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THE IMPACT OF ENVIRONMENTAL WASTE DUE TO AFTERMATH COVID-19 PANDEMIC

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Abstract

Aim of the Study: The purpose of our current study is to address the aftermath of COVID-19 pandemic which augments the enormity of medical waste clearance which in turn threatens the society along with greater impact on the environment.

Methodology: In spite of inadequate literature on controlling health caresquander has instigated global emergency to find out alternative approaches to mitigate the environmental hazards.

Results and Discussion: The disposal of solid waste such as PPEs, single-use plastics, tested kits and needles of tested persons have upsurged concerns regarding the environmental issues. However, data collected from several case study along with review articles created conception to recognize measures in mitigation of waste disposal without any damage to environment.

Conclusion: Amidst the pandemic virus infection, discarding the solid waste with safety measures is imperative along with substitute level of management. Our current review article stress on salvaging of waste, refurbishment measures with help of AI technology which prevents spread of the disease. Thus, artificial intelligence is best method to dispose solid waste hazards.

Keywords: Artificial Intelligence, Solid waste, Medical waste, Environmental hazards, COVID-19.

I. Introduction

The waste engendered around the world is prophesied to reach 2.2 billion tonnes by 2025, which would cost $375.5 billion in waste management [1]. The indecorous waste needs to be supervised to reduce the adversative impacts on the economy, the public health, and the environment [2]. Although, several recycling strategies have been developed for Municipal solid waste (MSW) based on the guidelines of Environmental Protection Agency (EPA) [3]. Earlier in order to support our environment and prevent pollution as well as to make it eco-friendly by opting recovering process of waste which helps in preserving energy alongside refrain the generation of greenhouse gases [4-5].

Generally, Waste disposal has become a subtle concern all around the world. Mismanagement and unawareness led to various environmental problems principally in densely populated countries, such as China, India, Pakistan, and Bangladesh [6-7]. However, during the pandemic outburst of corona virus has posed chief problem all over the world due to deposition of municipal solid waste (MSW) and hazardous biomedical waste management. The upcoming Artificial intelligence (AI) technology has been considered as equivalent to human brain [8-9]. Since, AI built machinery are described as super intelligent brains that can perceive, comprehend, and predict the environmental happenings and in accordance display appropriate action to achieve the target [10].

Nevertheless, the augmented invasion of AI software and hardware technologies in all fields of science and engineering from Internet of Things (IoTs) [11], visualization of machine [12], automated driving [13,14], deep machine learning along with natural language processing (NLP) [15,16], and 5G robotics [17]. However, the AI application in all fields including biomedical field especially during the time of pandemic is imperative to improve the health of human beings and thereby subsequently enhance the efficacy of the overall medical care industry [18–20].

Therefore, our current article major focus is in displaying the modifications to be implemented in medical waste disposal in safe manner in order to mitigate the transmission of disease globally. The regular method of controlling any biomedical waste is incineration, autoclaving and physical plus chemical methods. For mitigating the transmission of infection, the AI constructed technology is essential for tracking as well as reducing the employment of labourers for disposing solid wastes of infected persons. The major objective of IoT technology is to scan with help of sensors plus identifying the location, video surveillance, and WiFi access to each device employed for purpose of monitoring and discarding such solid wastes. Thus, through the expansion of artificial intelligence the appropriate management of waste disposal along with disinfection of rooms, instruments as well as suits are considerably possible using ultraviolet irradiation technique built within 5G robots.

II Municipal Waste Management during COVID-19 Pandemic

The production of food-by-food industries have been largely affected due to outbursts of COVID-19 [21]. The sudden shut down of schools, colleges, institutions along with all industries including the food industry resulted in generation of wastage of food in significant amounts [22]. In accordance, the United States Environmental Protection Agency (US EPA) [23] released certain recommendations for reprocessing and effective management of food waste during coronavirus outbreak globally. However, in India the month of March is regarded as peak time of harvesting a wide variety of crops especially diverse kinds of vegetables production, fruits production, paddy, wheat and barley, all got wasted due to lockdown countrywide. Therefore, there is significant rise on the volume of waste generated plus recyclables from the residences during COVID-19 outbreak has increased. Currently coronavirus pandemic is posing threat due to accumulation of municipal waste, the cleaners are going to face threat while handling wastes. Therefore, management practices need to be initiated keeping in mind such as safety and health measures for employees [24]. Several review articles have portrayed on the generation of wastes worldwide which is displayed in (Table-1).

Table-1 Literature papers on waste management practices globally

Literature review papers	Bibliography	Coverage
Waste management, air quality improvements, waste incineration, wildlife, global migration, and sustainability	[25]	Worldwide
Plastic waste management	[26]	Worldwide
An Internet of Things Based Smart Waste Management System Using LoRa and Tensorflow Deep Learning Model	[27]	Malaysia
Ocean environment, air and water quality	[28]	Worldwide
Healthcare waste management in Asian developing countries	[29]	Asia
Medical waste, plastic waste, and food waste management	[30]	Worldwide
Food waste management	[31]	Spain
Management of used personal protective equipment and wastes	[32]	South Korea
NO2 and PM2.5, cleanliness of beaches, environmental noise level, waste generation, and waste recycling	[33]	Worldwide
Implications of COVID-19 on plastic waste generation	[34]	Worldwide
Plastic pollution due to COVID-19 pandemic	[35]	Worldwide
Characteristics and Forecasting of Municipal Solid Waste Generation in China	[36]	Worldwide
MSW management practices	[37]	Worldwide
MSW from household, business, and industrial waste	[38]	Singapore, China, and Czech Republic
Waste and wastewater	[39]	Worldwide
Re-use and sustainable waste management of PPE	[40]	The Republic of Ireland

III Relative Frame of Study

We both have contributed our perspicacity as authors to bring consciousness to society about the latest artificial intelligence (AI) technology which can be significantly utilized to tackle the solid waste management particularly during COVID-19 pandemic where the discarding of medical waste is upsurging day by day is the main examination of the manuscript. Nevertheless, we have searched various research articles, systematic review articles, pilot study, IEEE papers, Elsevier, Wiley along with Springer articles for procuring guidance as well as to get comprehension about vital topics to be emphasised in our current study. Moreover, to give proper insights about the current AI technology and its implementation during pandemic caused relief to health care workers.

Nevertheless, we have constructed our study plan into following sections to offer clear spectre to readers as one requires to recognize what is occurring all-around us. Many researchers concentrate on IoT to built smart city. In our article we have

displayed all reader information on Artificial intelligence employment in reduction of solid waste. Nonetheless, literature survey was collected from Google search using verified resources such as Google scholar, Elsevier, PubMed, EMBASE, SCOPUS and IEEE. The beginning of our study with systematic abstract which provide wide sketch out on back ground study. Later, divided our paper with several subheading in order to provide clear picture about sustainability of waste with latest artificial intelligence technology. The section-1 gives a clear understanding about the application of Internet of Things (IoT) in detection of metals with Infrared (IR) sensors. The section-2, provides insight on Tensorflow framework. Further, the section-3 included the application of RFID module for benefit of society during the pandemic COVID-19.The section-4 highlights the Convolutional neural networks (CNN) in analyzing visual image. The section-5 the multiple layer hybrid system (MHS) for precise prediction (Shown in Figure-1).

In order to gather sufficient and relevant information about the Artificial Intelligence, the prime keyword used were, 'Artificial Intelligence in waste management',5G robots, applications of Internet of Things, Convolutional Neural Networking in Elsevier, IEEE and Pubmed and SciHub platforms for which the initial screening is performed by to analyse whether it is relevant for our study or not.

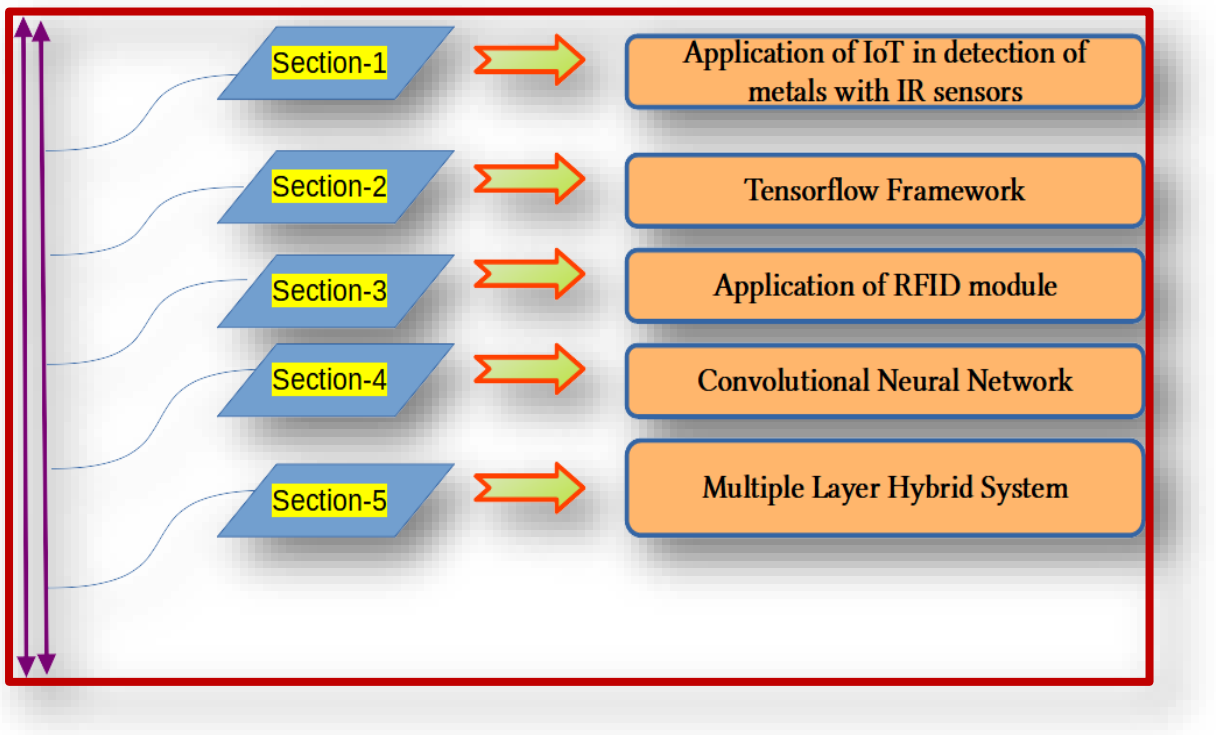

Figure-1: Design of our related study

IV Section-1: Application of IoT in detection of metals with IR sensors

Segregation of waste and their related products into dry, wet, wood products, metals and glass are carried out with help of ARDUINOUNO Board. This is latest technology built with artificial intelligence, machine learning program for segregation of biodegradable and non-biodegradable waste. Since landfills are considered as augmenting problem and initiates separation of waste for reduction of pollution in environment especially during COVID-19 pandemic outbreak [41].

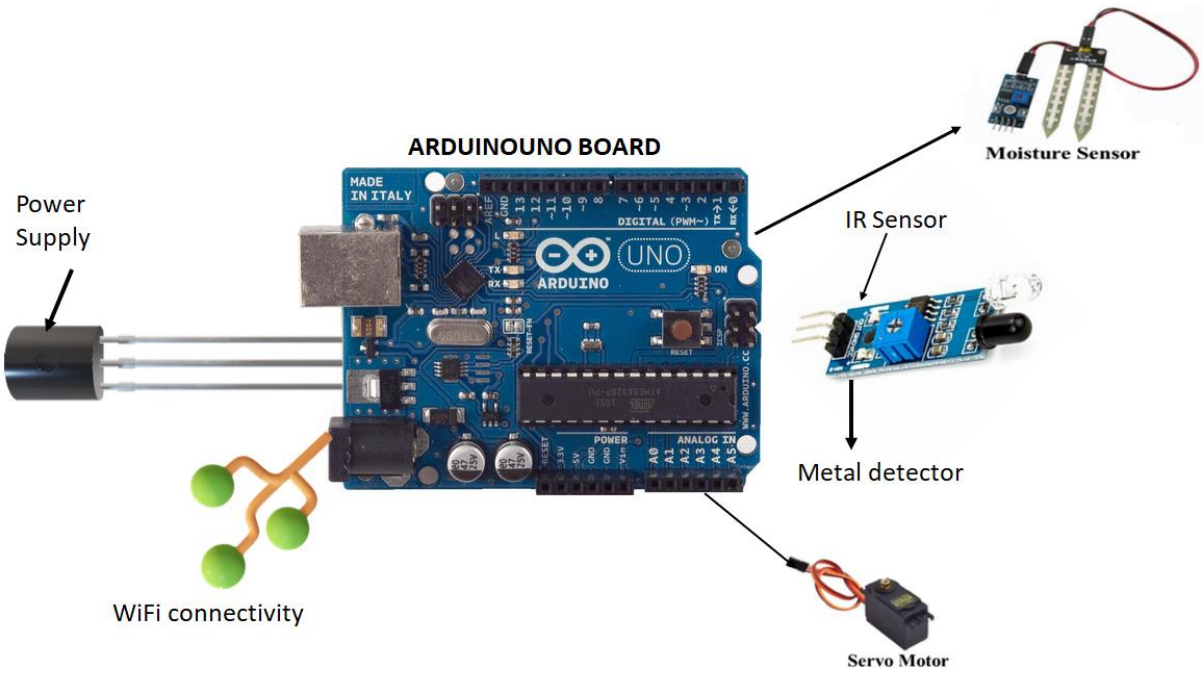

Figure-2: Conceptual Design of ARDUINOUNO Board for separation of waste materials which is detected with IR sensors

ARDUINO UNO is a software company which has first designed microcontroller board dependent on Wifi connectivity. The Uno has advanced yield pins and 16MHz quartz precious stone along with a USB linked with AC to DC connector battery. The chip is built with IR sensor for sensing materials and can be handled with remote control [42-45]. (Shown in figure-2). Nevertheless, the advancements in Wireless Sensor Networks (WSN), IoT built with Artificial Intelligence (AI) has instigated IoT-enabled smart cities and wide Industry 4.0 establishment [46-47]. With the development of IR sensors with Wifi connectivity and remote control, these smart devices have revealed greater performance in sorting of waste [48-49]. Thus, IoT based methodology have been displayed waste management through recognition of smart bins and sort waste according to category wise with help of inbuilt sensors installed in waste bins [50],

V Section-2 Tensorflow Framework

The most accepted technology which is used to design for execution of neural networks is termed as Tensorflow. This software involves google, NLM library and Deep Neural Networking, the dataset was divided into trained and test sets. The whole dataset was classified into two types such as organic or recycle. Currently during pandemic situation IoT built technology was found to be supportive in reduction of spread of virus as well as piling up of waste which in turn causes release of toxic substances into environment and indirectly can trigger other pathological distress. Tensorflow works on basis of machine learning application embedded with deep-learning applications for recognition of images and classify accordingly [51], text classification [52] and identification of waste objects. With advancements in AI technology IoT is associated with smart devices for management of waste.

VI Section-3: Application of RFID Module

An RFID module chip is inserted to waste bin and through GPS tracking the Garbage waste disposal vehicles easily identify. However, this module in turn instigates the Arduino Uno to unlock the electronic compartment. The RFID module has two parts, an WIFI antenna responsible for transmission, along with radio waves for receiving signals, which in turn triggers for communication [53-54]. The RFID tag detects the antenna since it is inbuilt with an integrated circuit which helps in identification of code and other relevant information. Only authorized personnel can access the bin through RFID encoded tags.

Figure-3: RFID chip inserted in waste bin helps to track solid wate and manage wate with GPS tracking system

VII Section 4 and 5: Convolutional Neural Network and Multiple Layer Hybrid System

Recent advancement in computer technology has contributed in improved vision. Convolutional neural network (CNN) uses deep learning program for identification. Detection, classification and segmentation [55-56]. The application of CNN in waste classification achieved nearly 70% accuracy [57-60]. The CNN first step is classification of waste into 6 kinds. The accuracy rate for Support Vector System was 65% and 25% for CNN. The classification of waste is also performed with support of multilayer hybrid method (MHS), which includes a convolutional neural network (CNN) and multilayer perceptrons (MLP). The Multiple hybrid procedure involves perceptrons with deep-learning language for comprehending the nonlinear classification & regression. These methods most frequently utilized for modelling & forecasting [61–64].

VIII Conclusion

In accordance to World Health Organization (WHO) the COVID-19 pandemic will continue for a long duration and our plans must be focused on preparation of ideal vaccine for mitigation of virus universally. Nonetheless, due to pandemic outburst there is no doubt that the amount of medical waste has increased along with regular solid wastes. Hence, disposal of waste, management of solid waste, treatment practices for household waste need to be considered. The introduction of AI technology built with machine learning and deep learning program languages enabled them to sort the wastes with help of inbuilt sensor. Without man power, the artificial intelligence technology supported human kind in disposal of wastes after sorting and also recycled the wastes to prevent contamination. Issues of this kind need to further studied and investigated in near future.

Author Contributions

KRP and KRD contributed in writing, drawing figures and tables in this review article.KRP solely drafted this review article.

Compliance with Ethics Requirements

NIL

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Conflicts of interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

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