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Nutri Vision: A Smart Plate Based on Health Aware

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Abstract:

In today's fast-paced lifestyle, maintaining a balanced diet has become increasingly challenging, leading to a rise in health issues such as obesity, diabetes, and nutritional deficiencies. To address this concern, this project introduces Nutri Vision, an intelligent smart plate designed to monitor and analyse food intake in real time. Nutri Vision aims to provide users with personalized dietary insights by tracking calorie intake, macronutrients, and overall eating habits. The smart plate is equipped with weight sensors and a camera module that captures the food placed on it. Using machine learning algorithms, the system processes the captured data to recognize food types and generate accurate nutritional information. This information is then displayed to the user through a connected mobile or web application, enabling better dietary decisions. The proposed system not only promotes healthy eating habits but also assists individuals with specific dietary requirements, such as patients with chronic diseases or fitness enthusiasts. By combining technology with health awareness, Nutri Vision bridges the gap between traditional eating practices and modern smart healthcare solutions, contributing to improved lifestyle management and preventive healthcare. The system provides real-time feedback to users, helping them understand what they are consuming and guiding them toward healthier eating habits. It can also track daily dietary patterns and offer personalized suggestions based on the user's health needs.

Keywords: Smart Plate, Nutri Vision, Real-Time Food Monitoring, Balanced Diet, Sensor Technology, Health Monitoring.

I.INTRODUCTION:

In today's fast-moving world, people often struggle to maintain healthy eating habits due to busy schedules, changing lifestyles, and easy access to fast and processed foods. As a result, many individuals face health problems such as obesity, diabetes, heart diseases, and nutritional deficiencies. One of the main reasons behind these issues is the lack of awareness about what we eat and how much we consume on a daily basis. Most people do not track their food intake regularly, which makes it difficult to maintain a balanced diet. Food and nutrition play a very important role in maintaining overall health and well-being. Many users find it difficult to consistently follow these methods, leading to irregular tracking and poor dietary management. Therefore, there is a need for a smarter and more convenient solution that can automatically monitor food intake and provide useful insights. To address this problem, this project introduces the Nutri Vision Smart Plate, a health-aware system designed to analyse food consumption in real time. The main goal of this system is to help users understand their eating habits and make better dietary choices. The smart plate uses a combination of modern technologies such as sensors, computer vision, and artificial intelligence to identify food items, measure portion sizes, and calculate nutritional values automatically. The system works by capturing images of the food placed on the plate using a camera and measuring its weight using sensors. The captured image is processed using computer vision techniques to recognize the type of food, while the weight data helps in estimating the quantity. Based on this

information, the system calculates important nutritional details such as calories, proteins, carbohydrates, and fats.

II. RELATED WORK:

In recent years, many researchers have explored the use of advanced technologies such as artificial intelligence, computer vision, and sensor systems to improve dietary monitoring and promote healthier lifestyles. A study by Salaki Reynaldo Joshua et al. introduced a smart plate system designed specifically for patients with type-2 diabetes. The system combines image recognition techniques with weight sensors to identify food items and calculate their nutritional values. It uses deep learning models like YOLO to detect food types and integrates load cell sensors to measure portion sizes accurately. The results showed promising performance in recognizing food and estimating nutritional information, highlighting the effectiveness of combining sensors with AI for health monitoring. Earlier research by Sumathi et al. focused on developing a smart plate for detecting food quality and freshness. This system used different types of sensors, including chemical and optical sensors, to determine whether food was safe to consume. Although this work mainly targeted food safety rather than nutrition tracking, it demonstrated how sensor-based systems can be integrated into everyday objects like plates to enhance food awareness.This system achieved high accuracy in recognizing food items and showed the potential of computer vision in automated dietary monitoring. Similarly, the Food AI system proposed by Doyen Sahoo et al. uses large-scale deep learning models trained on thousands of food images to enable smart food logging. The system simplifies the process of tracking food intake by automatically identifying meals from images and providing nutritional insights. Such systems reduce the need for manual data entry and improve user convenience. Another important research direction focuses on portion size estimation.

III. PROPOSED SYSTEM:

A. Overview of the proposed system:

The proposed system, Nutri Vision Smart Plate, is an intelligent and health-aware solution designed to monitor and analyse a user's food intake in real time. The main aim of this system is to promote healthy eating habits by providing accurate and instant information about the nutritional content of the food consumed. It combines modern technologies such as sensors, computer vision, and artificial intelligence to create an automated and user-friendly dietary monitoring system. The system works by integrating a smart plate with a camera and weight sensors. When food is placed on the plate, the sensors measure its weight while the camera captures an image of the food. The captured image is then processed using computer vision techniques to identify the type of food. At the same time, the weight data helps in determining the portion size. These two inputs are combined to calculate the nutritional values such as calories, carbohydrates, proteins, and fats. To perform accurate nutritional analysis, the system uses a pre-defined database that contains detailed information about different food items. Once the food is recognized, the system retrieves the relevant nutritional data and adjusts it based on the measured portion size.

B. Overall System Architecture:

The overall system architecture of the Nutri Vision Smart Plate is designed to efficiently capture, process, and analyse food-related data in real time, and present meaningful nutritional information to the user. The system is mainly divided into four major components: data acquisition layer, processing layer, analysis layer, and user interface layer. The data acquisition layer is responsible for collecting raw data from the environment. This includes sensors and a camera integrated into the smart plate. The weight sensors (load cells) measure the quantity of food placed on the plate, while the camera captures images of the food items. These components work together to gather essential inputs such as food type and portion size without requiring manual effort from the user. The next stage is the processing layer, where the collected

data is prepared for analysis. At the same time, the sensor data is calibrated and converted into meaningful units like grams. This layer ensures that both visual and sensor data are clean, consistent, and ready for further processing. Once the food is recognized, the system refers to a nutritional database to estimate values such as calories, carbohydrates, proteins, and fats. The portion size obtained from the sensors is combined with the identified food type to calculate accurate nutritional information. This layer acts as the core intelligence of the system. Finally, the user interface layer presents the analysed results to the user in a simple and understandable format. The output can be displayed through a mobile application or a connected display system. Users can view real-time nutritional details, track their daily intake, and receive personalized suggestions based on their health goals. This layer ensures that the information is accessible and useful for promoting better dietary habits. Overall, the Nutri Vision Smart Plate architecture is designed to be user-friendly, efficient, and accurate. By combining sensors, image processing, and artificial intelligence, the system provides a seamless solution for real-time food monitoring and health awareness, making it easier for individuals to maintain a balanced and healthy lifestyle.

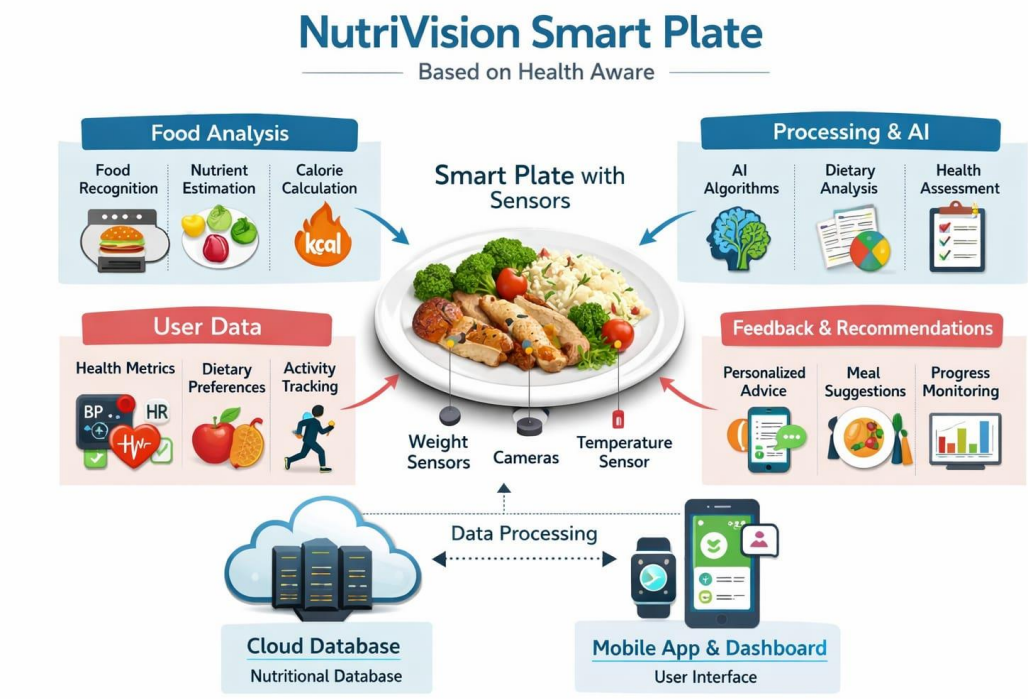

Figure: System Architecture of Nutri Vision Smart Plate

C. Data Collection Modules:

The data collection stage is one of the most important parts of the Nutri Vision Smart Plate, as it gathers all the necessary inputs required for accurate food analysis. The system uses multiple modules to collect different types of data such as food images, weight, and user-related information. These modules work together to ensure that the collected data is reliable and useful for further processing. The first module is the image acquisition module. This module uses a camera placed above or near the smart plate to capture images of the food items. The captured images are used to identify the type of food using image processing and artificial intelligence techniques. The camera is designed to capture clear and high-quality images under different lighting conditions so that the system can recognize the food accurately. This module plays a key role in understanding what the user is eating. When food is added or removed, the sensors detect changes in weight and send this data to the system. This helps in estimating portion sizes, which is essential for calculating nutritional values like calories and macronutrients. Accurate weight measurement ensures better analysis and reliable results. Although the system is designed to be automated, some additional

inputs from the user can improve accuracy. For example, users may enter details such as their age, weight, health conditions, or dietary preferences through a mobile application. This information helps the system provide personalized recommendations and better health insights. The system may also include a data storage module, which stores the collected data for future use. This module can be implemented using local storage or cloud-based databases. It keeps records of daily food intake, nutritional values, and user history. By analysing this stored data, the system can track eating patterns over time and provide long-term health suggestions. In addition, an optional environment sensing module can be included to improve system performance. This may involve sensors that detect lighting conditions or temperature, helping the camera adjust and capture better images. By combining image data, weight measurements, and user inputs, the system ensures a strong foundation for effective nutritional analysis and health awareness.

IV.IMPLEMENTATION DETAILS:

The implementation of the NutriVision Smart Plate using Computer Vision focuses on automatically identifying food items from images and analyzing their nutritional content. The process begins with image capture. A camera is placed above the smart plate to capture images of the food whenever it is placed on the plate. The camera ensures that the image is clear and properly focused so that the system can accurately recognize the food items. Once the image is captured, it is passed to the image preprocessing stage. In this step, various Computer Vision techniques are applied to enhance the image. The image is resized to a standard dimension, noise is reduced using filtering techniques, and the background is minimized using segmentation methods. After preprocessing, the system performs food detection and recognition. A trained deep learning model, such as a Convolutional Neural Network (CNN), is used to classify the food items present in the image. The model is trained on a large dataset of food images so that it can recognize different types of dishes. In case multiple food items are present, object detection techniques (like YOLO or SSD) can be used to identify each item separately. The visual data obtained from the image is combined with the weight data collected from sensors to determine the exact quantity of each food item. Computer Vision techniques can also estimate the area or volume of food, which improves the accuracy of portion measurement when combined with sensor data. Once the food item and its quantity are identified, the system performs nutritional analysis. It connects to a nutritional database that contains information about calories, proteins, fats, and carbohydrates for different food items. Based on the recognized food and its portion size, the system calculates the total nutritional values of the meal. The final step is result visualization. The calculated nutritional information is displayed to the user through a mobile app or web interface. The user can see details such as calorie intake, nutrient breakdown, and suggestions for maintaining a balanced diet.

V.ALGORITHM:

```
BEGIN
  SET objective ← "Develop an interactive web app to showcase Indian textiles by state"
  CREATE dataset
  FOR each state IN India DO
    COLLECT textile_type, region, artisan_details
    STORE data IN dataset
  END FOR
  CREATE web_page USING HTML, CSS, JavaScript
  DESIGN clickable_map OF India
  FOR each state_region IN map DO
    ADD click_event(state_region)
    ON click_event:
      DISPLAY popup WITH textile_details FROM dataset
```

```
    END FOR
    INITIALIZE server USING Node.js
    CONNECT server TO database
    STORE dataset IN database
    CREATE APIs TO fetch textile data
    TEST application FOR responsiveness, functionality
    IF errors_found THEN
        FIX errors
    END IF
    HOST application ON web_platform
END
```

VII. EXPERIMENTAL RESULT

The developed system was tested to evaluate its performance, usability, and effectiveness in presenting information about Indian textiles through an interactive web application. The application was executed on different devices such as desktops, laptops, and mobile phones to ensure compatibility and responsiveness. The results showed that the system performs smoothly across various screen sizes, maintaining a consistent and user-friendly interface. During testing, the interactive map feature responded accurately to user clicks. When a user selected a particular state, the system successfully displayed the corresponding textile information through pop-ups or modal views. Ensuring that users experienced minimal delay while navigating through the application. The database integration was also tested by adding, updating, and retrieving textile information. The system handled these operations effectively, demonstrating reliable data management. The backend built using Node.js showed stable performance and was able to process multiple requests without significant lag.

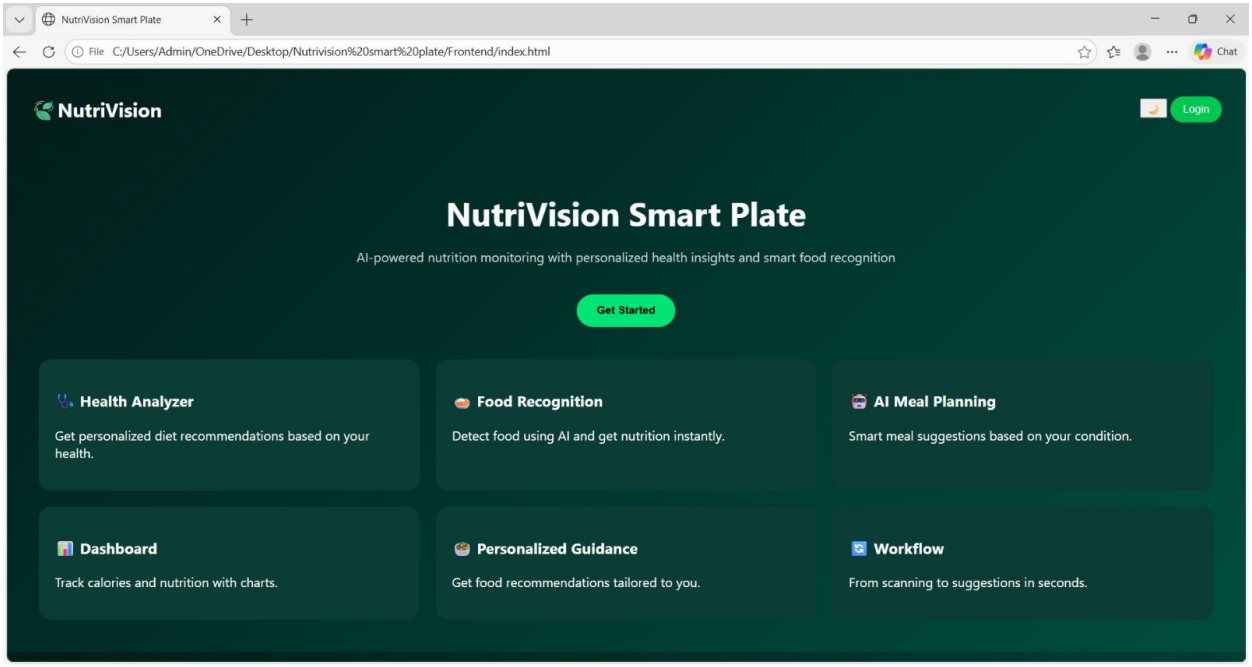

Figure 1: Example of Nutri Vision home page.

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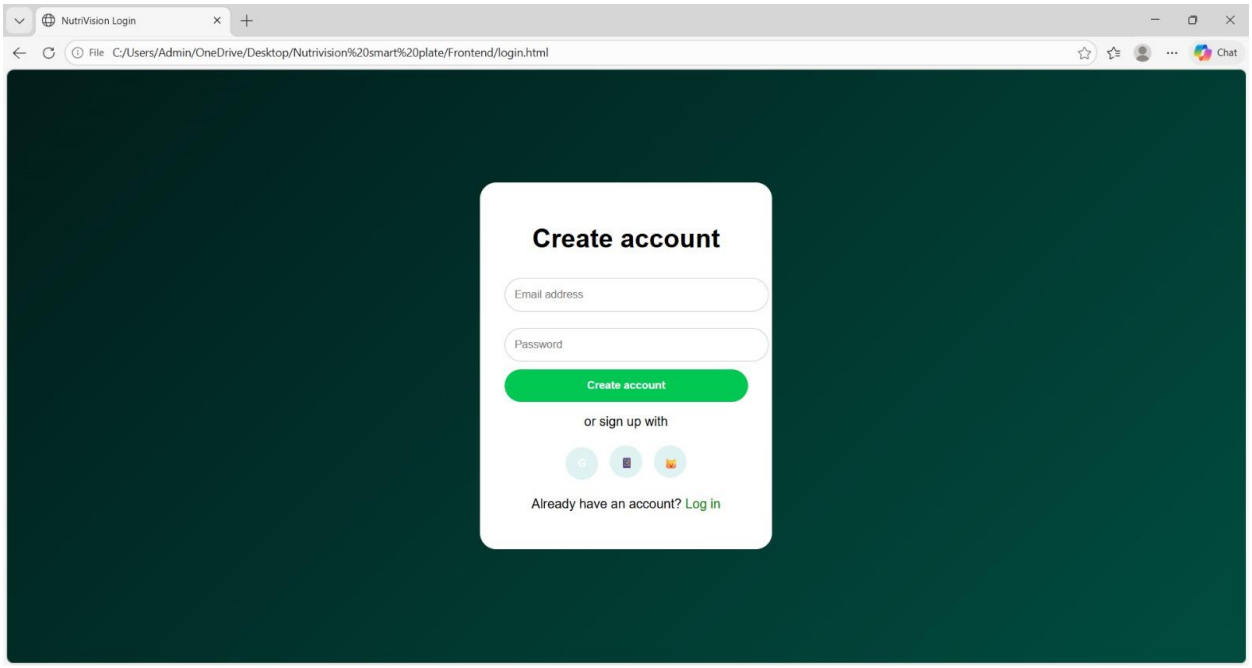

Figure 2: Example of Create Account.

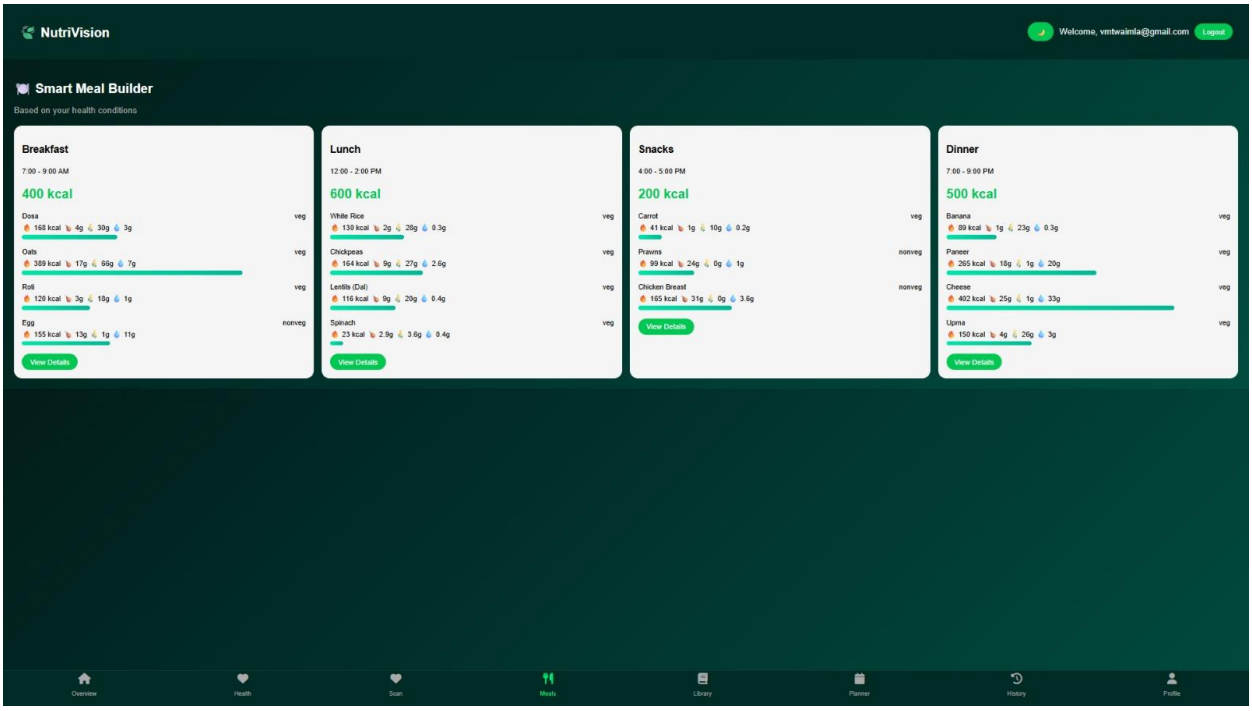

Figure 3: Example of Smart Meal Builder.

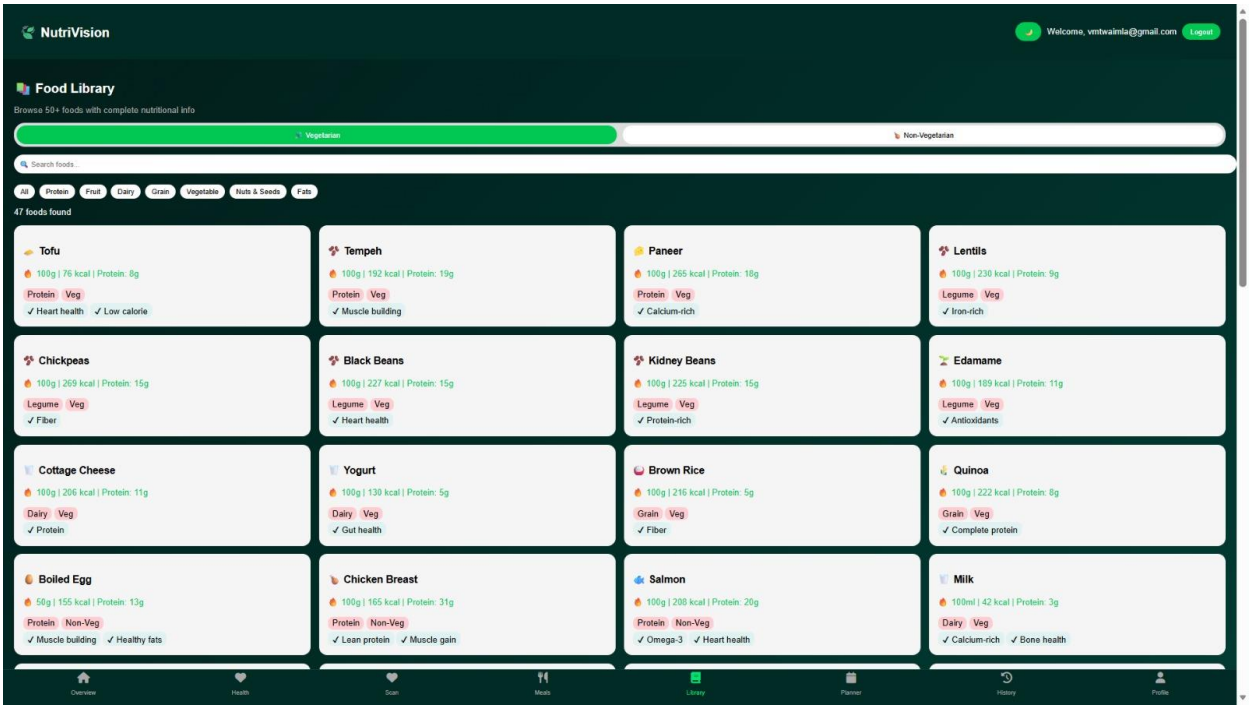

Figure 4: Example of Food Library.

VIII.CONCLUSION

The development of this interactive web application successfully demonstrates an effective way to present information about Indian textiles in a more engaging and accessible manner. By combining modern web technologies with a visually appealing design, the system allows users to explore textile traditions of different states through an interactive map. This approach not only improves user experience but also makes learning more interesting compared to traditional methods. The integration of frontend and backend technologies ensures smooth data handling and efficient performance. The system has proven to be responsive, user-friendly, and reliable across different devices and platforms. Overall, the project achieves its main objective of creating awareness and providing knowledge about the rich diversity of Indian textiles. It highlights how technology can be used to preserve and promote cultural heritage in an innovative way. With further improvements and additional features, the application can be expanded into a more comprehensive platform for education and cultural exploration.

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