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Survey on Smart City Platform Development through Waste Management

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***Abstract* - The global challenge of ensuring smart city in growing cities has inspired on implementing solid waste management. Clean and pure environment helps people to lead a healthy life. It is becoming a critical issue due to rapid increase in population. Appropriate solid waste management systems are important for improving the environment and the well-being of residents.In the Present Scenario we have seen that there are different waste boxes and over-weight trash cans in the urban gatherings and the area territories that are flooding an immediate aftereffect of wealth waste. Now it is very necessary to create an Internet of Things (IoT) based waste management structure to make our city clean and neat. This paper is a survey on all possible way to implement solid waste management.**
***Keywords:*Zigbee, ATmega328, 3-R's, LBS**

I. INTRODUCTION

One of the main concerns with our environment has been solid waste management which in addition to disturbing the balance of the environment also has adverse effects on the health of the society. The detection, monitoring and management of waste is one of the primary problems of the present era. The process of making the things automatic is being exploited in almost all the major fields of life. Solid waste which is one of the sources and causes of environmental pollution has been defined under Resource Conservation and Recovery Act as any solid, semi-solid liquid or contained gaseous materials discarded from industrial, commercial, mining or agricultural operations and from community activities.

The type of wastes which constitute environmental pollution and which this work emphasizes on is domestic refuse consisting of degradable food wastes, leaves, dead animals and non-degradable ones such as plastics, bottles, nylon, medical and hospital wastes, generated in households, hospitals, industries and commercial centers . In other words, solid wastes may be defined as the organic and inorganic waste materials produced by various activities of the society and which have lost their value to the first user. Waste bin is shown in fig 1.

The Internet of things (IoT) is the arrangement of physical devices, vehicles, structures and diverse things embedded with equipment, programming, sensors, actuators, andframework organize that enable these things to accumulate and exchange the data. By using the concept of IoT, an automatic waste management can be proposed.

Fig. 1 Unmonitored trash bin

II. METHODOLOGIES

A. Smart Monitoring and Controlling Hut

In this approach, the overall system of waste detections divided into four subsystems viz Smart Trash System, Vehicle System, Local Base Station and Smart Monitoring and controlling Hut is shown in fig 2.

This architecture consists of four sub-systems and the main system on which the others work is the Smart Trash System which has the functional unit called as Smart Trash Bin. It consists of ultrasonic and load sensors and zigbee. Sensors are used to detect the load as well as the level of the waste in the Smart Trash Bin. Whenever the Smart Trash Bin gets filled, the sensors get activated and generate a high signal which is transmitted through the zigbee. This transmitted signal is received by anotherzigbee tag which is placed in the local base station.

The zigbee in local base station receives the signal and then the signal is sent to monitoring cum controlling hut over the internet. At this monitoring cum controlling hut site, the information and status of the Smart Trash Bin is displayed. The details like weight and status of the filled Smart Trash Bin are displayed on the Smart Monitoring and controlling Hut Interface.

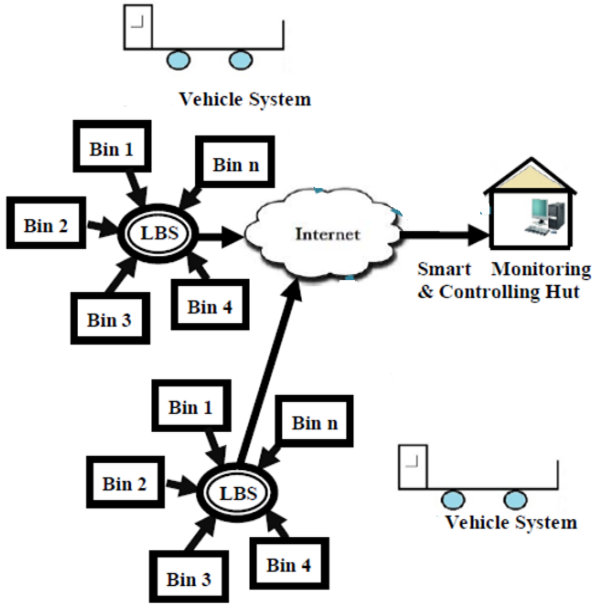

Fig.2 Architecture of Automatic Waste Management System

The Smart Monitoring and controlling Hut then sends the information signal to the Vehicle System. Once the job detail is received by the vehicle, the person in the vehicle moves to the spot and disposes off the waste from that Trash bin.

B. Microcontroller Based Monitoring System

In this method, the dustbins are related and associated with a microcontroller based structure having IR remote systems that are enclosed by a central system which exhibits the present status of trash, on compact web program with HTML page through Wi-Fi. From now on the status will be updated onto the HTML page. The genuine bit of our wander depends on the working of the Wi-Fi module, which is especially basic for the part of the structure. The rule purpose of this wonder is to decrease the human attempts and to make the tasteful and genuine elbowroom of the canisters and a while later to avoid the undesirable conditions and to save the benefits by applying the method of 3-R's (Reduce Reuse Recycle) close by the overhaul of an astute city vision

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These dustbins are interfaced with scaled downscale controller based structure that are related to an IR Sensors and RF modules related with it, here the IR sensors perceives the measure of waste canisters and send the signs to microcontroller and comparative signs are encoded and sends through RF transmitter and it is gotten and decoded by RF beneficiary at the Central System and an Internet affiliation is enabled through a LAN, which is connected from the modem and the information are secured to the cloud server[2]. The data has been acquired and separated by the respected forces and the brisk moves that are made and ideal courses of action and security are ensured to make the city clean.

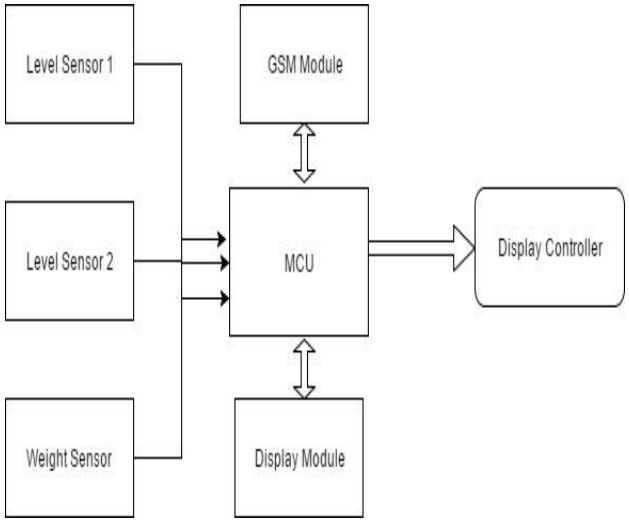

Fig. 3 Monitoring System

C. The SmartCollect Project

Romania has a level of waste collection well below the EU average and by 2020 should reacha target of 50% regarding the preparation for reuse and recycling of waste. Along with the public's lowawareness regarding the necessity for selective waste collection, the lack of waste collection systemsrepresents an obstacle in achieving the target. Currently, human operators are still used in separatewaste collecting systems for performing tasks associated with

Paper and cardboard sorting and weighing. Also, the operators transport the paper or cardboardto the baler, operates the bale press and the resulted bales are stored, etc.

1. Unloading containers of plastic and glass recipients or aluminum cans;
2. Large and small WEEEs identification, weighing, transport, transfer and storage.

To increase the level of waste collection, it is necessary to obtain a fully automated waste collecting system. The separate waste collection solutions currently implemented in Romania are not fully automated or ready to be integrated in the smart city infrastructure.

D. Sensor nodes

Sensor nodes are simple devices that can measure the emptyspace in the trash bins using ultrasonic sensors, and

latertransmit the data to the backend. Wireless communication isone of the key aspects of the design of the sensor node, andthe overall topology of the system. There exists a numberof different technologies, that offer high bandwidth (Wifi),long range (GSM/CDMA), low power (Bluetooth low energy(BLE)), or mesh-network capabilities (ZigBee).

The block diagram shown in fig 4 gives the clear idea on three levels process of implementing waste management.

Gateway: Gateway is the physical unit that receives the data packages from the nodes and forwards it to the backend system.

Background: The backend consists of a cloud-based app that receives data from the nodes using the MQTT (Message Queue Telemetry Transport) protocol. MQTT is lightweight and requires limited network bandwidth, making it optimal for such short messages.

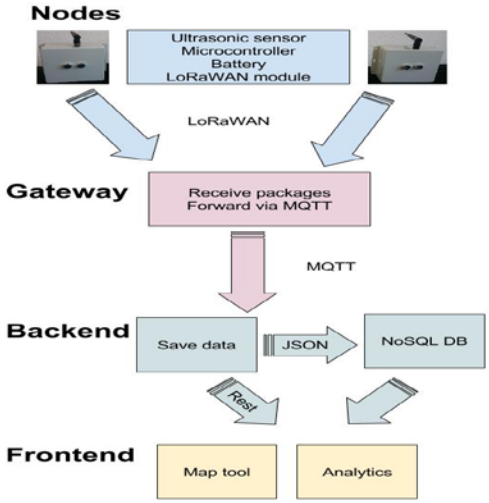

Fig. 4Block diagram

Frontend: Finally, there is a secure and web based front-end that allows the users to access a map tool as well as overview screens. The front-end is designed to provide an accessible interface for mobile devices as well as computer screens.

E. Moisture sensor and ATmega328 Microcontroller

Fig 5 shows the different components that are used to implement the smart waste management system. The working of the system may be described in three phases as explained below.

1. Phase I

1. Garbage bins located all-around the city will be fitted with ultrasonic sensor which senses garbage level in the bin and sends it to ATmega328 microcontroller.
2. ATmega328 uses the information received from sensor, checks if it's above upper-threshold level and sends it to authorized number using GSM/GPRS modem.
3. The number present at the waste management centre receives information from microcontroller and displays it on phone screen.
4. If garbage bin is emptied, microcontroller sets itself for continuous monitoring for next information on fill-levels.

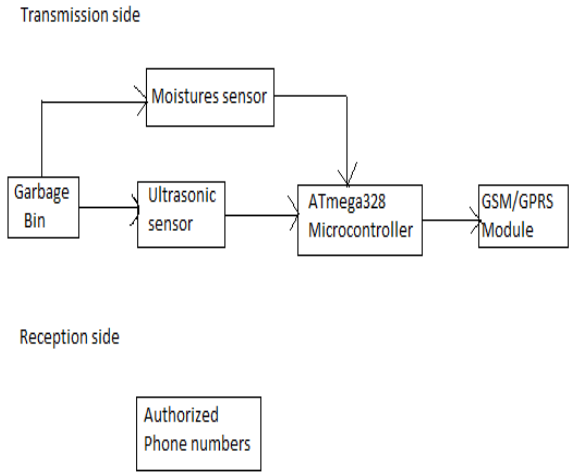

Fig. 5Block diagram for smart waste management system.

2. Phase II

1. If a person throws the garbage on Open Street (around the dustbin) instead of in the dustbin, the ultrasonic sensor which is fitted outside the dustbin senses it.
2. This information is collected and processed by the microcontroller and the siren is activated.
3. The siren is made to blow until the garbage is lifted from the street and put in the dustbin. Once the garbage is lifted from the street and there is no garbage around the bin, the siren stops blowing.
4. The microcontroller sets itself for continuous monitoring of next information.

3.Phase III

1. Most of the times even if the dustbin is not full, it may start stinking causing highly irresistible smell in the locality/city.
2. This is mainly due to the wet waste present in the bin. This issue can be addressed by fitting a moisture sensor.
3. The moisture sensor senses the moisture content in the garbage and if the content is more than a threshold level, the SMS is sent to the number present in the waste management centre.
4. The dustbin is then addressed even if it is not filled in order to prevent the stinking smell. Once the bin is addressed the microcontroller sets itself for next cycle.

III. CONCLUSION

This surveys focus is on more energy-efficient IoT as an enabler of various applications including waste management. Specifically, it aims to present a large set of models dealing with the efficient waste management and special attention is taken on the waste collection.

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