

# A Survey on Waste Management Monitoring System Based on IoT

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**Abstract:** - In the present day scenario, many times we see that the garbage bins or Dust bin are placed at public places in the cities that are overflowing due to an increase in the waste every day. It creates the unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness, to avoid such a situation we are planning unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concerned authorities from their place with the help of the Internet and immediate action can be made to clean the dustbins. This paper is a proposed IOT based smart waste clean management system that checks the waste level over the dustbins by using Sensor systems. Once it detected immediately this system altered to concern authorized through GSM/GPRS For this system used Microcontroller as an interface between the sensor system and GSM/GPRS system.

**Keywords:** WSN, Location Intelligence, Sensors, IoT, Solid Waste Management, Smart City, Geographic Data System.

## I. INTRODUCTION

Solid waste management is to the collecting, treating and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions, in turn, can lead to pollution of the environment and to outbreaks of vector-borne disease that is, diseases spread by rodents and Insects [1]. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved. The 'Thing' in IoT can be any device with any kind of built-in-sensors with the ability to collect and transfer data over a network without manual intervention. The embedded technology in the object helps them to interact with internal states and the external environment, which in turn helps in decisions in making process. In a nutshell, IoT is a concept that connects all the devices to the internet and let them communicate with each other over the internet. IoT is a giant network of connected devices all of which gather and share data about how they are used and the environments in which they are operated [2]. By doing so, each of your devices will be learning from the experience of other devices, as humans do. IoT is trying to expand the interdependence in human- i.e. interacts, contribute and collaborate to things. I know this sounds a bit complicated, let's understand this with an example. A developer applies with a document containing the standards, logic, errors & exceptions handled by him to the tester. Again, if there are

any issues Tester communicates it back to the Developer. It takes multiple iterations & in this manner a smart application is created. Similarly, room temperature sensors gather the data and send it across the network, which is then used by multiple device sensors to adjust their temperatures accordingly. For example, a refrigerator's sensor can gather the data regarding the outside temperature and accordingly adjust the refrigerator's temperature. Similarly, your air conditioners can also adjust its temperature accordingly. This is how devices can interact, contribute & collaborate. Adriano Uno is a microcontroller board developed by Arduino.cc and based on Atmega328. Electronic devices are becoming compact, flexible and cheap that is capable of doing more function as compared to their predecessors that happened to cover more space, turned out costly with the ability to perform fewer functions[3]. Microcontrollers are widely used in embedded systems and make devices work according to our needs and requirements. We have already discussed the controllers like 8051, Atmega16, Atmega328 and PIC16F877. Arduino Uno is a very valuable addition in the electronics that consists of the USB interface, 14 digital I/O pins, 6 analog pins, an Atmega328 microcontroller. It also supports serial communication using Tx and Rx pins. Ultrasonic level sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected from the target. Ultrasonic level sensors measure the distance to the target by measuring the time between the emission and the reception. This enables the miniaturization of the sensor head. Ultrasonic level sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected from the target. Ultrasonic level sensors measure the distance to the target by measuring the time between the emission and reception. Presence detection is stable even for targets such as mesh trays or springs. At the heart of the module is a SIM800L GSM cellular chip from Sitcom. The operating voltage of the chip is from 3.4V to 4.4V, which makes it an ideal candidate for direct LiPo battery supply. This makes it a good choice for embedding into projects without a lot of space [4, 5].

Hardware Used:

- 1) Arduino UNO R3
- 2) Ultrasonic Sensor(HC-SR04)
- 3) GSM Sim (SMS ALERT)
- 4) GPS Module

- A. Arduino UNO R3: Features Of Arduino Uno R3 microcontroller [6] : ATmega328  
Operating Voltage: 5v  
Input voltage(recommended) :7-12v  
Input voltage (limit) : 6-20v

Digital I/O pins : 14 (of which 6 provide PWM output)  
 Analog Input pins: 6  
 DC Current per I/O pin: 40mA  
 DC Current for 3.3v pin : 50mA

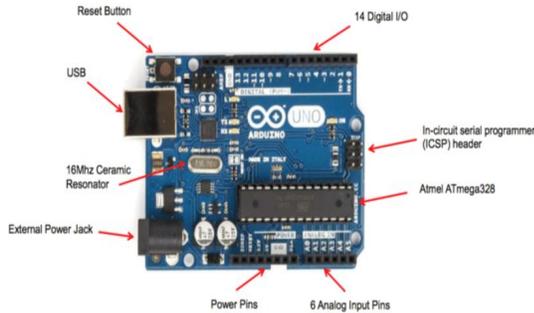


Figure 1: Arduino UNO R3

B. Ultra Sonic Sensor (HC-SR04): Features of Ultrasonic Sensor [6](HC - SR04)

- The Ultrasonic Sensor is used to measure the distance
- It can measure the distance from 2cm to 400cm or from 1 inch to 13 feet. It emits an ultrasound wave at the frequency of 40 kHz in the air and if the object will come in its way then it will bounce back to the sensor.
- By using that time which it takes to strike the object and comes back, you can calculate the distance.
- The ultrasonic sensor has four pins. Two are VCC and GND which will be connected to the 5V and the GND of the Arduino while the other two pins are Trig and Echo pins which will be connected to any digital pins of the Arduino [7,8].
- The trig pin will send the signal and the Echo pin will be used to receive the signal.
- To generate an ultrasound signal, you will have to make the Trig pin high for about 10us which will send an 8 cycle sonic burst at the speed of sound and after striking the object, it will be received by the Echo pin

Input Voltage: 5v  
 Current to Draw: 20ma (Max)  
 Digital Output: 5v  
 Digital Input: 0v (Low)  
 Working Temperature: -15 to 70 (Degree Celcius)  
 Sensing Angle: 30 Degree Cone  
 The angle of Effect: 15 Degree Cone  
 Ultrasonic Frequency: 40 kHz

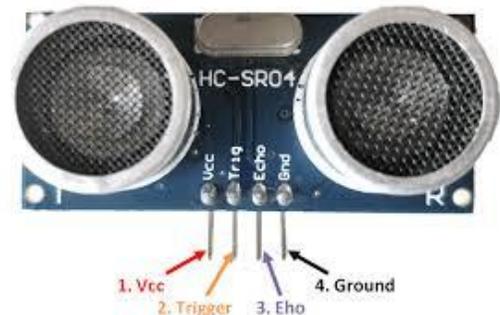


Figure 2: Ultrasonic Sensor (HC -SR04) PINS

- VCC: +5VDC
- TRIG: TRIGGER (INPUT)
- ECHO: ECHO (INPUT)
- GND: GND

C. GSM Sim (SMS Alert) Features:

- SIM800L GSM/GPRS module is a miniature GSM modem that allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls.
- The operating voltage of the chip is from 3.4V to 4.4V, which makes It an ideal candidate for direct LiPo battery supply.
- After connecting power module boots up, searches for cellular network and login automatically. Onboard LED displays connection state (no network coverage - fast blinking, logged in - slow blinking) [9].

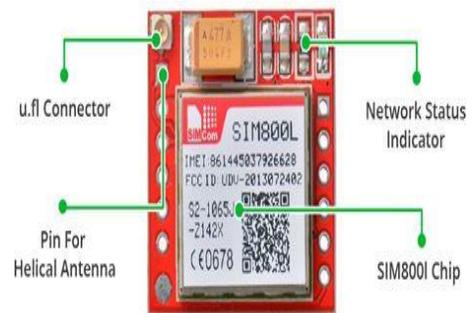


Fig 3: GSM Sim (SMS Alert)

D. GPS Module (VK16E) Features:

- Built-in Ublox G6010/G7020 low power
- Consumption GPS Chipset.
- 50 Channel GPS L1 frequency C/A code.
- Superior Sensitivity up to - 162dBm.
- Built-in WAAS/ EGNOS/MSAS demodulator without any additional hardware.
- Low power consumption.
- Waterproof design.
- USB interface with 2m long cable.
- Magnetic fix.



Fig 4: GPS Module (VK16E)

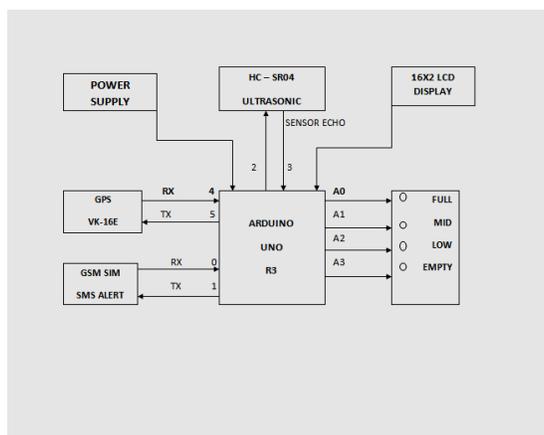


Fig 5: Block Diagram of Complete System

#### Software Used

- Mc Programming Language
- Embedded C
- Arduino IDE Software

### II. LITERATURE SURVEY

Survey on waste management and monitoring system based on IoT and study on previous papers related to IoT. Abdullah et al. [10] built up a sharp reject watching framework that is utilized in the estimation of deny level ceaselessly and cautions the fitting expert through SMS writings. The framework is wanted to screen the waste holder and send the messages as alerts when perceived to be full or in every way that matters full to help its evacuation of the compartment on time. The centrality of the structure is to improve the ability of strong waste trade the executives dependably. In any case, the downside is that the notice of the storehouses' status avoids the zone of the holder or its orientation, making it badly arranged to find and amass the waste canisters in a brief moment.

Prajakta et al. [11] proposed a garbage storing up framework that is adjusted having data gathering structure subject to the arranging of pictures taken and GSM module. To accomplish this point of confinement, the framework utilizes a camera which is set at each position where rubbish is amassed close to a stack cell sensor orchestrated at the base of the waste holder. For this

situation, the camera will constantly take surveys of the reject holder while the stack cell sensor takes the weight to pick whether full or not. Besides, an edge level is set which is utilized to separate the result of the camera and weight sensor. Exactly when the edge is practiced, the controller transmits a message by strategies for the GSM module to the suitable master urging them that the junk holder is full and ought to be engineered. Reasonably, the waste archive total vehicle is dispatched to gather the deny utilizing a robot instrument. In any case, the catch is that the camera takes pictures all through disregarding how that its purpose of containment is come to in any case just contemplate the latest to pick gathering. As requirements are, the use of a camera is senseless or unessential.

Chaware et al. [12] proposed a waste get-together structure considered imaginative to help with keeping urban domains clean. The structure works by watching rubbish stores and tell the experts and the waste collection vehicles about the part of garbage set away or contained in the reject holder through a web application. Regardless, the framework utilizes ultrasonic sensors in which their distinctive precision can be affected by changes in temperature. Besides, it utilizes Wi-Fi which is inherently a short-range alliance instrument. From this time forward, these disadvantages sway the ideal execution of the structure.

Kalpna, et al. [13] proposed a sharp canister the authority's framework which stores the majority of the bits of information concerning the dustbins and their district on the server. In this framework, the clients are responsible for checking the segment of the misfortune in the holder correspondingly as sending such data to the server. The subtleties are gotten to by the proper experts at the not charming end by techniques for the Internet and quick reaction can be started to arrange the vault of the waste. In this structure, the canister must be washed down when a client sends the status of the holder to the server through an adaptable application. Thusly, the damage is that concerned masters can't screen the waste estimation unendingly yet rather need to monitor things for messages. In like way, if a client is unfit to send the message it proposes that nature will be verified with waste when the holder is full.

Kumar et al. [14] in their work proposed an IOT based unbelievable waste clean association structure where sensor frameworks are utilized to steadily checking the waste component of the garbage canisters. In this methodology, when the waste estimation over the dustbins is recognized, the framework along these lines cautions the embraced individual by strategies for GSM/GPRS. The structure works by utilizing a microcontroller which gives interface between the sensor and the GSM/GPRS framework. Also, an Android application is utilized to screen and join the important data identifying with the unmistakable component of waste

found in various zones. With this framework, another client can choose the structure and not simply the manager. Regardless, anybody can make a record and the framework likewise surrender access to clients not expected for. This framework can be improved by setting two holders to self-rulingly collect dry and wet squanders. For this situation, the wet waste can be moreover masterminded and be utilized for the period of biogas, made intense by making it insignificant and fiscally astute.

Ruhin Mary Saji et al. [15] This paper proposed a method as follows. The level of garbage in the bin is detected by using the ultrasonic sensor and communicates to the control room using the GSM system. Four IR sensors are used to detect the level of the garbage bin. When the bin is full the output of the fourth IR is active low and this output is given to the microcontroller to send a message to the control room through GSM In this paper ZigBee, GSM and ARM7 controller is used to monitor the garbage bin level. When the garbage bin is full, this message of garbage level is sent to the ARM7 controller. Then ARM7 will send the SMS through GSM to authority as to which bin is overflowing and requires cleaning up.

### III. CONCLUSION

They have displayed an IoT based waste management and monitoring system. The system is based on the IoT recognizing model responsible for continuous monitoring of the waste levels in the dustbin and later send this information through the internet to a server that is the concern authorities responsible for disposal of the waste. This information helps in the timely collection and disposal of waste without creating any failures. In the future, we should need to focus on and improve the waste disposal of liquid and fluid waste. We should also focus on improving the automation in waste segregation techniques. By understanding this task we can maintain a level of pollution and toxic gases released by the rotating of waste in the dustbin. Moreover, the shocking smell can be decreased or avoided in light of social events the hardship before its rot. They set up the framework with devices embedded in the dustbin to check the level of dustbin constantly. In this framework when garbage is full the data is sent to the concerned authorities. The data will be sent in the form of a message on devices with the location of the dustbin. In this case, the message will be sent on the phone using (GSM SIM module) attached with Google map location using (GPS VK16E Module). By executing this purposed framework we can build up the smart cities at a reduced cost. By the productive utilization of smart dustbin, we can be technologically advanced. This framework can diminish the dirty and untidy picture of a waste bin in the Awe-inspiring cities and can make the environment clean and healthy.

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