Android based Wound Assessment System for Diabetes Type-2 Patients

Ravi Kumar
M.Tech IVsem
SJB Institute of Technology, Bangalore.
Bangalore, India

Mr. Chetan R
Asst. professor
SJB Institute of Technology, Bangalore.
Bangalore, India

***Abstract*: -Diabetic foot ulcers represents an important issues. Now a day's clinicians and nurses examine the wound patient on visual examinations of wound size and healing status, so the patient may not get accurate treatment. Hence a more quantitative and cost-effective examination method is required that enables the patient to take more active care in daily wound care potentially can accelerate wound healing, so it save travel cost and reduce health care expenses. Taking potential action on this we propose a novel wound image analysis implemented on the smartphone. The image is captured by the patient in smartphone it is then uploaded to app it performs the image segmentation process and detects the boundary of the image by applying an effective mean-shift algorithm. Based on the boundary the wound healing process is assessed. So moreover the healing status is quantitatively determined.**

I. INTRODUCTION

For individuals with type2 diabetes, foot ulcers constitute a more affective health issues for 5-6 million individual in US.[1], [2]. Foot ulcers are pain full and make a scratch, hole in foot and very slow to heal. According to survey foot ulcers are the primary cause to lower limb of the patient. For treating diabetic foot ulcers there are several problems first, patient must go to their wound clinic on a regular basis to have their wounds checked by their clinicians. This is not efficient, inconvenient and time consuming for both patients and clinicians, but also it requires a significant health care cost as transportation, wound examination is based on visual examination, as clinicians describes the wound by its physical dimensions and color. Because of the visual examination does not produce objective measurements and quantifiable parameters of the healing status[3]. Tracking a wound's healing process across the world is difficult task for both clinicians and patients. Diabetes is a disorder that affects the way your body uses food for energy, normally the food(sugar) you take in is digested and broken down into simple sugar known as glucose the glucose is then circulates in your blood, it waits to enter into cell to be used as a fuel. Insulin a hormone produced by the pancreas helps to move the glucose into cells, but if the people having diabetes this process breaks down and the blood sugar level becomes very high, people with type-2 diabetes can produce insulin, but their cells don't respond to it. Type-2 diabetes is the most common form of diabetes, if the people having type-2 diabetes the body doesn't use insulin properly.

The improved technology image analysis technic is potential solution to both the problems. Several attempts have been made to use image processing techniques for such tasks. Several approaches suffer from several drawbacks including high cost, complexity and lack of classification. Our solution provides image analysis algorithm that run on an android phone, it is easy to use by the diabetes type2 patients. Our solution makes the patients to actively participate to care their wound. And it is then sent to doctor for analysis, doctor analyse it and send a report to patient back as shown in fig 1.1

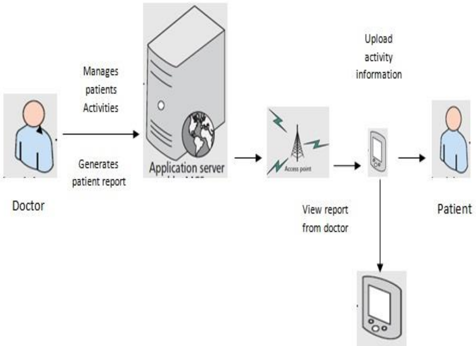

Fig 1.1 Block diagram

In this paper, we present the entire process of recording and analysing a wound image, using algorithms that are executable on a smartphone, and provide evidence of the efficiency and accuracy of these algorithms for analysing diabetic foot ulcers.

This paper is organized as follows, section II provides a design methods, and IIA provides Application security IIB image capturing and uploading IIC Wound image analysis IID Report generation. III provides an architecture of wound analysis system IV provides Experimental results.

II. RELATED WORK

Technology employing image analysis techniques is a potential solution to both these problems. Several attempts have been made to use image processing techniques for such tasks, including the measurement of area, or alternatively using a volume instrument system (MAVIS) [4] or a medical digital photogrammetric system (MEDPHOS) [5]. These approaches suffer from several drawbacks including high cost, complexity, and lack of tissue classification [6]. To better determine the wound boundary and classify wound tissues, researchers have applied image segmentation and supervised machine learning algorithm for wound analysis. A French research group proposed a method of using a support vector machine (SVM)-based wound classification method [7], [8]. The same idea has also been employed in [9] for the detection of melanoma at a curable stage. Although the SVM classifier method led to good results on typical wound images [7], it is not feasible to implement the training process and the feature extraction on current smartphones due to its computational demands. Furthermore, the supervised learning algorithm requires a large number of training image samples and experienced clinical input, which is difficult and costly. the wound boundary determination was done with a particular implementation of the level set algorithm, specifically the distance regularized level set evolutionmethod [10]. The principal disadvantage of the level setalgorithm is that the iteration of global level set function is too computationally intensive to be implemented on smartphones, even with the narrow band confined implementation based on GPUs [10]. In addition, the level set evolution completely depends on the initial curve which has to be predelineated either manually or by a well-designed algorithm. Finally, false edges may interfere with the evolution when the skin color is not uniform enough and when missing boundaries, as frequently occurring in medical images, results in evolution leakage (the level set evolution does not stop properly on the actual wound boundary). Hence, a better method was required to solve these problems.

III. PROPOSED METHOD

A. Application security.

Application has the user registration and password verification for the security purpose. User's registered information's are uploaded to the server. Where the user's activities are witnessed and maintained by the server admin.

B. Image capturing and uploading.

In our system, we use the built-in APIs of the Android smartphone platform to accomplish the JPEG compression and decompression task. The “image quality” parameter was used to control the JPEG compression rate. Setting “image quality” to 80 was shown empirically to provide the best balance between quality and storage space.

C. Wound image analysis

Our quantitative wound assessment system consists of several functional modules including wound image capture, wound image storage, wound image preprocessing, wound boundary determination, wound analysis by color segmentation and wound trend analysis based on a time sequence of wound images for a given patient. All these processing steps are carried out solely by the computational resources of the smartphone. When the wound boundary has been successfully determined and the wound area calculated, we next evaluate the healing state of the wound by performing Color segmentation, with the goal of categorizing each pixel in the wound boundary into certain classes labeled as granulation, slough and necrosis.

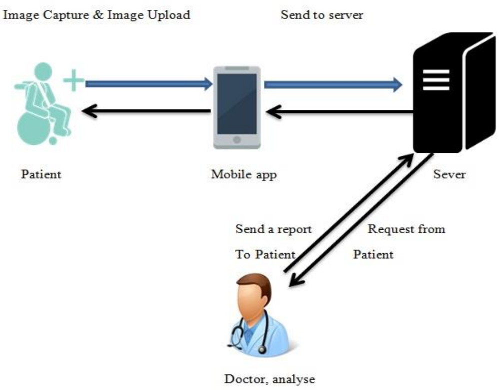

Fig 3.1 Architecture

D. Report generation.

Based on the wound size and patient body pressures and glucose level, the report is generated for the patient and it is uploaded by the doctor in the server. When the patient logins into the mediplus application, he/she will notified with the report.

IV. DESIGN TOOLS

In this paper we use following design methods to implement our solution.Eclipse IDE as integrated development environment as developing tool and it uses android sdk for developing powerful applications. Also used XAMPP(apache, mysql, php pearl) as a server, act as an interface between doctor and patient, and sublime text as a source code editor with python application programming interface so it allows quick editing and simultaneous editing.

V. EXPERIMENTAL RESULTS

To test our system accuracy, we applied mean-shift segmentation based algorithm on two types of images. For the first type, we used 20 images of wound type of moulage. It permits us to test the system.

For the second type, we applied 30 images to test the system. The goal of selecting these typical wound images from type 2 diabetic patients is to provide a more realistic test of our wound boundary determination and color segmentation algorithms. The following are the snapshots of our proposed system, fig 5.1 is the patient login.

Fig 5.1 Patient login

The patient is allowed to enter the patient details as name blood group, age etc. details as shown in fig 5.2.

Fig 5.2 Patient info

The XAMPP server is used to store and retrieve the patient information and doctor report as shown in fig 5.3.

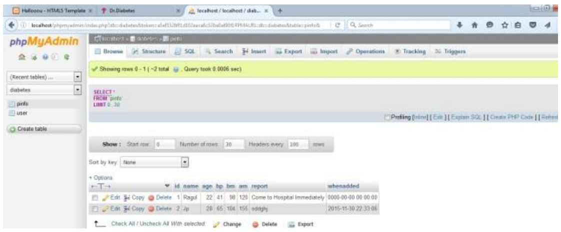

Fig 5.3 Server Storage

Doctor is able to fetch the patient details from server through web interface and analyze it then send the report back to patient as shown in below figures.

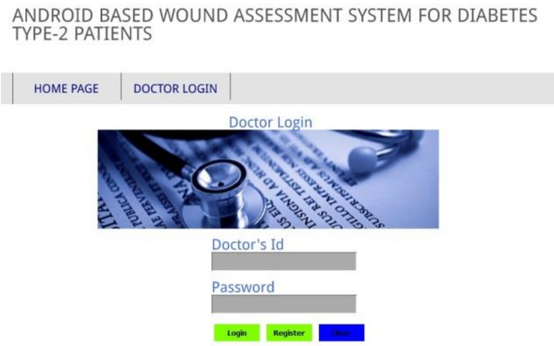

Fig 5.4 Doctor login

Fig 5.5 Doctor View

Fig 5.6 Doctor report generation

VI. CONCLUSION

We have designed and implemented a novel wound image analysis system for patients with type 2 diabetes suffering from foot ulcers. The wound images are captured by the smartphone camera, we have applied our mean-shift-based wound boundary determination Algorithm Analysis of these experimental results shows that this method efficiently provides accurate wound boundary detection results on all wound images with an appropriate parameter setting. Considering that the application is intended for the home environment, we can for each individual patient manually find an optimal parameter setting based on a single sample image taken from the patient before the practical application a fixed parameter setting works consistently well for a given Patient The primary application of our wound analysis system is home-based self-management by patients or their caregivers, with the expectation that regular use of the system will reduce both the frequency and the number of wound clinic visits. One concern is that some elderly patients may not be comfortable with operating a smartphone, but this concern could be addressed by further simplifying the image capture process to a simple voice command. In future work, we plan to apply machine learning methods to train the wound analysis system based on clinical input and hopefully thereby achieve better boundary determination results with less restrictive assumptions. Furthermore, we plan to compute a healing score to be assigned to each wound image to support trend analysis of a wound's healing status.

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