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Garbage Collection Management System

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Abstract: ***Introduction of adamantine problem for environment is pollution that causes fickleness, instability, hard or disquiet to ecosystem. Now days, there are a number of techniques, which are used for the collection and management of the garbage. Zigbee and GSM technologies are not only latest trends but also one of the best combinations to use in the project. Set of carefully chosen sensors to monitor the status of garbage bin. The smart garbage bin consist sensors namely ultrasonic sensor, gas sensor and moisture sensor. Ultrasonic Sensor is used for detect the garbage level. The ultrasonic sensor is placed inside the garbage bin at lead position, gas sensor will sense the toxic gases and moisture sensor will sense moist in bin then that indication will give to PIC micro-controller. The controller will give indication to the cleaning authority and needs urgent attention. The Pic-micro-controller will indication by sending SMS using GSM technology. These Dustbins are interfaced with the central system showing status of garbage in Dustbin on GUI.***

Keywords: GSM, Zigbee, PIC-controller, Ultrasonic sensor, Gas Sensor, Moisture sensors**.**

Introduction

Due to fleetly increase population growth, urbanization, developing countries because of this a lack of public awareness towards the waste management. The most important priorities are to ensure a clean and healthy globe and to protect the urban environment. Over a last few year, the operational cost for management of solid waste has increased gradually. The overall budget of solid management is 80-95% of expenditure is needed for the collection as well as transport of the solid waste [1].

Specially, in the developing countries, not only waste monitoring but also management is becoming an acute problem for their urbanization and economic development. Solid waste monitoring and management authorities are being tried to find the solution which is preferable and also cost effective. The main factors found by researcher are like economical, technical and administrative those affect the municipal solid waste management challenges in developing countries [2].

In public place, dustbins are being overflowed as well as the garbage spills out resulting in pollution. This also increases number of diseases as large number of insects as well as mosquitoes breed on it [3]. Hence our problem statement is to design a system based on PIC controller as well as sensors are forming bin to give the bin data. Waste has been thrown inside the bin. Due to these sensors are used ` for collection and management of garbage.

1. Literature Survey

Hassan et.al is being proposed system in that novel prototype of solid waste bin monitoring system using wireless sensor network. The system architecture uses zigbee and GSM communication technology as well as a set of carefully chosen sensors to monitor the status of solid waste bins in real time. In that system consist of three tier structure such as lower, middle and upper tier. The lower tier contains both sensor node installed in it to measure and transmit bin status to the next tier, the middle tier contains the gateway that stores and transmit bin information to control station and control station resides in the upper tier that stores as well as analyze the data for further use. An energy efficient sensing algorithm is also used in the first tier operation to collect the bin parameter.

Hannan et.al described that major challenge in urban areas throughout the world is management of solid waste. In that System, introduced an integrated system combined of Radio Frequency Identification (RFID), Global Position System (GPS), General Packet Radio Services (GPRS), Geographic Information System (GIS) and web camera. The RFID reader is built in truck would automatically retrieve all sorts of customer information and bin information from RFID tag, mounted with each bin. GPS is used to give the information of location of collection truck. All the information of the center server would update. The information is updated through GPRS communication system. GIS map server is used for truck monitoring. In this system, bin as well as database has developed in the way that information of not only bin but also truck ID, data and time of waste collection, bin and truck GPS co-ordinates information. Bin status and amount of waste are compiled in a data packet. The system is showed that real-time image processing and other bin information have been displayed in the GUI.

Kanchan Mahajan et.al described system, used two technologies. Zigbee and Global system for mobile communication (GSM) are the latest trends. This combination is one of the best combinations which is used in that system. There are number of techniques which are used as well as are being build up for well management of garbage. To give brief description of the system, the sensors are placed in the common garbage bins, which are placed at public places. In that, ARM7 controller is used when the garbage reaches the level of sensor, then the indication will

be given to controller. This ARM7 controller will give information to the driver of garbage collection truck as to which garbage bin is completely filled. ARM7 will give indication with the help of GSM technology by sending SMS.

Pavithra et.al described a system is developed for to mainly, concentrate on eradicating not only ugliness but also disorder. The smart trash uses two sensors namely IR and Gas sensor. IR sensor is used for to sense the level of trash inside bin and gas sensor will sense toxic gases. Once the trash is filled, the RFID placed inside the trash will give information about overflowing of trash to the corporation office.

Yarlagadda Pravallika et.al described that today's scenario due to increase in population, increase in garbage. Proper garbage disposal is necessary to make environment clean, but improper garbage disposal, leads to various issues like health problems and thus affects the environment. In that system consisting a transmitter unit and receiver. In transmitter unit consisting sensors and controller. This method involves three sensors namely infrared sensor, moisture sensor and gas sensor. These three sensors are attached to the garbage bins. The infrared sensor senses the level of garbage and then indication is sent to the micro-controller. Here PIC16f877A micro-controller is used that a particular garbage bin needs an attention to empty it by the worker. Another sensor is moisture sensor sense some moisture in the bin when the wet waste is deposited and gas sensor sense some not only unpleasant but also toxic smell from the bin an indication is sent to the PIC16F877A controller. In the transmission side the micro-controller receives the information as well as transmits the data using encoder and radio frequency receiver. In receiver unit, the information is received using decoder. By using radio frequency (RF) transceiver information will send from decoder to the micro-controller that is present at receiver side. The data will be displayed on the LCD indicating the garbage bin number, which need an immediate attention by the worker.

2. Problem Definition

We see many times the dustbins which are in bad conditions. Garbage in dustbin all overflowed as well as spelled out the garbage from dustbin. People thrown garbage on that dustbin which already overflowed. Sometimes due to this garbage bad smell created, toxic, unhygienic gases are produces due to unclean garbage bins. It is very bad look of the city which is way to support to the air pollution and to some harmful diseases which are easily spreadable.

i. Disadvantages of existing system

1. To completely occupy the time and less serviceable.
2. Unhygienic to the surrounding or environment.
3. Bad smell and toxic gases generated which are harmful or illness to the human being.

ii. Advantages of the proposed system

1. Real time information related to the garbage bin.
2. Improve the quality relate to the environment
   a) Fewer smells
   b) Cleaner cities
3. Intelligently manage the garbage bin.
4. Effectively use the dustbins.

4. Material

i. Sensors: Sensors are like Ultrasonic sensor, Moisture sensor, Gas sensors are used to attach the garbage bin. Ultrasonic sensor is connected to garbage bin for garbage level detection. Moisture sensor is used when some wet garbage is thrown into dustbin, then it is detected. Gas sensor is used to sense some toxic gases which harmful to human being.

ii. Ultrasonic sensor: Ultrasonic sensor is a popular as well as low cost module. This sensor provides the ranges from very short to long range for detection.

Fig.1 Ultrasonic sensor

For this system HC-SR04 ultrasonic sensor is used. This module consists of ultrasonic transmitter, ultrasonic receiver and control circuit.

- Ultrasonic sensor module consists of 4 pins:

VCC - 5V of power supply
TRIG - Trigger Pin
ECHO - Echo Pin
GND - To ground

- **Principle of ultrasonic sensor**

Ultrasonic sensor emanates short, high frequency sound pulses at particular time intervals. This propagation is carried out through the air at the velocity of sound. If they strike on object and it reflected back as echo signal to the sensor. Which it's self-calculate the distance to the target based on time interval between the transmitting signal and receiving the echo.

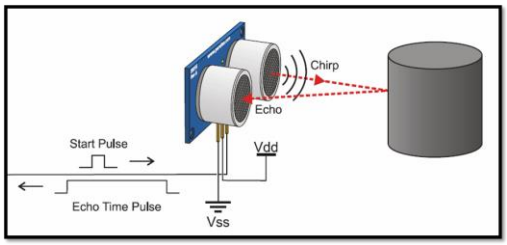

Fig.2 Principle of Ultrasonic sensor

iii. Moisture sensor: This sensor can be used to test the moisture. If there is water shortage, the output of module is high level else the output is at low level. This module is triple output mode. First is digital output mode. This digital output mode is simple. Another is analog output mode is more accurate. Last is serial output mode which gives exact reading

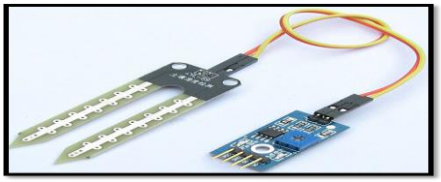

Fig.3 Moisture sensor

- **Features**
  1. Sensitivity adjustable.
  2. Has fixed bolt hole, convenient installation.
  3. Threshold level can be configured.
  4. Module triple output mode, digital output is Simple, analog output more accurate, serial output with exact reading.

- **Application**
  1. Agriculture.
  2. Landscape irrigation.
  3. Vadose zone monitoring.
  4. Plant-soil-water interaction studies.
  5. Water sensor.

iv. Gas sensor: This sensor is simple to use or Detect the carbon monoxide gas which is present in air**.** This sensor also detect the another gases like H_2 (Hydrogen), CH4 (Methane), LPG, Alcohol. This sensor has high response towards gases and quick response time.

Fig.4 Gas sensor

- **Characteristics**

1. Long time in use and low in price.
2. High response towards the natural gas.

v. PIC micro-controller: Sensors outputs are received by PIC micro-controller and then send them through zigbee transmitter. It is also send SMS to Mobile by using GSM.

vi. Zigbee: Zigbee is used for data transmission wirelessly over a long distance. Data transfer between PIC micro-controller as well as PC.

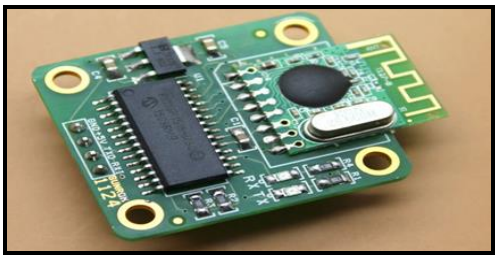

Fig.6. Zigbee 2500

vii. GSM Modem: Any GSM network operator SIM card is accepted by GSM modem as well as it acts like a mobile phone. Advantage of this modem is that there is RS232 port, which is used for communication purpose also used for advanced embedded application. Application like SMS handling, transferred data, etc. For wireless data transmission GSM is used. Radio waves perform vital in GSM. In GSM, Data is send as well as receive by using radio Waves. AT command Instruction is used for Modem control. GSM is connected to PIC Micro-controller. Message is send to that authority who takes appropriate action. GSM is low cost device and provide short message services.

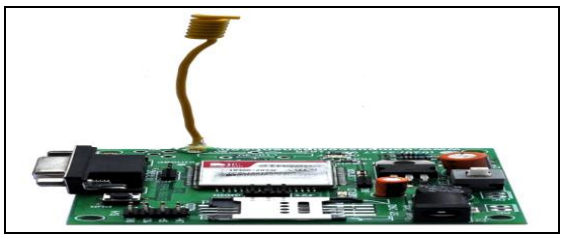

Fig.7.GSM Modem

5. Working Principle

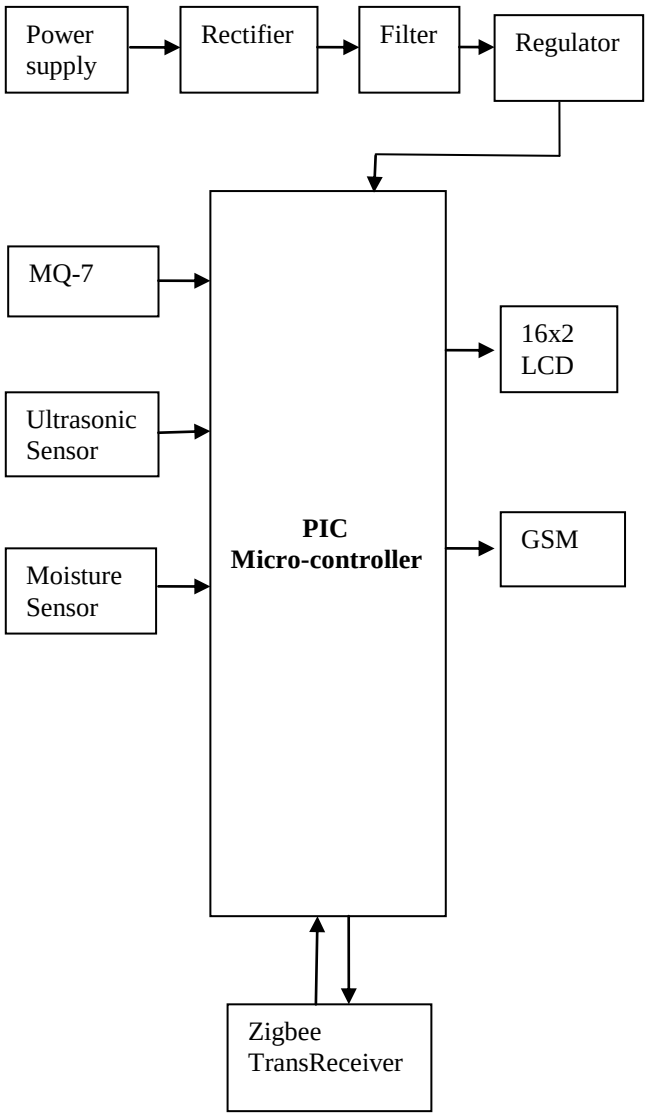

Fig.8. Block diagram of proposed system

The block diagram represents the components which are used in system. The block diagram shows different components are used in our system. Ultrasonic sensor, Gas sensor, Moisture sensor, PIC micro-controller, GSM Modem, Zigbee CC2500, Power supply. This proposed system is divided into two parts like transmitter section and receiver section. In transmitter section consist of sensors, PIC micro-controller, Zigbee transmitter is connected to the dustbin.

Where ultrasonic sensor is used to detect the level of garbage in dustbin, moisture sensor is used to detect the wet garbage in dustbin or water level in dustbin and gas sensor is used here to detect the toxic, unhygienic gases generated in dustbin due to the garbage or waste part which thrown into dustbin. These sensors are sensed the content related to the dustbin and send the information to the PIC micro-controller. There is power supply is given to the PIC micro-controller for drive the system. PIC micro-controller is read the data from sensor and then proceed to the next stage by using zigbee transmitter. This information is wirelessly transmitted. There is GSM Modem is

used here for sending the information related to the garbage in dustbin to the authority who take appropriate action. There is receiver section consist zigbee receiver which is used to display all information related to garbage in bin on PC screen in the for of graphical user interface (GUI).

- **Flow chart**

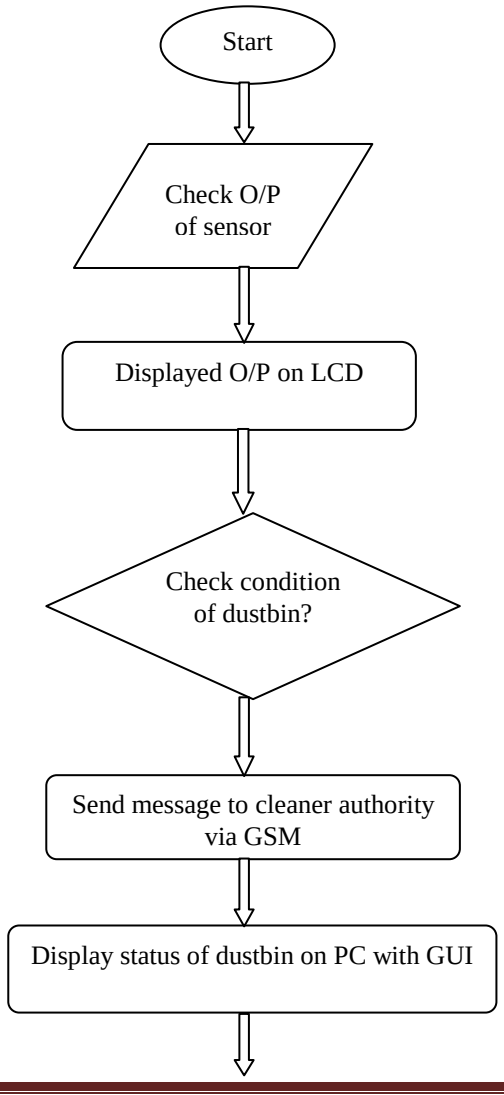

Fig.9. Flow chart

6. Results

Following are result which can be obtained from this proposed system,

- Garbage level, moisture level and toxic gases detection inside the dustbin.
- Transmit the information wirelessly.
- Data can be collected anytime and from anywhere.
- The real-time transmission of information carried Out.
- Avoid the situation of overflowed dustbin.

This Garbage Collection Management System is very useful for smart cities in different vision. We have seen that there are different dustbin are located in different area's sometimes which are overflowed but cleaning authority do not get the information about this. Our system is designed to solve this problem as well as will provide the complete details about the garbage bins located in different areas. Accordingly they can take a decision immediately.

Fig.10. Smart dustbin no.1

Fig.11. Smart dustbin no.2

Fig.10 and Fig.11 shows two smart dustbins are used for this proposed system. Ultrasonic sensors are mounted on lid of dustbin showed in Fig.10 and Fig.11 for detecting the garbage level.

Fig.12. Internal structure of dustbin

Fig.12 shows internal structure of dustbin. In dustbin there is moisture sensor is connected to the dustbin at the bottom side. This moisture sensor is used to detect the moist or water in dustbin. Gas sensor is connected to the lid position of dustbin for detecting the toxic gases generated in dustbin due to the garbage.

PIC micro-controller is used to read all the information related to the garbage bin is given by the sensors which are attached to the garbage bin and zigbee transmitter is transmit the information towards the central system.

Fig.13. sending SMS on LCD

When system is in ON condition, there is LCD on a system. All information related dustbin is also shown on LCD. There is garbage level is reaches on extreme level then send SMS to the authority by using GSM Modem at that time on LCD "sending SMS" displayed.

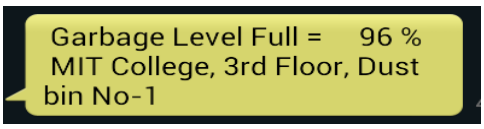

Fig.14. Garbage level

The garbage level in dustbin is reaches to the 96% then SMS send like in Fig.14. Also gives the information about the location of dustbin. No.1.

Fig.15. Water level

Water level in a dustbin is 84% , like this SMS send to the authority also displayed on LCD and GUI on PC.

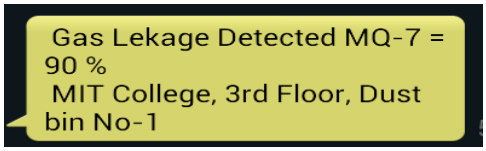

Fig.16 Gas leakage detected

Gas leakage detected at 90% is shown on LCD as well as GUI on PC. This SMS is send to the authority when gas leakage detected at the extreme level.

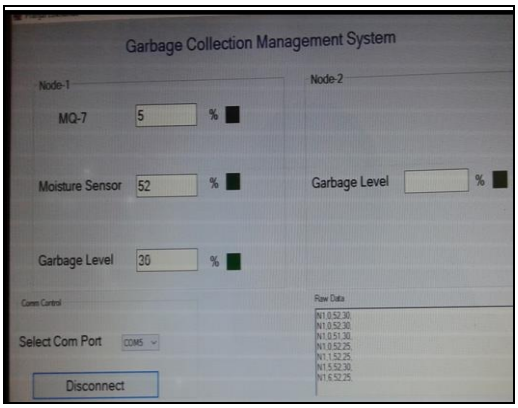

Fig.17.Information access on GUI for dustbin no.1

All information related to the dustbin like garbage level, water level and gas leakage are displayed on GUI for dustbin no. 1

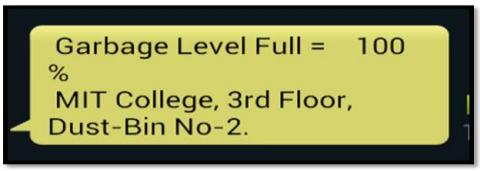

Fig.18.Garbage level detection for dustbin no.2

Garbage level is detected by ultrasonic sensor is 100% for dustbin no.2. And this information sends to the cleaning authority, On LCD.

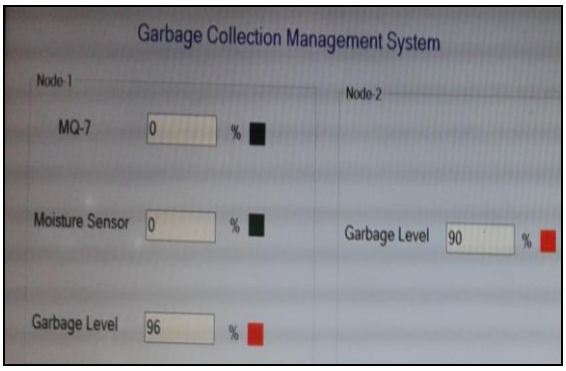

Fig.19. GUI on PC for dustbin no.1 and dustbin no.2

Information related to the dustbin no.1 and dustbin no.2 is displayed on GUI shown in Fig.19.

7. Conclusion

Garbage Management is a big issue for everyone to need action across it immediately. In this system is able to observe the different type garbage is thrown into dustbin by using sensors. When dustbin is full or overflowed then ultrasonic sensor is detected the level garbage in dustbin or some wet garbage is thrown into dustbin is detected by the Moisture sensor or some unpleasant smell as well as toxic gases are generated then gas sensor is give the information. This sensors output is given to the Micro-controller. In this system there are two technologies are used like Zigbee and Global system for Mobile communication (GSM). These two technologies are used for wirelessly data transmission over long distance. PIC controller is used to send the Message to cleaning authority who clean the dustbin by using GSM. It is a real time system; the dustbin status is shown on PC by using GUI. This type of system is used in college campus, offices and many places where it is suitable.

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