Smart Breath-Based Glucose Monitoring System

This project introduces an innovative, non-invasive approach to glucose monitoring, addressing critical challenges in diabetes management through breath analysis technology.

Challenges

- Diabetes affects millions worldwide
- Traditional glucose monitoring is:
  - Invasive
  - Painful
  - Expensive
  - Infrequent

Why Shift requires Monitoring system

- Current methods require blood extraction
- Limited patient comfort
- High monitoring costs
- Infrequent health tracking

Primary Objectives

- Develop non-invasive glucose monitoring system
- Enable real-time glucose level detection
- Reduce patient discomfort
- Create cost-effective monitoring solution

Detection Mechanism

- First low-cost Arduino-based breath analysis system
- Utilizes MQ138 gas sensor for VOC detection
- Provides continuous real-time monitoring
- No blood sampling required

Hardware Components Used

- Arduino Nano Microcontroller
- MQ138 Gas Sensor
- Serial Communication Interface
- 5V Power Supply

Software Requirements Used

- Arduino IDE
- C/C++ Programming Language

Working Principle

1. Breath Sample Collection
   - User breathes into specialized sensor
   - MQ138 detects Volatile Organic Compounds

2. Data Acquisition
   - Converts chemical signals to electrical readings
   - Analog reading captured via Pin A0
   - Voltage Conversion Formula:
     Voltage = sensorValue * (5.0/1024.0)

3. Glucose Calculation
   - Linear regression formula implementation
   - BGL = (158.12 * Voltage) - 519.35
   - Result displayed in mg/dL

4. Implementation of the code

Advantages

Parameter	Traditional Methods	Our Proposed System
Sampling Method	Blood Extraction	Breath Analysis
Cost	High	Low
Frequency	Limited	Continuous
Patient Comfort	Invasive	Non-Invasive
Technological Complexity	High	Moderate
Scalability	Limited	High

Advantages
- Completely non-invasive testing
- Real-time health monitoring
- Pain-free experience
- Frequent testing capability
- Significantly reduced monitoring costs

Limitations
- Requires comprehensive medical validation
- Potential environmental factor sensitivity
- Needs periodic recalibration
- Accuracy may vary under different conditions

Future Development

- Enhanced Sensor Array Development
- AI-Powered Predictive Analysis
- Mobile Application Integration
- Comprehensive Clinical Validation Studies