Waste Management Using Internet-Of-Things (IoT)

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Abstract- *Waste management is one of the primary problem that the world faces irrespective of the case of developed or developing country. The key issue in the waste management is that the garbage bin at public places gets overflowed well in advance before the commencement of the next cleaning process. It in turn leads to various hazards such as bad odor & ugliness to that place which may be the root cause for spread of various diseases. To avoid all such hazardous scenario and to make the cities greener, safer, and more efficient, Internet of Things (IoT) can play an important role. The recent technologies provide radical solution and effective way to handle these problems. In this work wireless sensor network (WSN) and internet of things (IOT) technologies are used to manage the usage of the waste containers. This paper presents real time monitoring of the container contents using sensors, displaying the result in the website and the sensed contents are analyzed to determine the optimized distribution of the containers.*

Keywords- wireless sensor network, internet of things, waste management, smart bin.

I. INTRODUCTION

Recently, human kind in large cities is suffered from serious health problem due to large amount of waste accumulation result from the activities in populated cites. Therefor a real- time waste management system is indispensable for monitoring and controlling accumulation of waste. Ultrasonic sensors are used to sense the waste level of monitored container for tracking the status of the waste containers. The sensed data is transmitted to Arduino UNO board using Zigbee module [1] that control the transmission Using ESP-Wi-Fi module to the web site through the TCP/IP protocol. The web site displays the state of waste level in the containers. The displayed status shows either containers get full or not, which helps for taking action to dispos the waste through sending SMS to the garbage truck.

II. RELATED WORKS

The System that are designed to reduce resource like human effort, time and cost by using intelligence waste management system. System consist of three subsystems are smart bin, smart control and monitoring system and waste vehicle. This study was carried out in two parts. The first part is the construction of a system that collects and monitors waste in a number of containers distributed in different geographic areas. The second section deals with the implementation of this system on a specific city. The system can be improved by connecting the system with the GPS system to determine the location of the bin and send message to near waste Vehicle to empty the bin as well as use internet of things to monitoring and access bins from anywhere [2]. Structure that use three parts are coordinate node, end device node and web server design. The coordinate node and end device node are connected by a radio transceiver, coordinate node connection based on the ZigBee protocol. Many sensors are used such as level sensor (ultrasonic sensor), Gas sensor and load cell. A smart bin will show a message for emptying the bin while this bin is to be full. and according to this methodology the data sensed by sensors would be shared between devices at which able to a Responsible authority taking additional steps to cleaning the containers. [3]. The paper review system for garbage management the reviewed system uses ultrasonic sensor that use for detecting the level of waste in the bin, Arduino UNO that work as controlling board [4]. The proposed system 'IoT based Garbage Management System' will provide the smart solution regarding overflowing of garbage bins. This system well be beneficial in keeping dry and wet garbage separately so that different processes-composting, recycling, incineration well be implemented to different type of garbage. By intimating the notification of garbage filled, the use of the garbage collecting vehicle well be optimized. By keeping the environment clean, contribution well be given to the society [5]. Architecture which based on Internet of Things (IoT) and that is categorized into three modules are smart control sensing system that consist of Ultrasonic Sensor, PIR Sensor, Servomotor, RFID Reader. Transceiver Unit consist of GSM, Wi-Fi and Smart Display Unit which consist of LCD,

Database, Monitor Section [6]. Proposed system considering the need of smart waste management can expensive but inevitable to limit the waste accumulation in populated cities. This is not original idea, for the implementation of the smart waste management system, the idea has existed for many years. Weight sensor is used for detection the amount of waste, but the weight is not accurate to determining the level of waste in the particular bin [7] paper

that presents a practical smart collection system is based on an Internet of Things sensing prototype which measures the waste level of container and sends this data over the Internet to a server for storage and processing data. Based on this data, an optimization process allows creating the most efficient collection routes, and these are forwarded to the workers. The paper is focused on the efficiency and economic feasibility of the system., The experiments are executed on a Geographic Information Systems (GIS) simulation environment [8].

III. SYSTEM COMPONENTS

Waste management System using internet of things contains of three basic components:

- Smart bin
- monitoring and control system
- Truck trash

A. Smart bin

In this project we use three bins distributed in different geographic location each of these bins consist of:

Ultrasonic Sensor: used to measure the distance of existing objects in the containers by according to sound waves. ultrasonic sensor measures the distance through sending sound waves at specific frequency and then listening for that the distance is measured as

distance = (speed of sound x time taken) / 2

Ultrasonic Sensors are placed on the top of bin, and it is used to determine the waste level of bin of calculated by above equation.

Arduino UNO: Is an open source microcontroller based on easy to use hardware, it is similar to the computer and used to connect and control the sensors through Arduino software

Wi-Fi ESP 8266 Module: Wi-Fi Module is a self- contained SOC with integrated TCP/IP protocol that is used to transfer the sensed data to the web site. Each ESP8266 Wi-Fi module is preprogrammed with an AT to configure the Wi-Fi mode to work as client, access point or client and access point. Wi-Fi module is used for sending data from the bin to the monitoring and control system by using Internet protocol TCP/IP.

B. monitoring and control system

monitoring and control system display the bin status instantaneously, the sensed data is stored in a database to be shown in graph and support the distribution of the containers decision. The monitoring and control system send the bin status and the location message to the garbage truck to empty the bin if it is full.

C. Garbage Truck

This part disposes the waste when received monitoring and control system's message in case of full status of the bin.

IV. SYSTEM ARCHITECTURE

Architecture of waste Management system is categorized into three parts are smart bin, monitoring and control system and garbage truck part. The following fig.1 illustrate the system architecture:

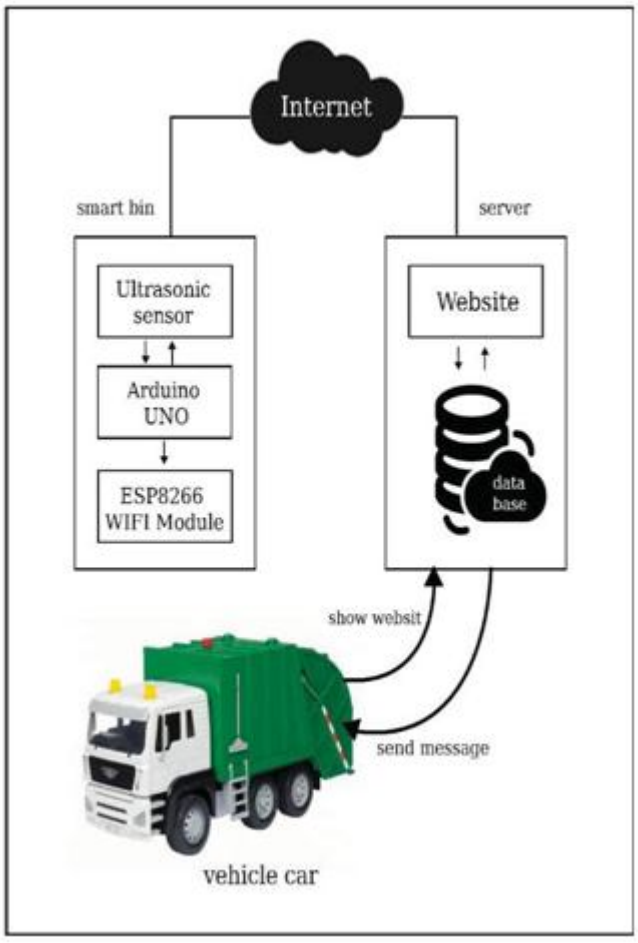

Fig.1: Waste management system architecture

The following fig.2 illustrates the process flow of waste management system using Internet of Things:

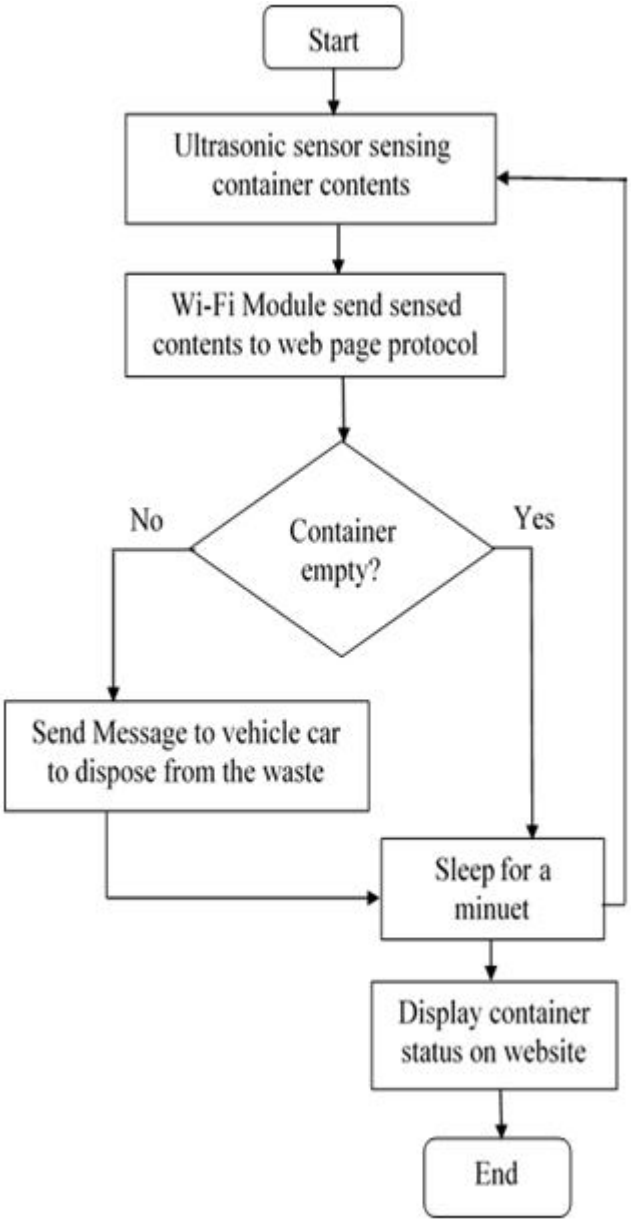

Fig.2: Process flow of waste management system using IoT.

V. RESULTS

In this work, the data is read using ultrasonic sensors which determine the level of waste in each container. The levels are divided into three categories which are empty, half and full. If the container is full the Message is sent to vehicle car to empty the bin, the Wi-Fi module is used to send data via the Internet protocol TCP/IP to the web page, data are stored in a database for future analysis to control container distribution in appropriate locations. The system was linked to the google maps to determine and display the containers location on the map. The following figures illustrate the waste management system outputs:

Fig.3 illustrate Containers status of waste management system

VI. CONCLUSION AND FUTURE WORK

The waste management system is one of the most important systems and it helps in the process of cleanliness of the environment and reduce the difficulties in cleaning operations, where many cities are seeking to apply the concept of smart cities and provide more effective services. The waste management system can be improved by using the tracking system in waste transport vehicles to determine the best and shortest path for waste transport vehicles.

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