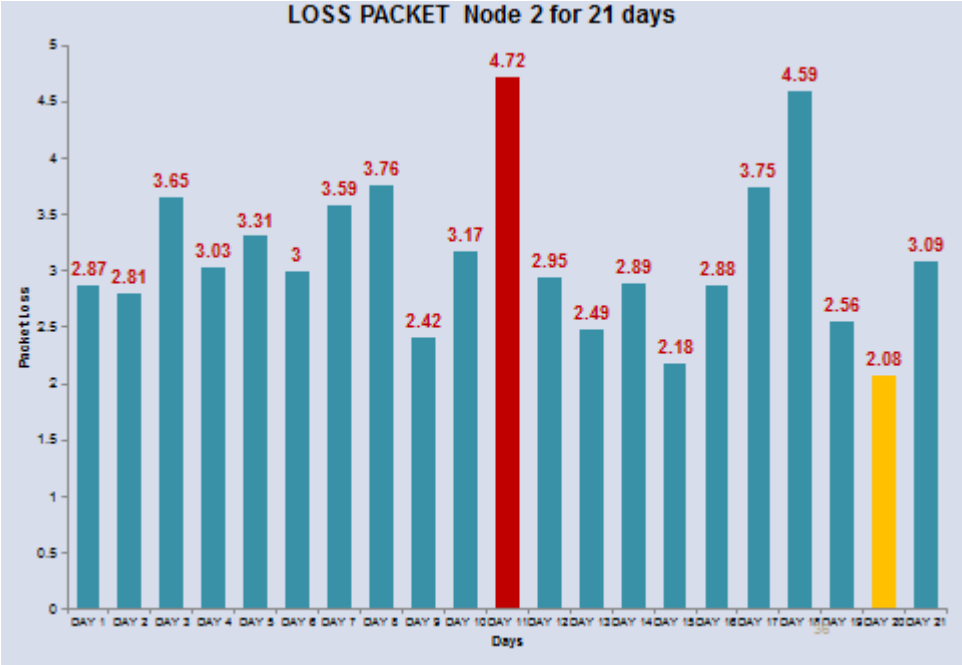

Figure 13: Bar Chart Packet loss analysis for Node 2 for 21 days

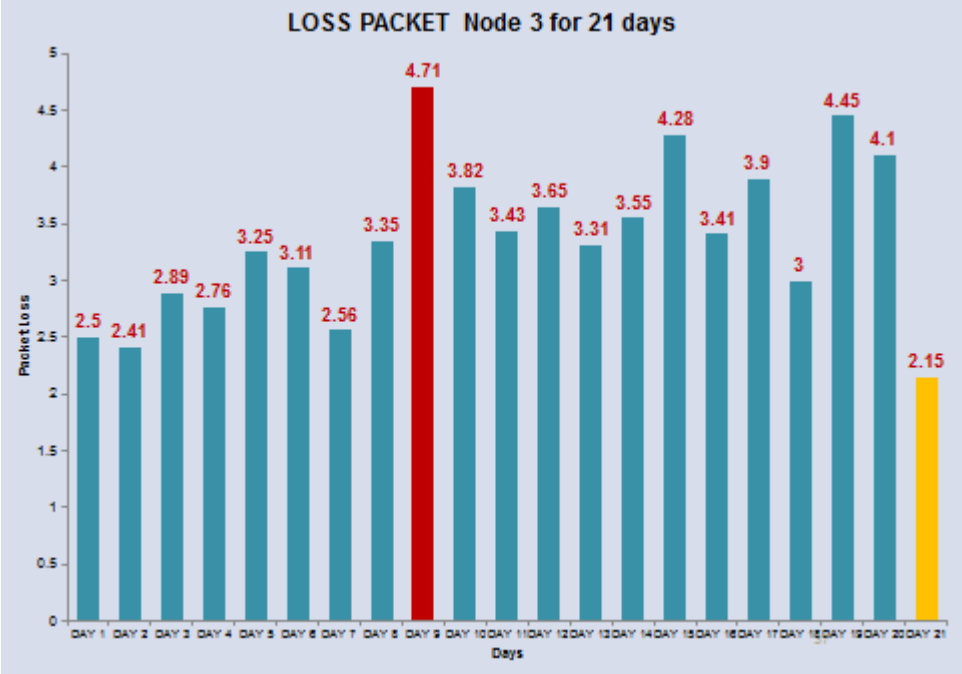

Figure 14: Bar Chart Packet loss analysis for Node 3 for 21 days

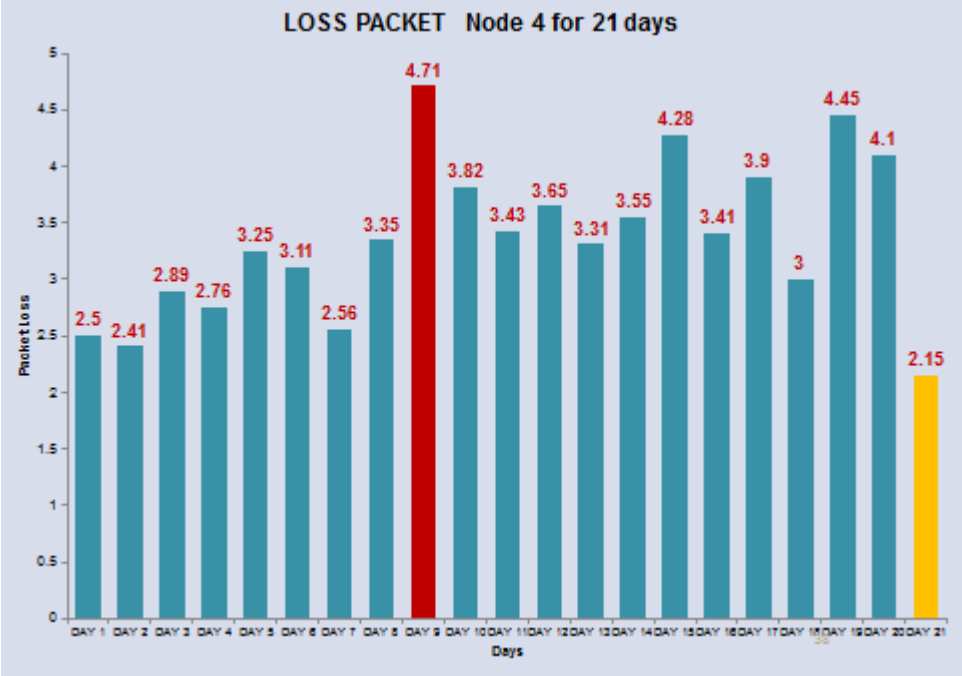

Figure 15: Bar Chart Packet loss analysis for Node 4 for 21 days

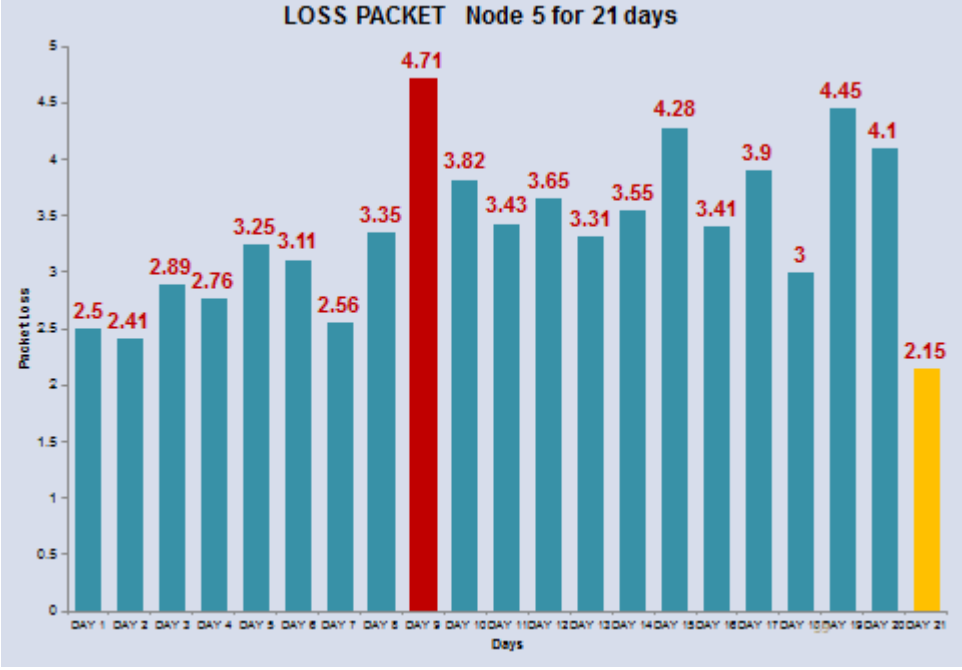

Figure 16: Bar Chart Packet loss analysis for Node 5 for 21 days

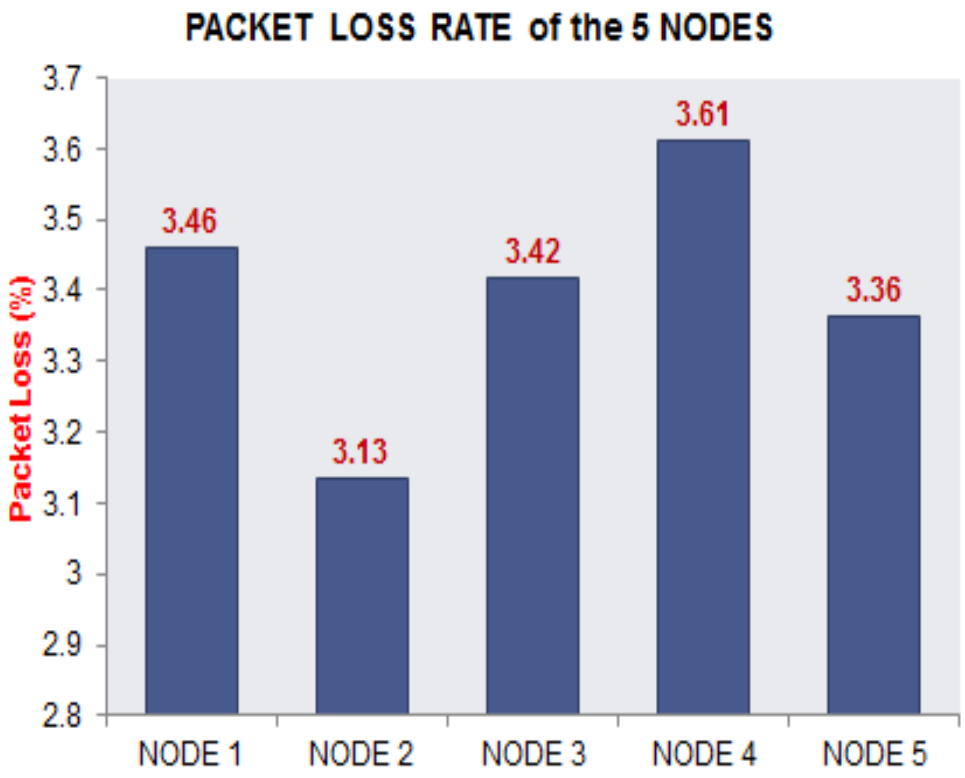

Figure 17: Summary of Packet Loss Rate of the 5 NODES

4. Conclusions

The research paper presents and examined the feasibility of integrating an improved technological framework for telediagnosis and prescription of herbal medicine in Nigeria. It explains how herbal substances are utilized to complement healthcare delivery. It analyzes how technical devices are used to enhance accessibility of information relating to herbal drugs, as well as diagnosis and usage of herbal medicine in the treatment of patients. An architectural framework was designed and developed for teleconsultations. The developed herbal telediagnosis application have capability of assist herbal practitioners in sharing of information about diseases and its treatment on a database using electronic medium for herbal medications. Based on the result obtained the packet loss ranged between 3.13 and 3.61 which is within maximum of 5% recommended by ITU Regulations; the result mean of 3.37 depicts the overall user's satisfaction with most of the features of the system shows that the system is capable of assisting herbal practitioner to make an accurate and timely decision taking. Further research can be carried out on an electronic herbal readiness assessment to access the level of preparedness for the deployment of e-herbal services to other parts of Nigeria; procedure of e-payment for herbal teleconsultations and record keeping in herbal consultation centres; and develop ontology on image transformations for telediagnosis and prescription

Conflicts of Interest

Authors have declared that no competing interests exist.

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