II. Literature Survey

First existing system is the manual system. After that new technologies are developed today.The Internet of Things gives a practical view, via the Internet set of rules to a huge variety of real-life objects and ranging from a car to a teacup, to building, to trees in a forest. Its appeal is the ubiquitous generalized access to the status and location of any "thing" we may be interested in Paper [4] presents the handy design and functioning of a complete WSN stage that can be used for a range of long-term environmental monitoring IoT applications. The application requirements for low cost, the high number of sensors, fast deployment, long life- time, maintenance and high quality of service are considered in the specification and design of the platform and of all its components.

Machine to machine interaction is an important feature in IoT. In future, as maximum things are going to be automated, machine to machine interaction must be accurate. Internet of things deals with M2M interaction continuously.

In [2] The system implements the feature of M2M interaction as the sensing, processing, storing and sending an alert in our system is done by M2M interactions. The paper[5] was proposed to design an electronic system, in order to provide a solution to the irregular waste disposal system. The designed system makes use of biosensor sensor, weight sensor and height sensor to detect overflow of the waste in the dust bin and the extent of pollution caused by unwanted toxic gases from the bin. These sensors are further fed to the controller. which would help the GSM module to send the notification to the respective authority regarding the status of the bin. The objective of the paper is to provide a solution for the waste management system. The technology which is suggested in this paper, achieved effective waste management system where sensors unit are used for sensing, a microcontroller for controlling and for communication we have used GSM module. Finally, for operating the system, it requires power for that we have used solar energy system.

Smart Cities constitute the future of civil habitation. Internet of Things (loT) enables innovative services exploiting sensor data from sensors embedded in the city. Waste collection is treated as a potential lot service which exploits robustness and cost efficiency of a heterogeneous fleet. In [6] paper they propose a dynamic routing algorithm which is robust and copes when a truck is overloaded or damaged and need replacement. Few take care of By incorporating HCTs we achieve reduction of the waste collection operational costs because route trips to the dumps are reduced due to the high waste storage capacity of these trucks. Petersburg, Russia. The models demonstrate consistency and correctness.A tremendous growth in the rate of the population which implied a necessity of economical urban development plans. Now using emerging technologies and vital approach, smart cities are developing all over the world. Without a smart waste management system, any smart city is incomplete. The paper [7] represents the application of the proposed model of Garbage Management using the Internet of Things for Smart Cities‖ in organizing the garbage collection system of residential or commercial areas. In the proposed system, the level of waste material in the garbage bin has been detected with the help of ultrasonic sensor and it will continuously communicate to the authorized control room through GSM module. Micro-controller is used to interface the sensor system with GSM system. A GUI is also developed to supervise the desired information related to the garbage for various selected locations. This system will help to assure a healthy and hygienic environment.

III. Proposed System

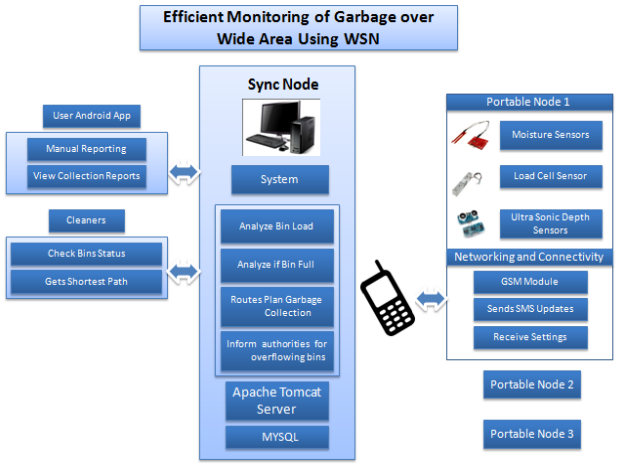

Figure 1 - System Architecture

Fig. shows that architecture of the proposed system. The user of our systems is Civic Authorities, City Inhabitants or Garbage Cleaners. As city inhabitants throw garbage into the weight of the bin increases. It can be used to analyze if the bin is actually full. We use a load sensor that would provide us with the current load in the bin. Throwing garbage also results in the garbage bin is full. This results in an increase in the height of the bin contents. It can be analyzed by the use of ultrasonic sensors that would give updates about the current condition of the bin. A capacitive moisture sensor is used to measure the moisture content (MC) in solid waste and odor correspondingly. For sorting of dry and moist garbage.

The data generated by the sensors on nodes must be sent to the server at regular intervals. For this, we include a GSM module into the system that would send

SMS to the server at periodic intervals. It would also be used to update any settings on the nodes Depending upon the conditions of the garbage bins, they would have to be collected by the cleaners. We aim to provide an optimal route for the same purpose. This will make the collection system more efficient. In case a bin overflows, authorities must be informed instantaneously. This would be achieved by sending SMS or email to concerned authorities for further action. As cleaners clean the bin, they would report its status as collected. This would help generate reports for authorities and users to check if garbage bins are regularly emptied. As a part of the objective, we also include manual reporting of filled garbage bins as an option to users. They can report the system of overflowing dustbins that are un-automated and thus can be included in planning garbage collection routes. This would also help integrate currently placed bins around the city.

Design consideration

- **Sensors** - Here we are using ultrasonic depth sensors, moisture sensor and load cell sensors are embedded in the garbage bin to continuously monitor the condition of the dustbin like checking the height weight and moisture present in the waste or in the dustbin.

- **Arduino Uno Board** - This board is used to receive data from the sensors. Process received data and the relative information will be sent to the respective authority where the server is present.

- **GSM Module** - GSM module is used to send and receive the information about the status of the waste in the dustbin over the distance.

- **Database** - It is used to save the data received from the garbage unit and if required data can be retrieved.

- **Mobile Application** - It will contain cleaners' information in that particular area and this application will contain the sub module to send and receive the alert. The nearest cleaner will be informed so that it avoids overflow.

IV. Algorithm Used

1. ID 3 ((Iterative Dichotomiser3) Algorithm

ID3 builds a decision tree from a fixed set of examples. The consequential tree is used to categorize prospect samples. The leaf nodes of the decision tree contain the class name whereas a non-leaf node is a decision node. The decision node is an attribute test with each branch (to another decision tree) being a possible value of the attribute. ID3 uses information gain to assist it to make a decision which attribute goes into a decision node.

Algorithm:

1) Establish Classification Attribute (in Table R)

2) Compute Classification Entropy.

3) For each attribute in R, calculate Information Gain using classification attribute.

4) Choose feature with the peak gain to be the next Node in the tree.

5) Remove Node Attribute, creating reduced table RS.

ENTROPY:

$$H(X) = -\sum_{i=1}^{n} p(x_i) \log_b p(x_i)$$

2. Travelling Sales Person

The TSP request the following question: specified a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city exactly once and returns to the origin city? It is an NP-hard problem in operations research and theoretical computer science.
The Branch and Bound strategy partition a difficulty to be solved into a number of sub-problems. It is a structure for solving a succession of sub-problems each of which may have several probable solutions and where the solution chosen for one sub-problem may affect the possible solutions of later sub-problems.

Suppose it is required to minimize an objective function. Suppose that we have a method for getting a lower bound on the cost of any solution among those in the set of solutions represented by some subset. If the top solution originate so far costs less than the lower bound for this subset, we need not discover this subset at all.

Algorithm:

Let S be some subset of solutions.

L(S)= a inferior bound on the price of any solution belonging to S.

Let C=cost of the best solution found so far

If C≤L(S), there is no need to explore S because it does not contain any better solution.

If C > L(S), then we need to explore S because it may contain a better solution.

V. Conclusion

The proposed system, keep away from overflowing of garbage and classification of dry and wet garbage from the bin in the suburban area which is previously either loaded manually or with the help of loaders in traditional trucks. labor-intensive loading takes time and reduces the productivity of the vehicles and manpower deployed. In addition, manual handling of waste poses a hazard to the health of the workers as the waste is highly contaminated. This method will help in keeping the city clean and healthy. In future when the concept of smart cities would flourish then this model will be the most efficient way of Garbage management.

VI. Future Scope

This system is useful for municipal corporation. Improves environment quality. Sensor based waste collection bins. Multipurpose smart street bins. Overflowing garbage should be collect properly autonomously .It will be helpful to municipal corporation.

Dustbin along location tracking will be implemented.

VII. Acknowledgment

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