# IoT Based Garbage Collection System

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***Abstract:*** *Waste management has always been a major issue for all the developing countries around the world. Often, in our society we come across overloaded and unattended garbage bins. It not only makes that place look ugly but also leads to unhygienic conditions resulting into widespread of diseases and foul smell in the vicinity. Also, the health and safety of the labour involved in the garbage collection process is ignored. It is our insufficient and irresponsible waste management system to be blamed for.*

*In order to avoid such situation and to provide a smarter and more reliable alternative, we have come up with an interesting project called 'IoT Based Garbage Collection System'. Our project not only deals with the present waste management problems efficiently but also requires minimum human assistance. It consists of a Smart Garbage Bin and a Garbage Collecting Robot Vehicle. In the Smart Bin, we have used an ultrasonic sensor which constantly monitors the level of garbage and displays the status on the server using a Wi-Fi module, once the Bin gets full. In response to this, the controller can use the Robot Vehicle to reach the location of the Smart Bin and collect the garbage from it. The controller can control the Robot Vehicle over Bluetooth using an Android application.*

## I.   Introduction

The Internet of Things (IoT) is a concept of connecting surrounding objects over a network (Wired or Wireless) without any human intervention. These objects communicate over the network and exchange information to provide the required services. Improper disposal of waste and inefficient waste management system are some major issues faced by every developing nation and so taking into consideration the properties and advantages of IoT, the 'IoT Based Garbage Collection System' could prove really useful. It deals with the problems of waste management in a smarter and organized manner. It consists of a garbage monitoring system and a garbage collecting robot vehicle.

## II.   Purpose

As the world population is increasing rapidly, the amount of waste produced daily is also increasing and due to lack of proper systems for disposal and collections, the garbage often ends up in the roads and surroundings. The waste management policy followed presently proves to be ineffective. The Garbage Collecting trucks moves from area to area with no proper status of the garbage in these areas. Also, the health and safety of the labour involved in these processes are often ignored. Presently available systems are all single feature technologies. For example, the Smart Bins just gives an indication of the level of garbage and no solid action is generally taken. The problem with Garbage Picking Robot is that it collects every other object that comes in its way, irrespective of the fact that is it really a waste or not.

The prime purpose of implementing this system based on IoT in a developing country is the social and economic infrastructure of the country itself. The initial stage of this system comprises of proper disposal and collection, which is the biggest challenge. In addition, to motivate and influence people to follow proper waste disposal methods is also important.

## III. System Description

'IoT Based Garbage Collection System' is a combination of Garbage Monitoring and Collecting mechanism. This results in reduced human assistance.

This Garbage Monitoring mechanism consists of a Smart Bin interfaced with a Wi-Fi Module. This system monitors the level of garbage in the bin using an ultrasonic sensor connected with ATmega 328p Microcontroller in the Arduino UNO kit. Once the bin gets completely filled with garbage, the Microcontroller transmits this data over the server with the help of a Wi-Fi Module. Using this data, the controller can operate the Robot Vehicle for picking and unloading the garbage from the Bin.

The garbage collection process takes place using a Robot Vehicle. For the picking and unloading procedure, an electro-mechanical gripper is used. DC gear motors are connected to all the four wheels of the vehicle for motion control and a Bluetooth module is assembled on the vehicle for connecting it with the

android device over Bluetooth. Wheels of the Robot are controlled using Motor Driver IC L293D. After unloading the Bin, it is put back to its original position.
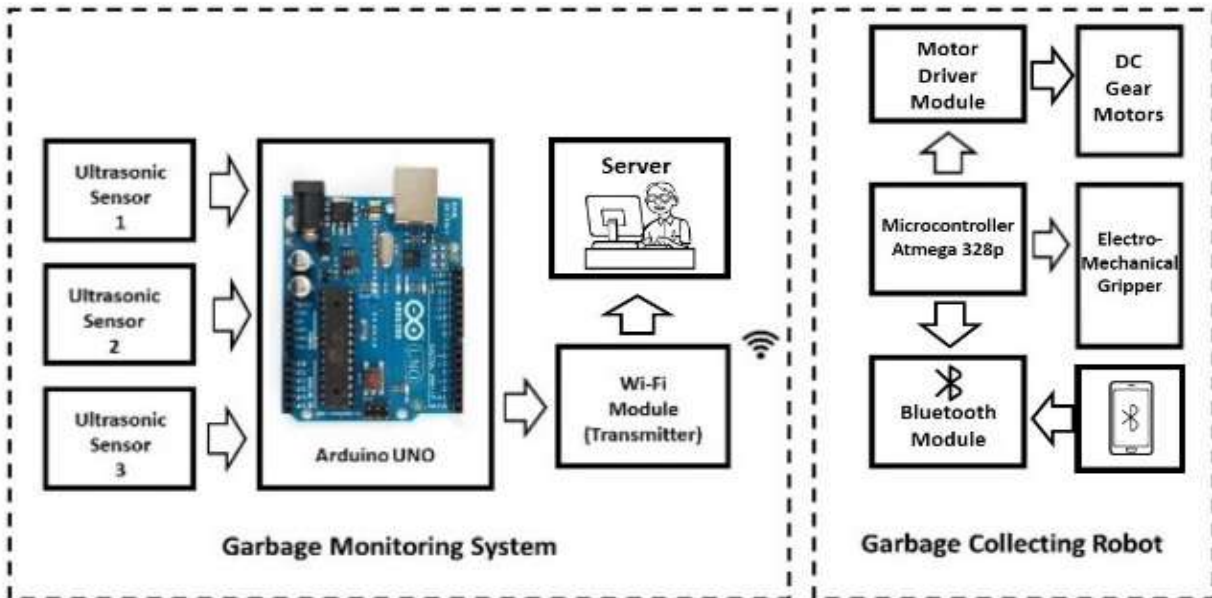
## IV. Block Diagram



**Fig. 1.** Block Diagram of IoT Based Garbage Collection System

## V. Important Hardware Components

**5.1 Ultrasonic Sensor**



**Fig. 2.** Ultrasonic Sensor

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

**5.2 Wi-Fi Module**



**Fig. 3.** Wi-Fi Module

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 ESP8266is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

### 5.3 Arduino UNO



Fig. 4: Arduino UNO

The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button.

### 5.4 DC Gear Motor



**Fig. 5.** DC Gear Motor

A DC motor is not the same as a "gear motor" - a "gear motor" may be an AC or DC motor coupled with a gearbox or transmission. A gear motor adds mechanical gears to alter the speed/torque of the motor for an application. Usually such an addition is to reduce speed and increase torque.

### 5.5 Motor Driver Circuit



**Fig. 6.** Motor Driver Circuit

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.

### 5.6 Bluetooth Module



**Fig. 7.** Bluetooth Module

The **HC-05** is a very cool module which can add two-way (full-duplex) wireless functionality to any project. This module can be used to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop.

### 5.7 Lead Acid Battery



**Fig. 6.** Lead Acid Battery

These batteries use sponge lead and lead peroxide for the conversion of the chemical energy into electrical power, such type of battery is called a lead acid battery. The lead acid battery is most commonly used in the power stations and substations because it has higher cell voltage and lower cost.

## VI. Conclusion

Implementation of 'IoT Based Garbage Collection System' will give waste management system an unbelievable push and also reduce health hazards caused to the people employed in this sector. Using this system, the level of garbage can be monitored by checking the updates on the updates on the server. Also, minimum manual assistance is required for unloading these bins as a Robot has been deployed for this very purpose. It can initially be tested at corporate offices, schools, colleges etc., before manufacturing them on a larger scale.

## Acknowledgement

## References

[1]. Dr. Sandeep M. Chaware," Smart Garbage Monitoring System using IoT," International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Volume 5, Issue 1, Jan 2017.
[2]. Apoorva s.," Autonomous Garbage Collector Robot", International Journal of Internet of Things, 2017.
[3]. Supantha Mandal; Suraj Kumar Saw; ShilpiMaji; Vivek Das; Sravanth Kumar Ramakuri; Sanjay Kumar; "Low cost Arduino Wi-Fi Bluetooth integrated path following robotic vehicle with wireless GUI remote control", ICICES, 2016.