

Efficient smart garbage management system using IOT technique

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Abstract

The Proposed Smart Waste Management System is to manage the waste with the help of smart sensors along with data fill-level indication, the garbage existence all over dustbin, containers and garbage bins foul smelling conditions will be sent as an alert to the registered / specified workers as a message. An accredited mobile number that are working in Waste Management Centres gathers fill-level. The remaining of multiple containers information transmitted where it placed all over the marginal location. Gathered data from the above process, utilised for gathering the garbage in a systematic plan and a route-map. Used communication devices in the implemented project transmitted the data from garbage bin to the authorised persons. An eight bit microcontroller i.e Atmega328P regulated the total functionality of this system. This narration demonstrates an effective design of IoT gateway which is utilised for offering the “smart waste management system” framework.

Keywords: Internet; Smart Cities; Wireless Sensor Networks; Smart Waste

1. Introduction

In current days, whole world show interest in building the smart cities. The major challenge faced by administration of the govt is management of the waste in the city. The Wastage means the material that is not usable but somewhat important. Through it has no economic value for its owner, we need preserve it. Based the state of the waste physically, it can be classified like solid waste & wet waste. As the population have been growing, the management of wastage is considered as very crucial for cleanness of the cities. We can reuse the waste with some typical processes. This includes some major steps such as outlining, gathering, shipping, treatment, reprocessing or clearing the waste by doing survey and controlling. The typical system for gathering the waste from homes, roads, streets and other places which is managed based on quotidian may not be effective. For example, in Raipur dist there is a village named as Giraud in the Chhattisgarh capital followed a waste management system. In this method, the govt put a Garbage bin in each street, the waste management workers collected that bins waste with the help of vehicles and etc. The approximate waste in the state of solid in that village per a day is the 558-kilo grams whereas 108040 litters in the form of liquid waste in a day. The entire garbage gathered by the workers everyday and dispatched to the landfills. If any persons in the village observes any prohibited depositing a harmful waste then anyone may gave a complaint regarding to the respective department of the govt. The inappropriate waste dumping impacts on human health seriously. May of unknown diseases will be speeded to the humans due to the effect of surroundings. So we can say that the govt have to take strict precautions to dispose the wastage which is collected from several areas. The implemented new scheme is to real-time monitor of level of the garbage in bins and indicates the appropriate person when it crosses the maximum level. Here not

only using the the sensors also used the Raspberry pi. All the gathered information can be transferred to a control unit & take necessary actions such as sending alerts to the persons time to time using a module of the WiFi, based the specified route which founded for “Garbage collecting Van”, consumption of the fuel dispossess, price, labor and the time. With the help of various sensors like humidity & wet we can know the status of the recycling; disposal; and waste reuse. For taking the reports of generation, we implemented the data mining & qualitative analysis in our system. Primary motto of the our implemented scheme is supersèd the tedious typical method that treat a city becomes the Smart City. Remaining paper described in the following sections as represented. 2nd Section covers overview of general architecture of the system i.e smart waste management. Coming to the III Section, it includes hardware s deployed details of the system. IV section represents how to scheme can be designed smartly to manage the waste generated by us.

2. Literature survey

Before going to implement the smart waste management system, we have to know the typical waste collection system process and disposal. Here, I described the different management systems for garbage which are proposed by various students and researchers in the world. Currently using waste regulation scheme is “smart garbage management system” method, by using the a special sensor process, the dustbins garbage can be detected and a alert can be send to the registered controllers with the help of the GSM technology. The interface of these sensors can be done through a Microcontroller along with the system of the GSM. For monitoring the required Garbage information of NCPD 2nd 2016 July of various specific places, I implemented a GUI. It becomes the an efficient garbage management system for everywhere. A infrared sensor is here we used for monitoring the level of the garbage in the bins. As this

sensor having the light visible property which are noticeable to the human eye, it can be observed effectively by some electronic system. For the purpose of an efficient communication of the GSM for transmitting the messages when the garbage is full we used this GSM method. Arduino board is helpful for the purpose of interfacing of GSM and sensors available in the project. For the observation of garbage level we used this type of IR sensors. Micro controller one of the input is Infrared sensor which acts as level indicator. With the help of GSM technique, and AT commands the SMS can be send to particular person. By using the Arduino software (IDE), we can dump the commands into microcontroller. Based on the Garbage information, an SMS transmitted to the authorised person of the control room with full data such as level of the garbage, and specified area. The specified humans gave the instructions to the vehicles which are using for cleaning of the garbage and responsible cleanness of that area.

3. System architecture

A New and efficient dustbins cleaning method named as smart cleaning of Garbage with the help of special sensors. The messages transmitted by these sensor about the level of the garbage in the bin and send the alerts to the appropriate persons. Whenever the bin is full, it goes to the a main container in a prearranged way by using fixed wheels and motors. Complete details about this scheme arrangement and implementation has been described in this section. Typically the sensors which are used for the Dustbin management fixed upper part of the bin, it helps to sene the level of the bin easily. However the information about the bin passed to the appropriate persons whenever it become fill. Here we used Zigbee Technology to connect the bin system to the central office of the waste management. If the waste reached the threshold value then used microcontroller sends a command to the cleaning team. with the help of the GSM, the team noticed the bin status and collect the wastage by a VAN. The MAX232 is used in this system for effective communication/interface between GSM modem & ARM processor. Here, the Master slave method is used in this system between dustbin and controller room. The proposed architecture will have a master slave configuration of dustbins. so we can avoid connectivity issues. The dustbins which are acts as can interface with master dustbins. As the master bin having the a microcontroller. This master dustbin also having the 3 types of the sensors. first one is Level sensor. The Dustbin level status acts be read by using this level sensor continuously. Once, the dustbin reaches the predefined level, then a command will be transferred to the cleaning team. coming to the second sensor, it is Humidity sensor. This Sensor recognises the difference of wastage consists in bin. It notices the wet and dry waste separately. The weight of the wastages presented in Bin can be known by the Load cell which acts as third sensor in this waste management system. with help of using the Load cell and level sensing sensor, we can reduce the false alarm and errors in this scheme. The Wifi module is an inbuilt device in Raspberry-pi 3 which we used in this as microcontroller. Master dustbins information will be regularly sending to cloud with the help of Wi-Fi module. this could be used for real time analysis that prepares the all reports such as Bin garbage level, Max level of the bin, sensors reports, type of the garbage presented in bins, and etc. with the help of all these observations, the govt Municipal corporation can remove the wastage effectively in a planner manor by using smart waste management system. Here, Service provides of the cloud technology can work as a backup server in this proposed technology. Not only getting the real time reports, we can also get the optimised ways by using Google maps to collect the garbage. As the result, we can reduce the fuel consumption also. all the applications which are running based on web can be hosted with the help of cloud technology in this implemented scheme. The controller can analyse the all monitored reports send by bins and optimised ways for collecting the garbage, and complete information about the master bins, slave bind and type of garbage everything. So, that a authorised person

can guide the waste receiving vans and implement best garbage management plans.

MICROCONTROLLER (AT89S52):

AT89S52 is an Low-power 8 bit microcontroller. it having the high level performance operated on CMOS technology. AT89S52 consists of the ISP flash memory of 8 kiloBytes. As it having the high-density; memory in nonvolatile nature, can be compatible to industry-standard 80C51 Pinout and instruction set. As we mentioned non volatile memory, we can program the memory and reprogram it according to the requirements with the help of typical programmer of the nonvolatile memories. So, we can say that it is the microcontroller which is powerful and can be suited with any type of embedded applications.

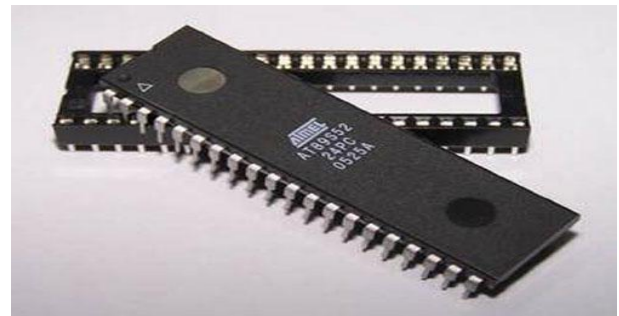


Fig. 1: AT89S52 Microcontroller.

The standard features of the AT89S52 having

- Flash Memory of 8K bytes
- RAM of 256 bytes
- I/O Lines which is count of 32
- Timer that can acts as Watchdog
- Data pointers count in 2 number
- 16-bit timer/counters - 3
- two-level interrupt architecture of 6 vector
- serial port works in full duplex mode
- an oscillator which is in built
- clock circuit

Not only having all these features, it also designed with logics i.e static which is useful for down to zero fQ and having the two power save modes which are regulated. The timers, RAM, Port, interrupt system are in working condition where as the CPU is in Non working mode when it operates in Idle Mode. Coming to the Power-down mode, continents of the RAM can be saved. but the oscillator can be freed and all remaining functions will be stopped till the next instruction received.

3.1. Ultrasonic sensor

It is important to know how much you are from the object or obstacle for the robotics or for driving purpose. The fig 2 describes the Ultrasonic sensors which uses the transmitter of the sound and receiver. The Ping which is an ultrasonic pulse created in 2016. this can be generated by sonar projector which having a generator the signal, power amplifier, a transducer of electro acoustic.



Fig. 2: Ultrasonic Sensor.

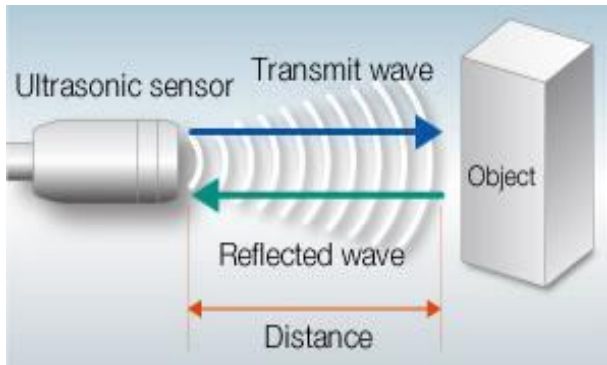


Fig. 3: Ultrasonic Sensor Transmitting Waves.

For measuring the distance between object and the human the time transmission of the pulse can be measured after that modelled into range with analysing the sound speed. Along with noise this signal can be transmitted via different types of signal processing, that can be understandable by the sensors to measure. At the decision device end it can be converted. Remaining operation is going on for classifying the target for measure the velocity.

3.2. Gas sensor

The typical gas sensors are the Electrochemical sensors. It is also known as gas locators which detects the level of Gas with the use of the objective gas oxidizing/diminishing at cathode. To measure the subsequent current. few cathodes presented in this, typically count in four, attach with electrolyte. By high surface range valuable metal settling on the permeable hydrophobic film, the anodes are made. All electrolyte are contact with working electrode. plastic is used to made this cathodes. that are having the gas section gap electrical contacts and the gas



Fig. 4: Gas Sensor.

for lower conductivity in air, the MQ-6 gas sensor is SnO₂ used. if any gas presented then it can be detectable and the output is converted with a simple circuit. Different type of the gases can be detectable with this. Especially LPG (propane).

3.3. Moisture sensor

The water content in the oil can be checked with the help of this sensor. Here, it having a probe of soil moisture, which is made with different types of the sensors of the soil moisture. The frequency Domain sensor is the a typical soil moisture sensor which are widely used in commercial purposes also called as capacitance sensor. we have another one called as neutron moisture gauge, that used for water for neutrons moderator in properties. cost effective sensors are typically useful in home based purposes. It consists of the 2 electrodes which are used for soil resistance measurement. we can also use the TDT i.e Time domain transmission & TDR i.e Time domain reflectometry for measuring the water content in soil

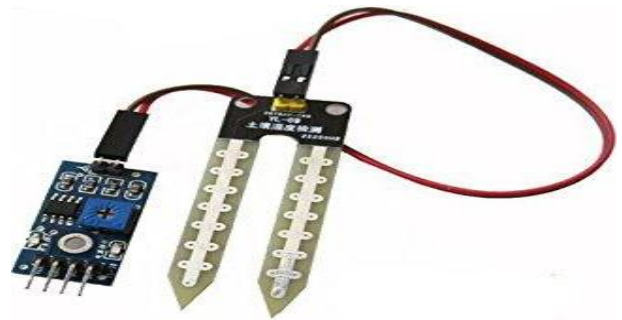


Fig. 5: Moisture Sensor.

The water content volume can be measured with the help of the Soil moisture sensors. The oil water potential sensors; include tensiometers ;gypsum blocks are another type of sensors measuring for soil moisture.

3.4. Gsm modem

The GSM network SIM card can accepted by only the operator of the GSM network which can be used as the mobile phone by using its own and unique phone number. It has many of the Advantages. With the help of this modem the RS232can interface and developed. SMS Control, data transfer, remote control and logging are some of the applications easily developed with gsm represented as figure 6.

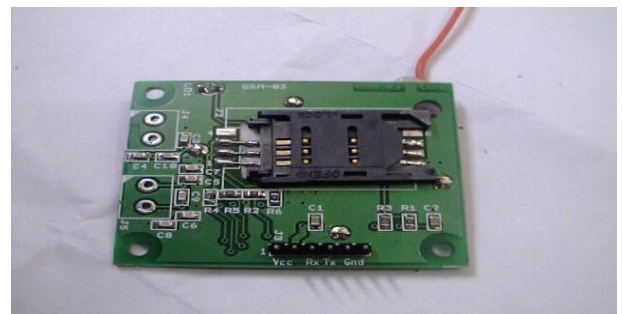


Fig. 6: GSM Modem.

we can connect modem for PC serial port otherwise you can connect to any other microcontroller by using the MAX232. For transmitting and receiving the SMS \ transmits / receive voice calls with it. in GPRS mode for connecting to the internet it can be useful. with the help of this GPRS mode; we can connecting the to the any type of the remote FTP server for data logging and upload files .

3.5. IX AT89S52 PIN diagram

(T2) P1.0	1	40	VCC
(T2 EX) P1.1	2	39	P0.0 (AD0)
P1.2	3	38	P0.1 (AD1)
P1.3	4	37	P0.2 (AD2)
P1.4	5	36	P0.3 (AD3)
(MOSI) P1.5	6	35	P0.4 (AD4)
(MISO) P1.6	7	34	P0.5 (AD5)
(SCK) P1.7	8	33	P0.6 (AD6)
RST	9	32	P0.7 (AD7)
(RXD) P3.0	10	31	EA/VPP
(TXD) P3.1	11	30	ALE/PROG
(INT0) P3.2	12	29	PSEN
(INT1) P3.3	13	28	P2.7 (A15)
(T0) P3.4	14	27	P2.6 (A14)
(T1) P3.5	15	26	P2.5 (A13)
(WR) P3.6	16	25	P2.4 (A12)
(RD) P3.7	17	24	P2.3 (A11)
XTAL2	18	23	P2.2 (A10)
XTAL1	19	22	P2.1 (A9)
GND	20	21	P2.0 (A8)

MCS-51 Product Compatibilities

- Built in Flash Memory which is programmable having a 8K Bytes storage

Endurance: 1000 Write/Erase Cycles

- Operating voltages are 4 V to 5.5 volts
- 0 Hz to 33 MHz Fully Static function
- Program Memory Lock available at 3 levels
- Internal RAM of 256 KB
- I/O Programmable Linescount - 32
- Timer/Counters of 16 bit - 3
- Interrupt Sources - 3
- UART Serial Channel operated in Full Duplex mode
- Low-power Idle
- Low power -down Modes
- Interrupt Recovery can be done with the help of Power-down Mode
- Timer acts as Watchdog
- Data Pointer operated in Dual Mode
- Power-off Flag

Low power nad a AT89S52 is COMS technology 8-bit microcontroller and having a built in programmable Flash memory pf 8KB. Atmel's high-density nonvolatile memory which compatible to the all industry-standard 80C51 microcontroller used in this. Program memory can be reprogrammable typical memory programmer of Nonvolatile with The on-chip Flash. Powerful 8-bit CPU and in-system programmable flash combined tso the Atmel AT89S52 becomes effective micro controller,

X MAX232: in 1987, the maxim-integrated products started the Max-232 IC. called as integrated circuit. In can able to converts the RS232 serial port signals to the proper, signal TTL compatible digital logic signals. the converted signals will be in the form of RX, TX, CTS, RTS. Max 232 is the dual driver or the receiver. It grow then the O/p voltage of TIA232 to 7.5 volts from 5 volts with the help for another adding capacitor along with a charge pumps which in built in device. TIA232 input levels can be reduced to the standard voltage 5volts from 25 volts by the receiver.



Fig. 6: Max232.

4. work ingle principle

In proposed system, we have two types of Garbage bins. Those are categorised based on our algorithm. we can as called as Master dustbins and slave dustbins. The Raspberry pi is implemented in Master Dustbins as well as for slave bins we attached the IoT module. each Dustbin weather it is master or slave allocated a unique id. for storing the information regarding the garbage Bins such as where it located or area or city, where we placed the what garbage bin and their Unique ids list and everything, we have used a DataBase. UV sensor , the load sensor which acts as level detector, and a humidity sensor to recognise wet as well as the dry wastage detection. each Garbage bin weather it is master or slave can interface with the Raspberry-pi 3, where Raspberry-pi 3 will act as a broker. The work of Raspberry-pi 3, which can gathered the information from the sensors that are put at master and slave garbage bins. By sing the an algorithm which is called as noise removal algorithm data can be transmitted to the Wifi Module. this messages consists the information about garbage level in the bin, weather it is wet or dry along its unique id. now the in server the ids of the bin and database ids

and can able to detect the area of the bin where it located at different places in city. Various Protocols related to IoT can also utilised for transmitting the such as MQTT or COaP. with the help of gathered data, and cloud, by using a analytic tool such as the Hadoop or Storm, data can grasped form the collected data about the garbage bins. By using the data send by microcontroller we can know the garbage level in garbage bin and optimised route to collect the wastage. If the garbage level is higher than the threshold level then an SMS or the alert can be sent to the control to room for collecting the wastage. By knowing the wet or dry garbage we can plan effectively to remove the garbage that increases the efficiency level of the algorithm. To make use of this scheme efficiently, we implemented a simple Web GUI. For transmitting messages about the level of the garbage here, we utilised the GSM 900A modem. the communication interface used in this scheme includes the modem of the GSM/GPRS modem RS-232 (Serial Port) which is a effective communication interface device. An USB also implemented in this for connecting the all other devices efficiently. For detecting the garbage levels in garbage bin at different time schedules an ultrasonic sensor. the 3 sensors implemented in this system can be fixed at 3 different levels. Such as h/3, 2h/3 and h, here h represents bin height for getting effective and accurate results one sensor has been fixed at surface level. The Aurdino Uno board also useful as an microcontroller platform. By shorting the pin of the RX in modem to the pin of TX in board Interfacing can be done GSM modem & Aurdino. The Aurdino board Pin 5 and Pin 13 connected to the ECHo and TRIGGER sensor pins. At 5 volts supply only, the Aurdino board can be worked where as the GSM modem operated at 2A. the fig4.1 represents the 10cm threshold height. The Variation of the height where the sensor is fixed & garbage level filled is taken as Threshold distance.

5. Experimental results

As we are using the IC's toi implement the system, it becomes easy to control the Firmware. In current days the Orcad design is widely used PCB design for a circuit and for Software development we use Keli μ v4 for writing as well as for compiling for the codes that are developed in C language. For writing this comp line code we used the Flash magic programmer in microcontroller. LPC 2148 ARM 7 is utilised in this for Hardware implementation. By using various module, we can provide effective and efficient communication interface between all the modules. This system has been implemented to met the all desirable features and challenges. This scheme includes the different sensors like Gas, Sensor; Ultrasonic sensor; GPS and GSM for the LPC2148. If the Dustbin reaches the threshold level or full of the garbage, then ultrasonic and gas sensor observed the data and send to the LPC2148. Now a SMS or alert can be sent via GSM and GPS to the registered user and control room. It sent every information about the Garbage bin such as location, level of the bin and optimised way. the entire system of this Smart waste Management can be shown in fir 8. There you can see the all interfaces and modules.

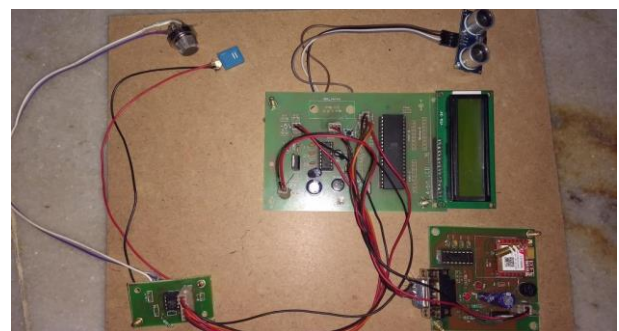


Fig. 8: Hardware Kit Model.

Advantages

- Dustbin filling level can monitored in Real time.
- Placement of dustbin can be depends on usage.

- Optimised resources.
- Cost effectiveness.
- Get Cleaning environment
- Intelligence monitoring of bins
- Saving the fuel
- Maintain clean and green city

Disadvantages

- Cost will be somewhat high then typical system
- we may also affected by the hacking problem
- we have to maintain the large database for real time and continuous monitoring of the dustbins

6. Conclusion

Here, I described How the “smart waste management using IoT” may be designed and implemented. With the help of this new system is for collecting the garbage as soon as possible whenever the Dustbin is full of waste. The garbage can be collected when the bin reached the threshold level. It gives real time efficient reports so that we can manage the wastage easily. we can also save the fuel by using this Garbage level Real-time monitoring with help of sensors and efficient communication interfaces. As a result, the expenditure also decreases. However we can build the smart city as the bins cleaned whenever it filled. We provide some of important features like aff durableness, affectability, damage prevention and the issues related to the maintenance are monitored by using this “smart dustbins system”. It gives hygienic environment while building the smart city. But we have to create the awareness about this to the people as it is new to our country.. Otherwise, because of improper usage leads to fail the sensitive devices such sensors and etc..

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