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Smart Waste Management Using Internet Of Things

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Abstract- Solid waste management is one of the primary problems that India faces in recent times. It is noted that most of the solid waste across the roadside bins are overloaded because the waste is not collected in a periodic fasion. Hence here, we came up with a low cost, less power consuming waste management system using Internet of Things which will be applicable in areasthat are not economically sound. This idea enables us to collect the waste trash as and when the can is full or when the trash inside is decomposed compared to daily collection. So that there will be proper waste management across the areas bringing forth proper hygiene in order to render a pleasurable surroundings.

Keywords- Solid waste management, Internet of Things, garbage, economically, decomposed, hygiene.

I. INTRODUCTION

All over the world the interest in Smart Cities has been aggrandized and fostered by the need in search of effective remedies to the major challenges faced for the next years. When we speak about Smart Cities, Waste Management in a city is a real-time challenge faced by the public administrations especially by the government. As we all know, WASTE is defined as any material or substance in which something valuable is not being used or is not usable and represents no economic value to its owner, who is the waste generator. Depending on the physical state of the waste, they are classified into solid waste and wet waste. With the boosting up of population, the scenario of cleanliness and hygiene with respect to the waste management has become crucial and critical. Waste management includes planning, collection, transport, treatment, recycling and disposal of waste-

-together with monitoring and regulation. The existing waste management system, where the trash is collected from the streets, houses and other sources on quotidian basis, is unable to effectively manage the waste that is generated every now and then. In order to sort out such issues we have come up with a solution.

This paper is organized as follows: initially we have discussed about the Waste Management system. Then, we have an illustration of the system using a use-case diagram. Following it, we have discussed about the architecture of the proposed system. Then, we have a short discussion about the modules and the implementation of the system. Following that there is our NVP Algorithm with the screenshots of the final output. We have ended our work with conclusion and future enhancements.

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II. WASTE MANAGEMENT:

Waste is an indispensable issue, which needs to be handledin a smart way. Actually, we separate the waste at our homes to aid recycling by all chance. We have seen thatthe waste collectors come irregular to homes creating a troubleto the households. Due to such reasons, many of usunloadouroverloadedtrashcans in open spaces irrespective of the availability of local municipal dustbins. This in turn increases the land pollution thereby affecting the environment. The civilians want to have better ideas with lowered cost and having easy access on periodic trash collection. This proposed system aims to directTrash-Collectors by finding the minimum traversal path between the almost filled waste bins and gives the user, a route for collection of the trash. This system will consist of setting up of smart trash cans per area (as per requirements), which will bemade into usage using Internet Of Things. These smart bins will transmit data about its own status (the percentage). Proposed system provides an efficient and optimized routes to collect maximum waste with less cost by implementing our algorithm. This system can be globalized further for the enhancement of the governmental services.

III. USE CASE DIAGRAM

Figure 1 describes the main actors in smart waste management system are the employee, server and admin. The employee will checks the status of the bin and the server gets the location with the use of sensor, check the wastes occupied in the bin & get the accurate percentage of bin, the server will display the map view & area view and the percentage of the bin

the admin will update the server & change the status ofthe bin.

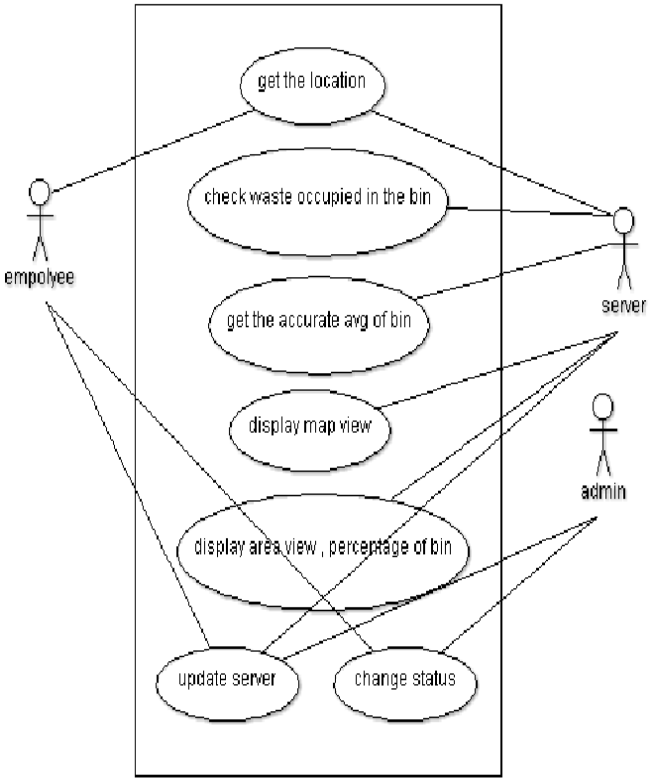

Figure 1: Use Case Diagram of the system

IV. PROPOSED SYSTEM

The proposed system is Smart waste management system using IOT which helps to the employee will checks the status of the bin and the server gets the location with the use of sensor, check the wastes occupied in the bin & get the accurate percentage of bin. The server will display the map view, area view & the percentage of the bin. Admin will update the server & change the status ofthe bin. Where REES52 is used to get the location of the bin & ultrasonic sensor is used to get the level of the bin.

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the waste bin in map with shortest path with bin placed on various locations.

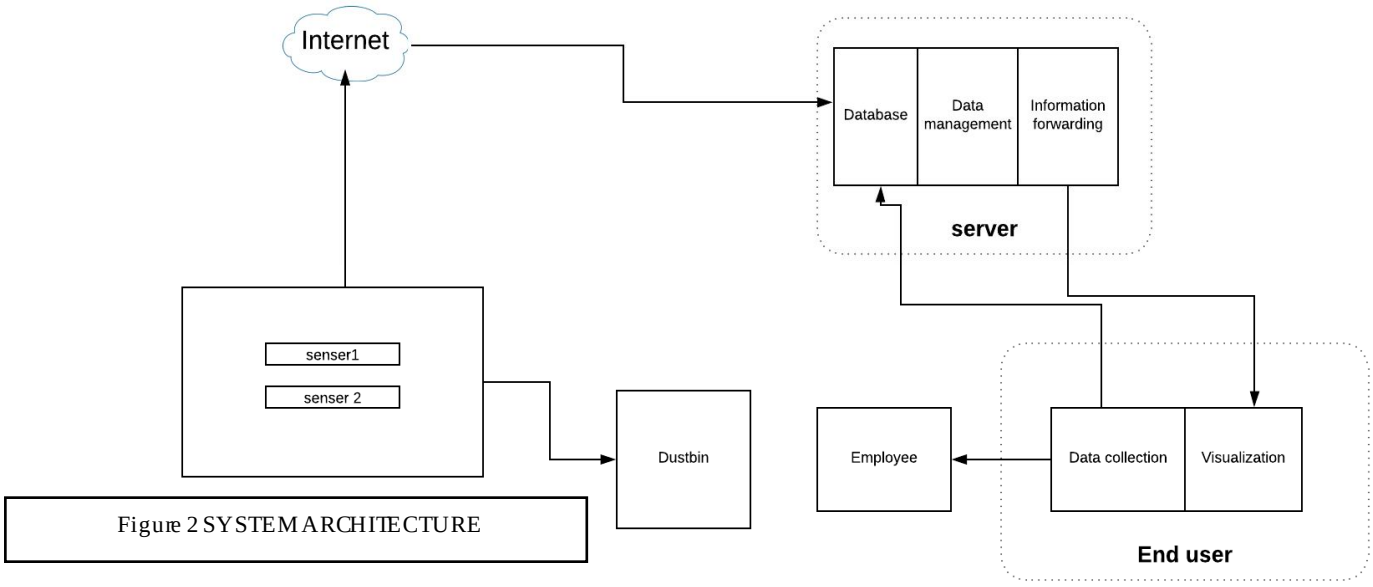

Figure 2 SYSTEM ARCHITECTURE

V. SYSTEM ARCHITECTURE

The Smart waste management system architecture (fig 2) consists of the sensing prototype, internet cloud, server and end user. The employee will check the status of the bin and the server get the location by using the sensor, check the wastes occupied in the bin and get the accurate percentage of bin. Server will display the map view, area view and the percentage of the bin. The admin will update the server and change the status of the bin.

VI. MODULE DESCRIPTION

The Smart waste management contains the following modules:

→Monitoring Application:

Check the bin status how much waste is occupied on the bin and check their location it shows

→Detect the level of the bin:

The ultrasonic sensor is used to measure how much waste is occupied in the bin and shows the amount of waste occupied in % displayed on the app.

→Get the current location of the bin:

It helps to show their bin accurate location displayed on the app it helps easy to find shortest path placed the bin in MAP with showed bin with % and density in Kg.

VII. IMPLEMENTATION

Smart Waste Management is implemented using Android and IoT (Arduino UNO) in Java. The java package consists of two activities. One is monitoring the trash level in the bin. Another one is pointing the accurate location of the bin in the map and drawing poly-line between various bin locations to view the shortest distance between the pointed

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locations. The UI designing is done in Android Studios. To use the Google Maps API, the key is purchased from Google. To plot the poly-lines a shortest path ADT is implemented.

VIII. NVP IMPLEMENTATION [Nearest Value Picker Algorithm]

```
intVer_n = adjM[0].length;
int[] srtdist = new int[Ver_n];
boolean[] nodes_added = new boolean[Ver_n];
for (intInd_v = 0; Ind_v<Ver_n;
Ind_v++) {
srtdist[Ind_v] = Integer.MAX_VALUE;
nodes_added[Ind_v] = false;
}
srtdist[Vrt_strt]
int[] prt = new int[Ver_n];
prt[Vrt_strt] = NO_PARENT;
for (int i = 1; i<Ver_n; i++)
{
intnrst_V = -1;
intsrtdist = Integer.MAX_VALUE;
for (intInd_v = 0;
Ind_v<Ver_n;
Ind_v++)
{
if (!nodes_added[Ind_v] &&
srtdist[Ind_v] <
srtdist)
{
nrst_V = Ind_v;
srtdist = srtdist[Ind_v];
}
}
nodes_added[nrst_V] = true;
for (intInd_v = 0;
Ind_v<Ver_n;
Ind_v++)
{
intdist_E = adjM[nrst_V][Ind_v];

if (dist_E> 0&& ((srtdist + dist_E) <srtdist[Ind_v]))
{
prt[Ind_v] = nrst_V;
srtdist[Ind_v] = srtdist +
dist_E;
}
}
}
```

EXPLANATION:

Consider the bins as nodes of a weighted graph. Initially, the weights of all the edges between the nodes are assigned as INFINITY. Then, the maximum levelled bin is chosen as the INITIAL_VERTEX. From the initial vertex using ADJACENCY_MATRIX of the graph, acquire the weights of the adjacent vertices.The weight is the distance between the INITIAL_VERTEX and the adjacent vertex. Select the smallest distance and make it CHILD_VERTEX to the INITIAL_VERTEX. Now, consider the previously added vertex as PARENT_VERTEX and repeat the above process. Finally, a TREE with all the nodes are arrived with least possible distance from initial to final node.

IMPLEMENTATION IN APPLICATION:

The TREE obtained is traversed to obtain the path. Whenever an edge is traversed in the TREE

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a line is drawn in the UI(as shown in Figure 5) for the convenience of the employee. The line is drawn using a POLYLINE() method.

IX. SCREENSHOTS:

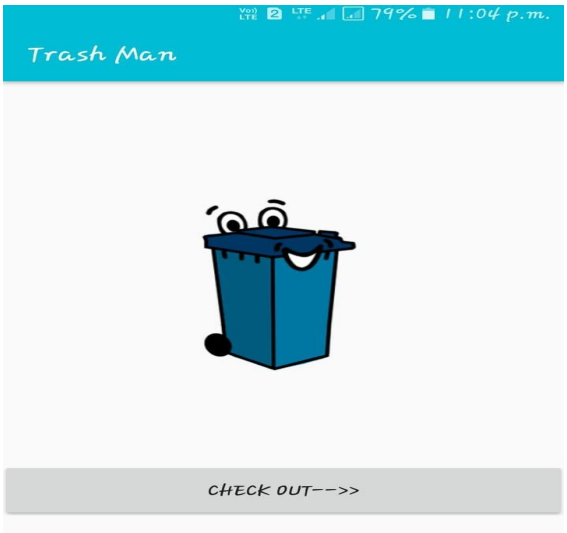

Figure 3: Initial page of the application

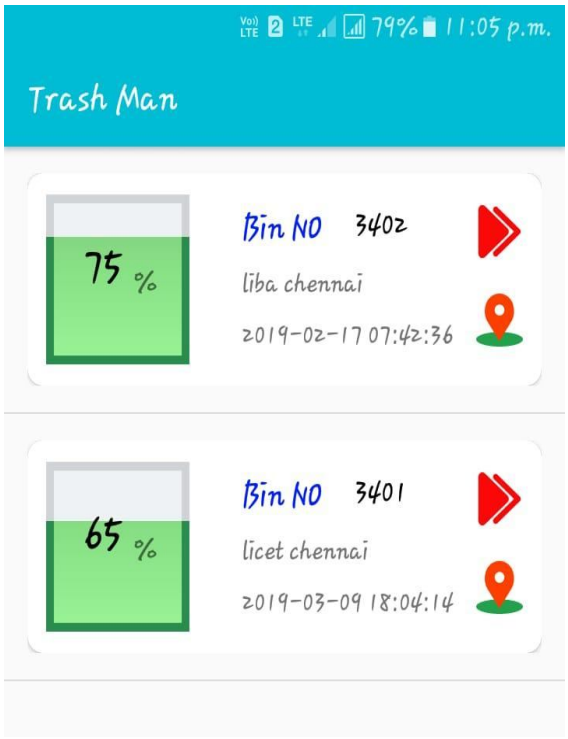

Figure 4: Bin Status Page

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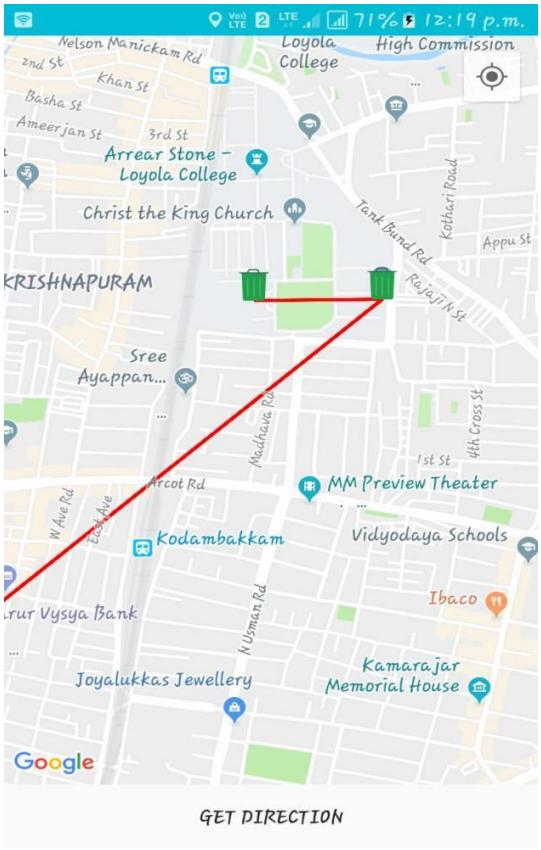

Figure 5: Location view using Google API

Figure 3, 4, 5 shows the UI output of the system. For which the APK of the application should be installed in the android mobile of the employee with necessary permissions granted. When the application is launched, it loads the status of the bins mean while Figure 3 will be displayed until it is fully loaded. Once loading of data is done, it shows the status of the bins as shown in figure 4. If the employee decides to collect the trash, he clicks the location icon. As a result the location of the bin is displayed on the map. If he clicks 'get direction' button, the poly-lines are drawn to connect various bins in a shorter way.

X. PERFORMANCE

The Smart waste management system is used to collect the wastes from the bin. The employee will check the status of the bin .When the bin is filled with trash to a certain level. The ultrasonic sensor detects the trash level and updates the data to the database for every 5 seconds. Accurate location of the bin is updated using REES52(Wi-Fi Sensor) to the mobile app. the bin location could be viewed on the map along with other bins. The server gets the location with the use of sensor. It will display the map view, area view with the percentage of the bin. The admin will update the server & change the status of the bin .The time is relatively reduced to half the time taken by the manual work. It does not tire the person undertaking the task as an employee has to only collect the waste. After collecting, module can check the status of the bin and update the server.

XI. CONCLUSION AND FUTURE ENHANCEMENT

Recently, based on the available ideas for the smart waste management systems that uses Internet Of Things, either they cost more or it is complex to be implemented on the point of view of a Smart-City. Out of those ideas 'The smart waste management system' (that is proposed here) is efficient to a great extend as it helps to collect waste with the usage of sensors. It can detect how much waste is occupied in a bin since it shows the accurate percentage, bin number and the exact location of the bin in mobile application. In future, this system will be used for smart city management to avoid overflow of waste in bin anywhere in cities. By this, hygienic smart cities can be brought into practice.

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XII. REFERENCE

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