

# DIAGNOSIS FOR DETERMINATION OF ITS COMPONENTS AND BIOMARKERS USING ELECTROCHEMICAL SENSORS AND ARTIFICIAL INTELLIGENCE

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## ABSTRACT

In ancient times, there was no appropriate technology to treat blood and analyze diseases. From bloodletting that causes death through haemorrhagic shock to the latest phlebotomy or venipuncture, it's all painful. Our project determines the CBC, blood group, and biomarkers for analysis with just ONE DROP of blood. This device's operation is based on the concept of electrochemical sensors. Red blood cells, white blood cells, and other components along with hormones are examined. Patients prick and dispense a drop of blood on the test strip which is placed into the device containing the microfluidic chips along with biomarker enzymes on them. Further, the device measures the levels of the parameters and quickly transmits the results via photonics. The user's results are appropriately compared with original values and retrieved through software application. In case of any critical reports, those will be directed to

nearest hospitals and the medical counsellors will contact the patients to get treated asap. The key technologies used are nanotechnology in the form of microfluidic chips, artificial intelligence, photonics or computer imagery and block chain technology. Our goal is to make it simple for people to receive medical care with the use of technology. Our main objective is complete analysis of blood within a single drop and encourage everyone to take initiative for improved health outcomes, optimal efficiency, and a more contented existence.

**Key words :** Blood Analysis, Electrochemical sensors, One drop, Artificial intelligence, Results through android apps, Counselling by medical professionals.

## I. INTRODUCTION

In the language of genes, every drop of blood contains a history book.

How many red blood cells do you think are present in a drop of blood?

About 5 million RBCs are found in just a drop of blood.

It is said that blood tests, sometimes referred to as "phlebotomies", are laboratory studies of blood samples that are normally obtained by venipuncture. While the patient is in the hospital, many tubes of blood are taken, which is quite invasive and uncomfortable.

Phlebotomy at medical facilities can cause blood loss, especially in infants and patients in intensive care units. When blood is drawn repeatedly, the veins are

harmed, which results in scarring. It might take days or even weeks to receive the results of a blood test. The blood that was discarded after testing includes germs that might infiltrate and proliferate within human hosts. As our key goals are to fully analyze blood using just one drop of blood and to inspire everyone to take action for better health outcomes. One drop of blood is all that is required for our product, to analyze it. Blood hormones, the CBC, blood grouping, and biomarkers are all analyzed. Electrochemical sensors underlie how the gadget functions. This research paper includes the literature survey of

our product by comparison with other similar companies.

## II.LITERATURE SURVEY

Laboratory examinations of blood samples that are frequently obtained by venipuncture are known as blood tests, also known as PHLEBOTOMY. While the patient is hospitalized, multiple tubes of blood are collected for regular diagnoses, which is exceedingly intrusive and uncomfortable. Phlebotomy can cause severe blood loss in hospitals, especially for babies and patients in intensive care units. When drawing blood or doing blood tests, the veins are harmed. Repeated blood tests leave scars. Results from blood tests can take days or even weeks to come back. Blood disposal after testing can be risky since it includes germs that might infiltrate and thrive inside of human hosts. There are competitors in the industry that employs the same technology. For eg Theranos, an American company which is described as a “FALLEN UNICORN” used the same technology of using one drop of blood for analysis of blood. A section of the patent stated that the sample required 10 drops of blood, whereas another section said that only one drop of blood was required which lead to a dispute. According to the Journal of Clinical Investigations, “significant interservice variability was present in 68% of the examined lab measurements”. The other

[2] Mehmet Toner found that Blood is separated using a variety of microfluidic techniques that allow precise control of the cellular environment and enable separation into very small volumes for analysis of blood component.

[3] Mark J Seamon analyzed Single, isolated bloodpressure readings in hypotensionare commonly disregarded or thought to be incorrect. They hypothesised that solitary isolated hypotensive blood pressure readings during trauma resuscitations suggest the presence of any injuries that frequently need prompt action, even if their clinical relevance is still unclear.

[4] Jing Wang concluded with strong anti-interference ability, a small sample size requirement (20 L), good recoveries (67.2-114.3%), and high analytical sensitivity were all displayed by the method (detection limit 0.05-0.1 ng mL<sup>-1</sup>). His study shows a workable tool for a minimal whole blood analysis in addition to offering a versatile enrichment material for

companies like OneDropTechnology ,rHealth, Abbott, Genalyte, Athellas, SevenSense Biosystems, Micro Blood Science Inc and Sight uses the same idea of Multi-omic micro sampling to only measure biomarkers and not all components of blood.

Abbott is an American company that uses 2-3 drops of blood to test 10 biomarkers or hormones. And there is no android application for retrieval of results as it is similar to a traditional glucometer.

Micro Blood Science Inc is a Japanese company that takes few drops of blood to determine only 14 biomarkers.

And none of the companies mentioned above have the feature of directing the results of the patients to nearest hospitals in case of critical condition.

### Related work:

[1] Prashant Singh paper's main goal is to clarify blood and blood pattern analysis. An experiment employing Awlata dye to create blood stains was carried out in a lab setting on the university's campus. In order to study how blood strains form with respect to varied heights and how they relate to satellite stains and spines, researchers employed awlata, an indian dye used for grooming women.

complex sample preparation. High throughput, speed, a small sample size need, and great sensitivity are some of these benefits.

[5] Sheng Tang kept away a lengthy amplification procedure involved in nucleic acid detection. A magnetic three phase single drop microextraction method was created for the measurement of nucleic acids in order to get an enhanced signal in a matter of seconds. The approach was further used to identify miRNA-122 and HBV-T in real serum samples from patients with hepatocellular cancer.

[6] Nicole Toepfner believed that blood is undoubtedly the most significant biological fluid, and its examination offers vital health status information. The differential blood count, which ascertains the frequency of all main blood cells, is a first regular step in clinical practice to help narrow down diagnosis. This strategy adds a functional benefits.

[7] In Kihwan Choi's study, we demonstrate that sample cleaning or preconcentration is typically a prerequisite for bioanalysis. Traditional sample preparation methods are frequently labour- and time-intensive. One of the most effective methods for sample cleansing and preconcentration in recent developments in sample preparation is single drop microextraction (SDME). For the study of pharmaceuticals, metal ions, and biomarkers in biological samples such as urine, blood, and saliva, recent SDME applications are examined.

[8] Meaghan M Bond understood that fingerprick blood is often utilised in point-of-care assays, but few research have examined the variable characteristics that can be acquired and the consecutive drops of blood that may pose issues for clinical decision-making and for the accuracy of point-of-care tests.

[9] Dasheng Lu used Polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) may now be determined quantitatively using just 50 mL of blood. A gas chromatography/high resolution mass spectrometer was used to analyze the target analytes in both the plasma sample (DBSV) and dried blood spot (DBS). Our findings imply that the DBS sample approach is practical for those biomonitoring in the human population.

[10] Shu-An Xia found out Hg and Cd contents in tiny amounts of samples may be evaluated with good linearity and sensitivity using a single capillary liquid electrode discharge source. When CLED-OES was used as the detector, limits of detection (LODs) of 10 g L<sup>-1</sup> for both Hg and Cd were attained under ideal conditions. However, the LODs for Hg and Cd were improved to 0.03 g L<sup>-1</sup> and 0.04 g L<sup>-1</sup> using AFS detector, respectively. Moreover, the very large linear ranges of 0.001-100 mg L<sup>-1</sup> and 0.001-40 mg L<sup>-1</sup> for Hg and Cd, respectively, were achieved. The method's prospective usage was verified by the successful analysis of six human blood samples.

Table to analyze the amount of blood, no. of components and the time taken.

Companies	Amount of Blood	No. of Components measured	Time taken
Theranos	1 drop	80	2-3 hrs
Genalyte	1 drop	62	10-30 mins
Abbott	2-3 drops	10	2 mins
Micro Blood science Inc	Few drops	14	Nil
SevenSense Biosystems	Few drops	Few tests	3 mins
Athellias	2 drops	Choose based	Few mins
1Drop Technologies	1 drop	Choose based	15 mins
Sight	2 drops	19	1 min
DiagUnus	1 drop	50+	4 mins

Comparison of amount of blood, no. of components and time taken.

**Infographic**

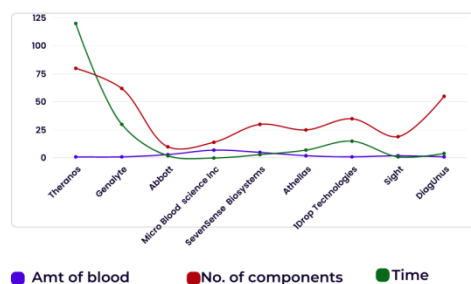


Figure 1

**III.METHODOLOGIES**

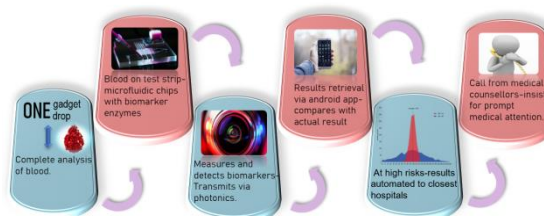


Figure 2

The major components and technologies involved:

**COMPONENTS**

1. A lancet
2. A test strip
3. Electrochemical sensors
4. Microfluidic chips
5. Biomarker enzymes
6. Mobile Application.

**TECHNOLOGIES**

1. Nanotechnology
2. Photonics
3. Artificial Intelligence
4. Block chain Technology

The role of patient:

The patient has to prick their finger using the lancet and dispense a drop of blood on the test strip placed into the device.

The role of the device:

The device contains the electrochemical sensors which converts the measurable analytes from blood to electrical signals by sensing it.

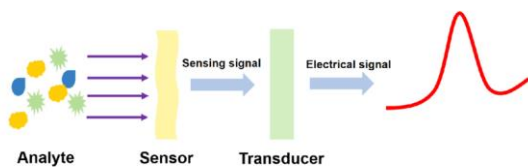


Figure 3

Further, the blood is absorbed by the microfluidic chips containing the biomarker enzymes that uses electrokinetic, capillary, vacuum, and other forces to mix and separate blood samples to achieve greater accuracy.

The biomarker enzymes reacts with the blood and sends out the results in the form of signals.

The system instantly operates and conveys the results by capturing the signal and retrieving it through photonics or computer imagery by a mobile application. The results are compared with actual values and are viewed as simple graphs using Artificial Intelligence.

The application contains many features such as

- View of results based on the preference
- View of results in any form ( graphical, pie chart, tabular format)

- Provision of risk line.

Alert button is provided as the feature of this application which can be used at the time of emergency after which the messages are passed to the emergency contacts which are provided as the time of login.

The patient’s monthly check up reports can be updated in the application as a database and so they can be used as a reference for future medication.

The progress of the patient’s blood test results are tracked.

There is a unique feature of diseases dictionary that let know about all the diseases and the symptoms.

If there is any discrepancies or critical values after the comparison of patient’s blood results with actual values , the pointer goes above the risk line. Then the results are directed to the nearest hospital with the knowledge of patients after which the medical counsellors would insists the patient about the risk and ask them to get treated as soon as possible.

**IV.RESULTS AND FINDINGS**

Our product desires to determine 50+ components of blood along with the biomarkers with high accuracy compared to other companies using the electrochemical sensors and artificial intelligence.

Role of device:

1. Determination of CBC
2. Finding blood group.
3. Detecting diseases using biomarkers.
4. Results generation through electrochemical sensors as signals.

Role of mobile application:

1. Generation of test reports instantly using computer imagery.
2. Comparison of results with actual values.
3. View of results in easily understandable format (graph, piechart, table).
4. Provision of risk line for emergency cases.

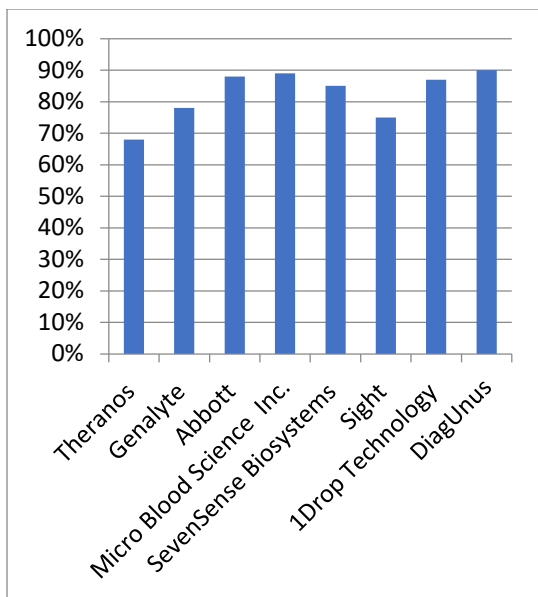


Figure 4

Table for comparison of accuracy with other companies and DiagUnus.

COMPANIES	ACCURACY
Theranos	68%
Genalyte	78%
Abbott	88%
Micro Blood Science Inc.	89%
SevenSense Biosystems	85%
Sight	75%
1Drop Technology	87%
DiagUnus	90%

Comparison of accuracy.

### V.CONCLUSION

Our main objective is complete analysis of blood within a single drop and encourage everyone to take initiative for improved health outcomes, optimal efficiency, and a more contented exists. Our product focus to process analysis of blood with just one drop of it. CBC, Blood grouping and biomarkers along with blood hormones are examined. It prevents high health risks of patients to save lives. A single gadget will be used to monitor health, reducing the need for additional

medical equipment. We guarantee that this device is affordable and economical, so everyone will be able to use it to access medical care. Due to the instantaneous generation of the reports, patients would be more cautious and vigilant. The time it takes for results to appear is cut down. The patients receive proper counselling from medical professionals as a result of which they are informed of the dangers of laziness to their health. We'll start with our focus on national level, but expand globally as we develop brand recognition among the society. Our product would be reasonably priced and accessible to regular people as well. Though it requires a lot of technology, including AI, photonics, and blockchain, we're working to make it more affordable. Since our product is making simple for people to receive medical care with the use of technology for monthly check-ups we predict a success rate of 95% which helps our financial gain. We solely assure that our product would be economically feasible socially acceptable product in near future.

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