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Solid Waste Management Using IOT & ML For Smart Cities

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Abstract: In recent decades, Urbanization has increased tremendously. We live during a world that's during a state of constant up-gradation and new arising technology, but there's one universal problem that we haven't yet affect, the matter that's disrupt our advancement to a hygienic, clean and healthy society, is especially garbage. Mostly in our lifestyle we experience dustbins that are unrestrictedly full and garbage are spill over them. This is often the type of situation which is neither good for our surroundings nor good for our evolution. This problem results in huge number of diseases as sizable amount of insects and mosquitoes breed on the waste assembled during this garbage. So here during this paper we've found some research gap to beat the above problem we've come up with an answer which is cost effective.

Index Terms – smart dustbin, solid waste management, optimized route, IOT & ML, smart cities

I. INTRODUCTION

The environment plays an important role in everyone's life, which efficiently supplies all-natural requirements but also we've some responsibilities towards our surroundings. In several urban areas although the dustbins are provided in order that it are often employed by the people but its proper maintenance is additionally needed lacking during which in hygiene increases destroying our surroundings day by day also leading to severe adverse effects for mankind.

A. Solid Waste Management(SWM):

Basically Solid-waste management comprises of collecting, treating an unwanted and discarded materials from houses, street sweeping, commercial and industrial operations, and removing solid material that's discarded because it's served its purpose or isn't any more useful. A rise in urban population and changing lifestyles cause an increase within the generation of solid waste.[1] Due to the huge increase in increase and economic development within the country, there's tremendous growth in solid waste generation in our country.[2]

B. Machine Learning(ML):

Machine Learning (ML) Machine learning is associate application of AI (AI) that gives systems the ability to mechanically learn and improve from expertise while not being expressly programmed. Machine learning focuses on the event of laptop programs which might access knowledge and use it to hunt out for themselves. The Strategy of learning begins with observations or knowledge, like examples, direct expertise, or instruction, to appear for patterns in knowledge and build higher choices among the long term supported on the examples that we offer. The first aim is to permit the computers to hunt out mechanically while not human intervention or help and modify actions consequently.

C. Route Optimization:

Route optimization is that the method of finding the foremost cost-effective route for a gaggle of stops. Many folks think this means finding the shortest distance or fastest time between point A and point B, but this is often almost right.

D. Internet Of Things(IOT):

The web of things describes the network of physical objects i.e. “things” that square measure embedded with sensors, software, and different technologies for the aim of connecting and exchanging knowledge with different devices and systems over the web. Web of Things (IOT) is that the latest technology wherever we'll connect all objects and automatize them through this technology.

In IoT, there square measure essentially 3 operating bodies that square measure chargeable for the complete communication [Sensors, Controller, communication Medium]. IOT (Internet of Things) square measure typically outlined as a result of the network of objects with the assistance of embedded sensors.

These sensors collect data concerning their surroundings and send the information to the accountable through wireless networks. We've the ability to figure several things from one device through the online of things [3].

This paper presents some revolutionary remedies during this context. People are more interested to use such technologies which may efficiently reduce their time and energy. Automation is that the most demandable feature now each day. For this purpose smart dustbins are a way suitable approach it'll be helpful to develop a green and smart city. [1]

It's observed that always the rubbish gets accumulated thanks to irregular removal of garbage present within the dustbin. Here we've found out a replacement model for the municipal dustbins which intimates the middle of a municipality for immediate cleaning of the dustbin.

For this, we've to develop a totally automatic dustbin ready to which can first be able to detect the present status and connected to the local area network and servers by sending the info to the system about its current status.

II. LITERATURE SURVEY

[1] Solid Waste Management, Green Index Calculation and Route Optimization:

1. Theme: This paper aims to form use of a worth like green index using which one can assign scores to buildings to urge a far better idea of how well the residents are following the principles and regulations.
2. Proposed Method: The propose system enforces the concept of segregation at source in peoples mind the thought is to develop a rating system (Green Index) using which a worth are often assigned to buildings which represent the reach which the buildings follow waste segregation and other waste management practices.
3. Experiment & Result: The proposed system considers optimal routing for solid waste collection and transport which is extremely essential for cost, distance and time reduction. For enhanced efficiency of the vehicle routing system, proposed system focuses on improving the efficiency by modifying the routes taken by trucks for waste collection and site of bins along the route.

[2] Stock Solid Waste Collection as a Service using IOT- Solution for Smart Cities:

1. Theme: During this paper, an IOT based solid waste management system which enables garbage bin monitoring, dynamic scheduling and routing of garbage man trucks during a smart city.
2. Proposed Method: The proposed system involves monitoring and collection of solid waste from wet and dry garbage bins placed at different places during a particular geographic area.
3. Experiment & Result: The author developed an application supported android platform, during which real time information about garbage bin is shown in graphical form on map garbage collector person can go on to the place where there's got to empty bin. Also, driver can have active participation in whole system.

[3] Research on Survey on IOT Based Smart Waste Bin:

1. Theme: During this paper, there's a sensible waste bin to form the smart waste collection system.
2. Proposed Method: A sensible bin contains a gaggle of sensor that collects all the info from Bin for real - time status of Bin
3. Experiment & Result: After experimenting the result was effective waste collection, reducing pollution, reducing health threats and carbon. This current waste management are often developed by using better technology and by social forecasting.

[4] Optimization of Waste Collection in Smart Cities with the use of Evolutionary Algorithms:

3. Theme: During this paper, with use of evolutionary algorithm, Genetic Algorithm, best path for visiting the cans are often planned during a very short time.
4. Proposed System: It contains an optimal waste collection mechanism with the utilization of some IOT devices within garbage cans which show the extent of waste in them.
5. Experiment & Result: With the utilization of sensors, aimed to detect which cans are needed to be visited. By using this approach, effectively using the workforce/resources of the smart cities and making less holdup on the road.

[5] Justification of the Common Information Space Components for the Solid Waste Management:

1. Theme: During this paper, Information about collecting, transporting, sorting, processing, dumping and consumption of municipal solid waste is typically stored at the enterprise
2. Proposed System: Distribution of solid waste by organizations, engaged in sorting, processing, dumping and consumption of the solid waste and therefore the results of solid waste processing.
3. Experiment & Result: The result were almost 70-80% and the person, who manages solid waste-makes a choice to enhance the activities of organizations. And also will ensures "transparency" of data on SWM.

[6] Technologies for Segregation and Management of Solid Waste: A review

1. Theme: The paper mainly deals with how Geographical Information System and other technologies like RFID, GPS etc. can be used as a decision support tool for proper planning of solid waste management.
2. Proposed System: The paper mainly deals with how Geographical Information System and other technologies like RFID, GPS etc. can be used as a decision support tool for proper planning of solid waste management.
3. Experiment & Result: Incorporating technologies like RFIDs, GPS has provided real time tracking and monitoring of the system. Also using the web based solutions has helped the citizens to interact with the municipal authorities and also provided bi- directional communication which is very important for a good and efficient system to work.

[7] A Review of Solid Waste Management Techniques using GIS and Other Technologies:

1. Theme: This paper presents a review on technologies for segregation and management of solid waste, by using GIS(Geographical Information System).
2. Proposed System: It collects the waste from the point of generation as well as with the transportation of waste, waste treatment, segregation of the waste and finally disposing of the waste .It successfully does this by GIS technology as well as with other technologies too.

III. Experiment & Result: By getting the results from proposed system and applying algorithms, the proper collection of waste from where it was generated, transmitted through the shortest route to the waste treatment plant. And it required minimum amount of time to avoid the effects caused by the waste.

IV. PROPOSED SYSTEM

Proposed system involves observation and assortment of solid waste from wet and dry garbage bins placed at totally different places throughout a specific region. Figure one shows the design of the planned system. Garbage is collected by garbage collectors travel through a tough and quick route. For the desired route improvement outcome, the 3 algorithms thought-about were Dijkstra's, travel employee drawback and Genetic rule.

Dijkstra's rule finds the shortest distance between 2 points. it's possible considering the time quality, however the foremost disadvantage with the given drawback statement is its in-feasibility in covering U-turns, sharp edge road. In most of the cases, it will blind search that takes batch of it slow in process the result. In TSP rule if n bin locations square measure then there is $(n-1)!$ Chance to travel to every location specifically once. Typically this can be } often associate major issue in victimization TSP in planet computation is that the time quality that is $O(n!)$.

Genetic rule uses original population of solutionsto infuse new population of upper solutions supported a operate. In this, the foremost vital element is that the fitness operate that determines the probability of the body at intervals the new population and is tough to figure out. one location (coordinate) is known as cistron. Set of genes is known as as chromosomes. Selection is performed by considering chromosomes and supported fitness operate another set of locations square measure found that is known as pairing pool. At every location, 2 garbage bins (for wet and dry garbage) square measure placed that contain unhearable sensors to purpose level of garbage at intervals the bin. Microcontroller and RFID based mostly electronic equipment is used to send the rubbish bin standing to central cloud server.

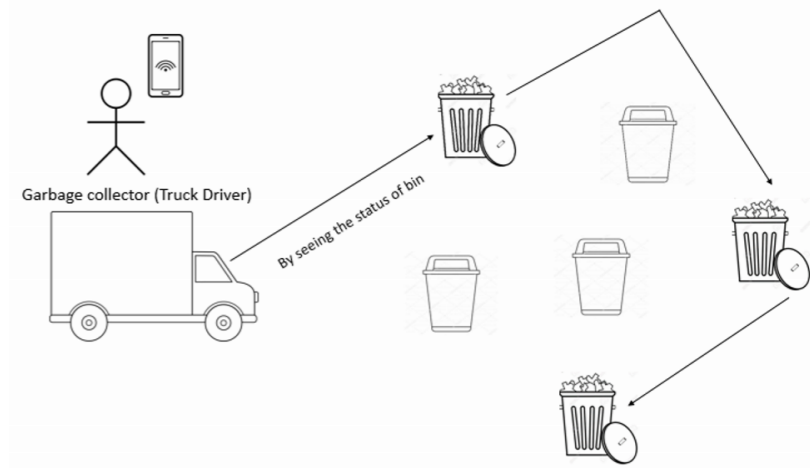


Figure 1: Route Tracking Functionality

Then module can receive real time standing updates from all the rubbish bins and endlessly show it on net application and additionally push the notifications on consumer side's (Municipal Corporation, dustman truck drivers etc.) mobile application.

Mobile application can show the vital time standing of garbage bins which might be used by trash collection truck drivers to purpose that garbage bins square measure full or probably to be full. Generation and show of dynamic shortest path from dustman truck to utterly crammed garbage bins. This module is in addition accountable to calculate shortest path from dustman truck to garbage bins.

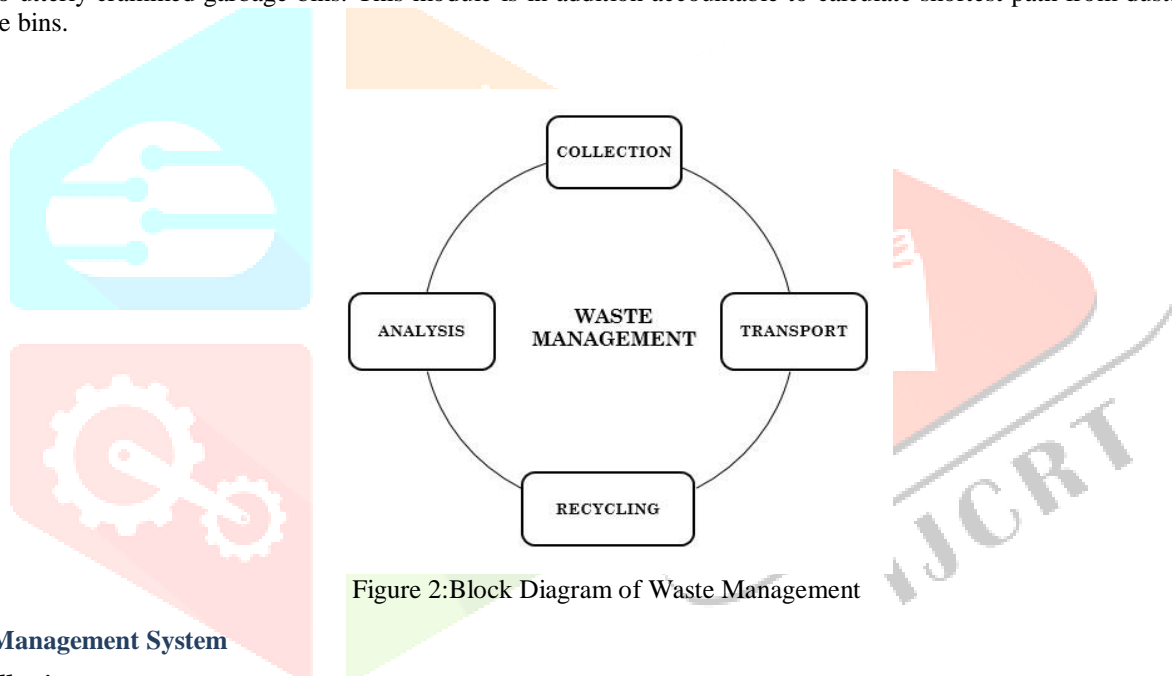


Figure 2:Block Diagram of Waste Management

Waste Management System

A. Collection

Collection means the objects or machinery by which waste is collected. For instance, Dustbin, Sewerage truck, Medical waste bin etc [3].Collection maybe a process during which waste are going to be collected by teamster then it'll be processed further. During this phase, two dustbins are going to be went to collect Garbage separately in Wet & Dry form. Collection may be a part of the method of waste management. It's the transfer of solid waste from the purpose of use and disposal to the purpose of treatment or landfill. Onlythe dustbin which is showing the status of full are going to be collected.

B. Transport

Transport means the choice of truck and route which is suitable for the transportation of waste from one place to another[3].Each and every time a vehicle are going to be selected and for transporting one optimized route are going to be taken into consideration.

C. Recycling

Waste will be going through the process of recycling that is totally different process for different type of waste like - agriculture, hazardous waste, dry waste, wet waste, medical waste.

D. Analysis

Analysis is done by which the whole data can analyzed [3].It is mainly done by using Algorithms like k-means, Dijkstra's algorithm. Using this analysis process, we will be getting data of bin status as well as pickup time. By this analytical data the collection process will again start by proper garbage waste, transporting and recycling it in a smart way.

V. EXPECTED OUTCOME

From the above survey we've obtained that garbage pickup in recent years was treated during a rather stagnant way. The propagation of sensors and actuators enable dynamic models also. This system is more efficient as it uses Internet of Things concept that have intelligent management of all garbage bins located throughout city with proposed features like resource optimization, cost reduction and as well time management.

VI. CONCLUSION

Garbage collection in recent years was treated during a rather stagnant way. The propagation of sensors and actuators enable dynamic models also. we've proposed a more efficient waste management system supported Internet of Things concept that have intelligent management of all garbage bins located throughout city with proposed features like resource optimization, cost reduction and also time management.

Waste Management overall may be a complicated process which contains segregating, collecting, disposing and waste treatment. It depends on several factors which aren't approached properly thanks to its poor implementation like inadequate waste infrastructure and waste dumping.

Green Index in an new term that's introduced that takes under consideration various parameters that are important for waste management and supported which an rating in provided to buildings. Supported which the building can consider approaches to enhance the waste management system and also increase their green index score.

Identifying the situation of waste bins should be the primary step for the solid waste management. Incorporating technologies like RFIDs, GPS etc. can provide real time tracking and monitoring of the system. Also using the online based solutions can help the citizens to interact with the municipal authorities and supply bi-directional communication which is extremely important for an honest and efficient system to figure.

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