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Android Mobile Informatics Application for some Hereditary Diseases and Disorders (AMAHD): A complementary framework for medical practitioners and patients

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ABSTRACT

Hereditary diseases and disorders constitute a public health problem. Many people in rural communities of developing countries of the world are particularly ignorant about the cause, modes of transmissions and the treatment plans for such diseases. In some cases, some people lack essential knowledge between common and rare hereditary diseases.

It is therefore appropriate and essential to develop a mobile application that will act as an educative resource and a good knowledge base for common and rare hereditary diseases.

The aim of this research is to develop **AMAHD** (**A**ndroid **M**obile Informatics **A**pplication for some **H**ereditary **D**iseases and **D**isorders).

The **objectives** of this research are to create an android mobile application that will act as a reference point and provide useful information about various hereditary diseases to medical personnel and professionals; provide additional educational resource to biological and bioinformatics researchers in different higher institutions; and provide a pedagogical, diagnostic and complementary foundational learning tool for African research students in biosciences, bioinformatics, and all other categories of students that currently engage in multidisciplinary research in the aspect of hereditary diseases.

Essential data was sourced from relevant literature. We developed AMAHD through an integration of programming languages in Java and XML (Extended Markup Language). SQLite was used to implement the database. We developed a **L**ogical **D**isjunction **R**ule-based **A**lgorithm (**LDRA**) for the AMAHD's diagnosis module.

A comparative analysis between existing commercial hereditary mobile applications and AMAHD was conducted and the results presented. A world-wide online survey (spanning Africa, Asia, Europe, America and Australia) was conducted to sample the opinion of individuals across the globe on the classification of hereditary diseases as either rare or common, within their respective regions. In addition, an evaluation of AMAHD on the offline platform was conducted by administering paper questionnaires and asking users direct questions about how they respectively rate the performance of AMAHD based on certain evaluation criteria. Furthermore, a separate evaluation of AMAHD was conducted using online survey monkey. Finally, a comparative analysis between the results obtained from the online evaluation and offline evaluation of AMAHD was conducted and presented.

The results of the surveymonkey online questionnaire revealed that: 58.49% of the participants agreed that AMAHD can be used to diagnose users ailments based on the hereditary disease symptoms they supplied to the mobile application; 13.21% disagreed, while 28.30% of the participants were indifferent. 71.7% of the participants agreed that AMAHD can act as a complementary resource for supplementary healthcare support; 5.66% disagreed, while 22.64% of the participants were indifferent. 88.46% of the participants agreed that AMAHD can be particularly supportive to developing countries where there is less awareness of the deadly effects on hereditary diseases; 1.92% disagreed, while 9.62% were indifferent. Finally, 86.79% of the participants agreed that AMAHD can be useful as an android health application, 13.21% disagreed.

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1. Introduction

Heredity diseases are diseases inherited by offspring from their respective parents. Such diseases are transmitted from parents to offspring. There are thousands of hereditary diseases among humans; some are common whereas some are not. The most disturbing thing about these diseases is that scientists are still trying to decipher the appropriate cure to them. A genetic disorder connotes an illness that results from one or more abnormalities in the human genome. Genetic disorders can cause hereditary diseases or it can result from mutations in DNA. Thus, when defective genes are inherited from parents, or when such defective genes are dominant, hereditary diseases are the outcome. There are currently about 4000 hereditary diseases and disorders; more are still being discovered [1].

A large proportion of deaths in West Africa are traceable to hereditary diseases. This is a public health problem. Inaccessibility to information and knowledge about hereditary diseases and disorders, especially in remote settings of the African continent constitutes another problem. Professor Ibrahim Gambari, Under Secretary-General, Special Adviser to the Secretary General of the United Nations, lamented that: "On Health and Education", he said, "the level of immunization of Children against dangerous childhood diseases, in the South-East is 44.6% immunization coverage, but the North-West has 3.7% and the North-East 3.6%." These childhood diseases span hereditary diseases and disorders [2]. In some situations, medical practitioners who are not knowledgeable, diagnose the wrong disease and prescribe the wrong medications.

The level of ignorance about hereditary diseases and disorders, the lack of comprehensive knowledge about its mode and medium of transmission from one generation to another, is of deep concern, especially among inhabitants of developing African countries. For instance, sickle cell anemia affects many people across different continents of the world [3–4]. Thus, it is expedient that the knowledge of hereditary diseases be made readily available to rural community dwellers in African regions through a mobile informatics approach. These are inhabitants that can read, write and knowledgeable about the use of mobile devices.

With the current trend of software development, focus is gradually shifting rapidly from the web based applications to the mobile platform, in order to foster portability and ease of access to these applications. The aim of this research is to develop **AMAHD** (**A**ndroid **M**obile Informatics **A**pplication for some **H**ereditary **D**iseases and **D**isorders). This will act as a complementary framework for medical practitioners, patients and inhabitants of communities within Africa and other developing continents of the world. The mobile application will help to provide detailed information about hereditary diseases, their symptoms, corresponding causes, and how they can be prevented or treated. It can also serve as a mini-diagnostic tool.

The incidences of genetic diseases between developed and developing countries differ. For instance, in Japan, they do not have high incidence of sickle cell anemia compared to African countries [5]. Different locations have different types of genetic/hereditary diseases and disorders mostly associated with them.

The **objectives** of this research are to:

- Create an android mobile application that will act as a reference point and provide useful information about various hereditary diseases to medical personnel and professionals
- Provide additional educational resource to biological and bioinformatics researchers in different higher institutions
- Provide a pedagogical and complementary foundational learning tool for African research students in biosciences, bioinformatics, and all other categories of students that currently engage in multidisciplinary research in the aspect of hereditary diseases.

The major reason for developing an android mobile informatics application is due to the wide acceptability and usage of android mobile applications. In 2012, according to a web design company based in Dubai [6], it was estimated that 80% of the world population now has a mobile phone, out of which only 1.08 billion are smart phones users. Based on the data compiled on smart phone user's statistics and facts, the android Smartphone platform has the highest market share of 46.9%. This growth is being driven by strong demand for low-cost Smartphone across major regions such as China, India and Africa. Based on these facts, an android mobile application was the most suitable platform for the implementation of AMAHD.

AMAHD contains information on different hereditary diseases and provides easy access to such information. It especially provides the information to curious individuals in order to sensitize them on the negative effects of these diseases. It also acts as a source of information and awareness to persons living with common hereditary diseases and disorders. It further acts as a complementary platform for medical practitioners, those ignorant of hereditary diseases and bioinformaticians in the areas of providing a comprehensive repository of knowledge.

2. Related works

Two separate reviews were conducted in this study. The first was the scholarly literature review while the second was the commercial application review.

2.1. Literature review

We searched for mobile application-related literature for prevalent hereditary diseases between 2003 and 2015 on the following academic indexing systems and databases: IEEE Explore, Science Direct, Scopus, PubMed and Web of Knowledge. Some of the prevalent hereditary diseases were sourced from the WHO Global Burden of Disease Report of 2004 [7]. From the search, we discovered that scholarly literature on mobile applications that dealt with diagnosis and treatments of hereditary diseases were relatively few. So we decided to focus on the review of commercially available hereditary-disease mobile applications.

2.2. Review of existing commercial mobile applications

From existing literature, we reviewed commercial mobile applications (from 2003 to 2013) that have been applied to some hereditary diseases or are still being applied to hereditary diseases from the application stores of different Smartphone brands [8,9], such as Google Playstore of Google Android [10], Apple itunes of Apple [25], BlackBerry World of BlackBerry [26] and Windows Phone Apps+Games Store of Microsoft [27]. The selected hereditary diseases are migraine [11], low vision [12], sickle cell disease [13], depression [14–16], asthma [17–20] and diabetes [21–24]. From a previous study conducted by Martinez Perez and colleagues [30], we were able to extract the tabulated statistical data for hereditary-related commercial mobile applications (See Table 1) with information about mobile applications and the corresponding stores where they were gotten from. After collating the list of hereditary-disease related mobile applications, we conducted a simple comparative analysis between existing mobile applications presented by Martínez-Pérez and colleagues [30] and AMAHD presented by us. This comparison is depicted in Table 2.