3.0 INTRODUCTION AND OVERVIEW OF TOPIC

- **Introduction**

In recent years, the intersection of waste management, charitable giving, and digital technology has gained significant attention. The concept of a data-driven platform in this context refers to a digital solution that leverages information technology to create an efficient bridge between donors and charities. Key features of such a platform might include advanced matching algorithms (using AI and machine learning to pair donors' available items with charities' specific needs), user profiles (allowing both donors and charities to create detailed profiles outlining their preferences, needs, and capabilities), real-time inventory management (enabling charities to update their needs in real-time and donors to see where their items are most needed), geolocation services (matching donors with nearby charities to reduce transportation costs and environmental impact), impact tracking (providing donors with information about how their donations are used and the impact they've made), data analytics (analyzing donation patterns, charity needs, and user behavior to continually improve the platform's efficiency), and integration with logistics services (facilitating the physical transfer of goods from donors to charities), (Smith and Jones, 2023; Tech for good 2024). By efficiently matching donors with charities based on specific needs and preferences, such a platform aims to reduce waste, improve resource utilization, and enhance the effectiveness of charitable organizations. This approach aligns with the principles of the circular economy, promoting the reuse of goods and extending their lifecycle, while also addressing social needs through charitable giving (Ellen MacArthur Foundation, 2023).

- **Project Overview and Objectives of the ReHome platform**

Rehome is a data driven platform which will connect donors of household items to charities which need these items. With data science and machine learning we will improve donor charity matching, optimize the donation collection process, thereby reducing the amount of household waste which ends up in landfills. ReHome is an innovative project that addresses two critical issues

simultaneously: the significant amount of household waste sent to landfills in the UK and the resource needs of charitable organizations. By developing a data-driven platform that connects donors with charities, ReHome aims to divert usable household items from landfills while supporting the vital work of community organizations. The project's selection is justified by the alarming statistics of municipal waste in the UK, with 14 million tons sent to landfill in 2021, and the relatively low household waste recycling rate of 44.6% (Department for Environment, Food & Rural Affairs, 2022). ReHome leverages advanced technologies such matching algorithms and geolocation services to efficiently pair donors' available items with charities' specific needs. This approach not only reduces waste and promotes reuse, aligning with circular economy principles, but also enhances the effectiveness of charitable organizations in

3.1 SCOPE OF STUDY

Research in this area has explored various aspects. Studies have examined how digital technologies can improve waste collection efficiency, promote recycling, and reduce overall waste generation. For instance, the use of smart bins and other internet devices has shown promise in optimizing waste collection routes and improving recycling rates (Garcia et al., 2022). Research has also investigated the effectiveness of existing donation platforms and their limitations, with some studies exploring how AI-powered matching systems could significantly improve the donation process (Miller, 2020). Additionally, the importance of user-friendly interfaces and transparent processes in encouraging continued use of donation platforms has been emphasized (Taylor, 2019). Research has looked into how data analytics can provide insights into waste generation patterns and help in better resource allocation for charities (Kim and Lee, 2021). However, studies have also highlighted potential obstacles in implementing digital solutions, such as privacy concerns, digital literacy issues, and the need for infrastructure development (William et al., 2020).

3.2 LITERATURE REVIEW

Collection and donation of household items can be complex hence, leveraging on technology and digital access to encourage charitable giving should be encouraged. Donor platforms makes it more convenient for individuals and organizations to dispose their items which is a challenge for many because disposing waste without donating them may seem like the easiest way to rid get of household waste, while donating them may take some time and effort.

The environmental protection agency underscore how donation platforms has helped significantly reduce the amount of waste that ends up in landfills (EPA, 2019). Donation platforms contribute to a waste free economy, minimizing the impact waste has on the environment (Singh et al. (2018), items are redirected and repurposed instead of disposing them off and ending up in landfills.

A research by (Wilson., 2018), identified that there is a 30% decrease in landfill waste in communities that utilizes donor platforms as compared to communities that do not, this further affirms that effective use of donor platforms helps contributes significantly in reducing landfill waste. For example, (ReUse network., 2020), effectively redirected over 5000 tons of waate away from landfills. This literature review focuses on creating awareness to reduce the high disposal of reusable household items that end up in landfills, understanding how data-driven solutions can bridge the gap between donors of household items and charities, thereby reducing waste and enhancing resource.

1. ***Creating Awareness to Reduce the High Disposal of Reusable Household Items that End up in Landfills.***

Increasing environmental concerns have heightened the awareness and the need to reduce waste and promote sustainable practices. According to the European Environment Agency, digital technologies are increasingly seen as tools to deliver more efficient waste management (European Environment Agency,2021). The most significant approach in managing household waste is to achieve a substantial decrease in waste generation while modifying consumption patterns (Damghani et al., 2008). Unfortunately, reusable items are still thrown in landfills, for example, a third of UK adults may throw away a furniture that may be used. Partly, this is because there is Limited awareness on donor

platforms, donors are under informed of the existence of online donor platforms that connects them to charity organizations (Martinez & Smith., 2010).

2. Connecting Household Donors to Charity.

Many non-profit organizations struggle to acquire the resources they need, and digital platforms offer potential solutions to connect these charities more efficiently with willing donors. (Doe and Roe, 2019). The relationship between donors and charity can be examined from several theoretical frameworks. The social exchange theory asserts that in charity, exchange of resources is a fundamental characteristic in human interaction, whether in cash or in kind. Often times prospective donors are unclear and confused on making a decision on settling with a particular charity (Andreoni et al., 2017). Researchers have wondered what motivates a donor and what contributes to the decision making process in the minds of a donor (Bénabou & Tirole., 2006; Piff et al., 2010).

3. Building a Platform for Household Donations.

Advancement in digital technology such as sophisticated data analytics, artificial intelligence, and mobile applications, have created new opportunities for innovative solutions in waste management and charitable giving. (Smith and Jones, 2020; Chen L, 2021). Donor platforms are necessary in bringing donors and recipients together while exploiting technology and enhancing giving. Studies highlight the importance of responsive design, security features, and integration with social media to enhance user engagement (Bennett, 2018). Block chain technology has been investigated within charity platforms to ensure transparency and traceability of donations, addressing issues of trust and fraud (Zheng et al., 2020).

3.2.1 Project Risk Considerations

While the potential benefits of a data-driven donation platform are significant, several challenges must be addressed to ensure successful implementation. Privacy concerns and data security are

paramount, as the platform will handle sensitive information about donors and charities. Ensuring robust data protection measures and transparent privacy policies will be essential to building trust with users.

1. **Ethical Considerations.**

Ethical concerns may arise, particularly concerning how donations are allocated. Donors may call for accountability from charity organizations and demand clarity on how their contributions or donations are used or distributed. It is therefore appropriate for charities to receive donations based on their actual level of needs to fully utilize donations and not for other unintended factors or purposes. Charities should be engaged and worked with on ensuring items that are not received in good conditions are properly disposed in other not to contribute to environmental degradation, whiles donors will be engaged on acknowledging the platform is not a means to donate unwanted damaged goods to charities. The platform will address these concerns through comprehensive engagement, reporting and audits (Eikenberry, 2009).

2. **Security Considerations.**

Security concerns will focus on protecting donors' and charities personal details ensuring that laws and regulations relating to charity operations and donors' data protection are strictly adhered to. Donors and charities should duly be informed on the purpose for which their information is taken and who can access their information while ensuring only necessary information is being requested. Measures to ensure personal information are protected should be prioritized and robust security measures must be implemented to protect data from breaches and access control. Complying with the General Data Protection regulation is necessary for maintaining trust (Cheng, 2014).

3. **Social Considerations.**

Social concerns focuses on potential donors having clear access to charity platforms regardless of their technological proficiency, socio-economic status or their digital illiteracy. The platform

is designed to be easily accessible to everyone irrespective of their religion, race or disabilities. There should not be any digital divide as no individual should be disadvantaged while using online platforms as it can be a challenge. The platform should be audited regularly to ensure there is fairness, accountability and no bias or discrimination during the matching process, ensuring that all stakeholders adhere to the ethical standards of engaging with individuals from different divides and diverse backgrounds.

4.0 PROTOTYPE DESIGN

The prototype design for the Charity-Donor Connection Platform aims to create a seamless and engaging experience for users, including both donors and charity representatives. This section outlines the design process and key components developed using Figma, a collaborative design tool.

4.1 User Interface Overview

The user interface (UI) of the Charity-Donor Connection Platform is designed to be intuitive, responsive, and user-friendly. The main UI components include:

- ***Sign Up and Login Pages***
    - **Registration Form**: Fields for name, email, and password, with validation messages.
    - **Login Form**: Fields for email and password, with error handling for incorrect credentials.
- ***Set Preference Page***
    - **Preference Buttons**: Display list of preference for donor to select.
- ***Home Page***
    - **Welcome Message**: Brief introduction to the platform and call to action button to donate now.

    - **Charity List**: Displays list of nearby charity names, categories, and brief descriptions.
    - **Navigation Menu**: Links to Home, Profile, Search Charities, Donate Now, Donation History.
- ***Charity Search Page***
    - **Search Bar**: Allows users to search for charities by name or category.
    - **Charity List**: Displays search results with charity names, categories, and brief descriptions.
- ***Recommendations Page***
    - **Personalized List**: Displays a list of recommended charities based on user location and preferences, past donations.
    - **Interaction Options**: Buttons for viewing charity details and making donations.
- ***Charity Detail Page***
    - **Charity Information**: Detailed view including mission, then proceed to charity registration information, causes, address, contact phone number and email address.
    - **Interaction Options**: Map for locating the charity address and making donations.

4.2 User Journey Maps

User journey maps were created to understand and optimize the flow of interactions for different types of users. These maps highlight the key steps users take to achieve their goals on the platform.

- ***Donor Journey***
    1. **Registration**: Donor signs up on the platform.
    2. **Login**: Donor logs in to their account.
    3. **Search for Charities**: Donor uses the search bar to find charities of interest.
    4. **View Charity Details**: Donor selects a charity to view detailed information.

5. **Make a Donation**: Donor enters donation item and completes the donation form.
6. **Receive Recommendations**: Donor receives personalized charity recommendations based on user location and preferences.

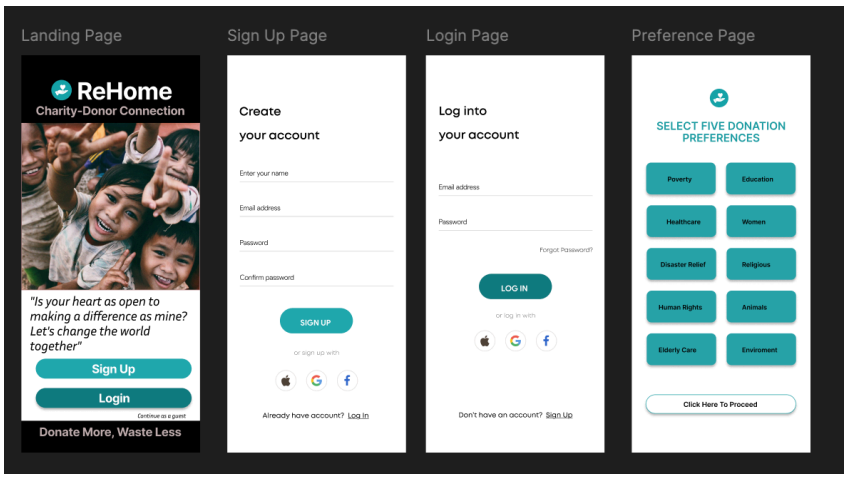
- ***Charity Representative Journey***
  1. **Registration**: Charity representative signs up on the platform.
  2. **Login**: Representative logs in to their account.
  3. **Create and Update Charity Profile**: Representative creates a detailed profile for their charity.

4.3 Wireframes and Mockups

Wireframes and mockups were developed using Figma to visualize the structure and layout of the platform's user interface. Wireframes were created to outline the basic structure of each page without detailed design elements and Mockups were developed to add visual design elements to the wireframes, providing a more detailed representation of the platform.

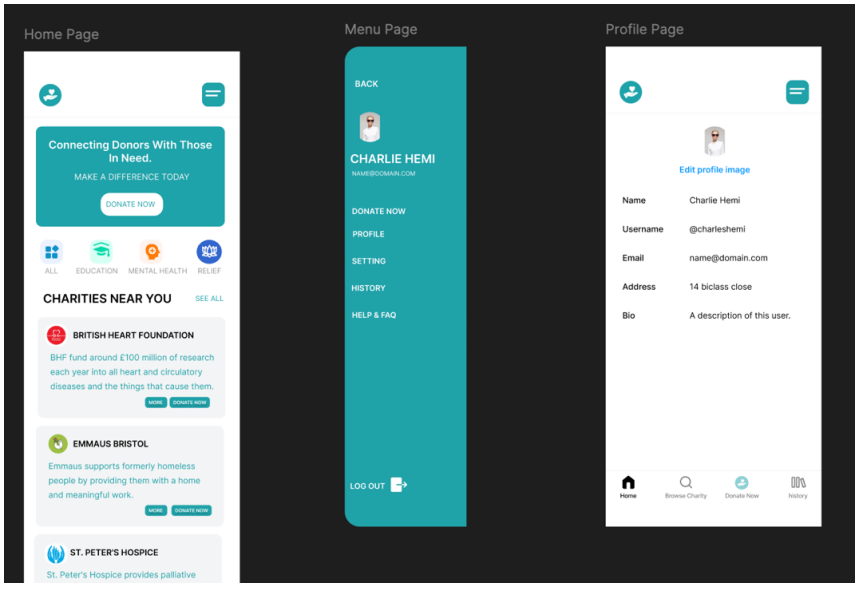
- ***Sign Up & Login Pages:***
  - Wireframe: Form layout with fields for name, email, and password.
  - Mockup: Styled form fields with validation messages and branded submit button.

Figma Designs:



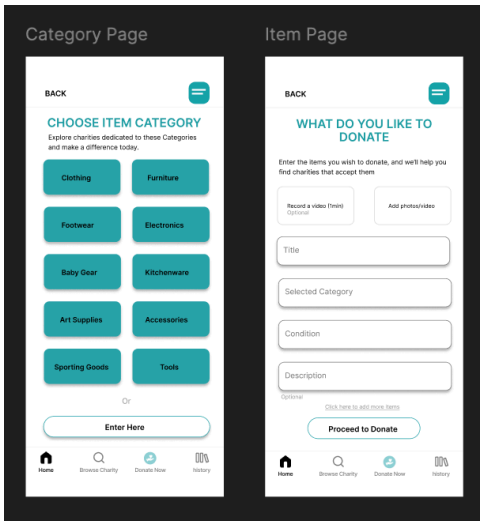
- ***Home Page***
  - Wireframe: Basic layout with navigation menu, welcome message, and links to other sections.
  - Mockup: Includes branding elements, color scheme, and styled navigation menu.

Figma Designs:



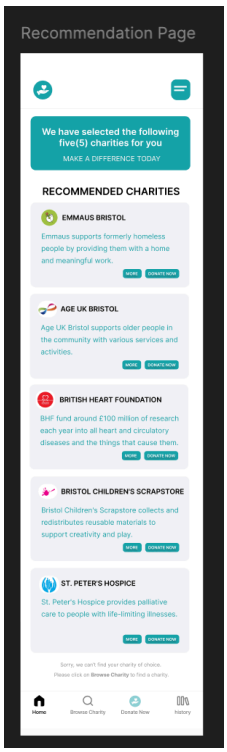
- **Item Details Pages**
  - Wireframe: Basic layout with navigation menu, welcome message, and links to other sections.
  - Mockup: Form fields styled with clear labels and placeholders for item donation details and a Submit button.

Figma Designs:



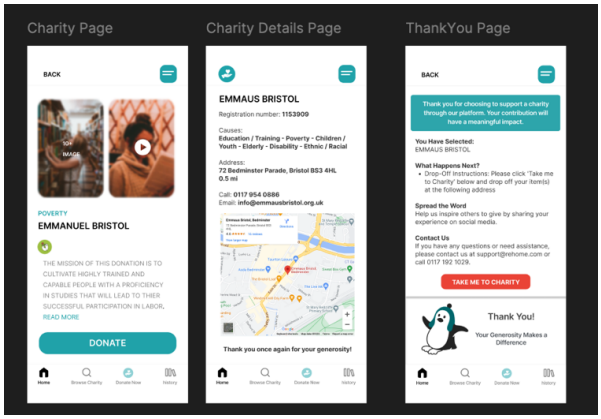
- **Recommendations Page**
  - Wireframe: Layout for displaying a list of recommended charities.
  - Mockup: Personalized recommendations displayed with charity logos and action buttons.

Figma Designs:



- **Charity Detail & Thank you Pages**
  - Wireframe: Detailed layout with sections for charity information and donation drop-off instructions.
  - Mockup: Detailed view with styled sections for charity information and location map interaction.

Figma Designs:



6.0 RECOMMENDATION SYSTEM. (ALGORITHM REPORT)

Introduction

Our recommendation system is designed to suggest charities to vendors based on geographic proximity and donor preferences. The algorithm effectively clusters charities by distance and aligns them with donor interests, ensuring recommendations are both relevant and conveniently located.

6.1 Charity Recommendation Algorithm

1. **Geographic Clustering:**

The algorithm utilizes the Haversine formula to calculate the distance between the donor and various charities. This allows us to cluster charities based on their proximity to the donor.

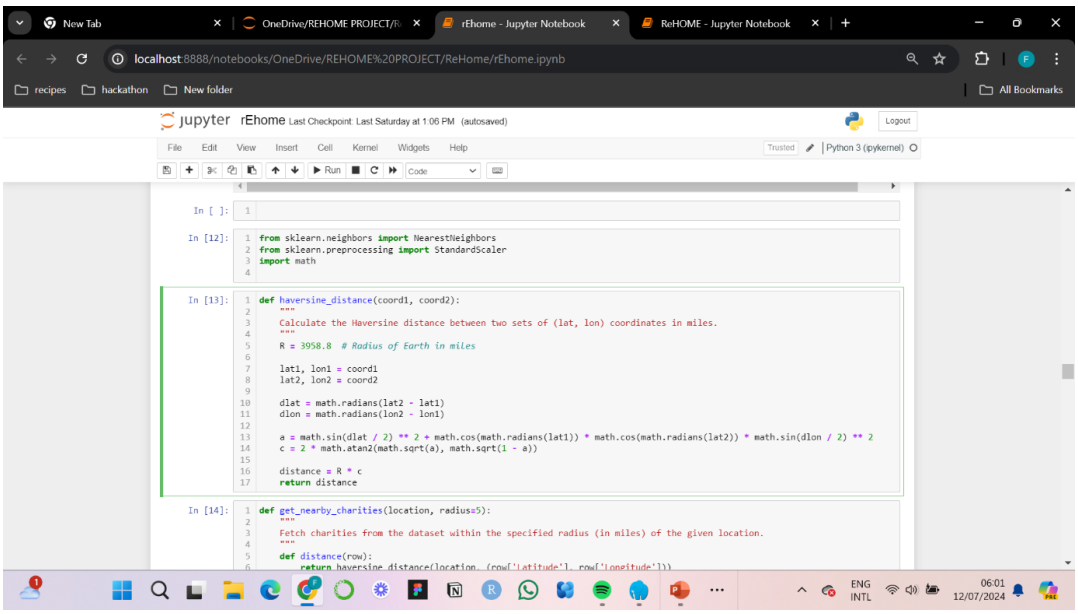
2. **Preference Matching**:

We implement a matching process that aligns charity causes with the donor's donation preferences. By prioritizing the most important preferences, the system ensures highly relevant recommendations.

Detailed Algorithm Steps

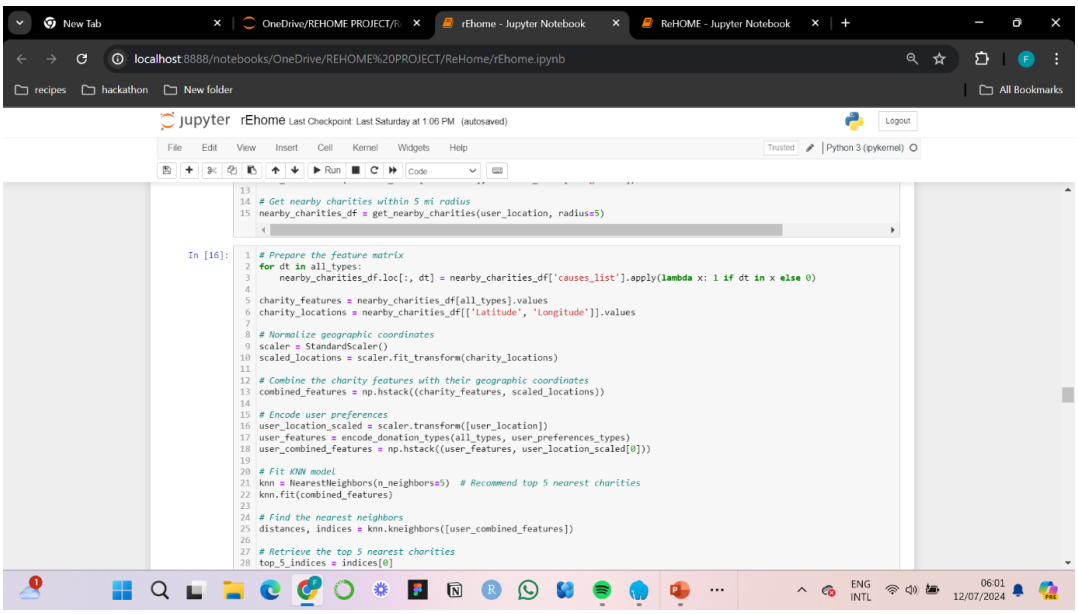
1. **Distance Calculation:**

Haversine Distance: This formula computes the shortest distance over the earth's surface, giving an accurate measure of proximity between two geographical points (donor and charity locations).

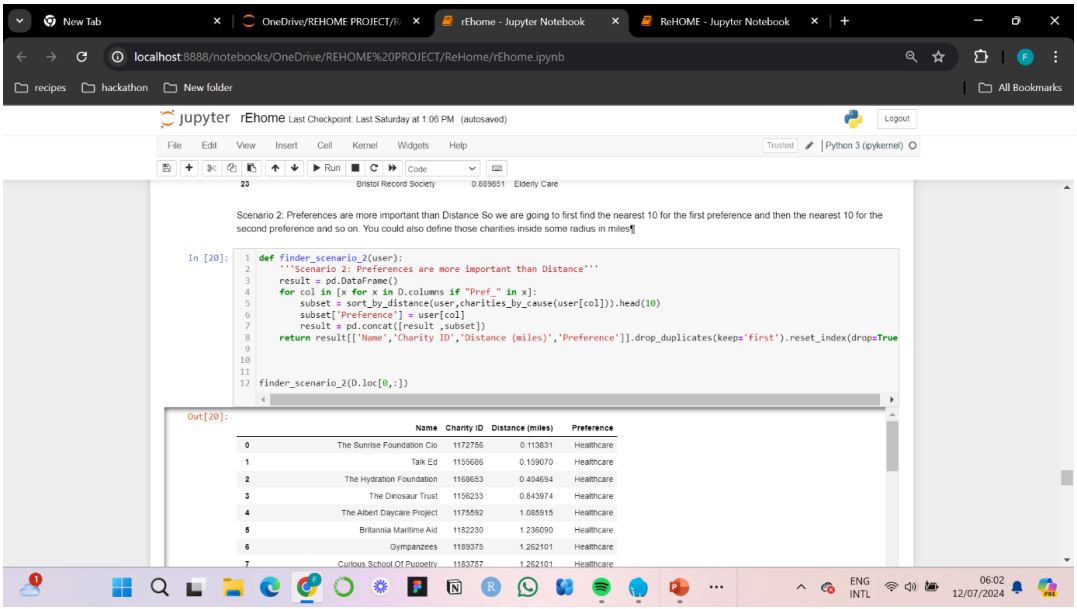


2. **Clustering and Ranking:**

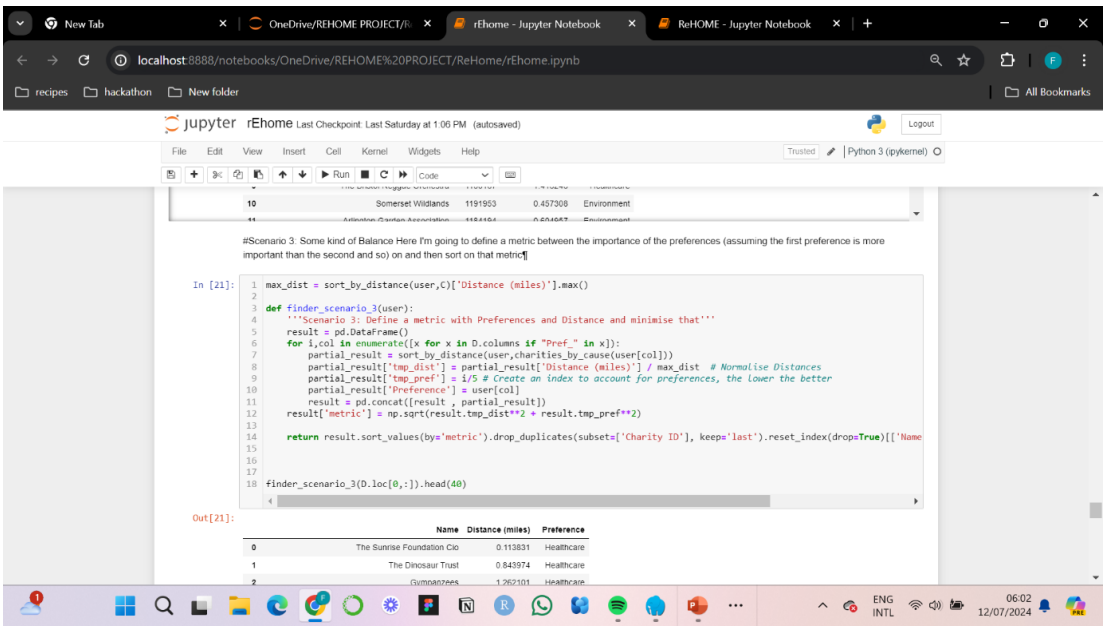
K-Nearest Neighbors (K-NN): This algorithm is employed to identify the nearest charities to the donor. By focusing on the closest charities, we enhance the relevance and convenience of our recommendations.



3. **Preference-Based Selection:**

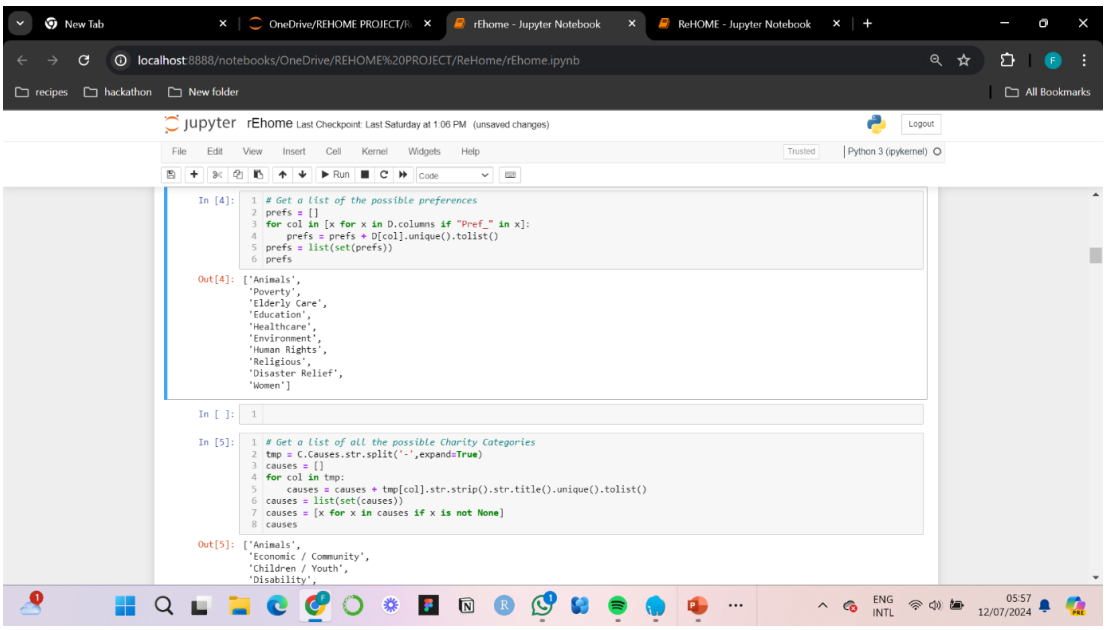


Python Functions: Custom functions are developed to filter and select charities that match the donor's specified preferences. These functions ensure that the recommended charities not only meet geographic criteria but also align with the donor's interests.



6.2 Feature Selection

User Preferences: The system captures and utilizes donor preferences, which are mapped against charity causes. This ensures that the recommendations are tailored to the individual donor's interests.



Geographic Distance: By clustering charities based on their physical proximity to the donor, we ensure that the recommendations are not only relevant but also practical in terms of accessibility.

6.3 Models Used

1. Haversine Distance Calculation: For precise geographic clustering.

2. K-Nearest Neighbors (K-NN): To identify and rank the nearest charities.

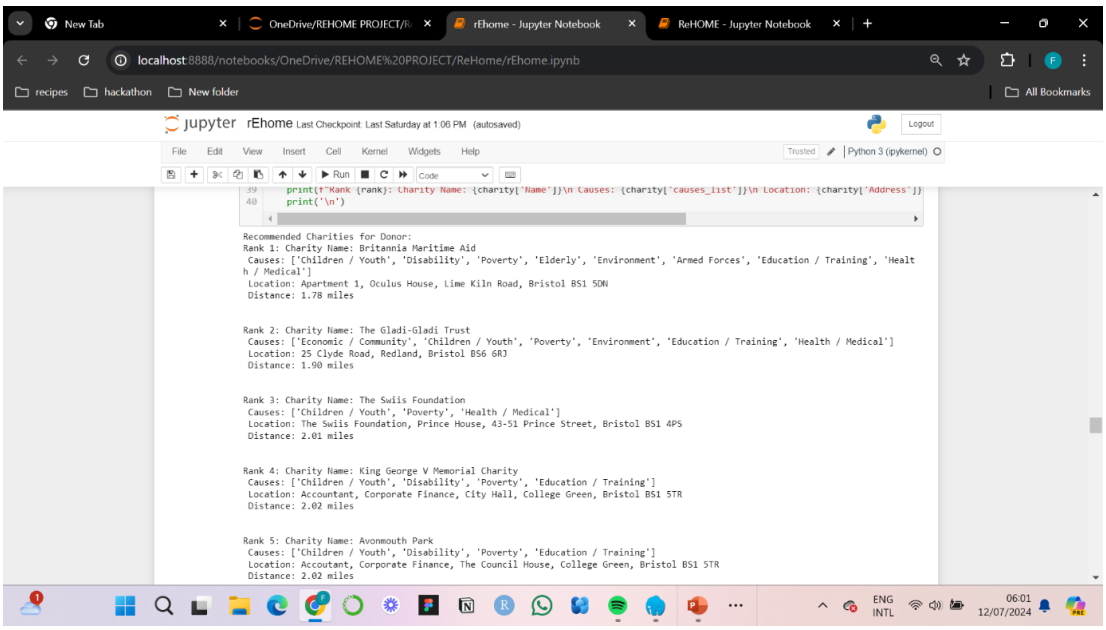
3. Custom Python Functions: For matching charity causes with donor preferences.

6.4 The recommendation system outputs a list of charities that:

1. Are geographically close to the donor.

2. Align closely with the donor's top preferences.

3. Are ranked by relevance and proximity, providing a prioritized list of suggestions.



7.0 PROJECT DICUSSION AND CONCLUSION

7.1 PROJECT DISCUSSION

The literature review highlights several key insights and considerations that have influenced the development of the ReHome platform. By examining similar applications, supporting technologies, and the operational landscape of UK charities, we can better understand the potential impact and challenges of implementing a data-driven donation platform.

7.1.1 Insights from Similar Applications

Applications like Olio, Freecycle, Too Good To Go, and RecycleNow have demonstrated the effectiveness of digital platforms in promoting waste reduction and resource sharing. Olio and Freecycle, for instance, have successfully facilitated the sharing of food and household items within communities, showcasing the potential for digital platforms to reduce waste and foster a culture of reuse. These platforms emphasize the importance of user-friendly interfaces and community engagement, which are critical for encouraging continued use and participation.

Too Good To Go's success in connecting users with surplus food from restaurants and stores highlights the value of real-time inventory management and geolocation services. These features ensure that donations are matched efficiently and reach those in need promptly. Similarly, RecycleNow's provision of accessible recycling information underscores the importance of educational resources in promoting sustainable practices.

7.1.2 Role of Supporting Technologies

The integration of advanced technologies such as machine learning, and geolocation services is pivotal to the functionality of the ReHome platform. Studies have shown that Machine Learning Integrated Recommendation system can significantly enhance the efficiency of donation processes by accurately pairing donors with charities based on specific needs and preferences. The use of the Haversine formula and K-Nearest Neighbors algorithm for geographic clustering and proximity-based ranking ensures that donations are directed to the nearest suitable charities, reducing transportation costs and environmental impact.

Data analytics also play a crucial role in understanding donation patterns and optimizing resource allocation. By analyzing user behavior and charity needs, the platform can continuously improve its matching algorithms and better serve both donors and charities. The insights gained from these technologies align with the principles of the circular economy, promoting the reuse of goods and extending their lifecycle.

7.1.3 Engaging users and giving them an experience

A study by (Taneja and Toombs, 2014) highlights the need for an intuitive navigation to ensure easy user experience and increase donation rates. Incorporating engaging elements such as milestones, leaderboard and badges can remarkably boost user engagement.

Social features like sharing, commenting, and collaborative campaigns also contribute to a sense of community and collective effort (Hamari & Koivisto, 2015), this motivates donors to cooperate effectively knowing they are contributing to a good cause in impacting the environment.

Personalized experiences, such as tailored donation suggestions and recognition of donor contributions, foster a stronger connection between the donor and the cause. Customization options for donation and recurring donations are also beneficial (Kaplan & Haenlein, 2010).

7.1.4 Challenges and Considerations

While the potential benefits of a data-driven donation platform are significant, several challenges must be addressed to ensure successful implementation. Privacy concerns and data security are paramount, as the platform will handle sensitive information about donors and charities. Ensuring robust data protection measures and transparent privacy policies will be essential to building trust with users.

Digital literacy and accessibility are also critical considerations. The platform must be designed to be user-friendly and accessible to individuals with varying levels of digital proficiency. Providing clear instructions, support resources, and an intuitive interface will help mitigate barriers to use.

Infrastructure development is another important factor. The platform's success depends on reliable internet access and technological infrastructure, particularly in rural or underserved areas.

Collaborating with local governments and organizations to enhance digital infrastructure can help address these challenges.

7.2 CONCLUSION

The intersection of waste management, charitable giving, and digital technology presents a promising avenue for addressing significant societal challenges. This literature review has synthesized research on donation platforms, waste reduction strategies, and the difficulties charities face in acquiring necessary resources. The convergence of increasing environmental concerns, advancements in digital technology, the resource needs of non-profit organizations, and the shift towards a circular economy underscores the importance of innovative, data-driven solutions.

Digital technologies, particularly through the development of sophisticated donation platforms, have shown potential in improving waste collection efficiency, promoting recycling, and optimizing the donation process. AI-powered matching systems and user-friendly interfaces are pivotal in enhancing the effectiveness and user engagement of these platforms. However, the implementation of such technologies also brings challenges, including privacy concerns, digital literacy barriers, and infrastructure needs.

Household waste remains a global issue, with significant quantities of reusable and recyclable items being discarded. Statistics from the UK illustrate the scale of this problem and highlight the progress made in reducing waste sent to landfills. Charitable organizations play a crucial role in mitigating this waste by providing essential services to communities, yet they often struggle to acquire resources. A data-driven platform can bridge this gap by efficiently connecting donors with charities, utilizing advanced matching algorithms and geolocation services.
The ReHome project exemplifies how a well-designed platform can enhance resource utilization in the charitable sector while promoting sustainability. The comprehensive methodology, from literature review to prototype development and user testing, has provided valuable insights and