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TOWARDS A GREENER FUTURE: HARNESSING TECHNOLOGY FOR EFFICIENT RECYCLING PROCESSES

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ABSTRACT

This project involves manage/process recycling process online. The request for recycling placed by the users should be fulfilled by the admin. Plastic image is recognized and evaluated using Deep learning. Plastic is evaluated by a Deep learning algorithm based on a dataset of images. Plastic quality and density are evaluated using Artificial Intelligence. The user can do online shopping for recycled products. The order goes through various payment phases till it finally reaches the customer. At any point of time customer, himself can track the delivery of the ordered product. Through this we can categorize and display products of plastic. Recycling ensures sustainable use of resources.

This project is developed to recycle products collected from users. This application retrieves the user's information returning the date, day and time for plastic collection. User's can do online shopping for the recycled products.

In addition to facilitating recycling activities, the system serves as a platform for information retrieval and communication. Users can access their recycling history, including dates, days, and times of plastic collection, promoting awareness and accountability.

Overall, this project represents a significant advancement in recycling initiatives, harnessing the power of technology to promote environmental sustainability. By integrating online functionalities with state-of-the-art AI capabilities, the system offers a comprehensive solution for managing recycling processes, promoting responsible consumption, and fostering a greener future.

Keywords: Online Recycling, Plastic Evaluation, Artificial Intelligence, Greener Future

1. INTRODUCTION

The proposed application aims to facilitate plastic recycling by enabling users to sign up, log in, and submit recycling requests to local hubs. Users capture a picture of the plastic, and the system assesses its quality. The reward details are displayed based on the plastic's condition. Administrators manage recycling hubs, adding and viewing them. Recycling hubs log in to review user requests, inspect plastic quality, fulfill orders, and award users with points. This system streamlines the recycling process, promoting environmental sustainability and fostering collaboration between users and recycling hubs for effective waste management.

In a world grappling with environmental challenges, our application seeks to revolutionize plastic recycling. By seamlessly connecting users with local recycling hubs, we empower individuals to actively participate in waste reduction. The innovative approach of capturing plastic images for quality assessment and providing rewards not only incentivizes recycling but also promotes a sustainable ecosystem. This initiative aspires to create a collective impact, fostering a sense of responsibility and collaboration for a greener, healthier planet.

Landfilling: Landfilling is the most rudimentary technique of PW disposal. Landfills contain a great deal of garbage and have been linked to a number of issues. It is not a sustainable means of disposing of PW illustrates the issues connected with the disposal of PW based on a review of the literature. Disposing of PW in landfills may exacerbate land shortages and hinder the operations of waste management organizations. Additionally, when PW encounters bodies of water, it contaminates them. Hence, dumping PW creates concerns for human health and the environment. Landfills have long been recognized as contaminating the soil. Thus, landfilling PW must be avoided, and other management techniques should be followed as described in the following sections to help protect the environment.

Recycling: Generally, recycling is the procedure through which PW is re-extruded. PW is mostly recycled mechanically, which is one of the most cost-effective methods. The first phase is shredding or cutting, which involves cutting PW using saws or shears into tiny fragments that are simpler to carry. In the contaminant-separation process, paper pieces, dirt, and smaller particles are removed from PW with the help of a cyclone separator. PW with varying densities is separated using a flotation method in order to manage plastic with varying densities. The next step is milling, which collects and mills the individual polymers. Without the pre-processing phases stated prior to milling, the plant’s efficiency is reduced. Following that, the milled PW is cleaned with water. Chemical washing is also useful for some types of material handling (most notably for removing adhesive from PW), where caustic soda and wetting agents are utilized. The materials are then collected and kept or transferred for further processing during the agglutination process. Extrusion of the plastic results in the formation of strands, which are subsequently pelletized to create a single-polymer plastic. The items are quenched by cooling them with room temperature water. Granulated plastic is then offered on the market as grocery bags, blinds, shutters, and other home items.

Environmental Aspects: This study aimed to carry out a scientometric analysis of the different aspects of the literature on PW management up through 2021 and a review of the various management strategies for PW. The study identified six broad categories of PW management, i.e., landfilling, recycling, pyrolysis, liquefaction, road construction and tar manufacture, and concrete production. The impact of each management strategy on various aspects, such as land requirements, carbon emissions, energy requirements, costs, skilled labour requirements, localization, sustainability of the products, and impacts on society, was compared by constructing. After comparing all of the aspects, it was noted that landfilling is the least desirable method due to its negative impact on the environment and human health. On the other hand, the other methods benefit both waste management and the environment. Recycling, the other prominent current strategy of PW handling, was found to have nearly equal benefits and drawbacks. Pyrolysis and liquefaction are favourable since they produce important by-products like char and fuel and the prospect of energy recovery. When plastic-to-fuel methods are used, the reliance on fossil fuels for energy can be significantly decreased.

Liquefication: Hydrothermal liquefaction has a prolonged history of being used to convert biomass, primarily of algal origin, to bio-oil. It entails the transformation of cellular material into valuable liquid fuel. The method has been adapted to absorb PW and is particularly appealing since it allows for the recovery of plastic for reuse alongside liquid gasoline. Typically, PW is liquefied in the presence of a biomass source, a process known as co-liquefaction. In comparison to alternative waste to value technologies, liquefaction of biomass results in a more even distribution of components among the products. Higher carbon content in the products should naturally result in improved fuel performance. It is worth noting that polymers may be liquefied in the absence of biomass although this is a less popular process than co-liquefaction.

2. LITERATURE SURVEY

As part of the Literature Survey, we have referred few project papers and the findings from them are:

Laura Pivoto Ambrósio; Elaine Cristina de Cássia Silva; Guilherme Pedro Aquino; Evandro César Vilas Boas; Recycling as Service: A Mobile Application for Circular Economy; 14-16 November 2022.[1]

This work presents an IoT mobile-based application to allow recycling as a service in developing and emerging countries. It comprises a user-friendly mobile application developed using Java through the Android Studio Integrated Development Environment, with the Database Realtime and Google Maps services.

Md. Atiqul Islam; Md. Abdur Rahman; An-Nazmus Sakib; A Waste Recycling System for a Better Living World; 27-29 September 2020.[2]

In this paper, we have proposed a waste recycling system thinking researchers will implement it in real-time and contribute toward a green and healthy living world. The input of the proposed system will be a mixture of wastes. The system will separate solid wastes like a bottle, wood pieces, brick pieces and other materials which can be reused or used raw material for the Solid Fuel Recover (SRF) system.

Mayukha Thumiki; Aditi Khandelwal; Real-time mobile application for classifying solid waste material into recyclable and non-recyclable using Image Recognition and Convolutional Neural Network; 19-20 February 2022.[3]

The objective of this paper is to monitor glucose level using non invasive technique by optical and IoT technology. The proposed sensor circuit consists of IR LED's of wavelength 650–2500nm for optical blood glucose measurement and NIR photodiodes (InGaAs) to receive the reflected light from body parts to determine the glucose level. The Beer-Lambert law is used for signal processing along with GSM based IoT real time information transmission.

Xiang Zuo-yi; Zhao Feng; Research on Waste Mobile Recycling Network Model and Application in the Context of E-commerce; 07-09 May 2010.[4]

Based on the Theory of Reverse Logistics, the paper designs a recycling logistics network suitable for waste mobile phones, which consists of collecting points, storage sites, disassembly recycling plants and the final disposition sites, then presents a mixed integer programming model and conducts an empirical study based on the actual situation of 14 prefecture-level cities of Guangxi. The paper gives the thought and method to design the recycling logistics network for waste mobile phones. Saman Madanian; S. Mohammadali Zanjani; Amir Baktash; Mahshad Mahmoudian; Ghazanfar Shahgholian; Mohammad-hossein Fayaz-dast; Recycling of Electrical and Electronic-Waste with the Help of Marx Power Pulse Generator; 10-12 November 2022.[5]

In this paper, the removal of the CD-ROM cover with the help of the proposed device of Marx is investigated. The Marx generator is designed and manufactured with an input voltage of 50 volts, an output voltage of about 370 volts, and a pulse power of 24.5 J. The results indicate the possibility of short-term separation of the CD-M coating with the help of the proposed generator.

K. Lalitha, S. Gowtham kumar, N. Karthick, P. Hari Krishnan; E – Plastic Waste Management System; May 2022.[6]

The Utilization of e plastic waste materials is a partial solution to environmental and ecological problems. As the use of E plastic waste will reduces the Aggregate cost and provides a good strength for the structures and roads. It will reduces the landfill cost and it is energy saving.

The E-plastic waste consists of discarded plastic waste; these plastics are nonbiodegradable components of E plastic waste as a partial replacement of the coarse or fine aggregates. Plastic is one such material which poses a big threat to the environment. A huge amount of plastic is produced and dumped into the environment which does not readily degrade naturally In this paper, we address theorganization of the large body ofLiterature published of the management of waste plastics being the most challenging issue of the modern world. This paper presents a systematic literature review on plastic waste, its fate and biodegradation in the environment.

Sai Kishore Tadi, Subhan Saheb Shaik, Sai Kiran Tirukkovalluri, Sandeep Ponnada, Tanveer Basha Shaik; Plastic Waste Management System; June 2023.[7]

Plastic waste is a major environmental problem. Every year, millions of tons of plastic end up in landfills, oceans, and other waterways. This plastic can take hundreds of years to decompose, and it can harm wildlife and pollute the environment. Recycling plastic is one of the most efficient ways to reduce plastic waste. When plastic is recycled, it can be reused to make new products.

This helps to reduce the amount of new plastic that needs to be produced, which can help to protect the environment. In this paper, we propose a new system for managing plastic waste. The system would use a webbased platform and a mobile app to allow users to register their plastic waste and receive payment for it. The municipality would then collect the plastic waste and recycle it.The proposed system would have a number of advantages over traditional methods of recycling plastic waste.

Yahaya1 S.H., Hasib2 H., Kamely M.A., MD Fauadi M.H.F., Yuhazri,M.Y.; E – Recycling System Model and its applications to Plastic;May 2016.[8]

Lately, Malaysians tend to generate wastes at an alarming rate, for instance; discs, paper and plastics. Abreast of that, the conventional recycling systems that have been constructed in Malaysia typically are not widely marketed and are lacking of practical applications. This study comes with an intention of concentrating on the improvement of this particular conventional renewed Erecycling system model that includes database system (generally known as Merit Point Incentive (MPI) system) and CAD model. Due to its applicability, the model is examined by Linear Static and Fatigue analyses.

Anju Pratap, Aiswarya Maria Joshy, Manumol Mathew, Elizebeth John, Jasmine Treesa James; IoT based design for a smart plastic waste collection system; January 2019.[9]

Plastics have become an inevitable material in India in diverse forms as food packing covers, bags, sachet etc; thus remain in wide spread use. The increase in the amount of population leads to a great increase in the production of waste. This has led to the accumulation of plastic wastes from households as well as shops. An automated communication mechanism between the household and waste collecting organization, would help to monitor and collect the plastic, for recycling or a centralized disposal.

This article proposes an IoT based design for partially automating the plastic waste collection mechanism from households. Such type of system will help the municipality or corporation to monitor and manage the plastic collection and disposal respectively in a centralized way.

Mithila Farjana, Abu Bakar Fahad, Syed Eftasum Alam, Md. Motaharul Islam; An IoT- and Cloud-Based E-Waste Management System for Resource Reclamation with a Data-Driven Decision-Making Process; July 2023.[10]

IoT-based smart e-waste management is an emerging field that combines technology and environmental sustainability. E-waste is a growing problem worldwide, as discarded electronics can have negative impacts on the environment and public health. In this paper, we have proposed a smart e-waste management system. This system uses IoT devices and sensors to monitor and manage the collection, sorting, and disposal of e-waste. The IoT devices in this system are typically embedded with sensors that can detect and monitor the amount of e-waste in a given area.

3. COMPARISION ANALYSIS

S. No.	Title	Methodology	Outcome	Drawback
1	Recycling as a Service: A Mobile Application for Circular Economy	Integration of Realtime Database and Google Maps Services	An improved mobile-based application to allow recycling as a service in developing and emerging countries	Waste Management Infrastructure. Inadequate or underdevelopment in certain areas.
2	A Waste Recycling System for a Better Living World	SRF system	The outcomes of the proposed system are biogas and bio-fertilizer.	Technical Complexity. Advanced technologies are required
3	Real-time mobile application for classifying solid waste material into recyclable and non-recyclable using Image Recognition and Convolutional Neural Network	Convolutional Neural Network (CNN)	The implementation of the CNN model leads to improved accuracy in classifying solid waste materials into various categories at the grassroots level.	Data Dependency. The effectiveness of the CNN model heavily relies on the Data availability
4	Research on Waste Mobile Recycling Network Model and Application in the Context of E-commerce	Theory of Reverse Logistics	The implementation of the proposed recycling logistics network facilitates the efficient collection, transportation, and recycling of waste mobile phones.	Poor performance. Data gaps or inaccuracies may affect the reliability of the study results.
5	Recycling of Electrical and Electronic-Waste with the Help of Marx Power Pulse Generator	Marx Generator Design	The results of the investigation demonstrate the feasibility of using the proposed Marx generator device to facilitate the short-term separation of the CD-ROM cover. This suggests that the device is effective in aiding the recycling process of electronic waste, specifically in dismantling CD-ROM components.	Technical Complexity. The design and implementation of the Marx generator device require specialized knowledge and expertise in electrical engineering and pulse generator technology
6	E – Plastic Waste Management System	Website Development, UI Design	The implementation of the E-Plastic Management System provides a practical solution for managing and recycling waste plastic.	Technological Barriers. The effectiveness of the E-Plastic Management System may be limited by technological barriers, such as internet connectivity issues or compatibility issues with certain devices.
7	Plastic Waste Management System	Mobile App Development	The proposed system offers convenience to users by allowing them to register their plastic waste from the comfort of their homes using either the web platform or mobile app.	Implementing the proposed system requires adequate infrastructure for waste collection, transportation, and recycling facilities. In regions with limited

			This eliminates the need for users to travel to recycling centers, making it more accessible and encouraging greater participation.	infrastructure or resources, additional investments may be needed to support the system's operations effectively.
8	E – Recycling System Model and its applications to Plastic	Linear Static and Fatigue Analyses	The study results in an enhanced E-recycling system model that incorporates the MPI database system and CAD model. These additions improve the functionality, efficiency, and practicality of the recycling system, addressing the limitations of conventional systems.	Challenges may arise during the implementation phase. These challenges could include resistance to change, logistical hurdles, regulatory compliance issues, and technological barriers.
9	IoT based design for a smart plastic waste collection system	IoT-Based Design	The centralized monitoring capabilities provided by the system allow municipal authorities or waste management corporations to track plastic waste generation, collection, and disposal in real time. This facilitates better decision-making and resource allocation.	Data Privacy and Security Concerns. The collection and exchange of data between households and waste management organizations raise concerns about data privacy and security.
10	An IoT- and Cloud-Based E-Waste Management System for Resource Reclamation with a Data-Driven Decision-Making Process	Machine Learning for E-Waste Distinguishment	By employing machine learning for e-waste distinguishment and pyrolysis for plastic waste transformation, the proposed system maximizes resource recovery and promotes recycling.	Implementing a smart e-waste management system may face challenges such as initial investment costs, technological complexities, and regulatory hurdles. Resulting data errors

4. FUTURE SCOPE

As technology continues to evolve, there is ample opportunity to expand the scope of the project to encompass a broader range of recyclable materials beyond plastics. By integrating additional Deep Learning algorithms tailored to recognize and evaluate different types of materials such as paper, glass, and metals, the platform can become a comprehensive solution for managing diverse recycling streams. This expansion would not only enhance the platform's utility but also contribute to a more holistic approach to environmental sustainability. Building upon the foundation of recycling, the project can explore avenues for integrating circular economy principles into its framework. This involves creating closed-loop systems where recycled materials are continuously reused, minimizing waste and resource depletion. By incorporating features such as incentivized recycling programs, collaborative consumption models, and partnerships with sustainable product manufacturers, the platform can promote a circular economy mindset among users and stakeholders.

This strategic shift towards circularity aligns with global sustainability goals and presents opportunities for long-term environmental and economic benefits. Leveraging the wealth of data generated by user interactions, recycling processes, and supply chain logistics, there is potential to enhance the project's analytics capabilities. By implementing advanced data analytics techniques and predictive modeling algorithms, the platform can gain insights into consumption patterns, recycling behaviors, and market trends. This data-driven approach enables proactive decision-making, optimization of resource allocation, and identification of opportunities for innovation. Moreover, it fosters continuous improvement and adaptation to changing environmental dynamics, ensuring the project remains at the forefront of sustainable waste management practices.

5. CONCLUSION

In conclusion, this project "Towards a greener future: Harnessing Technology for efficient recycling processes" presents a holistic approach to revolutionize recycling processes through innovative technology and user-centric design. By seamlessly integrating deep learning algorithms for plastic recognition and evaluation, alongside an intuitive online platform for recycling requests and product purchasing, it streamlines the entire recycling lifecycle. The system not only empowers users to actively participate in sustainable practices but also provides transparency and accountability through features like tracking recycling history. Furthermore, by promoting awareness and facilitating responsible consumption, it represents a significant step towards building a greener, more environmentally sustainable future. With its commitment to harnessing technology for the greater good, this project stands as a beacon

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