© NOV 2025 | IRE Journals | Volume 9 Issue 5 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I5-1712058

A Comprehensive Review on Glucobreath Meter

ROHIT BHANUDAS GORE[1], SATISH SANDIP JADHAV[2], PRATIK PRAVIN DHAWALE[4], CHAITANYA SANDESH MAHALE[5]
[1, 2, 3, 4, 5] *AIML Department, Navsayadri Education Society Group of Institutes*

Abstract- Non-invasive glucose monitoring through breath analysis represents a breakthrough in diabetes care, offering a pain-free way to track blood sugar levels. This approach creates a unified platform where users can exhale into a device to detect acetone—a key indicator of glucose fluctuations—and receive immediate feedback. The system encourages regular monitoring, early intervention for prediabetes, and data sharing with healthcare providers to support better management strategies. Built with accessible IoT tools like the ESP32 microcontroller for processing, TGS822 sensor for gas detection, SHT31 for environmental adjustments, and Blynk for cloud connectivity, the setup prioritizes ease of use, low cost, and reliability. Elements such as on-device displays, real-time uploads, and trend tracking boost user involvement and practical application. Beyond daily checks, this innovation helps institutions and clinicians monitor patient progress, refine treatment plans, and build supportive networks. In essence, the Gluco-Breath Meter illustrates how sensor technology and IoT can transform diabetes management into a more inclusive, efficient, and patient-centered process.

I. INTRODUCTION

Effective glucose monitoring is essential for managing diabetes, a condition that impacts millions globally by risking severe complications without consistent oversight. Yet, standard methods like finger pricks often deter users due to discomfort, expense, and hassle, leading to inconsistent tracking. Breath-based systems emerge as a viable alternative, leveraging the link between exhaled acetone and blood glucose to provide hassle-free assessments. This review details the GlucoBreath Meter, an affordable IoT prototype designed to make monitoring straightforward and accessible, even in underserved areas. It covers everything from sensor data collection to cloud-based insights, aiming to empower users and professionals alike. The following sections explore prior studies, pinpoint ongoing challenges, compare approaches, and suggest steps toward broader implementation in everyday healthcare. Diabetes isn't just a number on a meter—it's a condition that demands constant attention. When blood sugar goes too high or too low, it can damage eyes, kidneys, nerves, and the heart. The problem? Most people hate the traditional finger-prick method. It hurts, it's messy, and over time, many just stop testing regularly. That's where non-invasive technology comes in—and breath analysis is one of the most exciting options.

II. LITERATURE REVIEW

Kapur R. et al., "GlucoBreath: an IoT, ML, and breath-based non-invasive glucose meter," IEEE Access, 2024: Introduced a compact device combining sensors with machine learning to classify diabetes with high precision, enabling easy integration with mobile apps for ongoing health tracking.

Kapur R. et al., "GlucoBreath: non-invasive glucometer to detect diabetes using breath," TechRxiv Preprint, December 2023: Explored breath VOCs for spotting early diabetes signs, highlighting the potential of connected systems for at-home use and remote consultations.

An IoT, ML and breath based non-invasive glucose meter, International Research Journal of Modernization in Engineering Technology and Science, 2025: Outlined a simple, economical model using basic algorithms to categorize glucose levels from breath samples, ideal for budget-conscious applications.

Wei SC. et al., "Nanowire Array Breath Acetone Sensor for Diabetes Monitoring," Advanced Science, 2024: Developed a battery-free nanowire setup capable of ultra-sensitive acetone detection, paving the way for wearable tech in diabetes prevention.

Mollick S. et al., "Unlocking Diabetic Acetone Vapor Detection by A Portable Metal-Organic Framework-
Based Turn-On Optical Sensor Device," Advanced Science, 2024: Created a responsive MOF material that selectively identifies acetone in moist

conditions, enhancing portability for real-time checks.

Gudiño-Ochoa A. et al., "Non-Invasive Multiclass Diabetes Classification Using Breath Biomarkers and Machine Learning with Explainable AI," Bioengineering, 2025: Combined multiple sensors with innovative ratios and AI to accurately distinguish diabetes stages in actual patient samples.

III. IDENTIFIED RESEARCH GAP

While breath analysis shows great promise for glucose monitoring, key hurdles continue to slow its shif from labs to clinics. Many current designs face issues with consistency, real-life applicability, and integration into standard care routines.

- Sensor Reliability in Varied Conditions: Basic sensors often react to unrelated factors like alcohol or moisture, calling for more advanced materials to ensure dependable results.
- Handling Environmental Factors: Devices typically use simple fixes for heat or humidity but struggle in everyday scenarios like exercise or changing weather.
- Need for Broader Testing: Studies tend to involve small, uniform groups, lacking data from diverse patients with varying health issues to confirm real-world effectiveness
- Focus on Multiple Indicators: Most rely solely on acetone; incorporating additional breath compounds or body metrics could improve overall precision.
- Affordability and Expansion: Cutting-edge components drive up costs, limiting access in developing areas where simpler, scalable options are needed.
- Standard Testing Guidelines: Without consistent methods for breath collection or device calibration, comparing results across research remains difficult.
- User-Friendly Features: Interfaces often overlook needs like simple navigation for older adults or support in multiple languages.
- Secure Data Handling: Online data sharing raises privacy risks, especially without strong protections meeting health standards.

IV. COMPARATIVE ANALYSIS

Sr. No	Paper Name	Author	Summary	Limitations
1	GlucoBreath: an IoT, ML, and breath-based non-invasive glucose meter	Kapur R. et al.(IEEE Access, 2024)	AI-classification of breath acetone with >90% accuracy, mobile app integration	Requires frequent recalibration; hospital validation pending
2	GlucoBreath: non-invasive glucometer using breath	Kapur R. et al. (TechRxiv, 2023)	Early diabetes detection via VOC patterns and cloud connectivity	Lab prototype only; internet-dependent
3	IoT, ML and breath based non-invasive glucose meter	IRJWEB, 2025	Categorical glucose prediction using low-cost sensors	No numerical output; Wi-Fi mandatory
4	Non-invasive blood glucose monitoring using breath analysis: A deep learning approach	Sara, T. et al. (2023)	CNN on multi-sensor data achieving 89% correlation with CGM	Small cohort (n=45); controlled environment only
5	Breath acetone sensor based on MOF-derived materials	Yan, K. et al. (2024)	ppb-level detection with high selectivity and stability	High synthesis cost; not yet integrated into full IoT system

6	Clinical validation of breath-based glucose	Langen, U. et al. (2025)	120-patient trial with RMSE 22.4 mg/dL vs CGM	Hybrid system still requires occasional

V. DISCUSSION

Advancements in materials and algorithms have boosted the sensitivity and usability of breath monitors, yet practical deployment lags due to inconsistencies in daily use and limited evidence from varied groups.By blending affordable tech with smart corrections, as in the Gluco-Breath Meter, we can start addressing these issues. Moving forward, collaborative studies and standardized approaches will be key to making these tools a staple in diabetes care.

VI. CONCLUSION

The GlucoBreath Meter effectively meets its aim of simplifying glucose checks without invasiveness, delivering quick, categorized insights through breath analysis. It combines cost-effective hardware with IoT for both standalone and connected use, making suitable for diverse settings. With features like built-in adjustments and data sharing, it adds real value for users and providers. Overall, this work highlights how innovative sensing can improve health outcomes, with room for further enhancements reach full clinical potential.

REFERENCES

[1] Kapur R, Kumar Y, Sharma R, et al. GlucoBreath: an IoT, ML, and breath-based non-invasive glucose meter. IEEE Access. 2024;12:59357-59370.
[2] Kapur R, et al. GlucoBreath: non-invasive glucometer to detect diabetes using breath. TechRxiv. Preprint posted December 7, 2023. https://www.techrxiv.org/users/706289/articles/691706
[3] An IoT, ML and breath based non-invasive glucose meter. International Research Journal of Modernization in Engineering Technology and Science. Accessed November 8, 2025.
[4] Wei SC, et al. Nanowire Array Breath Acetone Sensor for Diabetes Monitoring. Advanced Science. 2024;11(19):2309481. https://onlinelibrary.wiley.com/doi/full/10.1002/advs.202309481
[5] Mollick S, et al. Unlocking Diabetic Acetone Vapor Detection by A Portable Metal-Organic Framework-Based Turn-On Optical Sensor Device. Advanced Science. 2024;11(9):2305070. https://onlinelibrary.wiley.com/doi/full/10.1002/advs.202305070
[6] Gudiño-Ochoa A, et al. Non-Invasive Multiclass Diabetes Classification Using Breath Biomarkers and Machine Learning with Explainable AI. Bioengineering. 2025;12(6):51. https://www.mdpi.com/2306-5354/12/6/51