

DEVELOPMENT OF AN INTELLIGENT DECISION SUPPORT SYSTEM TO ENHANCE THE QUALITY OF RURAL HEALTHCARE SERVICE DECISION MAKING

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Abstract:

The challenges faced by rural healthcare institutions are numerous. Unresolved issues for a fair and impartial resource allocation by the government to the urban versus rural communities, very poor ratio of qualified medical doctors to patients in rural areas in Nigeria among others are the challenges. Many rural communities in Nigeria today are characterized by bad roads, few or no educational and healthcare institutions and in general, little or no social development. This project develops an Intelligent Decision Support System that aids the few medical practitioners in the rural communities make decisions faster, more accurate and with less stress.

The proposed system was developed carefully by an extensive review of literatures on the challenges faced by the rural healthcare institutions and also by conducting personal interviews with medical practitioners in the rural communities.

The developed system is able to help the doctors in the rural communities make decisions faster, with less stress and more accuracy by incorporating elements of weak Artificial Intelligence. It also lessens the stress of retrieving patient's medical records as it eliminates the use of paper files.

Keywords: Intelligent Decision Support System, rural healthcare, Medical Information Repository, Artificial Intelligence

I. Introduction.

The challenges faced by healthcare in rural areas across Africa is not new or peculiar to this generation, it has been there since time immemorial. Several years ago, a publication of the Nigerian Medical Association highlighted the stress its members are experiencing on a daily basis. According to the association, with the population size of Nigeria, the ratio of doctor to patient is alarming 1:10,000, in addition to this poor ratio, qualified doctors always prefer to work with popular Federal Government owned tertiary health facilities in the urban areas or the well-established private hospitals compared to working with the secondary and primary health centers in the rural areas (NMA, 2009). This has brought about a lot of unpleasantness to the lives of the inhabitants of the

rural communities such as over crowdedness in the few poorly structured healthcare centers available, over working the few medical practitioners in these communities and so many other disheartening conditions. Therefore, the need to incorporate an Intelligent Decision Support System in the rural healthcare institutions to enhance the quality of services rendered to patient cannot be over emphasized.

Intelligent decision support system is described as decision support systems that make extensive use of Artificial Intelligence (AI) techniques. Artificial Intelligence is the science and engineering of making intelligent machines (McCarthy, 1995).

An ideal Intelligent Decision Support System should behave like a human consultant: supporting decision makers by collecting and analyzing data, identifying and diagnosing problems, proposing possible courses of actions and evaluating the proposed actions (Roger, 2009). The aim of embedding Artificial Intelligence techniques into the Intelligent Decision Support System is to enable the computer system carry out these tasks following the principles a human would apply, only the process is carried out faster than any human can ever imagine. The Development of decision support systems to support intelligent (human like) decision making is an area of research that has gained importance in recent years. Due to the increased complexity of decision making, active involvement of the user and the computer in an intelligent way is necessary in the decision making process that will, in this case, enhance the quality of rural health care service decision making (Druzdel, 2010).

II. Review of Literature.

Nigeria, a country with population of over 160 million people has a large proportion (60%) of Nigerians reside in this rural communities (census, 2011). Also, due to reasons like; economic factors (costs less to live in a rural area), location of birth (some people just can never move out of their comfort zone), age (when most people get to a certain age, they rather move to their rural community).

Nigeria has had its fair share of challenges in almost every sector and the health sector has not been left out. The poor state of the healthcare, education and general living conditions of the citizens has posed a big hindrance to the proper development of the nation.

The rural community in Nigeria is by far better today than what it used to represent some years back. It used to be synonymous with remote areas where mainly local farmers, hunters, fishermen and in general "illiterates" reside. Therefore, it was often short of many modern amenities, a situation facilitated by an idea that even though these amenities were provided, there will be little or no expertise to handle them (Awojobi, 2012).

Qualified medical practitioners do not want to practice in the rural areas due to the condition of living in these areas. All these factors made the use of roots and herbs, visiting divine healers, soothsayers, mid wives, spiritualist etc. the order of the day in treating health related issues in the rural communities. A curative rather than preventive mode of treatment was the orientation with such healthcare resolution techniques. As a result, diseases like measles remained the greatest killer of children (NMA, 2009).

There is a three tier system of healthcare in Nigeria and they include

1. Primary Healthcare (Especially found in Rural areas)
2. Secondary Healthcare
3. Tertiary Healthcare

One major problem suffered by the healthcare sector in the rural areas is negligence by the government who pay more attention to their Secondary and Tertiary counterpart (Awojobi, 2010). We discover that in most communities the ratio of the medical practitioners to the inhabitants is alarmingly small. Thus, causing over-crowdedness in the very few available medical facilities. Making the system not user-friendly, strenuous, involves lot of paper work and time-consuming leading to high mortality rate, Hooliganism and Terrorism: Hunger
After all, the indigenes make up the community, measures that have to be taken to resolve this problem should be done fast (Omorere, 2010).

Decision making is the process of coming to a conclusion or determination about something (Encarta, 2010). A decision is defined as a process of choosing among alternative courses of actions for the purpose of attaining a goal or goals (Simon, 2011). According to Mallach (2009), Decision making in its very simplest form has to do with just making a choice among several present/given alternatives.

Some people believe that simply understanding and outlining the components of a problem and critically looking into these components to identify creative decision alternatives, determine the ultimate quality of decisions. This approach is not exactly correct, as there are a number of cases where such approach cannot be enough to develop a sound and unbiased decision by a human (Simon, 2011). For instance, if a medical practitioner always employ this method of decision making then he's likely to prescribe the same type of treatment to patients with similar symptoms not withstanding whether they are male or female. That's where Decision support systems come in handy. They aim mainly at this broadest type of decision making, and in addition to supporting choice, they aid in modeling and analyzing systems / problems, identifying decision opportunities, and structuring decision problems (Dekock, 2010).

The development of an intelligent decision support system will enhance the quality of rural healthcare service decision making by helping rural medical practitioners to make more quality and accurate decisions in lieu of the many limiting factors in these communities which will in turn enhance the quality of decisions made by medical practitioners practicing in the rural areas of Nigeria and also increase the speed in making diagnoses and prescription decisions.

Decision making is a very stressful process. Even when the choices to make them from are very glaring, there are still a lot of factors that come together to inform our final choices (Simon, 2011).

III. Methodology

The Intelligent Decision Support System (IDSS) integrated with a Medical Information Repository (MIR) that has been designed in this research work is a system that will aid the decision making processes of diagnosing and drug prescriptions by the medical doctor and also with an added advantage of a faster medical record retrieval technique. This system is designed to automate the manual way of medical decision making in the rural area, by making the process faster and even more reliable.

When a first timer/new patient is been attended to, personal and medical information (name, address, family history, blood/urine sample collected for medical test) is obtained by the Admin and used to create a profile for them in the MIR of the IDSS. This process automatically generates an identification number for the patient which he uses every time he revisits the medical center to identify him/herself. The system will help by reducing drastically the time the doctor spends in attending to one patient. For example in the present system it takes approximately 15 to 20 minutes

to attend to a patient by the doctor. The developed system will drastically reduce this time to as little as 5 minutes including salutation time.

The developed system's method of filing patient's record is even more secured than the present system of filing as it incorporates the use of authentication methods (Passwords) to access any item in the system. Each authorized user will have their own unique username and password thus depriving unauthorized users access.

There are three user access levels Level 1 (Admin), Level 2(Doctor) and Level 3(Clerk) and each of them have the degree to which they are allowed to explore the system.

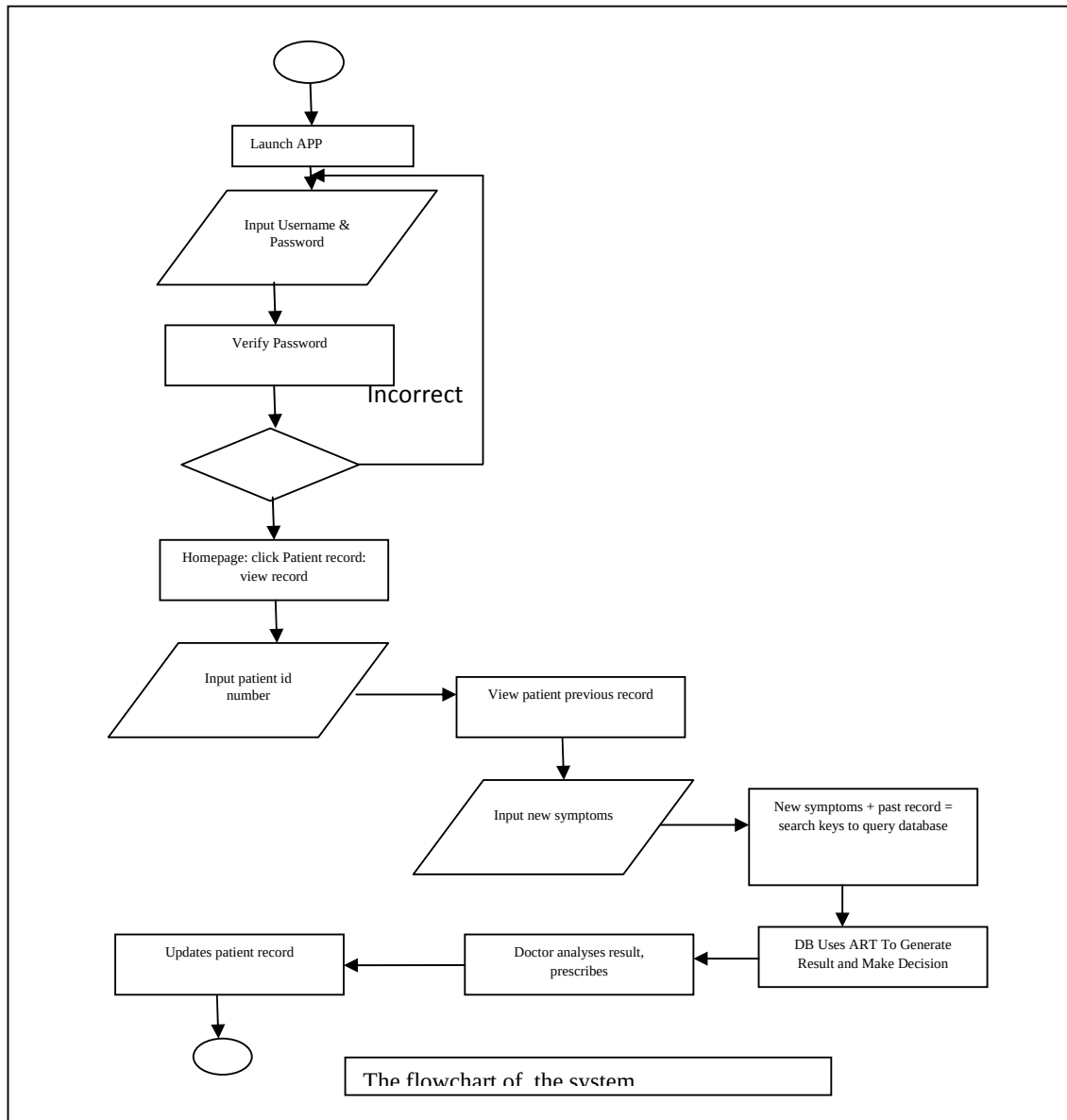


Figure 1: Flow Chart

IV. RESULT

The General Login Page: Every user gains access with their Unique Username and Passwords

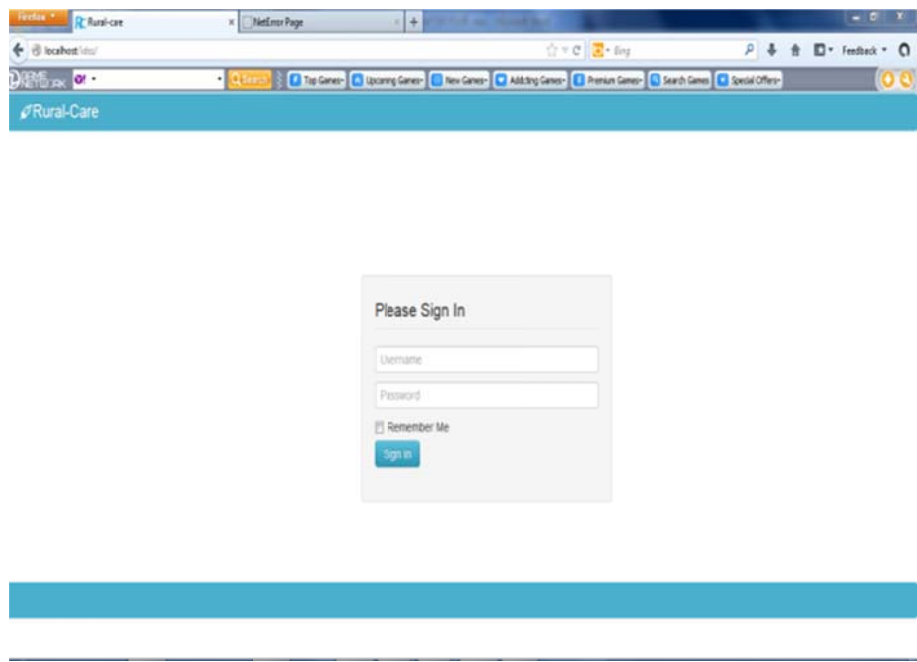


Figure 2: Login Page

The Administrator Home page: The Admin manage Patient, Ailments, Users and the Message subsystems

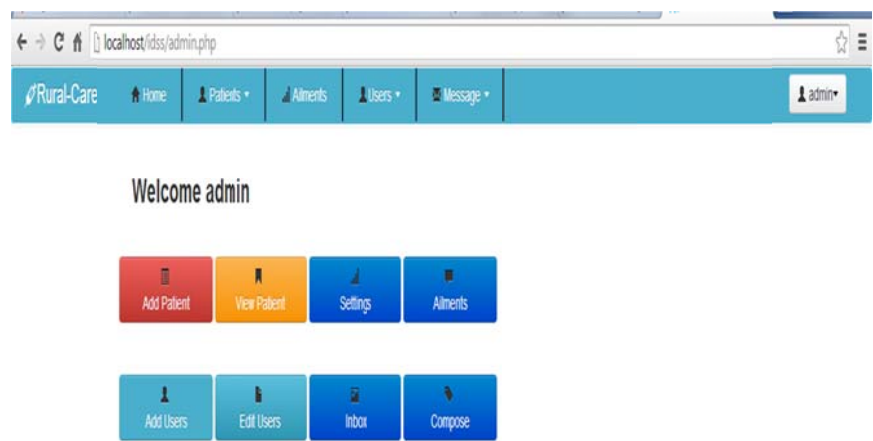


Figure 3: Admin Page

The Medical Practitioner's Homepage: The MP can choose to View Patient Record, Start a new session with patient or use the Message subsystem to communicate with other users.

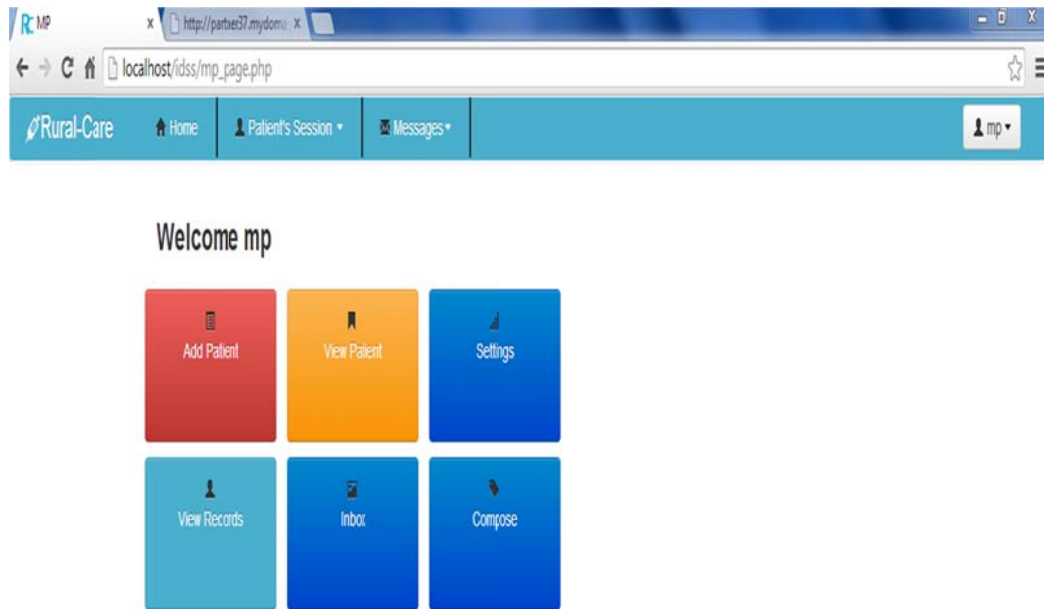


Figure 4: Medical Practitioner's Interface

The Patient's data Entry Page is used by the administrator to add and edit patient's information like Basic personal information and medical history

Firefox Administrator x NetError Page x

localhost/idos/add_patient.php

Rural-Care Home Patients Ailments Users Message admin

Patient EKOSE with ID HC225 Added Successfully

Add Patient Information

Patient Name

Personal Info Title Gender M/Status

Date of Birth

Education

Home Address

Phone Number

Email Address

Doctor in Charge

H-care ID

Medical History

Former Doctor

Former Hospital

Past Illness/Disease

Blood Info Genotype Blood Group

Family History

Eye Defects (If Any)

Allergies (If Any)

Figure 5: Patient's Data Entry Interface

The ailment interface is one of the most important aspect of the system where the name of an ailment, symptoms, cause(s), treatment and other basic information about such an ailment are gotten from.

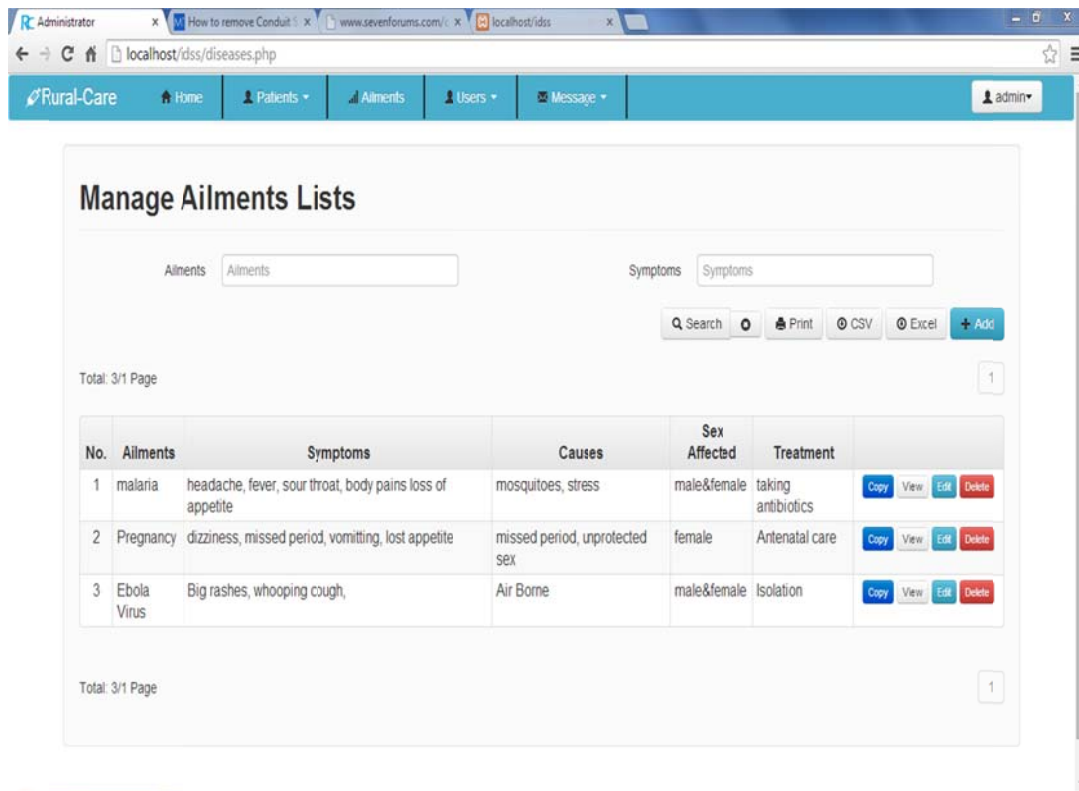


Figure 6: Ailment Management Interface

V. CONCLUSION

This paper is a result of an extensive physical and scholarly research carried out on the rural communities and the challenges they face especially in their healthcare institutions. After carrying out the research to ascertain the challenges faced by the rural healthcare institutions and health care centers, it was observed that the major challenge faced is over crowdedness which has been brought about by reasons of qualified medical practitioners not ready to move to rural areas due to lack of basic infrastructural facilities.. With the development of this system, there is increased timeliness in making decision even with the few Medical professionals present there. Equally, it will help in enhancing consistency in decision making process by the doctors in the rural communities in terms of diagnoses and prescriptions with more accuracy, at a faster pace and reduced stress; thereby eliminating the limitations of humans in decision making.

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