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Low Cost System for Malaria Detection using Mobile Phone

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ABSTRACT
In this paper, we propose a novel method to identify the presence of malaria parasites in blood image. Malaria is deadly infection disease affecting red blood cell in human body due to the plasmodium effect. In 2015, there is an estimated death toll of 438,000 patients out of the total 214 million malaria cases reported worldwide. Automated evaluation process can decreases the time needed for diagnosis of the disease. Thus building an accurate automatic system for detecting the malaria cases beneficial and has huge medical value in medical field. Here developing a new model which is reliable mobile phone Android application platform for blood image analysis and malaria detection from thin blood film images. The main objective is to achieve the performance equal to or better than the manual process. It is based on novel Annular Ring Ratio method which used to detect the parasite from the image. The methods utilize basic knowledge on different cell structure and brightness of the component due to the sample images and detect the location the RBC. The developed application detects the blood component such as normal RBC and infected RBC parasites. The application also recognizes the life stage of the malaria parasites and calculates the infected cell in percentage.

Keyword: -Malaria, Android platform, Java, RBC, Morphological operation, Annular Ring Ratio method

I. INTRODUCTION

Malaria is one of the severe diseases causes by the protozoan parasites of the genus Plasmodium, transmitted via female Anopheles mosquito. According to the WHO, this parasite is responsible for passing to more than two million individuals and approximately 300 to 500 million infection cases annually [1]. Normally malaria causes because of four types of plasmodium species called Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae. Among all of this Plasmodium falciparum is responsible for malaria fever in most of the cases. The diagnosis of the disease requires powerful and expensive tools unavailable for the poorest countries of the world. In manual processing method Microscopic malaria diagnosis is, by far, consider the most effective diagnostic method, but it is highly time-consuming and labor intensive. The accuracy of the system slowly depends on the expertise of the microcopies. Techniques widely involved in Malaria diagnosis are RDT (Rapid Diagnostic Test) and PCR (Polymerase Chain Reaction) tests. Hence, the accuracy of these tests depends on the extent of infection with sensitivity directly proportional to the level of infection.

There are various new techniques available for malaria diagnosis; conventional manual microscopy examination of peripheral blood smear is the gold standard & the most prevalent diagnostic technique for malaria. However due to the number of steps involved in manual assessment, this diagnostic method is time consuming and it is clear that to detect parasite from giemsa blood sample trained and experienced technicians or pathologists are needed to diagnosis.

In proposed system provide, a reliable automated Android based diagnostic platform, without expert intercession for the effective treatment and eradication of the deadly disease, which can be deployed in all the Android based mobile phones and tablets. The focus of this study is to develop a robust, unsupervised and sensitive malaria screening technique with low material cost and one that has an advantage over other techniques in that it minimizes human dependence and therefore, more consistent in applying diagnostic criteria

II. SYSTEM OVERVIEW

The flow of system shown in fig. using the mobile phone which going to detect the whether

person is suffering from malaria or not. In addition it will detect the life stage of malaria.

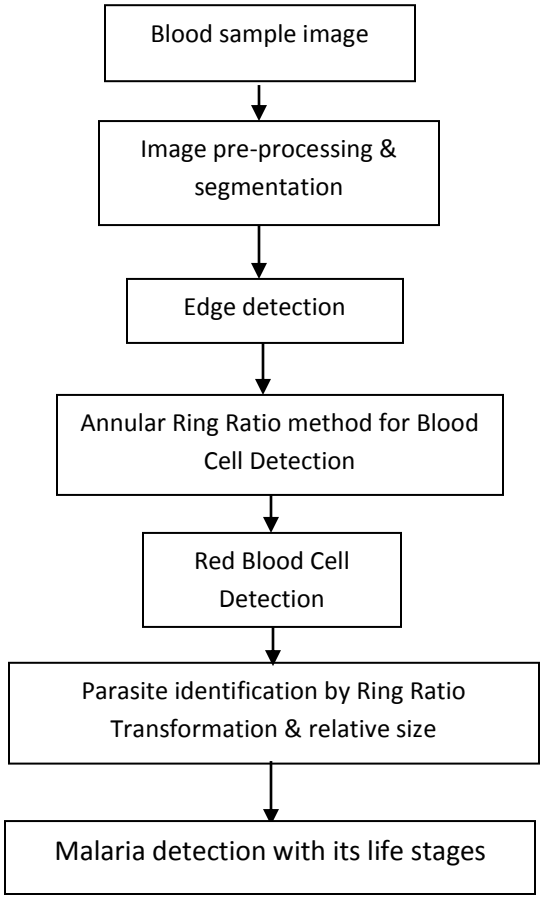
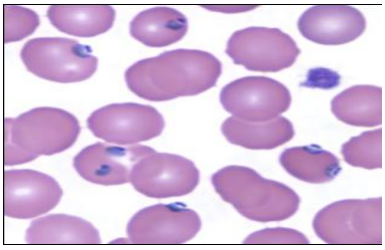


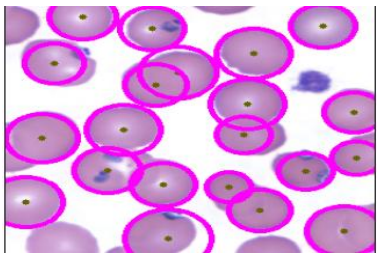
Fig 1: Flow of System

III. TECHNIQUE FOR MALARIA DETECTION ON ANDROID MOBILE PHONE

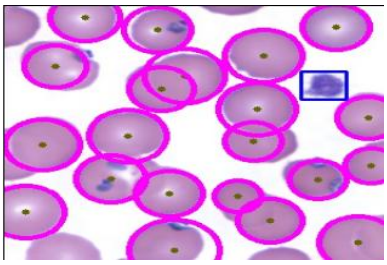
The first aim of blood image analysis for malaria parasite detection is to recognize the different objects present in the blood images previously to differentiating them as parasites and non-parasites. The foreground region of an infected blood image consists of RBCs, WBCs, parasites and any artifacts or noises induced by various other imaging factors. A sequence of image processing techniques is used to differentiate them. Once the cells are detected, a modified ARR method is performed to detect the center of each RBC also detect the boundary of each cell.



a) Blood Sample Image



b) Boundary detection of each cell



c) Infected Cell Detection

Annular Ring Ratio transforms method which detects peaks of intensity at the center of each RBC in the image. A peak detection algorithm we will use to determine the co-ordinates of each RBC. If then undergoes morphological filtering operation which involves dilation followed by erosion method using different structuring element (SE), a concentric ring SE for dilation and a disk shaped SE for erosion.

The radius of the structuring element depends on the radius of the RBC. ARR transform method calculates the ratio of intensity of outer cell to the intensity of inner cell by means of an annular ring-structuring element. Io is the average intensity

inside the annular ring & Ii is the average inner disk intensity. Annular Ring Ratio defined as the following,

$$ARR = max[(Io/Ii - 1), 0]$$

This method produces peak intensity at the center of each cell. The location of this peaks are sub-sequent found by searching the regional maxima in the ARR transformed image using circular structuring element. It will differentiate the WBCs & RBCs; the mean intensity of the region connected to each pixel of the closed image at location provided by the ARR transform is calculated.

IV. MOBILE PHONE DEVELOPMENT ALGORITHM

The implementation of the application on Android Operating System needs specialist software for Android & Java Development Tool. For Android based mobile phone implementation Android mobile requirement of android version 2.2 essential.

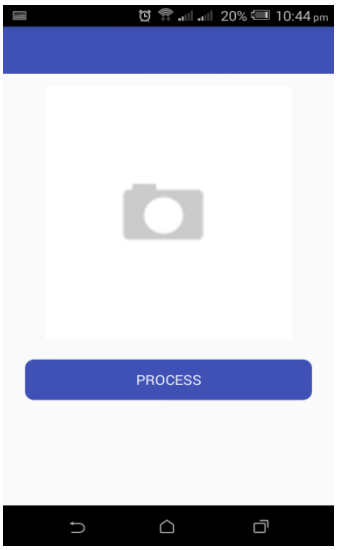
V. SOFTWARE DESIGN

Software used for the mobile phone application development. Android studio 3.0.1 is use for the designing page of the android mobile phone. Java programming is used for mobile application which is reliable for Android platform.

Graphical User Interface (GUI) page is design using Android studio software. For processing purpose here use RGB color model and HSI model. This image is in bitmap file format and size of file format is 14 byte, which is especially useful for graphical user interface.

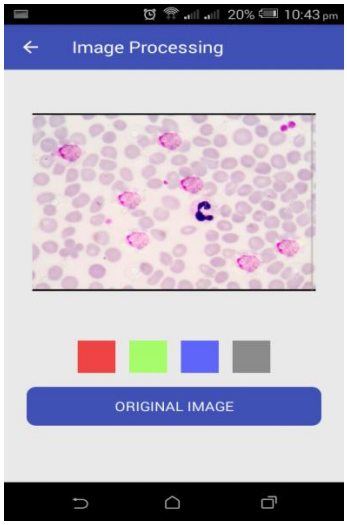
Symbol of Malaria Detection Application

(Step 1)



GUI Page 1
(Step 2)

In design system to provide two different options for taking blood sample image. One is the mobile camera and another one is mobile gallery. By pressing the process key it takes the image and process on that image. Display the result in the form of Segmentation and Edge Detection on the mobile phone.



GUI Page 2
(Step 3)

GUI Page 3
(Step 3)

VI. CONCLUSION

An efficient and reliable mobile phone application to diagnosis malaria has implemented. Some improvements have done such as the different layout of interface for different screen sizes or the use of captured high-resolution image. In this sysremove the noise, separate blood cell using the image segmentation method and detecting the discontinuities in brightness using edge detection method in the blood cell image. Result will display on the Android mobile phone after taking the image from the mobile gallery in less than 60 sec.

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