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Garbage Segregation and Admininistration System using K-Nearest Neighbor Algorithm

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ABSTRACT: Today big cities around the world are facing a common problem, managing the city waste effectively without making city unclean. Here a waste management system is introduced in which each dumpster is embedded in a monitoring system that will notify the corresponding personal if the dumpster is full. In this system, it is also possible to separate wet and dry waste into two separate containers. This system provides an effective solution to the waste management problem. By implementing various Machine Learning Algorithms such as K-Means, K-Nearest Neighbor and Sorting algorithms, we can predict optimized path for garbage collection. The project contains details about how to establish a Garbage Administration System and its applications. With proper use of integrity of software and hardware, this idea develops a better waste control in populated cities and towns. This system will save money and time compared to the already available process of waste management and also improves the society cleanliness.

KEYWORDS**: K-means, K-NN, sorting algorithm, waste management, dumpster.**

I. INTRODUCTION

Today big cities around the world are facing a common problem, managing the city waste effectively without making city unclean. Today's waste management systems involve a large number of employees being appointed to attend a certain number of dumpsters this is done every day periodically. This leads to a very inefficient and unclean system in which some dumpsters will be overflowing some dumpsters might not be even half full. This is caused by variation in population density in the city or some other random factor this makes it impossible to determine which part needs immediate attention. Here a waste management system is introduced in which each dumpster is embedded in a monitoring system that will notify the corresponding personal if the dumpster is full. In this system, it is also possible to separate wet and dry waste into two separate containers.

The dry waste can be segregated further and can be reused and recycled. At present there are waste separation plants present on large scale, it is better to separate waste at collection level. By separating the waste during collection level, the quality of waste would be higher for recycling process. This system provides an effective solution to the waste management problem.

II. LITERATURE SURVEY

Need for managing large amount of garbage has led to lot of research. Largely there are two activities in managing waste. Those are segregation and garbage collection. Another paper studied which gave sufficient information intended for garbage in municipal areas that system consists of dustbin equipped with sensors and communication model for managing garbage collection schedule and garbage status. Smart dustbin has different specifications and most critical specification is segregation. Dustbin will have separate compartment for dry waste and wet waste. It will also have various sensors which are necessary for managing garbage collecting activities. Data collected from dustbin's sensors and garbage collecting vans will be stored on the cloud. This data can be analyzed from which corporation can predict the area in which garbage generated is in larger quantity compared to others. Using this information garbage collecting vans will be send to those locations frequently. This system has large scope. Municipal Corporation can use integrated system for managing waste. Integrated system will contain all the information about dust bins and garbage collecting vans in the city. When solving various problems integrated system can be useful.

III. RELATED WORK

The system intends to examine the already available waste management system and collect the data to create more optimised waste management system. The system alerts the person working on it. It will help the Municipal corporations, Government organisations also individuals who till date use manual ways for collecting garbage from dustbins. It also aims at minimizing the process time and the interference of humans in the processes. In today's growing world continuously managing the rapidly increasing waste is a difficult job. In many cities where numerous

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of dustbins are placed, keeping watch on all dustbins is difficult task. Human interrogation is not that efficient to manage huge number of dustbins. A proper framework is needed for that purpose. Efficiency of the waste management is not up to mark. If dustbin gets filled before time, it will be very hard to know the dustbin location. So, proper infrastructure is required to know location and collecting waste from dustbin which is developed as follows.

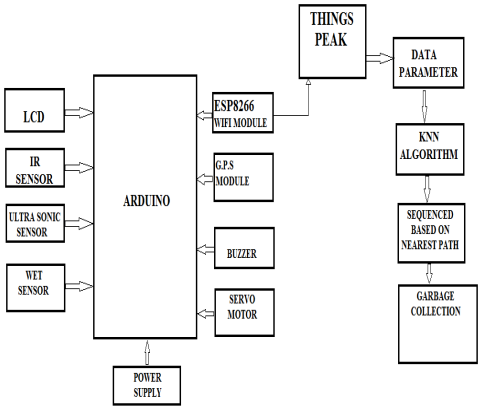

Fig.1. Architecture Diagram of Proposed System

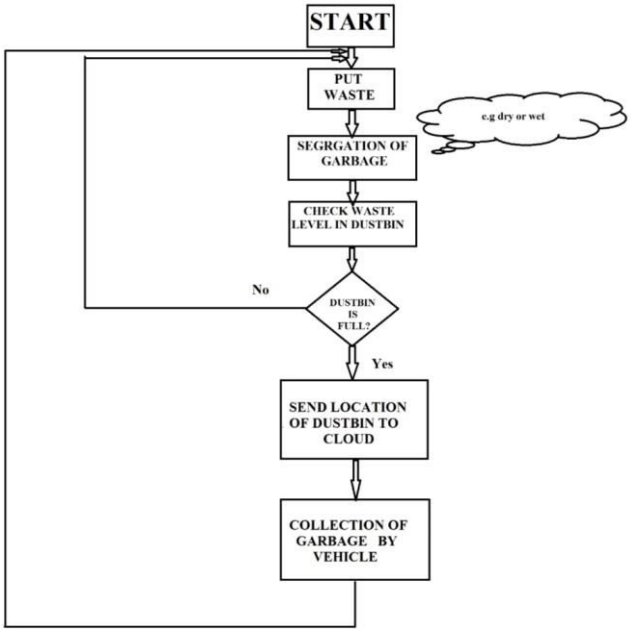

Fig.2. Flow diagram of Proposed System

The IR sensor detects the object or person in front of the dustbin, and ultrasonic sensor check the level of garbage inside the dustbin, if dustbin is full, buzzer will be turned on and alert message sent to authorized person. The LCD display is used to display the overflow of garbage in the bin. Wet Sensor is used for checking wet or dry waste. If either of the containers is full then an alert is sent to cloud. In turn, employees can clear the corresponding dumpster. All these sensors are connected to an Arduino Uno board. It can be used for controlling all mechanical setup based on current conditions.

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Fig.2 specifies the components of proposed system. Following are the details of the components used in the Fig.2.

- Ultrasonic Sensor: Measurement of level of waste in dustbin is estimated using ultrasonic sensor which is placed at the top of dustbin.
- Wet Sensor: Dustbin will have various types of waste. Hence to detect the kind of waste wet sensor is used.
- Arduino: The Arduino IDE is background framework for sensors in the system. It will connect different sensors which are working together to form the system.
- Servo Motor: The separation of waste is carried out in different compartments in dustbin. So, servo motor is used to separate waste in dustbin.
- ESP8266: ESP8266 is a Wi-Fi module. It is used for hosting the application
- IR sensor: Objects are detected using IR sensor.
- GPS Module: When bin is full location of the bin is sent to the cloud.
- Buzzer: Buzzer will be on when bin is full.

Fig.3 specifies the flow diagram in which as soon as the waste is thrown into the dustbin the waste is segregated into dry, wet. After the process of segregation of waste the level of waste in the dustbin is checked. If the dustbin is not full, more waste can be put in the dustbin. On the other hand, if the dustbin is full, the location of the dustbin is send to the cloud by using path optimization method and the status of the dustbin is updated in the cloud. This process is repeated for all the dustbins.

This proposed system works with the help of Ultrasonic sensors, Wet sensor. The ultrasonic sensor will sense the waste level in the bin as soon as the bin will start filling with waste, the ultrasonic sensor will measure the depth. The ultrasonic sensor is placed at the top of the dustbin and as soon as the dustbin starts filling it will emit sound waves. The transmitter will measure the level of garbage in the bin and emit a sound wave and the receiver will listen to the sound wave. In this way the distance between the ultrasonic sensor and garbage in the dustbin is calculated. When bin is full location of the bin is sent to the cloud.

This collected data is stored in the cloud. After storing the data in cloud, upon receiving the alert, the vehicle will go and collect the waste in the bin. To know the location of dustbin, Global Positioning System (GPS) is used. GPS will show location in form of latitude and longitude to user which will help to reach at dustbin in mean time. The dustbin will consist of two plates at a certain inclination. As soon as waste is kept on the area where the two plates meet, the wet sensor will sense the waste using the principle of the specific moisture level which is separating dry and wet things. The specific moisture level in this case is a function of water content. The sensor creates a voltage which is proportional to the specific moisture level and hence the water content in the waste is calculated and separated. The moisture level of a wet waste material will be more as compared to dry waste. Hence, like this the moisture sensor will segregate the waste as dry or wet.

When moisture level is calculated, then the waste on the two plates will be deposited according to moisture level in respective compartment. For this Servo motor rotates in which the waste is to be placed. If any or both of the chambers get full it will send notification to the cloud and garbage collector operator will come and empty the bin. This process is repeated for all the smart dustbins.

IV. PROPOSED ALGORITHM

K-Nearest Neighbor:

K-Nearest Neighbor (KNN) Algorithm for Machine Learning. K-Nearest Neighbor is one of the simplest Machine Learning algorithms based on Supervised Learning technique.

K-means algorithm:

Kmeans algorithm is an iterative algorithm that tries to partition the dataset into K pre-defined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group.

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Bubble sort algorithm:

Bubble sort, sometimes referred to as **sinking sort**, is a simple sorting algorithm that repeatedly steps through the list, compares adjacent elements and swaps them if they are in the wrong order. The pass through the list is repeated until the list is sorted.

V. PSEUDO CODE

The K-NN working can be explained on the basis of the below algorithm:

Step 1: Select the number K of the neighbours.
Step 2: Calculate the Euclidean distance of K number of neighbours.
Step 3: Take the K nearest neighbors as per the calculated Euclidean distance.
Step 4: Among these k neighbors, count the number of the data points in each category.
Step 5: Assign the new data points to that category for which the number of the neighbor is maximum.

The K-means working can be explained on the basis of the below algorithm:

Step 1; choose the number of clusters k.

Step 2: Select k random points from the data as centroids.

Step 3: Assign all the points to the closest cluster centroid.

Step 4: Recompute the centroids of newly formed clusters.

Step 5: Repeat steps 3 and 4.

VI. SIMULATION RESULTS

By implementing K-means, K nearest neighbor algorithm we can predict optimized path for garbage collection.
Input data is processed by clicking on machine_algo button on Navigation Screen shown in Fig 4.K-means algorithm performs clustering operation using pre-processed data then for each clustering K-Nearest Neighbor algorithm followed by sorting algorithm will be applied and optimal path computed as shown in Fig 5 to Fig 8.

Fig.4 Navigation Screen

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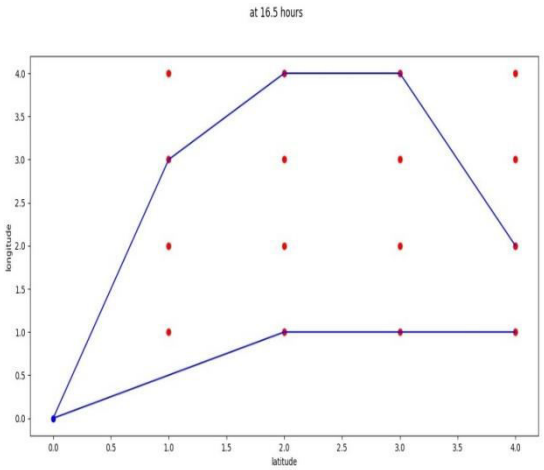

Fig.5 Normal path

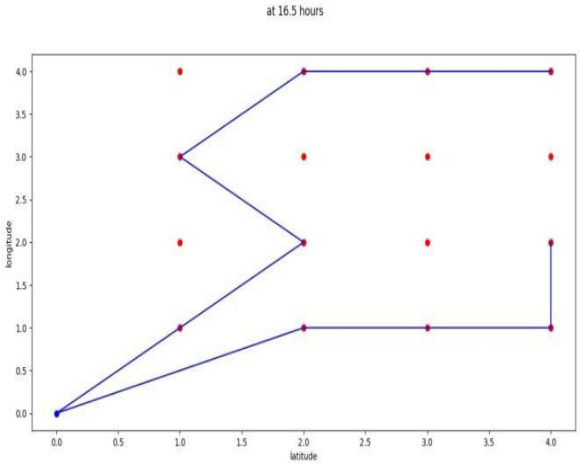

Fig.6 Optimized path

In the above Fig.5 normal path is shown for garbage collection and garbage collection vehicle moves to collect garbage from bins.

In the above Fig.6 optimized path is shown for garbage collection and garbage collection vehicle moves to collect garbage from bins. The optimal path is found by working every time the three closest points are compared and the smallest is taken as the next point in the optimal path. In large set of points, where each point represents a coordinate. Algorithm that calculates which points to visit in order to maximise the total distance travelled within a 16.5 hours time span. For each path between two points, the distance is obtained.

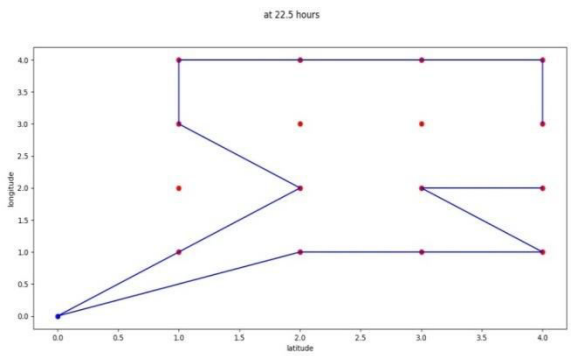

Fig.7 Normal path

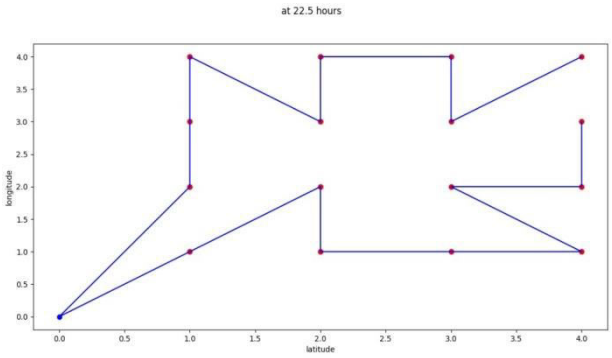

Fig 8. Optimized path

In the above Fig 7. normal path is shown for garbage collection and garbage collection vehicle moves to collect garbage from bins.

In the above Fig 8. normal path is shown for garbage collection and garbage collection vehicle moves to collect garbage from bins. where by every time the three closest points are compared and the smallest is taken as the next point in the optimal path. In large set of points, where each point represents a coordinate. Algorithm that calculates which points to visit in order to maximise the total distance travelled within a 22.5 hours time span. For each path between two points, the distance is obtained.

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VII. CONCLUSION AND FUTURE WORK

The project contains details about how to establish a Garbage Administration System and its applications. With proper use of integrity of software and hardware, this idea can develop a better waste control in over populated cities and towns. The curriculum of this project is just to focus on existing systems and solutions to improve the existing system. We have worked on path optimization technique to reduce fuel consumptions and provide better transition system in metropolitan cities. Peripheral work of project is based upon development of smart cities and overall development of our country in terms of hygiene issues.

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