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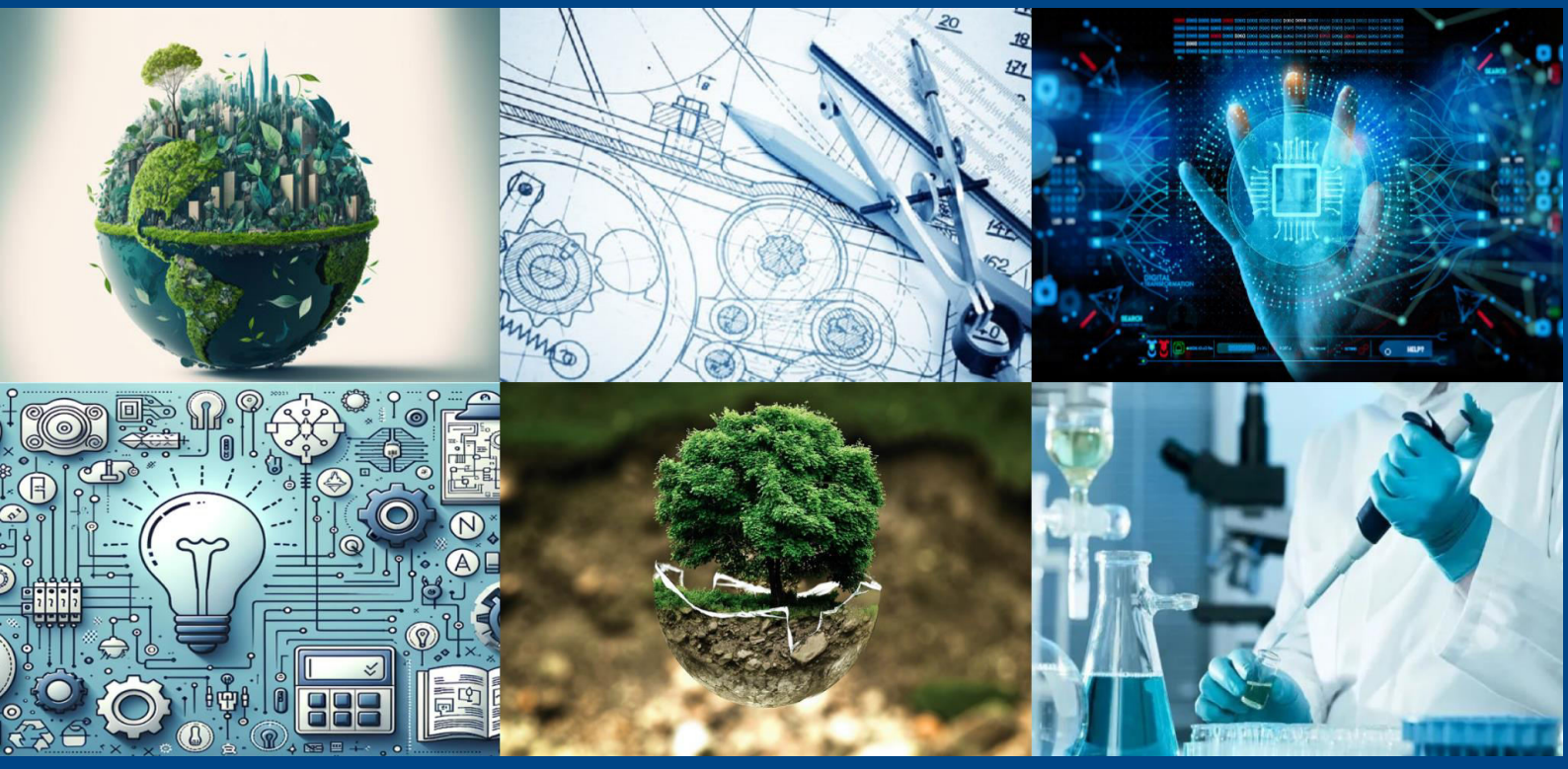

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International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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Diabetes Prediction

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ABSTRACT: Diabetes has turned into a worldwide health emergency and arose to become a leading global health hazard affecting mortality. Early diagnosis and prevention are the keys to cure this long-term disorder. This project provides a machine learning-based diabetes prediction system. The System uses different patient medical records and health parameters like Pregnancies, Glucose levels, BMI, Blood pressure, Insulin, Diabetes Pedigree Function. The system proposed here predicts whether any user can get diabetes (or) not. Here we employ different machine learning algorithms. In addition to prediction, the site also offers personalized diet such as what nutrients they should take in order to prevent getting diabetes and whether they get assists them not to raise the values and exercise guidance to encourage healthy living. The approach is all inclusive in terms of offering a full solution to managing diabetes through enhanced diagnosis and prevention measures.

KEYWORDS: Machine Learning ,KNN, SVM, Random Forest, LightGBM, Health Care, Medical Parameters

I. INTRODUCTION

Diabetes is a disease that disables the body's mechanism to use glucose efficiently, and as a result, high levels of sugar are found in the blood. Diabetes has two major forms: Type 1, in which the pancreas fails to make enough insulin, and Type 2, in which the body stops responding to insulin. With rising rates of unhealthy diets and lifestyles, Type 2 diabetes is spreading fast, even to the younger population. And another is Gestational Diabetes develops during pregnancy and normally disappear after child birth. It occurs when the body fails to make enough insulin to keep up with the increased demand of Pregnancy and resulting in excess sugar. The early diagnosis of diabetes is essential to avoid its complications like cardiovascular disease, kidney failure, and vision loss.

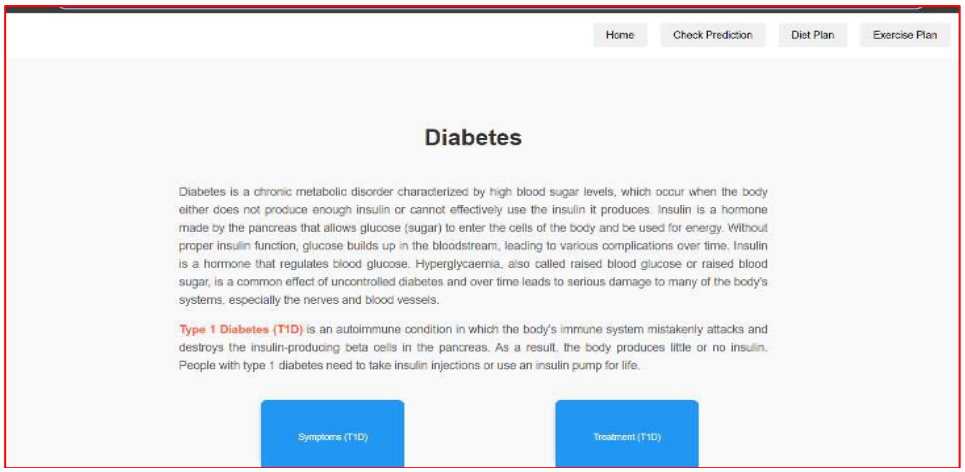

Fig1.Home Page

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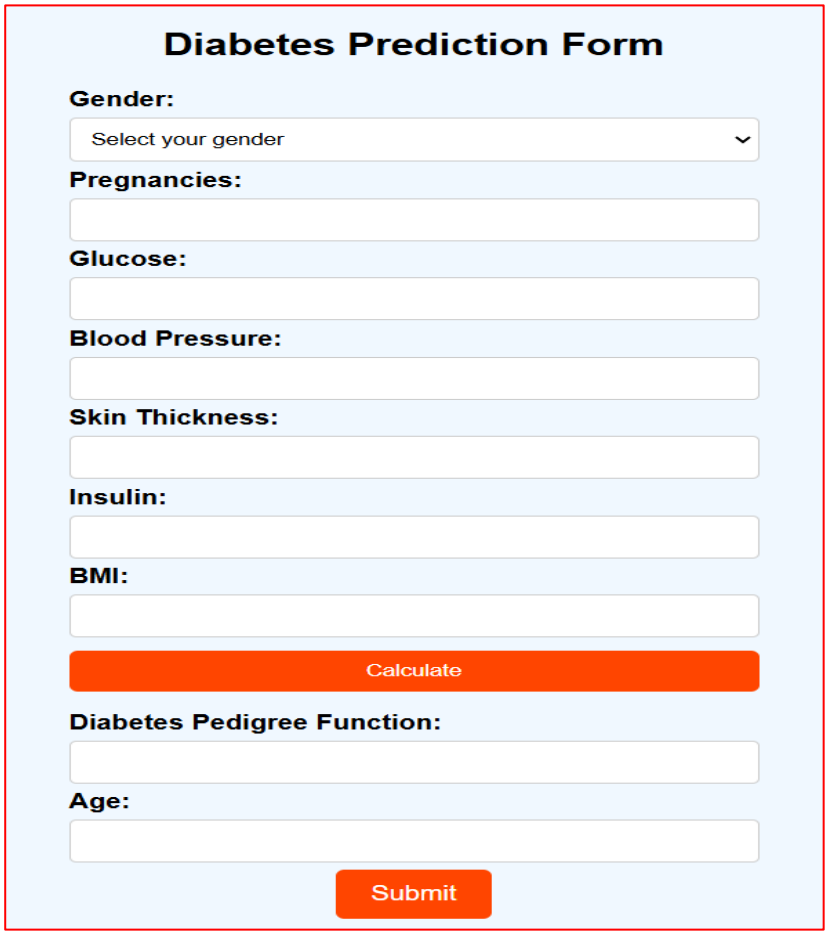
Machine learning (ML) has, in the last few years, proven to be an effective tool for disease prediction using clinical data. ML models utilize large datasets and predictive algorithms to identify patterns and risk factors that cannot be identified with conventional diagnostic procedures. The current paper addresses applying machine learning algorithms to predict diabetes from clinical features and integrating the predictions into an easy-to-use web interface with personalized diet and exercise plans.

Fig 2.Prediction Form



II. RESEARCHAND METHODOLOGY

The current research brings machine learning together with a web platform to offer users' real-time predictions of their risk of developing diabetes along with actionable tips for managing their health. The following methodology was utilized:

2.1 Data Collection

We used the Pima Indian Diabetes Dataset, a well-known dataset in diabetes literature. The dataset contains 768 patient records and eight important features: pregnancies, glucose, blood pressure, skin thickness, insulin, BMI, diabetes pedigree function, and age. These were selected because of their high correlation with the onset of diabetes.

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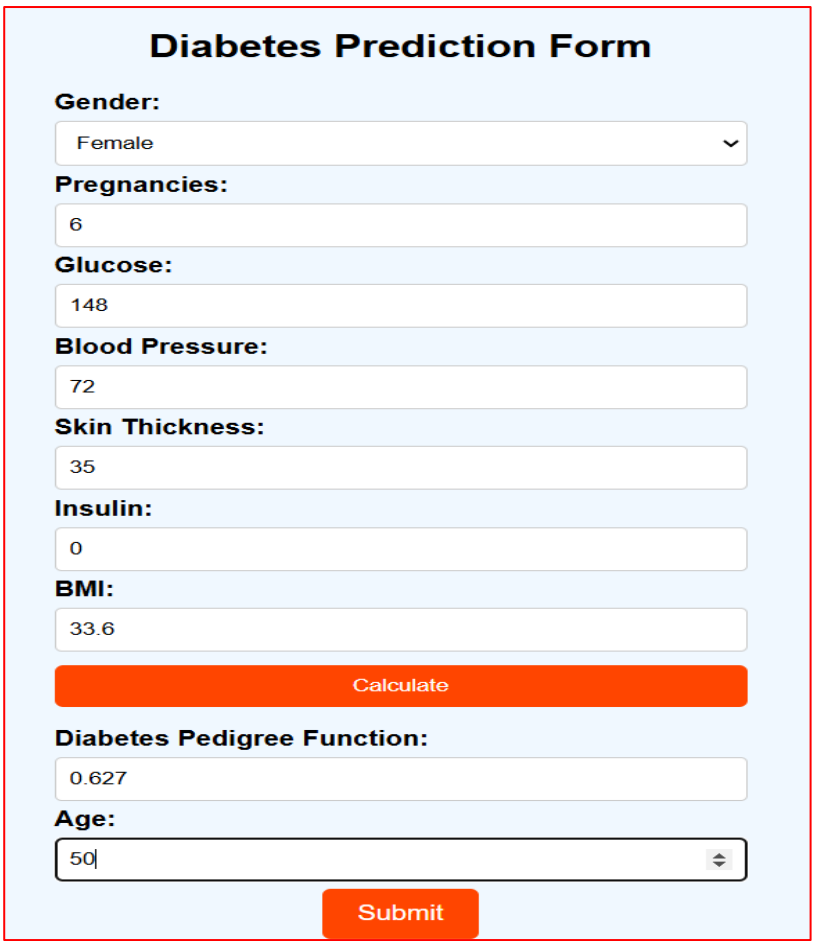

Fig 3. Here we enter the values to predict whether they have diabetes (or) not

2.2 Data Preprocessing Data preprocessing was conducted by dealing with missing values, scaling numeric data through the use of robust scaler, and one-hot encoding of categorical variables. We also binned BMI and insulin measurements into medically accepted intervals for better model prediction. In order to deal with class imbalance in the data, we used the Synthetic Minority Over-sampling Technique (SMOTE).

2.3 Machine Learning Models We implemented and compared four machine learning models:

- Random Forest (RF)
- LightGBM
- Support Vector Machine (SVM)
- K-Nearest Neighbors (KNN)

Each model was optimized with grid search to find the best hyperparameters, and cross-validation was done to test the performance of the models. The best models were chosen on the basis of their accuracy, precision, recall, and F1-score.

2.4 Web Application Development In order to make the system available to users, we created a web application based on the Flask framework. The application enables users to enter their health information through an easy-to-use form and offers instant feedback on their risk of diabetes. The application also features diet and exercise suggestion modules, intended to promote healthier lifestyles.

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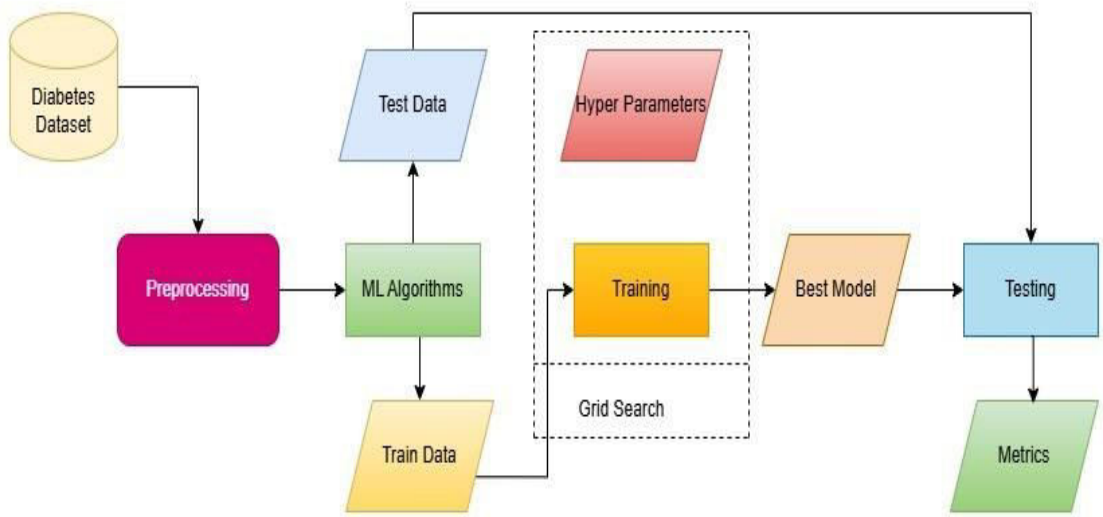
System Architecture



III. RESULTS AND DISCUSSION

3.1 Model Performance

Each of the models was trained on 80% of the data and evaluated on the remaining 20%. The following table presents the accuracy of each model on the test data:

Model	Accuracy
Random Forest	81.2%
LightGBM	83.4%
SVM	78.5%
KNN	74.6%

The LightGBM model performed better than the other models, with an accuracy of 83.4%. The Random Forest model also performed well, with an accuracy of 81.2%. These models proved to be capable of identifying the non-linear associations between clinical features and diabetes risk.

3.2 Explainability In order to improve model transparency, we included SHAP (Shapley Additive explanations) values for explaining predictions. SHAP highlighted glucose, BMI, and age as the most significant features in predicting diabetes risk, in agreement with clinical literature.

3.3 Web-Based System The web-based platform, created with Flask, combines the machine learning models to make real-time diabetes predictions. The users input their health parameters, and the system offers a prediction (whether they have "Diabetes" or not). The platform also offers customized meal plans (vegetarian and non-vegetarian) and exercises as per age groups. The above facility aids in lifestyle modifications towards controlling or preventing diabetes risk.

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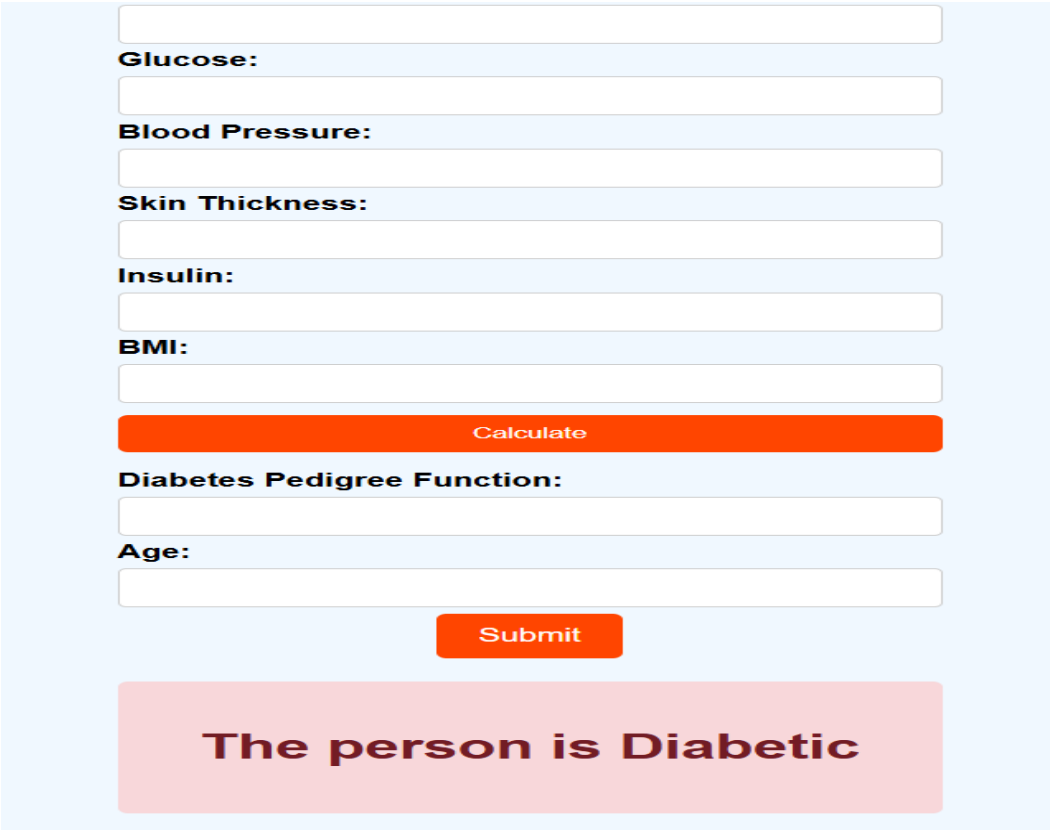

IV. THEORY AND CONCLUSIONS

The combination of web-based technology and machine learning provides an end-to-end solution for diabetes risk prediction and management. Using clinical information and advanced ML models, our system accurately predicts diabetes risk and enables users to make lifestyle choices based on informed decisions. The integration of predictive analytics with customized health management plans makes this platform a useful tool for individuals.

Future efforts will be directed at increasing the size of the system to include more varied datasets, enhancing prediction quality, and implementing more sophisticated explainability methods. In addition, investigating the application of deep learning algorithms may unlock even higher performance in prediction.

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