A Review on Solid Waste Management using SmartBin

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ABSTRACT: Urban India is world's third largest waste generator, hence proper planning is required to dispose the trash. Trash in waste containers are not collected on time which leads to garbage over flowing. It has serious hazardous problems on the environment leaving the place untidy and unhygienic. There has to be proper management techniques for efficient garbage collection. This paper describes the waste management techniques using technologies like GIS, GPS, RFID, etc. It would be easy to calculate the fill level estimations using these Techniques, according to the input of smart system efficient route can be decided for garbage collection and would help to reduce the human intervention in waste management.

KEYWORDS:GIS, GPS, RFID, Solid Waste, RFID.

I. INTRODUCTION

In India due to modernization the amount of waste generated is increasing day by day. In the era of technology, new techniques are applied in almost every field but the basic areas of sanitation are left out. In most cases the garbage collection is still carried out in same traditional ways. Waste can be categorized such as mineral waste, organic/inorganic waste, radioactive waste, biomedical waste, agricultural domestic waste, etc. It is very difficult to segregate various types of waste. All the waste ultimately is being dumped into municipal bins, irrespective of its type. The waste collection centers from where it is collected by the municipalities to be further thrown into landfills and dumping areas. There are various ill-effects caused due to untreated organic waste which leads to diseases. Non bio-degradable E-waste causes landfills. Radioactive waste has many health hazards. Improper disposal and management of solid waste affects all aspects of the society, namely physical, economical and environment. Cleaning of garbage bin at proper intervals is the necessary solution but manually monitoring them at regular intervals is a tedious job. Ignored waste in the surroundings invites flies, mosquitoes, rats etc. This leads to unhygienic conditions. Animals grazing on this waste or near such areas can pass on diseases through food chain. The waste which is not collected can clog storm water run-off leading to formation of sluggish and stagnant water bodies. These water bodies then become breeding space for disease causing bacteria. Waste thrown near water bodies leads to contamination of water. To suppress the increase in waste we need to develop an efficient and robust solid waste management system that can uplift the present system as well as be time and cost effective.

II. LITERATURE REVIEW

A. SMART AND WIRELESS WASTE MANAGEMENT AN INNOVATIVE WAY TO MANAGE WASTE AND ALSO PRODUCE ENERGY

The model proposed in this paper [2] helps to identify the level of garbage using ultrasonic sensors which will be interfaced with ultrasonic conditioning chip and it will be located on the top of dustbin. 4 load cells were used in case if ultrasonic sensor fails to give input. Input from sensors will be processed by the microcontroller using signal processing algorithms and the processed input will be sent municipal office through SMS using a GSM modem so they will get SMS to pick up the waste. GPS module is installed to detect the location of dustbin.
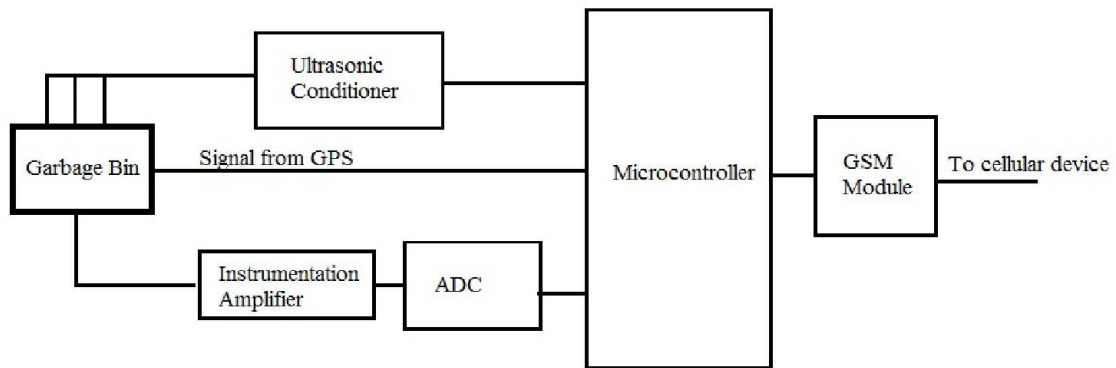
Fig. 1 Block diagram for Smart Garbage Bin

[2]Also describes the separation of plastics from solid waste which is a tedious and difficult task for Municipal Solid Waste(MSW) [2]Uses Near infrared (NIR) reflectance spectroscopy for separating five types of plastics namely polyethylene terephthalate (PET), high density polyethylene (HDPE),polyvinyl chloride (PVC), polypropylene (PP) and polystyrene. But it does not detect the black colour plastic bags and PET bottles with plastic caps. After separation of Plastics from solid waste intends to use Biogas plant.

Biogas is naturally extracted from organic waste. Biogas helps to produce electricity and heat. An alternative to this is the up gradation of biogas to bio methane, which can be supplied to natural gas supply. The by-product of food waste is to be subjected to process in which the materials are heated up to 70 degrees for an hour to the kill bacteria. An agitator is mixed into a homogeneous material. This process can be repeated every hour. When a uniform mixture is obtained, then the material can be pumped into a fermenter through a macerator in a sealed atmosphere, which ensures that no impurity enters it. Bacteria break down into individual enzymes and other components, which results in biogas. The advantage of this process over other process includes low energy expenditure and higher level of efficiency. All organic acids get decomposed during fermentation process. The nutrients remain intact and can be better absorbed by plants.

B.   SMARTBIN: "SMART WASTE MANAGEMENT SYSTEM"

[3]Presents a system to detect a fullness of a dustbin using sensors and wireless mesh networks reducing duty cycle. Collected data is analyzed to obtain litter bin utilization and seasonality information with which contractors are able to make better decisions.
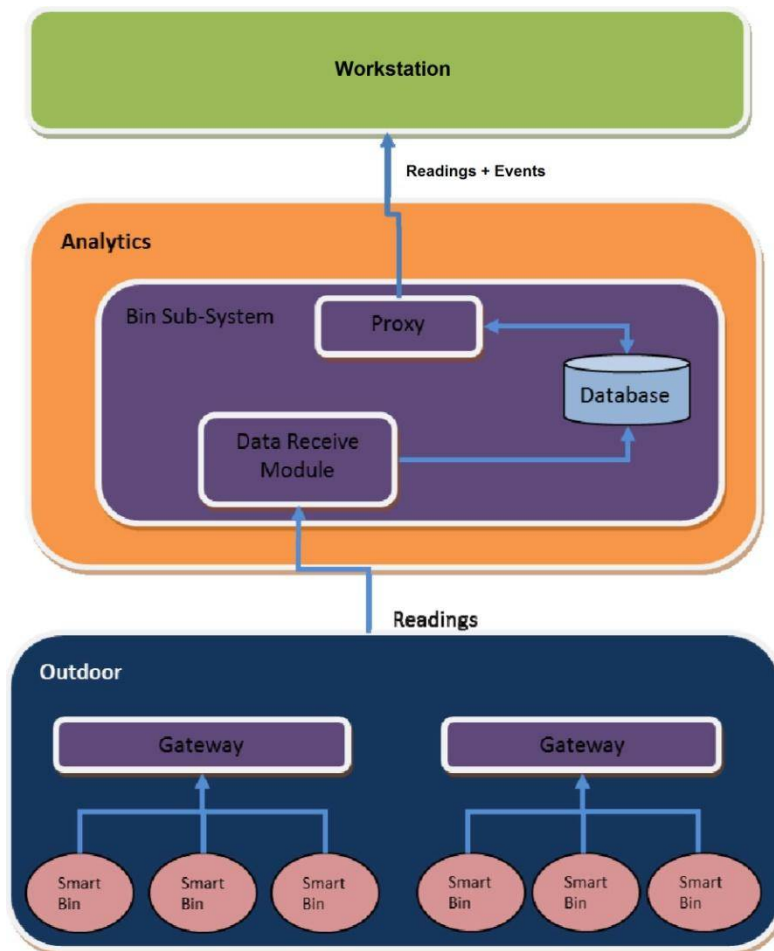
Fig. 2 SmartBin system architecture

The architecture shows the gateway nodes which will forward the data received from sensors to backend server via an internet connection. Wireless communication model is attached to the sensor node which has a low power and low bandwidth and the sensor node was deployed with a less battery power. At the backend the analytics module collects, processes and compares against rules and generates events upon exceeding threshold.

Subsystem sends information to workstation. Each bin will be visualized using a graphical user interface. Upon receiving the information the gateway forwards the data to backend server. The sensor node was also equipped with Global Positioning System (GPS) to obtain location information and wireless mesh network was implemented at the nodes to extend the coverage of Smart Bin. Total 11 Smart Bins were deployed in the area, duty cycle and this technique was employed to maximize the operational time of the system. Data of six months was collected, the average delivery ratio of a system is 99.25%.

C.   *VERSATILE SCALABLE SMART WASTE-BIN SYSTEM*

[4]Waste bin consists of the sensing units, an active RFID tag for data aggregation and transmission. Also they have provided a protective enclosure for sensors and RFID tags .Ultrasonic sensors are used as they provide most suitable solution. The waste-Bin system interacts with an active RFID reader. Ultrasonic Sensor provides distance of nearest object since waste is irregular in shape thus objects may occupy the bin space in different arrangement. But there is difference between the highest level of the bin and the actual fill percentage of it and this result can be obtained by

considering combination of two sensors such that their areas will not overlap during detection. Number of sensors depends on the size of bin. [4]

The proposed system consists of two units:

1) The Field Unit: It is mounted on the bin and has an RFID tag, ultrasonic sensors and external power source.

2) The Mobile Sink: It consists of RFID tags and a small-form-factor computer.

The RFID reader reads the tags and collects the information. The application on the mobile sink is responsible for receiving the information from the field units and, if needed it forwards this information to upper management systems. Thus we can conclude that the fill-level estimation method using ultrasonic sensors provides accurate results.

III. METHODOLOGY

Solid waste management in Pune is done by collecting, transporting, storing, processing and disposing of waste from bins that are located at different locations. Some people also burn the garbage in the open. Hotel trucks, bulk refuse carrier and *ghanta* trucks that are used for the collecting solid waste across city [1]. The collection routes are usually predefined, according to routes waste is collected and transported using garbage trucks and mini tempo to storage stations. Almost 600 vehicles are engaged every day of various capacities for waste management. PMC (Pune Municipal Corporation) has combined an integrated approach with a decentralized waste management strategy that encourages NGOs and private sector participation. At transfer stations the waste is segregated manually by PMC or SWACH (Solid Waste Handlers and Collectors' Society) workers and transported to dumping stations. Due to improper and incomplete information about the waste segregation affects the environment and the garbage dumping process. There is no system designed for monitoring the bins or keeping track of the garbage collecting vehicles and thus lacks coordination between garbage authority and garbage vehicle drivers. There is also a lack of communication between local people and Municipal Corporation about the problems related to garbage. The bins present in the nearby locality are not regularly collected which leads to overflowing of bins. Most of the solid waste generated is dumped into the landfill, dumping sites, and yards or outside the city. As these sites are not covered, it becomes breeding space for rats, flies and other diseases. The PMC has one waste processing plant at *Hanjar* working at full capacity. Around 1,500 to 1,800 metric tons of waste is generated in the city every day of which 1,000 metric tons is processed in *Hanjar.* The total e-waste generated in Pune is about 2584 tons and in PimpariChinchwad region is about 1032 tons [1].

IV. CONCLUSION

With the increase in population and the lack of good waste management system, collection of solid waste is becoming a major issue. The models which are described in this paper are innovative and solves the problem of overflowing garbage bins using latest technologies like RFID, GSM, and GPS but has many drawbacks such as lack of accurate real time system and analysis of collected garbage and visual representation of garbage collection.

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