

# IOT Based Smart Waste Management System

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**Abstract**— Many times we see in the societies the garbage bins or dustbins are placed at public places in the cities. Sometimes they overflow due to increasing in the waste or garbage. There is no automatic system to inform that dustbin is full to garbage office. In IOT based waste management proposed system, we are using smart dustbins to overcome these garbage problems. Nowadays certain actions are taken to improve the level of cleanliness in the country. People are getting more active in doing all the things possible to clean their surroundings. Various movements are also started by the government to increase cleanliness. We will try to build a system which will notify the corporations to empty the bin on time. In this system, we will put a sensor on top of the garbage bin which will detect the total level of garbage inside it according to the total size of the bin. When the garbage will reach the maximum level, a notification will be sent to the users android device and then alert message send to corporation's office, then the employees can take further actions to empty the bin. This system will help in cleaning the city in a better way. By using this system people do not have to check all the systems manually but they will get a notification when the bin will get filled.

**Keywords**—GSM Module (Mobile), SMS, Microcontroller, Arduino, ESP8266 WIFI Module, Ultrasonic sensor.

## I. INTRODUCTION

IoT or Internet Of Things refers to the network of connected physical objects that can communicate and exchange data among themselves without the desideratum of any human intervention. It has been formally defined as an Infrastructure of Information Society because IoT sanctions us to amass information from all kind of mediums such as humans, animals, conveyances, kitchen appliances. Thus, any object in the physical world which can be provided with an IP address to enable data transmission over a network can be made part of IoT system by embedding them with electronic hardware such as sensors, software and networking gear. IoT is different than Internet as in a way it transcends Internet connectivity by enabling everyday objects that utilizes embedded circuits to interact and communicate with each other utilizing the current Internet infrastructure. Since then the scope of IoT has grown tremendously as currently it consists of more than 12 billion connected devices and according to the experts it will increase to 50 billion by the end of 2020. With the advent of IoT both manufacturers and consumers have benefited. Manufacturers have gained insight into how their products are used and how they perform out in the real world and increase their revenues by providing value

added services which enhances and elongates the life cycle of their products or services. Consumers on the other hand have the ability to integrate and control more than one devices for a more customized and improved user experience.

In this paper, we are going to propose a system for the immediate cleaning of the dustbins. As dustbin is considered as a basic need to maintain the level of cleanliness in the city, so it is very important to clean all the dustbins as soon as they get filled. We will use ultrasonic sensors for this system. The sensor will be placed on top of bin which will help in sending the information to the once that the level of garbage has reached its maximum level. After this the bin should be emptied as soon as possible. The concept of IoT when used in this field will result in a better environment for the people to live in. No more unsanitary conditions will be formed in the city. With the help of this system minimal number of smart bins can be used around the whole city and the city will still be much cleaner. There has been an unprecedented growth in the number of devices being connected to the Internet since past few years. All these devices connected to the internet are part of the IoT infrastructure which can communicate with each other. The IoT network consists of embedded electronics, sensors and software that allows these devices to send and receive data among each other. This is why it is beneficial to use such an existing infrastructure for designing the proposed security system. The disadvantages of the existing system are that the employees have to go and check the bins daily whether they are filled or not, it results in high cost. If the bin doesn't get emptied on time then the environment becomes unhygienic and illness could be spread. The proposed system will help in removing all these disadvantages. The real-time information can be gained regarding the level of the dustbin filled on the system itself. It will also help in reducing the cost as the employees will have to go only at that time when the bin is full. This will also help in resource optimization and if the bins will be emptied at time then the environment will remain safe and free from all kinds of diseases. The cities will become more cleaner and the smells of the garbage will be much less.

## II. DETAILS DESCRIPTION AND IMPLEMENTATION:

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus, it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.

**1. Smart Bin Construction with The Help of Sensors:** We construct the smart dustbins with the help of Ultrasonic Sensors as level detector. Each dustbin comes only with Ultrasonic Sensor and they all connected together to centrally located Arduino.

**2. Interfacing of Smart Dustbins with Boards:** We planning to use Micro controller for interfacing purpose. All sensors of dustbins are connected to Arduino Module.

**3. Configuration of Communication Network:** With the help of Wi-Fi Module we are able to send status of dustbins

to Android device. These modules are configured with Arduino and Send notification to the municipal.

**4. Development of web Application:** We are going to use Android App to display the status of dustbins. It will receive the status of dustbins from Wi-Fi network with the help of that, it displays the status whether the dustbins are full or not and according to that it will generate the alert message.

**5. Generation of Notification or Alert:** With the help of Wi-Fi module it is also possible to send the alert message to particular garbage collector when the dustbins are completely fill. The IOT Garbage Monitoring system is a very innovative system which will help to keep the cities clean. This arrangement monitors the garbage bins and notices about the level of garbage collected in the garbage bins via a web page. For this the scheme uses ultrasonic sensors positioned over the bins to detect the garbage level and relate it with the garbage bins depth. The system makes use of Arduino family microcontroller, LCD screen, Wi-Fi modem for sending data and a buzzer. The scheme is powered by a 12V transformer. Whereas a web page is built to show the status to the user monitoring it. The web page gives a graphical view of the garbage bins and climaxes the garbage collected in colour in order to show the level of garbage collected. The LCD monitor shows the condition of the trash level. The scheme puts on the signal when the level of trash composed crosses the customary limit. Thus this scheme aids to remain the city spotless by updating about the trash levels of the bins by providing graphical representation of the bins via a web page. The ESP8266 Wi-Fi Module is a self-contained SOC with combined TCP/IP decorum stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is talented of either hosting an submission or unburdening all Wi-Fi networking functions from another application processor. Each ESP8266 Module comes pre-programmed with an AT command customary firmware. The ESP8266 module is an extremely price effective board with an enormous, and ever increasing, community.

**T1 Planning:** Communication Software development process starts with the communication between customer and developer. According to need of project, we gathered the requirements related to project. Requirement gathering is an important aspect as the developer will come to know what customer expects from the project and also he can help a customer to know more features that can be added to project as he is a technical person. The most important thing be smooth and clear that means developer should easily understand the demands of customer.

**T2 Planning:** System Design It includes the process model used for the development of the system. The Breakdown Structure (Modules) is also defined in this task. Different Modules used in the system are viewed in Breakdown Structure.

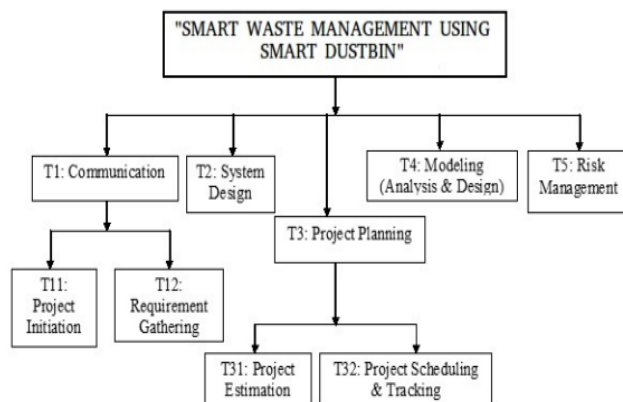
**T3 Planning:** It includes complete estimation and scheduling (complete time line chart for project development). Before starting the project tasks should be scheduled that means there should be starting and ending date assigned for each and every task and developer should work harder to complete the required task within time chosen at the time of scheduling.

**T4 Planning:** Modelling It includes detailed requirements analysis and project design (algorithm, flowchart etc). Flowchart shows complete pictorial view of the project and algorithm is step by step solution of problem. Both flowchart and algorithm will be helpful in knowing the overall view of project and serve as a base for development of whole project.

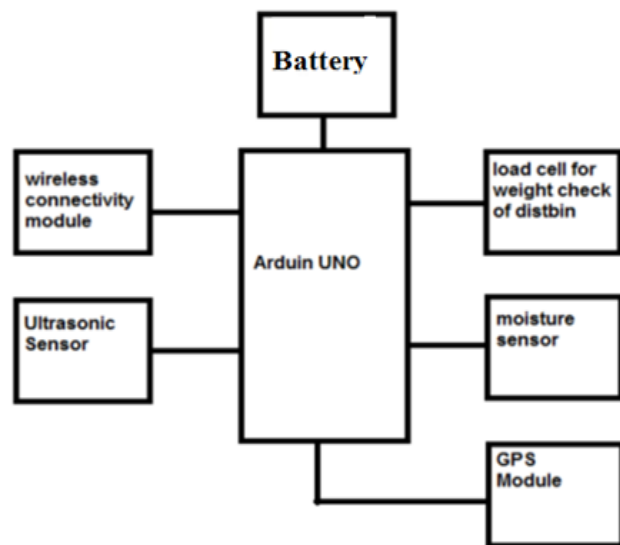
**T5 Planning:** Risk Management It includes identifying the risks during project development and according to that managing the risks which are affecting the project development.

### III. PROPOSED PAPER

This describes the process of building and monitoring schedules for software development. To build complex software systems, many engineering tasks need to take place in parallel with one another to complete the project on time. The project work is decomposed into the following work break down structure as a part of analysis phase.



### IV. BLOCK DIAGRAM



## V. HARDWARE DESCRIPTION

### A. Microcontrollers:

It is a microcontroller of AVR family based on the ATmega328. It has total 28 pins having 14 digital input/output pins, 6 analog inputs/output, a 16 MHz quartz crystal is used to provide external clock to microcontroller, 2 VCC pins, 2 GND pins, 2 XTAL pins used for the crystal oscillator. USB connection for program burning process, a power jack is also available, for external power supply and a pin 1 has a reset function. It contains everything needed to support the microcontroller; simply connect it to a computer through a USB cable or battery to get started. The ArduinoUno differs from all preceding USB-to-serial driver chip. 1 analog reference pin also available. It features the Atmega328 is simple to use, easy to handle, reliable, programmed as a USB-to-serial convertor.

### B. Ultrasonic Sensor:

Ultrasonic distance sensor is commonly used with both microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc. The following guide is universally since it has to be followed irrespective of the type of computational device used. As shown above the HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that Distance = Speed Time

#### Ultrasonic Sensor Feature:

Operating voltage: +5V

Theoretical Measuring Distance: 2cm to 450cm

Practical Measuring Distance: 2cm to 80cm

Accuracy: 3mm

Measuring angle covered: <15

Operating Current: <15mA

Operating Frequency: 40Hz

### C. Wi-Fi Module - ESP8266:

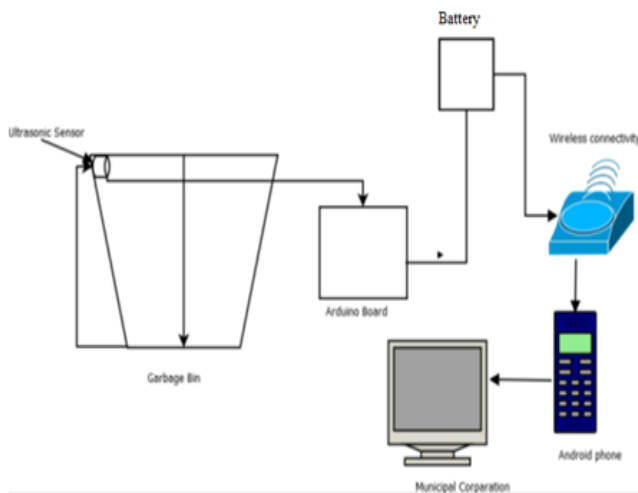
The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts. There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support.

### D. GSM:

the early of 1980s, analog cellular telephone system was experiencing rapid growth in Europe, particularly in Scandinavia and united kingdom, each country developed its own system, which was incompatible with everyone else's in equipment and operation. This GSM module operate on 800MHz frequency. This is SIM800 GSM module. This was an undesirable situation, because not only was the mobile equipment limited to operation within national boundaries, which in a unified Europe were increasingly unimportant, but there was also a very limited market for each type of equipment, so economies of scale and the subsequent savings could not be realized. The European country realized this in the early on, and in 1983 the conference of European

Posts and telegraphs formed a study group called the group special mobile global system for Mobile phone (GSM) to study and develop a pan-European public land mobile system. The modem needs at commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the Controller or processor. The modem sends back a sms after it receives a command. Different at commands supported by the modem can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network. Like a GSM mobile phone, a GSM modem requires a 2G SIM card from a wireless carrier in order to operate. The current status of the soil moisture, water level, pH value will be send to the farmer's mobile as SMS.

## VI. SYSTEM ARCHITECTURE DIAGRAM



### VII. ADVANTAGES

1. Waste collection is done on timely basis which also avoid the fuel wastage and give notification about over flowing of the wastes from the bins.
2. Ecological pollution decreases.
3. Inefficiency of the waste collection and sorting processes increases.
4. Ecological and save country.
5. Don't want to problem the elders by conveying the task of searching particle buyers.
6. Lazy to leave and retail your rubbish.

### VIII. DISADVANTAGES

1. Not user friendly to all.
2. High initial cost.

### IX. APPLICATION

1. Empowered Swachha Bharat Mission.
2. Support Digital India.
3. Real time Based cleaning our cities.
4. It make out system transparent between municipal corporation worker and public.

### X. RESULT

This system that we have proposed improves the current scenario, by bringing all the data on the internet so that systems operate more efficiently. Primarily, there is level sensor and toxicity sensor that will be sending the data collected at intervals of 15 minutes each. With the following data, we have a decision taking system that will decide whether to include the dustbin in the list of collection and mark it on the map of the municipal application. This will in fact save a lot of efforts and fuel wasted in collection process as real-time monitoring of bins is done. As well as the parameters of the dustbin is used to notify the user about the status of the dustbin so that user can dump their waste accordingly. All the municipal waste collection trucks would be registered with some more information like their capacities and registration numbers, etc. Here we use moisture sensor also this sensor detect if wet garbage is found in dry dustbin then alter message receive to user to separate the garbage.

### XI. CONCLUSION

We have implemented garbage management system by using smart dustbins to check the level of smart dustbins whether the dustbin are full or not. In this system when garbage is full the information is send to the authorized person. By implementing this proposed system we can develop the smart city concept and cost is reduced. By the effective usage of smart dustbins can the resource is optimized. This system reduces the traffic in the smart city, so that environment will be cleaned. The existed system will inform the status of the garbage in each and every dust bin, so that the concerned authority can send the garbage collection vehicle only when the dustbin is full.

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