# Garbage Monitoring System for a College

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*Abstract: These days certain moves are made to enhance the dimension of tidiness in the nation. Individuals are getting increasingly dynamic in doing every one of the things conceivable to clean their environment. Now in this project a smart garbage management has been suggested for a college. If the flooded garbage containers are not collected and emptied on time it will create an unhealthy environment. Hence it will promote to the ascend of several kinds of anonymous infections. This will worsen the standard of living. To overcome these circumstances an effective smart garbage management technique must be produced. Here in this project we use ATMEGA-2560 microcontroller, ultrasonic- sensors to measure the level of garbage filled in the garbage container, MQ-3 gas-sensor to detect the presence of gases. When the threshold value reaches for the ultrasonic or the gas sensor, a SMS will be sent through the ESP8266: Wi-Fi-Module to the responsible person. Each garbage bin contains a-RFID-tag. A RFID-Reader is there with the person who will collect the garbage. When the allotted person collects the garbage the RFID-Reader reads the RFID-tag automatically and hence the status that the garbage from that area is collected will also get updated automatically to the database. Thus, in the webpage we will be able to see all the updates. Suppose alert came about garbage container regarding garbage level high but still care was not taken after a certain interval of time SMS will be resend to that person, even if action is not taken, SMS will be sent to the managing authority. Hence, the suggested model describes as to how to make use of the modern technologies to make the college's environment hygienic.*

*Index Terms: ATMEGA 2560 , ESP8266,  , MQ-3 Gas-sensor, RFID-Reader, RFID-Tag, Ultrasonic-sensor.*

## I. INTRODUCTION

In contemporary times, there are masses of flats and apartments which have been built in the rapid urbanization area. This is because of high lodging requests which have been radically ascended because of movement from towns to urban communities to discover works. So as to oblige the developing populace in the urban zone, the legislature has manufactured pads, lofts or townhouses, to give safe house to them. Nowadays, flats are very common in all developing countries and the inhabitants of all flats have few complaints. One of them is the matter of the domestic waste removal, which cause contaminations. In flats a common dustbin is shared among all the people who lives in the same building thus those dustbins get filled quickly.

and further dumping into the bins from the residents will lead As a consequence, a chaotic and ineffective waste management might cause the containers to be always full with garbage, to garbage mounds scattered outside the bins. Subsequently, there will be an issue of cleanliness as those trash heaps may turn into the underlying driver of sickness and maladies for example like dengue, looseness of the bowels, and cholera. Furthermore, there are likewise issues with respect to the frames of mind of every occupant of the flats. There are situations where some negligent inhabitants, who generally live at the upper levels of the building, throw their waste from that floor directly into the dustbin below, which might cause pollution. When the garbage is thrown from a top floor of a building it might fall outside the bin or it might cause some injury to any person passing by falling on his head. The waste clearance can be overseen all the more appropriately and productively by frequently checking the container status and the trash level. In this project garbage monitoring system for a college is done. Like in any locality maintaining proper hygiene is important for any college campus as well. College is a place where people come for education. People from various places come and interact. Maintaining cleanliness in a college campus is also very important. That is why garbage should be monitored. In the campus if the garbage bins are overflowing, foul smell is coming, all these will lead to become a hub of insects and mosquitoes, which is harmful because it will lead to diseases. Students will get affected and overall it will hamper the college environment. That is why in this project a smart garbage collecting system is developed for a college campus.

## II. RELATED WORKS

The paper [1] recommended a method by using the microcontroller Arduino, GSM module, and Infrared sensors. Four Infrared sensors are being used to measure the level of trash in the bin. A GUI is made to observe all data of the garbage. Now when the value reaches its verge, the microcontroller sends message by the GSM module. Then action will be taken to clean the garbage instantly. If litterbin is not cleared on time, then message will go to the higher authority and the required action will be taken by them.

Another strategy as presented in [2] is, a wastebasket is interfaced with microcontroller, and IR sensors are used. All the status of the garbage can be seen in the html page with the help of Wi-Fi. Here weight sensor had been used for identifying the weight of the waste only. A message will go the cleaning vehicle regarding the garbage in the bin.

In paper [3] Infrared sensor (IR sensor) is used which will distinguish the dimension of waste. Sensor detects the level of trash in the bin.

Through a graphical representation it can be seen up to what distance the bin is filled. Once the bin level touches the threshold the LED starts to blink. When that blinking led is clicked on the webpage all information like the status of bin, area of bin, time when it got filled, bin number and what information to be send to that person will be see.

In [4] the proposed system is where the level of waste in the bin has been detected with the help of ultrasonic sensor which will continuously communicate through GSM module to the control room. In this system there is an obligation of master and slave units. Slave unit is placed in the garbage bin and the master unit is placed at the control room. Slave unit entails Atmega328 IC, ultrasonic sensor and GSM module, which is entirely placed at top of the dustbin. Once the level of garbage reaches the edge, ultrasonic sensor gives indication to Arduino Uno board and through-GSM, SMS will be send to control room mentioning that the bin is full. In master unit when the SMS is received at control room, it will indicate on the-GUI and all updates can be viewed there.

The system proposed as in [5] makes sure that the bin is cleaned when the garbage level reaches its extreme. The IR sensor acts as a level detector. The sensor senses the innards of the dustbin and sends the data to the ARM microcontroller then the microcontroller reads the data from the sensor and processes it, and ultimately sends to the Dashboard section. This section sends a mail/message to separate Municipal/Government expert individual or collection vehicle. In the event that the container is not eviscerated on time, at that point the record is sent to the higher authority who further can make proper move against the concerned temporary worker.

Another [6] strategy is that, when the trash achieves the edge level ultrasonic sensor will trigger the GSM modem which will ceaselessly alarm the required authority until the garbage in the dustbin is squashed. When the dustbin is squashed, individuals can reuse the dustbin. At customary interims dustbin will be cleaned. In this technique, GSM 900A modem is utilized to send the messages. The ultrasonic sensor is utilized to discover the tallness of trash filled at various interims of time. 3 sensors are utilized at different statures like h/3, 2h/3 and h, where h is the tallness of the bin however to make it moderate and to accomplish similar outcomes, just a single sensor is set at surface dimension in this model

### III. PROPOSED WORK

In all of the existing system as studied, either it was IOT based smart alert system where it focused on only sending alert to the municipality for instant cleaning of bin, or, it was IOT based garbage monitoring where buzzer will be on when toxic gas is detected or garbage level crosses the threshold limit, or else, a garbage monitoring using IOT where notification send in mobile using "Blynk" app if garbage level crosses the threshold, or a smart live tracking garbage collection where RFID is used to track the bins whether garbage collected or not, otherwise a smart garbage monitoring where only ultrasonic and gas sensors are used to detect and display the level of garbage and presence of gas in web page, or a Smart Garbage Monitoring where Raspberry-Pi is used to send a SMS to the concerned person if garbage level crosses the threshold value. None of the model was totally efficient.

Hence here in this proposed model we have come up with a garbage monitoring system for a college. We have considered 3 bins at a particular floor in the college campus. ATMEGA-2560- is used as the microcontroller here. We use ultrasonic sensor to measure the level of garbage filled in the garbage container.

Once the garbage has reached the maximum level an alert SMS will go to the responsible person to go and collect the garbage. The SMS will also mention the bin id. When the municipality wish to collect the garbage, they will access the webpage to check the status of the garbage containers.

Now each garbage containers contain a RFID tag. After SMS generation worker has to collect garbage from the bin. After he arrived, he has to flash his RFID card to the RFID reader attached to the bin so that status will be updated that he has collected garbage from the bin. The status will get updated only if the garbage is actually collected, if someone simply flashes RFID tag there will be no change in status in the website.

Also, gas sensors are placed in the bins to detect the presence of poisonous gases. A threshold value is also set for detecting presence of gases, if it crosses that value then alert SMS will go to the municipality.

Suppose SMS came to the worker still no action was taken, after some time another SMS will be received by the collector but still if no one comes to collect the garbage then after 1-hour message will go to authority and then necessary action will be taken.
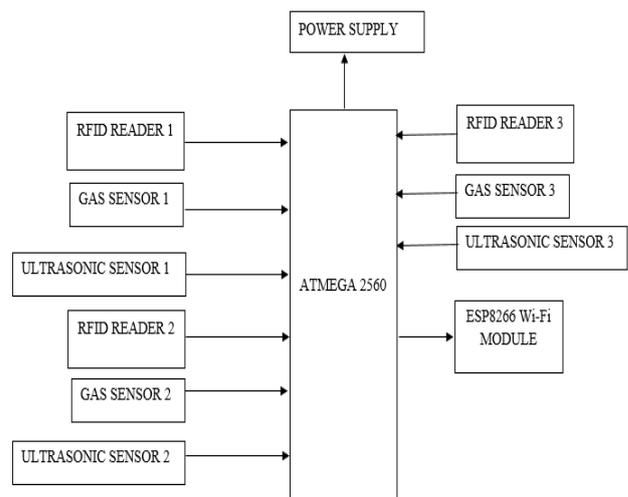


Fig 1. Proposed Model

For convenience we can also check the status of bins in a mobile app MQTT-Dashboard, where bin level and gas level '0' stands for it has not reached the threshold value and '1' stands for it has reached the threshold value. Also, for the status of whether garbage is cleared or not we can check in the app. If the RFID tag is scanned against the reader then in the app, we can see the status as "came for collection", and if not scanned then no status in the app. The proposed model is as shown in Fig 1.

## IV. METHODOLOGY

This system makes use of ATMEGA 2560 microcontroller, ultrasonic sensors for measuring the garbage level, MQ-3 gas sensor to detect presence of gases, RFID tag and readers for determining who collected garbage, ESP8266-Wi-Fi-Module for communication with server and Power supply. For front end html and CSS is used and backend Node.js is used. MySQL database is used.

At first data is read from the sensors, then it is sent to the microcontroller (ATMEGA-2560-). Now the logic is applied as it is embedded in the code of the microcontroller. All data from ATMEGA-2560- is sent to the ESP8266 Wi-Fi Module through-an UART-(Universal-asynchronous-receiver / -transmitter)-communication.
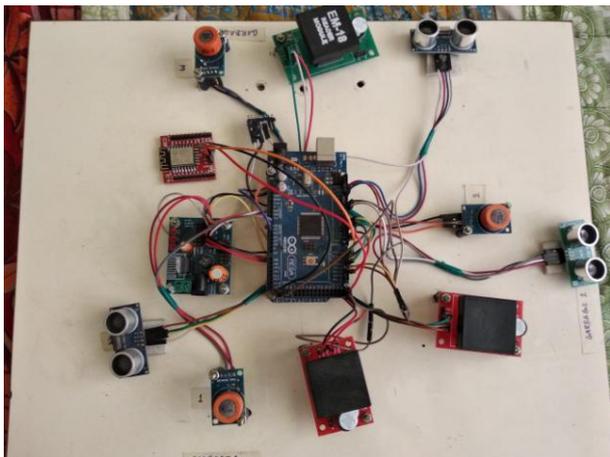


**Fig.2. Hardware Model**

The Wi-Fi module is programmed to connect to the MQTT-server. MQTT (Message Queuing Telemetry Transport) is an ISO standard publish- subscribe based messaging protocol. A client sends a message (the publisher) to that receive the messages (the subscribers). Here publisher is ATMEGA-2560- and Subscriber is node.js. MQTT uses the topics to determine which message goes to which subscriber. Here in this model we have 9 topics for 9 sensors. The client connections are handled by a broker (here Eclipse Mosquito) which is liable for getting all messages, filtering the messages, finding out who is subscribed to each message, and also to send the messages to the subscribed client (node.js). Thus in node.js we get the values which is then stored in the database. Node.js queries the data from the database and every 5-6 seconds data gets published which we retrieve through the web application. For sending the SMS to the respective person for collection of garbage, Node-JS contains SMS API through which it sends the message. The overall work flow is depicted in Fig 3

## V. RESULTS AND DISCUSSION

The Hardware model will be as shown in the Fig 2, proposed system Garbage Monitoring System for a College is very useful in any college. Here in this model a user will open the application, if he is already registered, he can directly log in to the application with his username and password. If he is a new user then he has to register in the application as shown in Fig 4.

The microcontroller has roughly 52 GPIO pins with which all can be used if in case of large scaling the whole model. The micro-controller can perform efficiently even after adding a greater number of sensors.as shown in Fig 2.
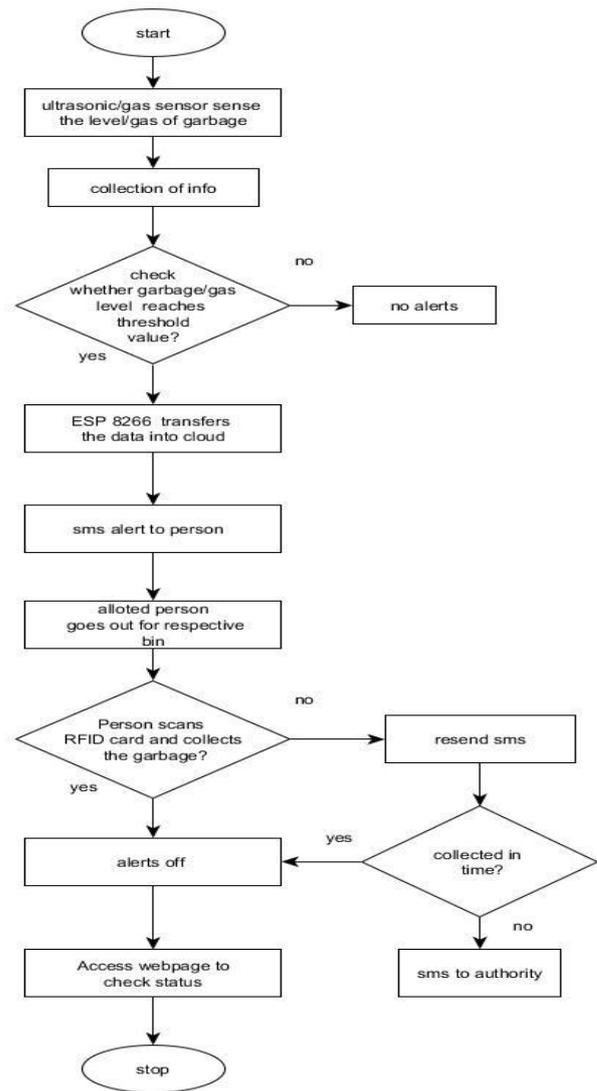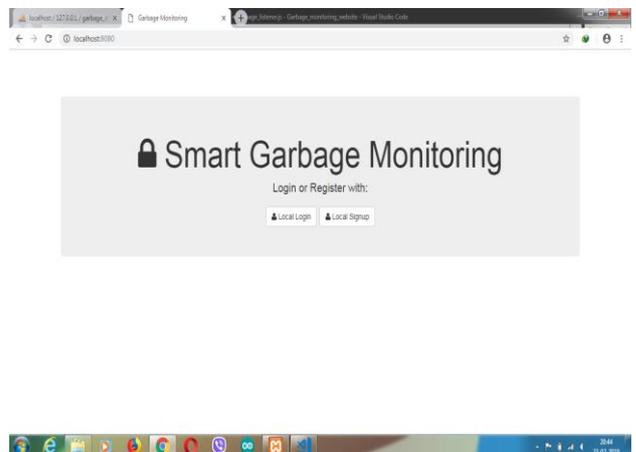


**Fig. 3. Work Flow Diagram**



**Fig.4. Home page of the Application**

In the login page in Fig 5, if the entered data matches with the data saved in the database then that login is successful and if the data doesn't match then the login fails and user is redirected to the login page again. Each time the user registers the value are being stored in the database. This can be very helpful if it is being handled floor wise or building wise with the same interface. As shown in Fig 6 will be UI for user in order to see all the related live updates of the bin.
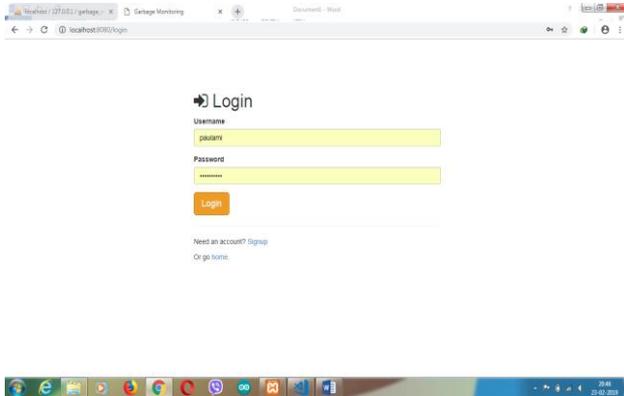


**Fig.5. Login Page of the Application**

After the user logs in to the application, he can see the status of the 3 bins about the garbage level, gas level and whether garbage has been collected or not as shown in Fig 6. Initially when both garbage and gas level is low, status of garbage will show as collected by default, but when the threshold value reaches it will show as 'not collected'. After the garbage has been collected the status will change to 'collected' again.
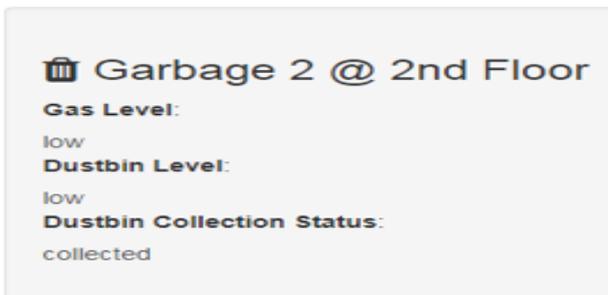


**Fig.6. Status of all the sensors**

Suppose dustbin 2 garbage level (<=20cm) and gas level (300unit) has crossed the threshold value so the status in the webpage will be as in Fig 7

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**Fig.7. Status of Garbage 2 as not-collected**

Also the garbage collector will get a SMS as instantly as shown in Fig 8, if the level crosses the threshold value to the one who needs to collect and the same status will be updated in the webpage as well as in the mobile application.
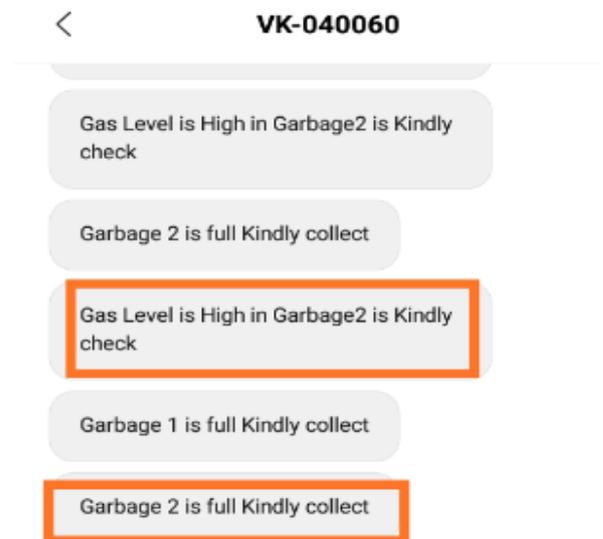


**Fig.8. SMS to the garbage collector when gas level and garbage level in garbage 2 crosses threshold value.**

Now suppose even after receiving the sms the person did not come to collect the garbage message will be send to authority to take some immediate action. The alert SMS will be followed as shown in below Fig 9.The the higher authority will know and proper action would be taken.



**Fig.9. SMS to the authority**

Simultaneously with the web application all these statuses can be checked in the MQTT Dashboard even remotely as shown in Fig.10. '0' stands for normal level and '1' stands for when threshold value crosses
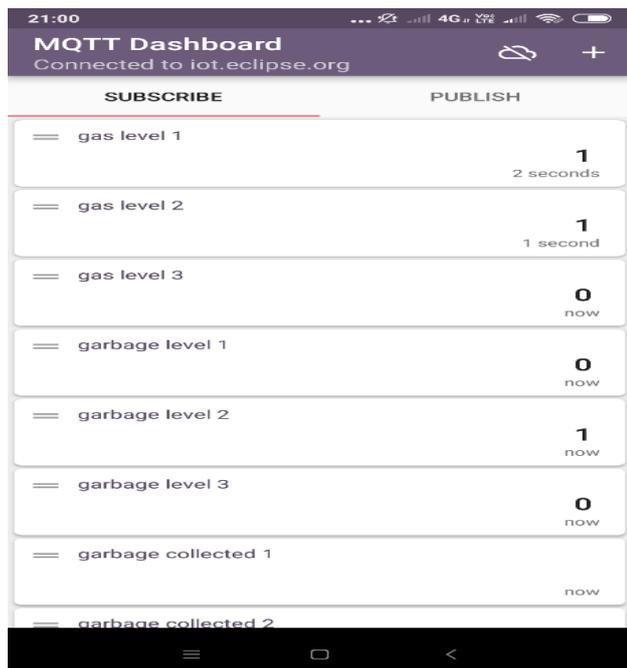


**Fig. 10. MQTT Dashboard**

If the RFID tag is scanned against the reader then in the app we can see the status as "came for collection" as shown in Fig.11, and if not scanned then no status in the app. But this will only show if anyone came to collect or not, in the website the bin is cleared or not can be checked
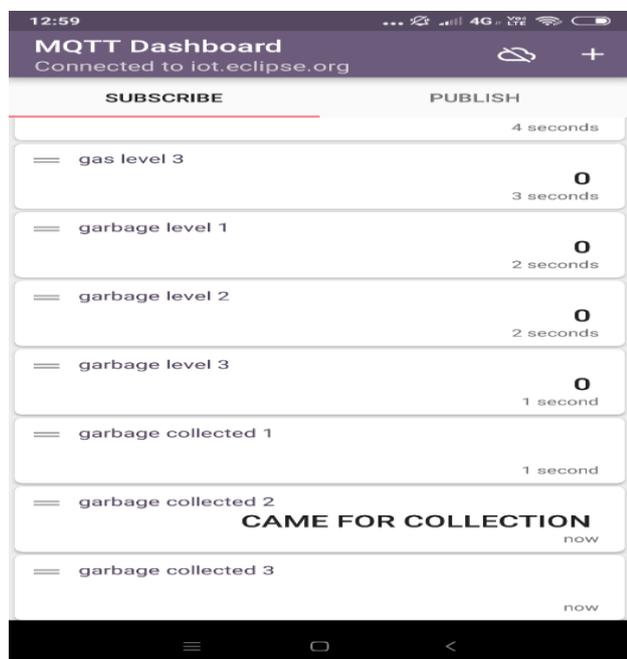


**Fig.11. Status in the app when RFID card is scanned**

## VI. CONCLUSION AND FUTURE WORK

Thus here a garbage monitoring system for a college is implemented where information of all smart dustbins can be accessed from the website at any time by the concerned person and he/she can take a decision accordingly. Automatic

SMS is sent to the allotted person to come and pick up the garbage. By implementing this proposed system, the cost reduction, resource optimization, effective usage of smart dustbins can be done. This System will inform the status of each and every dustbin in real time so that the concerned authority can send the garbage collection vehicle or the responsible person only when the dustbin is full.

Advantages of the proposed system:

- Effective garbage monitoring system for a college campus.

- Improves the quality of college environment.

- Real time information on garbage level in the dustbin.

- Real time information on the presence of gases or any foul smell in the bin.

- Real time update on whether garbage is collected or not. No false update in website simply by swiping the RFID tag, it will only get updated if garbage is cleared.

- If the bin is full still no action is taken in spite of getting the SMS, message sent to authority for proper action to be taken.

As a scope of the future work two bins can be retained to assemble dry and damp waste separately. Damp waste can be putrefied to make biogas. We can try to develop an android application so that it will be easy for the people to check the location of the nearest bin, and also whether it is full or empty from their mobiles. A time stamp can be included in the system so that it can be seen at what time bin was full- and what-time garbage was collected.

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