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Automated Skin Disease Analysis and Detection using AI Powered Mobile Application

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ABSTRACT: Skin diseases are one of the most common health problems affecting people worldwide, and early identification is essential for effective treatment and prevention. However, due to lack of awareness, limited access to dermatologists, and time constraints, many individuals fail to seek timely medical attention. To overcome these challenges, this project presents an AI-based system for multi skin disease detection using Flutter and Firebase, aimed at providing a preliminary and accessible skin disease identification solution. The proposed system utilizes image processing and traditional machine learning techniques to analyze skin images and detect multiple skin diseases without using deep learning models. The user captures or uploads a skin image through a mobile application. The image undergoes preprocessing steps such as resizing, noise removal, and color normalization to improve image quality. Feature extraction techniques are then applied to obtain important visual characteristics related to skin color, texture, and shape. These extracted features are classified using machine learning algorithms to identify possible skin diseases. The mobile application is developed using Flutter, which enables cross-platform compatibility and a user friendly interface. Firebase is used as the backend service to handle user authentication, cloud storage, and secure data management. The detected skin disease, along with relevant confidence information, is displayed to the user, and the results are securely stored in Firebase for future reference and analysis.

KEYWORDS: Machine learning ,python, Flutter, Firebase

I. INTODUCTION

Flutter is an open-source UI software development kit developed by Google for building natively compiled applications from a single codebase. It enables developers to create high-performance and visually appealing applications for multiple platforms including Android, iOS, web, and desktop. Flutter uses the Dart programming language, which is optimized for building fast and expressive user interfaces.One of the key advantages of Flutter is its widget-based architecture, where everything in the application is built using reusable and customizable widgets. These widgets help developers design responsive and consistent user interfaces across different screen sizes and platforms. Flutter also follows a reactive programming model, making it easier to update the UI dynamically based on data changes.Flutter's Hot Reload feature significantly improves developer productivity by allowing instant updates to the application without restarting it. This helps in faster debugging, experimentation, and UI design. Additionally, Flutter provides a rich set of pre-designed Material Design and Cupertino (iOS-style) widgets, enabling developers to create platform-specific designs with ease.Another important feature of Flutter is its high performance. Unlike other frameworks that rely on web views or intermediate layers, Flutter compiles directly into native machine code. This ensures smooth animations, faster rendering, and an overall better user experience.Flutter also offers seamless integration with backend services such as Firebase, REST APIs, and third-party libraries. Due to its cross-platform capability, cost-effectiveness, and ease of development, Flutter is widely used in academic projects, startups, and enterprise-level applications.

II. LITERATURE SURVEY

Dermatological diseases are highly prevalent worldwide due to factors such as environmental conditions, pollution, and adverse skin reactions. These diseases may be caused by fungal, bacterial, viral infections, or allergic responses. [1] Early detection of skin diseases is important but often delayed due to limited medical access. Smart Derma is an AI-

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based system using MobileNetV3 and cloud computing to provide fast and accurate predictions. It ensures scalability and real-time results. Future work focuses on improving accuracy and adding multilingual support. [2] Previous models used architectures like Inception ResNet v2 for detecting diseases such as eczema and psoriasis, showing good performance along with smartphone and web-based implementations.In this work, Transfer Learning is applied using a pre-trained ResNet50 model to improve performance and reduce complexity. The model achieves 97.6% accuracy, 95% precision, 99.4% recall, and 97.4% F1-score .[3] Skin diseases are a major global health issue, especially in areas with limited access to dermatologists. This system uses an Xception-based model to classify images into five categories, achieving 95% accuracy and 99.4% AUROC. Transfer learning is then applied to improve classification across multiple conditions. The system provides accurate, scalable, and real-time detection, supporting early diagnosis in remote areas.[4]Acne is commonly diagnosed manually by dermatologists, which can be time-consuming. This study proposes an automated acne detection system using an improved YOLOv7 model. Enhancements in feature extraction, multi-scale learning, and model optimization improve detection performance. Trained on the ACNE04 dataset, the model achieves 83.7% mAP, outperforming the base model. It provides a fast and reliable solution to support clinical diagnosis.[5]

III. PROBLEM STATEMENT

Skin diseases are common health problems, but early detection is difficult due to lack of awareness and limited access to dermatologists. Many people ignore symptoms or depend on self-diagnosis, leading to serious complications. Traditional diagnosis requires hospital visits, which can be time-consuming and costly. There is no simple and accessible tool for quick preliminary analysis of skin conditions. This creates a need for an efficient and user-friendly solution. The proposed system uses a mobile application with machine learning to detect skin diseases from images. It helps users get early predictions and take timely action.The system also reduces dependency on immediate clinical consultation for basic screening. It provides a fast and convenient way to analyze skin conditions anytime and anywhere. This improves awareness and supports better healthcare decision-making. To address this issue, the proposed system uses a mobile application integrated with machine learning techniques to detect skin diseases from images. Users can capture or upload images of affected skin areas, and the system provides quick predictions based on trained models. Image preprocessing techniques such as resizing and normalization improve the accuracy of predictions, while classification algorithms ensure reliable results. The system reduces dependency on immediate clinical consultation for basic screening and enables users to take early preventive measures. It offers a fast, user-friendly, and convenient platform that can be accessed anytime and anywhere, improving accessibility to healthcare services. Additionally, the application can store user history, allowing users to track previous results and monitor changes in their skin condition over time.Furthermore, the system is designed to be scalable and can be integrated with cloud technology for better performance and data management.

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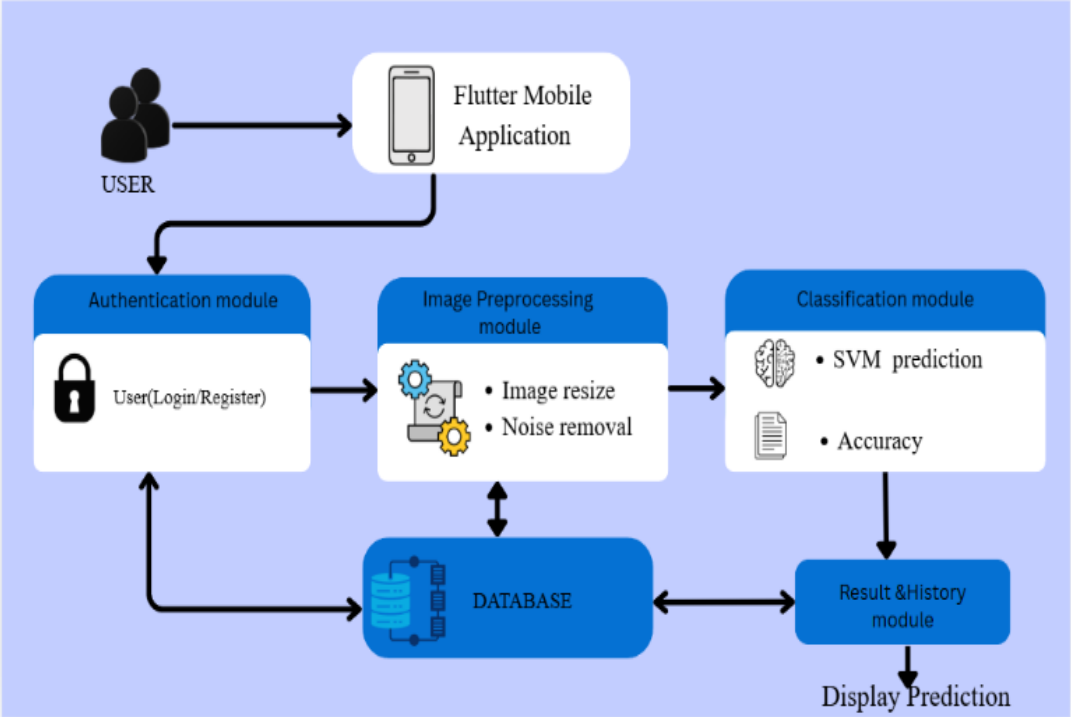

Fig.1. Architecture Diagram

The Fig.1 Shows proposed system for multi skin disease detection is based on image processing and machine learning techniques. Initially, a dataset of labeled skin disease images is collected from publicly available sources, including various conditions such as eczema, psoriasis, acne, melanoma, and skin lesions. A mobile application is developed using Flutter to provide an interactive user interface where users can capture images using the camera or upload them from the gallery. The backend is integrated using Firebase, which handles user authentication, image storage, and result management through Firestore.

1.Authentication

Provides secure user login and registration functionality ,Allows users to create accounts using email and password ,Ensures data privacy by verifying user credentials ,Supports Firebase Authentication for secure access.

2.Image Preprocessing

Resizes input images to a fixed dimension for model consistency ,Converts images into suitable format (e.g., RGB/Grayscale) ,Removes noise using filtering techniques for better clarity.

3.Classification

Trained using labeled dataset of skin images ,Finds optimal hyperplane to separate different classes ,Reduces overfitting using proper kernel functions.

Accuracy: Accuracy measures the overall correctness of the model by calculating the ratio of correctly predicted instances to the total number of predictions.

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}}$$

Precision: Precision measures how many of the predicted positive cases are actually correct. It indicates the model's exactness.

$$\text{Precision} = \frac{\text{TP}}{\text{TP} + \text{FP}}$$

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Recall: Recall measures how many actual positive cases are correctly identified by the model. It shows the model's ability to detect disease.

$$\text{Recall} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

F1-Scrore: F1-score is the harmonic mean of precision and recall. It provides a balance between both metrics, especially useful for imbalanced datasets.

$$\text{F1} = 2 \cdot \frac{\text{Precision} \cdot \text{Recall}}{\text{Precision} + \text{Recall}}$$

4.Result & History

Displays predicted skin disease result to the user ,Shows confidence level of the prediction ,Provides simple description of the detected condition. This a component of the system that displays the predicted skin disease along with accuracy and relevant details after image analysis, while also storing past results.

TABLE1. Comparative results of different class

Class	Precision	Recall	F1-Score	Support
Acne	0.79	0.85	0.83	63
Eczema	0.8	0.78	0.79	62
Melanoma	0.84	0.81	0.82	23
Pigmentation	0.79	0.76	0.77	43
Psoriasis	0.81	0.80	0.80	60

TABLE.1 Show theClass tabulation is a structured representation of a class in a system, showing its attributes and methods in a table format. It helps to clearly understand the data members (variables) and functions (operations) associated with the class in an organized manner, and Precision,Recall,F1-Score,Support

TABLE2. Accuracy of our model metric

Metric	Precision	Recall	F1-Score	Support
Accuracy			0.82	251
Macro Avg	0.81	0.80	0.80	251
Weighted Avg	0.82	0.82	0.82	251

TABLE.2 Shows the table represents the performance evaluation metrics of the proposed model. It shows how accurately the system predicts skin diseases using different evaluation measures. These metrics help in analyzing the reliability and effectiveness of the model.

They also assist in identifying areas for improvement in prediction performance.

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V. RESULT

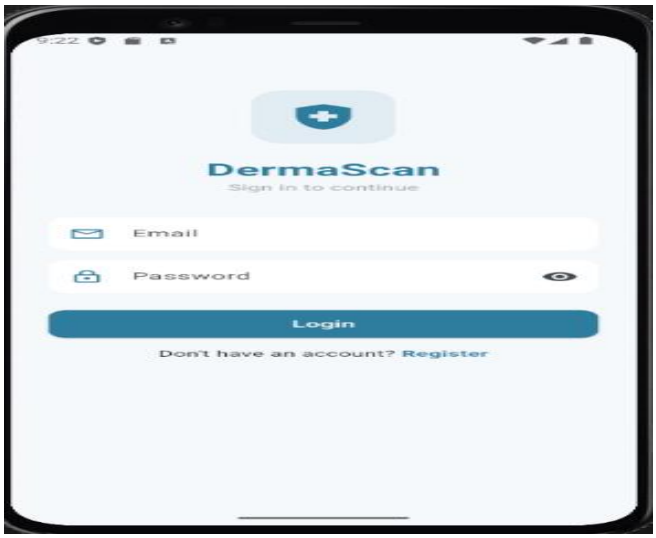

Fig.2.Login Screen For Mobile Application

The Fig.2 image shows that login screen of the application, which is used for secure user authentication. Users enter their email and password to access the system. This screen ensures that only authorized users can use the application features such as image upload, disease prediction, and result history, thereby maintaining data security and privacy.

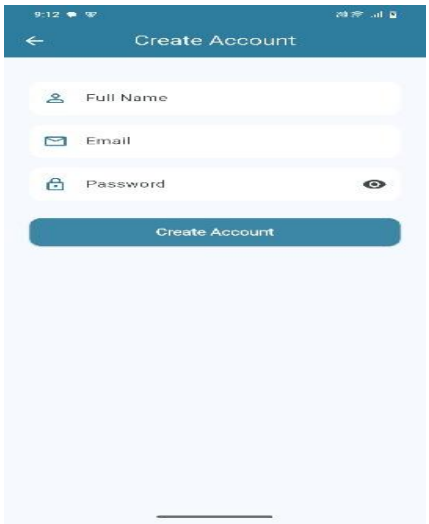

Fig.3.Registrstion Screen

The Fig.3 image shows the registration screen of the application, which allows new users to create an account by entering details such as name, email, and password. This screen enables users to securely register and gain access to the system. It ensures proper user management and is the first step for accessing features like login, image upload, and disease prediction. The registration module securely stores user information in the database and prevents duplicate accounts by verifying existing users. It acts as the initial step for accessing the system and ensures that only valid users can proceed to login.

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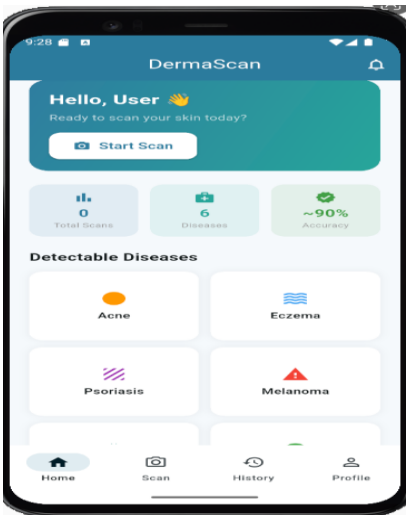

Fig.4.Home Screen For Mobile App

The Fig.4 shows the home screen of the application, which serves as the central dashboard for users after login. It provides quick and easy access to all main functionalities such as uploading an image, capturing a new image, viewing prediction results, and accessing history.

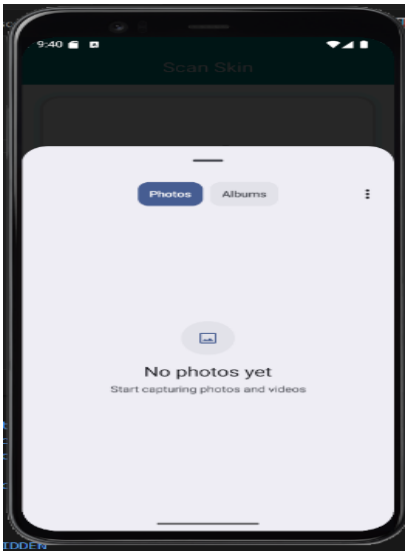

Fig.5.Upload Screen

The Fig.5 shows the upload screen of the application, which allows users to select or capture an image of the skin area for analysis. This screen provides options such as “Upload from Gallery” and “Capture using Camera,” enabling flexibility in image input. The upload screen performs basic preprocessing steps like resizing and formatting the image before sending it to the model for prediction. It ensures that the selected image meets the required quality and format for accurate analysis.

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Fig.6.Scan Page For Upload The Image

The Fig.6 shows the scan page of the application, where the selected skin image is processed for disease detection. Once the user uploads or captures an image, the system analyzes it using the trained machine learning model. The scan page acts as a bridge between the input (image upload) and the output (prediction result). It plays a key role in executing the detection process and providing a smooth user experience.

Fig.7.Result Page Analysis Skin

The Fig.7 shows the result screen of the application, where the predicted skin disease is displayed after the scanning process. It presents the classification result along with additional details such as confidence score or probability. This screen may also provide basic information about the detected condition, possible precautions, and suggestions for further medical consultation. It helps users understand the outcome clearly and take appropriate action. Additionally, the result can be saved for future reference and viewed later in the history section.

VI. CONCLUSION & FUTURE ENHANCEMENT

The skin disease detection system developed in this project demonstrates the effective use of mobile application technology and machine learning for early diagnosis of skin conditions. By integrating a Flutter-based user interface with Firebase and a Support Vector Machine (SVM) model, the system provides a simple and efficient platform for

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users to analyze skin images. The application allows users to capture or upload images and receive quick predictions regarding conditions such as melanoma, lesion, and normal skin. The use of preprocessing techniques and feature extraction improves the quality of input data, leading to reliable classification results. The system achieved satisfactory accuracy and performed well under different testing conditions. Overall, this project proves that machine learning can be effectively applied in healthcare applications for preliminary diagnosis. While it is not a replacement for professional medical advice, it serves as a helpful tool for early detection and awareness, encouraging users to seek timely medical consultation.

Future, the system can be enhanced by supporting a wider range of skin diseases and improving accuracy through advanced techniques such as Convolutional Neural Networks (CNN). The application can also include real-time doctor consultation and cloud-based deployment for better scalability and performance .

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