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A Survey on Wound Assessment System Patients of Foot Ulcer Diabetes Identification Based on Smartphone

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ABSTRACT: Diabetic foot ulcers represent a significant health issue. Currently, clinicians and nurses mainly base their wound assessment on visual examination of wound size and healing status, while the patients themselves seldom have an opportunity to play an active role. Hence, amore quantitative and cost-effective examination method that enables the patients and their caregivers to take a more active role in daily wound care potentially can accelerate wound healing, save travel cost and reduce healthcare expenses. Considering the prevalence of smartphones with a high-resolution digital camera, assessing wounds by analyzing images of chronic foot ulcers is an attractive option. In this paper, we propose a novel wound image analysis system implemented solely on the Android smartphone. The wound image is captured by the camera on the smartphone with the assistance of an image capture box. After that, the smartphone performs wound segmentation by applying the accelerated mean-shift algorithm. Specifically, the outline of the foot is determined based on skin color, and the wound boundary is found using a simple connected region detection method. Within the wound boundary, the healing status is next assessed based on red–yellow–black color evaluation model. Moreover, the healing status is quantitatively assessed, based on trend analysis of time records for a given patient. Experimental results on wound images collected in UMASS—Memorial Health Center Wound Clinic (Worcester, MA) following an Institutional Review Board approved protocol show that our system can be efficiently used to analyze the wound healing status with promising accuracy.

KEYWORDS: Android-Based Smartphone, Mean Shift, Patients With Diabetes, Wound Analysis.

I. INTRODUCTION

For individuals with type 2 diabetes, foot ulcers constitute a critical wellbeing issue influencing 5–6 million people in the US. Foot ulcers are agonizing, helpless to contamination and moderate to mend. By. measurements, diabetes-related injuries are the essential driver of non traumatic lower appendage removals and the expense of treatment is assessed at $15 000 every year for every person. There are a few issues with current practices for treating diabetic foot ulcers. To start with, patients must go to their injury center all the time to have their injuries checked by their clinicians. This requirement for incessant clinical assessment is not just awkward and tedious for patients and clinicians, additionally speaks to a noteworthy human services cost since patients might require unique transportation, e.g., ambulances. Second, a clinician's injury appraisal procedure depends on visual examination. He/she depicts the injury by its physical measurements and the shade of its tissues, giving vital signs of the injury sort and the phase of recuperating. Since visual appraisal does not create target estimations and quantifiable parameters of the recuperating status, following an injury's mending process crosswise over sequential visits is a troublesome assignment for both clinicians and patients. Innovation utilizing image examination strategies is a potential answer for both these issues. A few endeavors have been made to utilize image preparing strategies for such undertakings, including the estimation of territory, or on the other hand utilizing a volume instrument framework (MAVIS) or a restorative computerized photogrammetric framework (MEDPHOS).These approaches experience the ill effects of a few disadvantages including high cost, multifaceted nature, and absence of tissue order .To better decide the injury limit and group wound tissues, specialists have connected image division and administered machine learning calculation for wound examination. A French research bunch proposed a technique for utilizing a bolster vector machine (SVM)- based injury arrangement strategy . The same thought has likewise been utilized in for the location of melanoma at a treatable stage. Despite the fact that

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the SVM classifier technique prompted great results on run of the mill wound images , it is not attainable to execute the preparation process and the element extraction on current advanced mobile phones because of its computational requests. Besides, the directed learning calculation requires a substantial number of preparing image tests and experienced clinical data, which is troublesome and expensive. Our answer gives image investigation calculations that keep running on a Smartphone, and in this way give a minimal effort and simple to-utilize gadget for self-administration of foot ulcers for patients with sort 2 diabetes. Our answer connects with patients as dynamic members in their own consideration, meeting the proposal of the Committee on Quality of Health Care in America to give more data innovation arrangements. The generally utilized product cell phone containing a high-determination camera is a practical contender for image catch and image handling gave that the preparing calculations are both precise and appropriate for the accessible equipment and computational assets. To change over a common cell phone into a reasonable gadget for self-administration of diabetic injuries, we have to address two undertakings: 1) build up a straightforward strategy for patients to catch a image of their foot ulcers; and 2) plan an exceedingly proficient and exact calculation for ongoing injury investigation that can work inside of the computational imperatives of the cell phone. Our answer for undertaking 1) was particularly intended to help patients with sort 2 diabetes in capturing ulcers happening on the sole of their feet. This is especially testing because of portability restrictions, basic for people with cutting edge diabetes. To this end, we outlined and fabricated a image catch box with an optical framework containing a double arrangement of front surface mirrors, coordinated LED lighting and an agreeable, inclined surface for the patients to put their foot. The configuration guarantees reliable brightening and an altered optical way length between the sole of the foot and the camera, with the goal that photos caught at

distinctive times would be taken from the same camera edges and under the same lighting conditions. Errand 2) was executed by using an exact, yet computationally effective calculation, i.e., the mean-shift calculation, for wound limit determination, trailed by shading division inside of the injury territory for evaluating recuperating status. The essential inconvenience of the level set calculation is that the cycle of worldwide level set capacity is too computationally escalated to be executed on advanced cells, even with the slender band limited usage in view of GPUs. Moreover, the level set development totally relies on upon the introductory bend which must be pre depicted either physically or by a very much outlined calculation. At last, false edges might meddle with the development when the skin shading is not sufficiently uniform and while missing limits, as often as possible happening in restorative images, results in advancement spillage (the level set development does not stop appropriately on the real twisted limit). Henceforth, a superior strategy was required to take care of these issues. To address these issues, we supplanted the level set calculations with the effective mean-shift division calculation. While it addresses the past issues, it likewise makes extra difficulties, for example, over division, which we comprehended utilizing the area contiguousness diagram (RAG)- based district blend calculation. In this paper, we exhibit the whole procedure of recording and investigating an injury image, utilizing calculations that are executable on an advanced mobile phone, and give proof of the proficiency and exactness of these calculations for dissecting diabetic foot ulcers..

II. RELATED WORK

In [1] Sarah Ostadabbam.et.al, proposed, the criticality of sensor architectural tradeoff in developing the in-shoe plantar pressure monitoring systems. That evaluate the tradeoff by using our custom-made platform for data collection during normal walking. tradeoff also showed that smaller sensors underestimate the total force and may not be placed well to receive the peak pressure. The larger sensors, on the other hand, are more likely to contain the peak pressure, but the reading may be a significantly under-estimation of the peak pressure.

In [4] A.Suresh.et.al, proposed, the Chan-Vese active contour based method for medical purpose to easily identifying of ulcer affected area in a foot of a diabetic patient. Chan-Vese active contour method was used for segmentation. It took into account as of visualization of the diabetic ulcers in the foot and used segmentation and represented with effective ulcer area with color and also in grey color images.

In [5] Simerjit Singh.et.al, proposed, Diabetic foot ulcer is characterized by a classical triad of neuropathy, ischemia, and infection. Each of these has a multi factorial pathogenesis. These factors are compounded by mechanical stress created by foot deformities. The most commonly used classification systems are the Wagner-Ulcer Classification system and the University of Texas Wound Classification. These classifications help to predict the outcome of this condition. Prevention of this condition is paramount to prevent long term morbidity and sometimes mortality.

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Proposed System Procedure

The diabetes foot ulcer Scheme is classified into following technique: Wound Image Analysis System overview.

- Mean-Shift-Based Segmentation Algorithm.
- Wound Boundary Determination and Analysis Algorithms.
- K-Means Clustering Algorithm.
- According to wound Assessments System Several functional module in which wound image capture.

wound image storage in database, wound image preprocessing, wound limit recognition ,twisted examination by shading division by utilizing distinctive kind of calculation, for example, mean-shift calculation mean calculation ,change over all shading image to grayscale ,wound pattern investigation in view of the time grouping of tainted zone for given patient. These whole system steps are done by computational Smartphone. In these strategy because of its magnificent CPU + GPU high determination camera use to picked. The tainted range image is caught through the Smartphone. The JPEG record way of this image is included into wound image database. Compacted image record can't be handled straightforwardly with our primary image preparing calculation. Concurring standard RGB shading model 24bit bitmap record in light of it to requirement for decompressed. This method of image handling step, the first image (pixel measurements of 3264 X2248) that separated by „4" both vertical and level bearing to pixel measurement .i.e816 X612 which has demonstrated to give a decent between the injury determination and preprocessing effectiveness. In these procedure android Smartphone utilize high proficiency stage, According to foot diagram identification come about that can be dictated by wound limit .we do if the foot discovery result is viewed as parallel image around then contaminated range recognize by „White" and rest part set apart as „black" these simple to find the injury limit inside of the foot locale .when the foot limit not shut around then issue turn out to be more confused. By shading division assess the mending condition of wound. After the shading division highlight vector depict the size and measurements of both the injury &original best record which is the most punctual record for these patient.

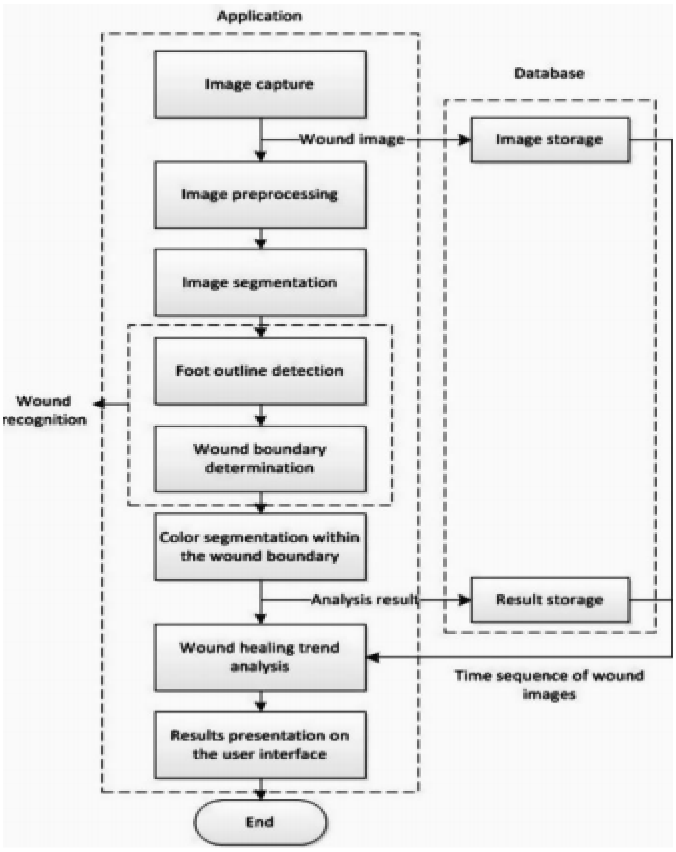

Fig 1: Proposed System Architecture

Now- a -days, we do a Wound limit determination taking into account the foot layout location result. the foot range set apart as "white" and rest part set apart as "dark," it is anything but difficult to find when the foot discovery result is viewed as a paired image with the injury limit inside of the foot locale limit by identifying the biggest associated dark" segment inside of the "white" part. At the point when the foot district limit is found, then the foot limit is not shut, around then the issue turns out to be more confused, i.e., we may need to first shape a shut limit. At the point when the injury range computed around then contaminated injury are distinguish. By movement calculation wound image region are effectively characterized, for example, shading space, spatial space or blend of two spaces it has a place with the thickness estimation based nonparametric grouping technique in mean movement based segmentation. In bunching strategy in which highlight space can be considered as likelihood thickness capacity of likelihood thickness capacity of the spoke to parameter.

Setup phase: A. Patient Registration: In these process Patient name in username field then click on new Patient registration button for creation of new user. Then verification is done and Wound image stored in database. Then Image selection process is done.

1. Image Capture through Smartphone: The mobile application prompts a patient to take an image of their wound, and then it sends the image to the host server. The server outputs the calculated surface area to the application where the data points are stored. The principal components of the solution include the Phone Application, Wound Measurement Code, and Host Server.

2. Image pre-processing: This technique of image processing step, the original image (pixel dimensions of 3264 X2248) that divided by „4" both vertical & horizontal direction to pixel dimension .i.e816 X612 which has proven to provide a good between the wound resolution & preprocessing efficiency.

3. Image segmentation: In case of image segmentation use K-mean algorithm in which infected area detect by „White" & rest part marked as „black" these easy to locate the wound boundary within the foot region.

4. Foot outline detection: User According to foot outline detection result that can be determined by wound boundary .we carry out if the foot detection result is regarded as binary image at that time infected area detect by „White" & rest part marked as „black" these easy to locate the wound boundary within the foot region .when the foot boundary not closed at that time problem become more complicated.

5. Color segmentation: According to performing color segmentation evaluate the healing state of wound. After the color segmentation feature vector describe the size & dimensions of both the wound &original best record which is the earliest record for these patient.

6. Wound healing trend: The wound feature vectors between the current wound record and the one that is just one standard time interval earlier are current trend is obtained.

7. Result analysis: Image will be store in database and system will be analyzes the infected area in percentage. In this technique, we replaced the level set algorithms with the efficient mean-shift segmentation algorithm. While it addresses the previous problems, it also creates additional challenges, such as over-segmentation, which we solved using the region adjacency graph (RAG)-based region merge algorithm.

III. CONCLUSION AND FUTURE WORK

The objective of proposed framework is to give great injury image investigation through the Smartphone. The injury image examination calculation is executed on Android Smartphone utilizing both CPU &GPU. We utilize the mean movement based limit determination calculation to examination of exact injury limit location result. This system Patients are dynamic members in their own particular consideration. For every individual patient physically locate an ideal parameter setting in view of single example image taken from the patient before the pragmatic application. The injury examination frameworks whereby clinicians can remotely get to the injury image and result .All outcome are store in database. Patient"s travel introduction is significantly lessened. Likewise it will decrease the patients stress. Specialist can without much of a stretch investigate the issue through images and its division. The correct report can be given to the patient on time. It"s stayed away from high cost, multifaceted nature, and absence of tissue grouping. It is anything but difficult to utilize gadget for self-administration of foot ulcer for patients with diabetes. The image division can be deciding the layout of foot ulcer and precise injury range are identify. The handling calculations are both precise and appropriate for the accessible equipment and computational assets that time Patient for image catch and image preparing gave. For constant injury examination that Design an exceptionally effective and precise calculation. That can work inside of the computational requirements of the Smartphone.

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