

An Intelligent Garbage and Malodorous Management System using GSM based Technique

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Abstract: This paper presents the objective of the “Swach Bharat” and “Digital India” Programme. It is a smart waste management system that control different activities and actions to handle waste. The smart dustbin has been used with digital sensors that sense the amount of waste and foul gases. If the bin is filled, then the GSM module will send a message to the control room and the control rooms will command the waste collection truck driver to reach at that specific place and clean that trash. The system consists of collection of garbage, tracing, treatment and dumping of garbage with smart tracking system and instruction. This paper shows the implementation of intelligent garbage and malodorous gas management system using components like ultrasonic sensors, microcontroller and GSM module. The systems assure the cleaning of waste quickly when the garbage is full in bin. There is the different waste management technique, but the GSM based system is one of the best in class because it requires less capital and infrastructure. It helps municipal cooperation to save time and money. The GSM based system can also monitor the location of the garbage collection trucks to track them and instruct them to reach nearer site that saves the time, fuel and manpower requirement. This technique helps the municipal cooperation to make their city clean.

Keywords: Global System for Mobile Communications, Arduino, Global Positioning System, Waste management, MQ5, Digital India, Swach Bharat.

1. Introduction

The disposal of garbage and the treatment of garbage produce several unwanted malodorous greenhouse gases. These gases are harmful in nature which contributes the climatic change in the environment. The highest part of the greenhouse gas includes Methane gas. Other form of the gas which are emitting from the various waste disposals contains Carbon dioxide. But CO₂ is less powerful greenhouse gas. Recycling of the waste particles produces few more gases. The reduction of waste particles in the environment decreases the climate change. It also helps in the reduction of various diseases which affects the human being. The sensor used in dustbin can able to measure the height of hard waste and if the waste is above the predefined level then it sends message to Municipal Corporation. It is able to sense different type of waste material either solid or liquid. The vehicles of Municipal Corporation can run on shortest path require less fuel emphasizes the aim of “DIGITAL INDIA”. So, they may go only for filled containers. Our smart operating

system enables two ways communication between the dustbins deployed in the city and service operator. This data is very helpful to find out when and where to urgent collection of waste is required. It may also require fewer infrastructures of trucks, garbage collection container and helps in less operating (fuel) as well as maintenance costs of the service 30%. It keeps the surroundings clean and green, free from bad odor of wastes, emphasizes on healthy environment and keeps cities more beautiful. It may also reduce the requirement of manpower for garbage collection. This can be best used by Municipal Corporation for their betterment of management regarding collection of wastes. In this paper we are using GPS technology, so that we can directly instruct to the truck driver to choose the shortest path and dust bin. It helps to achieve the model of “SMART CITY” and “DIGITAL INDIA” project.

2. Literature Survey

R. Narayanmoorthi, Shubham Thakker et al shows the smart and wireless waste management System. The system can detect the dust bin when it become full and alerts the municipal corporation and this arrangement shows the “Smart Garbage Bin”, It is used for separation of biodegradable waste.

Sauro Longhi, Davide Marzoni, Emanuele Alidori: Solid Waste Management Architecture using Wireless Sensor Network Technology. The system architecture is based on sensor nodes and makes use of Data Transfer Nodes (DTN) in order to provide to a remote server the retrieved data measurements from the garbage bins filling. A faraway tracking system solution erstwhile is executed; provide user the opportunity to relate with the arrangement using an internet browser. M. Faccio et al have a waste collection with multi management goal on real time traceability data Modern traceability devices, like gas sensors, IRF, and the GPRS and GPS, permit to obtain data in real time, which is fundamental to implement an efficient and innovative waste collection routing model. M. Arebey et al dry waste stuff monitoring and managing via RFID, GIS and GSM. The RFID system with the GSM mobile communication arrangement with geographical information system (GIS) to locate vehicle position.

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3. Hardware Description

The following hardware component has been used which plays an important role for the construction of smart dustbin, mobile trucks and a control room. This arrangement is very useful for the integration of serial communication in between them.

A. AVR ATmega8 Microcontroller

The Arduino is a microcontroller board based on the ATmega8 or ATmega328. The controller consists the 14 input and output pins, where the first 6 pins have output of the PWM and other 6 pins are called as analog inputs. The microcontroller also consists of a 16 MHz crystal oscillator with USB contact, power jack. The reset button is provided in module to reset it. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

B. IR Sensor

An IR sensor can measure the heat of an object as well as detects the motion. The sensor can measure infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. The radiations are not visible to eyes and can be detected by an infrared sensor. The emitter is simply an IR Light Emitting Diode and detector is Infrared photodiode which is responsive to IR light of similar wavelength emit by IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

C. Power Supply

The power supply of the given system block diagram in the figure 1 given below, which consist of a several equipment may be described the number of stages and embedded. AC is as input source given to the step down transformer have the specification of input voltage of 220V and 50 Hz and output of 12-20V. The output of the step-down transformer is given to the bridge rectifier that convert AC voltage into pulsating DC voltage of 12V, the filter can controller the harmonics of the converted output from rectifier. The regulator consists of the components include zener diodes, transistors as a switch integrated circuit. It is used to control the within a specified limit.

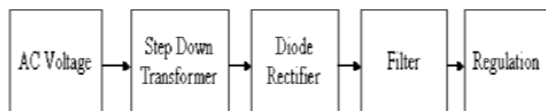


Fig. 1. Block Diagram of power

D. GSM

The figure 2 is an GSM module is dedicated and used as communication channel in between the control room and the garbage truck. It requires SIM card that works on over a hands on for a mobile operator. The benefit of using GSM based technique in the project is that it does not require extra supporting equipment's and very economical. And the main advantage of using it is its reliable wireless application. This is

just an updated form of the mobile phone application. In GSM Modem interfaces comes with USB, Serial ports and embedded through microcontroller and microcontroller control to GSM modem with AT. We use GSM model of SIM900 Quad-band GSM/GPRS module. Communication can be done by controllers passing through AT commands. It is able to read and save the software based programmed for set and reset of modem. It can run by the use of UART using AT commands.



Fig. 2. GSM Module Sim 900

E. Gas Sensor (MQ5)

The Gas sensor model MQ5 is one of the best in class to detect foul smell of gas in a installed area. It is also known as a gas sensor. MQ5 can determine the amount and presence of gas and its concentration form the dustbin. The determination can be done by sensing a gas and each gas have specific breakdown voltage, therefore it is ionized. So, the sensor recognizes gases via observing voltages and the amount of the gas calculated and observes the current discharge in the device. MQ5 gas sensor can detects various gases like hydrogen, carbon monoxide, methane and LPG gases form the range of 100ppm to 3,000ppm.

4. System Architecture

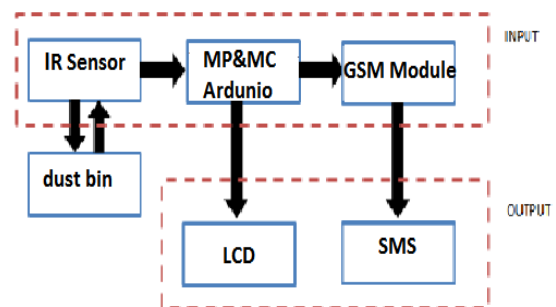


Fig. 3. Block diagram dustbin side

An IR is an A.K.A a distance sensor will be placed on the interior side of the bin as shown in the figure 3, and it's the one facing is at solid waste. As the waste inside the bin goes on increases due to this the distance among ultrasonic and the waste in bin decreases. At the same time the live information sent to micro-controller. The micro- controller, have Arduino 101 then processes the data and through the help of Wi-Fi sends it. Hardware requires a Grover Base Shield v2, Arduino 101, 9v Battery, these batteries will power the Arduino board, Plastic dust bin. IR Sensor, figure 4 consist of an ultrasonic sensor measures distance. It will be attached to the lid indicating the

quantity of trash. The other main component jumper Wires, Arduino MKR1000, one of Arduino's latest micro-controller and two GSM Modules one for dust bin truck and for control room. The GSM module controller allows communication with Wi-Fi compatible micro-controllers.

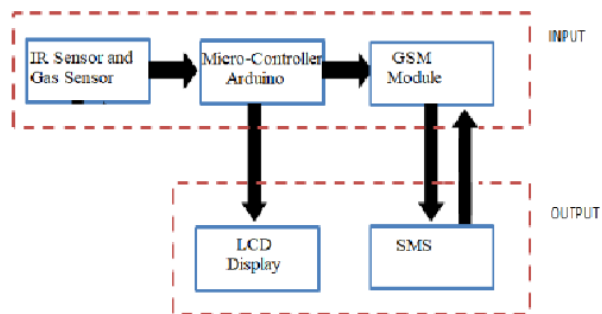


Fig. 4. Block diagram of control room

5. Circuit Design and Working

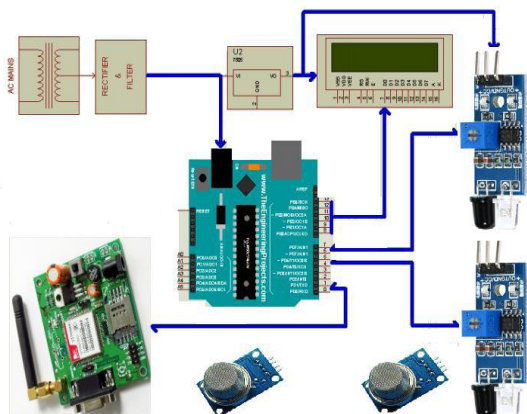


Fig. 5. Circuit diagram

The circuit consists of step down transformer generally the rating of 12V AC and rectifier to produce DC output with filter to the AVR ATmega8 microcontroller Arduino board, the board controller the several embedded components include the IR sensor, senses the height of the garbage in dustbin, MQ5 a gas sensor and a GSM module to send the message when the bin is full or have a high malodorous smell to the control room. The LCD screen is also provided shows the present statuses of the dustbin, it helpful in the case when the GSM module is not able to send a message to the control room so the truck driver can check the status of the dust bin without opening it and clean the trash inside the bin. Then the garbage collector can inform the control room that the GSM module have some malfunction issue. The figure 6 shows the two bins one is for dry bin and another is for wet waste, integrated with the sensors and Arduino board.

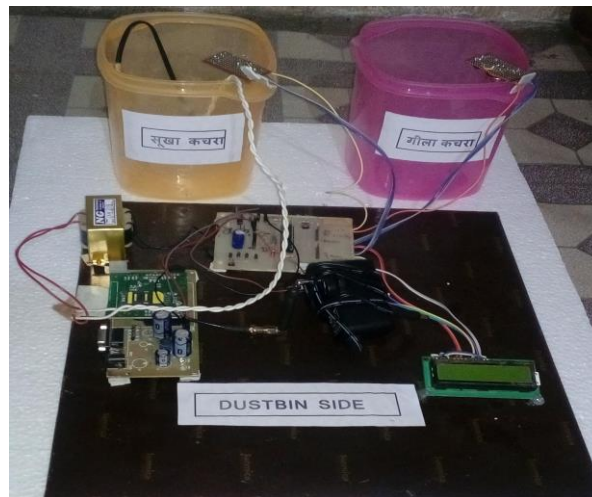


Fig. 6. Exciting hardware model

6. Conclusion

In the paper we have successfully shown the intelligent waste management system for the garbage collection with integration of GSM module and Arduino board. The Arduino board is open source programmable board. It is very simple to exercise and provide an authoritative board computer that has gained significant footing. The board is able to read inputs light on a sensor, Twitter message to control room. This technique helps municipal cooperation for a neat and clean city and reduces the affect of threatens aquatic life and human life.

References

- [1] M. N. K. Boulos and N. M. Al-shorbaji, "On the Internet of Things, smart cities and the WHO Healthy Cities," pp. 1–6, 2014.
- [2] Jain, Aaditya, and Ranu Bagherwal. "Design and implementation of a smart solid waste monitoring and collection system based on Internet of Things." Computing, Communication and Networking Technologies (ICCCNT), 2017 8th International Conference on. IEEE, 2017.
- [3] Vishesh Kumar Kurrel, Smart Garbage Collection Bin Overflows Indicator using the Internet of Things. Volume 3, Issue 05 May 2016.
- [4] Parkash, Prabu, IoT Based Waste Management for Smart City. IJECS Vol. 4, Issue 02 February 2016.
- [5] J. Q. Li, D. Borenstein, P. B. Mirchandani, "Truck Scheduling for Solid Waste Collection in the City of Porto Alegre, Brazil", Omega, 2008, vol. 36, pp. 1133-1149, 2008.
- [6] Abdul Atif Khan, "Study of Smart City Using Internet of Things," IJRITCC, March 2016.
- [7] Monika K, "Smart Dustbin-An Efficient Garbage Monitoring System," IJECS, vol. 6, no. 6 June 2016.
- [8] Jose M. Gutierrez, Smart Waste Collection System Based on Location Intelligence. Procedia Computer Science, 61, (2015), 120 – 127.
- [9] J. U. Duncombe, "Infrared navigation—Part I: An assessment of feasibility," IEEE Trans. Electron Devices, vol. ED-11, no. 1, pp. 34–39, Jan. 1959.
- [10] P. T. R. Ramos, M. I. Gomes, and A. P. B. Povia, "Assessing and improving Management Practices when Planning Packaging Waste Collection Systems", Resources Conservation and recycling, vol. 85, pp. 116- 129, 2014.