

# Non-Invasive Multi health meter for detecting Glucose levels, Oxygen levels and Heart rate

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## ABSTRACT

A non-invasive multi health meter is a device that can detect glucose level, heart rate and oxygen level without the need for invasive procedures. This type of device can be useful for monitoring the health of patients with diabetes, heart conditions and respiratory problems. This device is able to wirelessly connect to a smartphone so that the data can be easily accessed and analyzed. Glucose level measurement is a key factor in the management of diabetes. The ability to monitor glucose levels in real-time allows for more precise insulin dosing and adjustments to diet and exercise. This can lead to better overall blood sugar control and can help to prevent complications such as diabetic retinopathy, neuropathy and nephropathy. Heart rate monitoring is also an important factor in managing heart conditions. It allows for early detection of abnormal heart rhythms, such as atrial fibrillation, and can also provide insight into a patient's overall cardiovascular fitness. This can aid in the development of personalized exercise and treatment plans, and can also help to identify potential cardiac events before they occur. Oxygen level measurement is critical for patients with respiratory conditions such as COPD and asthma, as well as for athletes and other individuals who engage in high-intensity exercise. Low oxygen levels can lead to fatigue, shortness of breath, and other symptoms, and can also be an indicator of more serious conditions such as hypoxemia. By continuously monitoring oxygen levels, patients and athletes can better manage their symptoms and prevent potential complications

**Keywords:** Glucose level detection, Heart rate monitoring, Non-invasive health monitoring, Oxygen level measurement, Real-time health monitoring

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## INTRODUCTION

In recent years, the demand for personalized health monitoring and disease management has been on the rise. The ability to accurately and non-invasively monitor vital health parameters such as glucose levels, oxygen levels, and heart rate plays a crucial role in promoting well-being and enabling early detection of potential health issues. Traditional methods of measuring these parameters often involve invasive procedures, which can be uncomfortable, inconvenient, and pose certain risks.

To address these limitations, our project aims to develop a non-invasive multi-health meter that allows for the simultaneous measurement of glucose levels, oxygen levels, and heart rate. This innovative device utilizes cutting-edge technology to provide individuals with a user-friendly and accessible means of monitoring their vital health parameters in a convenient and reliable manner.

One of the key advantages of our non-invasive multi-health meter is its ability to provide real-time measurements without the need for invasive procedures. By employing advanced sensing techniques, the device can capture essential physiological data through non-invasive means, such as optical sensors and signal processing algorithms. This not only eliminates the discomfort associated with conventional methods but also reduces the risk of infection and enhances user compliance.

Our non-invasive multi-health meter seeks to combine the measurement capabilities for these vital parameters into a single portable device, making it convenient for users to monitor their health regularly, even in their daily routines. By providing a comprehensive assessment of these parameters, individuals can gain valuable insights into their overall health status and make informed decisions to improve their well-being.

## **PROJECT OBJECTIVE**

The objective of this project is to develop a non-invasive multi-health meter capable of accurately and simultaneously measuring glucose levels, oxygen levels, and heart rate. The specific goals of this project are:

**Design and Develop the Non-invasive Multi-Health Meter:** This objective involves the design and development of a portable and user-friendly device that integrates advanced sensing technologies, signal processing algorithms, and data visualization capabilities. The device should be capable of capturing reliable measurements of glucose levels, oxygen levels, and heart rate through non-invasive means.

**Ensure Accuracy and Reliability of Measurements:** This objective focuses on validating the accuracy and reliability of the non-invasive multi-health meter. It involves conducting rigorous experimentation and comparing the measurements obtained from the device with reference measurements. The aim is to ensure that the device provides precise and consistent results for glucose levels, oxygen levels, and heart rate.

**Optimize User Experience and Interface:** This objective aims to optimize the user experience by designing an intuitive and user-friendly interface for the non-invasive multi-health meter. The device should have a clear and informative display, easy-to-understand instructions, and intuitive navigation. The objective is to make the device accessible to users of varying technical expertise and ensure seamless interaction.

**Enhance Personalized Health Monitoring:** This objective aims to contribute to personalized health monitoring by providing individuals with a convenient and reliable means of monitoring their vital health parameters. The objective is to empower individuals to take an active role in managing their health by offering real-time and non-invasive measurements of glucose levels, oxygen levels, and heart rate. The device should facilitate informed decision-making regarding diet, medication, and lifestyle choices, ultimately improving overall well-being.

## **EXISTING MODEL**

The current methods for measuring glucose levels involve invasive techniques such as blood samples and Continuous Glucose Monitoring (CGM) devices. These methods require the collection of blood samples, which can be inconvenient, time-consuming, and pose risks of infection with regular use. Recognizing these limitations, there is a growing motivation to develop the next generation of minimally invasive devices that utilize small needles inserted into the skin for Continuous Glucose Monitoring. The aim is to achieve non-invasive, real-time continuous monitoring of glucose levels that can be remotely accessed. However, these next-generation devices are still undergoing trials and are in the development stages.

## **SOFTWARE AND HARDWARE REQUIREMENTS**

- Windows 7 or later
- Arduino IDE
- Flutter SDK
- Firebase Database
- Processor i5 or later
- HDD/SSD 20GB
- Memory 4GB RAM
- Arduino Nano
- HC-05 Bluetooth Module
- Tcrt5000
- Max30102
- Registers (100 ohm, 10k ohm)

## **PROPOSED WORK**

The problem of monitoring glucose level, heart rate, and oxygen level in real-time is a significant one in the field of personal healthcare and fitness. Diabetes, heart conditions, and respiratory problems are major public health issues, and the ability to non-invasively measure these physiological parameters can help to improve the management of these

conditions. Additionally, many athletes and other individuals are interested in tracking their fitness levels, and a device that can measure glucose level, heart rate and oxygen level in real-time can help them to better assess their fitness level and adjust their training accordingly.

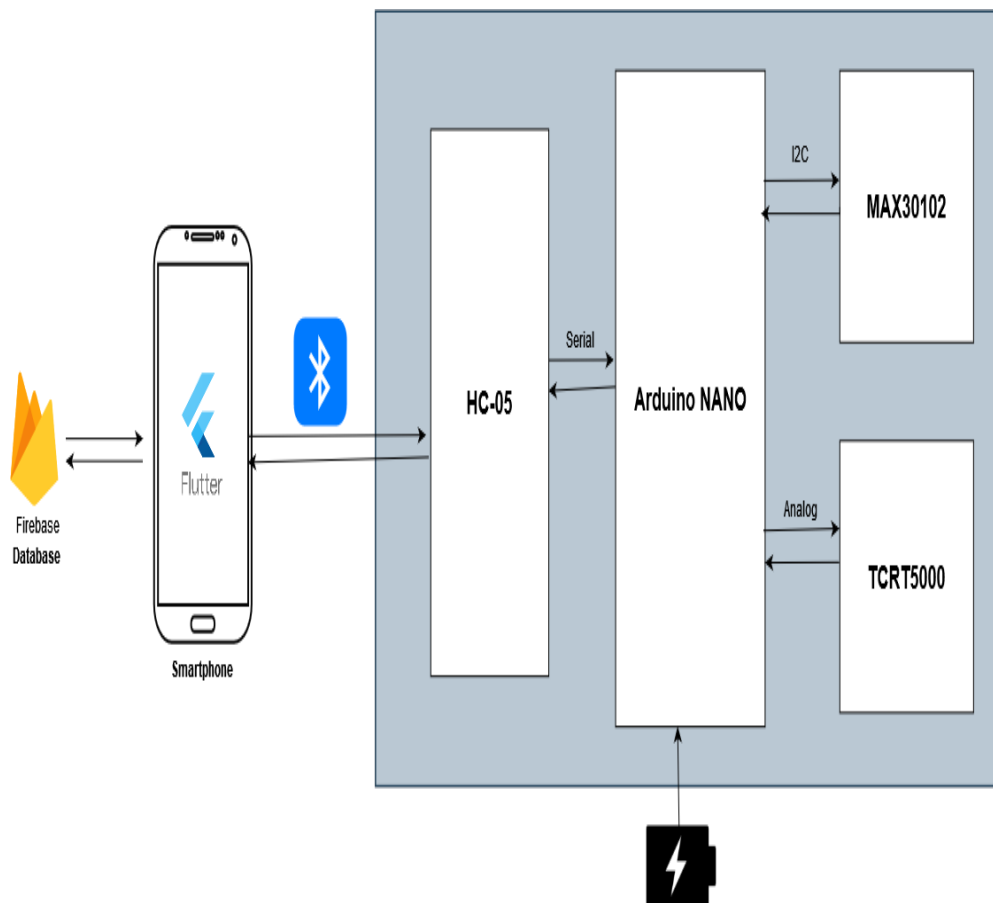
Currently, there are no devices available that can non-invasively measure all three of these physiological parameters in real-time. Patients with diabetes need to constantly monitor their glucose levels and adjust their insulin doses accordingly, but the current methods of glucose monitoring such as finger pricking can be painful and inconvenient. Heart conditions such as atrial fibrillation can be difficult to detect, and early detection is critical for preventing complications. Respiratory conditions such as COPD and asthma require continuous monitoring of oxygen levels in order to manage symptoms and prevent complications.

Athletes and other individuals who want to track their fitness levels need to measure their glucose level, heart rate and oxygen level in real-time to assess their fitness level and adjust their training accordingly. However, currently there are no devices available that can non-invasively measure all three of these physiological parameters in real-time.

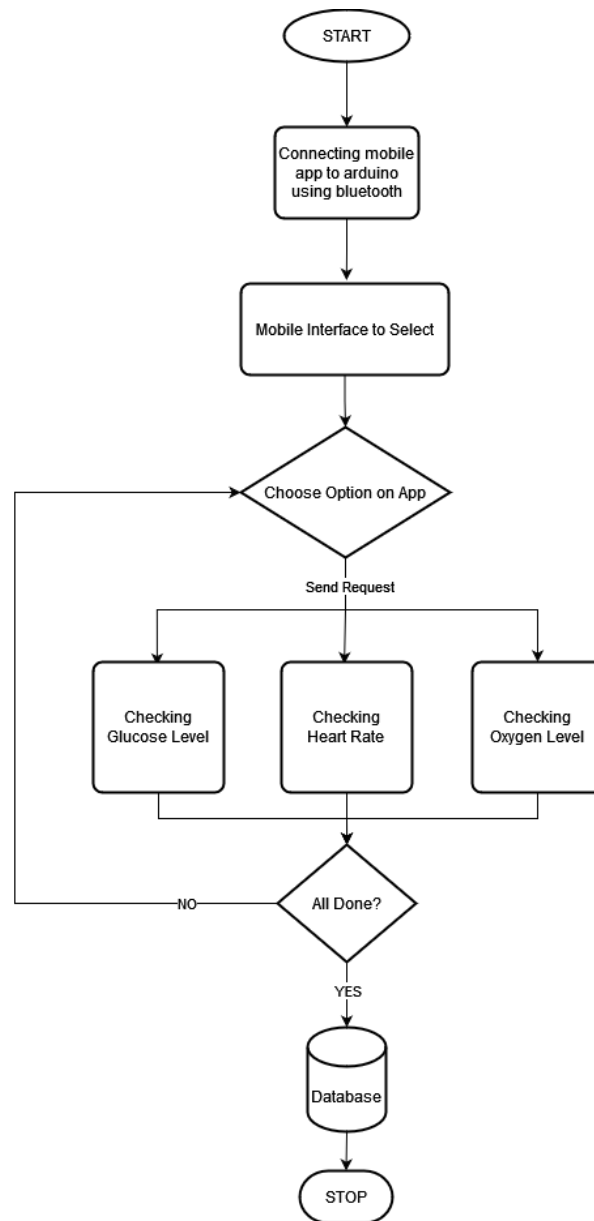
The development of a non-invasive multi health meter aims to address this problem by creating a device that can accurately and non-invasively measure glucose level, heart rate, and oxygen level in real-time. and wirelessly connect to a smartphone or other device for easy access and analysis of the data. This would provide a convenient and easy-to-use solution for individuals and healthcare providers to monitor glucose level, heart rate and oxygen level in real-time and make necessary adjustments to treatment plans and exercise regimes.

Overall, the problem that the non-invasive multi health meter aims to solve is the need for a convenient and easy-to-use device that can provide real-time information about glucose level, heart rate, and oxygen level. The device has the potential to improve the management of diabetes, heart conditions, and respiratory problems, as well as help individuals track their fitness levels. The current lack of such device in the market is a significant problem that needs to be addressed

**BLOCK DIAGRAM**



**Figure 1: Interaction between Mobile, Sensor and Database**



**Figure 2: Workflow of the project**

### WORKING

First the user has to download our app from the application store. Our device contains Bluetooth module so that the user has to connect the device to the mobile phone via Bluetooth. Upon opening our application, the user will have to put his/her required details which will allow the user to sign up. The user will have a privilege to choose an option of either measuring glucose level or heart rate or oxygen level each separately or measuring all the three at once. The reason behind the option for measuring separately is that the computation time for a single checkup is comparatively less than the time for measuring all three things at once. The user can choose this particular option in case of emergency or he/she has limited time. The user will have to place the index finger on the provided area on the device.

Once the user has placed the finger and chooses the options provided to him/her, the LED will emit light which will pass through the skin of the finger to the blood inside which will contain the information regarding the blood glucose, oxygen level and heart rate. This emitted light will be reflected due to proteins and lipids present inside the blood which will contain the information regarding the blood. This information will receive by the phototransistor which will provide the output in form of voltage and this output will be used for further computations regarding the above three options.

The above computed results will be displayed in the app in a numerical representation and graphical representation in form of line graph. These results will be stored in the history section of the app. The history section of the app will

allow the user to view his/her previous computed result, which will be stored in the database. The results stored in the database will have the time frame of 1 month after which the results will be automatically erased.

**Table 1: Invasive vs Non-invasive reading of Glucose levels**

Sr.No	Invasive(by watch)mg/Dl	Non-invasive (our device)mg/Dl	Difference
1	80	85	+5
2	100	97	-3
3	88	92	-4
4	92	88	-4
5	105	102	-3

**Table 2: Invasive vs Non-invasive reading of Oxygen levels**

Sr.No	Invasive(by watch) SpO2	Non-invasive (our device) SpO2	Difference
1	99	102	+1
2	100	98	-2
3	95	92	-3
4	99	100	+1
5	96	98	+2

**Table 3: Invasive vs Non-invasive reading of Heart rates**

Sr.No	Invasive(by watch) bpm	Non-invasive (our device) bpm	Difference
1	75	70	-5
2	92	95	+3
3	65	68	+3
4	79	86	+7
5	80	76	-4

### CONCLUSION

In conclusion, a non-invasive multi health meter is a valuable tool for monitoring the health of patients with diabetes, heart conditions, and respiratory problems, as well as for patients and other individuals who want to track their fitness levels. The device uses sensors to measure various physiological parameters, such as blood glucose levels, heart rate, and oxygen saturation. The data can be easily accessed and analyzed through a connected smartphone allowing for better overall management of symptoms and preventing potential complications. With its ability to measure glucose, heart rate and oxygen levels in real-time, this device has the potential to improve the lives of many patients and athletes.

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