AN IMPLANTABLE EMBEDDED CHIP FOR MONITORING THE IMMUNITY LEVELS

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***Abstract*— In this paper our aim is to provide an accurate count of the WBC cells in our body by implanting micro-embedded chips at eight places of bone marrows and two places of right arm forearm and left arm triceps in our body. This system is used for counting the WBC'S it can perform in any places not only in Health care. Even an ordinary citizen can able to operate this embedded system. The time required for processing this system will be less within microseconds and also we can able to get a perfect output. It can be used for real time applications.**

Keywords— **WBC's, embedded chips, Bone marrow, LED's**

I. INTRODUCTION

Blood is the fluid that circulates in a Human Body Which acts as a fuel for Electrophysiological activities in humans. So, when we have a closer look at blood, it has three different cells-RBC (Red Blood Corpuscles), WBC (White Blood Corpuscles), Blood Platelets. Among these three, WBC's can be called as the police (or) this escort system of our body [1]. They protect our body against infectious diseases and foreign materials. So they can be referred to as the 'Important to the Important' [2]. In medical terms, they are called as the Leukocytes. So even though there may increase or decrease the count of WBC'S our body may be under the threat of attack by diseases [1]. So it is significant to know about its count regularly especially for AIDS and Cancer patients. There are two count procedures followed by hospitals worldwide Manual count and Electronic count. The Manual count is performed by taking out a blood sample of 3.5ml through Vein puncture. It is performed by a trained 'phlebotomist'. But there are high chances of error due to time consuming is more than other procedures. In the electronic counting, cell counter and image analysis procedure is used. Then for differential in blood cells, the sample is spread on a thin film, which is placed on a glass slide for microscopic analysis. In this method the main drawback is the examining period for WBC'S is always under microscope. It is painful to the patients. There may be a case that the WBC's maybe concentrated more in other areas than the one, where vein puncture is performed. Our idea of implanting embedded chip will provides an alternative to the above mentioned drawbacks.

II. ARCHITECTURE

Our implant chip consists of a micro chamber and a micro membrane, an Analyzer with micro counter, a power supply and a micro transmitter with a same inlet for three different blood cell's (RBC'S , Platelets and WBC'S) and two different outlets one for RBC- Platelet pair and another for WBC.

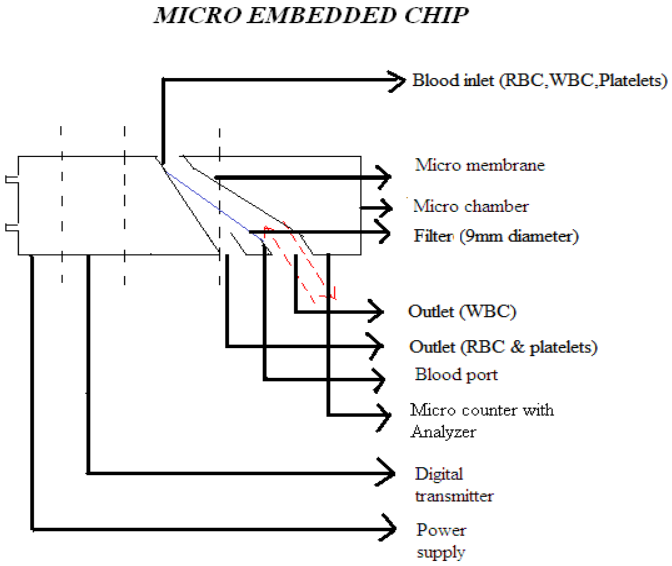

Fig 1.1: Structure of Micro Embedded chip

III. POSITIONING OF THE CHIP

In previously used methods are difficult to locate the chip where to place. So the chips should be positioned where we are confident that the concentration of the WBC'S is more. The only one region present in Human body is the Bone marrow, where the WBC's are produced [1]. We can able to implant 10 chips in our body out of that eight chip can able to place at the eight positions of bone marrows and the other two at left arm triceps and right forearm. The WBC's are generated at the multi-potent cells in bone marrow called as 'hematoprietic stem cells' [3]. The WBC'S count at this location is about 36,000-42,000. If the count is reduced to

above range there may be affect to our body by various infections (foreign bodies). The regular checking should be monitored periodically to overcome any threads that affected WBC'S function. We have to place the chips at areas where there is a high-blood flow. That's the reason why we positioned the two chips at triceps and forearms, where there is a high blood flow.

IV. WORKING

After the placement of the chips in our body, we can see how it process

a) Micro Membrane with Micro Chamber

The blood enters through the micro chamber by the Inlet Port. It is designed in such a way that it allows only a micro liter of blood to pass inside to outside of the chamber (RBC, platelets in order to separate the WBC from RBC, platelets). The pressure is provided by our body pressure. Once it had entered the chamber, it encounters a micro membrane, which has holes about 9 micro meters in diameter.

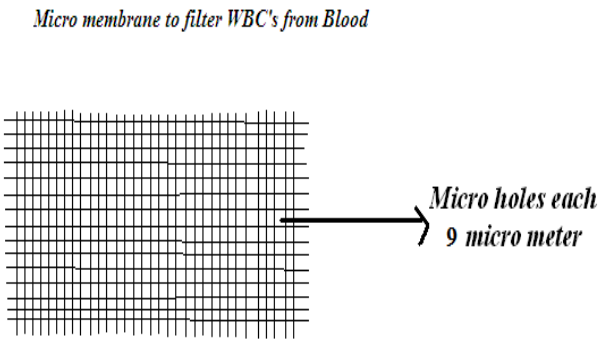

Fig 1.2: Micro Membrane Filter

It is used to filter the WBC's from RBC and platelets .We can be sure that only RBC and Platelets passes through this membrane.

b) Analyzer with Micro counter

Now after a filtration, there is a small tube, radius of 9micrometer, where the WBC's cannot flow outwards because it has about more size than the filter radius size and also due to the slanting position of filter it flow towards the second outlet (i.e.) from chip to body. The tube is provided with a micro counter so the number of WBC'S cells entering the tube is counted. So, in Analyzer we have predefined the number of WBC (i.e.) 36000-42000 for Bone marrow chips, 4500-11000 for the other 2 chips [3]. The two Analyzer are used to measure the correct WBC count to display the output. It compares the predefined value with the counted value got from the micro counter [4].

c) Digital Transmitter:

Both Analyzer and Digital Transmitter are connected to each other. When the count of WBC'S is normal or in between the Predefined value, it transmits "10". If the count is less than Predefined value it displays "00" and greater than predefined value it transmits "11" are transmitted respectively. In the case of the two chips implanted away from bone marrows if the count is less than 1000, then it clearly implant that the concentration of WBC's is not uniform and transmits a "01" meaning an error in the sample [4]. In this condition the placement of the chip should be measured before implementing the chips.

d) Power Supply and External Circuit:

Here we are using the concept of Wireless power transmission batteries. It is similar to the batteries which are used in the supermarkets to detect the theft.

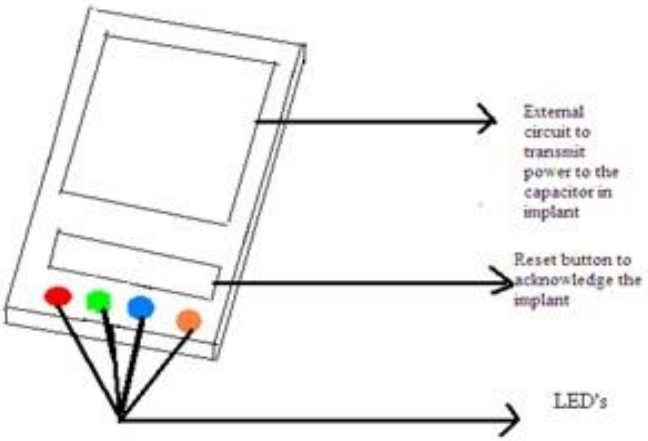

Fig 1.3: External Circuit with LED's and Power Transmitting circuit

The External circuit is recharged normally has Mobile phones. The circuit in implanted chip is consists of a parallel plate capacitor [5]. After charging the external circuit, if we rub it near the areas where the chips are implanted the power will be transmitted wirelessly to the implanted chip. The power will be stored as energy inside the parallel plate capacitor.

$W = 0.5\ C\ (V^2)\ J$

Where,

C- Capacitance of the Capacitor

V- Electric potential

W- Energy stored in the capacitor

In order to get an enough power to carry out the process in real time, we should rub the external circuit against the implanted chip at least eight times per day.

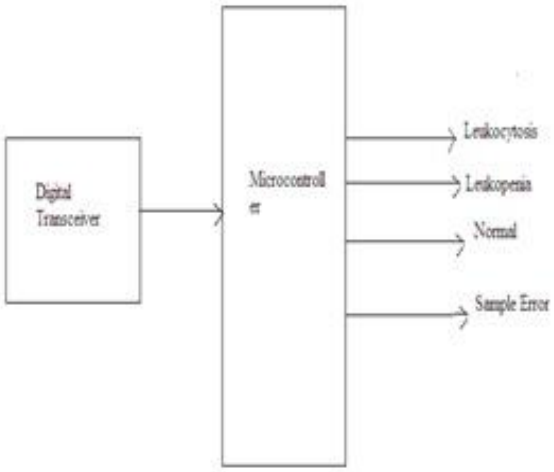

Fig 1.4: Block Diagram of External Alert System

Other than this wireless power transmission circuit, we have a digital transceiver, a microcontroller with memory and some LED's. The transceiver receives the data from the digital transmitter in the implanted chip and sends it to the microcontroller and it analyses the received data [5]. If the signal is received as "11", the yellow LED burns, and signs for Leukocytosis, (high WBC count) [1]. If the signal is "00", it indicates red LED and it Signs for Leukopenia, (low WBC count) [1]. If the signal is "10", it indicates normal and green LED burns. If there is a sample error, blue LED glow by indicating "01".

V. STERILIZATION

It is the important aspect for every implantable material. Though it is necessary to sterilize this Embedded Micro Chip but it cannot able to withstand more heat nor Humidity. So we are using an alternative method by putting the chips in a sealed container and exposed to Ethylene oxide for two days. After two days, it can be taken out to implant. This time period is referred to Incubation period.

VI. CHIP SPECIFICATIONS

Its size is slightly longer than the size of single wheat grain about the length specifications as (0.75x0.5x0.75) mm in inches.

VII. IMPLANTING CHIP

The Biopsy technique is used to implant eight chips in the Bone Marrow [3] and the normal surgery is performed to implant other two chips in the arms [5]. After the surgery the patient should be in bed for couple of days.

VIII. CONCLUSION

This implanted chip system helps to provide accurate information about the WBC count. It will have an important say in medication of AIDS affected and Tumour affected patients since their WBC rate will always be under the normal rate. If we get to know about their WBC count at the exact time when the rate decreases even slightly, we might be able to give them medications and increase their life span. Our device can also indicate when the WBC count increases. But as many think higher WBC count is a dangerous condition. Bone marrow tumours maybe a cause for this situation [3]. It will be important that doctors diagnose this condition. Our chip is not only to help the disease affected patients and also helps to prevent the person from accruing diseases

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