

Integrated IOT System for Type-2 Diabetes Patient Monitoring

B.Lekhya¹, C.Lakshmi Prasanna², T.Chinna Sanjamma³, P.Deekshitha⁴, P.Chaitanya⁵

1

Department of ECE , AITS , Tirupati

²Department of ECE , AITS, Tirupati

³Department of ECE , AITS , Tirupati

4

Department of ECE , AITS , Tirupati

5

Department of ECE , AITS , Tirupati

Abstract-Diabetes is a chronic disease that requires continuous monitoring to maintain the patient's health. This project presents an Integrated IoT System for Type 2 Diabetic Patient Monitoring using IoT technology. The system uses sensors such as a glucose sensor, blood pressure sensor, and temperature sensor to collect health data from the patient. An Arduino microcontroller is used to process the data collected from the sensors. The system sends the collected data to the ThingSpeak cloud platform using IoT communication technology for monitoring and analysis. The cloud platform allows continuous tracking of the patient's health parameters and helps in identifying abnormal values. If any abnormal condition is detected, the system can indicate possible health risks and help in taking timely medical action. This system provides a simple, efficient, and cost-effective solution for monitoring diabetic patients remotely.

Keywords-Diabetes Patient Monitoring, Glucose Sensor, Blood Pressure Sensor, Temperature Sensor, Internet of Things (IoT), Arduino, ThingSpeak Cloud Platform.

I. INTRODUCTION

Type 2 Diabetes is a long-term metabolic disorder that requires regular monitoring to avoid severe health complications. Traditional methods of monitoring often involve frequent hospital visits and manual record-keeping, which can be inconvenient and time-consuming for patients. With the advancement of Internet of Things

(IoT) technology, continuous and remote health monitoring has become more accessible and efficient. This project focuses on developing an IoT-based system that enables real-time monitoring of important physiological parameters such as glucose level, blood pressure, and body temperature, providing a smarter approach to diabetes management.

The proposed system integrates sensors with an Arduino microcontroller for data acquisition and processing, while a NodeMCU module is used for wireless communication and cloud connectivity. The collected data is transmitted to an IoT cloud platform like ThingSpeak, where it can be stored, visualized, and accessed remotely by healthcare professionals. The system also supports early detection of abnormal conditions by comparing real-time values with predefined limits, allowing timely medical attention. Overall, this solution aims to improve patient convenience, reduce healthcare burden, and contribute to the development of reliable and cost-effective smart healthcare systems.

II. LITERATURE SURVEY

Recent advancements in IoT have improved diabetes monitoring systems. Many works focus on non-invasive and real-time health tracking. These systems help in early detection of abnormalities. This section reviews recent related studies.

Shau Lim (2023) [1] developed a non-invasive glucose monitoring system using Near-Infrared (NIR) sensors placed on the fingertip. The system allows continuous

glucose monitoring and stores data on the ThingSpeak cloud platform for analysis and better diabetes management.

G. Ramkumar et al. (2022) [2] proposed an IoT-based blood pressure prediction system using a Hybrid GoogleNet-SVM model. The system collects real-time data from wearable devices and uses Azure cloud services for predictive analytics and continuous monitoring.

Keswani et al. (2022) [3] presented a review of machine learning techniques like CNN and Random Forest for blood pressure prediction.

Mahdy et al. (2021) [4] introduced an LSTM-based hypoglycaemia prediction system using CGM and wearable data for Type 1 Diabetes management.

Authors (2021) [5] developed a NodeMCU-based glucose monitoring system using IR sensors to analyze glucose variations and display results graphically.

Bader et al. (2020) [6] designed a non-invasive infrared-based device to measure glucose levels through fingertip light intensity variations.

III. PROPOSED METHODOLOGY

The proposed method uses IoT technology to monitor diabetic patients in real time. Sensors collect health data like glucose-related values, blood pressure, and temperature. An Arduino processes this data and controls the system. A NodeMCU sends the data to the ThingSpeak cloud platform. The system detects abnormal values and helps in timely medical action.

The proposed method uses IoT technology to monitor diabetic patients in real time.

Sensors collect health data like glucose-related values, blood pressure, and temperature.

An Arduino processes this data and controls the system.

A NodeMCU sends the data to the ThingSpeak cloud platform.

The system detects abnormal values and helps in timely medical action.

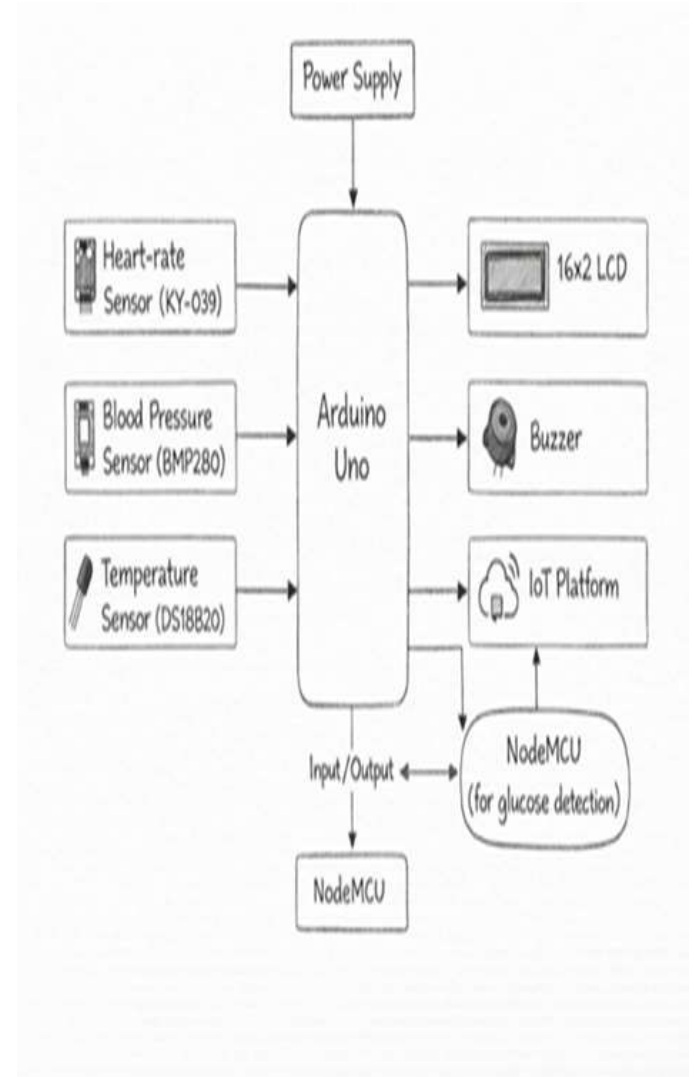


Fig 1: Proposed System Block Diagram

The proposed method uses IoT technology to monitor diabetic patients in real time. Sensors are used to collect health parameters such as heart rate, blood pressure, and body temperature. These values are sent to the Arduino, which processes the data and manages the system operations. Instead of using a direct glucose sensor, the system uses a NodeMCU module to estimate the glucose level based on the collected parameters.

The NodeMCU also enables wireless communication by sending the processed data to the ThingSpeak cloud platform. The data is continuously monitored and compared with predefined limits to detect abnormal conditions. If any abnormality is identified, the system helps in taking timely medical action. This method provides a simple, cost-effective, and efficient solution for remote health monitoring.

Operational Flow:

Power Supply:The system is powered using a normal power supply which provides required voltage to all components including Arduino, NodeMCU, and sensors.

System Initialization:When the system is turned on, the Arduino starts working and initializes all connected sensors and modules for operation.

Data Collection:Sensors such as temperature sensor, blood pressure sensor, and heart rate sensor collect real-time health data from the patient.

Data Processing:The collected data is sent to the Arduino, where it is processed and prepared for further analysis.

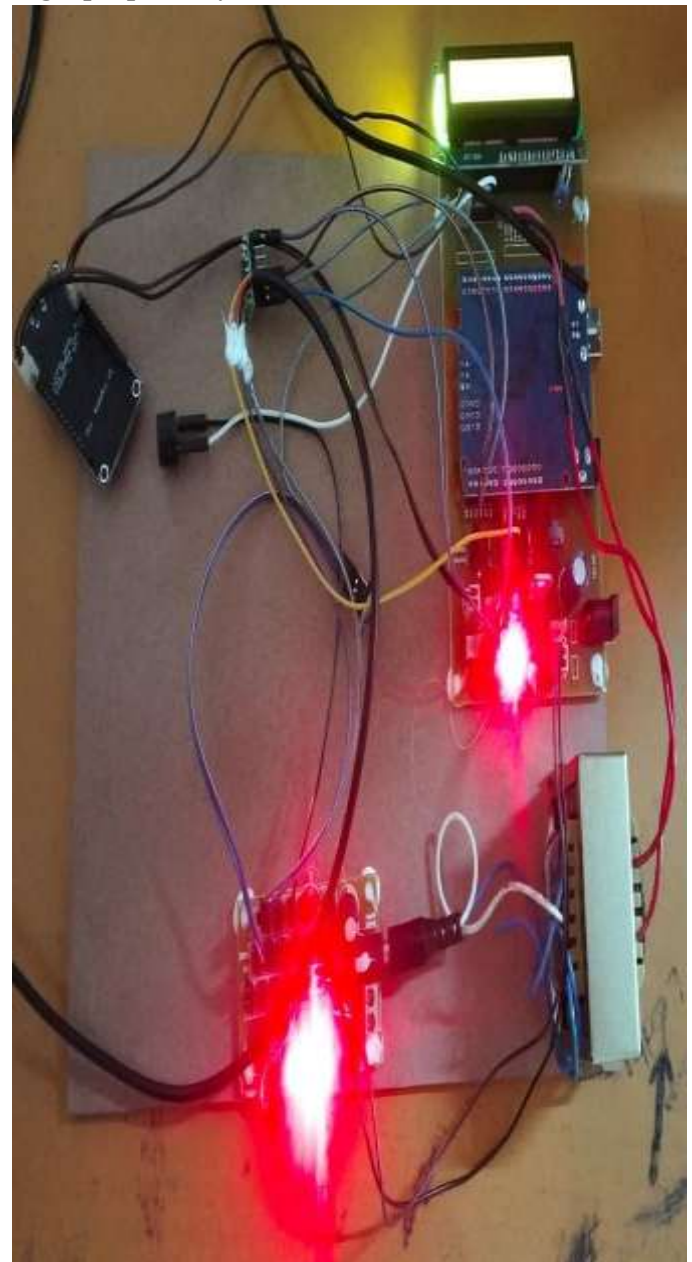
Glucose Estimation:The NodeMCU estimates the glucose level based on the collected parameters instead of using a direct glucose sensor.

Data Monitoring:The processed data is sent to the ThingSpeak cloud platform, where it is stored and displayed for remote monitoring.

Alert Generation:The system compares the values with predefined limits and generates alerts using a buzzer if any abnormal condition is detected.

Continuous Operation:The system continuously monitors the patient's health in real time and updates the data regularly for effective tracking.

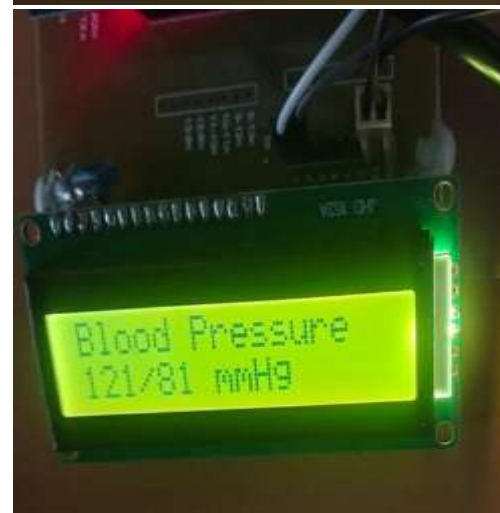
Fig 2 proposed system



IV. ARDUINO IDE PLATFORM

Arduino is a company and user community that designs, produces single-board microcontrollers using open-source computer hardware and software. Input data from sensing devices can be used to send instructions to the board's microcontroller, which can then be processed into a specific output. The Arduino proposal makes available the Arduino integrated development environment (IDE), a multiplatform app written in the Arduino programming language. The Arduino used in the construction of the Smart Shopping Cart is a generic type known as the Arduino Uno.

V. RESULTS AND DISCUSSION



The obtained results show that the proposed system is capable of monitoring multiple health parameters in real time. The LCD display clearly shows the measured values of heart rate, blood pressure, and body temperature, indicating that the sensors are functioning properly and providing accurate readings. In addition to these parameters, the system also estimates the glucose level using the NodeMCU based on the collected data. All the measured and estimated values are continuously updated and can be transmitted to the IoT cloud platform for remote monitoring. These results confirm that the system works efficiently and can be used for continuous health tracking of diabetic patients.

VI.CONCLUSION

In conclusion, the proposed IoT-based system provides an effective solution for real-time monitoring of diabetic patients. It successfully collects and processes health parameters such as heart rate, blood pressure, and temperature, and estimates glucose levels using the NodeMCU. The system enables continuous monitoring through the cloud and helps in detecting abnormal conditions early. Overall, it is a simple, cost-effective, and reliable system that improves patient care and supports smart healthcare applications.

VII.DISADVANTAGE

The system estimates glucose levels indirectly, which may be less accurate compared to direct glucose sensors.

VIII.FUTURESCOPE

The system can be improved by integrating advanced sensors and AI algorithms for more accurate and predictive health monitoring

IX.REFERENCES

- [1] S. Lim, S. Z. Ibrahim, M. N. A. Karim, W. Boonsong, K. Masrakin, and F. H. Mohd Noh, "IoT-Based Blood Glucose Detection System," 2023 IEEE 6th International Conference on Electrical, Electronics and System Engineering (ICEESE), Shah Alam, Malaysia, 2023, pp. 7–11.
- [2] G. Ramkumar, "Experimental Evaluation of an IoT-enabled Blood Pressure Prediction System using Enhanced Learning Methodology," 2024 5th International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 2024, pp. 448–454
- [3] N. A. Mahdy, A. F. Elnokrashy, D. A. Hammad, and W. A. Mohamed, "Intelligent Real-Time Hypoglycemia Prediction for Type 1 Diabetes," 2024 Intelligent Methods, Systems, and Applications (IMSA), Giza, Egypt, 2024, pp. 325–329.

- [4] H. D. Bader and M. S. Jarjees, "Infrared-Based Non-Invasive Blood Glucose Measurement and Monitoring System," 2023 International Conference on Engineering, Science and Advanced Technology (ICESAT), Mosul, Iraq, 2023, pp. 95–100.

- [5] H. Y. Lu et al., "Digital Health and Machine Learning Technologies for Blood Glucose Monitoring and Management of Gestational Diabetes," IEEE Reviews in Biomedical Engineering, vol. 17, pp. 98–117, 2024.