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Potential of Artificial Intelligence in Removal of Medical Waste

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ABSTRACT

With the inventive development of advanced technologies in the realm of medicine, new issues such as biomedical waste management are becoming more prevalent. Hazardous waste generated by hospitals must be managed in a timely manner, which can be accomplished with the use of computer science technology. The Biomedical Waste (BMW) problem is tackled using Artificial Intelligence, which takes route optimization into account. Route optimization is critical in BMW management because there are numerous risks connected with moving the BMW from the hospital to the depot (disposal site), such as traffic, vehicle malfunction. To avoid the harmful impacts of BMW on persons and the environment, the distance must be optimized. It can aid in the promotion of a healthy and risk-free lifestyle.

Keywords: Artificial intelligence, Medical waste removal, Environmental sustainability, Internet of things, Robots.

1. Introduction

Medical waste's poor management is not only harmful to the environment, but it may also have an impact on hospital employees. It is critical to appropriately manage the trash created within hospitals in order to minimize health issues and environmental hazards.

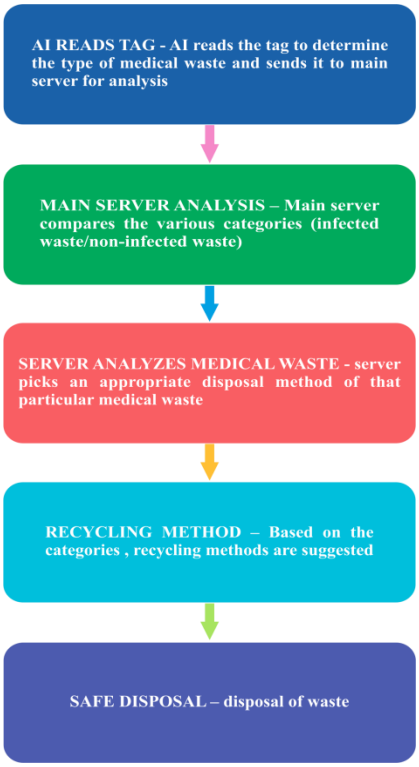

Fig.1. AI in medical waste disposal and smart recycling

As humans fight infectious diseases such as HIV, hepatitis, and others, it is necessary to correctly manage medical waste. Hospital waste management encompasses a wide range of tasks, including garbage collection,

transportation, treatment, and disposal. The hospital generates a variety of hazardous trash that must be transported and disposed of safely.

Many academics have worked on biological waste concerns in recent years, focusing on the collection, separation, and treatment of biomedical waste in hospitals using bins [1],[2]. However, there is also a requirement to concentrate on the safe transportation of biomedical waste [3],[4].

2. Literature Review

Deshpande et al., combined a modified multi-objective Ant Colony system (ACS) with a clustering approach to find the shortest and safest route for the Biomedical Waste Complex Transportation (BMWCT) problem. The authors used the risk associated with BMW transportation and collection, total vehicle scheduling time, and vehicle number as the primary criteria for route selection. Clusters of hospital nodes are established in the suggested method based on the late time window associated with the hospital node and its distance from the nearest depot. The routes are then scheduled and optimized using a modified Multi-Objective Ant Colony System (MOACS). The acquired data demonstrated that the proposed system performs well.

For the delivery of hazardous chemicals, Dua et al. worked on the Multi-Depot Vehicle Routing Problem (MDVRP). The authors developed a fuzzy bi-level programming approach to reduce the total projected transportation risk when moving products made of hazardous materials to consumers from multiple depots. The authors created four fuzzy simulation-based heuristic algorithms to deliver perfect answers to the programming model. The algorithms aided in the exploration of the best approaches, the assignment of consumers to depots, and the discovery of the optimal routing solutions for all depots and consumers.

To solve the full-truckload selected multi-depot vehicle routing problem with time windows constraints, El Bouyahyiouy et al., proposed an Ant Colony Optimization (ACO) (FT-SMDVRPTW). Researchers developed a solution consisting of a collection of truck-related directions that aims to optimise overall profit in this study. In order to maintain operational restrictions, all routes are viewed as a sequence of nominated orders to be served. When the autos return, the problem becomes apparent. To tackle the whole cargo, the authors improved the ant colony system by merging it with a robust optimization mechanism.

Kacker and Tembhurkar established a strategy for assessing and investigating the threat posed by biomedical waste management systems in nations such as India. The data for this model was gathered through a questionnaire survey of investors and experts in the sector. The authors created a software method to estimate threat levels and analyse the whole scope of the biomedical waste management system issue. This can help the organiser, designer, or supervisor in charge of the biomedical waste management system understand the threat posed by the system and guide people in selecting appropriate techniques, and procedures to avoid harm to people and the environment.

3. How AI can revolutionize medical waste management

3.1. AI - smart medical waste disposal

The type of medical waste recognized is sent to the main server for analysis by AI.

The main server then assesses the various recycling procedures and selects the most appropriate method of disposal. Medical waste is properly disposed of or recycled in a safe manner.

With the introduction of RFID medical waste tags, waste sorting mechanisms have undergone a revolution. Songdo, a South Korean city, employs RFID tags to sort rubbish into several categories. These tags are then scanned by a pneumatic rubbish disposal device.

As a result, the central server, which stores all of this information, calculates the best way to dispose of the overall medical garbage generated.

3.2. AI and IoT in medical waste management

Another breakthrough notion in waste management is the intelligent trashcan, which is equipped with AI programs and IoT sensors. The sensors on these trashcans measure the waste levels of the garbage dumped inside and transfer this information to the main disposal system for processing via intermediate servers. The data is divided into three categories: garbage kind, quantity of each sort of rubbish, and waste disposal technique. This system as a whole can also increase its efficiency over time by reviewing previous records.

3.3. Use of automated intelligent machines (Robots)

Waste sorting robots have begun to be used in garbage landfills. Traditional waste sorting methods are gradually being replaced by automated intelligence equipment. The robots, who are adept at multitasking, can sort tonnes of waste in a single day. With their computer vision programs, these robots are highly autonomous and can easily distinguish between tin foil and paper. Such large-scale systems have enormous potential for use in a variety of sectors.

4. Future Scope & Conclusion

The goal of this article was to provide a detailed overview of AI's application in the elimination of medical waste.

The current robotic systems for trash disposal applications have a restricted scope of modification, which is one of their limitations. The value of waste disposal system modification cannot be overstated.

Declarations

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Competing Interests Statement

The authors declare no competing financial, professional and personal interests.

Consent for publication

Authors declares that they consented for the publication of this research work.

Ethical Approval

Not Applicable.

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