

# IMPLEMENTATION OF IOT BASED WASTE CARRIER MANAGEMENT SYSTEM

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## ABSTRACT

Waste management is one of the primary problem that the world faces irrespective of the case of developed or developing country. The key issue in the waste management is that the garbage bin at public places gets overflowed well in advance before the commencement of the next cleaning process. It in turn leads to various hazards such as bad odor & ugliness to that place which may be the root cause for spread of various diseases. To avoid all such hazardous scenario and maintain public cleanliness and health this work is mounted on a smart waste management system. The main theme of this paper is to develop a smart intelligent garbage alert system for a proper garbage management. This paper proposes a smart alert system for garbage clearance by giving an alert signal to the municipal web server for instant cleaning of dustbin with proper verification based on level of garbage filling. This process is aided by the ultrasonic sensor which is interfaced with Arduino Mega to check the level of garbage filled in the dustbin and sends the alert to the municipal web server once if garbage is filled.

## I. INTRODUCTION

As the population is increasing the solid waste is additionally increasing in urban and rural areas and waste management has become a worldwide concern. We need to require the right call so as to manage this overflowing garbage. Mainly there are 3 areas of sources wherever garbage is generated viz. residential, commercial and industrial. The garbage created within the residential district is collected directly from home or by creating a meeting for mass assortment in this area and might be upraised mistreatment vehicles.

Internet and its applications have become an integral part of today's human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers went beyond connecting just computers into the web. These researches led to the birth of a sensational gizmo, Internet of Things (IoT). Communication over the internet has grown from user - user interaction to device – device interactions these days. The IoT concepts were proposed years back but still it's in the initial stage of commercial deployment. Home automation industry and transportation industries are seeing rapid growth with IoT. This work aims in structuring a state of the art review on IoT. The technology, history and applications have been discussed briefly along with various statistics. Since most of the process is done through the internet we must have an active high speed internet connection. The technology can be simply explained as a connection between human computers-things. All the equipment's we use in our day to day life can be controlled and monitored using the IoT. A majority of process is done with the help of sensors in IoT. Sensors are deployed everywhere and these sensors convert raw physical data into digital signals and transmits them to its control center. By this way we can monitor environment changes remotely from any part of the world via internet. These systems architecture would be based on context of operations and processes in real-time scenarios.

Things (Embedded devices) that are connected to Internet and sometimes these devices can be controlled from the internet is commonly 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. In the recent years, there was a rapid growth in population which leads to more waste disposal. So a proper waste management system is necessary to avoid spreading some deadly diseases. Managing the smart bins by monitoring the status of it and accordingly taking the decision. There are multiple dustbins are located throughout the city or the Campus (Educational Institutions, Companies, Hospitals etc.). These dustbins are interfaced with micro controller based system with ultrasonic Sensor, fire sensor and wi-fi module. Where the ultrasonic sensor detects the level of the dust in dustbin and sends the signals to micro controller the same signal are encoded and send through Wi-Fi at the Central System and an Internet connection is enabled through a LAN cable from the modem. The data has been received, analyzed and processed in the cloud, which displays the status of the Garbage in the dustbin on the GUI on the web browser.

## II. SYSTEM DESIGN:

The implemented design of the system is used to monitor garbage level of dustbins. The main aim of the project is to effectively perform the internet data acquisition process and using the Arduino Mega accurately. This system monitors the garbage bins to detect the garbage level

and compare it with the garbage bins depth and informs the level of total garbage collected in the garbage bins to the monitoring person at the different place. The one of the main aim of this system is to stop overflow of garbage in dustbins which can be achieved by managing the time of garbage collection. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth.

This paper could be a lead taken towards clean environment. Arduino Mega microcontroller is used in this monitoring system. A 16\*2 LCD is used at the dustbins to display the garbage levels. Ultrasonic sensors HC-SR04 are used to detect the garbage level of dustbins in different regions. Fire sensors are used in the system to detect the fire in dustbin if any. Also a temperature sensor and a gas sensor are also used to detect the smoke and to measure the temperature in the dustbin due to any reason. A power supply circuit is used for supplying power the circuit. Crystal oscillator is used for applying pulses to trigger the process of level detection in the system.

## 2.1 BLOCK DIAGRAM

The block diagram of the “IOT Based Waste Carrier Management System” is as shown in the figure above. This system consists of various sensors for the monitoring purpose. The system consists of an Arduino Mega microcontroller, which is the main block of the system and acts as brain of the system.

The power supply unit is used to provide the required power supply to the circuit components in this system. This power supply unit provides regulated 5v power supply to the microcontroller and other circuit components. The level detector consists of an ultrasonic sensor which is used to detect the level of the garbage in the dustbin. The output of ultrasonic sensor i.e. level of garbage in dustbin is given to Arduino. When the dustbin is filled up to the highest level, the alert message is sent to the centre office.

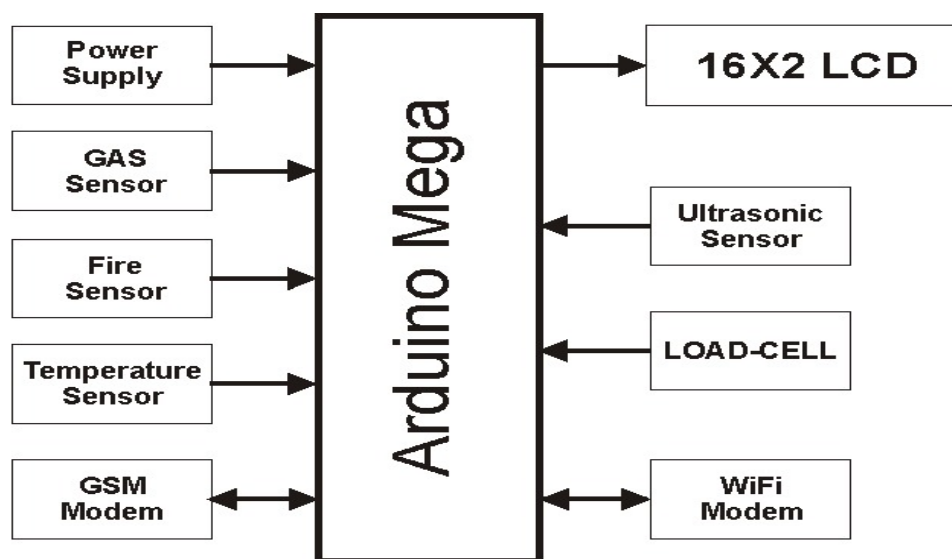


Figure 1: Block Diagram of “IOT Based Waste Carrier Management System”

The hardware of the system also consists of a fire sensor as shown in the block diagram above. This fire sensor is used to detect the fire in the dustbin or garbage due to any reason. This fire sensor sends signal to the controller as soon as it detects the fire due to any reason. The load cell will provide information related to the weight of the garbage in the dustbin. On checking for two of the parameters- level sensor and load cell, the error rate of false alarm will greatly reduce. To avoid the danger of fire and to intimate the monitoring office about the danger of fire a gas sensor and a temperature sensor are interfaced with the Arduino board. The system consists of a LCD display used to display the level of the garbage in the dustbin and also will display the fire detected if fire is detected in the dustbin. The display displays all the conditions and alert messages according to the output of the sensors used in the system. The system consists of a Wi-Fi modem to transmit all the data over the internet to monitor the dustbin from anywhere and the data will be sent to the municipal office.

## 2.2 CIRCUIT IMPLEMENTATION

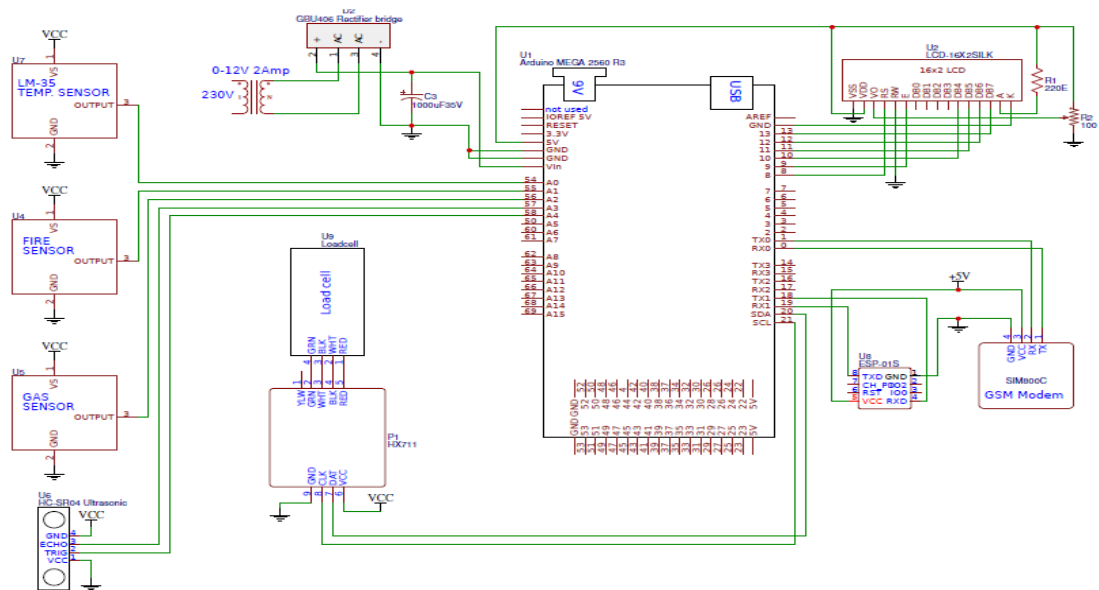


Figure 2: Circuit diagram of “IOT Based Waste Carrier Management System”

The above diagram represents the circuit implementation of the IOT Based Waste Carrier Management System. We have designed a power supply unit to provide regulated power supply to the circuit components. In this system, we have used an ultrasonic sensor HC-SR04 to measure the level of the garbage in the dustbin. In this system, for demo purpose, we have used a single dustbin. To measure the level of the garbage in the dustbin, the ultrasonic sensor is mounted on the top of the dustbin. This ultrasonic sensor is connected to the analog pin A3 and A4 of the Arduino board.

Also, to measure the weight of the dustbin, that is, garbage weight, we have used a load cell in this system. This load cell is interfaced with the Arduino board and is implemented below the dustbin. In this system, a fire sensor is also interfaced with the Arduino and is mounted on the dustbin for fire detection. This fire sensor provides the signal to the microcontroller. The controller board receives the signal from the sensor and, after processing, it will take the appropriate action to alert the authorized person about the fire.

In this system, we also used a temperature sensor used to measure the temperature of the dustbin continuously. To provide more secure monitoring and controlling of the dustbins, we have used a GAS sensor used to detect the smoke after the stifle of the fire in the dustbin.

To send all the measured data over the internet on a webpage, a Wi-Fi modem is interfaced with the Arduino as shown in the circuit diagram of the system. The transmitter terminal of the Wi-Fi modem is connected to the receiver terminal of the microcontroller that is

pin number 19 of the controller IC. And the receiver terminal of the Wi-Fi modem is connected to the pin number 18 that is transmitter terminal of the controller IC as shown in the circuit diagram of the system. All the measured data that is level of the garbage in the dustbin and if the fire is detected will be displayed on the LCD display. The system also incorporates a GSM modem which is used to send an alert message to the authorized person in terms of a text message.

### III. WORKING:

The module is divided into two parts Transmitter section and Receiver section. Here in the transmitter section we are using Arduino microcontroller, Wi-Fi modem and sensors these are attached to the dustbin. Sensors are used to detect the garbage level in the dustbin, whether the dustbin is full or empty. The sensor senses the content of the dustbin and sends the signals or the data to the microcontroller. The microcontroller reads the data from the sensor and process the data received from sensor, and the same data wirelessly transmitted to the internet.

Ultra sonic sensor is used to detect the level of garbage. The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor. Ultrasonic sensors can detect movement of targets and measure the distance to them.

In this method we have placed the dustbins on load cells to monitor the weight of the waste material in the dustbins. This is used if any one puts some heavy material in the dustbin or sand or some solid heavy materials in it. In such case the ultrasonic sensor will provide the normal level in the dustbin but the weight will be increased so that the monitoring person will be notified about such malfunctioning.

Also a fire sensor detects fire if any and sends signal to the controller. Controller receives the signal and by comparing it will take decision. The microcontroller reads the data from the sensor and process the data received from sensor, and the same data wirelessly transmitted to the internet. All the data will be seen on the webpage for this system. This webpage also contains indications for fire and garbage level in the dustbin. The temperature sensor measures the temperature of the dustbin continuously and provides the temperature value to the Arduino for monitoring and comparing it. Similarly a gas sensor is used to detect the smoke generated due to any reason or after the stifle of the fire. All the measured parameters and alert message will also be displayed on the display used in this system for locality in that area where the dustbin is placed.



## IV. RESULTS

Following are the results obtained after implementation of this system:

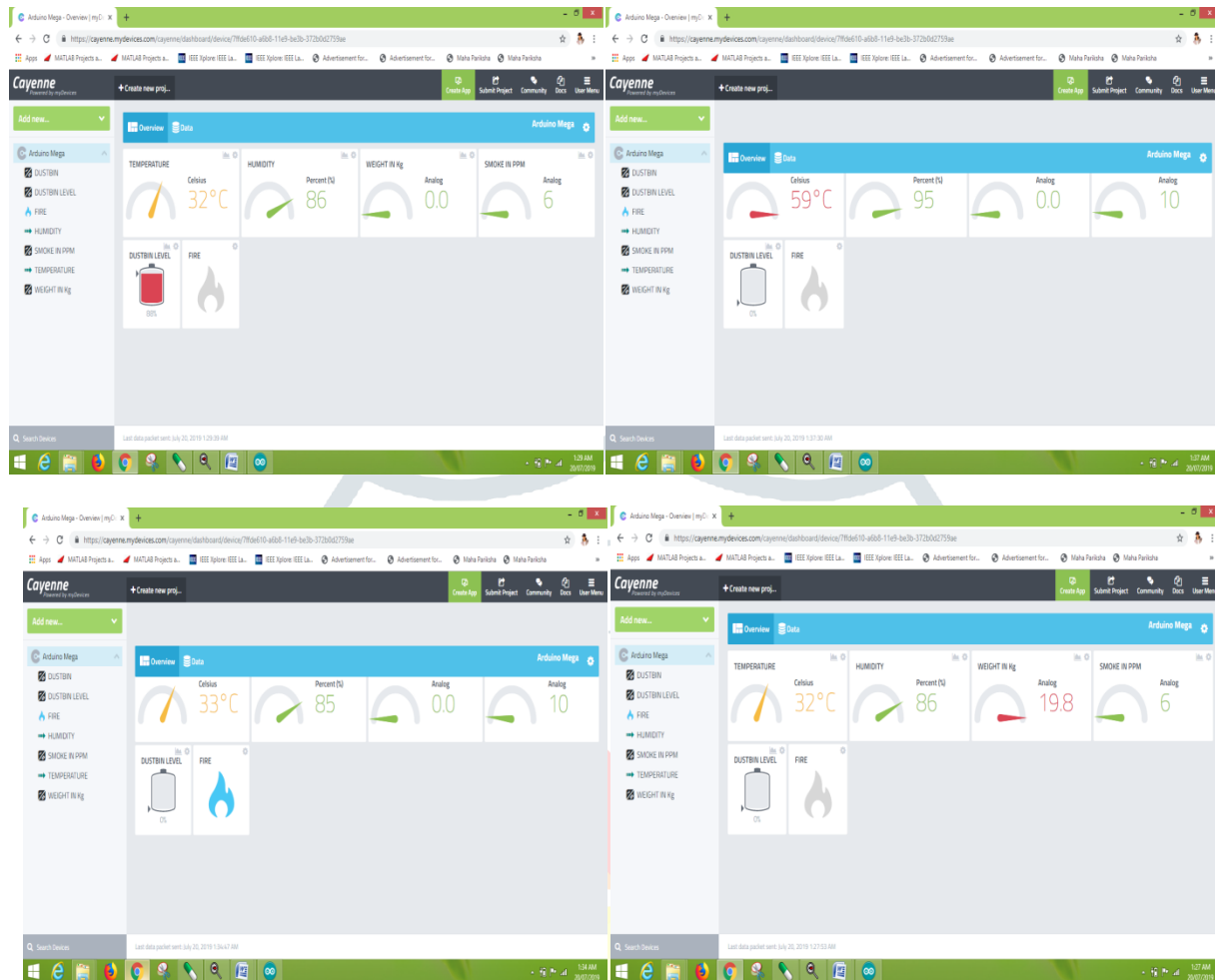


Figure 3: IoT window showing status of all sensors



Figure 4: LCD Display showing status of all sensors

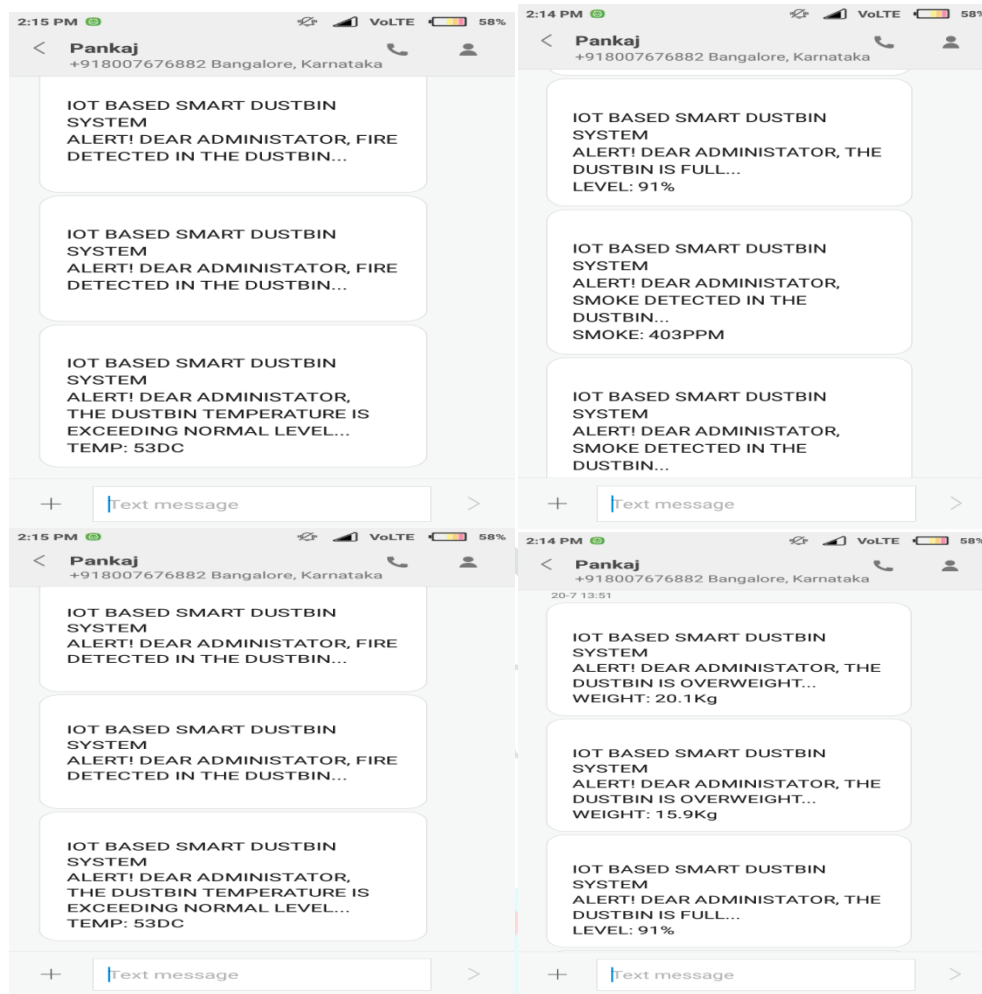


Figure 5: Message Display showing status of all sensors

## CONCLUSION

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

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