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A Web Based Decision Support System for Soil Classification and Crop Suitability

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ABSTRACT
A Web Based Decision Support System for soil classification and Crop suitability is a virgin research area in Information Technology as regards to Nigeria agricultural sector. In Nigeria, we have a rich pool of agricultural data available yet little or no knowledge gleaned from it. A famous aphorism goes that "we are drowning in data, but starving for knowledge!!" as is the case in the Nigerian agricultural sector. Nigeria faces huge food security challenges. The problems of agriculture in Nigeria beginning with the soil. Most of the farmable land in Nigeria contains soil that is low to medium in productivity. According to the Food and Agriculture Organization of the United Nations (FAO, 2001), "with proper management, the soil can achieve medium to good productivity. With the development of the Internet, Web-based Decision Support Systems (DSS) have become a new trend in DSS research. A DSS for soil classification and suitability solves this problem. The future of this work is to add intelligence to decision making by computing inferential rules and metrics to provide decisions based on data read from our design model. Consequently it becomes possible to tell the soil type that would provide maximum yield in quantity and quality for a particular crop based on computations on the chemical and physical properties of the soil types matched with computations on the chemical properties of the crop, to find the optimal result

KEYWORDS: *Decision Support Systems; Internet; Web-based*

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I. BACKGROUND OF STUDY

Nigeria faces huge food security challenges. Nigeria has about 79 million hectares of arable land, of which 32 million hectares are cultivated. Small holders, mostly subsistence producers account for 80% of all farm holdings. Both crop and livestock production remain below potentials. Inadequate access to and low uptake of high -quality seeds, low fertilizer use, and inefficient production systems has led to this shortfall. Despite a seven percent growth rate in agricultural production (2006 – 2008), Nigeria's food import bill has risen. The growing population is dependent on imported food staples, including rice, wheat, and fish (Nwajiuba C., 2012). Nigerian agriculture contributes to global warming albeit to a small extent through bush burning and other poor land management practices. This matches the findings on the state of agriculture in sub-Saharan Africa, summarized in the international assessment of agricultural knowledge, science and technology (IAASTD,2008.NwajiubaC.,2012).

II. INTRODUCTION

The problems of agriculture in Nigeria beginning with the soil. Most of the farmable land in Nigeria contains soil that is low to medium in productivity. According to the Food and Agriculture Organization of the United Nations (FAO, 2001), "with proper management, the soil can achieve medium to good productivity". To obtain optimum results in crop production, certain strategies must be taken into consideration, which includes the extensive use of arable land and where necessary with the application of irrigation. According to the Global Land Assessment of degradation (Glasod) estimation, in Africa, of the 3.2 billion hectares available which are under pasture, 21 percent is degraded, while of the nearly 1.5 billion hectares in the croplands, 38 percent are degraded in various degrees. The degradation of cropland appears to be most extensive in Africa affecting 55 percent of the crop area, compared with 51 percent in Latin America and 38 percent in Asia.

Soil types in Nigeria are influenced by and follow very broadly, the climatic and vegetation zones of the country. This is expected because the degree of available moisture in the soil is an important factor in soil reactions and fertility and productivity. The soils of the humid tropical forests are quite different from those of the drier forests and the savanna zone, which in turn are different from the savanna zone (Oyenuga, 1967). The major soil types in Nigeria, according to FAO soil taxonomy legends are fluvisols, regosols, gleysols, acrisols, ferrasols, alisols, lixisols, cambisols, luvisols, nitosols, arenosols and vertisols. These soil types vary in their potential for agricultural use (Aregheore, E. M., 2005).The irrational use of agricultural lands as well as the adoption of archaic methods has resulted in the sector producing less than its expected capacity and in the process contributes to the current food security challenges.(Zhi-Qiang, W., &Zhi-Chao, C., 2010)states that more advanced methods and technologies are needed to manage all the information from different sources, and interruptedly analyze all the information to get better strategies for crop production.

Provision of adequate food supply to satisfy the needs of the whole population has always been one the pressing need of every country's government. In Nigeria, one of the reasons for the failure of agricultural plans is underestimating the importance of soil status and, therefore, mismanagement of the nation's soil. This paper deals with the present status/state of Nigeria's soil and the challenges of soil management in the country.

III. MATERIALS AND METHOD

Under this project, a decision support system is developed to enable farmers and soil scientist test for soil suitability based on its physio-chemical properties, such as soil PH, Sandy, Clayey, Loamy soils respectively farmers are expected to register on the site before they can Login and have access to the application Next Neighbour Algorithm was used to develop the system. The software comprises of both the front end (client side)and the back-end (server side)The front-end technology was built using Hyper Text Markup Language(HTML),Cascading Style Sheet(CSS) and JavaScript the Back-end was built using PHP.

Fig 3.0 Graphical user Interface of the prediction software

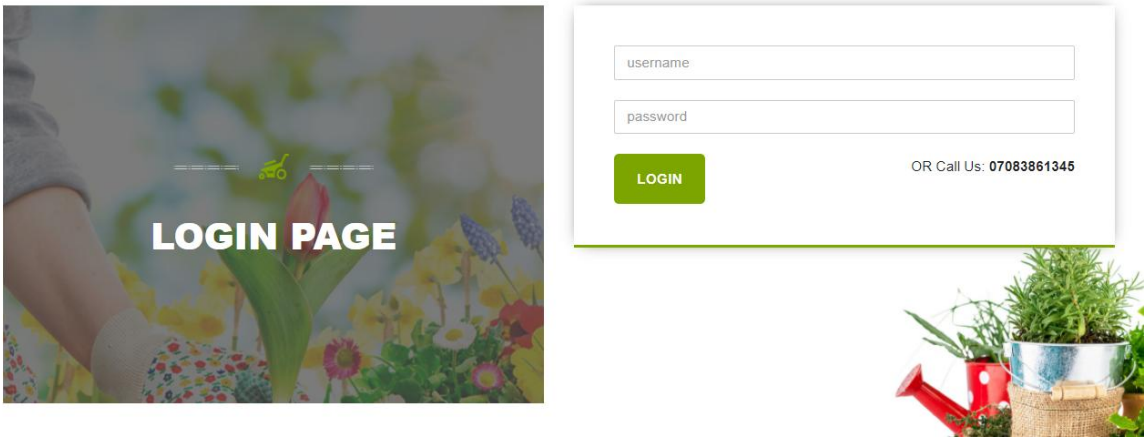

Fig 3.0 Graphical user Interface of the prediction software

The developed tool is simple, and very easy to use and well equipped with flexible user interface. The system requires input data based on the soils physio-chemical properties such as soil PH, sand, loamy, clayey soil respectively. The output of the system will be the suitability classes from non-suitable to highly suitable based on input parameters.

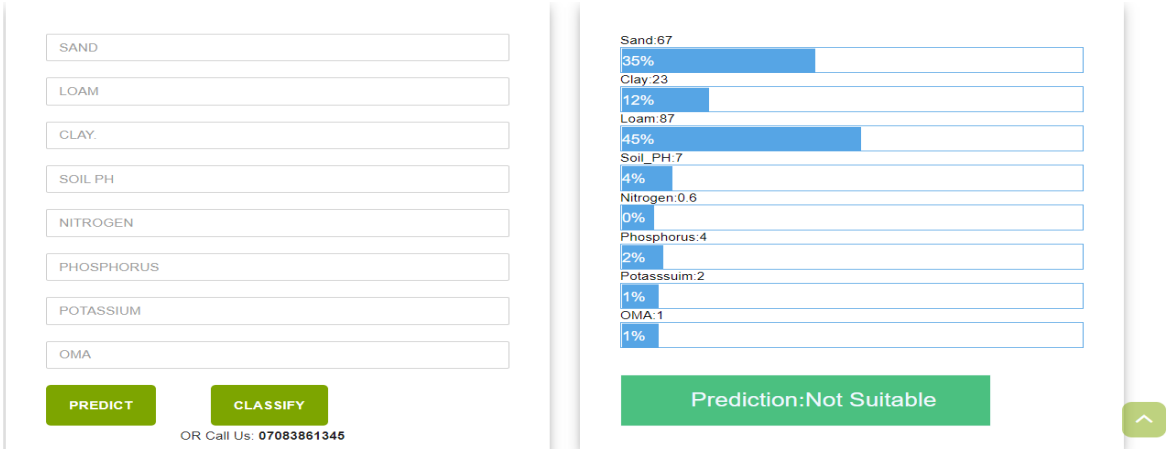

Fig 3.0 Graphical user Interface of the prediction software

The potential degree of suitability of a piece of land was predicted based on the model which was built using php. The system works by providing an interface for the users to input their information concerning the prospective soil. MYSQL was adopted to handle the server-side development due to its capability to coordinate the request-response cycle from the web browser to the server for processing.

With the development of the Internet, Web-based Decision Support Systems (DSS) have become a new trend in DSS research. Compared to traditional DSS, there are two changes brought by the Web-based DSS. First, the underlying architecture for Web-based DSS has moved from mainframes to client-server systems, to Web-and network technology-based distributed systems. Consequently, large amounts of data and related decision support tools from multidisciplinary sources, which may be located in a distributed computing environment, have the possibility to be integrated together to support decision-making.

IV. CONCLUSION

In Nigeria, we have a rich pool of agricultural data available yet little or no knowledge gleaned from it. A famous aphorism goes that “we are drowning in data, but starving for knowledge!!” as is the case in the Nigerian agricultural sector. Various researches and scientific exploration s have been conducted over the years by government agencies, non-governmental organizations (NGOs) and university scholars that have produced ground-breaking results, with huge potentials to take the agricultural sector in Nigeria to the next level. Unfortunately we find this knowledge being swept under the carpet in the archival shelves as the proverbial candle lighted and put under a bushel and not readily available to the common populace especially for the chief implementer, which in this case are the farmers. Those that are available are either too technical for common

consumption or have a narrow spread, hence not accessible to all stakeholders across the country. As this information is not readily made available, it has become quite common for crop farmers to use substandard approaches which have resulted in low productivity in terms of quality and quantity. We also find many farmers holding on to archaic ideas/ methods, therefore not being able to achieve maximum productivity in crop production. A DSS for soil classification and suitability solves this problem. The future of this work is to add intelligence to decision making by computing inferential rules and metrics to provide decisions based on data read from our design model. Consequently it becomes possible to tell the soil type that would provide maximum yield in quantity and quality for a particular crop based on computations on the chemical and physical properties of the soil types matched with computations on the chemical properties of the crop, to find the optimal result. This example and other matrices can and should involve computational analysis to increase decision support.

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