IoT BASED GARBAGE MONITORING SYSTEM

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***Abstract*—**In our surroundings, many times an observation is made that the garbage bins kept at public places overflows because of increase in the garbage regularly. It results in unhealthy condition for the people and spreads bad smell which results in spreading some serious diseases in Human Beings. So, to avoid such a situation, the basic idea is to develop a system named "IOT Based Garbage Monitoring System". In this system multiple dustbins are located throughout the city and these dustbins has micro-controllers which help to track the garbage bins level and a unique ID will be provided for each and every dustbin so it will be easy to identify which particular garbage bin is full. These dustbins are built using infrared sensors. When the level of the garbage collected inside the dustbins reach some calculated threshold notification is sent to the concerned authority through a webpage. Some networking concepts will also be used for the communication between simulators and application. Laptops will be utilized for the simulation purpose. Whereas a web page is built to show the status of garbage level to the user monitoring it. The web page gives a view of the garbage bins and highlights the garbage collected. The` system puts on the GSM module 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 how much garbage is filled in the bins via a web page.

Keywords*—*microcontroller; infrared sensors, simulation, IOT

I. INTRODUCTION

From 1947 until 2019, India's population has rapidly increase 74% which makeup into India current population which is 1,31, 164, 177 where 77% of the population is staying at urban. According to United Nations Population Fund (see www.unfpa.org), by 2030 five billion of people will be lived in urban areas, therefore, there is no surprise where Indian produce an average of 30,000 tons of waste every day and only 5% percent of it is recycled [1,2]. According to Ministry of Urban Wellbeing, Housing and Local Government shows that these wastes are resulting in tremendous land and air pollution for the environment, health problems for communities and bottlenecks to the economic growth. Taken together, the problem of poor waste management in Indian is one of the nation's biggest issues to date. Waste can be divided into two categories, liquid or solid waste, both can be hazardous. Both of these wastes can be group into organic, re-usable and recyclable waste. Mainly, liquid waste came from a point source or non-point source discharges such as wash water from homes, liquids used from cleaning in industries and waste detergents. Meanwhile, solid waste is any garbage, refuse or rubbish that make from home. These include old car tires, old newspapers, broken furniture and even food waste. Generally, in India waste management is monitor by the state council.

The domestic wastes are collected daily while the recycled wastes are collected twice a week [3]. Though, the waste collection is consistent however the current collection does not allow the local municipal to know the status of the garbage bin either full or empty. This practice of garbage collection become irregular and not relevant, once the increasing of state's population. Whilst, it does not have a systematic schedule to collect every type of garbage, the overloaded garbage will attract animals and insects. So, it will create unhygienic condition for surrounding environment and creates bad small which can lead in spreading some deadly disease and human illness. Current garbage collection is inefficiencies, time waste and required a huge amount of human energy. This is because the garbage collectors need to check whether the garbage is full or not according to the fix schedule. The objectives of the project are to design a prototype of Internet-of-Thing (IoT) garbage monitoring system and alert the garbage collectors the fullness of the bin by identify the level of garbage based on the depth of the bin.

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. The sensor will be placed on top of bin which will help in sending the Things (Embedded devices) which are connected to Internet and sometimes these devices can be controlled from the internet is called as Internet of Things. In our system, the Smart dust bins are connected to the internet to get the real time information of the smart dustbins. A proper waste management system is required to keep the city clean and hygienic. There are multiple dustbins situated across the city or the Campus (Educational Institutions, Companies, and Hospitals etc.).These dustbins are connected with micro controller, Ultrasonic Sensors and GSM modules where the Ultrasonic sensor will detect the level of the dustbin and will send the signals to micro controller. The data received will be analyzed and processed and accordingly the dustbin level can be found out on weekly basis. K-means clustering Algorithm will provide with the analysis to figure out on which days the dustbin is been filled more. All this activity can be tracked out through the Android Application [4,5]. Authorized personnel will have the Android Application which will show the current level of dustbin. This will help in regularly monitoring the

current status of dustbin and clean the dustbins at right times so unnecessary bad smell will be reduced.

II. PROPOSED SYSTEM

The system contains various parameters such as IR sensor, Node MCU, WI-FI module, power supply, GSM module, LED drivers, dustbin, and web server. Now let us start with the following hardware requirements.

A. Methodology:

The working of the whole framework is appeared in a basic stream or flowchart. The framework starts with the sensor being connected to the dustbin making it a smart dustbin. The information from sensor is sent to the Node MCU. From the equipment the information is pushed into the cloud. The information that is should have been sent as a push notice to the enlisted versatile application is sent from the sensor to the web server and it is displayed on the webpage.
The implementation details are given as,

1. A database must be created which includes dustbin names and its real time data.
2. The webpage is built to receive push notification.
3. The android device is registered to access the built application.
4. The sensor data is transferred to Node MCU on timely basis.
5. The data from the microcontroller i.e. Node MCU is pushed to the web server.
6. Node MCU gets IP from Wi-Fi router to which it is connected. With this IP address, it can act as an HTTP server to which any wi-fi device can connect.
7. The status of each bin is shown separately on the web server either bin is low or high.
8. If the dustbin exceeds the threshold value then it will be in critical situation.
9. Message is sent to the authority when dustbin is at critical situation.
10. If no notifications or results come from the sensor for many days, it's assumed that the sensor might be damaged.

The block diagram in figure 1 represents the overall workflow of the system.

B. Hardware setup:

The system contains hardware parameters such as IR sensor, Node MCU, Wi-Fi module, LED drivers, power supply, and GSM module. The whole framework of the system has major hardware part as Node MCU. It is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Express if Systems, and hardware which is based on the ESP-12 module. The term "Node MCU" by default refers to the firmware rather than the development kits. Node MCU Dev Kit/board consists of ESP8266 wi-fi enabled chip. The **ESP8266** is a low-cost Wi-Fi chip developed by Espress if Systems with TCP/IP protocol. Dustbin is interfaced with microcontroller-based system having IR wireless systems along with central system showing current status of garbage, on mobile web browser with html page by Wi-Fi. Hence the status will be updated on to the html page. There by to reduce human resources and efforts along with the enhancement of a smart city vision. Considering the need of modern technology, the smart garbage bin can expensive but considering the amount of dustbin needed in India, therefore they used based sensors to reduce its cost and also make it efficient in applications and at the sender side they used only a Wi-Fi module to send and receive data.

The figure 2 shows connection set up for each component. The IR sensors act as input to the Node MCU. Node MCU contains Wi-Fi module inbuilt within it. The serial connection is established between Node MCU and GSM module. Serial ports are used for transmitter and receiver purpose. Once the all set up is done according to programmed levels the garbage level is detected and it is displayed on the webpage. Real time data is updated continuously as the garbage level changes. When the garbage level is reached up to the threshold level the GSM sends the text message to the concerned mobile number which already exists in the system. The system is divided into two sides one is transmitter and another one is receiver.

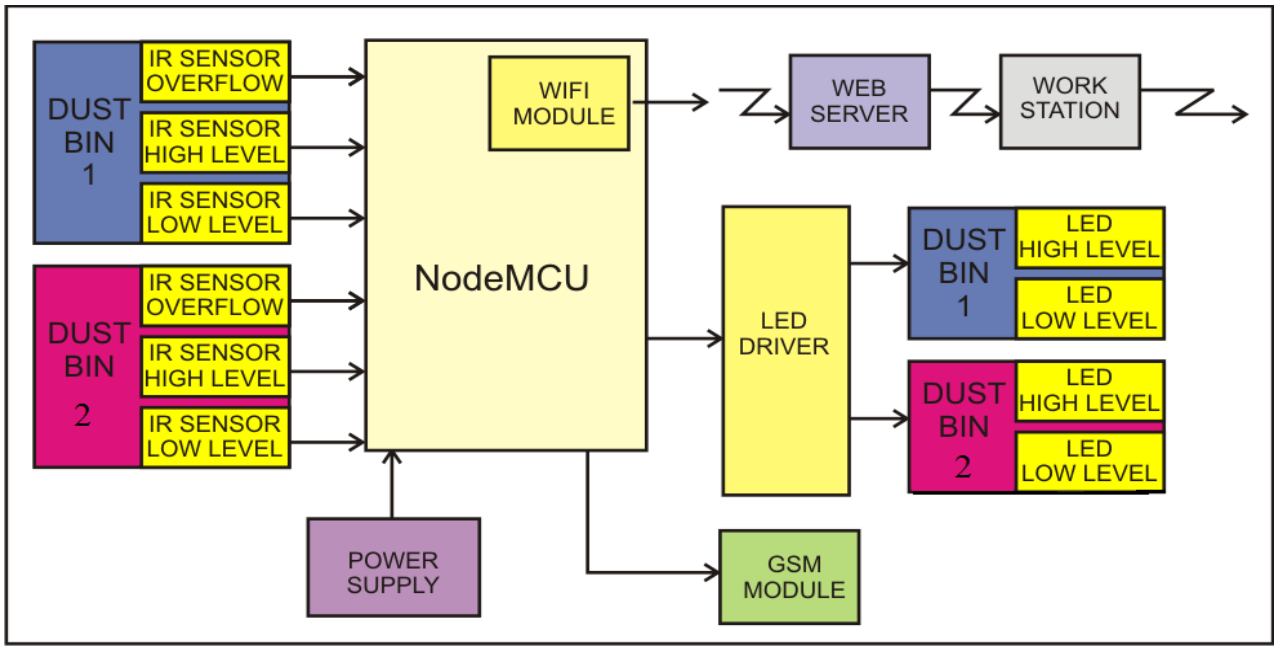

Figure 1: Block diagram for Methodology

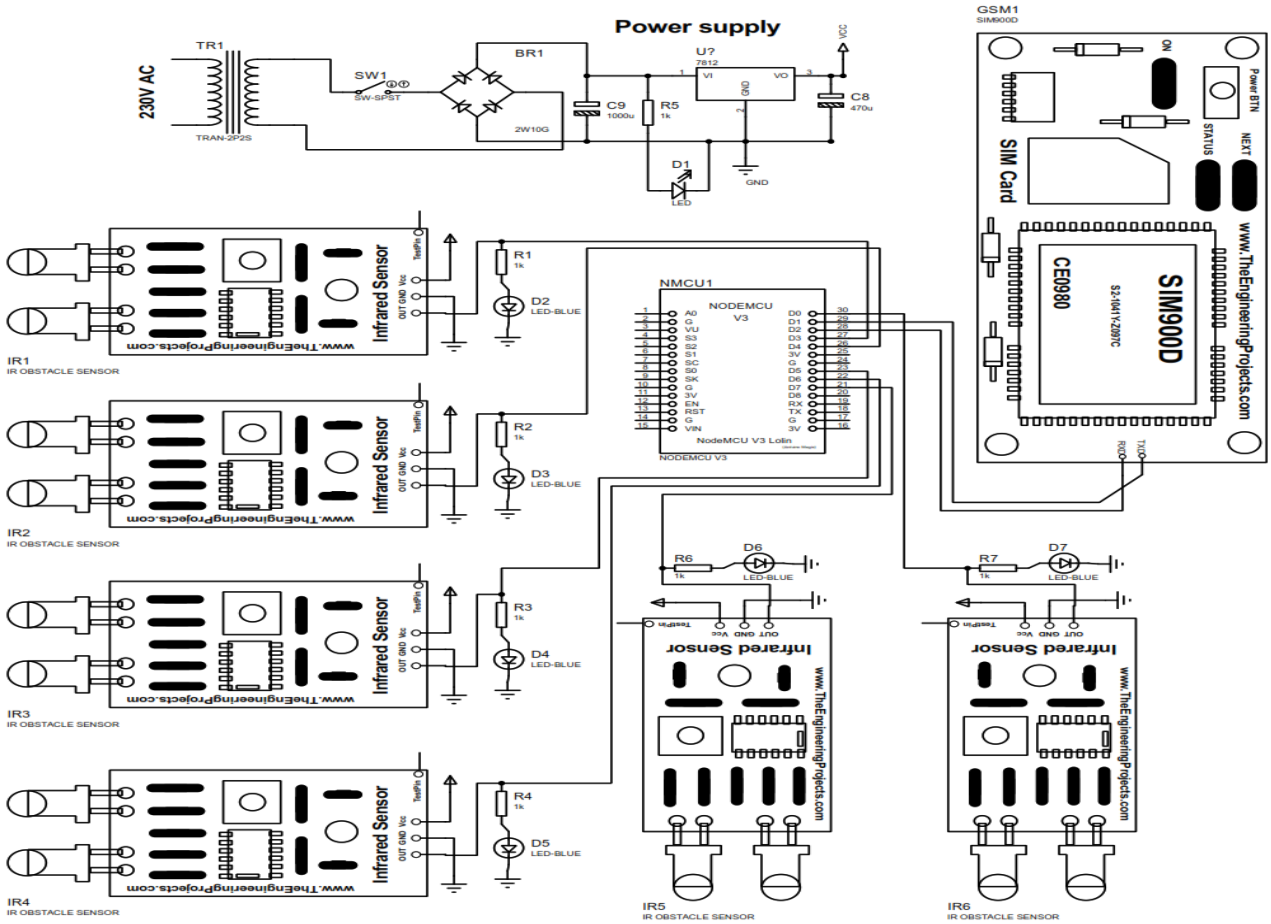

Figure 2: Hardware setup

III Results and Discussions

Garbage monitoring system using IoT gives the following results after testing it. The system is observed for many times and its efficiency is up to the mark and levels detected are approximately equal to the actual results. The readings obtained from the developed systems are as follows:

Sr. No.	Dustbin 1 Status	Dustbin 2 Status	Time	Date
1	Low	Low	7:00 AM	15/10/2019
2	Low	High	8:00 AM	16/10/2019
3	Low	Critical	2:13 PM	18/10/2019
4	High	Low	10:00 AM	19/10/2019
5	High	High	11:00 AM	20/10/2019
6	High	Critical	11:30 AM	21/10/2019
7	Critical	Low	2:12 PM	22/10/2019
8	Low	Low	2:00 PM	23/10/2019
9	High	High	3:00 PM	25/10/2019
10	High	Critical	2:13 PM	27/10/2019
11	Critical	Low	2:21 PM	30/10/2019
12	Low	Low	7:00 PM	1/11/2019
13	High	High	9:00 AM	5/11/2019
14	High	Critical	2:08 PM	7/11/2019
15	High	Low	11:30 AM	9/11/2019
16	Critical	Low	2:00 PM	10/11/2019
17	Low	High	4:00 PM	12/11/2019
18	High	High	6:00 PM	15/11/2019
19	Critical	Critical	2:13 PM	19/11/2019
20	Low	Low	11:00 AM	19/11/2019
21	Low	High	1:00 PM	20/11/2019
22	High	High	2:00 PM	22/11/2019
23	Critical	High	4:00 PM	25/11/2019
24	Low	Critical	4:05 PM	25/11/2019
25	High	Low	10:00 AM	27/11/2019

IV Conclusion and Future Enhancements:

The main objective is to maintain the level of cleanliness in the city and form an environment which is better for living. 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. If a dustbin has reached the maximum level, then the employees can be informed, and they can immediately take certain actions to empty it as soon as possible. The employees can check the status of these bins anytime on their mobile phones. This can prove to be a very useful system if used properly.

This report presents the work accomplished on real time solid waste municipal Garbage bins monitoring system. Solid waste can be monitored effectively by sending alert to the local corporation. If the garbage in garbage bin is not cleared in a specific period, then alert will be sent to the head office so that proper action will be taken accordingly. In this way time can be managed and solid waste can be monitored effectively. So finally, we conclude that our system is so much helpful for monitoring the bins effectively without overflowing onto the streets.

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