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ECOFEAST - A Food Redistribution Platform for Sustainable Food Waste Management and Community Empowerment

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Abstract: ***ECOFEAST is a digital platform designed to address the critical issues of food waste and food insecurity through efficient food redistribution. By connecting surplus food providers with NGOs and community volunteers, the platform ensures that excess food from restaurants, hotels, and residential societies reaches those in need rather than ending up in landfills. Developed using Dart, Flutter, and Firebase, ECOFEAST integrates features like geolocation tracking, notifications, and data analytics to streamline food collection and distribution processes. The platform also emphasises environmental sustainability by helping reduce the carbon footprint associated with food waste. This paper discusses the development, implementation, and initial impactof ECOFEAST, highlighting its potential to createa more sustainable and food-secure community.***
Keywords: Food Waste, Food insecurity, sustainable development, environmental impact,food surplus, digital platform.

I. INTRODUCTION

Food waste and food insecurity are pressing global issues. Each year, approximately one-third of all food produced is wasted, amounting to about 1.3 billion tons, while millions suffer from hunger and malnutrition. This paradox of food surplus and scarcity has significant environmental and social impacts. When food is wasted, not only are the resources used to produce it also wasted, but the decomposing food contributes to greenhouse gas emissions, exacerbating climate change. Addressing this issue requires innovative solutions that bridge the gap between surplus food and thosein need..

ECOFEAST is a digital platform developed to provide a sustainable solution to these challenges. It facilitates the redistribution of surplus food fromproviders—such as hotels, restaurants, and residential communities—to NGOs and community volunteers who ensure it reaches food-insecure populations. Designed using Dart, Flutter, and Firebase, the platform incorporates features like geolocation tracking, notifications, and real-time data analytics, making food collection and distribution efficient and transparent, The goal of ECOFEAST is to create a network that not only reduce food waste but also supports community welfare by addressing hunger. By Leveraging technology, ECOFEAST aims to minimise the environmental impact asscociated with food waste while promoting social responsibility.This paper explores the platform'sdevelopment, initial impact, and the potential it holds for creating a more sustainable and food-secure society. Through ECOFEAST, surplus food is transformed from waste into a valuable resource for communities in need.

Food waste is a pressing problem with significant economic and environmental implications, as wellas links to climate change [4,5]. Therefore, it is crucial to urgently search for effective andenvironmentally friendly methods to address food waste issues. Food waste in households can occur intentionally or unintentionally. Much of the waste in households is a result of forgetfulness or neglecting to check food expiry dates. In countries such as Finland where the cost of living is high, consumers may choose to purchase food items that are nearing their expiry date because discount sellers often offer them at reduced prices.

II. OBJECTIVE

The aim of the app-based tool designed to reduce food waste is to gather surplus or unused food from various sources like restaurants, hotels, and wedding halls, and also from apartments or others.

In this system, our aim is to minimise food wastage from restaurants by redirecting leftover food to NGO otherwise poor peoples if possible. Let I am manager of Hotel, if by mistakenly made over food or excess food which is going to waste then I am just send notification to ECOFEAST with proper quantity of food then This notification received by our team members .After approval by the NGO manager or volunteer they are going to collect the food donated to those in need and poor persons.

III. LITERATURE SURVEY

Food wastage needs to be measured and monitored. Jagtap and Rahimifard [1] reduced the meat waste of a Chicken Tikka Masala restaurant by 60.7% in eight months. This was achieved by using a bin fitted with a load cell that measures the amount of wasted meat and sends the message to a mobile application through a Bluetooth sensor. The data is then transmitted to the cloud server for further analysis and storage. The research uses eNose and weight sensors, Wi-Fi, and Arduino modules to detect, track, and manage food waste..

Du, X., Kowalski, 2019 [2], SeVa has been designed to be a go-between for food operators and customers. It has a resource database that can be accessed by the customers to interact with one another. Users can log in to the application using different options according to the profile established and filling all the required details to have the outcome. The suppliers and consumers can log into the application. This project helps in facilitating effective waste recycling and management, K. Jayalakshmi (2017) [3]. In it, RFID and Wi-Fi modules are used. When someone has waste to be thrown off, they can request for a smart bin with a web service and drop the wastes specifying the types of wastes. The system identifies whether the waste is recyclable or not, and if it is recyclable, then it sends it to a collector-vendor who will recycle it. If it is not recyclable, then it will be disposed of as normal waste.

The billing system is by the weight where users can use RFID to pay their bills. Combining various systems, a trash can containing food waste is designed, which employs RFID technology, weight sensors, and level sensors to recognize the bag's ID, measure waste weight, and estimate three levels of waste level detection. The trash bin is picked up by an advanced vehicle and the disposed of food waste is converted into fertiliser using food waste disposal machines made from auto parts and IoT devices. The system can also show some results and information which was acquired from sensors using LCD displays[4].

The smart refrigerator recognizes food items and their freshness status using AI and image processing. It is then established using NLP analysis that foods are nearing expiration and the system automatically contacts the user's mobile phone in order to avoid food spoilage and properly control food stores, T.Nagaraju (2020) [5].

Social innovation reinforces the notion of food redistribution with the purpose to reduce food waste and food poverty. The administrator collects food from donors in the neighbourhood tout by agents and such food is given to orphanages or poor people in the neighbourhood. An alert message is then sent to the donor through the administrator to appreciate the donors for coming through when the donor receives the food parcel. This method helps to reduce wastage of food. Web applications, as tools for making strategic decisions regarding waste valorization opportunities, provide a basis for making decisions, such as: incorporating waste-to energy facilities in optimal geographical areas, optimal waste recycling methods, determining the quantity of waste streams that can be employed as feedstock (Paul Mathew, 2020) [6].

It was reported that the web application is integrated with geospatial analysis to handle emerging waste management issues such as an increase of generation of MSW, an increase in the need for landfill minimization, and complicated logistics and supply chains for waste conversion.

In the present survey, 35 countries including Bangladesh, China, India, Iran, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam were included in the parks and other tasks of solid-waste management, a case today's practice regarding barriers these problems present future possibilities, and programs that were designed to solve them. The objective of the survey was to create a reliable framework on solid waste important for national level plans as well as regional strategy formulation [7].

In their study, Troschinetz (2005), considering these three components of sustainable development – environmental, social and economic – distinguishes twelve factors determining sustainable recycling in developing countries. The factors were identified with the use of 23 cases related to quantitative and qualitative methods[8].

A case in point is the work of Jennifer (2005) who prepared a detailed composting project feasibility study and action plan aimed at the Riverton disposal site in Kingston, Nigeria, which seeks to include waste minimization initiatives into the scope of the operational solid waste management (SWM) system and recover compostable wastes from landfills [9].

The waste management project addressed in the report related exclusively to the treatment of commercial organic wastes and excluded the treatment of organic domestic wastes. As in several other less developed regions, a large proportion of solid waste in this region consists of biodegradable constituents. However, the last few years have witnessed a marked rise in the generation of plastic and electronic waste. In order to assess the Municipal Solid Waste Management (MSWM) practices of various communities, an environmental audit was carried out collecting all relevant secondary data from government and other agencies, engaging the stakeholders in interviews and field surveys [10].

In field surveys, observations were made in various locations in order to investigate existing procedures and pinpoint the necessary advancements.

The analysis found that only 35%of the bins are fitted with lids, while there are community bins in only 24% of the areas, and in case of residential areas, 90% have a door to door collection system for waste. The informal recycling sector is vital as its components such as rag pickers have been shown to be effective in recovering recyclables from every aspect of waste handling, including disposal in dump sites [11].

IV. TOOLS USED

This project utilises various technologies and tools. We are using HTML, CSS and JavaScript But our main motive is to create applications for our system because the use of applications is easier than the use of websites for many of us. So we created a simple website as well as an application for this project. Some software used in project were:

1) Figma: For Creating User friendly Application's User interface.
2) Android Studio: For coding and hence developing the front and back end of our application by using flutter.
3) Firebase: saving our data entered by user and food details like food quantity, food typeetc.
4) Grammarly: online writing assistant tool used to improve the quality of writing.
5) Google Drive: cloud storage and collaboration tool used to store and share the report with our team members.
6) SurveyMonkey: online survey tool used to gather data for the data analysis and for report also.

Each of these tools and technologies played an important role in the successful completion of this project.

A. HTML

HTML (Hypertext Markup Language) is the commonly accepted language used for designing and building web pages. It consists of a series of elements (tags) that define the structure and content of a web page. HTML tags are used to describe the content that appears on a web page, such as headings, paragraphs, images, links, and more. When a web browser renders an HTML page, it uses the tags to determine how the content should be displayed on the screen. HTML is often used in conjunction with other web development technologies such as CSS (Cascading Style Sheets) and JavaScript to create more dynamic and interactive web pages.

B. CSS

CSS stands for Cascading Style Sheets. It is a stylesheet language used to describe the presentation of HTML or XML documents on the web, including colours, layout, fonts, and other visual elements. CSS provides web developers with the ability to separate document content from document presentation, allowing for more efficient design and easier maintenance of websites. It is an essential part of web development and is widely used in creating responsive and visually appealing web pages.

C. Javascript

JavaScript was quite crucial in the building of Ecofeast and guarantees its interactive, working, and user-friendly nature. It makes it possible to establish dynamic user interface and provides such functionalities as real-time from validation, responsive design, and live update for food listings. Using javascript, the app could initiate real-time notification regarding food availability and integrate location service like mapping and navigation provided by APIs such as Google Maps.

D. Figma

Figma is an integral part of the design process of ECOFEAST by providing a collaborative space for intuitive and user-friendly interfaces. Its prototyping capabilities allow the design team to visualise how the app layout would work, describe user workflows, and outline how features such as food listing, notifications, and location tracking will function. Figma's interactive prototyping capabilities make it possible to simulate user interactions, enabling the app's design to be tested and iterated over quickly.

E. Android Studio

Android studio, combined with Flutter and Dart, plays a central role in developing the ECOFEAST app by providing a good and efficient environment for building and deploying applications. It allows the creation of a single codebase in Dart that works seamlessly across Android and ios, and it is cost-effective, cross platform solution. Android studio supports an interactive, responsive to Ecofeast's requirements, with Flutter's framework of widgets.

It has features such as hot reload, which accelerates development by making updates in real-time without restarting the application.

Additionally, Android studio has its built-in emulators and debugging tools that ensure testing of the app for performance and reliability across various devices.

F. Firebase

It is Firebase's Realtime Database or Firestore, which allows the application to store and synchronise food-related data, such as food listings, user profiles, and transaction histories in real-time so that users receive updates in real time. Firebase Authentication facilitates easy and secure signing-in of users ,basic features that can be used, such as volunteering or making profiles for donors, using social logins. Firebase's cloud messaging gives auto-updates for new food listings, updates, or requests to collect food.

V. METHODOLOGY

The methodology for developing ECOFEAST follows a structured approach to ensure a user-centric and effective solution. It begins with problem definition, where the issue of food wastage and hunger is thoroughly analysed. This is followed by analysis, conducted using tools like SurveyMonkey and offline surveys to gather insights from potential users, including their expectations and challenges. Next, the design phase is carried out using Figma to create a user-friendly interface, mapping workflows and features for an intuitive experience. The coding phase uses Android Studio, Flutter, and Dart to develop the application, focusing on cross-platform compatibility and core functionalities like food listing, notifications, and location tracking. The app then undergoes testing to identify and fix any bugs, ensuring smooth performance and usability. Finally, as shown in Fig 1., the application is implemented, made available to users through deployment on app stores, and introduced to the target audience for real-world usage.

A. Working of the Project

The food waste management web-based application is composed of four distinct modules - Admin, Donor, NGO, and Logistics (delivery system). Each module has registration and login options. The admin verifies the registration of Donors and NGOs to prevent any fraudulent or fake requests. After verification, both the Donors and NGOs can request for donation and supply, respectively. The admin can view the requests and supplies and facilitate communication between them based on the availability, type, and quantity of food. NGOs can view the history of restaurants and send requests to manage their leftover/excess food. In this proposed system proper implementation of the website is achieved with various features. In Fig 2., this platform facilitates easy connection between Donors and NGOs through information provided by the administrator. It includes a dedicated logistics login

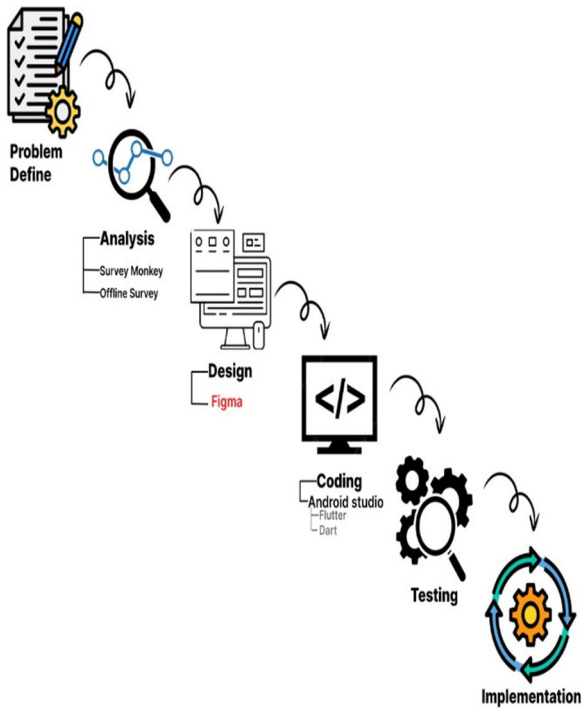

Fig 1. Project Flow Model

For the collection and delivery of food packets from Donors to NGOs. The administrator manages all aspects of the site, including user management, content editing, and settings. The users can access the homepage, about us, innovation, market, and contact us pages. Donors can share details about their leftover food, location, and contact the site administrator as needed.

B. Four Major Modules

The system comprises of four major modules:

1) Admin:

- The application allows users to view requests raised by Donors, NGOs, andLogistics.
- They can either accept or deny the requestsafter verifying the information provided.
- The system can also map Logistics.

2) Donor:

- Register with name, username, password and some personal information.
- Raise the request with details like date, number of packets that can be sent and location.
- Users are able to access and review their submitted requests, and can view the current status of each request to determine if it has been approved or rejected by the administrator.
- Users are able to provide feedback or suggestions regarding the capabilities of the website.
- Track their food whether it is delivered or not

3) NGO:

- Register with name, username, password and some personal information.
- Login with registered Username and password.
- Raise the request with details like date, number of packets needed and location.

VI. METHODOLOGY

1) User-centric design involving:
2) Surveys to understand user needs.
3) Prototyping using Figma.
4) Development and testing with Android Studio and Firebase.
5) Features: Food listing, live tracking, notifications, and user feedback mechanisms.

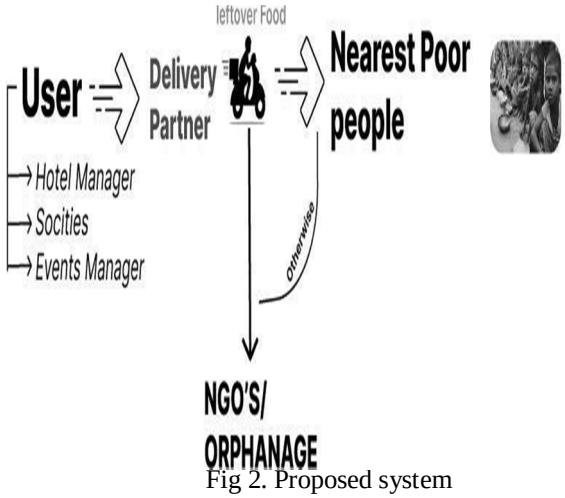

Fig 2. Proposed system

Impacts

- Social Impact: Reduces hunger by effectively linking surplus food to underprivileged communities.
- Environmental Sustainability: Mitigates food waste and associated carbon emissions.

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VII. THE CONCEPTUALFRAMEWORK

A. *Problem Identification*

1) Food Waste and Hunger - A dualchallenge where surplus food coexists with widespread food insecurity.
2) Environmental Impact - Food waste contributes to resource wastage and greenhouse gas emissions, exacerbating climate change.

B. *Objectives*

1) Minimise food wastage by redistributing surplus food.
2) Support communities by addressing food insecurity and fostering sustainability.
3) Reduce the environmental footprint offood waste.

C. *Technological Solutions*

1) Platform Design: Built using Dart, Flutter, and Firebase for cross-platform compatibility and real-time data management. Includes features like geolocation tracking, notifications, and analytics for efficient food collection and delivery.
2) Operational Windows: Modules for Admin, Donors, NGOs, and Logistics ensure streamlined processes. Admin verifies donors and NGOs, while logistics handles delivery of surplus food.

D. *Admin*

The admin account is responsible for controlling the flow of data within the system and has the authority to regulate user access to that data. The primary objective of this account is to ensure the relevance of user data and to provide inputs to other interface modules in order to optimise the system's performance and generate specific timetables.

VIII. RESULTS

In Fig 3., we can see that this is the front page of our application ECOFEAST. Any existing user or any new member who visits our page gets to see this page, and also we can see the sign-up page where a new user can register on our website and then start donating.

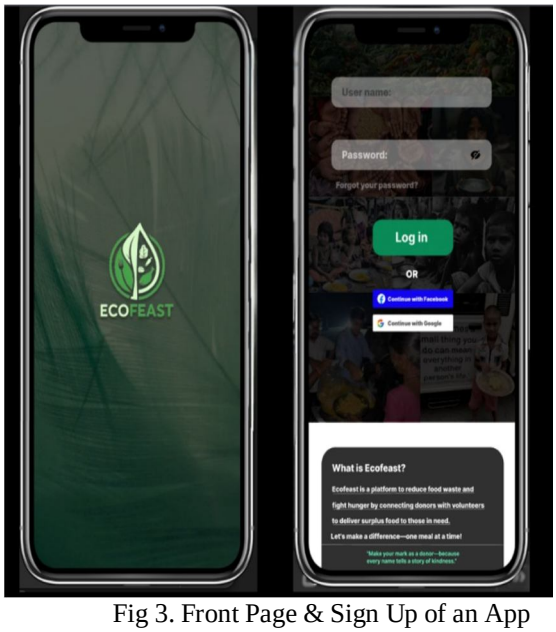

Fig 3. Front Page & Sign Up of an App

In Fig 4., this section shows the option like donor and volunteer if we are volunteers who join our team then just click on this otherwise by default continue with the donor section. The first step is toenter the exact location because location is mandatory for connecting Donors to NGO or Volunteers.

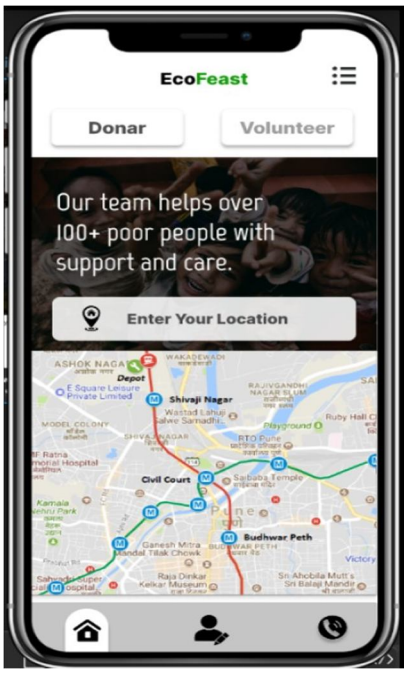

Fig 4. Main Page

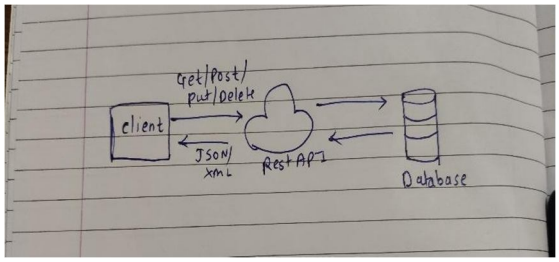

Fig 5. Flow Diagram

In Fig 6., these sections ask for confirmation pickup point and pickup time for confirmation of leftover food with a query box which helps users to give any suggestion or complaints to our team.

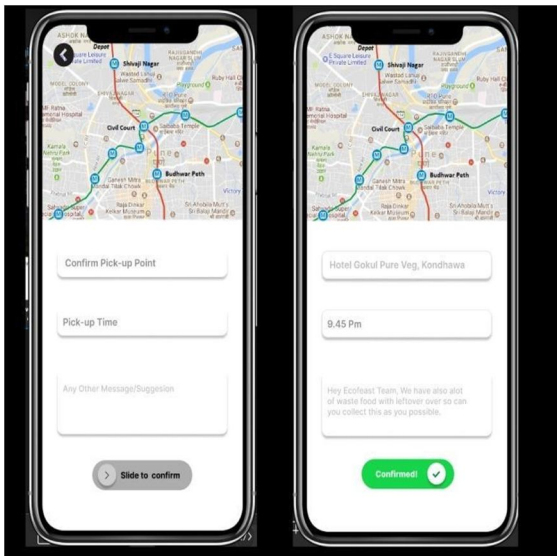

Fig 6. Live Location and User Information.

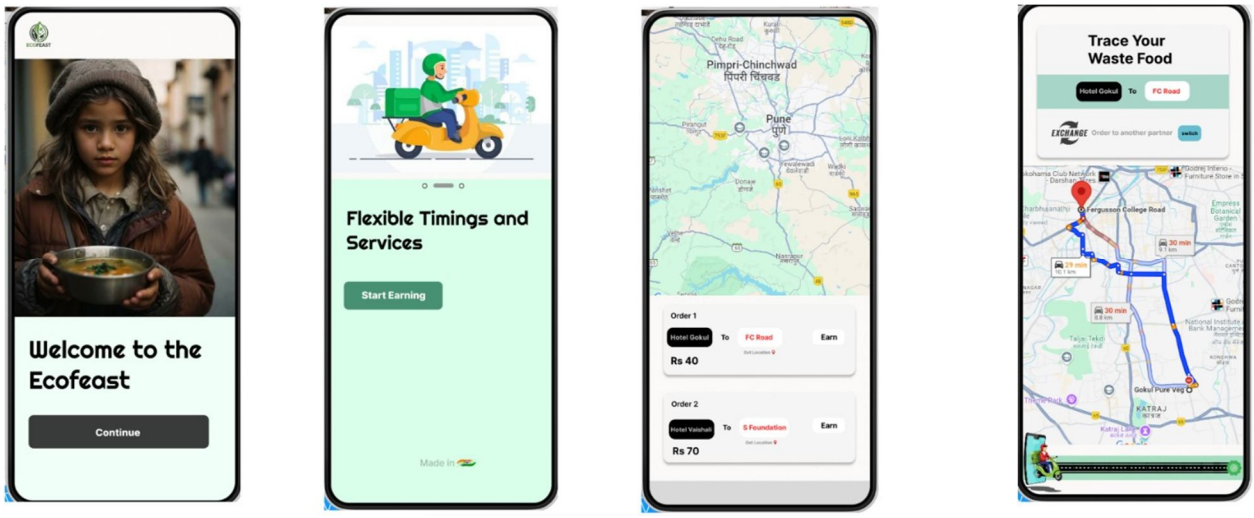

Fig 7. Final Output

IX. CONCLUSIONS

ECOFEAST is a groundbreaking initiative aimed at combating food waste while addressing hunger and poverty. By leveraging modern technology, it connects individuals and organisations with surplus food to those in need, fostering a sense of community and social responsibility. The app not only reduces environmental waste but also promotes a culture of sharing and sustainability. With its user-friendly interface and seamless functionality, Ecofeast has the potential to make a significant impact, ensuring that no meal goes to waste and every individual has access to food. This initiative embodies the power of technology to drive meaningful social change, making the worlda better and more equitable place

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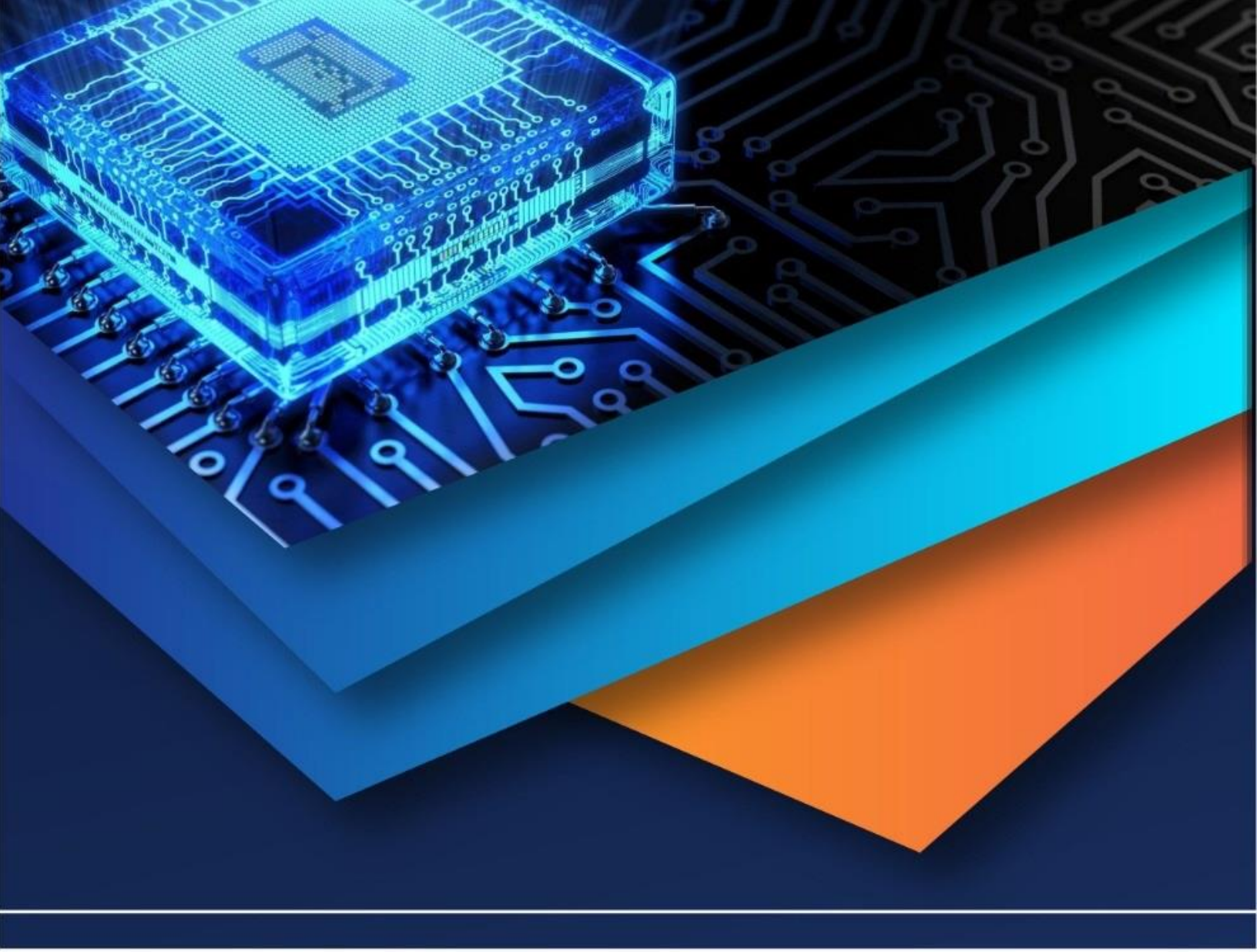

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