VIVA-Tech International Journal for Research and Innovation
ISSN(Online): 2581-7280

Volume 1, Issue 7 (2024)
Article No. COMP_22
PP 1-6

VIVA-TECH IJRI
ANNUAL RESEARCH JOURNAL

VIVA-TECH INTERNATIONAL JOURNAL FOR RESEARCH AND INNOVATION
ANNUAL RESEARCH JOURNAL
ISSN(ONLINE): 2581-7280

SmartPoshan – Poshan Tracking for Students

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Abstract : *The PM POSHAN mid-day meal program aims to Provide nutritional assistance to students enrolled in pre-primary, primary (classes 1 to 8), and government or government-aided schools.. This initiative ensures that each child receives a specified daily intake of calories and protein, promoting improved health, attendance, and cognitive growth. To effectively manage this program, an integrated tracking system has been proposed, utilizing a QR code system for attendance tracking. The web application facilitates real-time meal consumption data and routine photographic documentation of meals served. Additionally, an AI-based tracker app has been developed for data collection and analysis, empowering stakeholders to monitor the program's impact across various scenarios. Nutrition analysis software is employed to plan diverse menus that meet nutritional requirements. Regular health check-ups and maternal involvement further enhance the program's effectiveness. Through the implementation of this comprehensive monitoring and evaluation system, the PM POSHAN program ensures transparency, accountability, and the optimal well-being of the students, thereby fostering a healthier and more academically successful school environment.*

Keywords *– PM POSHAN, Mid-day meal program, QR code system ,Nutrition analysis software*

I. Introduction

In the realm of educational technology, the SmartPoshan system emerges as a groundbreaking web application poised to revolutionize nutritional monitoring and attendance tracking within academic institutions. Addressing the intricate needs of schools and administrators, this innovative platform seamlessly integrates a QR code attendance mechanism with advanced nutritional analysis of school meals, offering an all-encompassing solution for the modern educational landscape. SmartPoshan's architecture is characterized by two pivotal user roles - the School User and the Admin. These roles encapsulate distinct responsibilities, each contributing to the system's overarching functionality. For School Users, the platform provides a comprehensive suite of features, including meticulous Student Record Management, automated ID Card Generation with QR codes for streamlined attendance tracking, and a cutting-edge Meal Upload system. This Meal Upload system employs sophisticated image processing techniques to calculate nutritional metrics, such as protein, calories, and fat content, while also identifying specific meal item names. The attendance tracking system utilizes photographic evidence, timestamped for verification, ensuring accuracy and reliability. Admins, on the other hand, wield exclusive control over User Management, Geographical Classification, Admin Hierarchy, and Report Generation. This hierarchical structure not only safeguards the integrity of user accounts but also ensures that only designated administrators have the authority to create additional admin accounts.

The reporting system is a standout feature, offering an interactive map displaying Indian states. Upon selecting a state and district, the system generates detailed reports containing school names, meal specifics with accompanying images, and student attendance records with photographic evidence. Reports are downloadable in PDF format, facilitating seamless record-keeping. SmartPoshan stands at the forefront of educational technology, seamlessly blending attendance tracking and nutritional monitoring. This paper endeavors to delve into the intricate technical facets of the system, elucidating its potential to redefine administrative processes and foster holistic the welfare of students within educational institutions.

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II. Review Of Literature Study

This research project focuses on the development of an advanced recognition model using transfer learning methods. The main goal is to accurately classify 101 different food categories, achieving an impressive accuracy rate of 80%. The model relies on Efficientnetb0 as its backbone, a state-of-the-art transfer learning technique known for its efficiency in extracting significant features from complex datasets. In the field of food categorization, this model outperforms existing models, thanks to the advanced capabilities of Efficientnetb0, which allow it to identify intricate patterns and nuances within a wide range of food types. Additionally, the research expands the model's applications to include the assessment of individuals' nutritional habits across different nationalities.

VijayaKumari G. a, Priyanka Vutkur a, Vishwanath P [1]. Utilizing the same transfer learning technique, the model extends its capabilities beyond traditional food categorization to assess the nutritional profiles linked with various dietary patterns. This dual functionality distinguishes the model, highlighting its versatility in handling both food categorization and nutritional analysis tasks simultaneously.

Sabiha Samad a, Fahmida Ahmed a, Samsun Naher a, Sheikh Mohammed Shariful Islam [2]. The incorporation of AI into food consumption tracking and recommendation applications has prompted the necessity for an evaluation framework. Examining 473 apps from three prominent app stores, a comprehensive analysis of 80 apps was conducted, focusing on their core functionalities, AI-driven features, and software quality attributes. Additionally, the study assessed the internal consistency and reliability of the rating tool employed. Results indicate that the majority of mobile apps fail to meet the comprehensive standards for monitoring food consumption and providing recommendations. This study offers valuable insights for researchers and developers, outlining essential features and software quality attributes crucial for enhancing app design and functionality.

Mehrdad Rostami a, Usman Muhammad a, Saman Forouzandeh b, Kamal Berahmand c, Vahid Farrahi a,d, Mourad Oussalah [3]. The paper introduces an Explainable Food Recommendation system utilizing deep learning-based image clustering to provide transparent justifications for food recommendations. It introduces a novel similarity score derived from user preferences and incorporates rule-based explainability to enhance transparency. Experimental results demonstrate that the proposed method enhances recommendation quality, as evidenced by improvements in precision, recall, F1 score, and NDCG compared to alternative methodologies. Furthermore, the system undergoes an ablation study, affirming its technical robustness and efficacy.

Dim P. Papadopoulos ,Enrique Mora, Nadiia Chepurko, Kuan Wei Huang, Ferda Ofli Antonio Torralba [4]. The study endeavors to represent cooking recipes as high-level entities using cooking programs, which encapsulate cooking semantics and sequential actions in a graph structure, facilitating convenient manipulation and execution. Through training, a model acquires a unified embedding for recipes and images, enabling the generation of a program from this embedding. Validation is conducted through crowdsourcing programs, demonstrating enhanced cross-modal retrieval, recognition, and food image generation capabilities.

Parisa Pouladzadeh1, Shervin Shirmohammadi1, and Rana Almaghrabi [5]. The paper introduces a food calorie and nutrition measurement system designed to aid patients and dietitians in monitoring daily food intake. Leveraging food image processing and nutritional fact tables, the system is implemented on personal mobile devices such as smartphones or tablets. Users utilize the built-in camera of these devices to capture photos of food before and after consumption, enabling the measurement of calorie and nutrient intake. The system demonstrates acceptable accuracy and offers significant improvements over traditional manual calorie measurement techniques, enhancing efficiency and facilitating dietary management processes.

Rana Almaghrabi, Gregorio Villalobos, Parisa Pouladzadeh, Shervin Shirmohammadi [6]. This paper presents a state-of-the-art medical-grade food nutrition and energy intake recognition system, utilizing food image processing and shape recognition technologies. By capturing food photos before and after consumption, the system estimates calorie and nutrient intake, potentially revolutionizing precision obesity treatments. Smartphone integration enhances the system's accessibility, offering a practical tool for obesity management. Real-time nutritional assessment enables personalized interventions, empowering individuals and healthcare professionals. This innovative system bridges traditional methods with modern healthcare needs, providing actionable insights for tailored interventions and promising effective obesity management.

Salaki Reynaldo Joshua , Seungheon Shin , Je Hoon Lee , Seong Kun Kim [7]. The treatment of type 2 diabetes mellitus (T2DM) frequently neglects medical nutrition therapy, primarily due to challenges in determining appropriate dietary patterns, regulating daily intake, and adhering to healthcare provider recommendations. Smart Plate Health to Eat presents a technological breakthrough aimed at assisting patients in

comprehending the type, quantity, and nutritional content of various foods. In a study utilizing the YOLOv5s algorithm, the system successfully identified, measured, and assessed the weight and nutrition of over 30,800 foods. This feat was accomplished through the integration of a Chenbo load cell weight sensor, HX711 weight weighing A/D module pressure sensor, and an IMX219-160 camera module.

Lutfi Fanani, Hanifah Muslimah Az-Zahra, Muhammad Aminul Akbar, Riswan Septriayadi Sianturi [8]. The study aims to develop a user-centric mobile nutrition app using Augmented Reality (AR). The process includes empathizing, defining, ideating, prototyping, and testing. Initial data collection informs empathy maps and Personas. Ideation involves crafting a user journey map and information architecture. Wireframes and mockups visualize the app in the prototype stage. Usability testing evaluates learnability and efficiency, with user satisfaction measured using the System Usability Scale (SUS).

Jana Wieme, Kaveh Mollazade, Ioannis Malounas, Manuela Zude-Sasse, Ming Zhao, Aoife Gowen, Dimitrios Argyropoulos, Spyros Fountas, Jonathan Van Beek [9]. The paper provides an extensive review of quality theory and hyperspectral imaging systems, exploring emerging methodologies for assessing quality parameters pre- and post-harvest. Additionally, it discusses the current and potential applications of artificial intelligence, such as machine learning and deep learning, in analyzing hyperspectral imaging data in horticulture. Emphasis is placed on the need for future research to improve data accessibility, integrate AI techniques, and transfer knowledge to relevant industrial stakeholders.

Qiang ZhaiID, Chun Ye, Shuang Li, Jizhong LiuID, Zhiming Guo, Ruzhi Chang, Jing Hua [10]. Traditional methods for assessing nitrogen nutrition in rice cultivation, reliant on expert observations of leaf color and growth, are being replaced by a novel approach. This method utilizes Convolutional Neural Network (CNN) models, showcasing their effectiveness in determining the nitrogen nutrition status of rice plants. Evaluation metrics like accuracy, recall, precision, and F1 score were used to assess the model's performance, with the GoogleNet model, leveraging its Inception architecture, achieving an outstanding accuracy of 95.7%. This marks a significant improvement in precision and reliability, highlighting the potential of advanced CNN models for accurate and efficient monitoring of nitrogen nutrition in rice cultivation.

Jackey J.K. Chai a , Carol O,Sullivan a , Aoife A. Gowen b , Brendan Rooney c , Jun-Li Xu [11]. The food industry is globally influential, driven by Industry 4.0 advancements. Augmented Reality (AR) and Mixed Reality (MR) have gained traction, with 111 articles on Scopus. These technologies enhance efficiency and accuracy in dietary assessment, food analysis, retail operations, education, and farming practices, revolutionizing various food industry domains.

Manuela Gallón Bedoya a,b, Daniel Restrepo Montoya c, Gipsy Tabilo-Munizaga d , Mario Pérez-Won d, Roberto Lemus-Mondaca a [12]. Novel food matrices from sources like algae, insects, and plants are being explored for their high protein content and functionality. 3D food printing (3D-FP) has emerged as a promising technique in the food industry, enabling innovations in gastronomy, personalized nutrition, and sensory experiences.

III. METHODOLOGY

The developing SmartPoshan involved a systematic approach aimed at ensuring the system's effectiveness and reliability. It included stages such as requirement gathering and analysis, system design and architecture, technology selection, development and implementation, deployment and integration, and monitoring and maintenance. Each stage was meticulously executed, incorporating industry best practices and iterative development methods to deliver a robust, user-centric solution. Through comprehensive requirement analysis, careful system design, judicious technology selection, and rigorous testing and maintenance, SmartPoshan was developed as a scalable, secure, and user-friendly platform, addressing the complex challenges of attendance tracking and nutritional monitoring in educational institutions. The development and implementation of SmartPoshan followed a systematic methodology, combining various technologies to create a robust and user-friendly system. The project's methodology is detailed as follows:

Requirement Elicitation: - Collaborated closely with educational institutions to understand the specific needs of attendance tracking and nutritional monitoring. Conducted surveys and interviews to gather detailed user requirements for both School Users and Admins.

System Architecture Design:- Defined the functionalities of the School User dashboard, including menu options such as "Student Details," "Meal Image," and "Student Attendance." Structured the Admin dashboard with sections for "User Details," "Admin Details," and a dedicated "Report" feature.

Database Integration:- Employed MongoDB as the database system to efficiently store and retrieve data related to student records, user details, and geographical information.

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GUI Framework: - Implemented the Flask framework to create an intuitive graphical user interface (GUI) for both School Users and Admins, ensuring a seamless and responsive user experience.

Image Processing with CNN:- Utilized Convolutional Neural Networks (CNN) for advanced image processing in analyzing meal images. This allowed the system to calculate nutritional parameters and identify meal item names accurately.

QR Code System:- Integrated a QR code system for efficient attendance tracking. QR codes were generated and embedded into student ID cards, facilitating quick and accurate marking.

Image Storage:- Stored images in byte form to optimize data storage efficiency, ensuring quick retrieval and seamless integration with the image processing and attendance verification systems.

Data Security: - Implemented SHA-256 key encryption for data security, safeguarding sensitive information such as user details and attendance records.

Geographical Mapping:- Utilized geographical mapping features to categorize schools based on state and district information. This facilitated efficient data organization and analysis for Admins.

Photographic Attendance Verification:- Incorporated a photographic attendance verification system, allowing School Users to capture images during meal times. The system timestamped each image, enhancing accuracy and providing a visual record.

This methodology ensured a comprehensive and technically sound development process, integrating MongoDB, Flask, CNN, QR codes, and other technologies to create SmartPoshan—a cutting-edge solution for attendance tracking and nutritional monitoring in educational settings.

IV. Design Details

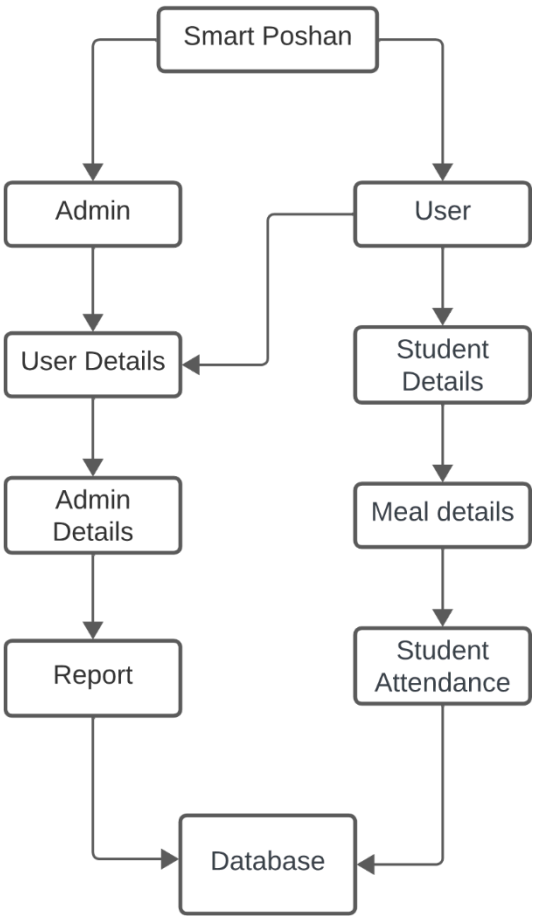

Fig. 1: Block Diagram

The above figure shows the different blocks of the project. The blocks are the different entities involved in project. This figure shows how those blocks are connected to each other and work. Our project, SmartPoshan, involves different entities such as Schools, Admins, and System Users. Key contracts streamline interactions: the Meal Data Contract connects School Users and Admins for meal image and attendance record submissions, while the Nutrition Analysis Contract ensures accurate nutritional analysis. The Reporting Contract facilitates

seamless communication, enabling comprehensive report exchange between Admins and School Users. These contracts form the foundation of SmartPoshan, facilitating efficient meal image uploading, nutritional analysis, and collaborative reporting.

V. IMPLEMENTATION RESULTS

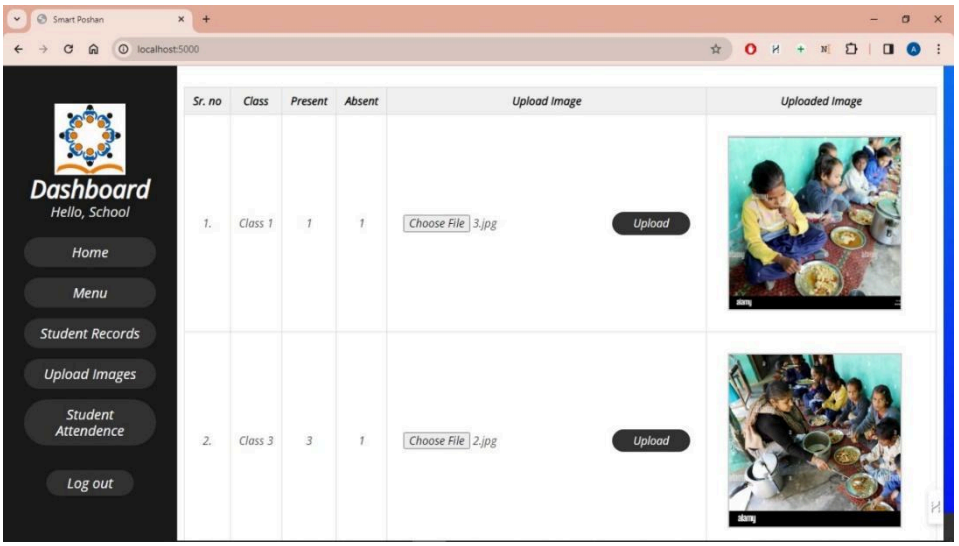

Fig. 2 :Student Attendence

The Figure 2 SmartPoshan ensures precise student attendance by incorporating photographical proof, using timestamped images to enhance accuracy and verification in educational settings.

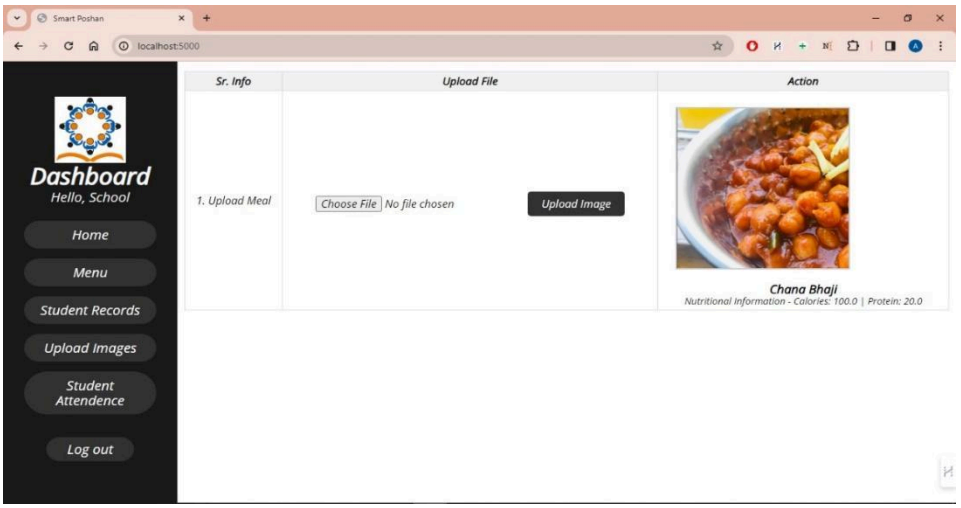

Fig. 3: Meal Nutrition Calculation

The Figure 3 SmartPoshan calculates meal nutrition with precision, employing advanced image processing techniques, including Convolutional Neural Networks (CNN), to analyze uploaded meal images, providing real-time insights into protein, calories, and fat content.

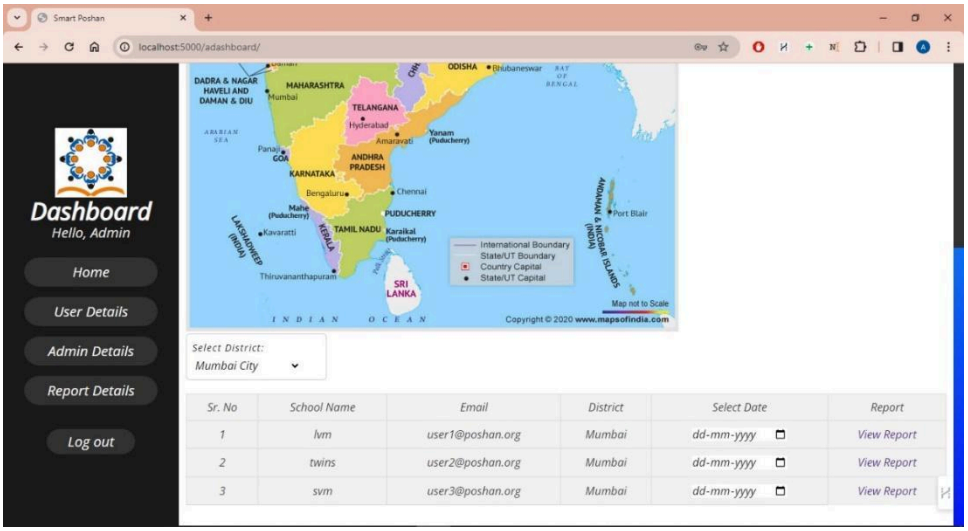

Fig. 4: Report

The Figure 4 SmartPoshan's robust reporting system offers administrators an interactive map, allowing them to analyze detailed school reports. The system provides insights into meal specifics, student attendance records, and geographical data, enhancing informed decision-making.

VI. Conclusion

SmartPoshan, a cutting-edge educational technology solution, seamlessly integrates attendance tracking and nutritional monitoring. Developed with a meticulous methodology, the system employs MongoDB for efficient data storage, Flask for an intuitive GUI, CNN for image processing, and a QR code system for precise attendance tracking. User-friendly dashboards for School Users and Admins, coupled with features like geographical mapping and photographic attendance verification, elevate the user experience. With byte-form image storage and SHA-256 key encryption ensuring data efficiency and security, SmartPoshan stands as a pioneering web application, redefining administrative Processes and factors contributing to the overall well-being of students in educational institutions.

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