

Smart Garbage Monitoring System Using AVR Microcontroller

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Abstract In last few decades garbage management has become a perilous matter in the developing country along with the rapid growth in the population and pollution. In India, like other developing countries, garbage management has been ignored in many places and thus there is need of some effective solution. In most of the areas it is revealed that overflowed garbage bins are not emptied on time thus creating disease-ridden environment and infirm countries. Collection of garbage in bins faces daily variation in time as well as quantity. Waste picking vehicles of Municipal Corporation which are at fixed intervals has dwindling reliability and unmonitored collection system. In today's scenario the fuel and time consumed by the conventional system is more. The proposed model makes an IOT based smart garbage monitoring system which can detect the garbage level of the dustbin and via Wi-Fi and GSM the status and location of bins can be displayed on web server. This system will improve the coordination between the garbage collection and transportation process. The main aim of the model is to manage garbage through GPS and GSM technologies, used for tracking the vehicle and IR sensors, to identify the status of bins, if it is filled or empty.

Keywords IR Sensors, AVR, ATmega16 Microcontroller, LCD, IOT, ESP8266 Wi-Fi Module, SIM800 GSM Module, SKG13C GPS Module.

I. INTRODUCTION

In India, improper garbage management has posed severe problems that results from moderate to severe health risk. Through different surveys and medical reports, one can make a denouement that GARBAGE is the major problem of disease-ridden and infirm environment. With increase in the population and demand for food and other stuff, there has been enlargement in amount of waste generated by smaller and bigger areas. This garbage is collected by the area municipalities for further disposal. Generally, garbage collection vehicles have particular schedule of collecting the garbage from bins. Two major problems are faced in today's

waste collection system. 1. Vehicles do not collect waste either within given time or when bins are overflowed 2. Garbage collection system consume large no. of resources as vehicle are made to run to every garbage collection site without prior checking whether the bin is Full or Empty [2]. As a solution to this, the proposed idea can save lots of fuel, time and work. Smart Garbage Monitoring System can help nation to create a garbage free and nourishing environment. The proposed model can monitor the level of garbage in bins and send necessary information to the control room of municipality, from where to and fro of vehicles can be controlled. The system consists of IR sensors, GSM, GPS, AVR Microcontroller, Wi-Fi module and Sensors. Transmitter emits infrared radiations which get reflected back by various levels of garbage. These levels get further detected by receiver. The received signals are send to the control room on webpage via Wi-Fi module. Provision of text message on mobile phone is made when bins get overflowed via GSM module. This system can bring in best-in-class operation efficiency which will ensure that the services are delivered on consistent basis to meet objectives of clean nation.

II. LITERATURE SURVEY

Internet of things (IOT) is a promising concept with blooming applications leading to new technologies. IOT include identification, sensing, communication and computation and services [8]. IOT can be effectively used for waste management. Many ideas and designs are proposed to handle the waste management. In Solid waste bin detection system, dustbin is designed in such a way that it will compress the garbage. Arduino UNO microcontroller is used as the system processor with Ultrasonic sensor to sense the level of garbage collected in bin. RFID tags are used for verification and automatic identification of garbage filled in bins. [1] Load sensor and level sensor can be used to calculate the weight and monitor the level of garbage

filled in dustbins and GSM module connects all the sensors to the web server [2]. Garbage monitoring can be done effectively by placing sensors which senses levels of garbage in bins and sends the status to cloud which is then accessed by the concerned authority [3]. An IOT based garbage collection system is built wherein camera is set on bin [4]. The images are captured continuously and sent to workstation. RFID technology is used for communication between the bins and garbage loaded trucks. Ultrasonic

III. SYSTEM MODEL

The proposed model is a real time system which gives the information about the level of garbage in dustbin. An alert signal is sent before the dustbin gets overflowed. Whenever sensors sense the full level it immediately sends the text message via GSM module and will update the status on web server. The whole system is controlled by using micro controller. The overall system architecture is given below

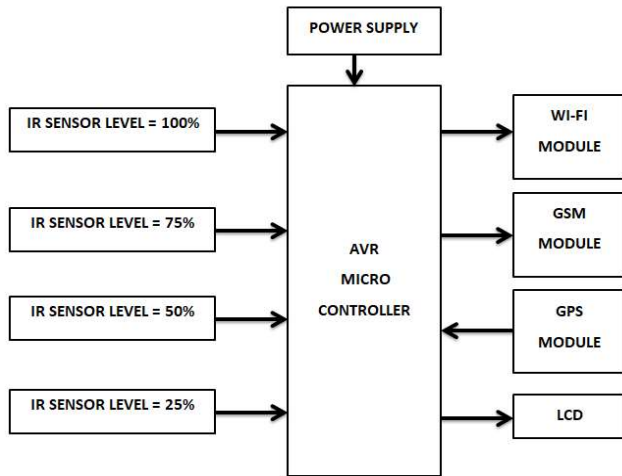


Fig. 1. Block Diagram of Smart Garbage Management System

A. Microcontroller

The microcontroller AVR Atmega16 is the heart of the system. It receives the information from the IR system and processes signal. ATmega16 device come into 40 pin PDIP as well as 44 lead TQFP package. It has 16K bytes of programmable flash memory and 512 bytes of EEPROM. It can work on a maximum frequency 16 MHz. It also contains 32 GPR and also JTAG interface for boundary scan. It consists of MSSP with two modes of operation. i.e. 2 wire SPI and I2C master and slave mode. It has 10 bits, 8 channel analog to digital converter (A/D) module.

B. IR Sensor

IR sensors are used for detecting different levels of garbage in bins. Figure 2 represents circuit schematic of a IR sensor. The circuit contains of a pair of infrared transmitter (IR_Tx) and infrared receiver (IR_Rx). The light transmitted by the transmitter IR LED is reflected by an object and it falls on detector. The module consists of comparator IC 358. Comparator IC has one input set to threshold value while the other input will change as the resistance of photodetector changes. This change is indicated with the help of LED.

sensor is used for level detection and chemical sensor used to transform the chemical information. Wi-Fi modem is used to send status on cloud and GSM for sending SMS to the work station. Android application is also developed for the information of various levels of waste in different locations [5]. Smart bin system proposed in [7] identifies the level of litter bin. The system uses duty cycle techniques for low power consumption and maximum operation time.

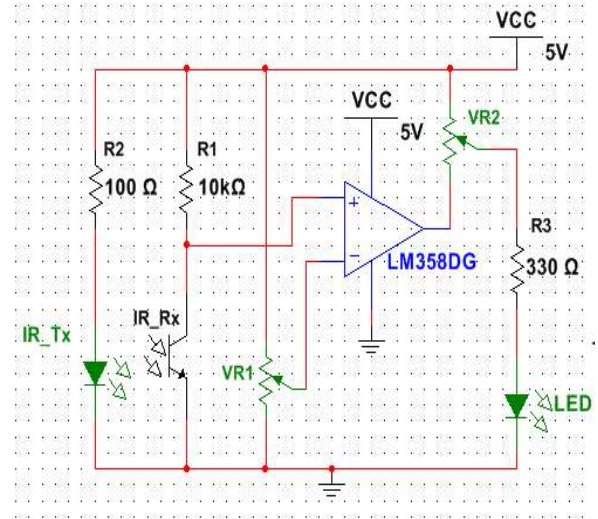


Fig. 2 Circuit schematic of IR Sensor

When the IR sensor detects the garbage level (object), the light is reflected back to photodetector which makes the output of op-amp high and LED glows. Thus, board LED indicator helps user to identify status of the sensor.

C. Wi-Fi module

ESP8266 is a low cost SOC Wi Fi module. It has features like 802.11 b/g/n, integrated low power 32bit MCU, integrated 10bit ADC, TCP/IP protocol stack, Wi-Fi 2.4GHz etc.

D. GSM modem

SIM800 GSM modem is used for sending SMS to municipal worker with dustbin number and respective area, to empty the dustbin. SIM 800 (Version name) is Quad band GSM/GPRS module. It works on GSM 850 MHz, 900MHz, 1800MHz and 1900MHz frequencies with baud rate from 9600 11520 through AT commands. It has internal TCP/IP stack to enable internet connectivity via. GPRS.

E. GPS module

SKG13BL is a GPS module. It has ultra-high sensitivity 165dBm with high TTFF (Time to First Fix) at low signal level. Power consumption is typically 45 mA at 3.3V. GPS module can be easily integrated into portable device like PNDs (Portable Navigation Device), mobile phones, LBS (Location Based Service), cameras and vehicle navigation system because of its small form factor and low power consumption make.

IV. FLOW OF SYSTEM

The algorithm of the prototype is as shown in figure 3

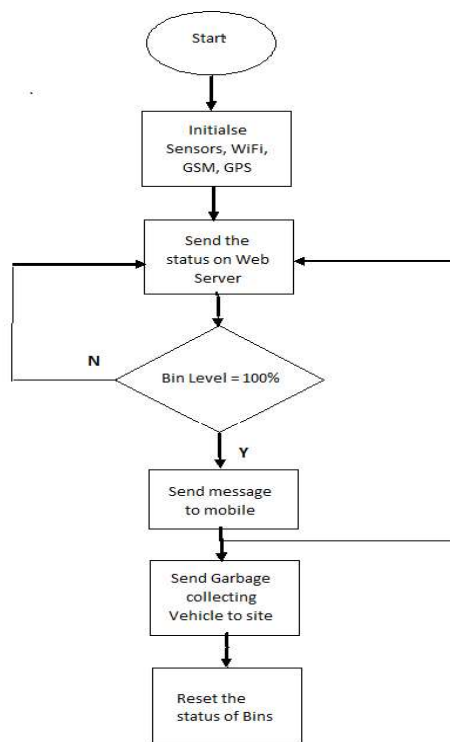


Fig. 3. Flowchart of the System

V. RESULTS

The hardware module is shown in figure 4. The IR sensor are attached to a dustbin at the four different levels. Figure 5 shows that the IR sensors detects the level of the garbage on LCD display. As soon as threshold level is reached, a SMS is send to the authorized person through GSM. As shown in figure 6 GSM module sends a text message of BIN FULL along with the position (Latitude and Longitude) of the BIN



Fig. 4. Hardware setup with GPS and Wifi module

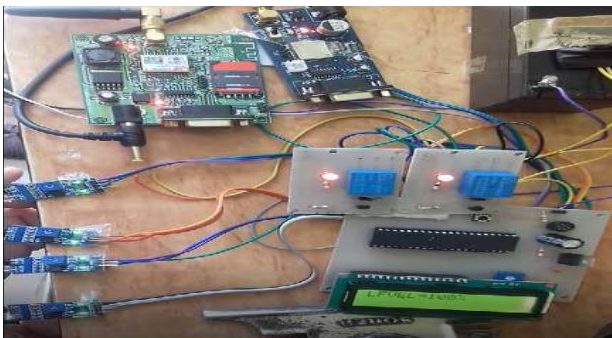


Fig 5. The hardware set up with garbage level detection

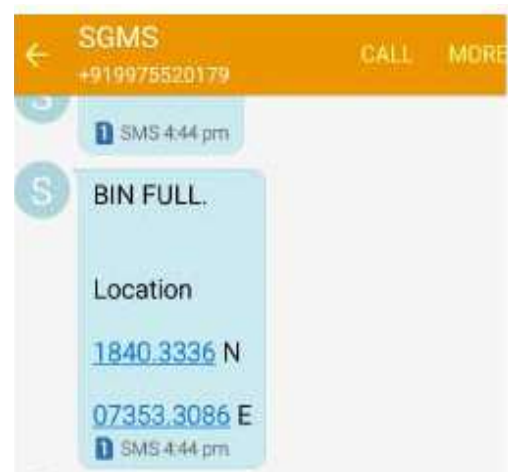


Fig. 6. SMS on mobile

ThingSpeak is used as a webservice. It is an application of IOT. ThingSpeak permits sensors, to send data to the cloud where it is stored in either a private or a public channel. As shown in figure 5 continuous status of bin is displayed on Web server indicating different levels. Four levels are set: 25, 50, 75 and 100%. This project was tested at MITAOE, Alandi campus and the day-wise status is displayed as shown in figure 7. A CSV file is generated on web server as shown in Figure 8

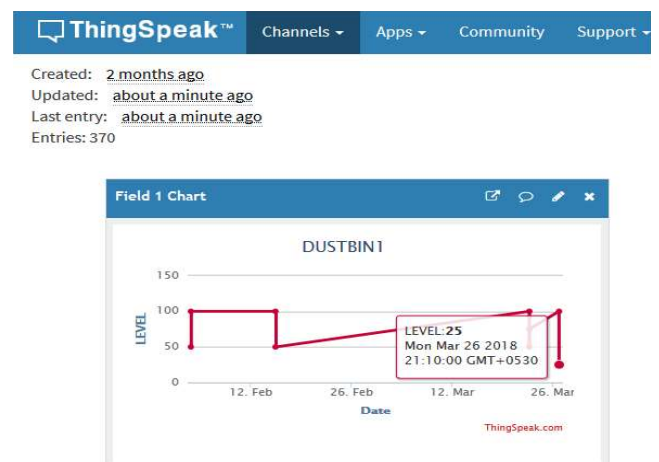


Fig 7 Status of bins on Think Speak

	A	B	C	D
75	created_at	entry_id	field1	
76	2018-01-29 06:13:48 UTC	75	75	
77	2018-01-29 06:14:08 UTC	76	100	
78	2018-01-29 06:14:34 UTC	77	100	
79	2018-01-29 06:15:04 UTC	78	50	
80	2018-01-29 06:15:41 UTC	79	100	
81	2018-01-29 06:16:03 UTC	80	100	
82	2018-01-29 06:16:24 UTC	81	25	
83	2018-01-29 06:16:46 UTC	82	25	
84	2018-01-29 06:17:06 UTC	83	100	
85	2018-01-29 06:17:27 UTC	84	100	
86	2018-01-29 06:17:49 UTC	85	75	
87	2018-01-29 06:18:08 UTC	86	50	
88	2018-01-29 06:18:28 UTC	87	50	

Fig. 8 CSV file generated on web server

CONCLUSION

The project intends to propose an IOT based smart garbage monitoring system. A small prototype is build which averts the irregular garbage collection by sending alerts through Web server and SMS to the concerned people. The real time data can be used for efficient garbage collection. In future we can enhance this work by implementing the segregation techniques for different types of waste.

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