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SCRAP DOCTOR : A RECYCLING APPLICATION

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Abstract : The Waste Recycling Application is a user-friendly and interactive platform designed to promote sustainable waste management practices and foster environmental awareness within communities. The app serves as a comprehensive resource that provides users with access to essential information, educational resources, and community engagement opportunities related to responsible waste disposal and recycling initiatives. By integrating features such as location-based services, real-time updates, and educational content, the app empowers users to actively participate in recycling activities, collaborate with local stakeholders, and contribute to a cleaner and more sustainable living environment. With its focus on user education, community engagement, and data-driven insights, the Recycle Android app aims to inspire behavioral change and cultivate a culture of environmental consciousness, ultimately fostering a more sustainable and eco-friendly future for generations to come.

I. INTRODUCTION

1.1 INTRODUCTION

The need for efficient waste management techniques has grown in the present era of increased environmental consciousness and sustainability. With increasing population, the need of resources is increasing proportionally, which directly calls for recycle and reuse. Recycling is not only about reducing the solid waste, but mostly about preserving the resources for future. The creation of a Scrap Doctor is an attempt to address this worldwide issue by offering a practical and easy to-use platform that encourages people to actively engage in recycling programs on an individual and community level. In this paper we have tried to highlight some of the existing solutions to the defined problem and the methodologies used to tackle them, also finding the limitations and gaps of these solutions preventing them to be more sustainable for public use.

1.2 NEED OF THE STUDY.

According to studies, India generates about 62 million tons of solid waste per year, from which only 43 million tons (70%) are collected of which about 12 million tons are treated and 31 million tons are dumped in landfill sites. This untreated waste later causes the green gas emission leading to global warming and spread of hazardous diseases. Recycling not only conserves the resources , but also helps the environment in preserving its temperature and lead to better surroundings .Increasing global awareness about the detrimental impact of improper waste disposal on the environment has sparked a growing interest in adapting sustainable practices, such as recycling, to minimize the ecological footprint and preserve natural resources .The Recycle Android app aims to address these challenges by encouraging proper waste segregation and disposal .The main reasons behind lack of recycling is inconvenience and lack of access to recycling resources . The app seeks to educate and raise awareness about the benefits of recycling and its positive impact on the environment. The convenience of a mobile application provides users with easy access to information about nearby recycling centers, collection points, and recycling programs, promoting user participation and engage in sustainable waste management practices. By 2025, the waste management market size in India is projected to be worth ~USD 15 billion, with annual growth around 7 percent, encouraging young generation to take interest in this field which can not only be profitable but also do some good to earth's environment.

II. RESEARCH METHODOLOGY

Many communities and urban areas lack sufficient recycling infrastructure, including accessible recycling centers and efficient waste collection systems, leading to increased levels of unmanaged waste and environmental pollution. A lack of awareness and engagement among individuals and communities regarding the importance of recycling and sustainable waste management practices contributes to low participation rates and hinders efforts to reduce waste and promote environmental conservation .The absence of clear guidelines and resources for proper waste disposal and recycling methods often leads to confusion among individuals, resulting in improper waste segregation and disposal practices that can harm the environment and compromise recycling efforts. The lack of coordination between collectors and PCB registered recyclers has contributed to improper disposal of waste. Additionally, the lack of interest in people to recycle and lack of discipline has motivated improper waste disposal practices. In light of the above problems, our project aims to develop an application which will be easy to access, user friendly and which will keep the user interested in recycling by achieving various rewards and earning points. There will be a proper flow and from end user to waste disposer. This application highlights user friendly interface through ser can efficiently use application. It is a basic app that four main tabs i.e. Home tab, Scan tab, Profile tab and Learn tab. Below each tab is discussed briefly.

2.1 THEORETICAL FRAMEWORK
The Unified Theory of Acceptance and Use of Technology (UTAUT) emerged as a result of combining eight frameworks
1. Technology Acceptance Model (TAM);
2. Theory of Planned Behavior (TPB);
3. A combination of TPB and TAM (C-TBPTAM);
4. Theory of Reasoned Action (TRA);
5. Motivational Model (MM);
6. Social Cognitive Theory (SCT);
7. Model of PC Utilization (MPCU);
 8. Diffusion of Innovation (DOI)
Theory Multiple studies have applied the UTAUT to evaluate mobile ICTs acceptance. This model inspected the adoption of fitness app by two constructs that is self-efficacy and personal innovativeness. A survey was conducted in some areas of new jersey where the use of recycling application was taken. Through this survey, it was concluded that the intentions of people using this recycling application, the engagement in the application. Few construct that affect the interaction of the application:

1. Performance Expectancy (PE): PE is the most powerful predictors in behavioral intention. In this context, if users consider the recycling application are useful for to recycle waste, then they would engage in recycling activities, such as if they recycle waste then they would get rewards, learning through the app about how to recycle waste, etc.
2. Effort Expectancy (EE): Effort Expectancy y(EE) determines the intention of using the technology. In this context, if the recycling application is easy to use, means the user is more likely to use the technology. In a survey it was observed that females are most likely to use technology than males.
3. Facilitating Conditions (FC): FC determines the intention to use technology. In this Context, we say that if user have required resources like device, compatible operating system, they would be willing to use recycling applications.
4. Social Influence (SI): SI implies that it is one of the predictors of behavioral intentions. It is people importance to use the recycling app is considered important to see user behavioral intentions for using it. For example, if the user is conscious about current environmental issues, then user would be engaged in the recycling activities to keep environmental clean.
5. Hedonic Motivation (HM): HM predicts the behavior intention of using the technology. If the app involves the pleasure due to its gamification feature which implies that the user is engaged in use in of technology.
6. Habit (HA): One should mind the two crucial distinctions between habit and technology experience.
• Technology experience is a mandatory, but not the only precondition, of forming a habit;
• Technology experience implies a span of chronological time (i.e., how long a user has been engaging with the technology); the greater the experience, the stronger the habit. Habit affect the intention of using technology. In this context, if the user are using the application automatically then the user is most likely have higher behavior intention
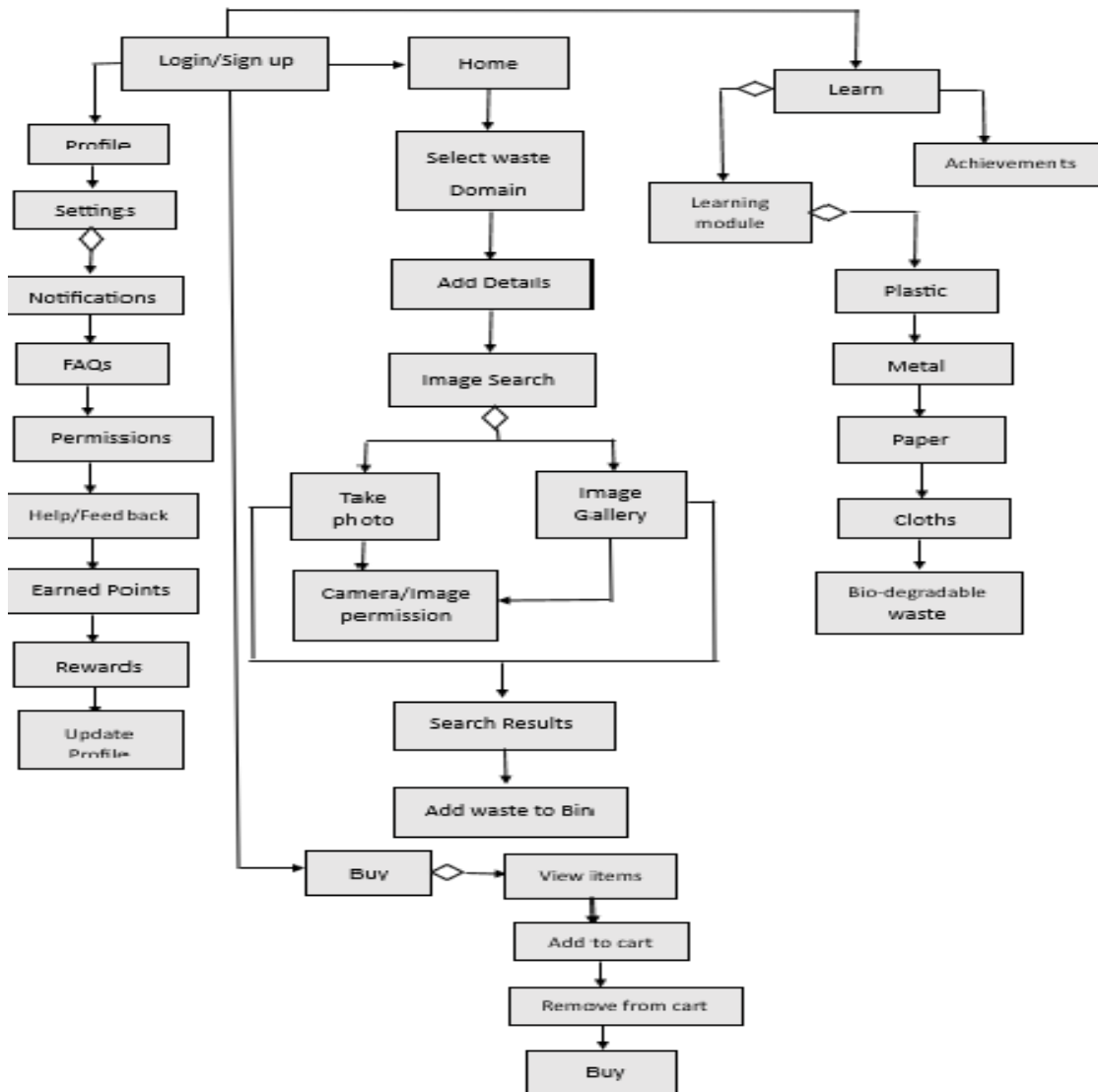
2.2 Flowchart of proposed system :

Fig.2: Workflow Diagram of the application

1. Login/ Sign Up Page: With help UI/UX user intentions can be identified, if the user is more attracted to the application then the user will sign up for the application. If the user is already a user of application then the user will login to the application. After login/ signup user can access further tab and explore the application.

2. Home Tab: Home tab is the main page of the application. In this tab user will get access to domains that are included that is plastic, cloths, paper, metal and biodegradable waste. User can choose any of the following domain that they wish to recycle. This tab will also include any events happening related to recycling or cleanness drive in user's nearby location.

3. Scan Tab:
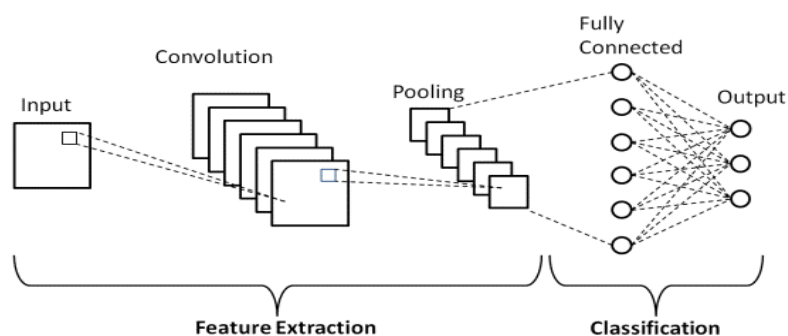
After choosing the domain user can scan the recyclable waste to upload the image to the application server to check the nearest PCB Registered recyclers and upload the image to the application. While scanning the image, if the user cannot identify the type of

waste then the CNN algorithm is used to identify the type of waste to help the user to identify it. Following image indicates the working of CNN algorithm.

4. Profile Tab: Profile Tab gives the information about the user. It includes personal information, setting, FAQs, help/feedback, permission, earned points and rewards.

5. Learn Tab: Learn tab gives the user information about how to recycle each type of waste. It also tells how to reuse the waste and make it reusable. If the bio-degradable waste is belongs to food category then an additional functionality is provided in learn tab , where some recipes will be provided to use leftover food to decrease the amount of biodegradable waste generated and also users can post their own recipes.

III.   LITERATURE SURVEY

[1] "Encouraging Children to Actively Recycle: A mobile application to promote recycling in the Dominican Republic", this research paper has specifically focused on children from age 7 to 13 as the end users considering they learn faster than adults. This paper has highlighted some of habitual and psychological factors which hinders the recycling practices such as lack of interest, low prioritization of the activity, etc. This paper explores behavioral design methods and use of gamification and augmented reality to engage children with application, also providing rewards with real-world recycling actions allowing children to transform recycled materials into energy for virtual robots increasing their engagement with the app. The certain factors that lack in this application is limited scope of end-users and higher gamification factors which may restrict parents from allowing their children from using the application.

[2] "Time spent on separating waste is never wasted: Fostering people's recycling behavior through the use of a mobile application", the aim of this paper is to investigate whether a green app improves recycling behavior and investigate what factors influence use of green apps. This research has been done using Experience Sampling Methodology (ESM: data collection method in which participants responds to repeated questions of certain moments in life), by taking opinions of participants through social media apps. This study also gives a through comparison of TPB (Theory of Planned Behavior) and TAM (Technology Acceptance Model) and proving which one fits the best to analyze human behavior after a green app use. This study has also highlighted some of the major factors affecting green app use which are self-efficacy (people believing themselves to be capable of successfully executing a task to achieve a desired outcome), knowledge and behavior, self-efficacy being the most important. This research effectively provides information about various factors which may affect our apps efficiency and reach to wider range of users.

[3] Project Report "Green Blocks" (recycling project), This project is executed at university level by a group of lecturers. The objective of this project is to reduce a number of one-sided copies left at the printing room, - to raise the environmental awareness among the students of the gymnasium, - to promote school as such that encourages recycling by creating min 100 of blocks out of one-sided waste copies. This paper has specifically focused on reduction of amount of waste paper and increase in the chances of its recycle and rising the environmental awareness among the students. As this project was executed on college level it's accuracy and flow were maximum. But, still some of the drawbacks of this projects were, the scope of this project is very limited to number of people and the type of recyclable waste is also restricted to paper only which creates gap between this project.

[4] Investigating Residents' Acceptance of Mobile Apps for Household Recycling: A Case Study of New Jersey, This research focuses on investigating the acceptance of Recycling application in household of New Jersy. The possible growth of population till 2030, will cause tremendous hike in demand of resources such as food, water and raw materials. REI reports that it generated 681000 jobs and $37.8 billion wages in municipal recycling sector. This research provides multiple reviews on the existing Recycling applications and the various ICTs (Information Communication Technology) models used in those applications. The first technology acceptance studied have used the Technology Acceptance Model (TAM) which suggests that good UX design increases the acceptance of technology, but the predictive power of TAM model is only about 40-50%, which paved the way for UTAUT (Unified Theory of Acceptance and Use of Technology) framework which is a result of combining eight frameworks. The various constructs include in UTAUT framework are. Performance Expectancy (PE), Effort Expectancy (EE), Facilitating conditions (FC), Social Influence (SI), Hedonic Motivation (HM) and Habit (HA), each of these constructs is to analyze the system based on individual perspective to analyze the intention of user to use the application.

[5] Assignment Solid Waste management, this paper has given a through research about solid waste, types of solid waste, sources through which solid waste is generate, the waste collection methodologies and their disposal techniques. Solid waste management is the term that refers to the process of collection and treatment of solid waste while giving solution of how to recycle the reusable waste. The solid waste can be categorized as Municipal Solid Waste (MSW), Hazardous Wastes, Agricultural Wastes and Bio-Medical Wastes, in these the highest amount of waste generated is Municipal Solid Waste through household, industries and commercial business-like hotels. The major sources of solid waste are Residential (household waste), Industrial (one of the biggest contributors of solid waste, and produce waste in the form of housekeeping waste, packaging waste, ashes and hazardous chemical waste), commercial (commercial facilities such as hotels, offices, shops, markets and restaurants are another source of solid waste), Institutional (institutional centers like schools, colleges, prisons, military camps also produce solid waste). The disposal of such solid waste is commonly done by the traditional approach of landfill disposal. The recent technique of disposing or reusing the solid waste is of Refuse Derived Fuel (RDF), which is a fuel derived from various solid wastes such as MSW.

[6] "The Green Frontier of Mobile Applications in Improving Recycling Consumers' Behavior,", this application was developed during the COVID-19 pandemic, at a time when users have become more environmentally conscious and aware of plastic pollution. This time period has also seen an increase in the use of mobile applications, which provide social engagement and other benefits. By understanding how to design engaging and user-friendly apps, research can lead to higher adoption rates and sustained engagement with recycling-related mobile applications. Studies quantify the environmental benefits of improved recycling behavior facilitated by mobile apps, aiding in understanding the extent of waste reduction and resource conservation. Some of the research

might have a narrow focus or limited geographical context, making it challenging to generalize findings to broader populations or diverse cultural settings.

[7] Mobile Applications & Waste Management: Recycling, Personal Behavior, Logistics. This research paper provides the study of change of user behavior with the help of recycling application. It focuses on the stakeholders view and users view about this application. The main stakeholders in this application can be authorities, companies and NGO's, etc. Aim of this paper is to examine the unexplored challenges of mobile apps to deliver sustainable waste management emphasizing on recycling and waste prevention performance, especially for emerging developing countries. Furthermore, it presents the opportunities that are involved in using mobile apps in order to improve both the systemic performance of a specific waste management system and the individual behavior of the users. I have also provided the reviews of some existing recycling applications such as D-Waste Atlas, EPA at Warm, NGO's, etc., etc. It also states about the different components affecting the application. such as the importance of Mobile application in today's world which also affects its usage and it's reach to people

[8] Wastepaper: Smarter Waste Recycling for Smart Citizens. The paper provides an introduction to Wastepaper, outlining its purpose, functionality, and its significance in the context of modern waste management challenges. It highlights the need for innovative solutions to address the increasing global waste crisis. This app is developed by analyzing 37 different existing recycling applications available in US, Canada and Australia. This applications is divided into multiple sectors making it easy to use, providing some extra functionalities such as , Waste collection calendar : It indicates which type of waste is collected during each day of the week , Reminders : Possibility to receive reminders with relevant collection information the day before or even during the same day , Recycling Guide : Access to a recycling guide, to support them during the recycling process, providing relevant information in a clear and accessible way . But some disadvantages identified in this research are, it is task centric it is based on giving the users some specific tasks to recycle and sometimes the task is not completed and it gives no specific rewards after task completion.

IV.   RESULTS AND DISCUSSION

4.1 Conclusion

In this research paper we have analyzed some of the existing solutions related to waste management and dived into many problems faced during development and execution of existing applications. Each project was implemented for different problem but the aim was same that is waste management. The growing need of waste management along with population has been explained in this research. Firstly, the research paper highlighted the traditional methodologies implemented previously and how it was affecting the environment, the consequences related to improper disposal of waste, conveying the need of development of new and improved techniques of waste disposal. The lack of coordination between the dealer and end user was also highlighted in the research papers along with limited scope of recycling waste domains. Our research has also included the different technologies used in development of various systems and their performance. How the design and performance of the system affects the user reachability towards the system. Furthermore, we have also observed that the gamification and reward-based application has increased user's motivation and interest to use the application. The various rewards given to the user has increased their participation in recycling activities. In conclusion, our research has identified the potential of technology especially mobile applications in improving the efficiency and reach of the application. Additionally, it has discovered the importance of user interference in elevating the user's interest in application and activities.

4.2 Future Scope

While highlighting the advantages of our study, it is important to specify the limitations and future scope. Such as applications having a collaboration with higher organizations or municipal corporation has not been identified in any research done above, which can have a huge impact on the system utilization. The actions taken to the communal participation has not been declared anywhere in the research paper, along with GPS system through which the user can search its nearest recycling center. These are the components which can be improved in our system and can increase its impact and use reachability

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