

## An IoT and Cloud Based Waste Management System

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**Abstract—** *The Integrated Internet of Things (IoT) and Cloud-Based Waste Management System presents a groundbreaking solution to the pressing challenges of contemporary waste management. This innovation leverages the power of IoT technology, employing a network of precision-calibrated sensors embedded within waste bins to monitor critical parameters, including fill levels, temperature, and waste composition. The real-time data collected by these sensors is seamlessly transmitted to a cloud based platform. Kitchen waste is organic in nature that decomposes quickly, producing foul odours and attracts rodents and insects. Management of kitchen waste reduces or eliminates adverse impacts on land, contamination of the atmosphere, soil and water. The aim of the present study is to convert kitchen waste into useful product for better growth and quality of crops so as to promote sustainable waste management.*

### I. INTRODUCTION

India is rapidly developing country in the world. As a growing economy it is important to manage its waste. In India on an average 64 million tons of detritus is produced which ranks 5th in global scenario. Now a days in many localities garbage is thrown arbitrary and roads are seen with full of litter. These unplanned things causes many problems sometimes it may cause hazardous diseases. It necessitates a management system that will curb this issue and has a complete observation on the detritus. The composting process has received much attention in recent years because of pollution concerns due to increase in volume of

waste. This project report describe a smart way for the mitigation of the waste generation which is smart compost bin. The characteristics of the smart compost bin and its structure are also explained. Composting is a microbiological anaerobic process. Smart compost bin is a system which comprises of several components such as, metal and plastic detector, composting unit and outlet provision for produced fertilizer. Composting process is controlled by some parameters such as temperature, moisture and oxygen content Maintaining temperature fluctuations during composting period could allow adequate control of the process in case of any difficulty. Moisture content is the factor which makes the nutrients bioavailable. To be successful, we will need to provide the microorganisms in the system. This system totally works on solar energy. Smart compost bin can enhance public health by returning vital nutrients to the soil. This project reviews information on the composting for waste as a means of addressing the environmental pollution concerns Composting has been used as a means of recycling organic matter back into the soil to improve soil structure and fertility. Improper waste management is detrimental to human health.. Wastes are often improperly managed [1,2] using conventional methods. Wastes are burnt, disposed into oceans, waterways, and dumped by the roadsides [3]. These practices breed insects and pests, release offensive odors, are unsightly and contribute to global warming (during combustion). Organic (degradable) wastes transformation is either aerobic or anaerobic. When transformed under aerobic conditions, Composting is a safe method of waste management. Composting is an aerobic process where complex degradable materials are degraded and transformed by

microorganisms into organic and inorganic byproducts [4]. The by products contain ‘humic-like’ compounds that differentiate them from those found in native soil, coals, and peats. Composting is a means of transforming different degradable wastes into products that can be used safely and beneficially as bio fertilizers and soil amendments[5-7]. The controlling process differentiates composting from decomposition (a naturally occurring process) [8]. As beneficial as composting is, it takes a longer time to be ready, produces offensive odor, has long mineralization time, may contain some pathogens that can withstand high temperature to some extent, i.e., thermotolerant pathogens and insufficient nutrient content. All these have discouraged farmers from incorporating them as a means of sustainable agriculture. This made the synthetic counterpart (chemical fertilizers), which is readily available, preferred to the organic source, i.e., composting. More information on how to trap odor, a rapid method of pathogen and heavy metal detection will make composting more utilized. Several works have focused majorly on the agronomic evaluation, microbial contamination, and nutrient composition of compost [9-12], leaving out the causes of long duration in composting and prospects to alleviate odor, pathogen and heavy metals. This review evaluates the challenges associated with composting and the prospects which can make composting to ensure sustainable agriculture.

## II. LITREATURE REVIEW

India is rapidly developing country in the world. As a growing economy it is important to manage its waste. In India on an average 64 million tons of detritus is produced which ranks 5th in global scenario. Now a days in many localities garbage is thrown arbitrary and roads are seen with full of litter. These unplanned things causes many problems sometimes it may cause hazardous diseases. It necessitates a management system that will curb this issue and has a complete observation on the detritus.

Composting is not only a modern age matter, this practice Took place long time ago. The earliest records state Evidence that before the introduction

of modern sewage Systems, the major fertilizers were animal manure and Composts of garden and kitchen wastes. Composting Existed 10 000 years ago through the Akkadian empire Which was located in modern day Iraq. When the citizens Noticed that their plants grew better in area where there Was manure they started putting manure in their soil. The History of composting also states that early farmers in Scotland, during the Stone Age, used to put manure and Vegetable compost in their soil. Moving to Ancient Asia, There is evidence that the tools found in Neolithic sites in Northern china contained similar features as those used by The Scottish farmers. The Greeks, Romans and Egyptians Used composting too. In Egypt, after observing the Worms’ composting abilities, Cleopatra enacted a law that States that anyone who removes earthworms from Egypt Was punished by death. During the 12<sup>th</sup> century, the Handbook Kitab Al Falah written by Ibn AL Awam gave Detailed information about composting and the use of Manure. . In 1943, George Washington Carver said “Make Your own fertilizer, compost can be done with little labor And practically no cash outlay”. Yet, composting was soon Replaced in the early 20<sup>th</sup> century. Justus Von Liebig, a German scientist, proved in 1840 that the plants can get Nourishment from the chemicals. Therefore, the Vegetables’ and animals’ waste mixture was replaced Quickly by artificial fertilizers, and that was the beginning Of the scientific method of farming. But like all the Artificial solutions, fertilizers had their opponent.

## III. PROPOSED SYSTEM

We have potentially enhanced the efficiency and accuracy of waste recycling processes, enabling a more effective sorting and separation of valuable components by leveraging these cutting-edge technologies. We have trained a digital image processing camera to recognize the perfect waste parts, and the interconnection between the sensors and cloud processes the data and recycles the wastes in a perfect manner. We have built a small prototype of an IoT-based waste management system with the help of the cloud, which will make this whole system automated. We are turning waste

into assets by developing our waste management and recycling system.

Our main purpose is to collect waste and send it for recycling in an efficient and automated manner. We are using the combination of the IoT and machine learning for gathering waste for recycling purposes

#### IV. OBJECTIVE OF PROJECT

The main objective of the project is to design a smart compost bin having a capacity of 20 liters to carry out the composting of all types of biodegradable materials and to obtain good quality of manure.

#### V. DESIGN CRITERIA

**Frequency of use**-The biodegradable waste is input every day, so we can use this bin for community .

**Use of Energy**- As the bin is totally works on solar energy, and hence there is no need of any external power/electricity.

**Product Handling**- The output product i.e. compost, should be in such a manner that there should not be any inconvenience to user and it should collected in tray/pan and can be used easily for home gardening.

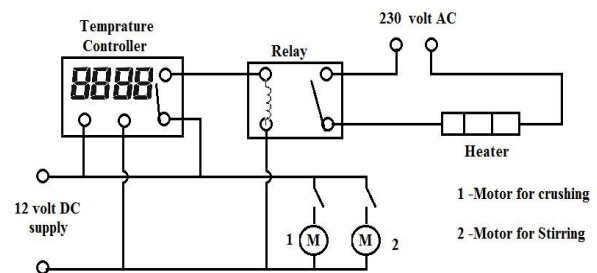
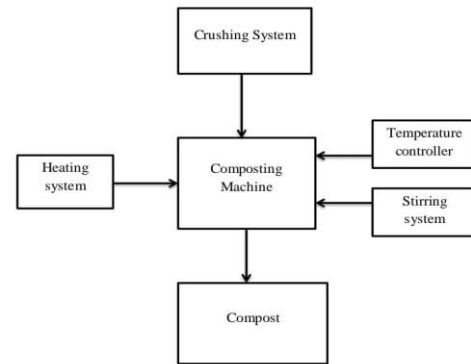
**Easy Process**- This composter is to be operable by everyone as there is no need of any special skills for operating it.

**Product location**: - The smart compost bin to be placed in either balconies or other places where optimum sunlight is available.

**Product size**: - The dimensions of the Smart compost bin would be ergonomic in nature and it will maintain the standard modular kitchen dimensions followed in Indian kitchens. Depending upon the quantity of the waste generated the size of smart compost bin may vary. **Odour free**: - The smart compost bin would not give out any bad odour.

**Low noise**: The smart compost bin's noise limit shall be well within the limits of a kitchen appliance.

#### VI. BLOCK DIAGRAM



#### VII. RESULT





## VIII. CONCLUSION

The proposed strategies for the management and disposal of degradable waste by composting with smart compost bin have shown feasibility in terms of organic matter mineralization and humification. Compost bin plays a major role in solid waste management in India as it is easy to use and cost effective, can be implemented at lower rate. The new design of compost bin is aesthetically good looking, it has no odour, keep insects flies away from bin. Based on the study, it can be conclude that composting is the best way to reduce or recycle the municipal solid waste and it causes less pollution and more beneficial to environment as well as economy when compared to the current methods of collection and disposal. It has lots of benefits like reduce surface and water leachates, minimize landfill space, methane emission, air pollution by burning of waste, transportation cost etc. It also reduce load on disposal units. Compost obtained by this can be used as organic fertilizer in agricultural field instead of chemical fertilizer also due to shredding of waste in bin fast process of composting takes place. The liquid fertilizer obtained can be directly used or stored which increases the yield of crop in natural way. Finally, it is conclude that the proposed alternative should be sealed up in developing areas to reduce and diversify the urban waste streams producing high quality and balanced organic fertilizer with significant economic value.

Improper waste management is a common practice which is not safe and can be replaced with safer waste management method such as composting. The world is tending towards improving environmental and human health. As a form of organic fertilizer ,composting can play a significant role in achieving this goal. Focus on composting will cause a shift in the use of chemical fertilizer in favour of compost. This shift will invariably promote environmental and human health by reducing the number of toxic chemicals released into the environment. In the present state, a lot of awareness still needs to be done concerning the potentials of this technology for its full acceptance by farmers. Concerning the improvement technologies, some recommendations are hereby

suggested to aid its improvement.

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