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Integrated Approach to Clean and Green Environment Estimation

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Abstract:** This paper delineates a prototype for assessing, viewing, and estimating some environmental constraints such as temperature, humidity, toxic gas levels in intensely contaminated regions, and collection of garbage in the surrounding areas. This system was developed using the Arduino Uno microcontroller and various sensors namely DHT11, MQ-135, HC-SR04 Ultrasonic, it is a device of great scalability levels, price effectiveness and suitable for other environmental monitoring applications. Environmental air parameters directly have an effect on the current entity, and will amend from regularity or maybe every single second in a while, with a speedy manufacture beyond several decades earlier and dramatic increase of demand for individuals to observe the native air quality. The atmosphere is a tumultuous system, air quality is predisposed by several aspects and may vary hastily. Air constraints and quality directly have an effect on human's normal lives, and also well-being of outside tasks. At present times, technologies are getting smarter day-by-day, as to clean the environment waste management system was developed by using Arduino. This Ultrasonic sensor is integrated to the microcontroller and is positioned on the top of the dustbin. If dustbin is not upheld then this can cause an insalubrious environment and further affects the people living in close proximities this article comprises comprehensive illustration of the system architecture, hardware and software requirements. The practicality of the system is validated through the publication of the outcomes achieved.
Keywords: DHT11 sensor, MQ-135 sensor, HC-SR04 Ultrasonic sensor, Arduino UNO, Jumper wires.

I. INTRODUCTION

In general, individuals attain atmospheric circumstances through weather departments, yet these offer only partial statistics in any specific locality, and are not really precise. Certain innovative systems that may try to observe numerous distinctive constraints[2], such types of systems typically categorize their capacities over a huge extent, for instance, observing real-time constraints for a few metropolitan zones or enormous suburbs using a few observation points. Moreover, subsequently revising many articles[3], at present there is no device existing in the market that could spontaneously view numerous varieties of air quality constraints at the same time, specially the combination of O2 (Oxygen), CO2 (Carbon Dioxide), rain, temperature and humidity[1]. It makes getting the entire image in terms of toxic elements, gases, temperature and humidity very problematic. Therefore, it is beneficial to improve a single mobile device that is entirely and can capture measurements at any location for temporary and lasting analysis[4].

The system which is proposed provides a user- favorable, less expensive, and also provides portable response to analyze numerous environmental constraints. Human life is changing very rapidly, and the role of automation in daily life is increasing too, where residents in developing countries are concerned about overflowing garbage. As the population grows, the cleanliness scenario for waste management is significantly deteriorating. In everyday life, the trash bin becomes full and the garbage flows and becomes polluted[6]. Therefore, the explanation of the problem is to design a system that collects garbage from specific areas filled with public bin prior concerns. This project was proposed to clean up the city. This system assesses the trash in bins and intimates the members of GHMC[8]. The system uses ultrasonic sensors located above the trash bin to allow them to detect the garbage level. Cities' big challenge is solid junk administration, not particularly in India but in a number of countries around the globe[5]. This project offers one of the most effective ways to protect the environment.

II. BLOCK DIAGRAM

The DHT11 Sensor is connected to the arduino microcontroller via jumper wires in order to obtain the values of temperature and humidity and MQ135 sensor is used to find out the gas emissions like carbon monoxide, ammonia, Alcohol, Benzene, Smoke, CO2 in the air. The connectivity of the circuit is done using the breadboard and data cables, the supply to each of the sensors is 5v it is not taken directly from the controller, at the initial stage itself connect the Vcc and ground slots from the arduino to the bottom slots of the breadboard that denotes the supply trails. Now, an equal amount of supply will be given to the first set of slots where the sensors are interfaced.

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If the led which is integrated on the sensor blink, it's an indication that the connection is established. Connect the data pins as per the assigned pin slots, the sensors are attached to the GPIO pins of the Arduino uno, so the data will be sent and stored in the controller. Ultrasonic is helpful to compute the amount of junk in the bin, it is positioned at the top of the dustbin. The Entire data obtained will be displayed in the serial monitor window of the Arduino ide, the blocks are shown in Fig 1.

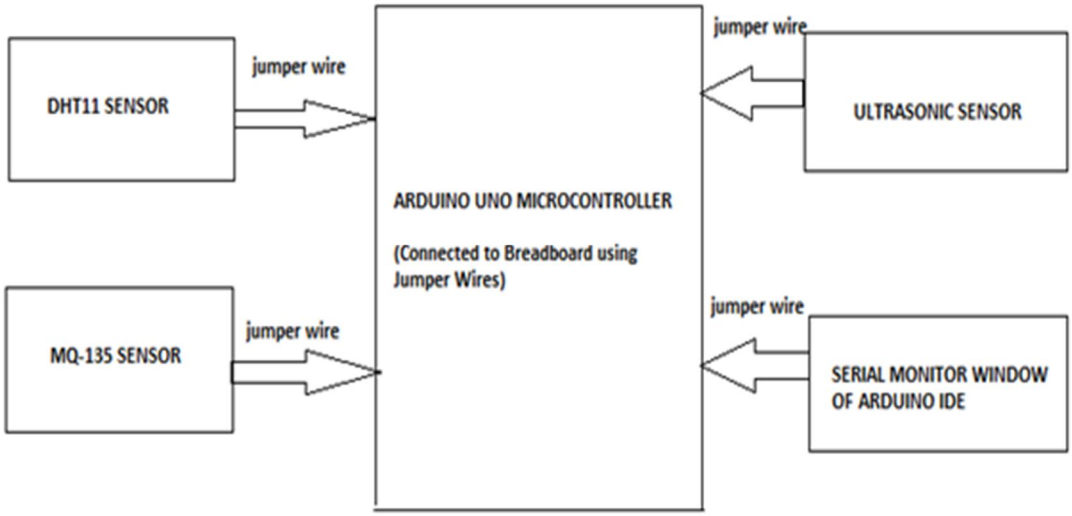


Fig 1. Block Diagram

III. SYSTEM IMPLEMENTATION

DHT11 Sensor consists of 3 pins namely Vcc, Data, Ground, the vcc pin is attached to the 3.3V slot of the arduino uno board. The ground is attached to one of the gnd pins of the same board. Data end can be interfaced to any of the digital GPIO pins. In the below figure it is given to the digital pin 5. The supply to the arduino board can be given either through the USB cable or the adapter. The output window consists of Humidity (%) and temperature in °C and °F as shown in Table 1. MQ-135 Gas sensor is helpful to control air quality and is apt for sensing or computing of ammonia, NOx, Alcohol, Benzene, Smoke, and carbon monoxide. It comes with a Digital Pin, sorts sensor to work even in absence of microcontroller and it is adaptable to detect a particular gas. The MQ135 sensor consists of 4pins Vcc, Gnd, Analog and Digital pins.

The Vcc pin is attached to the 5V slot of the arduino board. The gnd pin is linked to one of the gnd pins. The Analog pin can be interfaced to any one of the (A0-A5)analog pins. There are 14 GPIO digital pins, the digital pin is interfaced to slot 10 of the arduino uno. The Ultrasonic Sensor contains 4 pins Vcc, gnd, trig, echo pins, Vcc is attached to the 5V slot of the arduino uno. The gnd pin is attached to one of the gnd pins. The trig pin is wired to the digital GPIO slot 2 and the echo pin is attached to the analog. This is used to measure the distance from the transmitting end to the reflecting end, interfacing of sensors is shown in Fig 2.

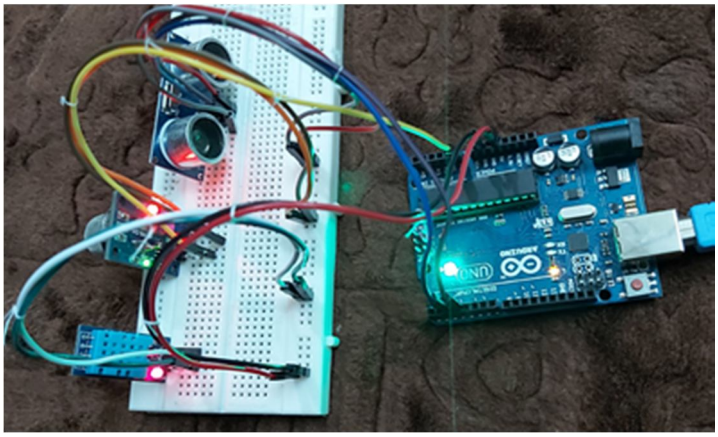


Fig 2. Interfacing of sensors (DHT11, MQ135, Ultrasonic) to the Arduino using Breadboard

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IV. RESULTS

Various sensors are integrated together to the Arduino Uno microcontroller for viewing the variations in the atmosphere by using sensors like DHT11 for computing the temperature in both celsius and fahrenheit, humidity in terms of percentage, the gas level sensor is used to measure the amount of hazardous gas in the atmosphere it contains both analog and digital pins, but generally analog values are more preferred. The values of distance are obtained by connecting an ultrasonic sensor; it will be useful in the waste management system for measuring the amount of trash in the dustbin in the form of cm; it can also be converted in terms of percentages for easy identification.

The Programming language used to code the device is C, initially the user has to install some of the supporting libraries or packages, if necessary libraries are not downloaded then it results in compilation errors. In order to avoid such problems select sketch and opt include library option. The below Fig 9 represents serial monitor window comprising of temperature, humidity, analog, digital, and distance. Inorder to obtain the output a joss stick is placed in front of the MQ135 sensor and certain values are obtained when an object is placed few centimeters away from the ultrasonic sensor, serial monitor window is shown in Fig 3.

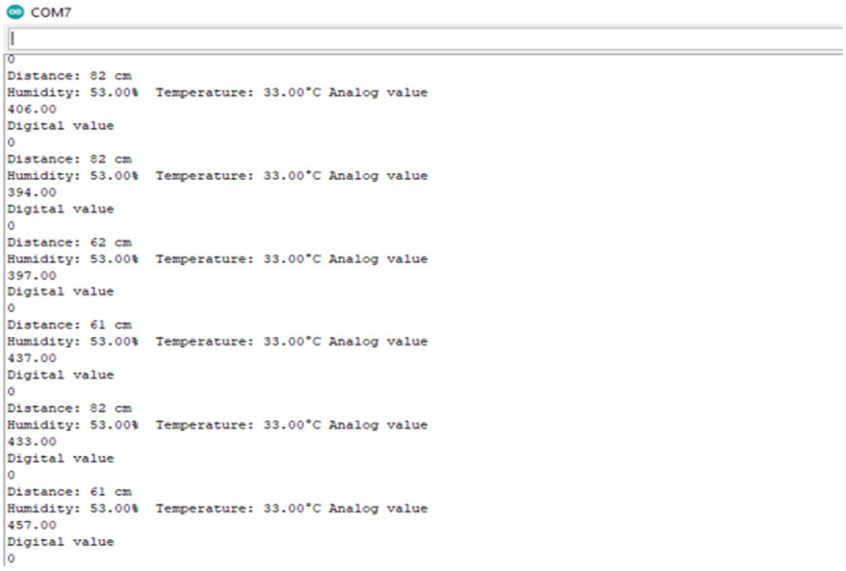


Fig 3. Serial Monitor Window of Arduino

The below table 1 implies values of humidness in terms of percentages, Variation of temperature in both celsius and fahrenheit. The value in cm indicates the amount of waste in the bin, as it computes the distance from transmitting end and receiving end. The distance values keep decreasing based upon the amount of garbage dumped in the bin. The digital values either 0 or 1 indicate presence of some gas and analog values are obtained when smoke and alcohol is placed ahead of the sensor module.

Table 1 . Values of sensors

Humidity (%)	Temperature		Distance (cm)	MQ135	
	°C	°F		Analog	Digital
53.00%	27.70°	81.86°	82	406.00	1
50.00%	28.70°	83.66°	61	304.00	0
53.00%	33.00°	91.04°	7	457.00	1
52.00%	28.80°	83.84°	2	171.00	0

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The values indicated in the below table are obtained using a sensor which detects the temperature in terms of celsius and fahrenheit and humidity during the three seasons namely summer, winter, monsoon at various time slots (IST). The Time slots include 7 AM, 1 PM, 6 PM, 11:30 PM, the entire hardware setup is exposed to the environment. DHT11 consists of a sensor and the module, the module is integrated with the three pins for the connectivity purpose. The blue rectangular shaped unit indicates the sensor, the end terminals are soldered to the module, and the summer season shows the maximum set of values compared to the other seasons as shown in Table 2.

Table 2 . Temperature and Humidity values

Time zone (Indian Standard Time)	DHT11 sensor values								
	Summer			Winter			Monsoon		
	Temp		Hum (%)	Temp		Hum (%)	Temp		Hum (%)
	^{0}C	^{0}F		^{0}C	^{0}F		^{0}C	^{0}F	
7:00 AM	26.03	78.85	52	22.42	72.35	50	23.07	73.52	50
1:00 PM	49.16	120.48	68	33.60	92.48	54	36.26	97.26	55
6:00 PM	36.47	97.64	55	26.12	79.01	52	32.18	89.92	54
11:30 PM	25.29	77.52	51	20.87	69.56	49	24.34	75.81	51

A Bar graph is plotted between the three seasons: Summer, Winter, Monsoon based upon the values indicated in the tabular column. The graph clearly states that the value of temperature is very high during the summer and especially the amount of heat in the afternoon(1 PM) is excessive compared to the other time slots and seasons. The minor bar indicates the winter season due to low temperature values that leads to frostiness. The x axis denotes the time zone in IST, y denotes the temperature values and the legend is indicated at the right corner. The below Fig 4 designates various temperatures.

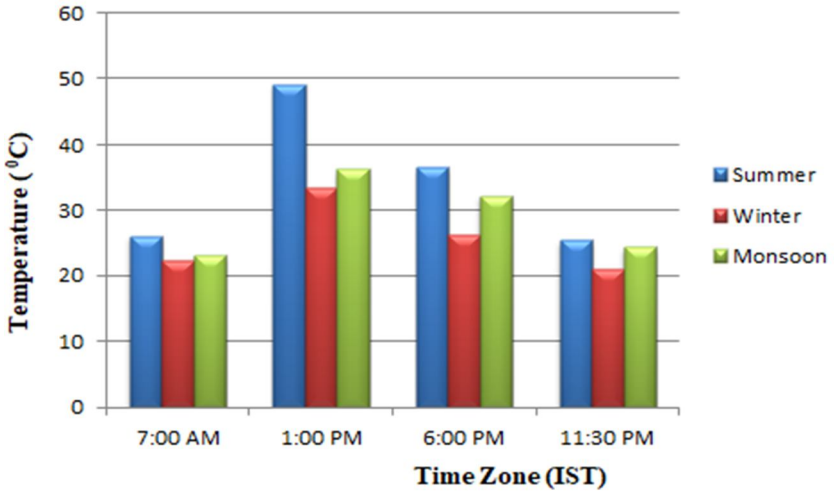


Fig 4. Variations in temperature across seasons

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The MQ-135 Gas sensors are used in air quality management equipment and are apt for detecting or measuring various hazardous gases like NH3, NOx, Alcohol, Benzene, Smoke, CO2. This sensor module comes with a Digital pin which makes this sensor to function even without a microcontroller and that comes in accessible while one attempts to discover a specific gas. If one desires to detect the gases in PPM the analog pin needs to be used. The analog pin is TTL driven and works on 5V and so may be used with maximum collective microcontrollers. The below table indicates the values obtained when smoke and alcohol are positioned infront of the gas sensor and also in its ideal state, table 3 shows the values detected by the gas sensor.

Table 3. Values detected by the Gas sensor

S.no	MQ-135 Sensor Value		
	Ideal state	Alcohol	Smoke(Joss stick)
1.	128	356	786
2.	151	398	753
3.	198	458	982
4.	219	512	1023

The values obtained in the above tabular column are plotted on the line chart, the rising curve indicates smoke, it is given out when a joss stick is placed in front of the sensor, in this case the values are very high 700- 1050 PPM, when compared to the other two cases. The amount of concentration of gas is measured in terms of parts per million. The alcohol values are in the range of 300-500 PPM and when the sensor is in the ideal state the values range from 120-220 PPM. In the same way numerous gases like carbon monoxide, ammonia, methane, sulphur dioxide can be detected, which in turn reduces the amount of toxicity in the environment. The axis indicates the level of concentration in ppm, the legend is indicated at the right corner. The green pyramids indicate smoke, red squares indicate alcohol and blue rhombus indicate the ideal state of the sensor, the levels of gas is shown in Fig 5.

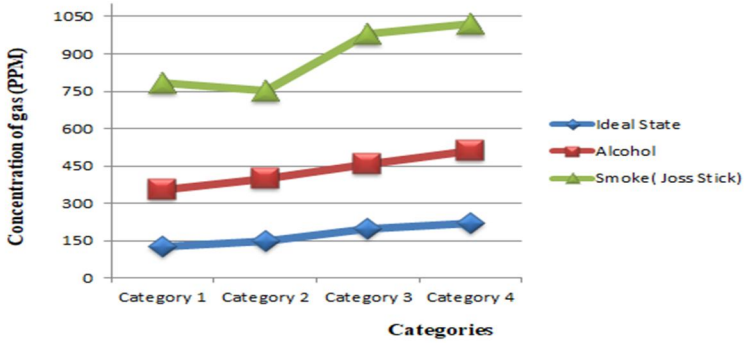


Fig 5. Levels of gas emission in the environment

V. CONCLUSION

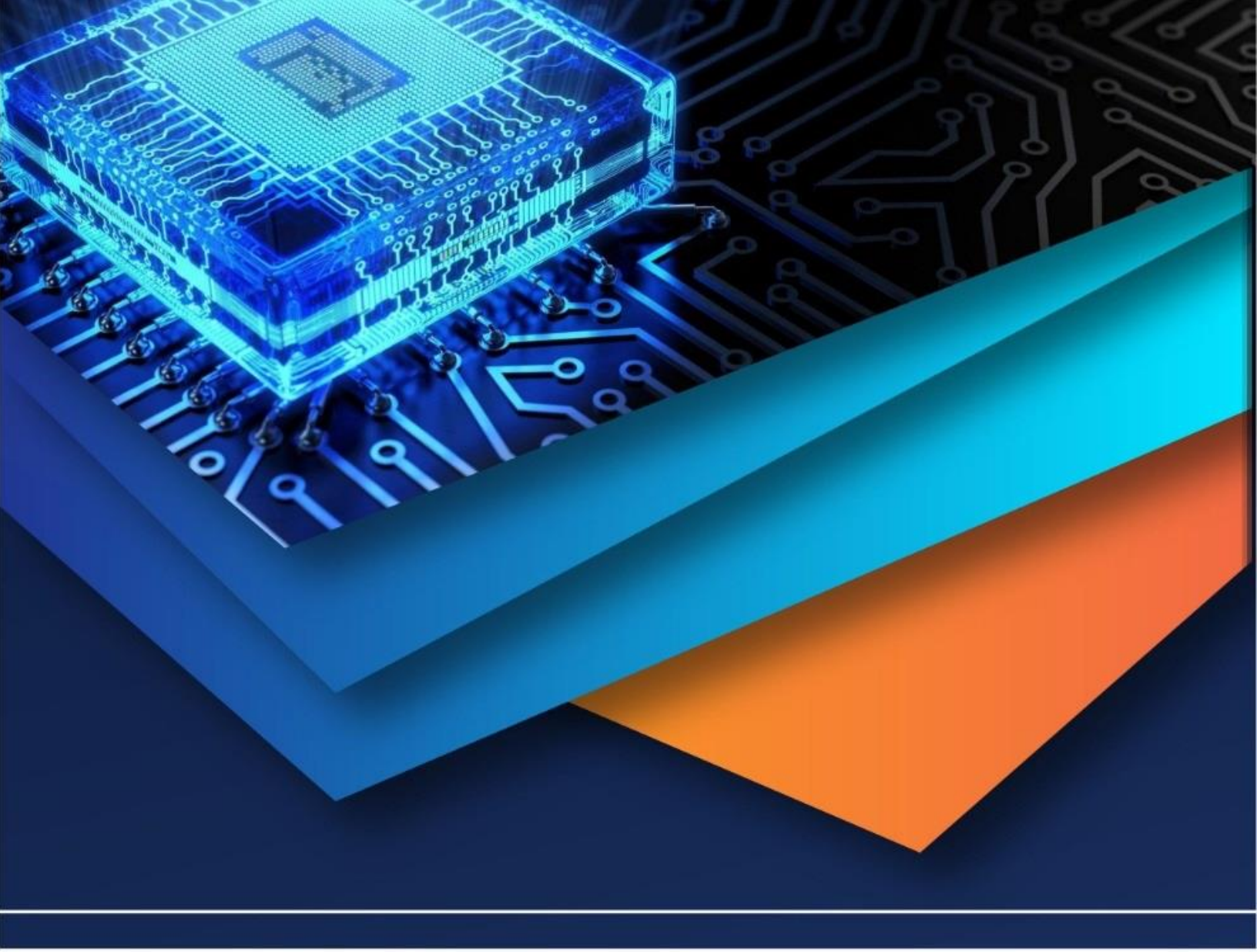
In this work, an environment detecting system has been presented and it is developed using a controller. It contains numerous smart traits, which comprise less-price, scalable, provisions miniaturization, affluence of implementation and easy handling. This custom is the subsequent stage of research which will concentrate on renovating this system into a wireless connectivity related system by launching a ZigBee Module, Raspberry Pi, LoRa, Sigfox and a web-application for managing the system. The work discussed in this paper is a massive phase headed for subsidizing the Swachh Bharat program. It consequently accentuates on the practicability of the prototype to be put into mass manufacture concerning its easiness in strategy and low production cost. Ultrasonic sensor has been used in this system to detect the garbage in the dustbins but later in upcoming generations additional sorts of sensors can be used with the ultrasonic sensor to get more clear-cut output and to take this system to an extra level. Now this system can be used in certain areas but as soon as it proves its integrity, can be used in all the big areas.

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