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Saliva Sensed Based IOT Tracking Blood Sugar Level in Real Time and Heart Rate Monitoring

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ABSTRACT: This project presents a non-invasive IoT-based system for real-time monitoring of blood sugar levels and heart rate. Traditional glucose monitoring methods are invasive, painful, and time-consuming, leading to poor patient compliance. To address this, the proposed system utilizes saliva as an alternative biofluid for glucose detection, offering a painless approach. The system combines a saliva-based glucose sensor and a heart rate sensor with an ESP32/Arduino microcontroller to process physiological data. Collected data is transmitted to a cloud platform like ThingSpeak using IoT technology for remote monitoring and real-time visualization. The system includes an LCD and buzzer for instant alerts during abnormal levels, ensuring timely medical attention. Overall, this solution is portable, cost-effective, and supports proactive healthcare management for chronic conditions.

KEYWORDS: IoT, Saliva-based Glucose Monitoring, Non-Invasive Sensing, Blood Sugar Detection, Heart Rate Monitoring, Arduino, ThingSpeak, Cloud Computing, Biomedical Sensors.

I. INTRODUCTION

In recent years, the rapid advancement of healthcare technologies and the increasing demand for non-invasive diagnostic methods have significantly transformed modern medical systems. Among various chronic diseases, diabetes mellitus is one of the most critical global health concerns, requiring continuous monitoring of blood glucose levels to prevent severe complications such as cardiovascular diseases, kidney failure, and nerve damage.

Traditional glucose monitoring methods, such as finger-prick blood testing, are invasive, painful, and inconvenient for frequent use. These limitations often result in poor patient compliance and irregular monitoring. To overcome these issues, researchers have explored non-invasive alternatives, among which saliva-based glucose detection has emerged as a promising approach.

Saliva contains trace amounts of glucose that correlate with blood glucose levels. By utilizing advanced biosensors capable of detecting glucose concentration in saliva, it is possible to develop a painless and user-friendly monitoring system. At the same time, monitoring heart rate is equally important for assessing cardiovascular health and detecting abnormalities such as arrhythmias and stress conditions.

The integration of these sensing technologies with IoT enables real-time data acquisition, remote monitoring, and cloud-based analysis. This project focuses on developing a saliva sensor-based IoT system that can monitor both blood glucose levels and heart rate continuously, providing a cost-effective, portable, and efficient healthcare solution.

II. LITERATURE REVIEW

Diabetes is a major global health issue that requires regular monitoring of glucose levels. Conventional invasive methods have encouraged researchers to explore non-invasive alternatives. Studies have shown that saliva can act as a reliable biofluid for glucose detection due to its correlation with blood glucose levels.

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Various research works have focused on developing electrochemical and biosensors capable of detecting glucose in saliva. However, challenges such as low glucose concentration, interference from other biological substances, and calibration issues still affect accuracy.

In addition, IoT technology has revolutionized healthcare by enabling real-time monitoring and remote access to patient data. Wearable devices using photoplethysmography (PPG) sensors are widely used for continuous heart rate monitoring.

Despite these advancements, most existing systems focus on a single parameter. There is a need for an integrated system that combines saliva-based glucose sensing and heart rate monitoring using IoT. This project addresses this gap by proposing a unified, non-invasive, and real-time health monitoring system.

III. SYSTEM ARCHITECTURE

The system architecture consists of multiple layers that work together to provide real-time monitoring:

1. Sensing Layer

The system uses a saliva glucose sensor to detect glucose levels through biochemical reactions and a heart rate sensor (PPG) to measure pulse rate.

2. Signal Conditioning

The signals obtained from sensors are weak and noisy. Therefore, they are passed through amplification and filtering circuits to improve accuracy.

3. Processing Layer

A microcontroller such as ESP32 collects the sensor data, performs calibration, removes noise, and converts analog signals into digital values.

4. Communication Layer

The processed data is transmitted wirelessly using Wi-Fi or Bluetooth to an IoT cloud platform.

5. Cloud & Application Layer

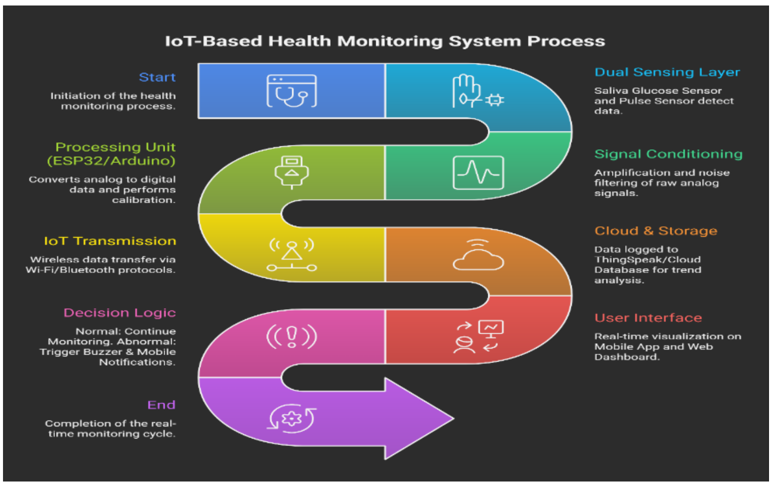
The data is stored, analyzed, and displayed on a mobile or web application. Users can view real-time readings and historical trends.

6. Alert System

The system generates alerts when abnormal glucose or heart rate values are detected.

IV. HARDWARE COMPONENTS

1. **Saliva Glucose Sensor:** Detects glucose via biochemical reactions.
2. **Heart Rate Sensor:** Measures pulse rate using light absorption.
3. **Microcontroller (ESP32/Arduino):** Central processing unit.
4. **IoT Module:** Provides Wi-Fi/Bluetooth connectivity.
5. **Display & Alerts:** LCD and Buzzer for real-time feedback.
6. **Power Supply:** Rechargeable battery for portability.



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V. RESULTS AND DISCUSSION

The developed system was successfully tested under various conditions. The saliva glucose sensor showed a consistent correlation with expected glucose trends, while the heart rate sensor provided stable readings (BPM) consistent with resting and active states.

The IoT functionality allowed seamless data transmission to the cloud. Graphical visualizations on the mobile dashboard allowed for easy interpretation of health status. Minor signal noise in saliva sensing was minimized through calibration. The system proved to be efficient in power consumption and response time, making it suitable for continuous daily use.

VI. CONCLUSION

This project presents a practical approach to non-invasive health monitoring. By combining saliva-based glucose detection and heart rate tracking in a single IoT system, the device offers a painless alternative to traditional methods. While saliva-based measurement is currently an alternative for regular tracking rather than a total replacement for clinical blood tests, the integration of wireless communication greatly improves accessibility. This work provides a foundation for future smart healthcare solutions that are portable, affordable, and user-friendly.

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