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# PERSONALIZED DIABETES SUGGESTION USING MACHINE LEARNING AND CLOUD TECHNOLOGY

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**Abstract -** Diabetes is a chronic disease that requires continuous monitoring and personalized healthcare support. Traditional healthcare systems are often reactive and fail to provide real-time and individualized recommendations. This paper presents a **Personalized Diabetes Suggestion System** using Machine Learning and Cloud Technology to improve early detection and management of diabetes. The proposed system utilizes a hybrid model combining Deep Learning and Adaptive Neuro-Fuzzy Inference System (ANFIS) to analyze clinical and lifestyle data such as glucose levels, diet, physical activity, and stress. A cloud-based infrastructure enables scalable data processing and storage, while blockchain technology ensures secure and tamper-proof medical records. The system generates real-time alerts and personalized suggestions for users, improving decision-making and disease management. Experimental results indicate improved prediction accuracy and enhanced user engagement compared to traditional approaches. The proposed solution offers a proactive, secure, and intelligent framework for diabetes care, contributing to better health outcomes and patient empowerment.

***Key Words***: Diabetes Prediction, Machine Learning, ANFIS, Cloud Computing, Blockchain, Personalized Healthcare.

## 1.INTRODUCTION

Diabetes is one of the most rapidly increasing chronic diseases worldwide, requiring continuous monitoring and effective management. Traditional healthcare systems rely on periodic clinical visits and often lack the ability to provide real-time insights and personalized recommendations. This limitation can lead to delayed diagnosis, poor disease control, and increased health risks.

With the advancement of Machine Learning and Cloud Computing, intelligent healthcare systems can be developed to address these challenges. These systems enable real-time data processing, early prediction of disease risk, and personalized health recommendations based on individual patient data. However, many existing solutions still lack data security, scalability, and true personalization.

To overcome these limitations, this project proposes a **Personalized Diabetes Suggestion System** that integrates Machine Learning techniques with cloud-based infrastructure. The system analyzes both clinical and lifestyle parameters such as blood glucose levels, diet, physical activity, and stress levels to provide accurate predictions and customized suggestions.

Additionally, blockchain technology is incorporated to ensure secure and tamper-proof storage of sensitive health data. The proposed system aims to shift diabetes management from a reactive approach to a proactive, intelligent, and patient-centric model, ultimately improving healthcare outcomes and quality of life.

## 2. Body of Paper

The proposed Personalized Diabetes Suggestion System is designed as a multi-layer architecture that integrates Machine Learning (ML), Cloud Computing, and Blockchain technologies to provide accurate predictions and secure data handling.

### 2.1 Data Collection and Preprocessing

The system collects both clinical and lifestyle data, including blood glucose levels, blood pressure, diet patterns, physical activity, and stress levels. The collected data is preprocessed using normalization and noise removal techniques to improve model performance. Missing values are handled to ensure data consistency.

### 2.2 Machine Learning Model

A hybrid model combining Deep Learning and Adaptive Neuro-Fuzzy Inference System (ANFIS) is used for prediction. Deep Learning helps in identifying complex patterns in historical health data, while ANFIS provides rule-based decision-making for better interpretability.

For example, the system generates rules such as: "If glucose level is high and stress is high, then diabetes risk is severe."

### 2.3 Cloud Integration

Cloud infrastructure is used to store large volumes of patient data and perform computationally intensive tasks such as model training and analysis. This ensures scalability and accessibility of the system across multiple devices.

### 2.4 Blockchain for Security

To ensure data security, blockchain technology is integrated into the system. Patient records are securely stored using encrypted blocks, preventing unauthorized access and data tampering. Patients have full control over their data access permissions.

### 2.5 Alert and Recommendation System

The system continuously monitors user data and provides real-time alerts. Based on prediction results:

- Normal condition → Data is stored for analysis
- Risk detected → User receives notification
- Critical condition → Alert is sent to healthcare provider

Personalized suggestions related to diet, exercise, and lifestyle are also generated.

**Table -1:** Input Parameters for Diabetes Prediction

Variables Table

| Variable Name | Role | Type | Demographic | Description | Units | Missing Values |
|---|---|---|---|---|---|---|
| Age | Feature | Integer | Age | Any ages in years when a women during pregnant. | | no |
| SystolicBP | Feature | Integer | | Upper value of Blood Pressure in mmHg, another significant attribute during pregnancy. | | no |
| DiastolicBP | Feature | Integer | | Lower value of Blood Pressure in mmHg, another significant attribute during pregnancy. | | no |
| BS | Feature | Integer | | Blood glucose levels is in terms of a molar concentration | mmol/L | no |
| BodyTemp | Feature | Integer | | | F | no |
| HeartRate | Feature | Integer | | A normal resting heart rate | bpm | no |
| RiskLevel | Target | Categorical | | Predicted Risk Intensity Level during pregnancy considering the previous attribute. | | no |

**Table -2:** Comparison of models

| Model | Accuracy | Precision (Weighted Avg) | Recall (Weighted Avg) | F1-Score (Weighted Avg) |
|---|---|---|---|---|
| Random Forest | 0.9053 | 0.90 | 0.91 | 0.90 |
| Gradient Boosting | 0.8489 | 0.85 | 0.85 | 0.85 |
| Logistic Regression | 0.8007 | 0.80 | 0.80 | 0.80 |
| Support Vector Machine | 0.7647 | 0.77 | 0.76 | 0.74 |
| K-Nearest Neighbors | 0.8090 | 0.80 | 0.81 | 0.80 |
| Gaussian Naive Bayes | 0.4346 | 0.72 | 0.43 | 0.37 |

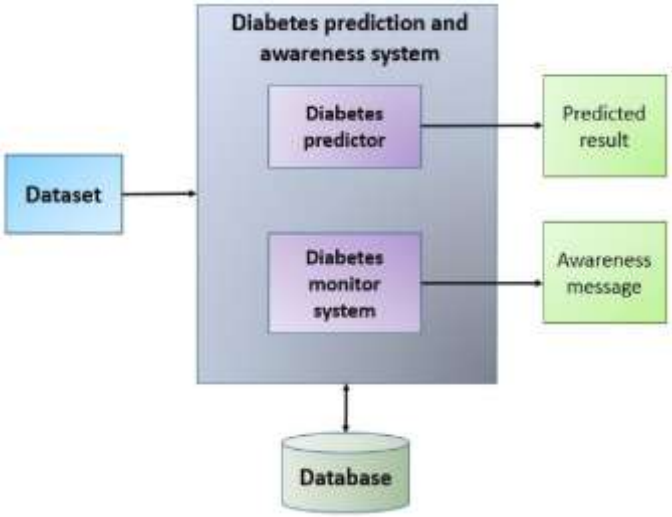


**Fig -1**: System Architecture

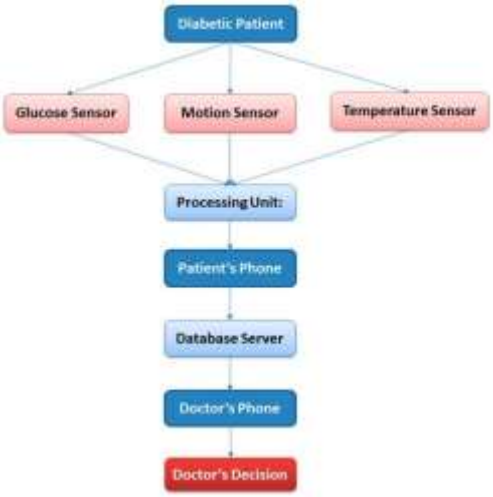


**Fig -2**: System Workflow

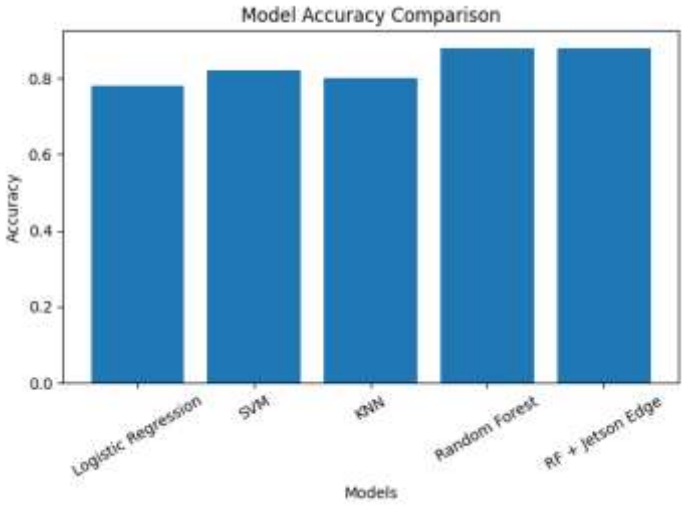


**Fig -3**: Model Comparisons

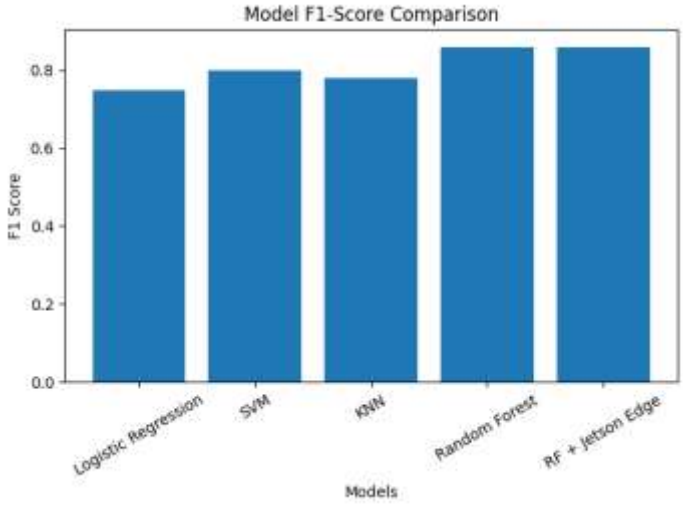


**Fig -4**: Score Comparisons

## 3. CONCLUSIONS

This paper presented a **Personalized Diabetes Suggestion System** that integrates Machine Learning, Cloud Computing, and Blockchain technologies to improve diabetes management. The system effectively analyzes both clinical and lifestyle data to provide accurate predictions and personalized recommendations. By incorporating a hybrid model using Deep Learning and Adaptive Neuro-Fuzzy Inference System (ANFIS), the proposed approach enhances prediction accuracy and interpretability.

The use of cloud infrastructure ensures scalability and real-time data processing, while blockchain technology guarantees secure and tamper-proof storage of sensitive medical information. Additionally, the system provides timely alerts and user-friendly suggestions, improving patient engagement and proactive disease management.

Overall, the proposed system offers a reliable, secure, and intelligent solution for diabetes care, helping shift healthcare from a reactive approach to a proactive and patient-centric model.

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