

Smart City Garbage Collection & Monitoring System

P M.Palkar¹, T. Pathan², Ankita P. Hedaoo³, Kalyani A. Harode⁴, Nutan M. Petkule⁵, Pranjali P. Kakade⁶, Pranita D. Kolhe⁷.

¹ Assistant Professor, Electronics and Communication Engg., PBCOE, Maharashtra, India

² Assistant Professor, Electronics and Communication Engg., PBCOE, Maharashtra, India

³ Students, Electronics and Communication Engg., PBCOE, Maharashtra, India

⁴ Students, Electronics and Communication Engg., PBCOE, Maharashtra, India

⁵ Students, Electronics and Communication Engg., PBCOE, Maharashtra, India

⁶ Students, Electronics and Communication Engg., PBCOE, Maharashtra, India

⁷ Students, Electronics and Communication Engg., PBCOE, Maharashtra, India

ABSTRACT

Recently, it is seen that dustbins placed at a various places like public places such as hospitals, educational Institutes and Industries are overflowing. This overflowing of garbage bins create unhygienic condition which can spread the diseases. Also rapid increase in population waste give rise to improper waste management. To avoid this situation, we proposed new system "Smart City Garbage Collection & Monitoring System". In the recent decades, Urbanization has increased tremendously. At the same time there is an increase in waste production. Waste management has been a crucial issue to be considered. This paper is a way to achieve this good cause. In this paper, smart bin is built on a microcontroller based platform Aurdino Uno board which is interfaced with GSM modem and Ultrasonic sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the status of the dustbin. The threshold limit is set as 10cm. Aurdino will be programmed in such a way that when the dustbin is being filled, the remaining height from the threshold height will be displayed. Once the garbage reaches the threshold level ultrasonic sensor will trigger the GSM modem which will continuously alert the required authority until the garbage in the dustbin is squashed. According to the location, authority will sends the message to the respective operator; garbage vehicle can collect the garbage, which is done with the help of robot mechanism.

Keyword: - Load cell, GSM module, Level sensor, ARM7, GPS and IOT.

1. INTRODUCTION

Swachh Bharat Abhiyan in English: Clean India Mission and abbreviated as SBA or SBM for "Swachh Bharat Mission" is a national campaign by the Government of India, covering 4,041 statutory cities and towns, to clean the streets, roads and infrastructure of the country.

1.1 Aim of the Purposed model

The aim of the mission is to cover all the rural and urban areas of the country to present this country as an ideal country before the world. With the proliferation of Mobile network devices such as smart phones, sensors, cameras. It is possible to collect massive amount of garbage. In the metropolitan cities it is not possible to check each and every place where the garbage dump yard is full or not.

Therefore, we have introduced a new concept using load cell. This is a sensor which intimates about the load placed on it. So that the garbage can also be checked in this way. Smart collection bin works in the similar manner with the combination of sensors namely weight sensor and Weight sensor that indicates its weight and different levels

respectively. The Weight sensors will show us the various levels of garbage in the dustbins and also the weight sensor gets activated to send its output ahead when its threshold level is crossed. These details are further given to the ARM7 (LPC2148) and the controller gives the details to the transmitter module (GPS and GSM).

1.2 How it works?

In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out resulting in pollution. This also increases number of diseases as large number of insects and mosquitoes breed on it. Hence our problem statement is to design a System Based on Arm 7 for collecting the garbage from a particular area. A big Challenge in the urban cities is Solid waste management, not only in India but for most of the countries in the world. The project gives us one of the most efficient ways to keep our environment clean and green.

Global Positioning System (GPS) and Global System for Mobile Communication (GSM) are the latest trends and are one of the best combinations to be used in the project. Hence, a combination of both of these technologies is used in the project. To give a brief description of the project, the sensors are placed in the common garbage bins placed at the public places. When the garbage reaches the level of the sensor, then that indication will be given to LPC2148 ARM7. The controller will give indication to the driver of garbage collection truck as to which garbage bin is completely filled and needs urgent attention. LPC2148 ARM7 will give indication by sending SMS using GSM technology and location using GPS with Longitude and Latitude.

2. PROPOSED SYSTEM

Now a days, there are a number of techniques which are purposefully used and are being build up for well management of garbage or solid waste. Global Positioning System (GPS) and Global System for Mobile Communication (GSM) are the latest trends and are one of the best combinations to be used in the project.

Considering the need of modern technology the smart garbage bin can expensive but considering the amount of dustbin needed in India, expensive garbage bin would not be a prior experiment that is why we have decide to use based sensors to reduce its cost and also make it efficient in applications.

LPC2148 controller will give indication by sending information using IOT technology. For detecting the garbage, many sensors like weight sensors, level sensors, etc. can be used. Weight sensor is the one which gives the information about the weight of garbage and level sensor used to detect the level of garbage bin.

2.1 Problem Definition

As we have seen number of times the dustbins are getting overflowed and concern person don't get the information within a time and due to which unsanitary condition formed in the surroundings, at the same time bad smell spread out due to waste, bad look of the city which create the way for air pollution and to some harmful diseases around the locality which is easily spreadable.

2.2 Methodology

Each garbage can is given a number id which is stored in database with its location. This is interfaced with microcontroller with help of RS232 cable. Simultaneously weighing sensor (load cell) is used. It senses the weight of garbage can. It is interfaced with microcontroller through ADC.

The microcontroller compares the set limit with input data .if anyone or both input data crosses threshold level. Then microcontroller which is interfaced with GSM module sends a message to the server .The sent messages contains the slave id of the garbage bin.

The server compares the slave id with its database which contains record of slave id and location of each garbage bin located in city. Then it gives exact location and message of the garbage bin which is full or over weighted to the respective authority.

After receiving the message by the server the waste disposal vehicle reaches to the desired location.

3. FLOW CHART

The Flowchart of the proposed model is as shown in fig.1. Each garbage bin is given a no. of id which stores in database with its location. Weighing sensor is used measure the load placed of the garbage bin. A/D converter compare the set limit with input data. If received threshold level send message to the server through GSM. After receiving message by the server the waste disposal vehicle reaches to the desired location. Then disposal vehicle collect the garbage.

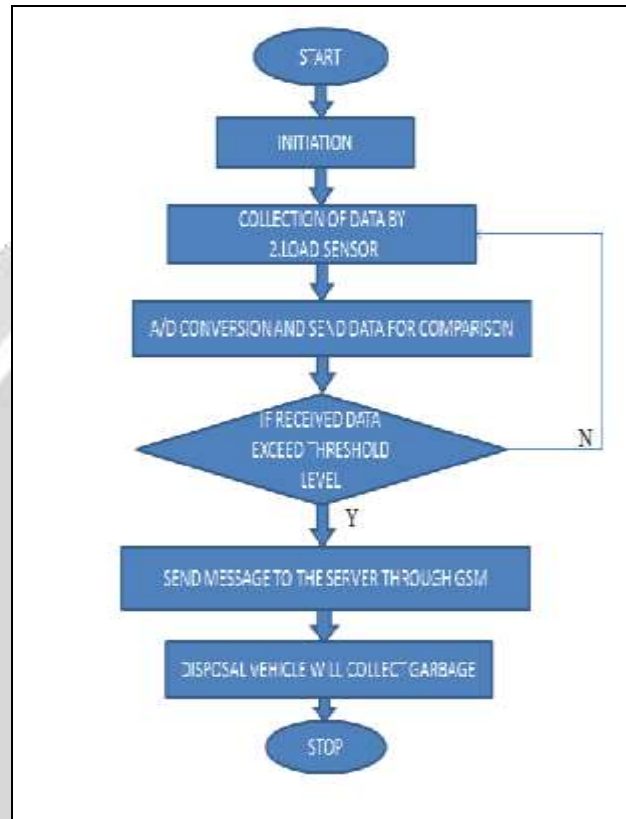


Fig.1 Flowchart

4. SYSTEM ARCHITECTURE

An embedded system is a component within some larger system. For example, modern cars and trucks contain many embedded systems. One embedded system controls the anti-lock brakes, other monitors and controls the vehicle's emissions, and a third displays information on the dashboard. In some cases, these embedded systems are connected by some sort of a communication network, but that is certainly not a requirement.

4.1 Embedded System

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. A good example is the microwave oven. Almost every household has one, and tens of millions of them are used every day, but very few people realize that a processor and software are involved in the preparation of their lunch or dinner. This is in direct contrast to the personal computer in the family room. It too is comprised of computer hardware and software and mechanical components (disk drives, for example). However, a personal computer is not designed to perform a specific function rather; it is able to do many different things. Many people use the term general-purpose computer to make this distinction clear. As shipped, a general-purpose computer is a blank slate; the manufacturer does not know what the customer will do wish it. One customer may use it for a network file server another may use it exclusively for playing games, and a third may use it to write the next great American novel.

4.2 GSM/GPRS Modem

GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations-

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

The MODEM needs AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network.

A GSM/GPRS module assembles a GSM/GPRS modem with standard communication interfaces like RS-232 (Serial Port), USB etc., so that it can be easily interfaced with a computer or a microprocessor / microcontroller based system. The power supply circuit is also built in the module that can be activated by using a suitable adaptor.

4.3 Test cases

- i) Dustbin when empty - 0% (when 1st level Weight Sensor gives output)
- ii) Dustbin half – 50% (when 1st level and 2nd level Weight Sensor gives output)
- iii) Dustbin full – 90% (when all three level sensors gives output)
- iv) Dustbin is heavy- when threshold weight of dustbin is crossed (weight sensor gives output)
- v) And also we can monitor it is at IOT web protocol

5. BLOCK DIAGRAM

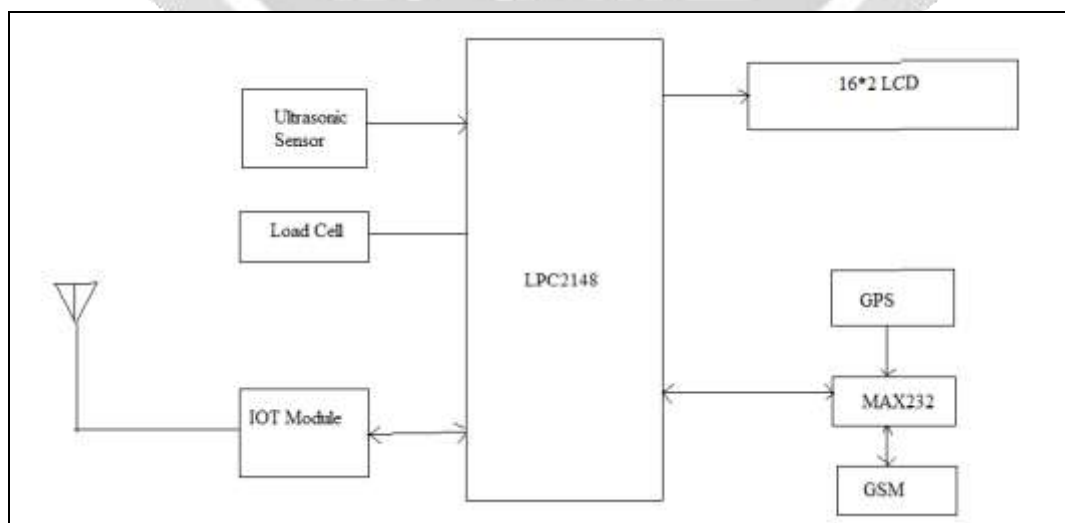


Fig. 1 Block Diagram

5.1 Power Supply:

It is mainly used to provide DC voltage to the components on board. It supply 12V for DC motor, 3.3V for microcontroller and 5V for others. This project uses regulated 500mA, 5v power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230V/12V step down transformer.

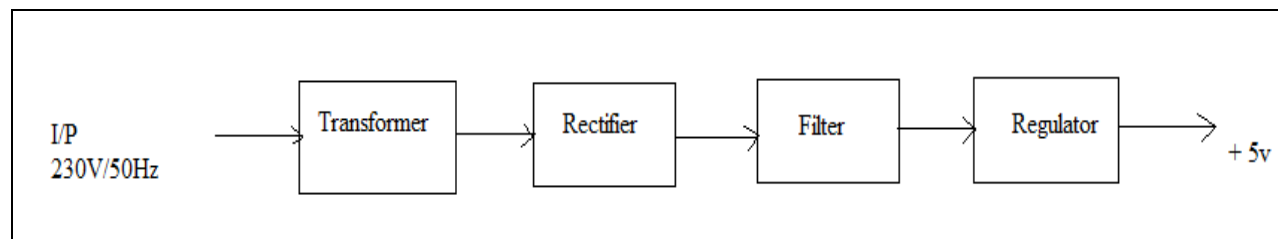


Fig 2. Block diagram of power supply

5.2 Load Sensor:

Placed below the Garbage Can to sense the weight of it . The LOAD cell will continuously give the weight readings in voltage format, which is then given to a signal conditioning unit which amplifies the voltage and is then given to the μC . The μC then converts the analog signal to digital format. A load cell is a transducer that is used to sense and convert a force into an electrical signal. The output of the transducer can be scaled to calculate the force applied to the transducer. The various types of load cells are available, like include Hydraulic load cells sensor, Pneumatic load cells sensor and Strain gauge load cells sensor.

5.3 GSM Module:

It is used to send message to the garbage depot if the Garbage Can exceeds the set threshold level. With the help of GSM module interfaced, we can send short text messages to the required authorities. GSM module is provided by SIM uses the mobile service provider and send SMS to the respective authorities as per programmed. It operates at either the 900 MHz or 1800 MHz frequency band.

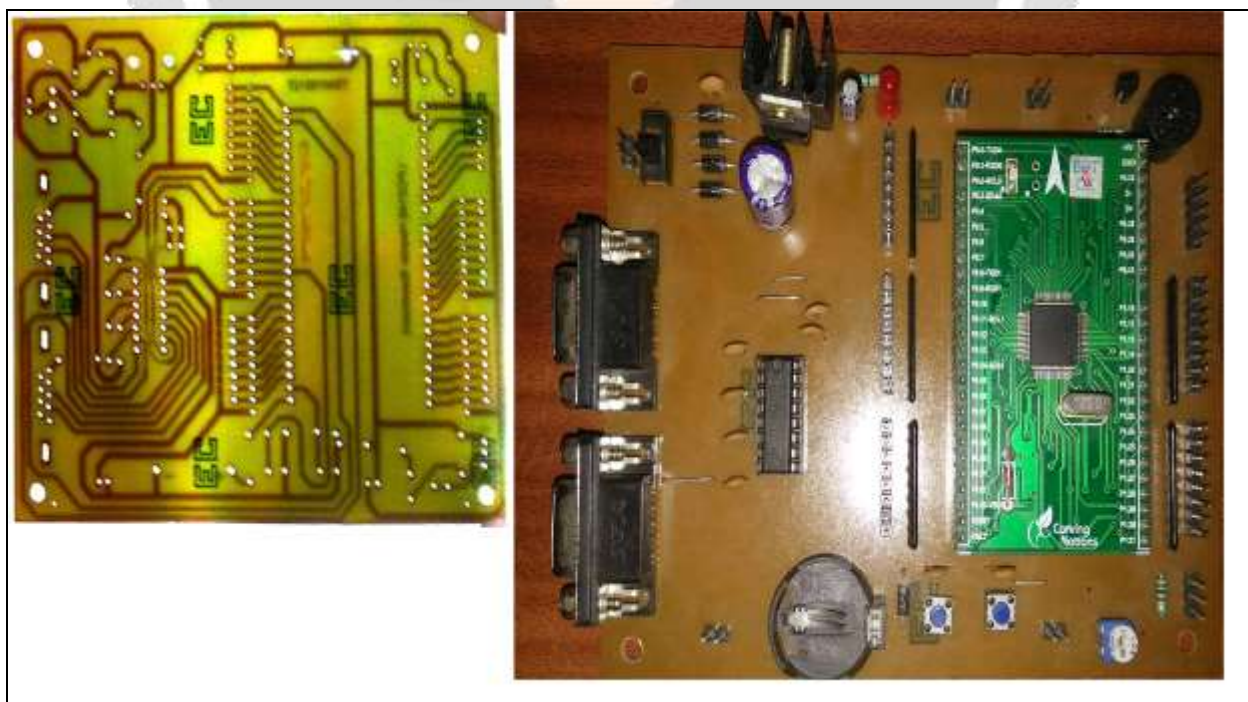


Fig.3 Project Module

6. ADVANTAGES

- Real time information on the fill level of the dustbin.
- Deployment of dustbin based on the actual needs.
- Cost Reduction and resource optimization.
- Improves Environment quality -Fewer smells -Cleaner cities
- Intelligent management of the services in the city.
- Effective usage of dustbins.

7. CONCLUSION

With the help of this new proposed system we can able to avoid over flowing of garbage. This project work is the implementation of smart garbage management system using sensors, ARM7, GSM module, GPS and IOT. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This method finally helps in keeping the environment clean. Thus, the garbage collection is made more efficient.

8. FUTURE ENHANCEMENT

By implementing this proposed system the cost reduction, resource optimization, effective usage of smart dustbins can be done. This system indirectly reducing traffic in the city . In major cities the garbage collection vehicle visit the area's everyday twice or thrice depends on the population of the particular area and sometimes these dustbins may not be full. Our System will inform the status of each and every dust bin in real time so that the concerned authority can send the garbage collection vehicle only when the dustbin is full. The scope for the future work is this system can be implemented with time stamp in which real-time clock shown to the concern person at what time dust bin is full and at what time the waste is collected from the smart dustbins.

9. REFERENCES

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