Unload Junk: A Mobile Application for Recyclable Waste Scheduled Pickup

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ABSTRACT
Globally, large populations are migrating and settling in urban areas. Urban settling is a notable phenomenon in this decade. Rapid urbanization has brought in several challenges. One significant challenge identified in urban areas is the management of Solid Waste. Solid Waste Management (SWM) involves waste collection, segregation, recycling, and disposal. The municipal and government authorities are putting their best efforts into educating people about segregation and disposing of waste. In addition to the wet, dry, and biomedical waste, it is found that domestic, and commercial outlets and industries in urban areas are generating recyclable waste. These recyclable wastes are termed Scrap Waste. The scrap waste includes metal parts like motors, chains, brass items, and iron, and building construction wastes like bricks and vehicle and office space disposed batteries, etc. that are recyclable and reusable. Scrap waste management needs a specialized way of segregation and disposal to the right people/industry that can recycle and help reuse this waste. Poorly managed scrap poses safety risks and environmental hazards, amplifying the significance of effective scrap management. Sustainable practices and cutting-edge technologies, such as mobile apps and real-time data, contribute to a cleaner environment, economic prospects, and sustainable development. This paper presents a mobile application Unload Junk that is designed to manage the scheduled pick of scrap waste from waste generators. This connects the waste generators to recyclers. This mobile application aims to automate scrap pickup scheduling and coordination in Bangalore. Further, this application helps in scrap management, arising from collection methods, communication barriers, and marketplace constraints.

General Terms
Solid Waste, Recycling, Mobile App.

Keywords
Mobile Application, Recycling, Scheduled pickup, Scrap Waste, Solid Waste Management, Sustainability.

1. INTRODUCTION
Waste generation across the world is massively increasing and the reports indicate that by 2050, worldwide solid waste generation is expected to increase by 70 percent which amounts to 3.4 billion metric tons [1]. With this alarming rise, there is a need for appropriate water collection, segregation treatment, and disposal of waste. Further, several studies point out that only around 20 percent of the waste is recycled each year with the majority of the remaining waste going to landfills. Specifically, it is noted that developing nations are dumping waste in a hazardous way [2]. India is also facing the challenge of managing solid waste. India generates 62 million tons of waste each year about 43 million tons are collected and only 12 million tons are treated and the rest of the 31 million tons go into landfills. An estimate from the Indian urban management and municipal authorities reports that by 2023, solid waste is expected to increase by 165 million tons [3], [4]. Thus, there is an urgent need to handle solid waste and move towards a sustainable environment. An appropriate mechanism assisted by the technology is expected to bring a positive impact on the health, environment, society, and economy at large. Hence, there is a need to manage Solid Waste for a greener and healthier planet. Recyclable waste which is termed scrap waste plays a vital role in minimizing waste generation, maximizing resource recovery, and reducing the environmental impact of waste.

Scrap management involves the collection, sorting, processing, and recycling of different types of scrap materials in various industries. To manage scrap materials efficiently. Today with technology and mobility options there are several ways to handle these urban challenges. The objective of this research work is to provide a digital solution for urbanites to dispose of scrap wastes. The urbanites are termed scrap generators/customers and the individuals who handle this waste are termed scrap collectors and recyclers. Further, the solution is a mobile application that helps connect these recyclable material generators and scrap waste collectors. The collection schedule is at the mutual convenience of the waste generators and recyclers. This paper presents a mobile application "Unload Junk" designed for Android Smartphone users. This mobile app aims to automate the process of scheduling and organizing scrap pickups. The automated scrap management system is designed to promote sustainable development, a cleaner environment, and economic opportunities by implementing sustainable practices and utilizing innovative technologies. The lack of a standardized process for scrap management often leads to inefficiencies, with scrap materials filling up and occupying valuable space. This results in increased storage costs and decreased operational efficiency. Moreover, poor scrap management can pose safety hazards and environmental concerns. Mobile apps can be integrated into scrap management systems to achieve several benefits. Using real-time data, the stakeholders can optimize resource allocation, identify areas for improvement, and make informed decisions.

Coordinating and transferring information between stakeholders, such as scrap generators, collectors, and recyclers, is enhanced by improved communication. Additionally, the mobile apps provide enhanced transparency and accountability, improving tracking and monitoring of scrap materials. By improving recycling efficiency, costs can be saved and environmental impact reduced. As a result, more stakeholders become involved, making the process more sustainable. Unload Junk is a mobile application designed to

revolutionize scrap pick-up scheduling. With this innovative application, the waste generators will save time and simplify the process of selling scrap materials, eliminating the need for physical scrap store visits for price inquiries and sales.

The rest of this paper is organized as follows. Section II gives an overview of related work. Section III provides a detailed discussion of the system design. Section IV is on implementation and results. Finally, Section V concludes the work with future directions.

2. RELATED WORK

Solid Waste Management is a prevalent issue in the urban areas. This problem of managing solid waste tends to grow faster than the rate of urbanization. Several studies identify the correlation of waste generation with the income group. The low-to-middle-income group of the population predominantly generates organic waste, whereas the higher-income population produces mostly paper, metal, and glass waste, etc. However, one of the prominent wastes that supports reuse and recycling is scrap waste. Thus, segregating scrap waste helps manage recyclable waste and saves the environment. This section presents some of the significant contributions in the areas of waste management, the impact of digital evolution and the emergence of mobile applications, discussion on similar applications and ideas implemented worldwide.

Authors Viraja et al. [5] have proposed a novel integrated model for recovering precious metals like gold and silver in e-waste. A detailed review of solid waste data management by the municipal authorities in Turkey is discussed in the research work by Metin et al. [6]. Brazil has initiatives to manage e-waste that is judiciously segregated and sent to recycling units [7]. Worldwide people and governments are putting their best efforts into promoting a sustainable environment and elevating the quality of life. Similar initiatives are taken in India.

The authors Mundada et al. [8] have discussed the sources of e-waste processing and they have provided guidelines for improvement of waste management spanning technological improvements, operational plans, and institutional arrangements. With the digital evolution and developments in technology for building mobile applications, there is the emergence of a new era of governance.

Digital connectivity using various modern devices is creating new opportunities. The modern-day challenge from the SWM can be appropriately designed as a mobile application. The applications are designed to assist in managing the pickup of the waste and help reach the recyclers. Perazuhan; Pera is money and Basura refers to trash/waste, which means earning money by selling waste. Perazuhan is a mobile application framework that is designed to earn money by selling solid waste [9]. This application is presented by the authors Ballaran et al. [10]. This mobile app platform is specifically designed for handling solid waste in the Philippines.

Researchers in China have proposed a quantitative analysis model that examines the implications of municipal solid waste collection on the environment. They have developed an Internet+Recycling mobile application named Aibolv which does this impact analysis [11].

Similarly, in India, mobile applications are developed to manage solid, recyclable waste with technology intervention. A digital platform that includes both the web and the mobile application named Scrap Uncle is launched in the Google Play [12] store platform. This application enables users to dispose of their recyclables called "kabad" responsibly and rewardingly. ScrapUncle offers scrap recycling services through a website

and an app. Customers can book trained and verified agents to collect scrap from their homes or offices. These agents accurately weigh the scrap and provide the best value for it. The services of this app are currently available in most parts of Delhi NCR.

On the same lines, Ahmedabad has launched its first online kabadiwala named Scrapbazar [13] facilitating doorstep pickup of scrap waste, and encouraging recycling of the scrap waste. On the same lines, the Google Play store has a Kabadiwala [14] app that collects industrial scrap, scrap from colleges and universities, scrap from the packaging industry, scrap from construction sites, scrap from society's redevelopment, scrap from IT companies, and scrap from banks and offices.

The literature review outlines the various research contributions and applications developed to manage solid and scrap waste collection, and disposal with several methods, and technologies used worldwide. However, this survey also highlighted that there were no mobile applications that connected the solid waste collectors directly to the recyclers. This work has proposed a mobile application that connects the municipal authorities to recyclers and waste generators specifically for scrap waste recyclers in Bangalore.

3. SYSTEM DESIGN

3.1 Design

The proposed mobile application Unload Junk, is a scheduled scrap waste booking application that aims to simplify the process of booking, and managing scrap pickups.

The proposed mobile application Unload Junk will be referred to as a "mobile app" in the rest of the discussion in this paper.

The design of this mobile app includes user registration, profile management, scheduling the pickup, notification of the pickup time feedback, etc. The details of the design are discussed below:

- *User Registration and One Time Password (OTP) based authentication:* This mobile app will enable users to register with a valid mobile number that is valid for Indian citizens. The authenticity of the user is verified using the OTP-based authentication technique. This adds a layer of protection during account creation.

- *User Profile Management:* After the successful registration, users will have a personal profile dashboard reflecting the completed details of the registered user based on the role. The users have roles like administrators, sub-administrators (the recyclers), and customers (domestic, industry, or any other category of scrap waste generators).

- *Booking Pick-Up Schedule:* Users are provided with the option to book a scrap pick-up schedule based on their preferred date and time. This ensures convenience and flexibility and will also promote sustainable pickup service.
- *Pick-Up Address Information:* Users will be able to provide the appropriate pick-up address, making it easier for scrap collectors to locate and collect the materials.

- *Notification System:* The application features a robust notification system. Users will receive notifications when their booking requests are either accepted or rejected. Additionally, they will be informed about the status of their scheduled pick-ups.

• *Feedback and Ratings:* The mobile app interface provides an option to give feedback and rate their scrap collection experiences. This feature promotes transparency and helps improve service quality.

• *Sharing Functionality:* The application includes sharing functionality, allowing users to recommend and share the app with others. This promotes user engagement and expands the app's user base.

3.2 Technologies

This subsection discusses the technology stack used to develop this mobile app.

• *Android Studio:* Android Studio is the official Integrated Development Environment (IDE) for Android app development. It provides a user-friendly interface and a range of tools for designing, coding, and testing Android apps. Unload Junk is developed using Android Studio 2022.3.1 catering to Android-based smartphones and mobile devices [15].

• *Firebase and Real-time Database:* Firebase is a comprehensive platform by Google that offers various services for app development, including user authentication, real-time database, cloud storage, and push notifications. The Firebase Real-time Database is a NoSQL cloud database designed for real-time data synchronization, making it easy to store and retrieve data efficiently. This technology ensures updated real-time data synchronization. This mobile app uses the Firebase Cloud Storage for storing user authentication and managing user data. [16], [17].

4. IMPLEMENTATION AND RESULTS

This subsection presents the discussion of the implementation details of the designed mobile app with screenshots of the various options available in the designed mobile app. The mobile app welcomes the user with a splash screen which is the landing screen for the mobile app that is depicted in Fig 1.

The splash screen is designed to provide a visually appealing start to the user experience, helping to establish the app's identity.
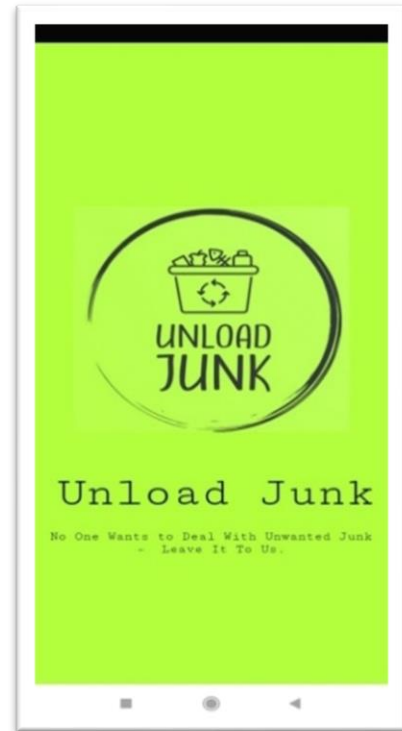

Fig 1: Splash Screen on Unload Junk

Fig 2 (a) shows the "User Selection Page" that provides role-based user authentication. This mobile app facilitates the registration of administrators (called admin in this app), and other users. The user category includes recyclers and customers. Fig 2(b) shows the login page for all the users. Unload Junk requires the admin to register themselves to authenticate and authorize other users.

Figure 3(a) depicts the admin's registration page with a choice of location for the admin shown in Fig 3(b). This option facilitates admins from different locations in a city to register to this system.

Fig 4 shows the Admin Home Page. Authorized administrators can find a comprehensive list of available items along with their corresponding rates. This information is crucial for administrators to make informed decisions regarding the rates, bookings, and other details. Like the admin, the users can register to the system.

Fig 5 represents the user profile page and the various menu options available to the users. This includes sending requests, viewing profile details, booking a schedule for waste pickup, rating their experience, and sharing the details through email, social media apps, etc.

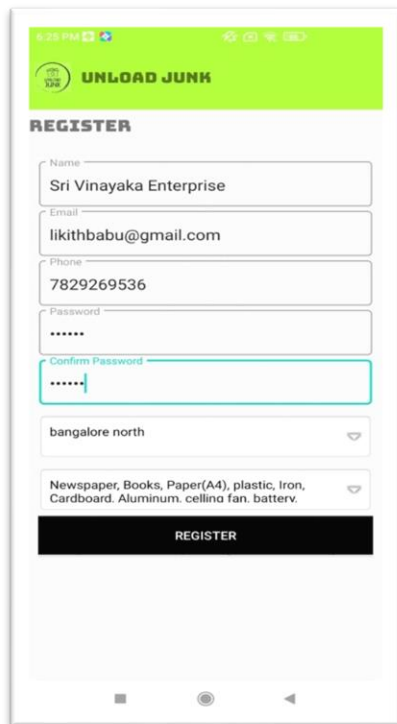**Fig 2a: User Selection Page**

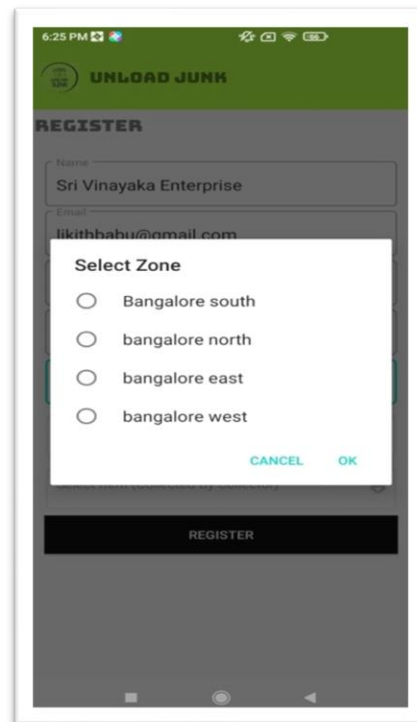**Fig 2b: User Login Page**

Fig 3a: Admin Registration page
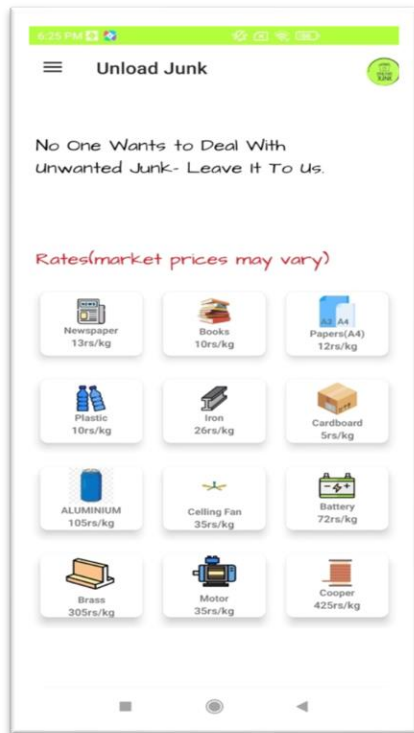

Fig 3b: Zone selection
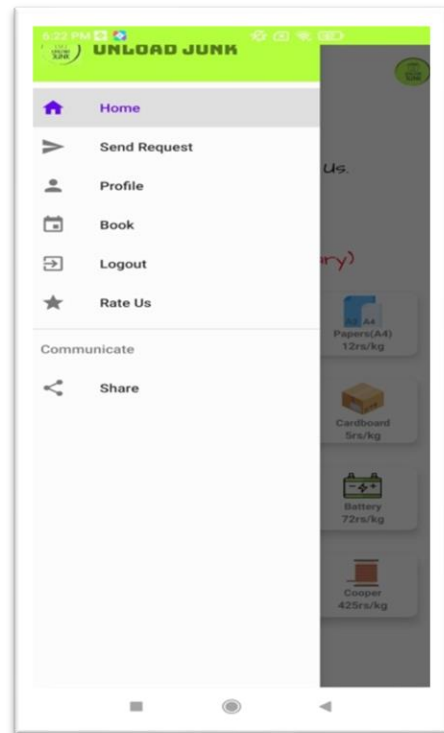
Figure 4. Admin Home Page

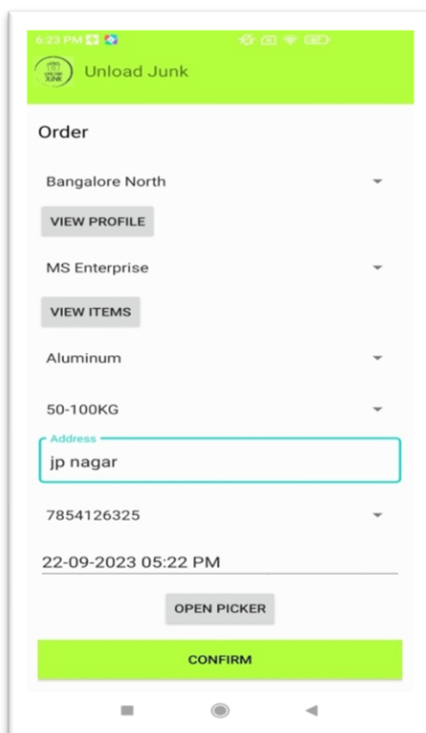**Figure 5. Menu Options in User Profile**

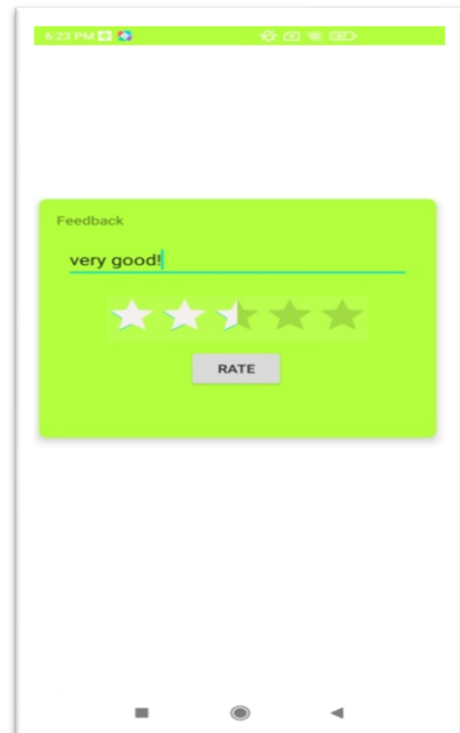**Figure 6. Waste Pick-up Request Page**

Figure 7. User Feedback Page

One of the main features of this app is to manage the scheduled pickup, this option is shown in Fig 6. This waste pick-up request page allows users to schedule a pick-up for their desired date and time, providing the necessary details for a smooth pick-up process. This necessitates the user to fill in a pick-up request form that collects the date and time of pick-up, the address of the user, and the contact details. After filling in the necessary information, the user has to confirm his choice by clicking the Confirm Button. This action imitates the pick-up

request. Finally, the user is prompted to the feedback page with a star rating. This is shown in Fig 7.

5. CONCLUSION

This paper presents a mobile app developed for the scheduled disposal of scrap waste in urban areas. The Unload Junk app serves as an efficient, user-friendly, and reliable platform for scheduled booking of scrap pick-up. Unload Junk brings convenience to scrap recyclers and customers who want to dispose of the waste responsibly. With its user-friendly features, this mobile app aims to eliminate the hassle of manual scrap collection and selling. This scheduled booking application is a significant contribution to waste management and recycling in urban areas. With the convenience of checking rates, making bookings conveniently, and receiving real-time notifications, users can efficiently manage their scrap materials disposal.

Furthermore, Unload Junk is envisioned to provide a positive impact on society, by providing economic opportunities to scrap collectors and supporting the environment. This is a pivotal project covering a few areas in Bangalore, however, this idea can be extended to city-wide coverage with the help of municipal authorities. Additionally, the feedback and rating system ensures transparency and accountability while maintaining high service quality.

Presently the app is designed only for the Android OS. The plan is to extend it to all the mobile operating system platforms, facilitating location-based tracking of the scrap waste collection vehicles, and extending this service to the major cities in Karnataka.

6. REFERENCES

[1] [Available Online]: https://www.unep.org/explore-topics/resource-efficiency/what-we-do/cities/solid-waste-management

[2] [AvailableOnline]:https://www.statista.com/topics/4983/waste-generation-worldwide/#topicOverviewSolid waste management rules, 2016.

[3] [Available Online]: https://www.civilsdaily.com/solid-waste-management-rules-2016.

[4] Bhat, Viraja, Prakash Rao, and Yogesh Patil. "Development of an integrated model to recover precious metals from electronic scrap-A novel strategy for e-waste management." Procedia-Social and Behavioral Sciences 37 (2012): 397-406.

[5] Metin, Erdogdu, Alphan Eröztürk, and Cezmi Neyim. "Solid waste management practices and review of recovery and recycling operations in Turkey." Waste management 23, no. 5 (2003): 425-432.

[6] de Oliveira, Camila Reis, Andréa Moura Bernardes, and Annelise Engel Gerbase. "Collection and recycling of electronic scrap: A worldwide overview and comparison with the Brazilian situation." Waste management 32, no. 8 (2012): 1592-1610.

[7] Mundada, M. N., Sunil Kumar, and A. V. Shekdar. "E-waste: a new challenge for waste management in India." International Journal of Environmental Studies 61, no. 3 (2004): 265-279.

[8] Mavropoulos, Antonis, Maria Tsakona, and Aida Anthouli. "Urban waste management and the mobile challenge." Waste Management & Research 33, no. 4 (2015): 381-387.

[9] P. M. Ballaran, C. B. A. Corpuz, L. A. R. Paras, B. S. Fabito and E. R. Rivera, "Perazuhan: A Mobile Application for Solid Waste Micro-Management Framework," 2019 IEEE Student Conference on Research and Development (SCOReD), Bandar Seri Iskandar, Malaysia, 2019, pp. 17-20, doi: 10.1109/SCORED.2019.8896301.

[10] Gu, Fu, Wujie Zhang, Jianfeng Guo, and Philip Hall. "Exploring "Internet+ Recycling": Mass balance and life cycle assessment of a waste management system associated with a mobile application." Science of the total environment 649 (2019): 172-185.

[11] [Available Online]: https://scrapuncle.com/

[12] [Available Online]: https://scrapbazar.in/

[13] [Available Online]: https://www.thekabadiwala.com/

[14] [Available Online]: https://developer.android.com/

[15] [Available Online]: https://firebase.google.com/

[16] [AvailableOnline]:https://firebase.google.com/docs/database