

## Smart Garbage Tracking System

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**Abstract:** A new age of computing called the Internet of Things (IoT) is used to connect devices through the internet. It is a huge network which gathers information such as how they are used, where they are operated and their surroundings. The process of collecting the waste is not done in the efficient manner some bins would be left out without collecting the waste and sometimes even though the bin overflows with waste it will be collected only at the scheduled days.

This may lead to diseases like malaria, dengue etc. The existing system used RFID, GIS, GSM technology to pass the information of the garbage bin to the garbage collecting truck driver. Rather than sending messages through text, viewing the information in google map will be more efficient. Using IoT technology, a smart living concept called smart garbage tracking system is implemented. This system was an integration of technologies such as IOT, Android, GPS and Google API. We can overcome social issues such as overflow of dustbins, control the spread of bacterial and viral infections and also empower SWACHH BHARAT mission.

**Keywords:** Internet of Things, Android, Google API.

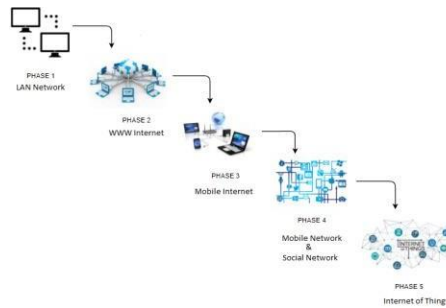
### 1. Introduction

#### Internet of Things

Every part of human life is involved with Iot technology. It is the extension of internet connectivity into physical devices and everyday objects. It helps the human to handle their work in a more smart and easy way. Such a kind of networking ecosystem enables communication- capable resource-constrained heterogeneous objects or devices to be connected over the Internet, in addition to the interconnections of computationally resourceful devices like computers, smartphones, PDA, etc. Thus, IoT renders the entire Internet space as the working area for such devices. In other words, the IoT paradigm begins to facilitate devices to acquire smartness by performing all sorts of operations (monitor, compute, process, exchange, make decisions collaboratively or indigenously) and accordingly take the required actions, based on the information being sensed anywhere across the globe.

#### Evolution of IoT

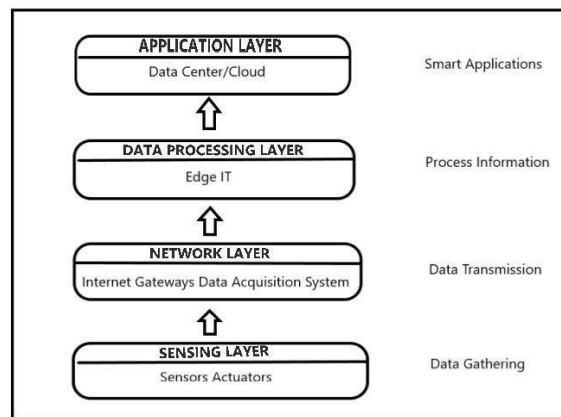
Initially, the main aim of the computer network is to share resources in the more economic and efficient way so that it can be available to anyone without any physical location barriers. Soon, the development of TCP/IP protocol adds fuel to the growth and leads to the advent of the global networking facility known as the Internet. Since then, the Internet has evolved tremendously and has achieved several decades of a successful existence. The evolution of IoT can be described in five phases as shown in fig1.1. Initial phase deals with connection between computers of the local network, then the second phase deals with the World Wide Web which forms a web by connecting a large number of computers. Then, the mobile-Internet came into picture where mobile devices are connected using the internet and it also deals with social networks where peoples' identities also stepped in and joined the internet. Finally, the present phase deals with IoT that envisions the connection of day-to-day physical objects to the Internet.



**Fig.1.1 Evolution of IOT**

**1.2 IoT Architecture**

The architecture of IoT depends upon its functionality and implementation in different sectors. To develop a process flow for a definite framework over which an IoT solution is built, the IoT Architecture generally comprises of these 4 stages: (shown in Fig 1.2)



**Figure1.2 Architecture of IoT**

**Sensing layer**

Sensors, Actuators devices are present in this layer. Sensors collect data from the object or environment under measurement and turn it into useful data then processes the data and emits the data over network.

**Network layer**

Data Acquisition System (DAS) are present in this layer. It perform data aggregation and conversion functions. The DAS connects to the aggregates outputs, sensor network and performs the analog- to-digital conversion. Advanced gateways which mainly opens up connection between Sensor networks

**Data processing layer**

Once IoT data has been aggregated and digitized, before it enters the data centre it may require further processing, this is where Edge Analytics is used. Here data is analyzed and pre-processed before sending it to the data centre from where data is accessed by software applications.

**Application layer**

This is the last layer of 4 stages of IoT architecture. Cloud or Data centre is a management stage of data where data is managed and is used by end-user applications like health care, agriculture ,aerospace, defense, farming etc.

## 1.4 Ultimate Goal of IoT

The main aim of the Internet of Things is enabling the integration and interconnection of the cyberspace and physical world . It represents the future of computer networking, and in the IT industry revolution it creates the third wave. It wants to produce devices that give self report in real time, improving its efficiency and providing key information to the surface more rapidly than a system hang on human intervention.

## 2. Related Works

Some of the works that are related to the current proposal done by various researchers, whose concepts and the drawbacks of their work are listed below:

(Abdul Quadir.M, et al. May 2017) It would provide the garbage collection of that particular area, tracking the vehicle position through the GIS database and also notice that the truck no need to visit that particular place. After the bin is full the particular vehicle is reached to that particular area we identify that the vehicle is reached or not by the RFID. Once the RFID reader is detected the tag so it will send data to the server by the MQTT protocol. After reaching the server it will store it in some database for further clarifications. The disadvantage is that the information is passed through text.

(Sonal Chakole, Priya Khadse, et, al March 2017 ) This system plans a System Based on AT89S52 for collecting the garbage from a particular region. We have introduced an integrated system pooled with an integrated system of Global Positioning System (GPS) and Global System for Mobile Communication (GSM).The sensors would be placed in the common garbage bins sited on the public places. AT89S52 is generally utilized in micro equipment. It is a complex structure.

(DhanaShree K, Janani.B, et al. NOV 2019) The system Smart garbage monitoring system where the lid will be opened only when a person operates when needed and does not open and close automatically. So it reduces mosquitoes growing on rainwater thus reducing disease growth. The thermal sensor is used to detect humans or any living things interrupting the dustbin. Thus it helps us to choose the bin which is filled rather than to search for all of them. IFTTT is not as comprehensive when it comes to multiple outcomes ,not all the products and services are supported.

(Asifa Indi, et al. 2017) The key aspect of this system is to identify the level of garbage in the dustbin with sensor systems and alert the authorized control room through wireless modem. An Android application will act as GUI to supervise the garbage status. The GPS system employed will pinpoint the exact location of the garbage bin. This system will avoid the regular monitoring of the bins and thereby reduce the operational time required. In Raspberry Pi, Graphics Processor is missing and it gets overheated.

## 3. Existing System And Issues

The application of “garbage Bin” is used in management of the garbage collection system of a whole city. The Ultrasonic sensors will enables the smart garbage bins which is connected to the cellular network called Global System for Mobile communication (GSM) that will generate a large amount of data, it will monitor the total system of smart bins, if the bin was about to fill then it will intimate the truck driver by sending the message which is passed by the GSM module .It is used to monitor the garbage around the city.

We can track the truck collecting the waste from the bin easily , by utilizing your mobile by dialing the portable number of the SIM joined to the GSM modem. We will automatically get the area of the vehicle as a SMS (short message) on your cell phone. This framework permits you to track your vehicle at anyplace.

The GPS module gets the information of the area from satellites as scope and longitude. This data is sent to the GSM modem. The GSM modem then sends the data to the user cell phone. GPS is a space-based satellite route framework. It gives data about time and area in every climate condition, anyplace of the world. GPS are utilized for route, positioning of the location, time spread resource purposes.

The main issue of the existing system is that the message would be passed to the municipal corporation and then it would be passed to the truck driver ,it makes the system complicated and people working as truck driver are mostly unlettered.

## 4.Proposed System

The idea behind the proposed system is to deliver an effective mobile application service and make it a successful one. This application is used to show the details graphically to the user using google API rather than sending messages. The Google map shows the details about location of the bin and color of the bin represented in the map changes according to the level of the bin. And it also shows the location of the truck by using GPS. All these information are fetched from the database. At first the ultrasonic sensor is used to detect the level of waste in the bin. Then the message is passed to Arduino which passes the information to store it in the database using wifi module (as shown in fig.4.1). Likewise location of the truck is also stored in database using GPS and wifi module.

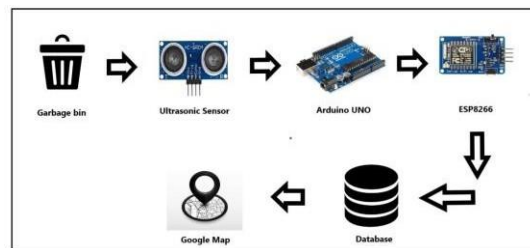


Fig:4.1.Process of smart bin

## 5. Work Done

### 5.1.Implementation of smart garbage bin

The system uses a bin where the ultrasonic sensor is placed over it to detect the level of the waste. The sensor uses the sound transmitter and a receiver to check the level of the bin. Ultrasonic ranging module provide 2cm – 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The system makes use of Node mcu microcontroller, Wi-Fi module, LCD screen, thermal sensor and a buzzer. The system is powered by a 12V transformer and a capacitor is also used to provide current equally to 5V. Thermal sensor is also used to detect if any fire accident occurs. The LCD screen is used to display the status of the level of garbage collected in the bins and also shows the temperature level ,if the temperature goes higher it produces buzzer sound to indicate the emergency. The mobile application gives a graphical view of the garbage bins and highlights the garbage collected in color in order to show the level of garbage collected the red color bin indicates only when the bin is fully filled with waste otherwise the bin will remain in green color. The arduino code is passed to Node MCU, it is an open source firmware available for open source prototyping board designs which is integrated with ESP8266 wifi-module as shown in fig.5.1. And fig 5.2 shows the mobile application of smart garbage tracking system. In that bin location and its color code are shown.

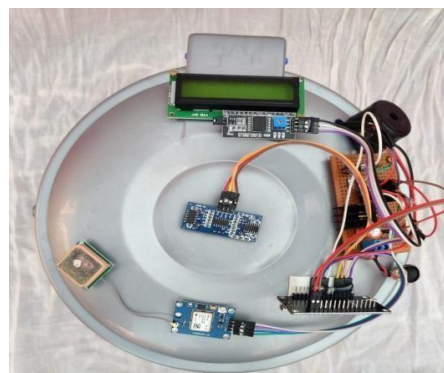


Figure:5.1.Smart bin

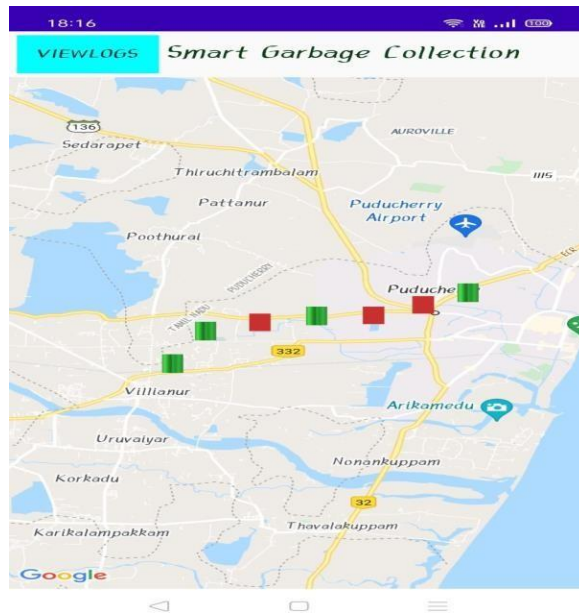


Figure5.2 Location of dustbin

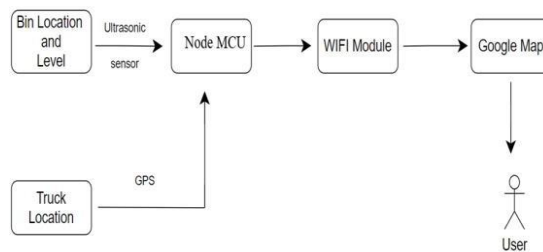


Figure.5.3 Architecture of Smart garbage tracking system

So using wifi module the data are stored in database. From database the informations are fetched and shown in google map using google api (as shown in Fig:5.3). The DC thermal sensor is used to detect and gives a beep sound to alarm if any fire accident occurs as shown in fig:5.4.

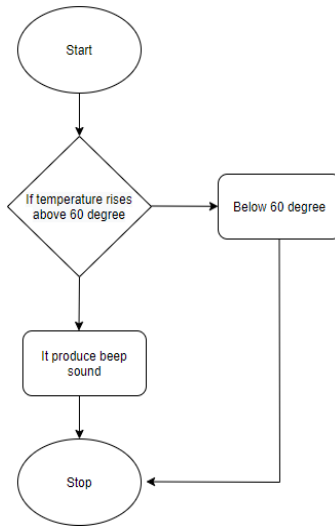


Figure5.4. Flowchart of Thermal Sensor

### 5.2 Implementation of garbage truck

Location of the garbage collecting truck is tracked using GPS, and the information is shown in the google map. How will the mobile application work is shown in the below flow chart(Fig:5.5).The wifi must be connected with the device so that the information can be transferred easily.

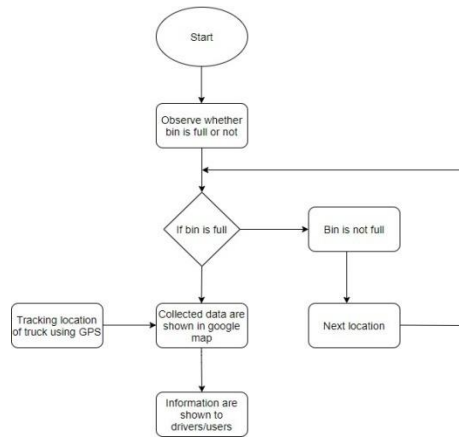


Figure5.5 Flowchart of smart bin and truck

## 6. System Requirements

### 6.1 Hardware

Ultrasonic sensor is used to detect the level of the bin. It ranges from 2cm-400cm. Node MCU is integrated with Arduino Code. Power supply of 12V is used. ESP8266 wifi-module integrated with Node MCU. A thermal sensor is used which is connected with the LCD display.

### 6.2 Software

Mongo db is used for database storage. Android studio is used to create mobile application and the code is written in JAVA and XML, which is integrated with Google API. C# code is written in Visual studio.

## 7. Conclusion

It presents a robust way of managing the waste, so that not only the whole process becomes efficient, but also, the disposal of waste is done in a productive way. Besides food industry, healthcare, tourism, and other such departments, can take benefit from this model. It empowers SWACHH BHARAT mission. It e-Governance based on Digital India. It reduces the raise of unwanted factors causing diseases and environmental pollution. The Real-time based cleaning of garbage at necessary intervals. This model makes the system transparent between Municipal Corporation, workers and the public. In future work we can add information such as to find the shortest route and segregation of waste types such as biodegradable and non-biodegradable.

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