

Garbage Monitoring System Using Smart Bins

Dhana Shree K, Janani B, Reenadevi R, Rajesh R

Abstract : The population in developing metropolitan city increases day-by-day. Solid waste management is one of the major concerns of the modern world. Monitoring of waste bins manually in metropolitan areas and cities every day is not an easy one. The amount of garbage differs in different areas and manual monitoring causes more human effort and cost. Non-disposal of wastes at the right time affects human health and the environment. This system proposes a methodology for an automatic garbage monitoring system using an ultrasonic sensor and detects the garbage level in dustbin and intimates to the concerned in-charge for disposal. This method involves less manpower and also avoids contamination.

Index Terms: IF This Then That (IFTTT), Internet of Things (IoT), Message Queue Telemetry Transport (MQTT),

1. INTRODUCTION

As the population increases the cleanliness also decreases. In the metropolitan city, more diseases have spread the problem of garbage waste. The development of smart cities needs a smart garbage monitoring system. So the garbage waste management system plays a major problem in the global world. The garbage monitoring system is succeeding with smart bins. We develop the smart bins and it is connected to the dashboard and it can be accessed anywhere. Our smart bins is implemented using IoT, cloud technology and data science. IoT is used for hardware progress on the devices and cloud is used for storing the data.

2 RELATED WORK

S.Vinoth Kumar et al [1] in their proposed work understood the smartness based waste management system which checks the waste level over the dustbins using sensors. When it detects the waste level it identifies using GSM/GPS. Microcontrollers are using interface between users and smart bins. To monitor the waste level using the android application. Most of the city garbage bins are filled and it makes the unhygienic environment. They develop an effective method to monitor garbage wastes. They develop smart bins using a sensor and microcontroller. The sensing system connected to the internet and it connected to the server. In the server, it contains database, data management system, Optimization algorithms, Artificial intelligence technology, and information forwarding. In that user dashboard data collection and data visualization are there. The garbage monitor system proposed by ShashankShukla[2] Jose M.Gutierrez et al [3] in their proposed work understood the smart waste collection monitor system using the integration of data, geographic information and combinational operation to improve the cities. The IoT sensors are connected to the road bins to collect the sensor data, read and write the data. KasliwalManasi et al[4] in their proposed work understood the waste level is detected using an ultrasonic sensor and it communicated with the control room with the help of GSM module.

They use the Wi-fi module for implementing smart bins. The entire analysis published in the web page and mobile application. as The system proposed by S.S.Navghane[5]. Harwar Singh et al[6] in their proposed work understood the smart bins are monitored using the machine learning concept. The threshold value is fixed after filling the smart bins the data analyzed. The analysis is done by using the continuous data it monitors it gives a message or alert to the municipality. It decreases air pollution and prevents the spreading of diseases. It saves money and time efficiently.

2.1 EXISTING SYSTEM

There is no existing framework to monitor the dustbin system on an entire day. Existing system does not have provision to send messages and alert municipal when the bins are filled. Hence the bins over-fill and contaminate the whole area. Existing system contains an ultrasonic sensor which gets damaged during rainy reason. It also does not cover in all directions rather than in a straight line. So in the proposed system we use the sensor inside the dustbin to measure garbage level.

2.2 PROPOSED SYSTEM

Our proposed work in a smart garbage monitoring system where the lid will be opened only when a person operates when needed and does not open and close automatically. So it reduces mosquitoes growing on rainwater thus reducing disease growth. The thermal sensor is used to detect humans or any living things interrupting the dustbin. Thus it helps us to choose bin which is filled rather than to search for all of them.

3 METHODOLOGIES IMPLEMENTED

3.1 IoT

The Internet of Things (IoT) is the most important thing in the emerging modern world. It is an integration of computing devices, digital machines, and people. IoT technology is a means for human to human and human to computer interaction. In the IoT, there are four levels. The stages are

- Sensors or Actuators
- Data Acquisition Systems
- Preprocessing
- Edge Analytics and Cloud analytics.

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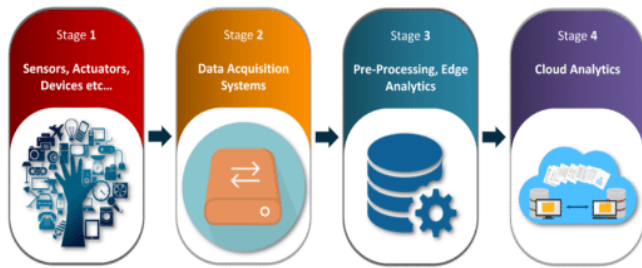


Fig. 1. Stages of IoT



Fig.4. Gas sensor

3.2 NODE MCU:

Node MCU is an open-source firmware IoT platform. NodeMCU is like an Arduino board. It contains 14 digital and 6 analog pins. It contains the wifi module. ESP-12 is used for hardware-based modulo. The firmware uses the Lua scripting language. It contains 17 GPIO pins. 6 pins used for flash memory chips.



Fig. 2. Node MCU

3.3.3 ULTRASONIC SENSOR



Fig. 3. Ultrasonic Sensor

The ultrasonic sensor works the principle of RADAR and SONAR. It measures the distance using transmitting and receiving signals. The sensor contains a trigger pin, echo pin, power pin, and ground. Ultrasonic sensors made with piezoelectric crystals. The sensor targets to calculate the distance using sending and receiving signals. The main objective of the ultrasonic sensor to find the distance between the object and an ultrasonic sensor. It works up to 70 feet distance.

3.4 GAS SENSOR:

The sensor contains a sensing electrode, a reference electrode, a counter electrode, Filter, Capillary, Hydrophobic membrane and electrolyte. AOUT, DOUT, Vcc and Gnd pins are in the gas sensor. It operates based on the diffusion of gas of intersect to the sensor. The diffused gas in turn gets oxidized at sensing the electrode. In the gas sensor concentration is specified. The sensor responds to the concentration level. It detects toxic gases like carbon monoxide and nitrogen oxide.

3.5 ADAFRUIT IO:

Adafruitio is a system that makes use of data and the future use of data. Ease of using data with connections and it needs programming techniques. Message Queue Telemetry Transport (MQTT) supports protocol device communications. MQTT is most commonly using protocol. It requires a small size, low power usage, and easy implementation. It runs with an embedded environment.

3.6 IFTTT

IFTTT is a free web-based to create chains with simple conditions. IF This Then That (IFTTT) is used to connect different apps and devices. IFTTT contains different options like Twitter, Facebook, Gmail and LinkedIn.



Fig. 5. IFTTT Cloud

4 IMPLEMENTATION

4.1 METHODOLOGY:

The ultrasonic sensor is fixed on the interior side of the waste bin, facing the wastes. It measures the waste level. When the garbage level exceeds a certain limit, it sends a signal to the sim808 and the message is sent to the corporation. The thermal sensor is fixed on the top of the waste bin with the lid. It constantly detects the sensor is fixed on the top of the waste bin with the lid. It constantly detects the environment heat. The lid remains closed until there is a change in the heat signature near the bin. When a human near the bin, the change in heat level is detected by the thermal sensor and the servo motor is used to open the lid.

4.2 REAL TIME INTERFACE

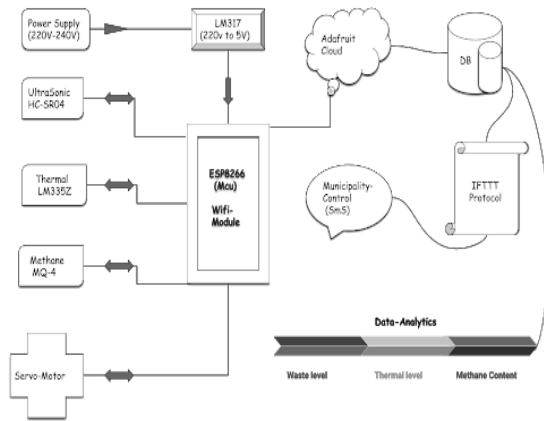


Fig 6:Real-time Interface

Solid waste management is the big challenge in urban cities not only in India but most of the countries. Every smart bin is fixed according the easy way to transport and dispose the waste. The cities are monitored and analyzed using the google map for implementation of smart bins in cities. Smart bins are fixed with wifi module (Esp8266) they are inter-connected with the network and the data is stored in DB. The solid waste level is monitored using HC-SR04 and the presence of gas content inside the bin identified using MQ-4 if some toxic gases are present inside it will indicate an alarm to the specific municipality control to awareness. The data from the smart bins are stored in DB for data analytics. Once the data is analyzed we can find in which location the waste are filled in short-period of time. After analyzing we can provide more bins for specific location if they needed. If some toxic content are regularly filled in the bins we can take some safety measures to avoid formation of toxic gases. We used to technology which will automatically open the lid when the person came near the bin this is helpful during the rainy seasons if the rainwater is filled in the bins it leads to formation of mosquitoes and dangerous diseases by implementing the automation of bins we can prevent the people from affecting by disease. The bins connected with the internet will automatically notify the municipalities which will helpful for certain truck drivers in specific location to collect the waste without checking the every bin for the waste level.



Fig 7. Smart bin Connection

In many places we are seeing that the dust-bin are filled and overflow by implementing the smart bins concept we can reduce the solid waste in urban cities.

5 RESULT AND ANALYSIS:

5.1 SMART BIN CONNECTION

The whole connection consists ultrasonic sensor, gas sensor, Node MCU, Servo motor and alert led. The system is fixed inside the bin which automatically performs the fixed functions which is already hard-coded for every bin. Every module used is fixed inside the bin it can be with- standable for any temperature, pressure, and humidity. Micro-controller is connected with HC-SR04 to find waste level and servo motor is also connected with controller and Gas-sensor is fixed to measure the gas content. The gas sensor is fixed to find the gas-content present inside the bin which can be monitored by municipality and if any toxic content is present the red alert is played near the bin.

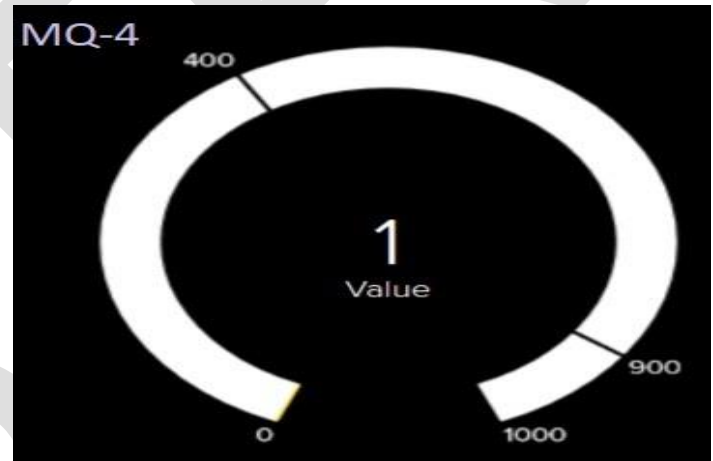


Fig 8. Gas Content

Here the DHT11 sensor module is used which helps the truck driver to know if any harmful content is present inside and also we have used thermal sensor to automatically open the lid when a human came near to the bin this methodology helps to decrease the spreading of disease during the rainy season. If the bin lid kept open the rainwater is filled inside the bin it helps the formation of mosquito inside the bin. By implementing this concept we reduce the spreading of disease. This data sheet shows the waste-level and indication of overflow of the bin with exact date and time which helps to analyze the data for further improvement and need.

Created at	Value
2019/09/08 1:04:25pm	58.00
2019/09/08 1:04:22pm	58.00
2019/09/08 1:04:17pm	58.00
2019/09/08 1:04:14pm	58.00
2019/09/08 1:04:09pm	58.00
2019/09/08 1:04:05pm	58.00
2019/09/08 1:04:01pm	58.00
2019/09/08 1:03:57pm	58.00
2019/09/08 1:03:53pm	58.00
2019/09/08 1:03:49pm	58.00
2019/09/08 1:03:45pm	58.00
2019/09/08 1:03:41pm	59.00
2019/09/08 12:52:18pm	59.00
2019/09/08 12:52:14pm	59.00
2019/09/08 12:52:10pm	59.00
2019/09/08 12:52:06pm	59.00
2019/09/08 12:52:02pm	59.00

Fig 9 Data

The waste level can be monitored using adafruit dashboard and the high alert message is displayed once the dustbin overflows and it automatically sends an alert message to exact truck drivers which helps for them to pick the waste without roaming the full city.

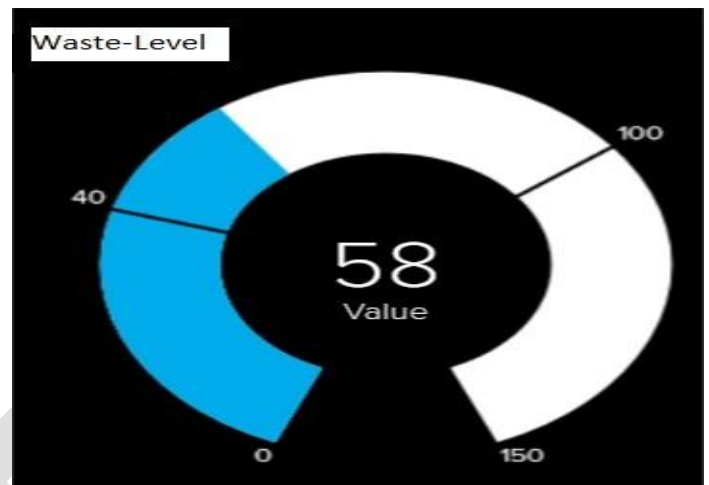


Fig. 12. Waste level

The graph uses to find out which city is needs high count of the dustbin. It will help the municipality to improve the consumers to store the large-amount of waste without throwing the waste outside the bin.

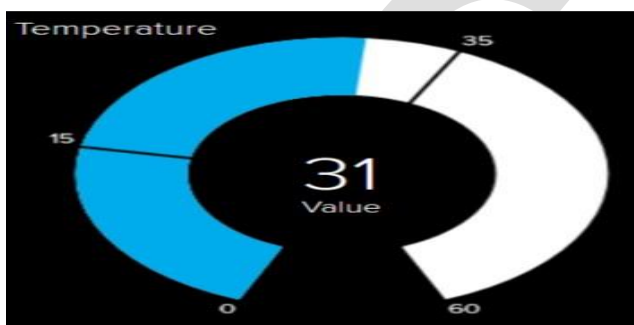


Fig. 10.: Temperature

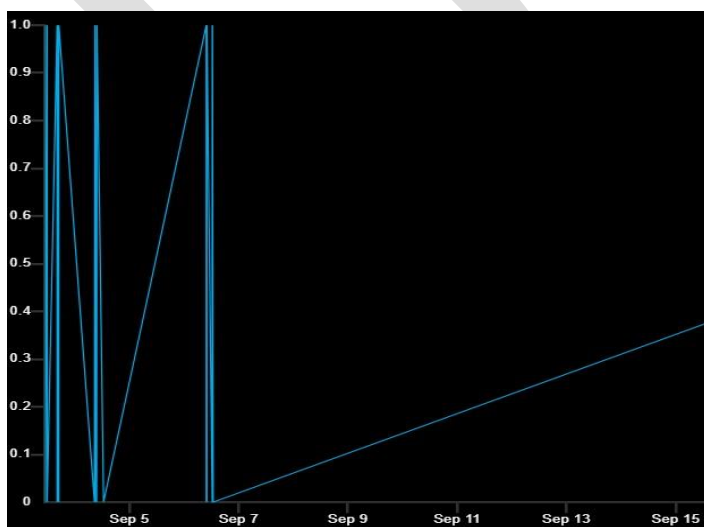


Fig 11 Graph

6 CONCLUSION:

The garbage system needs to be cleaned when it is filled to maintain a hygienic environment. Our smart garbage collection system contains NodeMCU, Ultrasonic sensor, Gas sensor, servo motor and Adafruit cloud. The system monitor the garbage level and it reaches the particular level it sends the notification. This notification system helps the municipality to monitor the garbage wastes. If the garbage wastes are not cleaned it sends the message to higher authority. Our model overcomesthe entire problem in smart garbage system monitoring. Our future work is to collect the data from the various cities. That data will be analyzed and it will be used to predict the garbage waste level from the cities. It will be useful to segregate the biodegradable and non-degradable wastes. It can also be used to make fertilizers for agriculture purpose.

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