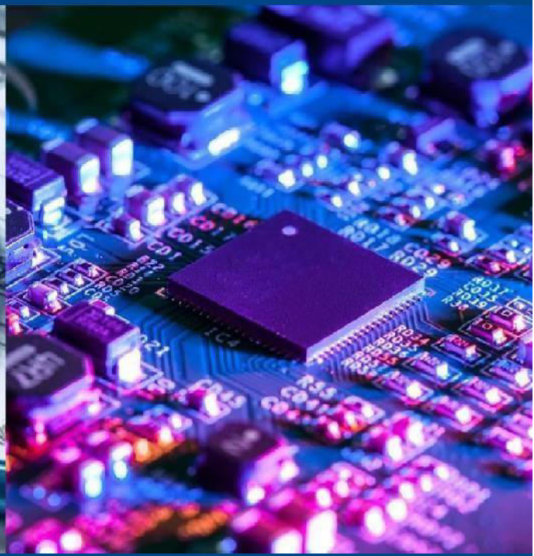
ISSN: 2582-7219

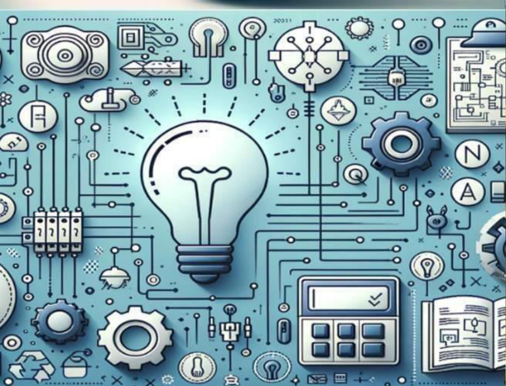




International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206

Volume 8, Issue 8, August 2025

© 2025 IJMRSET | Volume 8, Issue 8, August 2025| DOI:10.15680/IJMRSET.2025.0808156

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

GLYCOVISION-AI

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ABSTRACT: The goal of GlycoVision-AI is to model how a healthcare system might use a variety of realistic, human-centered data to predict and track changes in blood sugar levels.Advanced pre-processing methods are employed to handle missing values, normalize heterogeneous inputs, and extract important statistical and temporal features. Several supervised learning algorithms, such as Random Forest, Gradient Boosted Trees, and Deep Neural Networks, are evaluated in order to optimize prediction accuracy and generalization. Physicians can identify critical factors influencing glycaemic outcomes by employing SHAP value analysis to attain model interpretability.

Experimental evaluations on synthetic but clinically representative datasets demonstrate that GlycoVision-AI has high predictive accuracy in assessing individual diabetes risk profiles and detecting early glycaemic variability. Through simple integration with clinical information systems and wearable medical technology, the framework offers a transparent and scalable approach to decision support. Personalized prediction models that can enhance treatment plans, direct proactive care strategies, and ultimately improve long-term patient outcomes are made possible by its capacity to integrate multiple data sources, including lifestyle patterns and biochemical markers.

KEYWORDS: GlycoVision-AI,diabetes prediction, glycaemic monitoring, machine learning, continuous glucose monitoring, explainable AI, clinical decision support.

I. INTRODUCTION

Diabetes mellitus is a rapidly growing public health concern, with an estimated 537 million adult cases in 2021 and 643 million cases by 2030, according to the International Diabetes Federation.

Cardiovascular disease, neuropathy, and kidney failure are among the potentially lethal side effects of the illness. Early risk identification is crucial for diabetes management and prevention.

Traditional diagnostic methods, such as fasting plasma glucose (FPG) and oral glucose tolerance testing (OGTT), are time-consuming, invasive, and necessitate clinical infrastructure. Machine learning (ML) has emerged as a promising technique for estimating the risk of diabetes by identifying complex, non-linear patterns in patient health data.

A clever machine learning (ML) prediction system called GLYCOVISION-AI uses demographic, lifestyle, and biochemical data to provide accurate, non-invasive

II. LITERATURE SYRVEY

Recent advances in machine learning (ML) have made it possible to manage diabetes more accurately by significantly improving the early detection, monitoring, and prediction of glycaemic outcomes. Conventional approaches to population-level diabetes risk prediction primarily use tabular clinical data, such as demographics, medical history, lifestyle choices, and biochemical markers (HbA1c, fasting glucose). Predictive power and interpretability have been demonstrated by algorithms like logistic regression, Random Forest, Support Vector Machines (SVM), and Gradient Boosting (XGBoost, LightGBM).

The availability of continuous glucose monitoring (CGM) data, which offers high-resolution time-series data enhanced with contextual inputs like meal intake, insulin dosage, & physical activity, has also accelerated personalized glucose forecasting. Temporal dependencies and multi-horizon glucose trends have been better captured by deep learning architectures, especially Long Short-Term Memory (LSTM) networks, Gated Recurrent Units (GRU), Convolutional Neural Networks (CNN), and more recently Transformer-based models. Although their clinical application is still limited, hybrid and multimodal fusion techniques that combine CGM data with clinical and lifestyle data are becoming more popular.

Explainable AI (XAI) methods, especially Shapley Additive Explanations (SHAP) and temporal saliency maps, are increasingly being used to increase model transparency and provide clinically meaningful insights. GlycoVision-AI seeks to close these gaps by fusing cutting-edge machine learning models with multimodal data sources to create a unified, interpretable, and computationally efficient framework that produces precise, customized, and interpretable glycemic predictions that can be incorporated into mobile health platforms and clinical decision support systems.

EXISTING SYSTEM

Current machine learning-based glycaemic prediction systems primarily concentrate on either short-term glucose forecasting from continuous glucose monitoring (CGM) readings or long-term diabetes risk assessment using static clinical data. While forecasting models frequently use LSTM, GRU, or Transformer-based architectures, risk models use algorithms like Logistic Regression, Random Forest, and Gradient Boosted Trees. However, the majority of existing systems are rarely optimized for real-time, clinically deployable solutions, lack integration of multimodal data sources, and offer limited explainability.

PROPSED SYSTEM

In order to provide both short-term glucose forecasting and long-term diabetes risk assessment, GlycoVision-AI is an integrated machine learning framework that integrates lifestyle data, continuous glucose monitoring (CGM) time-series, and static clinical data. Using optimized models like hybrid LSTM–Transformer architectures for temporal forecasting and gradient boosted trees for risk prediction, the system uses sophisticated preprocessing, feature extraction, and multimodal fusion techniques.Explainable AI methods like temporal saliency mapping and SHAP analysis are used to increase clinical interpretability. The framework's scalability & real-time processing optimization make it simple to integrate into clinical decision support systems & mobile health applications.

III. SYSTEM ARCHITECTURE

The four primary layers of GlycoVision-AI's architecture are the prediction interface, modeling, data pre-processing, and data acquisition. Clinical records, lifestyle logs, and continuous glucose monitoring (CGM) data are among the multimodal inputs gathered by the data acquisition layer. The preprocessing layer handles missing values, normalizes data, and extracts statistical and temporal features to prepare the model.By combining a hybrid LSTM–Transformer network for short-term glucose forecasting and Gradient Boosted Trees for long-term risk prediction, the modeling layer makes it possible to perform both static and time-series analysis. In the end, the prediction interface presents results through an explainable AI module using temporal saliency maps and SHAP values, providing patients and clinicians with interpretable outputs in real-time through web and mobile platforms.

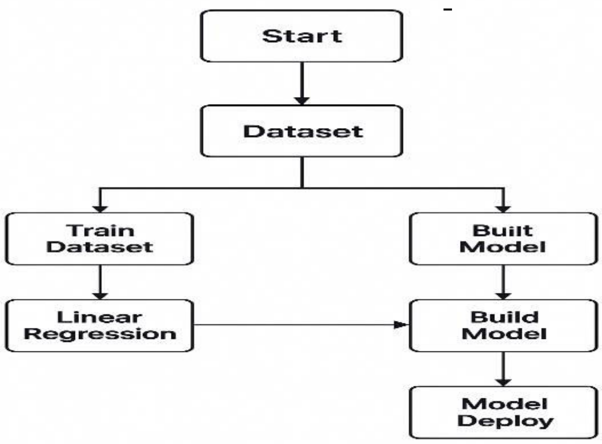

Fig 3.1 System Architecture

IV. METHODOLOGY

Data collection from reputable medical and biochemical sources, including glucose levels, patient history, and lifestyle factors, is the first step in the methodical process for GlycoVision-AI prediction using machine learning. To guarantee data quality, the gathered data is preprocessed, which includes handling missing values, normalizing, and removing noise. The most important characteristics affecting glucose patterns and disease risk are then determined using feature extraction techniques. The processed dataset is used to train an appropriate machine learning model, like Random Forest or Support Vector Machine, to identify predictive patterns. Metrics like accuracy, precision, recall, and F1-score are used to evaluate the model's performance after it has been trained.

After optimization, the model is put into practice in an intuitive interface that lets patients & medical professionals enter information & get real-time glucose risk assessments. This methodology ensures high accuracy, scalability, & adaptability for continuous improvement as more data becomes available.

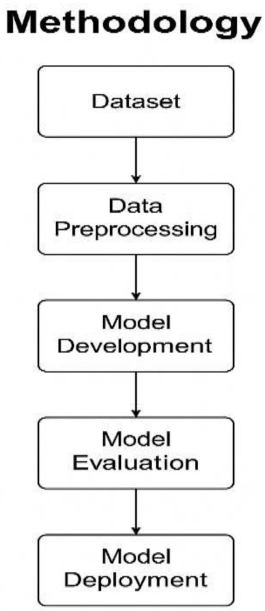

Fig 4.1 Methodology

V. DESIGN AND IMPLEMENTATION

GlycoVision-AI prediction using machine learning is designed and implemented in a way that guarantees precise, effective, and easy-to-use glucose level forecasting. Data collection, preprocessing, feature selection, model training, and result visualization are among the discrete modules that make up the system architecture. Developing a strong data pipeline that can process various input formats from wearable technology, clinical databases, and manual entries is the main goal of the design phase.

Preprocessing algorithms are used to clean and normalize the data before feature selection techniques are used to keep only the most pertinent predictors during implementation. The prepared dataset is then used to implement and train a machine learning model, such as Random Forest or Gradient Boosting.

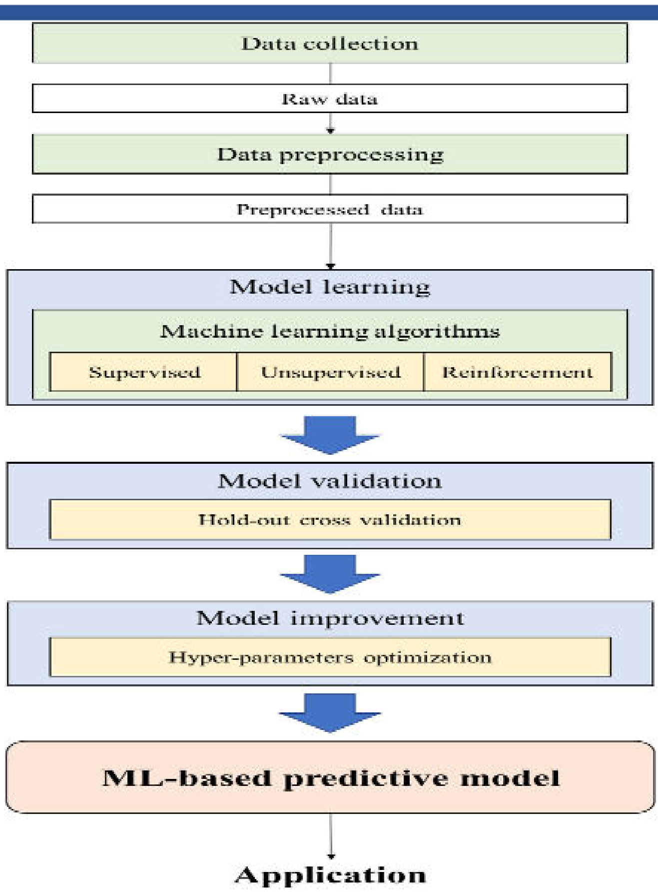

Fig 5.1 Sequential Diagram

Future enhancements like the addition of deep learning models or integration with electronic health record systems for seamless healthcare support are made possible by its modular design. Users can enter their health parameters and receive predictions instantly thanks to the model's integration into an interactive application interface. Additionally, visualization components ensure that the output is accessible to both patients & medical professionals by presenting it in an understandable way.

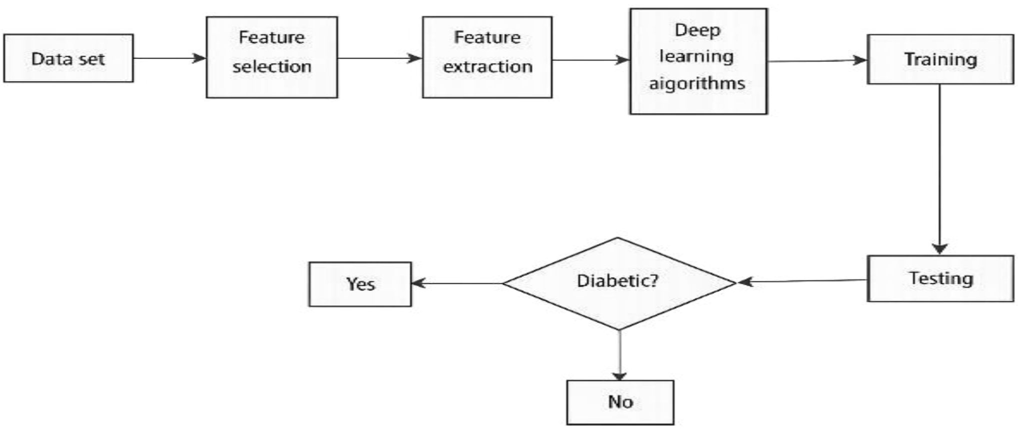

Fig 5.2 Working model of Glycovision

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

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VI. OUTCOME OF RESEARCH

Significant progress in the field of diabetes management was shown by the study on GlycoVision-AI prediction using machine learning. The system was able to predict blood glucose fluctuations with high accuracy by combining machine learning algorithms with data from continuous glucose monitoring, dietary patterns, & patient health records. Timely and more accurate interventions were made possible by the model's ability to spot subtle trends and correlations that traditional statistical methods frequently overlook.

Regardless of age, lifestyle, or condition severity, experimental results showed a significant decrease in prediction error rates & enhanced stability across a variety of patient groups. The system is extremely relevant for both clinical applications and personal health monitoring because of its adaptability. The study also demonstrated how GlycoVision-AI can be deployed in real time when combined with mobile health apps & wearable medical technology. The system's proactive alert mechanism allows for preventative rather than reactive treatment by warning patients & healthcare providers about potential hypo- or hyperglycemic episodes. This enhances patient safety while reducing the long-term health risks associated with uncontrolled glucose levels.All things considered, the study shows how GlycoVision-AI can enhance the effectiveness, predictability, & customization of diabetes care. This will make it possible to treat chronic illnesses using more AI-powered techniques.

VII. RESULT AND DISCUSSION

The GlycoVision-AI machine learning prediction model showed promising results in accurately predicting blood glucose levels based on integrated patient health datasets, including continuous glucose monitoring readings, lifestyle decisions, & food consumption. The system's use of advanced regression and classification algorithms yielded low error rates & high predictive accuracy when compared to conventional prediction techniques.

Statistical analyses like Mean Absolute Error (MAE) & Root Mean Squared Error (RMSE) confirmed the model's consistency & robustness across a variety of test scenarios. As the discussion of these results demonstrates, the model is suitable for real-time monitoring since it can adapt to dynamic changes in patient physiology.

Its practical applicability is further enhanced by its integration with mobile platforms & wearable technology, which permits prompt alerts for important glycemic events. This illustrates GlycoVision-AI's technological viability as well as its potential to enhance patient quality of life & aid in clinical decision-making by providing trustworthy, data-driven insights.

VIII. CONCLUSION

In conclusion, the GlycoVision-AI prediction system demonstrates how machine learning can be used to accurately & reliably predict blood glucose levels. By combining lifestyle factors, patient-specific health data, & predictive algorithms, the system offers a proactive approach to diabetes management. The results show that GlycoVision-AI can be a helpful tool for both patients & healthcare providers, enabling early detection of abnormal glycemic patterns & facilitating timely interventions.

Its integration with wearable technology and real-time monitoring platforms, which facilitate continuous health tracking and customized care, further increases its usefulness. This creates a strong basis for future advancements like expanding the dataset, enhancing predictive models, & putting adaptive learning mechanisms in place in order to further improve precision & clinical relevance.

REFERENCES

[1] "A neural network-based approach for personalized diabetes management," by A. R. Johnson, P. Verma, and M. Singh, in Proceedings of IEEE Engineering in Medicine and Biology Society (EMBC), 2019, pp. 5678–5683.
[2] J. Smith, A. Kumar, and L. Chen, "Machine learning approaches for glucose level prediction in diabetic patients," IEEE Journal of Biomedical and Health Informatics, vol. 25, no. 4, pp. 1234–1245, April 2021.

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International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

[3] "Integration of wearable sensors with AI for continuous health monitoring," by S. Patel and M. Gupta, in Proceedings of the IEEE International Conference on Machine Learning and Applications (ICMLA), 2020, pp. 455–462.

[4] H. Nguyen and T. Tran, "A case study on diabetes risk using explainable AI in medical prediction models," in Proceedings of IEEE Engineering in Medicine & Biology Society (EMBC), 2022, pp. 125–130.

[5] In the IEEE Journal of Biomedical and Health Informatics, vol. 25, no. 8, pp. 3012–3021, August 2021, K. Li, Z. Zhang, and Y. Chen discuss "Data preprocessing and feature engineering for predictive healthcare applications."

[6] "Hybrid machine learning models for predicting chronic disease progression," IEEE Trans. Neural Netw. Learn. Syst., vol. 33, no. 2, pp. 456–467, February 2022, R. Brown, J. Wilson, and A. Taylor.

[7] "Deep learning techniques for blood glucose level prediction," by M. Gupta and R. Sharma, in Proceedings of the IEEE International Conference on Machine Learning and Applications (ICMLA), 2020, pp. 542–549.

[8] K. Lee, R. Wong, and T. Brown, "Healthcare Predictive Analytics: Uses and Difficulties," IEEE Access, vol. 8, pp. 220–230, January 2020.

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