SUGUARD

AI-BASED OPTICAL GLUCOMETER

How can affordable smart devices make diabetes monitoring accessible to everyone?

Team members:

Bekarys M. from NIS of S&M,Uralsk, Kazakhstan
Ganibet M. from NIS of S&M,Uralsk, Kazakhstan
Kaidar M. from NIS of S&M,Uralsk, Kazakhstan

The Engage - The Problem We Had to Address

Modern methods of blood glucose monitoring are invasive and costly due to the need for purchasing consumables.

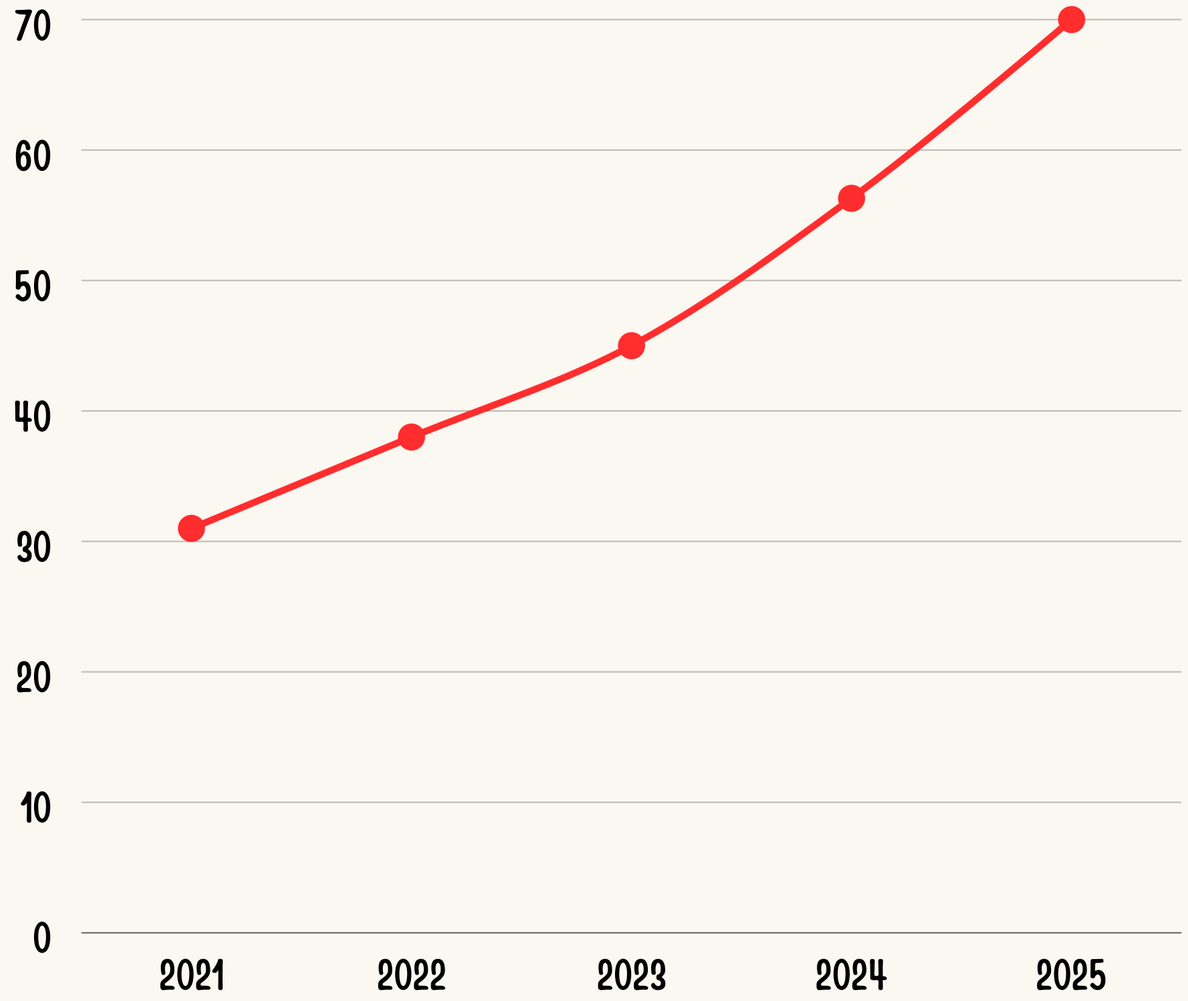
REASONS

Fear and anxiety

Reduced blood flow

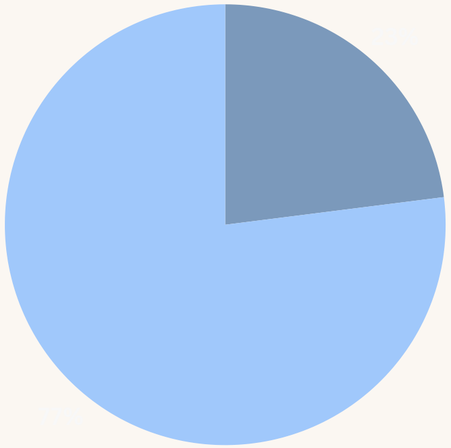
Risk of infection

Amount of funds allocated to combat diabetes (in billion KZT)



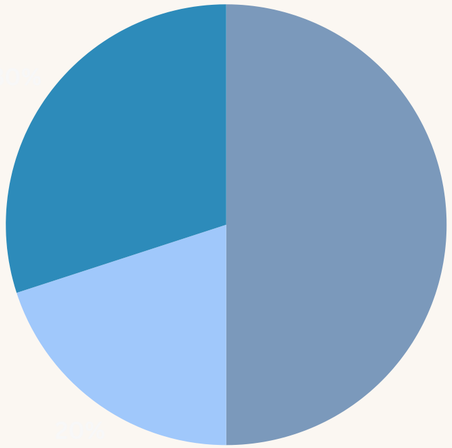
We Asked. The Community Answered.

Do you think that a more affordable and painless device for monitoring blood sugar levels would improve the quality of life for people with diabetes?



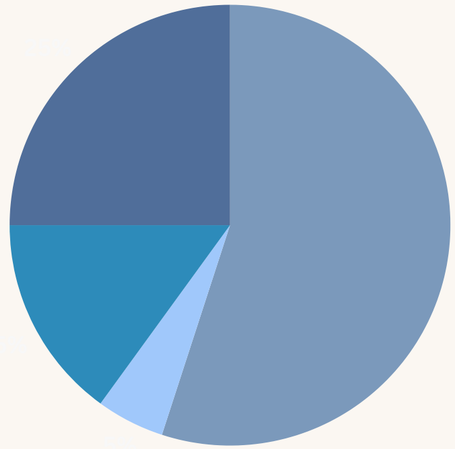
- Yes
- No

What format of blood glucose monitoring device do you find most convenient?



- Portable device for home use
- Wearable device
- Mobile application with external sensor

In your opinion, how does the high cost of glucometers and consumables affect the regularity of blood sugar monitoring in people with diabetes?



- very much
- moderately
- insignificantly
- has no effect

We surveyed more than 30 people diagnosed with diabetes and those at risk of elevated blood sugar levels.

Confirmation of demand

United Nations Sustainable Development Goals

Demonstrating homegrown technological innovation by combining AI, optical sensors, and machine learning to create a novel non-invasive medical device.

Enabling pain-free, affordable, and continuous glucose monitoring to help millions with diabetes manage their condition effectively and prevent complications.

Making advanced glucose monitoring accessible and affordable for all, removing the financial barrier of expensive test strips that creates health disparities.

Our Investigation: From Biology to Technology

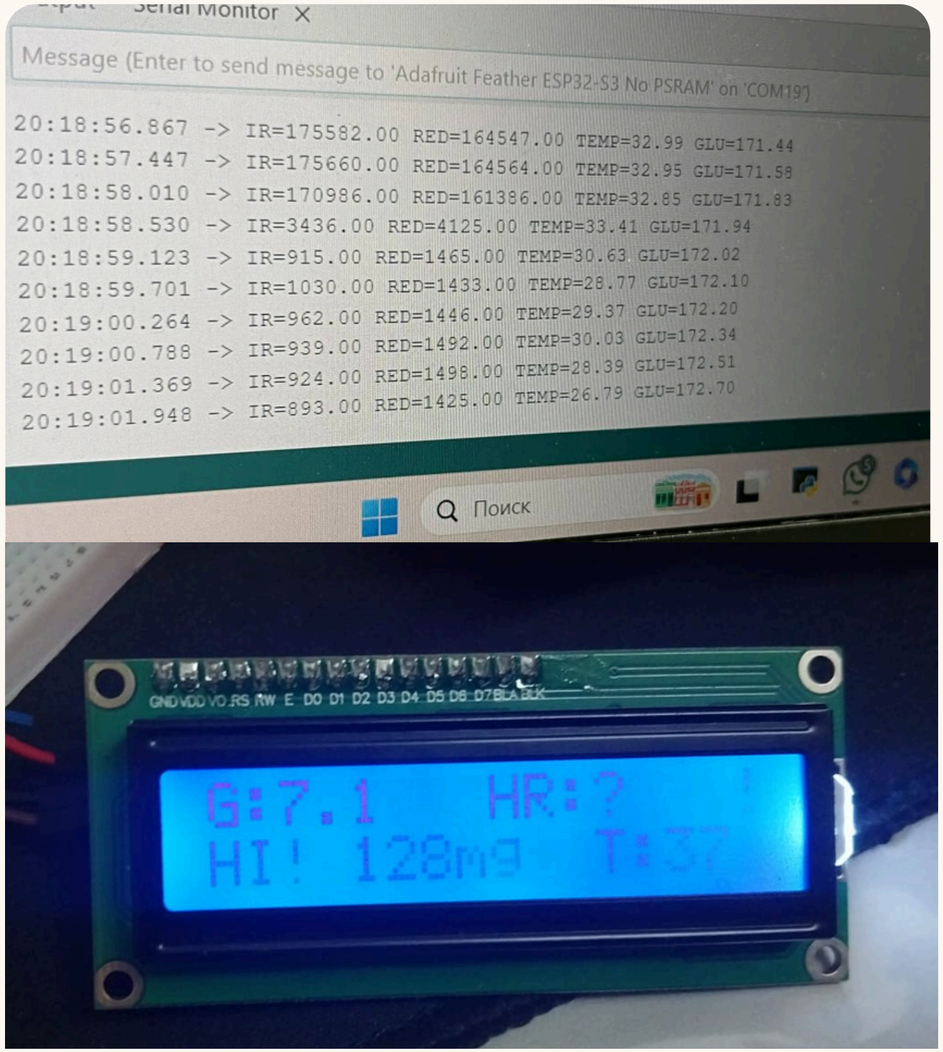
What we learned:

We discovered that glucose levels affect how light interacts with tissue. This is the scientific principle behind our non-invasive approach.

The Gap:

Existing solutions are either painful (traditional meters), expensive (continuous monitors), or both. We saw an opportunity to create a new alternative.

From Formula to Function: How It Works



We learned that glucose levels (G) can be estimated by analyzing infrared light (IR) and skin temperature (T).

Calculations using the following formula:

$G = a \cdot (IR / IR_0) + b \cdot (T - T_0) + c$

1) MAX30102: IR — infrared reflection
2) MLX90614: T — skin temperature

G — glucose level estimate (mmol/L)

IR_0 — baseline IR value

T_0 — baseline temperature

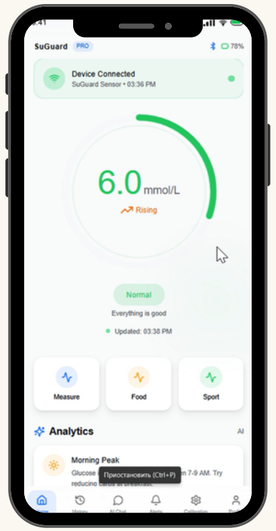
a, b, c — calibration coefficients

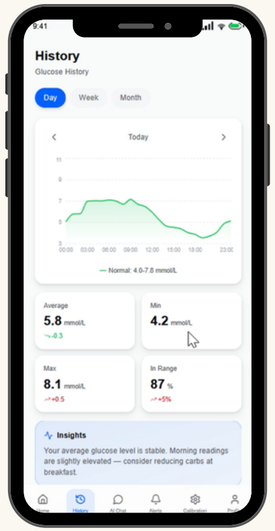
SuGuard is an AI-powered optical sensor that continuously estimates glucose levels without a single finger prick.

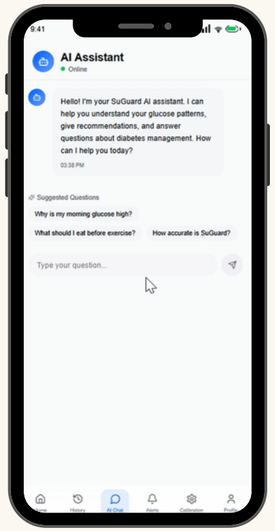
Working principle

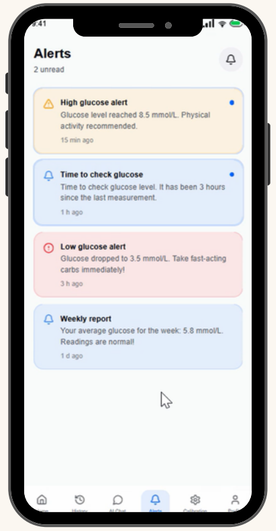
Emission	The sensor emits infrared and red light.
Reflection	Skin and blood reflect light differently at various glucose levels.
Compensation	A temperature sensor corrects for measurement errors.
Analysis	The microcontroller calculates the estimated glucose level.
Display	Data is shown on the screen and in the app.

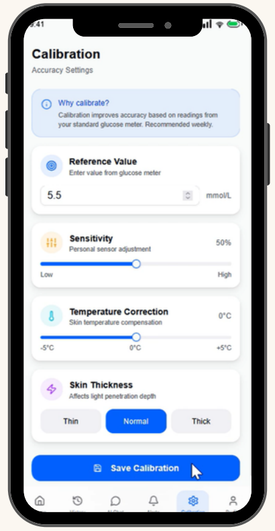
BRIDGING LIGHT AND LIFE: OUR TECH STACK- WEBSITE AND MOBILE APP

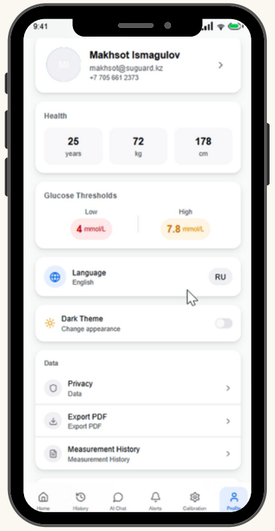


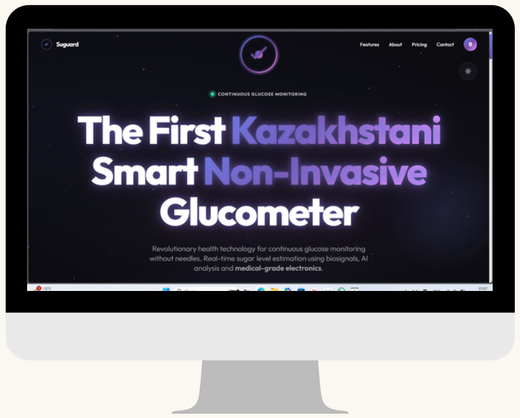


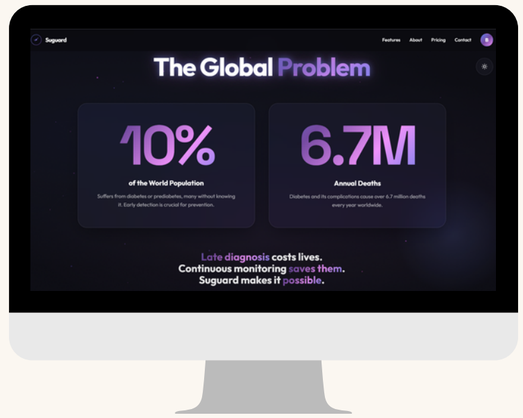




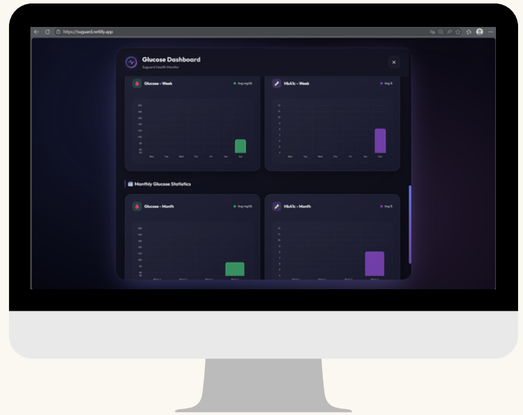








Scan me!

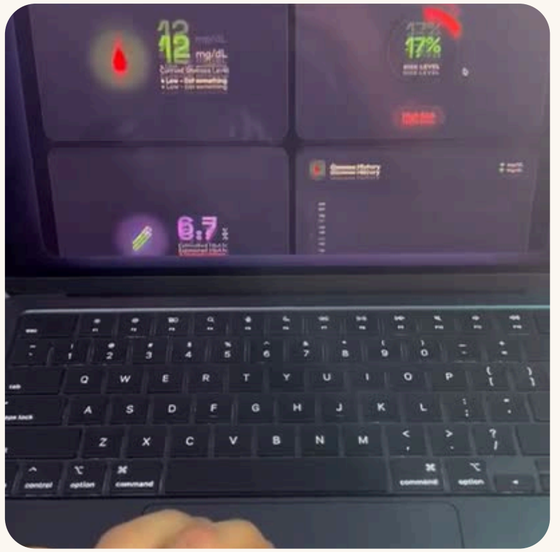


We trained a custom machine learning model that calibrates itself to each user, achieving its accuracy not through chemistry, but through data.

Not Just Data, But a Change in Life

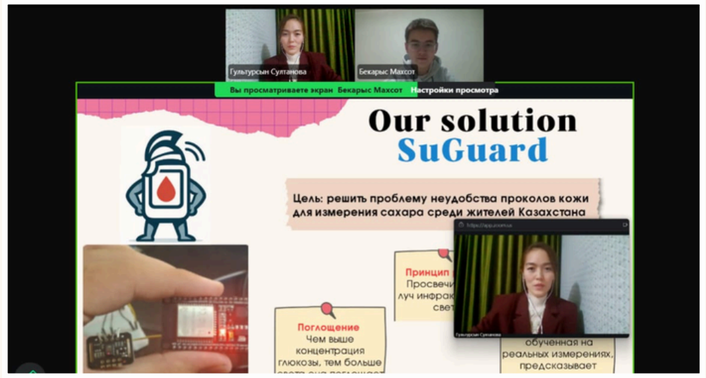
👤 **User Profile**

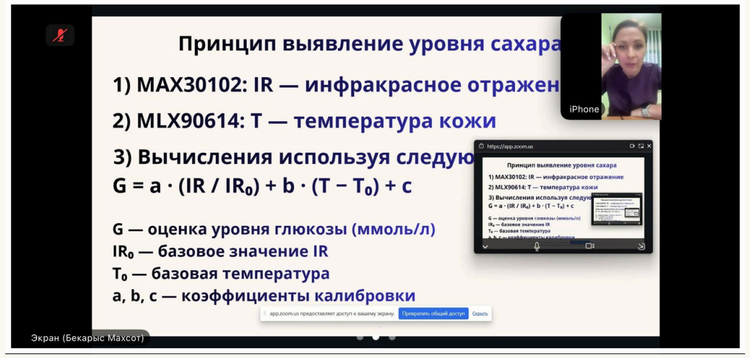
- **Age:** 15
- **Diagnosed with:** Type 1 Diabetes
- Monitoring glucose daily
- Interested in non-invasive monitoring



User Feedback:
“Now I can track my condition without constant finger pricks.”

Guided by Experts, Validated by Science





We didn't work in a bubble. We engaged with medical and engineering experts from KPO, Avicenna Medical Center.

Key Endorsement: Feature the quote from the endocrinologist, Dr. Irina Nikolayevna Lozova: "SuGuard is a promising development... and can be used as an auxiliary tool for health monitoring."

Outcome: "Our device is now undergoing testing at Avicenna Medical Center to improve its accuracy."

MEDICAL ACCREDITATION
Uralsk
2026

I hereby confirm that the SuGuard project has received professional expert approval in the field of endocrinology.

I, Irina Nikolaevna Lozovaya, a first-category physician, pediatric endocrinologist, member of the Association of Endocrinologists of the Republic of Kazakhstan, and practicing specialist at the Avicenna Medical Center (Uralsk), have reviewed the concept and technical implementation of the SuGuard project.

The SuGuard project represents a compact intelligent system for the non-invasive assessment of glucose levels and early detection of diabetes risk. In the context of the rapidly increasing prevalence of diabetes and prediabetes, the development of accessible tools for primary diagnostics and monitoring is an extremely relevant task of modern medicine.

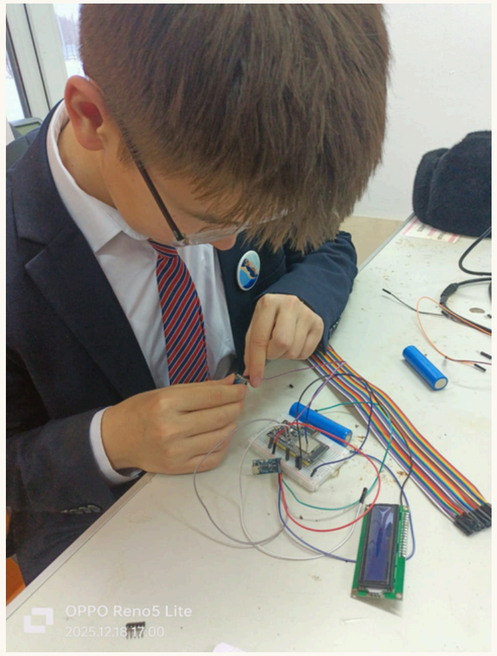
The presented system demonstrates:
• a scientifically grounded approach to the assessment of physiological indicators;
• the use of a mathematical model with individual calibration;
• integration with a mobile application and web platform for dynamic data analysis;
• artificial intelligence elements for assessing the risk of diabetes development;
• a measurement history storage function and a notification system for critical deviations.

The project's particular value lies in its preventive focus, aimed at early identification of risk factors and the formation of personalized health-preserving recommendations.

SuGuard does not replace laboratory diagnostics or clinical examination; however, it may be considered as an auxiliary screening and self-monitoring tool that promotes patient awareness and timely medical consultation.

I consider the project promising in the field of preventive medicine and digital healthcare and support its further development and implementation.

Irina Nikolaevna Lozovaya
First-Category Physician
Pediatric Endocrinologist
Member of the Association of Endocrinologists of the Republic of Kazakhstan
Avicenna Medical Center, Uralsk
Tel.: +7 707 232 80 47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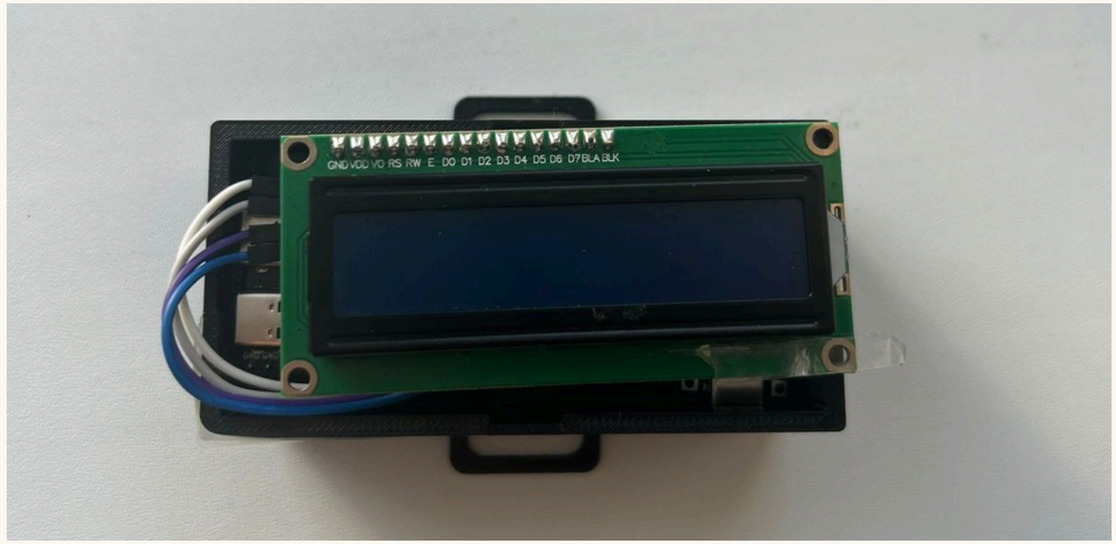
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Conclusion

Solution: SuGuard is an AI-based optical glucometer that estimates blood glucose levels non-invasively using infrared sensors (MAX30102), temperature sensors (MLX90614), and machine learning algorithms, eliminating the need for painful finger pricks and expensive test strips.
Relevance: Addresses the global issue of diabetes management by making glucose monitoring affordable, pain-free, and accessible, aligning with UN SDGs:

- SDG 3: Good Health and Well-being
- SDG 9: Industry, Innovation and Infrastructure
- SDG 10: Reduced Inequalities

Impact: The device empowers millions to monitor their glucose levels continuously without financial burden, improving quality of life and enabling early prevention of complications.
Scalability: Can be adapted for clinical use in hospitals, schools, and remote healthcare settings. Future improvements include enhanced accuracy through larger datasets and integration with mobile health platforms.
Future Prospects: Development of a mobile application for real-time data tracking, AI-driven health insights, and cloud-based storage for medical professionals, as well as miniaturization for wearable form factors.
Innovation: The project integrates artificial intelligence, optical sensor technology, and sustainable design to create a practical, eco-conscious, and life-changing healthcare solution.

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