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Automated Waste Segregation with Real Time Notification System

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Abstract: *The "Smart Waste Segregation and Management System" is a cutting edge solution designed to improve waste handling and recycling efficiency. Utilizing advanced sensor technology, the system detects, classifies, and sorts waste into appropriate sections based on material type, such as plastic or dry waste. The dustbin is equipped with capacitive sensors to identify plastic and moisture sensors to detect wet and dry materials. Additionally, it uses an ultrasonic sensor to monitor the fill level, triggering real-time SMS alerts to recycling companies and government authorities when full. Integrated with an Android application, the system allows users to log complaints via QR codes if waste remains uncollected, enhancing accountability.*

Keywords: Smart Waste Segregation and Management System

I. INTRODUCTION

Effective waste management is a critical challenge faced by urban areas worldwide. With increasing waste generation and limited resources for waste processing, innovative solutions are necessary to streamline waste segregation and recycling. The Smart Waste Segregation and Management System leverages sensor based technology to automate the waste sorting process and ensures prompt action through real-time alerts and complaint handling.

The Internet of Things (IoT) is a concept in which surrounding objects are connected through wired and wireless networks without user intervention.

This project enables the organizations to meet their needs of smart garbage management systems. This system allows the user to know the fill level of each garbage bin in a locality or city at all times, to give a cost-effective and time-saving route to the truck drivers. This system aims to reduce human intervention, improve waste collection efficiency, and promote sustainable practices.

II. LITERATURE REVIEW

PAPER NAMES 1 : A Reliable and Robust Deep Learning Model for Effective Recyclable Waste Classification
AUTHOR - md. mosarrof hossen, molla e majid, saad bin abdul kashem,amith
ABSTRACT - In response to the growing waste problem caused by industrialization and modernization, the need for an automated waste sorting and recycling system for sustainable waste management has become ever more pressing. Deep learning has made significant advancements in image classification, making it ideally suited for waste sorting applications. This application depends on the development of a suitable deep learning model capable of accurately categorizing various categories of waste. In this study, we present RWCNet (recyclable waste classification network), a novel deep learning model designed for the classification of six distinct waste categories using the Trash Net dataset of 2,527 images of waste. The performance of our model is subjected to intensive quantitative and qualitative evaluations and is compared to various stateofart waste classification techniques. The proposed model outperformed several state-of-the-art models by obtaining a remarkable overall accuracy rate of 95.01 percent. In addition, it receives high F1- scores for each of the six waste categories: 97.24% for cardboard, 96.18% for glass, 94% for metal, 95.73% for paper, 93.67% for plastic, and 88.55% for litter. The reliability of the model is demonstrated qualitatively through the saliency maps

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generated by Score-CAM (class activation mapping) model, which provide visual insights into its performance across various waste categories. These results highlight the model's accuracy and demonstrate its potential as an effective automated waste classification and management solution.

PAPER NAME 2= Blockchain-Based Forward Supply Chain and Waste Management for COVID-19 Medical Equipment and supplies

AUTHOR - raja wasim ahmed, khaled salah,(senior member ieee) raja jayaraman,ibrar yaqoob mohammed omar and sameer ellaham .

ABSTRACT= The year 2020 has witnessed unprecedented levels of demand for COVID-19 medical equipment and supplies. However, most of today's systems, methods, and technologies leveraged for handling the forward supply chain of COVID-19 medical equipment and the waste that results from them after usage are inefficient. They fall short in providing traceability, reliability, operational transparency, security, and trust features. Also, they are centralized that can cause a single point of failure problem. In this paper, we propose a decentralized blockchain-based solution to automate forward supply chain processes for the COVID-19 medical equipment and enable information exchange among all the stakeholders involved in their waste management in a manner that is fully secure, transparent, traceable, and trustworthy. We integrate the Ethereum blockchain with decentralized storage of interplanetary file systems (IPFS) to securely fetch, store, and share the data related to the forward supply chain of COVID-19 medical equipment and their waste management. We develop algorithms to define interaction rules regarding COVID-19 waste handling and penalties to be imposed on the stakeholders in case of violations. We present system design along with its full implementation details. We evaluate the performance of the proposed solution using cost analysis to show its affordability. We present the security analysis to verify the reliability of the smart contracts, and discuss our solution from the generalization and applicability point of view. Furthermore, we outline the limitations of our solution in form of open challenges that can act as future research directions. We make our smart contracts code publicly available on GitHub. IND

PAPER NAME 3= An Intelligent Hierarchical Cyber-Physical System for Beach Waste Management: The BIOBLU Case Study.

AUTHOR - MD. MOSARROF HOSSEN MOLLA E. MAJID2 , SAAD BIN ABUL KASHEM 3 , AMITH KHANDAKAR

ABSTRACT= Nestled at the confluence of nature grandeur and human civilization, beaches command an influential presence that resonates throughout the environment, society, and culture. However, climate change and pollution overhang the beach health and need to be properly dealt with. Proactive measures involve education, responsible waste management, sustainable infrastructure, and environmental regulations, while reactive ones focus on immediate response and cleanup efforts. Nevertheless, continuous monitoring and cleaning are challenging due to various factors such as beach characteristics, hidden waste, weather conditions and, consequently, high costs. To overcome such challenges, this paper proposes an autonomous system for beach cleaning adopting an Intelligent Hierarchical Cyber-Physical System (IHCPS) approach and Information and Communication Technologies. The proposed beach waste management (BeWastMan) solution integrates an Unmanned Aerial Vehicle for the beach aerial surveillance and monitoring, a ground station for data processing, and an Unmanned Ground Vehicle to collect and sort waste autonomously. The research findings contribute to the development of innovative and fully automated approaches in beach waste management, and demonstrate the feasibility and effectiveness of the BeWastMan IHCPS by a real case study, developed in the frame of the BIOBLU project

OBJECTIVE

The objective of the Automated Waste Segregation with Real-time Notification System is to:

1. Improve Waste Segregation Efficiency: Automate the waste segregation process to reduce manual labor and increase accuracy.

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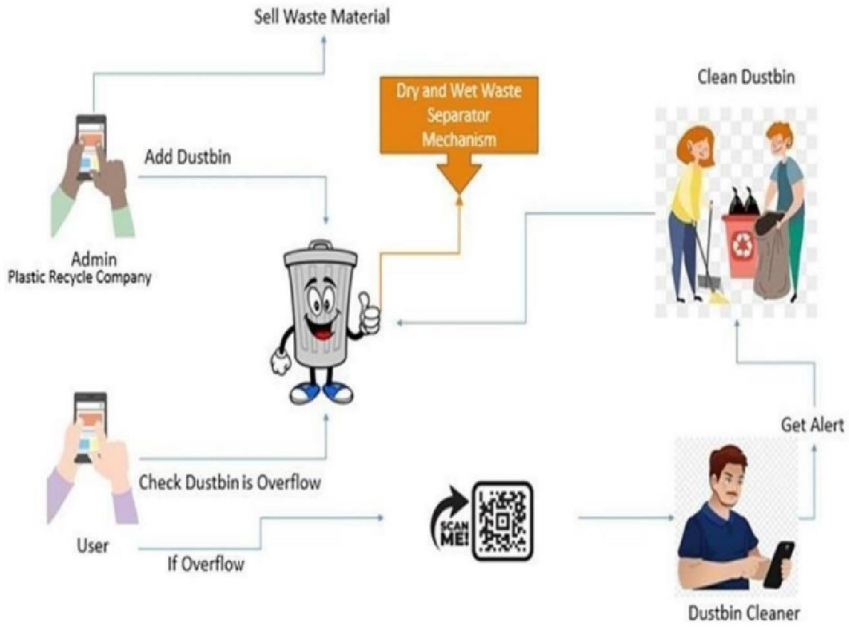
2. Enhance Waste Management: Streamline waste collection and disposal processes, reducing costs and environmental pollution.
3. Promote Sustainability: Encourage sustainable waste management practices, reducing waste sent to landfills and promoting recycling.
4. Provide Real-time Insights: Offer real-time notifications and data on waste generation and segregation, enabling informed decision-making.

III. TECHNOLOGY

The Automated Waste Segregation with Real-time Notification System can utilize the following technologies:
1. Sensors: Infrared, ultrasonic, camera, and weight sensors.
2. Machine Learning: Image recognition, classification algorithms.
3. Internet of Things (IoT): Wi-Fi, Bluetooth, or cellular connectivity.
4. Microcontrollers: Arduino, Raspberry Pi, ESP32.
5. Cloud Computing: AWS, Google Cloud, Microsoft Azure.
6. Mobile App: Android, iOS apps for notifications and monitoring.
7. Data Analytics: Predictive analytics, data visualization.
8. Robotics: Robotic arms for automated waste sorting.
9. Computer Vision: Object detection, classification.
10. Communication Protocols: MQTT, HTTP, HTTPS.

These technologies enable efficient waste segregation, real-time monitoring, and data-driven decision-making

IV. SYSTEM ARCHITECTURE DIAGRAM



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V. MAJOR FIELD APPLICATION

- Smart Cities
- Residential Complexes and Housing Societies
- Educational Institutions (Schools, Colleges, and Universities):
- Hospitals and Healthcare Facilities

VI. ADVANTAGES AND APPLICATIONS

6.1 ADVANTAGES

1. Increased Efficiency
2. Improved Accuracy
3. Real-time Monitoring
4. Reduced Waste Management Costs
5. Environmental Benefits
6. Enhanced Public Health
7. Data-Driven Decision Making

6.2 APPLICATION

1. Smart Cities
2. Municipal Waste Management
3. Industrial Waste Management
4. Recycling Facilities
5. Environmental Monitoring

VII. CONCLUSION AND FUTURE SCOPE

In conclusion, the Smart Waste Segregation and Management System represents a transformative approach to handling waste in urban environments. By leveraging sensor-based technology, IoT, and automated processes, it offers an efficient solution to the growing waste challenges faced by cities worldwide.

AI-Powered Waste Recognition and Sorting: Future versions of the system can integrate machine learning and computer vision to improve the accuracy of waste recognition. With AI, the system can classify more complex waste types (such as mixed materials) and adapt to new waste categorization standards over time.

Integration with Robotics for Automated Collection: Autonomous robots or drones could be employed to empty bins and transport waste to processing centers, reducing human intervention further. Robots could navigate complex terrains and collect waste in areas that are harder for humans to reach.

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