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Nourish: Food Donation App Using Android and ML

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Abstract: ***This research paper introduces an App designed to modernize food donation practices by digitizing the process and offering support to volunteers, from organizations such, as NGOs orphanages and other charitable institutions. Encouraged by the recurring difficulties of food waste together with worldwide food scarcity the task looks for to develop an easy-to-use system promoting smooth and also clear contributions from people, services as well as dining establishments. To minimize the wastage of food this effort attempts to link the space in between excess food and hunger among the poorer. The Mobile application display the advancement of a user-friendly application user interface streamlining the uploading, with organized functions as well as a focus on transparency. Especially, the application integrates identity confirmation system enabling contributors to post and also confirm their identity by verifying their Aadhar card therefore guaranteeing authenticity of donors and recipients. Furthermore, the app serves as a hub, for resources providing people with access, to guidelines, best practices and other information aimed at raising awareness to combat food waste. By fostering neighborhood interaction and also forging collaborations with neighborhood organizations this study adds to a much more lasting future by making excess food easily offered to those encountering food instability therefore dealing with the double obstacles of food waste as well as needs while harnessing modern technology for favorable social effect.***

Keywords: Food Donation, Android Studio, Geofencing, User Acceptance Testing, Database Management, Convolutional Neural Network

I. INTRODUCTION

Hunger is a significant issue of the present generation, and despite the fact that food producers generate more food than necessary, still half of the global population has no proper meal. Of course, such a contradiction poses the question of how one can come up with strategies that can help reconcile such elements. With regard to this burning challenge, the goal of our team has been to create the mobile application whose mission is to serve as the link between individuals who have excess of foodstuff and those who need the meal most other [1].

Hence, this app aims at helping to fasten the way of reusing leftover food to prevent wastage while at the same time making sure that those living in underprivileged societies have the meals they need. Besides its assertiveness in operation, it supports community engagement and survival with the solutions that also imply constant occurrence or absence of harvests. Our major reason for undertaking this project is the globally high level of food loss and waste which ranges from 33% to 50% of all produced food internationally [3]. From the statement above, it can clearly be seen that this is a great waste due to various reasons including; poor planning of the meals and the general attitude of people of preparing and purchasing large quantities of food than they are capable of consuming, as well as systematic overproduction in the restaurant business. These effects are not limited to environmental degradation and high incidences of hunger, but also to the social-economic fabric of many societies globally. We therefore aim at addressing the root issue by laying down a robust framework that will enable our users to locate a map of surplus food information in their locality through visualization. In this way, our work not only digs itself an immediate remedy to hunger but also contributes to a growing problem of food waste; thereby providing two-fold means of promoting a more sustainable and socially responsible food production and distribution [3]. Besides, applying such initiative in the given direction to minimize adverse environmental and economic consequences linked with societies' throw-away tendencies concerning food, it is crucial to utilize technology as means to encourage community engagement addressing positive societal change with regard to addressing the problem of hunger and providing sustainable patterns of nutrition.

The rest of the paper is organized as follows. Proposed embedding and extraction algorithms are explained in section II. Architecture of the App are given in section. III. Implementation of the App are given in section VI. Lastly, result, future scope and conclusion are given in V, VI, VII respectively.

II. ALGORITHM

A. Machine Learning Approach:

The implementation of a machine learning approach for rotten and fresh food classification in the Android application involves a comprehensive methodology. The chosen methodology focuses on employing a Convolutional Neural Network (CNN) for model training, specifically suitable for image recognition. CNNs exhibit efficiency in capturing spatial hierarchies and patterns within images, making them adept at recognizing visual inputs. The testing phase rigorously evaluates the model's accuracy, precision, and recall, ensuring its reliability across diverse scenarios.

In our model, there are three Conv2D layers. Each layer has a different number of filters (32, 64, and 128 respectively) with a kernel size of (3, 3). ReLU activation function is used after each convolutional operation, which introduces non-linearity to the model. After each convolutional layer, there is a MaxPooling2D layer with a pool size of (2, 2). Next, the flatten layer flattens the input without affecting the batch size. It transforms the multi-dimensional input into a one-dimensional array. This is necessary to connect the convolutional layers to the fully connected (Dense) layers. The first Dense layer has 512 neurons, and ReLU activation is applied as it helps to alleviate the vanishing gradient problem.

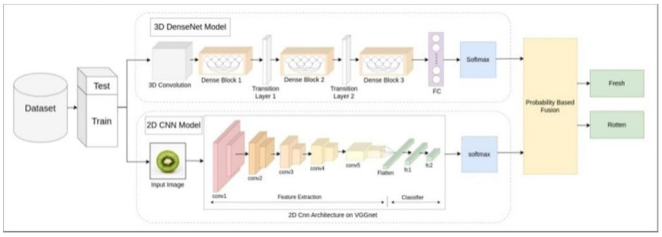

Fig 1: CNN model

B. Geo-fencing services:

The methodology for integrating geo-fencing services in the Android application centers on optimizing food donation processes. Geolocation technologies track real-time user locations, while geo-fencing creates virtual perimeters to trigger actions based on users' entry or exit from specific zones. Algorithms dynamically match donors with nearby recipients, considering factors like distance, traffic, and food quantity for efficient redistribution. The methodology ensures real-time route optimization, reducing travel time and facilitating timely food distribution.

A circular geofence is created around the user's current location with a specified radius. For each location within the geofence, a marker is added to the map with a green color to represent a potential donor. Distance between the user's current location and each donor location is calculated. If the distance is within the circumference, the donation location is considered within range and displayed on the map.

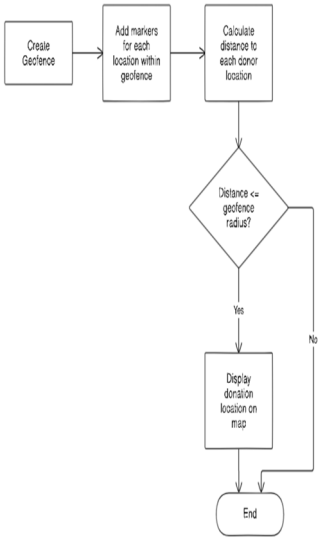

Fig 2: Geofencing process flowchart

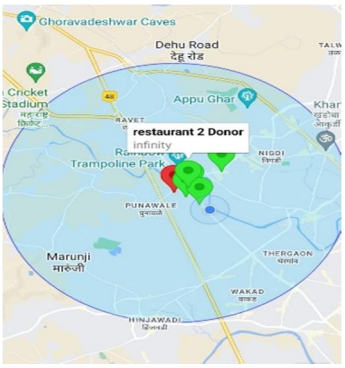

Fig 3: Geofence created

III. ARCHITECTURE

The recommended food donation Android app's architecture shows a comprehensive design that consists of multiple layers and elements. The User Interface (UI) on the Presentation Layer has screens such as requesting recipient, user profile, and communication capabilities.

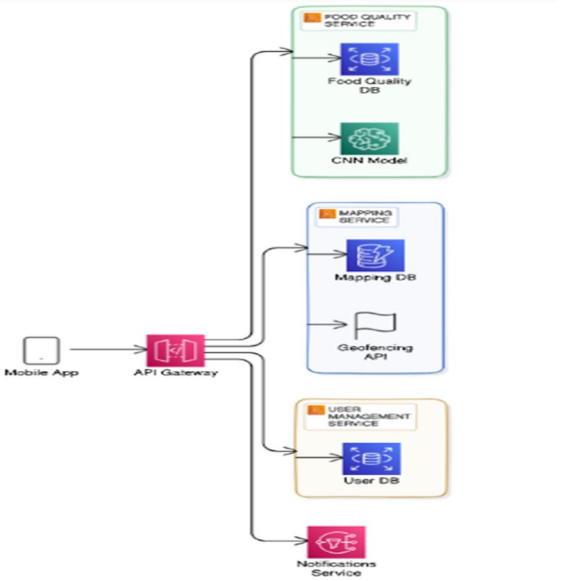

Figure 1. Architecture Diagram

The Application Layer handles main functionalities like User Management (registration, authentication and profile creation); Donor and Recipient Subsystems (food donation activities and recipient actions are controlled by this subsystems); Matching Algorithm Subsystem (donor –recipient pairs are effectively selected through this subsystem using location data) [5].

Business Logic Layer is responsible for the Database Management that keeps the database with user profiles, meal listings, interactions etc. It houses a central Matching Engine which serves as the algorithmic hub for matching donors and recipients while Notification Service provides instant alerts. Besides managing user profiles, restaurant listings, reviews and ratings; Data Access Layer communicates with external services via APIs. One instance of an outward service is a mapping service that offers location data. The software makes use of different internal data structures which are specifically developed for certain data management needs including the User Profile, Food Listing, Donation [2].

Finally, Cache, Temporary Files and Temporarily Stored User Input are performed with temporary data structures during some processes to manage ephemeral data appropriately.

The architectural framework aims at addressing food waste and hunger in society while advancing technological perspectives of donation platforms by providing user-friendly interface ensuring seamless experience as well as reliable data management that help real-time communication come true through efficient matching algorithms.

IV. IMPLEMENTATION

This Food Donation App is made to create a connection between food donors and recipients, hence reducing food waste and solving hunger locally.

It comes with an easy interface that allows users to post excess foods effortlessly as well as connect them with the nearby recipients. Android Studio will help in the construction of this application using Java and Python languages while XML will be used in creating a user-friendly interface on Figma for prototyping. Google Maps API has contributed towards enrichment of this app through location-based services associated with mapping and geolocation features Git improves source code management where it ensures collaborative development alongside version control. The algorithms are implemented in Convolutional Neural Networks (CNN) that can handle image-based tasks, Genetic Algorithms, Reinforcement Learning for optimal route planning as well as Clustering algorithms (e.g., K-Means) that is used to analyze user behavior and provide personalized donation recommendations [2]. Pseudo code describes an organized procedure of entering data into the base, searching it using constraints, validating inputs or outputs then storing results.

Functional testing thus subject's key functionalities such as user registration, food listing, and the complex matching algorithm to rigorous examination in order to ensure their correct operation. Security testing counts high to confirm robustness of sensitive donor and recipient details by looking out for any possible vulnerabilities in the system or use of secured protocols like encryption. Performance testing checks if the app is able to work under varying conditions regarding its speed, scalability and how responsive it is even during peak usage times. User Acceptance Testing (UAT), which involves real users who will help identify some improvements that could be made on the app before it goes viral among customers who are expected to find it useful. In order not to lose integrity of food donation records stored in database data validation must be implemented carefully. Load testing focuses on checking how well an application performs when its traffic volume increases significantly thus preventing crashes or slow down at times of increased demand for the service. With this respect continuous testing and maintenance activities are established including feedback mechanism from user community; bug tracking and regular updates done by developers themselves.

V. RESULTS

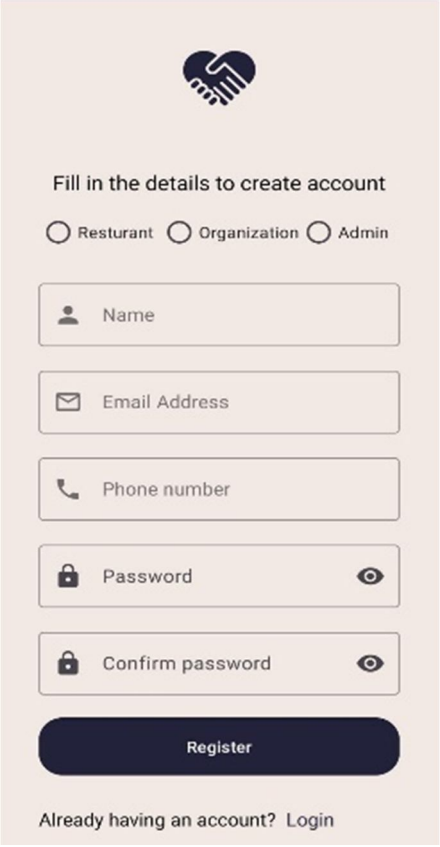

Figure 1. Signup Screen

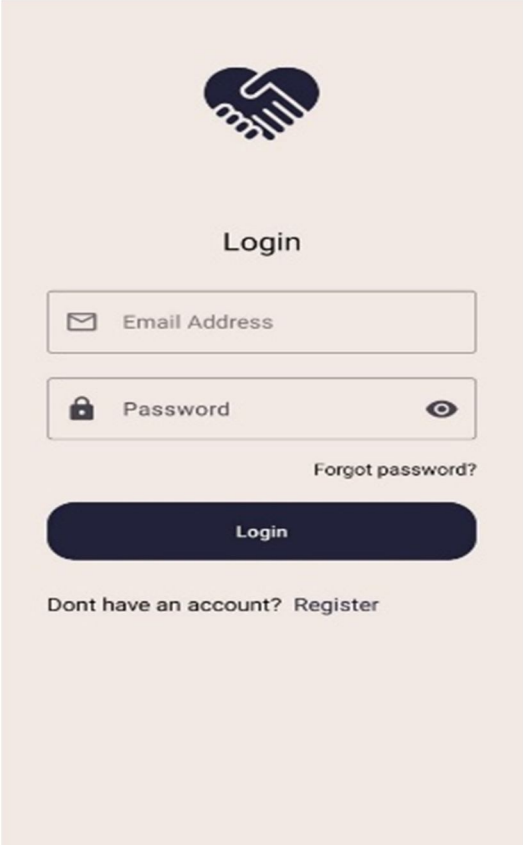

Figure 2. Login Screen

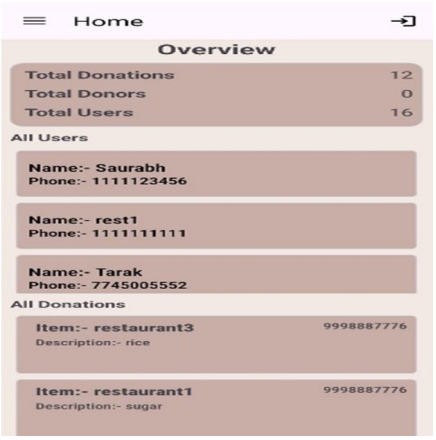

Figure 3. Home Screen

Figure 4 Location Screen

Figure 5. Donation Screen

Figure 6 Receive Screen

VI. FUTURE SCOPE

The future scope is in the use of more advanced algorithms and broaden access to IoT systems like gas sensors such as the incorporation of MQ4 [10]. This would make it possible to monitor food's quality in real-time; thus, guaranteeing that customers are being supplied safely. Various Machine Learning Algorithms can forecast when surplus foods are available and better synchronize with customer organizations. In addition, Blockchain could ensure transparency in the donation system, improving the trust between donators and receptors.

VII. CONCULSION

In conclusion, the Food Donation App fills a critical void in the fight against food waste and hunger by creating an easy to navigate platform for linking donors with recipients. Following strict functional and non-functional requirements, the app a valuable tool for facilitating sustainable food production and community health. The security of the app is hinged on how well the committed development team has created the robust and scalable platform. In order to ensure that it functions optimally and serves different users' needs, there is ongoing support, rigorous testing as well as adherence of best practices. Socially responsible technology, this app demonstrates promise in contributing meaningfully towards building more sustainable communities while also realizing wider goals such as reducing food wastage or eliminating hunger cases.

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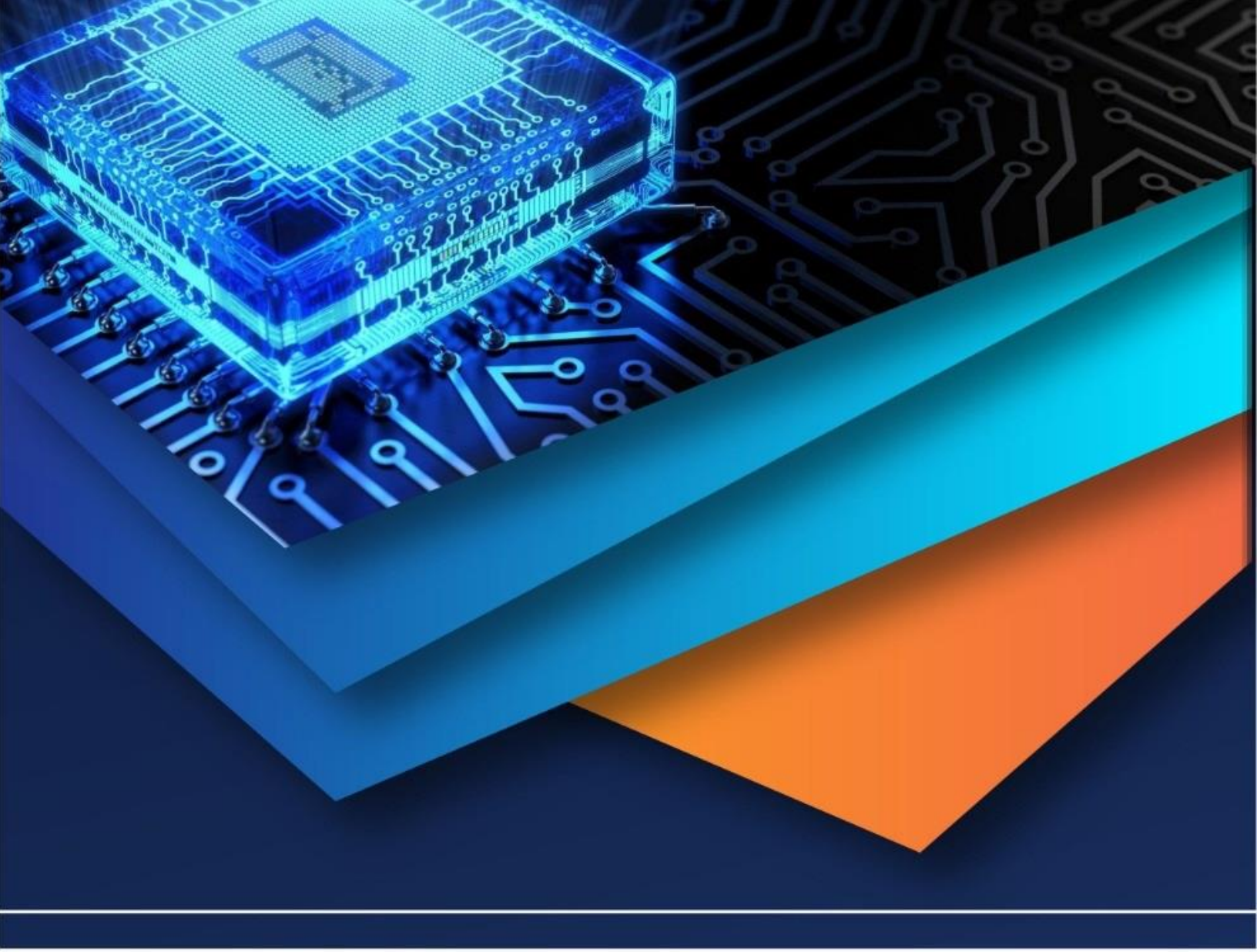

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