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DODI-APP: A Mobile-Based Application for Dog Diagnosis

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Abstract:
Avoidable medical errors on dogs exist which have led to the death of some partly caused as a result of wrong diagnosis, insufficient and inadequate knowledge. Dog owners have had to go through the rigor of consulting protocols such has documentation and location of veterinary clinics which have led to the death of their pets. Dog diagnosis requires an effectively, a quickly and an accurate approach. There is therefore a need to provide an easy-to-access and quick approach to carry out diagnosis by engaging the advantages of smart technology using mobile-based application. This paper proposes a mobile-based dog diagnosis application, DODI-APP for effective diagnosis of diseases in dogs. The Architectural framework and Integration architecture were presented to describe the functionalities of the application. The result showed its ease of use, effectiveness and accuracy of the application. It encourages dog breeders to diagnose their dogs to offer aids before visiting a veterinary clinic and veterinarians to make faster diagnosis and treatments.

Keywords: Dog, Diagnosis, Mobile Technology, Mobile-based, Application

I. INTRODUCTION

Keeping domestic animals have become the flair of men for a long time. These animals are kept for several reason. Some are kept for pleasure while others for security purposes. One of such animals that serves both pleasurable and security purpose are dogs. Dogs have the ability to easy adaptation that by taking exploit for human survival (Schkeeper et al, 2016). As living entities, they are liable to fall ill and need to be diagnose of their illness (Alvar et al., 2004). They appear not to be able to tell in human language of their incapacitation but symptoms are evident in them that they are ill (Sayorkies 2017). The behaviour and disposition of pets like dog need to be well observed by their owners (Ellson, 2008). But most of the time, owners are new and less experienced about healthcare of dogs. By learning to recognize some canine illness symptoms and signals, one will come to notice quite quickly what is wrong with your dog and what action you need to take. Research conducted have been able to show that the challenges in terms of health between humans and dogs are quite close (Herzog, 2011). Some of this health issues includes cancer, kidney disease, fever, epilepsy, diabetes, rabies, allergies, parvovirus, mumps e.t.c. Sometimes, such diseases could be transmitted and communicable which call for an efficient and effective diagnosis system.

There is a great level of economical effectiveness when animal diagnosis is done accurately, precisely and effectively. Mobile technology has become a very advantageous system that have made life and services easier (Hurling et al., 2007). It has gain great relevance in the medical patent environment (Blake, 2008). This technology is yet to be employed extensively in the animal medical environment. Mobile phone diagnosis will make it easier for dog owners to carry out diagnosis and know accurately what illness is affecting their pet. This will prevent the unnecessary expense of time and money in treating a different illness from what is actually wrong with the dog's health. An exploration of the applicability of the use of knowledge-based system technology in dog disease diagnosis domain by employing mobile application. This can aid a diagnosis that is accurate and easy (Yankah, 2015).

This research work addresses the need to provide a means of effectively, quickly and accurately diagnose dogs by dog owners. Also, there is a need to provide an easy-to-access and quick approach to carry out diagnosis by engaging the advantages of the mobile phone technology. Avoidable medical errors on animals exist which have led to the death of some. The wrong diagnosis have partly been a cause for this as well. Insufficient and inadequate knowledge has the potency of making diagnosis ineffective. Dog owners have had to go through the rigor of consulting protocols such has documentation in and location of veterinary clinics which have led to the death of their pets. Some instances where the veterinarian is reached, adequate time is not given to the treatment of the pets. A mobile based system is needed to address these problems.

This paper aims to describe the design and implementation of a mobile application to diagnose and improve early diagnosis of diseases in dogs. The specific objectives of this research work are to study and review existing dog diagnosis study, design and implement a mobile dog disease diagnosis system. This system will serve as a tool for diagnosing symptoms in dog. The rest of this paper are organized as follows: Section 2 discusses the review of the related works, Section 3 the research methodology, Section 4 the implementation and result of the research. Section 5 discusses the conclusion and recommendation on the research.

II. RELATED WORKS

Nowadays the use of computer technology in the fields of medicine area diagnosis, treatment of illnesses and patient pursuit has highly increased. These recent advances in mobile devices and wireless communications has spurred the development of new software techniques and mobile services for widespread healthcare computing (Karan et al, 2012). Some of the related works done by different research scholars in the areas of human and animal disease diagnosis using various methods is presented here.

Rong et al. (2007) explored the dynamics of web-based expert systems for cow disease diagnosis. This web-based intelligent system can mimic human cow disease expertise and diagnose

about 67 types of common dairy cow diseases with a user-friendly interface. The web pages were programmed using html and C# code running from ASP.NET filter which is a component of Internet Information Server (IIS). Users (patient or medical worker) enter the system via the web. It contains a large amount of cow disease data and images, which are used to conduct online disease diagnosis. Additional tools such as a dictionary, information on medicine, contact information of medicine vendors, etc, which help the users to study online are also presented.

Adeli et al. (2010) designed a Fuzzy Expert System for heart disease diagnosis. Like many other diagnosis system, it can mimic the manner of an expert-doctor. The system was designed to accept 13 input fields give out one output field. Input fields are chest pain type, blood pressure, cholesterol, resting blood sugar, maximum heart rate, resting electrocardiography (ECG), exercise, old peak (ST depression induced by exercise relative to rest), thallium scan, sex and age. The output field tells whether heart disease is present or not. It is integer valued from 0 (no presence) to 4 (distinguish presence (values 1, 2, 3, 4)). This system uses Mamdani inference method in Matlab. The results obtained from the system are then compared with the data in upon database and observed the results to be 94% accurate.

Karan et al. (2012) presented a novel approach for diagnosing diabetes using neural networks and pervasive healthcare computing technologies. In the study, three-layered Multilayer Perceptron (MLP) feed forward neural network architecture was used and trained with the error back propagation algorithm. The PDA client application was developed in .NET Compact Framework and the server application was developed in .NET Framework 3.5. Both client and server applications were developed using the C# programming language.

Suharjito et al. (2017) had a motivation to address the issue of reproductive disorders in the cattle farming businesses as a result of ignorance. They proposed an application of an expert system for providing an approach of consultation imitating the reasoning process of an expert to address complex problems related to cow health. They employed a Fuzzy Tsukamoto method to help diagnose the level of risk of disease in cattle based on six clinical symptoms. They employed mobile based technology on an Android environment. The system was able to determine risk level of endometritis for cow's reproduction disease.

This research work proposes a dog diagnosis mobile application that is quick to use and fetch knowledge of disease and treatment for dogs.

III. RESEARCH METHODOLOGY

Design Consideration

The research work considered the use of mobile phone technology for the diagnosis of diseases in dogs. This will make it easier and effective for dog owners to carry out an easy means of diagnosis at their tip of their palm. An android mobile technology was employed in this work. The methodology, architecture and algorithms that are employed will be described in this work. The mobile application in this work is called DODI-APP:

Architectural Framework for the DODI-APP

The framework for the mobile application for diagnosing disease in dogs as shown in Figure 1 describes the components involved in the development. Figure 1 shows the architectural integration of the mobile application technology. The interactions that takes place between each component is also shown. At the stage of design, the system architecture was developed with a consideration of the constraints imposed by the user requirements and the available technology. The following components are involved in the development:

Mobile Devices: This is a component that is used in accessing the application. The mobile application is being launched via this device. The selection of the observable symptoms that leads to the diagnosis is done via this medium. The component can be of different forms or sizes which is not our major consideration in this research work. The consideration is that it has an android operating system.

Interface layer: This layer does the work of interaction between the system and the application. The system provides the result through the mobile interface. This layer grants users access to the required information in the knowledge base via the selection made in the interface. The inference engine comes to a final diagnosis which is displayed by the user interface to the user.

Functional description layer: This layer carries out a description and projection of any existent problem placed in form of a condition that must be met before the diagnoses is done. These necessary conditions is to be met before the system diagnose the result. For example, if the required number of symptoms is not adequately selected, the system issues a signal acknowledging the user of the inadequacies.

Knowledge representation layer: This layer makes provision of the knowledge about problem description, associations among these concepts, and constraints on these concepts and associations.

Knowledge Base: Knowledge base consists of some encoding of the domain of expertise for the system. This can be in the form of semantic nets, procedural representations, production rules, or frames. These rules occur in sequences when the rules are examined by the inference engine, actions are executed if the information supplied by the user satisfies the conditions in the rules.

Inference Engine: Inference engine is the dialogue conducted by the user interface between the user and the system. The user provides information about the problem to be solved and the system then attempts to provide insights derived or inferred from the knowledge base. These insights are provided by the inference engine after examining the knowledge base.

Database Server: Database server is a fundamental part of the system. It is also called the working storage; it works hand in hand with both the knowledge base and the inference engine as a means of data storage. Important details on which consultation or medication is required for the diagnosed disease.

IV ALGORITHM FOR THE DODI-APP OPERATION

INPUT: Selected symptoms S[]

OUTPUT: Diagnosed disease DG, Recommended medication RM

PROCESS:

1: Start

2: for i = 1 to N of all available symptoms

3: if symptoms is observed

4: S[i] = select observed symptom

5: else

6: leave symptom unselected

7: end if

8: return diagnosed disease got from knowledge base

9: return necessary recommendation

10: end for

11: end process

The data were collected via recommendations from veterinarians online to develop the mobile application. This can be gotten through consultations and personal interview sessions with them in areas where they are resident. Their recommendations in terms of feeds, medications and activities can as well be received to aid their recovery from any kind of illness.

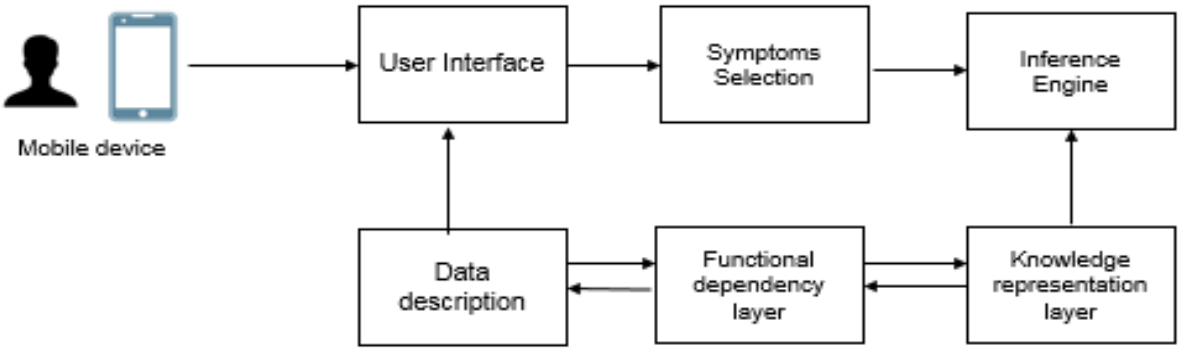

Figure 1: Architectural Framework for the DODI-APP.

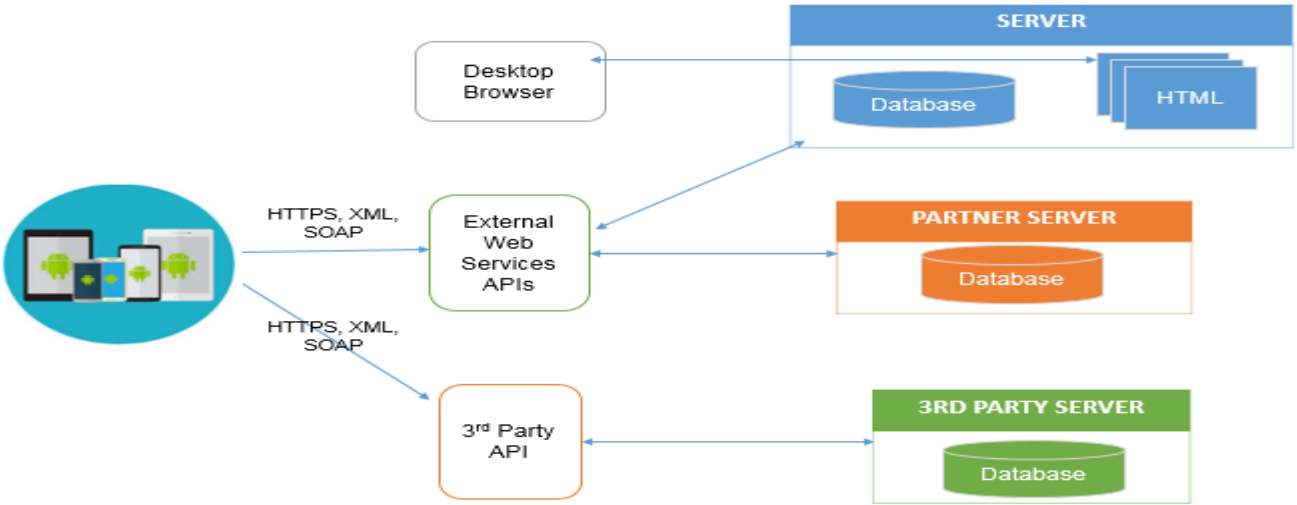

Figure 2: Integration Architecture of DODI-APP

V ALGORITHM TO PERFORM INFERENCE UPDATE ON KNOWLEDGE BASE

INPUT: symptoms S[], disease D[], recommendation R[]
OUTPUT: Upload report
PROCESS:

1: start
2: open update icon
3: for i = 1 to N of all symptoms
4: if symptoms scenario exist
5: check S[i]
6: else
7: uncheck S[i]
8: end if
9: input recommendation
10: return upload report
11: end process

VI DATABASE

The symptoms and recommendations that will be employed in the mobile diagnosis system from the data collected will be stored in the database. The representation of each symptoms that will be used is shown below:

S_1 = Running nose
S_2 = Coughing
S_3 = Vomiting
S_4 = Lethargy
S_5 = Loss of appetite, ...
S_n = Smelly

VII SEQUENCE DIAGRAM OF DODI-APP

Figure 4 shows the sequence diagram of DODI-APP. It reveals how interactions take place between the user, the mobile application and the diagnosis page.

VIII IMPLEMENTATION AND RESULTS

The mobile was developed using Java and XML programming languages on the Android studio environment. The system comprises of various interfaces based on the several sections required for the operations of the system. The sections are;

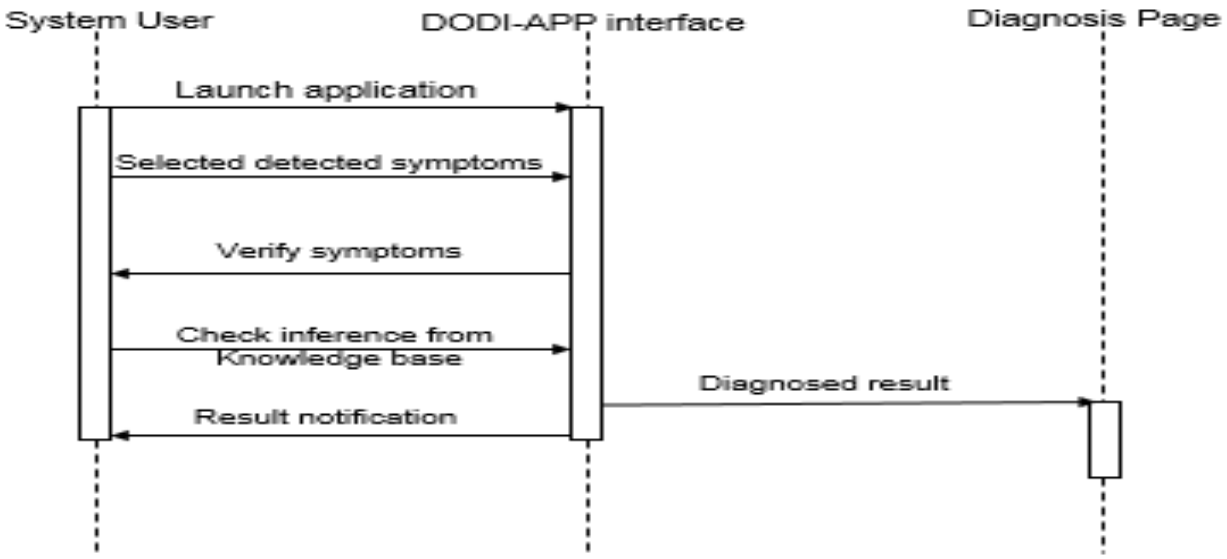

Figure 4: The sequence diagram of DODI-APP operation.

1. Login/Sign up section
2. Diagnosis section
3. Report section

Each of these sections will be viewed and described as they apply to the system one after the other in this section.

1. Login/Sign Up Section

This section has to do with ensuring that the individual who is allowed to access the application has been granted the access by the control agency. Any user who does not have the correct login details will not be permitted to use the system else he/she is advised to sign up. Figure 5 and 6 describes this phase of the application.

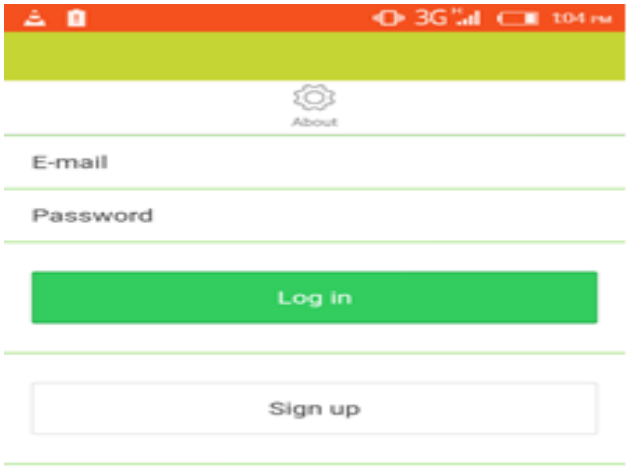

Figure 5: Screenshot of the mobile application login interface.

2 Diagnosis Phase

This phase is where the user selects a number of evident symptoms on the dog and diagnosis what must have gone wrong with the dog. Figure 7 shows a screen shot of this phase.

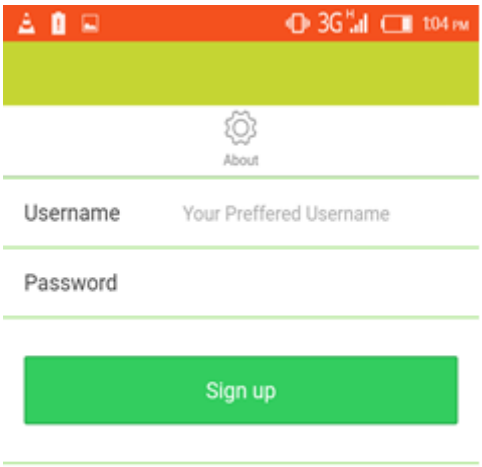

Figure 6: Screenshot of the mobile application sign up interface.

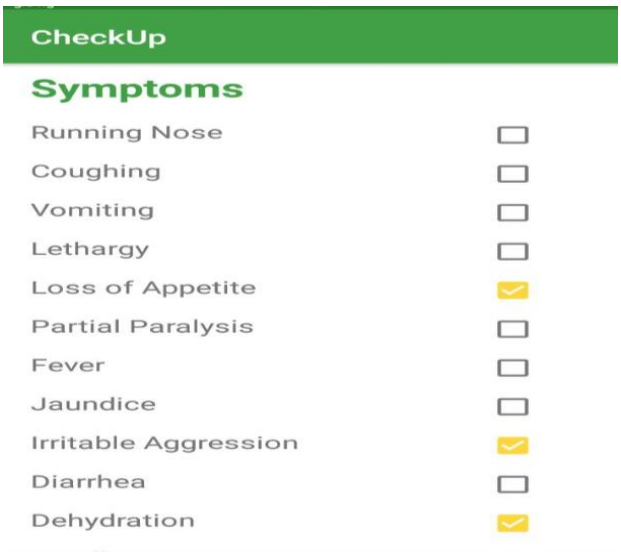

Figure 7: Screenshot of the diagnosis interface of the mobile application

3 Diagnosis Phase

This phase is where the user selects a number of evident symptoms on the dog and diagnosis what must have gone wrong with the dog. Figure 7 shows a screen shot of this phase.

4 Report Phase

This phase of the mobile application shows what the outcome of the symptoms selection is. The application shows the disease and recommendation of treatment. Figure 8 and 9 shows screenshots of sample diseases diagnosed. Figure 10 shows the about interface while Figure 11 shows the exit interface of the application.

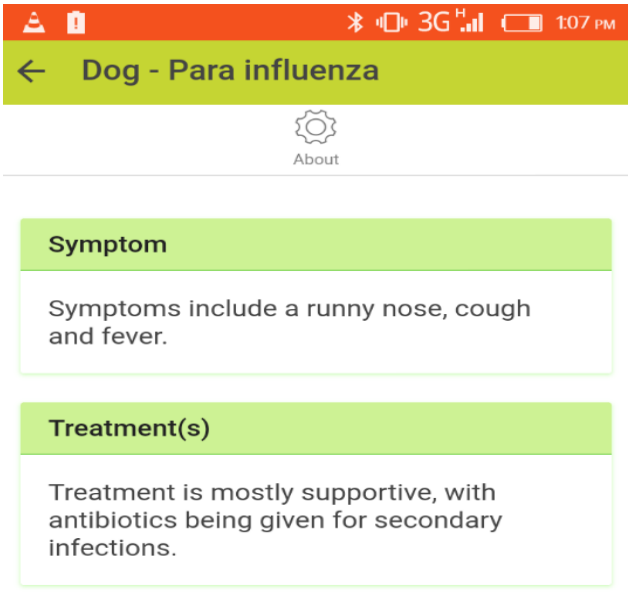

Figure 8: Screenshot of diagnosis report of a Para influenza disease

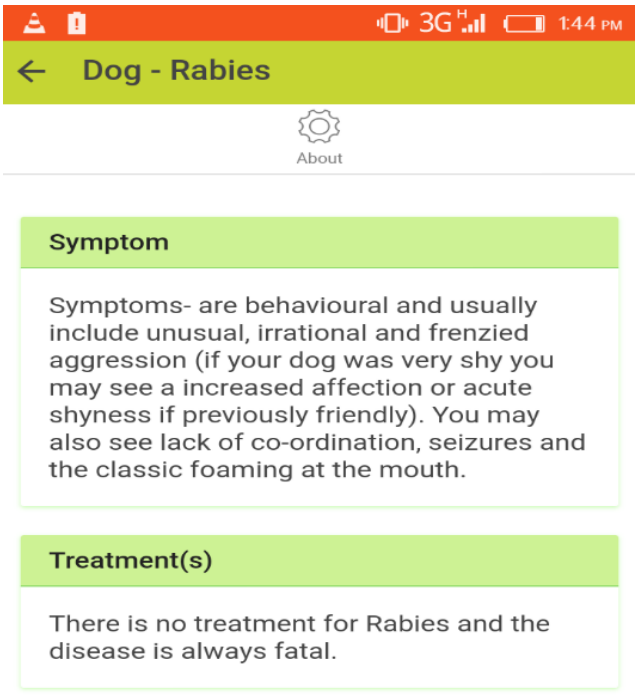

Figure 9: Screenshot of diagnosis report of a Rabies disease

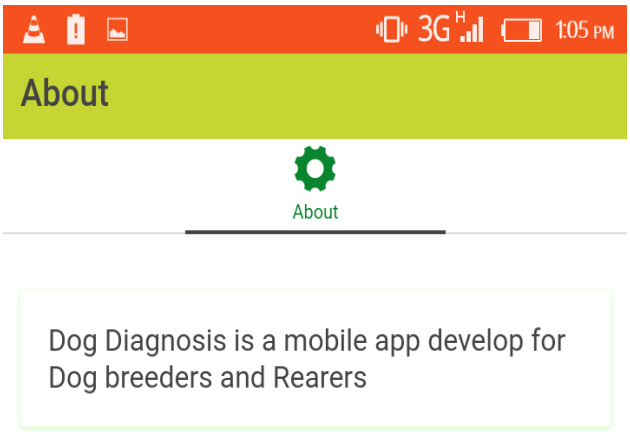

Figure 10: Screenshot of about interface of the application.

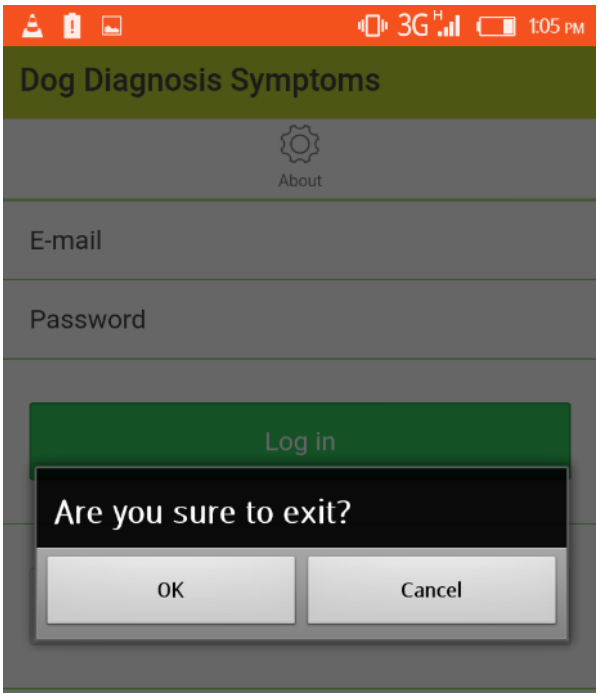

Figure 11: Screenshot of exit interface of the mobile application.

IX CONCLUSION AND RECOMMENDATION

This research developed a mobile application (DODI-APP) for diagnosing disease in dogs. The gross adaptation of dogs for domestic purposes and security in homes necessitates a means of diagnosing them when they are diseased. Though several means have been employed but are not easily done in a quick and easy way that have employed the mobile technology approach. The ability for users to diagnose dog diseases using their cell phone makes it faster to give the dog owner an idea of what have gone wrong with the dog. The application comprises of different phases that includes the registration/login phase, diagnoses phase and report phase. The application have been developed to address the insufficiency of knowledge and delay in passing through protocols in veterinary clinics. The application enhance the mode of operation in terms of efficiency and effectiveness. Veterinary experts could also upload new diagnosis information to the knowledge base of the application whenever they exist. The ability for new discovery of

symptoms to be included is an indication that the system has high level of flexibility.
It is highly recommended therefore that DODI-APP should be promoted and sponsored by appropriate agencies and industries. Also, this mobile application could be given an international support that will make it get to different continents of the world. This system will help diagnosis and recommend treatments of diseases in dogs. Hence, leading faster decision making. Also, the level of dog death as a result of late diagnoses will be addressed. This research work can further be employed in diagnosing diseases in other animals and used in veterinary clinics to further ease the treatment given to animals.

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