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A Novel Method for Enactment of A Biometric System for Diagnosis of Pathogenic Diseases

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Abstract : In the contemporary scenario, the diagnosis of pathogenic diseases has emerged to a higher extent as a result of the outburst of epidemic diseases thus, in order to preclude the spreading of diseases caused due to the usage of blood samples taken from the infected patients, this device has been progressed. This paper emphasizes on the Novel method of invention of a cost effective biometric analyzer for the diagnosis of pathogenic diseases by using non-invasive technique. Prime goal is to develop a biometric scanner to capture the image of the blood cells by passing UV light rays with frequency range of 280-400 nm for detection of pathogens present in the blood cells by means of medical image processing. Abnormalities of the images will be appraised by comparing the obtained biometric scanner image of the patient with the enrolled images of pathogenic diseases which are collected from medical laboratories and images will be recurrently modernized as per the discovery of new pathogenic diseases. The evaluation platform used is MATLAB for recognition of microbes based on linear algorithm method; blood cell count; size of blood cells and staging of the infection patients, which is beneficial in cases where immediate therapy obligatory has to be done. In comparison to the customary invasive methods the accuracy level of this non-invasive method is also high around up to 90%. There are even potentials for discovery of blood cancer and blood flow rate.

Keywords : Non-invasive, epidemic diseases UV light, medical imaging, microbes, linear algorithm, pathogenic diseases, pre-installed images, immediate therapy obligatory.

1. INTRODUCTION

A common way of detecting the disease causing microorganisms in the blood is usually invasive. Till now no machines have been found for the diagnosis of microorganisms in blood without taking the sample of the patient. The most common method used is the laboratory method in which, blood sample will be taken from the patient and examined by 2 or 3 technicians under identical laboratory conditions by using the microscopic method. The advantages of this invasive type of detection of microorganisms are of low cost and results are quite accurate. The main disadvantages of the invasive type of detection of microorganisms is:1) during collection of blood samples if syringes are not properly sterilized it will be cause more diseases to the patient. 2) It is a longer process. 3) Requires the working of 2 or more personnel inorder to interpret the results. 4) the final report analysis may vary at times.5) effort of the technicians detecting the disease causing pathogens is more in this method.6) the ultimate disadvantage is loss of blood of the patient. In this method there are many disadvantages so the creation of a non-invasive machine will be very useful for the analysis purpose. There is another of identification of the pathogenic fungi in the blood by taking the blood sample and allowing the pathogenic fungi to reproduce by culturing techniques inorder to find the presence of the disease in the particular patient [1]. The main disadvantage in this method is that results are not accurate, a very slow process and also certain microbes cannot be cultivated so only some diseases can be identified in this method. Hence, we have suggested a non-invasive method to overcome these disadvantages.

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A. Pathogenic Disease

Pathogens are any contagious agents that causes diseases to humans. The infective agents include virus, bacteria, microorganisms, parasites, etc. The diseases triggered by pathogens are called as pathogenic diseases. The study of this pathogenic diseases is referred to as pathology. In TABLE 1 there are a list of various pathogenic diseases instigated in human, their mode of transmission and also the main causative pathogens."[1]

Table 1. Indication of the types of pathogenic diseases and their mode of transmission on and disease causing microbes.

Human Disease	*Causative Micro-organisms*	*Mode of Transmission*
Tuberculosis	Bacteria	Air
Cholera	Bacteria	Water/Food
Typhoid	Bacteria	Water
Polio	Virus	Air/Water

B. Blood Cancer

Blood cancer is caused by cancer or tumor. Blood cancer is also called as "LEUKEMIA" which is the cancer of blood. The RBC cells in blood cancer patients will be bulged and the total blood count will be decreased as in Table 2. Blood cancer will be characterized mainly by the abnormal increase in WBC count as mentioned in Table 3.

Table 2. Indicates the normal and abnormal RBC range to determine blood cancer.

Gender	*Normal Range of Blood Count*	*Normal Size of a Single RBC*	*Abnormal Range of the red blood Cell Count and a Single Red Blood Cell Size Human*
Men	4.2-5.4 million/mm^3	Diameter 6.2–8.2 μm Thickness : 2–2.5 μm	Blood Count Value will be reduce when compared to the normal range and the size of the RBC will be increased enormously in blood cancer cases.
Women	3.6–5.0 million/mm^3	Diameter 6.2–8.2 μm Thickness : 2–2.5 μm	Blood Count Values will be reduce when compared to the normal range and the size of the RBC will be increased enormously in blood cancer cases.

Table 3. Indication of the normal and abnormal WBC range to determine blood cancer.

Normal Range of of WBC Count	*Normal Range of Lymphocytes, Neutophils, Platelets*	*Abnormal Range*
3.5–10.5 billion cells/L	Lymphocytes : 1.3–3.5 10^9/L Neutrophils : 2–7.5 10^9/L 6000 to 4500/uL Platelets : 100–450 *x* 109/L	• Abnormal increase in the WBC count.· • Lymphocytes count decreases from • Neutrophils count increased from1400 to 1600/uL • Platelets counts increased from 90,000 to100,500/uL

2. MATERIALS & METHODS

These are various invasive methods used to discover the pathogenic diseases in humans. The first known method is the investigation and gathering of the human blood samples and by using a filter paper the diseases are detected [3].The latest method is the usage of the cultures of the blood sample and the pathogenic fungi to identify the pathogenic disease by via a multiplex PCR process. [1] An additional method is the examination of the interruption of the normal functions of the heart due to the presence of pathogenic diseases by using a non-invasive technique to measure the pulse wave velocity correlated with the coronary arterial plaque in the infected patients.[7]A new method is the identification of the inflammatory bowel diseases is found by using the rapid and noninvasive molecular classifications of the microbes. [6]

3. PROPOSED MODEL

The parameters that will be measured by this proposed methodology are :

1. Recognition of the microbes present to determine the pathogenic diseases.
2. Total Blood Cell Count in the sample.
3. Size of the Blood cells in the sample.
4. Staging of the infection.
5. Blood Flow Rate
6. Manifestation of Blood Cancer(Simple finding)

There will be 2 systems in this setup 1) Hardware system 2) Software system. The components needed will be: I HARDWARE**:** 1) Biometric scanner 2) UV Sources 3) UV Detector 4) Inbuilt camera II SOFTWARE**:**1) Computer2) MATLAB SOFTWARE. In the inbuilt camera, there needs to be 3 main components: 1) Microcontroller 2) Positioning circuitry 3) Analog to Digital Convertor (ADC).The components are divided into 2 categories: 1) Hardware System 2) Software system. The Hardware system will have more components and plays the major role in the pathogenic disease analysis. The hardware system will be very difficult to construct. The hardware system comprises of 1.Biometric scanners 2. UV sources 3.UV detectors 4. Inbuilt camera Fig 2.

A. Hardware System

Biometrics is the collection of metrics related to human characteristics. There will be more number of UV sources since one source is not enough to give a clearer image. Inorder to find the blood flow rate the UV sources must be kept in different angles for accurate results. Each UV source will be having aseparate UV detector, amplifier and special filter to improve the colour intensity accuracy of the image. In the in-built camera, there are three main components: 1.Microcontroller 2.Positioning circuitry 3.ADC. The microcontroller will be programmed to find the Doppler frequency. Doppler frequency is nothing but the calculation of the difference between source intensity and receiving intensity (destination). Since we need an image and not a signal, the microprocessor is programmed to calculate the Doppler frequency. Positioning circuitry is a separate circuit which is built in the camera to know the coordinates of the various detectors in order to know which part of the body is being scanned. A signal is only one-directional ie. Gives only amplitude whereas an image is two – directional which gives both amplitude and intensity in the x and y axis format respectively. The information from the positioning circuitry is given to the microcontroller. Then, the analog to digital converter will convert the digital data to digital image. Some microcontrollers will be having the ability to program ADC component in it also but if incase the ADC cannot be programmed in it then separate ADC component must be used. The ADC component must be placed before the microcontroller because the microcontroller can only accept digital data as input source and not the analog source as input. This is the entire circuitry system for the inbuilt camera.

B. Software System

The hardware system is interfaced with the software system with the help of the microcontroller which is inbuilt in the camera. The software system is very simple to construct. It only consists of the computer which represents the central processing unit (CPU). The computer will have a built-in memory storage chip which will contain the pre-stored microscopic images of various pathogenic diseases. The CPU will compare the pre-stored image with the image provided by the microcontroller. After this process, the results will be provided. To provide more accurate results, a feature of the image will be taken and analysed with the help of MATLAB.MATLAB is used in this method to provide accurate results by using linear algorithm programming to compare the pre stored results and the image produced. The main principle of working of this machine is biometric scanning, total internal reflection and medical image processing with the help of UV light rays of range of around 280to400nm. When the microcontroller is preprogrammed to find the intensity and velocity of the reflected UV rays the blood flow rate of the patient can be easily calculated. This is the software programming to find the above mentioned parameters.

C. Measurement of Blood Flow Rate

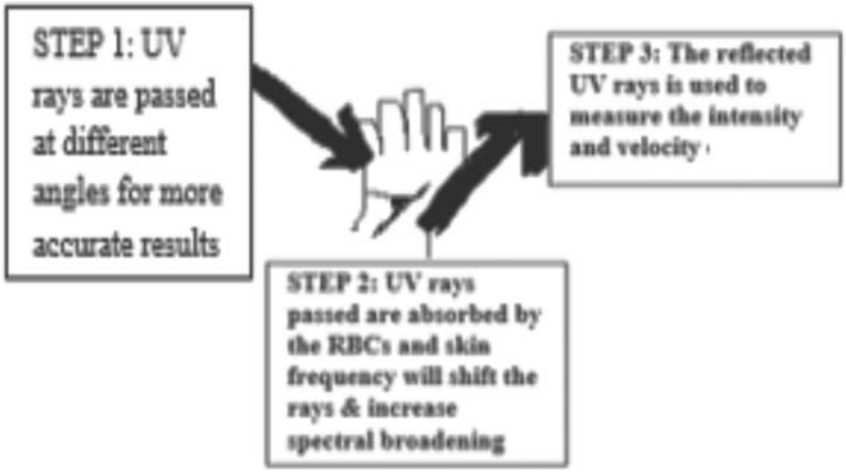

Fig. 1. Process of Finding the Blood Flow Rate.

The UV sources will be placed in different angles for more accurate results. The UV rays will fall on the patient's hand. Then due to the movement of the blood cells the light rays will get absorbed and the skin frequency will cause the light rays to get shifted which increases spectral broadening. With the reflected UV rays the intensity and velocity of the blood corpuscles can be calculated to find the blood flow rate. [7]

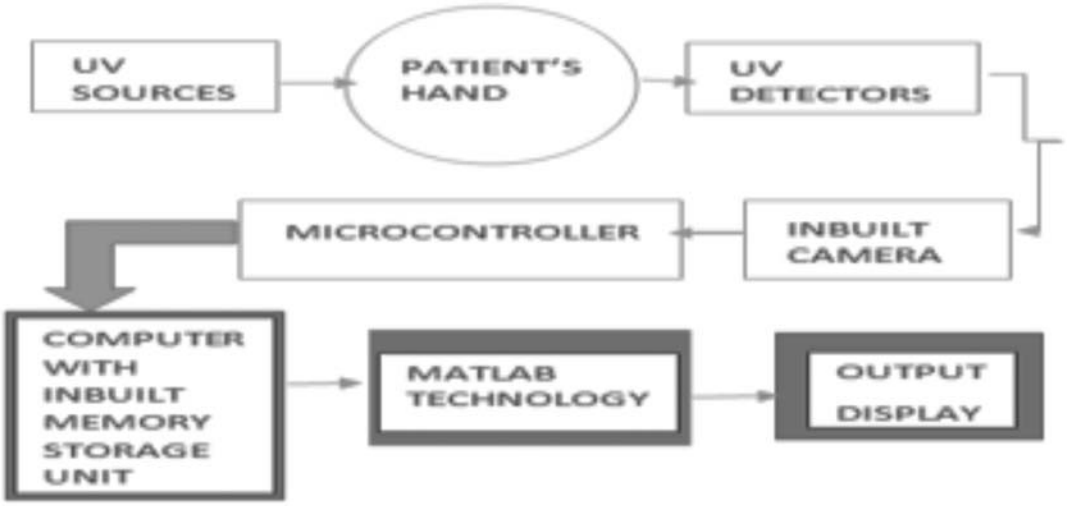

Fig. 2. Setup structure of proposed model.

The working process is very simple and the construction is also very simple as shown in the fig3. Firstly, the patient will be keeping his hand on the biometric scanner. The Ultraviolent radiations of the suggested frequency will penetrate through the patient's hand. The UV rays will be transmitted in an inclined angle and it falls on the moving blood cells. The reflected rays will be detected by the UV detector. The UV detector will detect the output signal. The information is passed to the in-built camera. In the in-built camera, the microcontroller calculates the Doppler's frequency [7] and the positioning circuitry gives the image's x and y coordinates information to the microcontroller. The microcontroller will calculate the blood flow rate bymeasuring the absorption of the passed UV rays and the intensity and velocity of the reflected UV rays are measured to determine the blood flow rate. The ADC will convert the analog signal to digital image. The image will be sent to the computer which is the software system. [2]The computer has in-built memory which has pre-stored microscopic images of the pathogenic diseases. By comparison, the result is obtained. For higher accuracy rate, the MATLAB will be useful. It is used here to change the image which is produced from colour to a grey scale image. It perform the linear algorithm method to compare the pre stored images and a feature extracted from the images of the sample produced. The MATLAB experimental results will be displayed in the printed format or as a written format.

4. RESULTS & DISCUSSION

The MATLAB software to convert the original blood sample images from a colour image to a grey scale image. Then it also did the counting of the number of blood cells in a particular blood sample image using this software which will also help to indicate the abnormal amount of blood cell counts when the patient is affected by a particular disease. Since the hardware system of this proposed model has not yet been instigated fig 3, 4(*a*), 5(*a*), 6(*a*) have been taken from the internet websites such as Google images and Wikipedia.

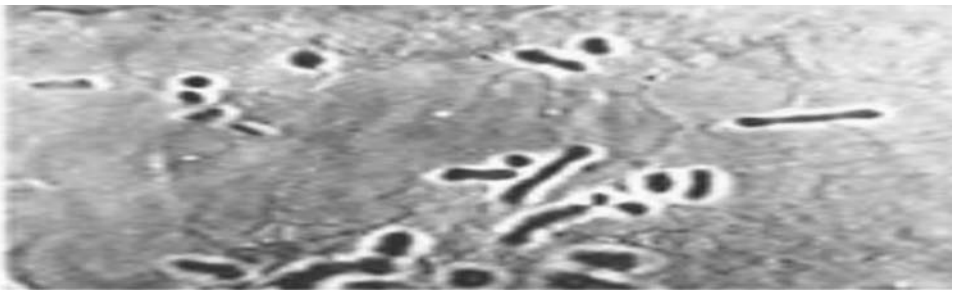

Fig. 3. Blood sample image with microbes using UV light rays.

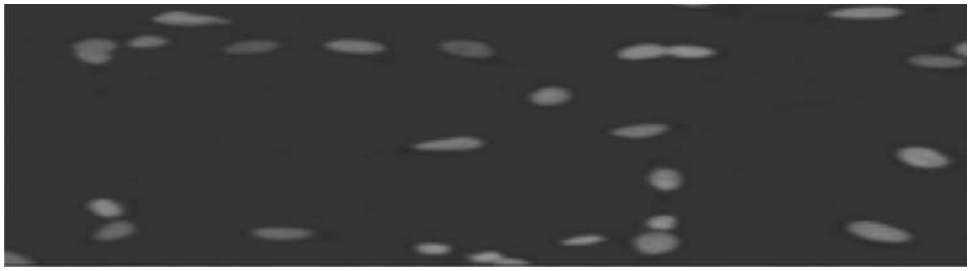

Fig. 4(*a*). Original colour image of a blood sample obtained using UV microscope

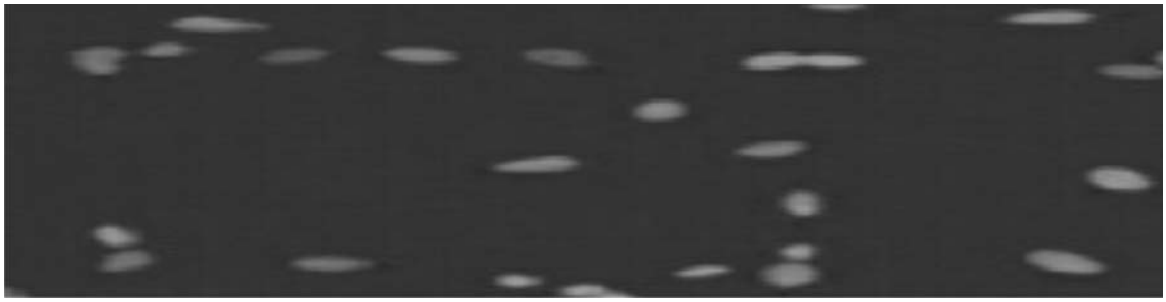

Fig. 4(*b*). Conversion of the image 4(*a*) from a colour image to gray scale image using MATLAB software.

Fig. 5(*a*). Original colour image of a blood sample obtained using UV microscope

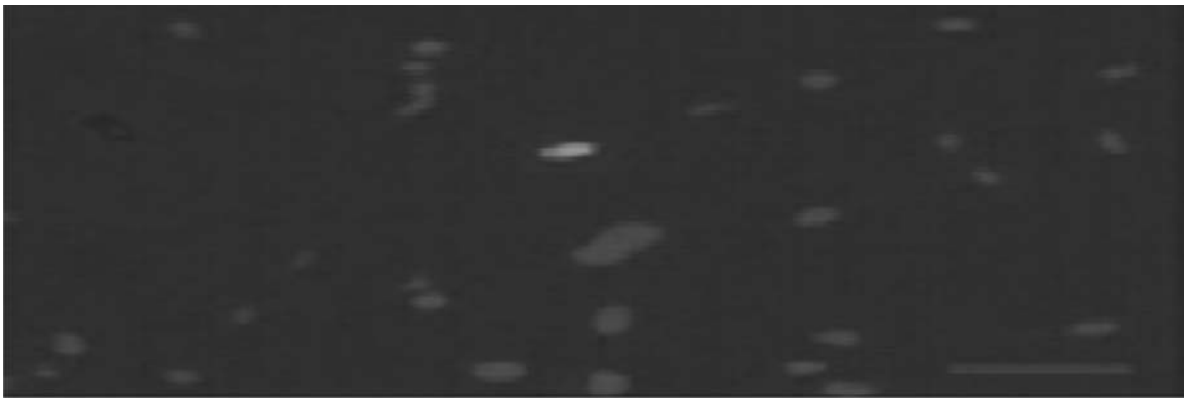

Fig. 5(*b*). Conversion of the image 5(*a*) from a colour image to gray scale image using MATLAB software.

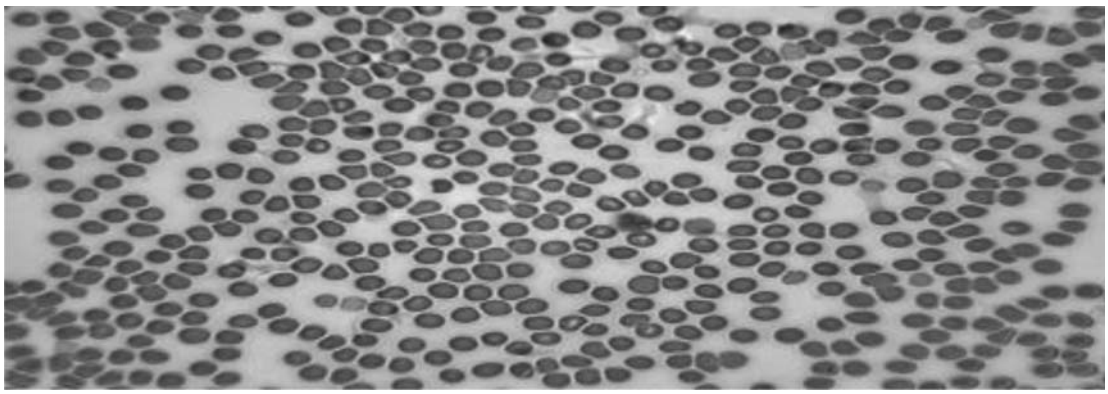

Fig. 6(*a*). Particular feature extraction of a Human Blood Image used for blood cell counting.

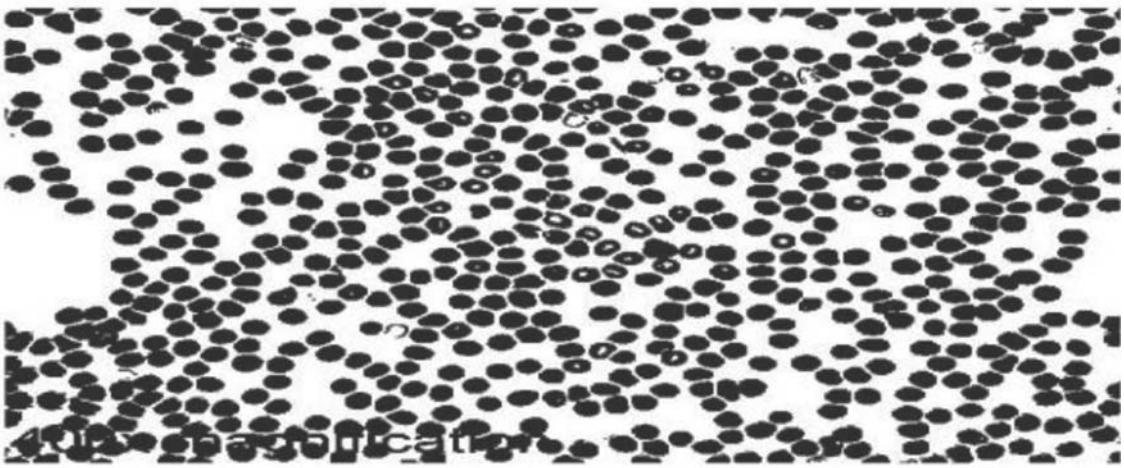

Fig. 6(*b*). The image 6(*a*) is converted from a colour image to a gray scale image with the help of MATLAB software.

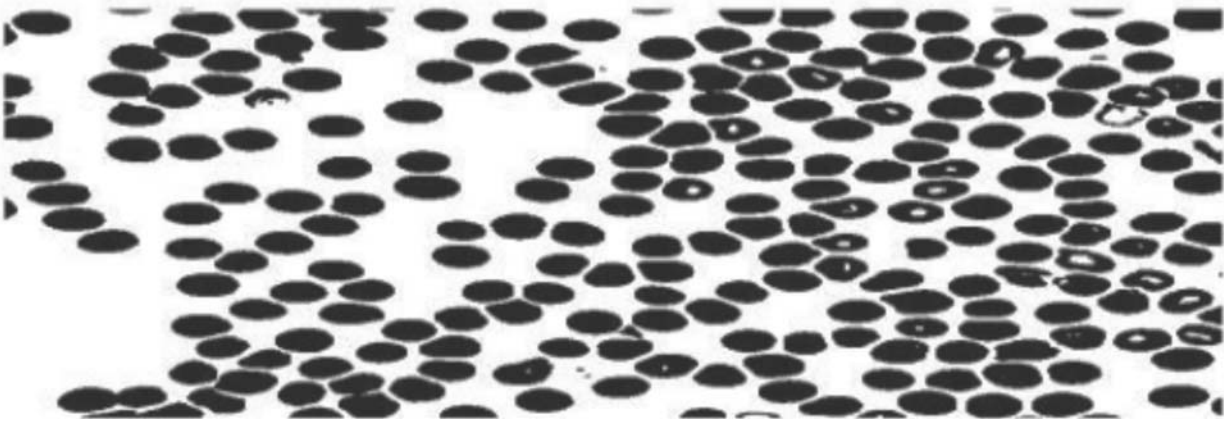

Fig. 6(*c*). A part of the grey scale image's feature is extracted and enlarged for easier counting of the blood components such as RBC, microbes, etc.

```
cc =

    Connectivity: 4
       ImageSize: [675 900]
      NumObjects: 148
    PixelIdxList: {1x148 cell}


ans =

   148
```

Fig. 6(*d*). Image for counting the blood cells from the particular enlarged image using MATLAB software.

5. CONCLUSION

By implementing this proposed model many advantages are there such as no loss of blood, accuracy rate is high, real time results, processing speed is fast, environmental friendly components, no pain of patient, no spread of any infections due to improper handling of equipments, less labour demand, also it's extremely cost effective and it can measure 5 different parameters. The creation of this intelligent device will be very efficient in the medical field sector. This will help many patients whom have certain fears of diagnose and also if the results of the diagnosis has to be obtained quickly this method will be most convenient. This machine will save the lives of even technicians as they will not get affected in any way due to the analysis of the blood sample of the patient. Thus, if this machine comes into market it will also help in the quicker diagnosis of the diseased patients. Hence, this new machine which is totally non-invasion should come into effect and help everyone in the world for their betterment of life. When implemented for further analysis the outcome of this device can be interpreted more accurately. The hardware system has not yet been invented and there will be much future advancement for this model after conception of this model.

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