

“Review of: Smart Bins for Garbage Monitoring and Collection Using IoT System”

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Abstract - In the few years, city area population increasing rapidly. At the same time the percentage of increasing waste production is too much. Garbage collection and management has been a major issue to be considered. This paper represents the proposed system of Garbage collection and management using Internet of Things for residential or commercial areas. In this paper, smart bin is built on a microcontroller-based platform Arduino 328board which is interfaced with GSM modem and Ultrasonic sensor. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. This web page also sends all information to garbage collection vehicles. This project IoT Garbage monitoring system is a very innovative system which will help to keep the cities clean. Whenever the dustbin comes to its maximum level, the management department gets alert via SMS via GSM system placed at dustbin, so department can send waste collector vehicle to respective location to collect garbage. Now a day's Automatic systems are being preferred over manual system to make life simpler and easier in all aspects. The number of users of internet has grown so rapidly that it has become a necessary part of our daily life. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present day technologies in any way. This an advanced method in which waste management is automated.

Keywords - Arduino ATMEGA 328board, Ultrasonic Sensor, IR sensor, Wi-Fi Module, GSM Module.

I. INTRODUCTION

In the current scenario the rapidly increasing population and less awareness of waste management programs in the city area is the challenging task solid waste management, This has been creating a huge health issues all over the world. Proper management of waste materials is important to maintain healthy and hygienic environment to live. Municipal authorities have not sufficient resources for waste management institutions for the collection of waste generated. It gets an excessive wastage of resources when wastebins are collected that are filled up partially. This system is related to the “Smart City” and based on “Internet of Things” (IOT). So for smart lifestyle, cleanliness is needed, and cleanliness is begins with Garbage bin. For number of times we have seen that the dustbins are being overflowed with the waste materials and the concern person don't have any information about it within the time, due to which unsanitary conditions are formed in the surroundings environment and living area. Bad smell is out due to waste in dustbin at the same time. Also, the bad look of the city which leads to air and environmental

pollution and to some harmful infections and diseases around the locality which is spreadable easily. There are number of unwanted manual checks of garbage bin's level by municipal corporations which is less effective and time consuming. Trucks are sent to empty the dustbins whether they are full or not. And the trucks need fuel which is costly. Several sensing methods have been integrated and have combined their verdicts that offer the detection of bin condition and its parameter measurement. Though results and developed algorithms are efficient for automatic bin status monitoring work lacks remote monitoring of bin. So, in this paper we have proposed system which can be deployed in general purpose dust bins placed at public places and which allows us to monitor its status remotely over web browser for efficient waste management. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare 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 LCD screen is used to display the status of the level of garbage collected in the bins. Where as 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 highlights the garbage collected in colour in order to show the level of garbage collected. The LCD screen shows the status of the garbage level. The system puts on the buzzer when the level of garbage collected crosses the set limit. Thus this system helps to keep the city clean by informing about the garbage levels of the bins by providing graphical image of the bins via a web page.

Hence, smart dustbin is a system which can resolve this problem or at least reduce it to the minimum level.

A. Main Objectives is to:

- Develop an automatic garbage alert system for proper garbage management,
- Remove and destroy unhygienic condition, and to maintain the environment clean.
- Provide exact information regarding location of garbage.
- Monitor and analyses the generated garbage area wise.

B. Proposed System

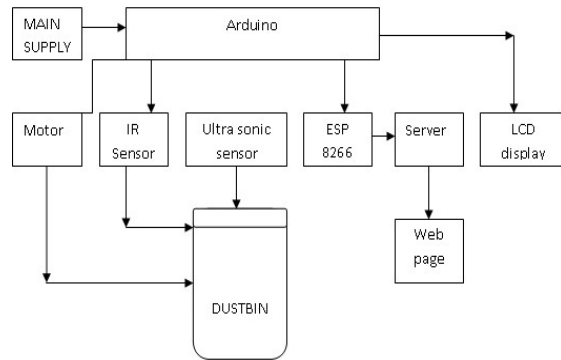


Fig. 1 Block Diagram

C. Literature Survey

First paper “IoT Based Waste Management, Monitoring & Tracking – SMART BIN”, Publish by Abeesh A I, Amal Prakash P, Parvathy Mohan, Poornima, Dhanya M in International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, In this paper, smart bin is built on a microcontroller-based platform Arduino Mega board which is interfaced with GSM modem and Ultrasonic sensor. The IoT based garbage monitoring system is a very innovative system which will help to keep the environment and cities clean. This system monitors the garbage bins throughout the city and informs about the level of garbage collected in the garbage bins to a person in the administrative department [1].

Second Paper, “SMART GARBAGE MONITORING AND COLLECTION SYSTEM USING INTERNET OF THINGS” Published by Miss. Priya A. Jadhao, Miss. Sonal D. Sakhare, Miss. Kajal G. Bhaldane, Prof. Abhishek P. Narkhede, Prof. Vaibhav S. Girnale. In this paper smart garbage monitoring and collection system using internet of things (IOT) is an innovative system. It works on Arduino controller; two dustbin for dry garbage and wet garbage were used. This two type of garbage will be detected by moisture sensor and respectively dustbin will open or close automatically. IR sensor is placed inside the dustbin to detect the level of garbage. When a garbage level is at threshold level then it will give a call & message through GSM module to garbage collective person and the level will be indicated at a web server with the help of a IOT module [2].

Third paper, “Garbage and Street Light Monitoring System Using Internet of Things”, Publish by Prof. R. M. Sahu, Akshay Godase, Pramod Shinde, Reshma Shinde in International journal of innovative research. In this paper bin set the public place then Camera set for garbage bin location. The camera captured image of garbage bin. Radio Frequency Identification (RFID), GPS and GIS send image for work station. The System are use controlling hut. This controlling hut are SMS technology. The GPS and GPRS mapping server analyzing data of location [3].

In fourth paper, “Waste Bin Monitoring System Using Integrated Technologies”, Publish by Kanchan Mahajan, Prof. J. S. Chitode. In International Journal of Innovative Research in Science, Engineering and Technology. In this paper zig bee and Global mobile communication system (GSM) used. The sensors are place in the garbage bins placed at the public place when the garbage reaches the level of the sensors. When garbage at threshold level gives sms through GSM. The technology use by Zig bee, Global mobile system (GSM), ARM 7 Controller. The range of communication of the zig bee is almost 50 meter.

In fifth paper, “SMART DUSTBIN”, this paper publish by Twinkle Sinha, K. mugesh Kumar, P. Saisharan. In International Journal. The compressing plate consists of a side hole through which the leaf switch is suspended upside down. Technology use Piston, Switch, microcontroller, the single directional cylinder, smart dustbin. Only use for smart dustbins, they are not provide garbage collection. Smart Dustbins can prevent the accumulation of the garbage along the roadside to a great extent thereby controlling the widespread of many diseases [5].

D. Proposed Methodology

In this IOT based innovative system, an Ultrasonic Sensor is used for detecting whether the bin is filled with garbage or not. Here Ultrasonic Sensor is installed at the top of bin and will measure the distance of garbage from the top of bin by setting a threshold value according to the size of bin. If the distance is less than this threshold value, means that the bin is full of garbage and we will print the message “Basket is Full” on the webpage and if the distance is more than this threshold value, then we will print the message “Basket is Empty”. Here we have set the Threshold value of 5cm in the Program code. We will use ESP8266 Wi-Fi module for connecting the Arduino to the webserver. Here we have used Local webserver to demonstrate the working of this Garbage Monitoring System. The servo motor is used to open the lid of the dustbin when IR sensor detects the human the servo motor gets the lid open. The lid will be open for 10seconds and then will be automatically closed. When dustbin gets fully filled then the lid of the dustbin will not get open and the display on the lcd will be “DUSTBIN IS FULL EMPTY THE GARBAGE”. When the worker will press the push button and empty the garbage the display on lcd will be “LID IS FORCELY OPEN” and the whole status will be displayed on things peaks server.

If once the garbage level reaches the particular height, then it will immediately process the information to the web-based software including the message as garbage is being filled by using Wi-Fi module. IR sensor is interfaced with Arduino for detecting the presence of waste outside the bin. The LDR Sensor Module is used to detect the presence of light / measuring the intensity of light. The output of the module goes high in the presence of light and it becomes low in the absence of light. The preeminent functions of LDR can be stated as follows : Primarily for providing street light in order

to differentiate day and night and secondarily for favoring the prime priority to the bins that are filled up a bit previous than the others. The provided gas sensor is able to detect the foul smell outside the bin and thereby identifies presence of nearby waste surrounding the bin. It also helps in monitoring the air quality of the atmosphere where the bin is placed.

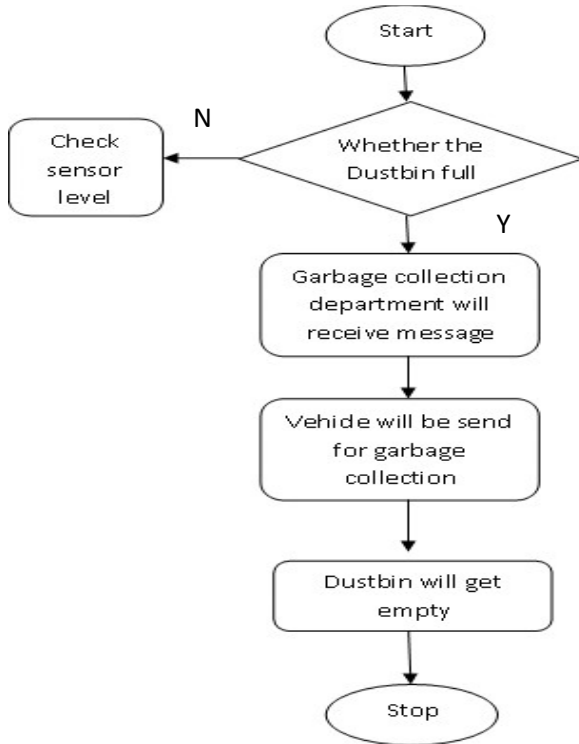


Fig. 2 Simple Flow diagram

E. Hardware Setup & Implementation

Using different sensors, we have implemented solid waste management system which is described previous sections. Dust bin used for experiment is having cross section 15 X 15X 35cm, weight 400 gm and capacity of 5 litres. To get the accurate level we have installed ultrasonic sensor (HC-SR04) at the top of dust bin. Ultrasonic ranging module HC - SR04 provides 3cm - 400cm, the ranging accuracy can reach to 5mm. The system include ultrasonic transceiver and control circuit. This module automatically sends eight 40 kHz and detect whether there is a pulse signal back. If the signal back, through high level, time of high output duration is the time from sending ultrasonic to returning.

The 12V power is given to the complete system. That is to an arduino, IR sensor and moisture sensor both input are given to Arduino and two output dry dustbin and wet dustbin. For two condition first is if the garbage is wet then the moisture sensor will sense the moisture and wet dustbin door will open automatically for 20 second same way if it is dry garbage then the dry dustbin door will open automatically for 20 second due to moisture sensor. Now when any one dustbin will get full then, Buzzer will get ON and due to GSM message as

well as call will be received by the garbage collection department person. IOT online notification will send on web page for the collection of garbage.

1) *Arduino MC*: Arduino is a microcontroller board based on the ATmega328 and it is brain of system. It is open source, computer hardware and software device. It sense and control objects in the physical world. Its operates on + 5V supply. It is basically microcontroller. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

2) *GSM Module*: GSM is a global system for mobile communication. It operates either the 900MHZ to 1800MHZ frequency band In this system GSM is used for sending message and call to garbage collective person from municipality office. when the garbage will be at threshold level then the GSM will work .

3) *ESP 8266*: The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif Systems .The chip first came to the attention of western makers in August 2014 with the **ESP-01** module, made by a third-party manufacturer, Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using HAYES -style commands. The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.

4) *IOT*: The IOT is an internet of things (IOT). It is a network of physical device, vehicles, homes appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these object to connect and exchange data. Here ESP8266 Module is used as a wireless network. It is a WIFI Module. ESP is 3.3v device.

5) *IR Sensor*: Infrared sensor is an electronic instrument which sense certain characteristics if its surroundings by emitting or detecting infrared radiation. It is also capable of measuring the heat being emitted by an object and detecting motion. Infrared Radiation. An infrared sensor circuit is one of the basic and popular sensor module in an electronic device.

6) *LCD*: Flat screen **LCD** and plasma screens **work** in a completely different way. ... In a plasma screen, each pixel is a tiny fluorescent lamp switched on or off electronically. In an **LCD** television, the pixels are switched on or off electronically using liquid crystals to rotate polarized light. LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines

7) *Ultrasonic sensor*: Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back.

F. Block Diagram Explanation

1. IR SENSOR detects the presence of human in front of dustbin. And then it sends logical signal to microcontroller ATMEGA 328. In accordance with the controller output servo motor opens the lid of the dustbin.
2. ULTRASONIC SENSOR detects the level of garbage present in the dustbin in accordance with that it sends logical signal to microcontroller ATMEGA 328.
3. Level of dustbin will be shown on LCD.
4. ESP 8266 will transmit the dustbin's status on the webpage.
5. If dustbin is full then BUZZER will get on.
6. All the control and logical operation of system is governed by microcontroller ATMEGA328.

1.1 Working:

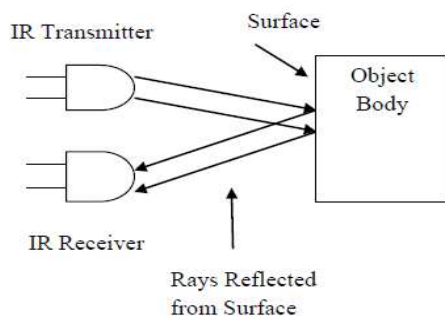


Figure No. 3: Working Principle of IR Sensor

The input signal from Arduino is applied to IR sensor transmitter (Tx). If there is any garbage the waves are disturb and received by the receiver and send signal to Arduino if the garbage is present then IR sensor sense the garbage the moisture sensor sense the moisture in garbage if the moisture is present in garbage then it opens the door of wet bin and if not then it opens the door of dry bin.

1.2 *The Garbage Detection*: In this process of garbage detection. there is a level detector sensor which detects the level of the garbage in the bin. If the bin is 75% full then it sends message by using IOT (Blynk app) and GSM. By using GSM message is send and inform them about the garbage. If the bin is 75% full then buzzer is ON and sounds for few seconds after that it will OFF. With this process we can inform the work station about the garbage is collected in the society.

Advantages:

The main advantage of this project is as follows:

- Due to IR sensors detection method it is possible to inform immediately and take certain actions to empty it as soon as possible.
- The status of these bins can be checked anytime on their mobile phones.
- Support digital India and “SWACH BAHART MISSION”.
- To maintain clean & green Environment.

Limitation:

- Since the technology is new in India, proper awareness should be created among the public before it is implemented on a large scale. Otherwise, sensitive devices like sensors might be damaged due to Improper handling by the users.
- As the size of garbage bin increases, requirement of sensors will also increases.

Applications:

- The main objective is to maintain the level of cleanliness in the city and form an environment which is better for living.
- This smart bin system can be used in developing the “SMART CITY”.
- This can contribute and is helpful in keeping the society clean under the the “SWACHH BHARAT ABHIYAN”.
- By using this system we can constantly check the level of the garbage in the dustbins which are placed in various parts of the city.
- The system can be used as a standard reference by the people who are willing to take one step further for increasing the cleanliness in their respected areas

II. CONCLUSION

With this system we conclude that the expenses on transportation can be saved by knowing the exact location through sms system. Hence unnecessary traffic an be reduced. Whenever the Dust bin fully filled, GSM modem is activated to send an alert message to the concerned person through an SMS. The SMS contain Google map link to the exact location of the bin. As soon as an SMS alert is received, person can take immediate actions for cleaning the filled bins on time before overflow. Also the air pollution is controlled with the use of automatic dustbin opening and closing and also the problem of garbage pickup and thrown away by animals is overcome. It can automatically monitor the garbage level & send the information to collection truck. The technologies which are used, good enough to ensure the practical and perfect for solid waste garbage collection process monitoring and management for green environment. The overall system is very much cost effective, user friendly and also helps to reduce human resources, and hence helps in resource optimization.

Future Scope:

- CCTV camera can be used to monitor the things.
- Manure can be generated using wet waste garbage by using additional system.
- By knowing the pollution level, its quantity as well as quantity can be improved.
- By giving free Wi-Fi access to the user for future activity.

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