IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Integrated Smart Waste Management: A Sustainable Approach To Urban Cleanliness

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Abstract:

Waste management is a critical challenge in urban and rural areas due to rapid population growth, industrialization, and urbanization. Traditional waste collection and disposal methods are often inefficient, costly, and environmentally damaging. Integrated Smart Waste Management (ISWM) combines modern technology with waste management practices to enhance efficiency, sustainability, and responsiveness.

Keywords:

Municipal garbage bin, ultrasonic sensor, Arduino, Node MCU, ThingSPEAK, Stepper Motor, IoT Monitoring.

Introduction:

Waste management are the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. One of the main concerns with our environment has been solid waste management which impacts the health and environment of our society. A large portion of waste management practices deal with municipal solid waste (MSW) which is the bulk of the waste that is created by household, industrial, and commercial activity. There are different types of waste:

1. Liquid waste.
2. Soild Rubbish.
3. Organic waste.
4. Recyclable waste.
5. Hazardous waste.

1. Liquid waste.

- Liquid waste is commonly found both in households as well as in industries. This waste includes dirty water, organic liquids, wash water, waste detergents and even rainwater.
- You should also know that liquid waste can be classified into point and non-point source waste. All manufactured liquid waste is classified as point source waste. On the other hand, natural liquid waste is classified as non-point source waste.
- It is best get in touch with waste removal experts, such as 4 Waste Removals, to disposal of liquid waste properly.

2. Solids Rubbish.

- Solid rubbish can include a variety of items found in your household along with commercial and industrial locations.
- Solid rubbish is commonly broken down into the following types:
- *Plastic waste* - This consists of bags, containers, jars, bottles and many other products that can be found in your household. Plastic is not biodegradable, but many types of plastic can be recycled. Plastic should not be mix in with your regular waste, it should be sorted and placed in your recycling bin.
- *Paper/card waste* -This includes packaging materials, newspapers, cardboards and other products. Paper can easily be recycled and reused so make sure to place them in your recycling bin or take them to your closest Brisbane recycling depot.
- *Tins and metals* - This can be found in various forms throughout your home. Most metals can be recycled. Consider taking these items to a scrap yard or your closest Brisbane recycling depot to dispose of this waste type properly.
- *Ceramics and glass* - These items can easily be recycled. Look for special glass recycling bins and bottle banks to dispose them correctly.

3. Organic waste.

- Organic waste is another common household. All food waste, garden waste, manure and rotten meat are classified as organic waste. Over time, organic waste is turned into manure by microorganisms. However, this does not mean that you can dispose them anywhere.
- Organic waste in landfills causes the production of methane, so it must never be simply discarded with general waste. Instead, look to get a green bin from the Brisbane council, or hire a green skin bin or garden bag for proper waste disposal.

4. Recyclable waste.

- Recyclable rubbish includes all waste items that can be converted into products that can be used again. Solid items such as paper, metals, furniture and organic waste can all be recycled. • Instead of throwing these items in with regular waste, which then ends up in landfills, place them in your yellow recycling bin or take them to your local Brisbane recycling depot.
- If you're unsure whether an item is recyclable or not, look at the packaging or the diagrams on the lid of your yellow recycling bin. Most products will explicitly state whether they are recyclable or not

5. Hazardous waste.

- Hazardous waste includes all types of rubbish that are flammable, toxic, corrosive and reactive.
- These items can harm you as well as the environment and must be disposed of correctly. Therefore, I recommend you make use of a waste removal company for proper disposal of all hazardous waste.

Literature Review:

IOT is playing an important role in growing technologies and there are various studies about many applications.

(1) Kodwo Miezah,Moses Y.

PROJECT TITLE: Municipal solid waste characterization in Ghana-December 2017

WORK DONE: Collection of dialy reports on waste collection in Ghana and prepared the reports for the collection efficiency.

CONCLUSION: Organic waste fraction in the waste was 45 to 69%,National sorting and separation efficiency was 84% for biodegradables and 76% for other waste was separated.

(2) Sehyun park,Sunghoi park

PROJECT TITLE: IOT based Smart waste management for food-July 2015

WORK DONE: Collected dialy and weekly reports for food waste and bins are designed to collect large amount of waste.

CONCLUSION: Web based services are provided for the collection, disposal of food waste. This method improved the collection efficiency of waste collection by 39%.

(3) P.Rajkumar joshi

PROJECT TITLE: Challenges of municipal waste management-October 2017. CONCLUSION: Protection of groundwater contamination from leachate ,developing bio-degradable polythene bags and recycled products.

(4) C.JeyaBharathi

PROJECT TITLE: Development of an Iot System for Efficient Classification and Management of Solid Waste in Indian Cities-November 2018

WORKDONE: Developing an effective system for the collection of waste for different zones in city.

CONCLUSION: This study develops the internet of things practicality based on the management and collection of solid waste for smart city. The automatic sensing system is designed using load cell and ultrasonic sensor to provide an automatic and efficient status of dustbin monitoring system.

(5) Medevdev.J

PROJECT TITLE: Waste collection system- August 2017

WORKDONE: Developing the new efficient method for the collection of waste zones with muncipality.

CONCLUSION: Provides greater service quality to smart city citizens. The automatic sensing system is designed using load cell and ultrasonic sensor to provide an automatic and efficient status of dustbin monitoring system.

(6) Navaghane.M,Mahesh.K

PROJECT TITLE: Waste collection using IR system.- January 2017

WORKDONE: Using IR sensor to sense the depth and helps the transformation in to various webserver.

CONCLUSION: Monitor the duplicate reports, reduces the corruption in management system, reduces the number of trips of garbage collection vehicle and reduces the overall expenditure related with garbage collection

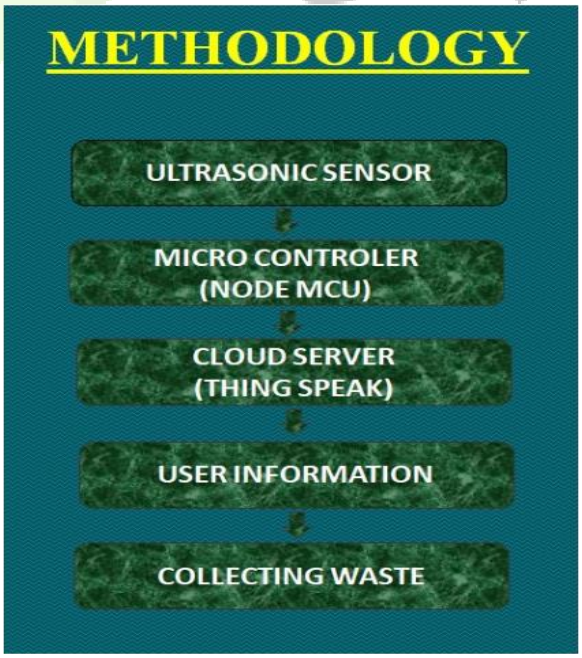
(7) Vaishali.P,Manoj.T

PROJECT TITLE: Waste collection using Raspberry Pi.- July 2017

WORKDONE: Using Raspberry Pi sensor to sense the depth and helps to give information to drivers.

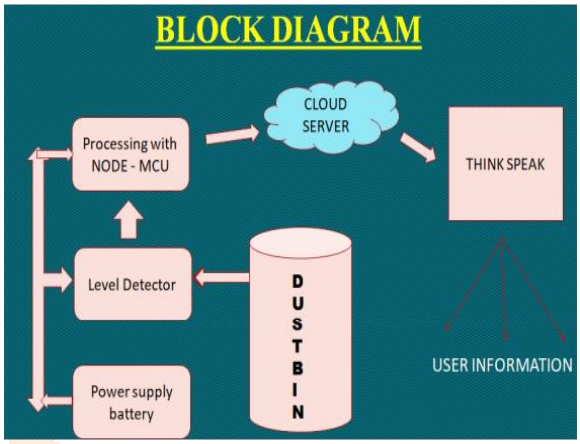
CONCLUSION: Maintain the surge of dustbin and make the earth clean and immaculate, reduce the wastage of cost, time and importance of human being and the drivers acquired.

Methodology:



Proposed System:

Integrated smart waste management use technology to optimize waste collection, reduce costs, and improve sustainability. These system leverage IoT sensors , real time data analysis to monitor waste levels, optimize collection routes, and potentially automate sorting. This lead to more efficient waste management, reduce environmental impact, and cleaner urban environment.



Future Scope:

The future of waste management is moving toward more sustainable technologically advanced and circular approach. This include a greater emphasis in waste reduction, resource recovery and minimizing landfill reliance through innovation technology and integrated system.

Conclusion:

The structure depends upon IoT recognizing model. The status of the bin has recorded graphically in cloud server. The information of the bin(full or empty) given to the drivers from the main office in the town. The execution of waste association framework by utilizing sharp dustbins to check the segment of impressive dustbins paying little notice to whether the dustbin are full or not. In this framework when garbage is full the data is sent to the insisted individual. By executing this proposed framework, we can build up the sharp city thought and cost is reduced. By the productive utilization of sharp dustbins can the advantage is advanced. This framework diminishes the improvement in the awe-inspiring city, with the target that condition will be cleaned. Also, This IoT-based waste segregation system provides a scalable, automated, and intelligent solution to urban waste management. By combining smart, it offers a significant step toward sustainable, clean, and efficient smart cities.

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1,Lillian.A and William H (2012). Solid waste challenges for cities in developing countries, Journal of waste management.

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3. Sehyun and Williams B (2010). Food waste management by WHO , Geneva.

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