Chapter 1

Introduction

In the fast pace of modern life, many of us have caught ourselves at least once in a situation where we were feeling compelled to have a checkup, yet something was holding us back and eventually prevented us from doing it. Our everyday activities and responsibilities seem to come forth rather than the concern for our health quality, which seems to be more imperative than our daily routine, if we just consider and the increasing number of health related injuries in urban cities. On top of that, people generally the information they need about health services to make informed decisions about their care.

A remedy to deter people from neglecting their health issues is providing further and targeted information, while this information is available on the main devices most people use on a regular basis, namely any station or a mobile phone connected to Internet, enabling access to their health status anytime and at any place. Ultimately, a time consuming and uneconomical checkup becomes a non pestering procedure and also aids people to focus on more salient things, which is their test analyses..

This project introduces an automated system that detects the malaria parasites in a blood smears. More specifically, it is application that communicates with a clients' laboratory where medical tests are stored. A medical analysis could be as simple as a check-up or more complexional as an ultrasound. Physicians and medical institutes can upload their clients' medical tests on this application and view their results quickly. A sophisticated module of this system is the medical diagnosis that is being conducted all automatically. The automated diagnosis system can diagnose patients with remarkable success assigning a coefficient on each of the risk factors that consist in a medical illness. Image processing is the core of this job. An automated medical diagnosis system is needful indeed, considering that many physicians come to a medical diagnosis result, based on personal biases. For example, a physician may assess a symptom or a value of a medical test analysis that is more important towards another symptom or a value, while another physician may give a different credit and weight to the specific symptoms and values. This implies that a lot of medical

diagnoses cannot be accurate, but also it is a fact that individuals' medical analyses are susceptible to several interpretations among doctors. This imposes the need of a system that minimizes human bias and considers all relevant and irrelevant data in determining a diagnosis. Also, by having the system online, it is ensured that every doctor has access to the latest scientific diagnoses.

Malaria is a mosquito borne disease caused by parasites of genus plasmodium. The person gets affected by malaria when malaria parasites are introduced into circulatory system by infected female anopheles mosquito bites. According to WHO it causes one million death per year and nearly 250 million people are affected by it. Hence prevention and control of vector borne diseases like malaria, dengue, chickungunya etc government of India has started national vector borne disease control Programme (NVBDCP) under Directorate General of Health Services.

One of the important information that doctors usually use to diagnosis disease is the count of red blood cells. The red blood cells are most numerous blood cells in human body. In health, the red blood cells vary relatively little in size and shape. In well-spread, dried and stained films the great majority of cells have rounds, smooth contours and diameters within comparatively narrow range of 6.08.5m. According to American Cancer Society (2009), the normal red blood cell in our body is divided into four categories of ages, which are newborn, children, women and men. The effect of having high red blood cells in our blood is it can be an indication of an undetected heart or lung problems. When any of these organs is not functioning properly, then blood oxygen levels go down

Table 1.1: Normal Blood Count Differentiate By Gender

Blood Cell Type	Gender	
	Men	Women
RBC	4.5-6.0 million/microlitre	4.0-5.0 million/microlitre
WBC	4.5-11 thousand/microlitre	4.5-11 thousand/microlitre
Platelet	150-450 thousand/microlitre	150-450 thousand/microlitre
Hematocrit	42%-50%	36% to 45%
Hemoglobin	14-17 grams/100 millilitres	12-15 grams/100 millilitres

Counting of red blood cells in a blood sample can give the pathologists valuable information regarding various haematological disorders. In the classical method for diagnosis of red blood examination in a blood sample, it is counted by manpower; hence it has deficiencies such as poor reliability, low efficiency and strong subjectivity. The diagnosis is the process of finding out what kind of disease a certain patient has and those diagnosed must always be accurate. A wrong diagnosis may lead the situation and condition of a patient become worst and some case, patient dies due to wrong dosage of drugs given. In order to overcome that weakness, some researchers have done some useful works especially in classifying blood cells from other cells, for example, classifying white blood cells from other cells such as red blood cells and platelets. However, by counting the red blood cells, it also provides some information about the abnormal condition in our body. Analysis of microscopic images is used in many fields of technology and medicine. In some medical experiments, some drugs, with known effects in red blood cells membranes, are used to find out their activity. In addition, different diseases affect the appearance of R.B.Cs and cause the malfunction of the internal organs.

Inside the human body, the parasite undergoes a complex life cycle in which it grows and reproduces. During this process, the red blood cells (RBCs) are used as hosts and are destroyed afterwards. Hence, the ratio of parasite-infected cells to the total number of red blood cells – called important determinant in selecting the appropriate treatment and drug dose.

1.1Microscopy Diagnosis

Using a microscope, visual detection and identification of plasmodium is possible and efficient via a chemical process called staining. A popular stain, Giesma slightly colors red blood cells but highlights the parasites, white blood cells, platelets and various artifacts. Inorder to detect the infectious cells it could be sufficient to divide the stained objects into two groups such as parasites and non parasites and differentiate between healthy and infectious cell present in a blood smear. The detection of Plasmodium spp requires detection of the stained objects. However, to prevent false diagnosis the stained objects have to be analyzed further to determine if

they are parasites or not. There are four types of human malaria – Plasmodium falciparum, P. vivax, P. malariae, and P. ovale. P. falciparum and P. vivax are the most common. P. falciparum and P.vivax are the most deadly type of malaria infection.

A specimen for manual microscopy diagnosis can be prepared on a glass slide in two different forms.

- A thick blood film enables examination of a larger volume of blood, hence it is more sensitive to detect parasites, however the thick film preparation process destroys red blood cells and thus makes identification of infected cells difficult.
- On the other hand a thin blood film preserves red blood cells shape and parasite making more suitable for detection of infected cells,

A common practice in manual diagnosis is to perform the red blood cell test and calculate the count of red blood cells to the infected cells so that parasitaemia can be calculated.

The main problem with the method of counting manually under the microscope is accuracy, this method needs a real experienced laboratory technician who is trained enough to produce an accurate cell counting report, and even if the laboratory technician if well trained and experienced still one cannot neglect the chance of error in the report due to error caused by apparatus, personal errors, statistical errors etc.