International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 10 | Oct -2020 ISSN: 2582-3930

SMART WASTE MANAGEMENT SYSTEM

Tanaz Bagwan[1], Sadiya Bagayat[2], Md Afroz Alam[3], Shali Hussain Basantpur[4], Netra purohit[5]

[1]Student, Department of Computer Science and Engineering,Malik sandal polytechnic, Vijayapur, Karnataka, India
[2]Student, Department of Computer Science and Engineering, Malik sandal polytechnic, Vijayapur, Karnataka, India
[3]Student, Department of Computer Science and Engineering, Malik sandal polytechnic, Vijayapur, Karnataka, India
[4]Student, Department of Computer Science and Engineering, Malik sandal polytechnic, Vijayapur, Karnataka, India
[5]Lecturer, Department of Computer Science and Engineering, Malik sandal polytechnic, Vijayapur, Karnataka, India

---

Abstract -The aim of this project is to provide a solution for waste management system.This project IOT Garbage Monitoring system is a very innovative technique which will help us to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of Arduino Uno board, LCD screen, Wi-Fi modem for sending data. The system is powered by a 9V battery. The LCD screen is used to display the status of the level of garbage collected in the bins. Whereas a web page (thinkspeak IOT platform) is integrated to show the status to the user monitoring it, the web page gives a graphical view of the garbage bins and highlights the garbage collected in color in order to show the level of garbage collected to the monitoring agency.
.

***Key Words*:**Embedded system, Ultrasonic sensor, GSM adapter, Arduino UNO, GSM

1.INTRODUCTION

As a developing nation and as one of the most populous country in the world, we in India face unique problems that require a unique solution for a problem like waste management. As of now, there is no proper monitoring system on the working of labours whoever is working in the corporations, if they failed to clean the garbage bins within the stipulated time then there will be an overflow condition and diseases and hazardous gases spread easily which makes city or town worst affected. This project IOT Garbage Monitoring system is a very innovative technique which will help us to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of Arduino Uno board, LCD screen, Wi-Fi modem for sending data. The system is powered by a 9V battery. The LCD screen is used to display the status of the level of garbage collected in the bins. Whereas a web page (thinkspeak IOT platform) is integrated to show the status to the user monitoring it, the web page gives a graphical view of the garbage bins and highlights the garbage collected in color in order to show the level of garbage collected to the monitoring agency. The LCD screen shows the status of the garbage level. Thus this system helps us to keep the city clean by informing about the garbage levels of the bins by providing graphical image of the bins via a web page.

INTRODUCTION TO EMBEDDED SYSTEMS: As its name suggests, Embedded means something that is attached to another thing. An embedded system can be thought of as a computer hardware system having software embedded in it. An embedded system can be an independent system or it can be a part of a large system. An embedded system is a microcontroller or microprocessor based system which is designed to perform a specific task. For example, a fire alarm is an embedded system; it will sense only smoke. An embedded system has three components − • It has hardware. • It has application software. • It has Real Time Operating system (RTOS) that supervises the application software and provide mechanism to let the processor run a process as per scheduling by following a plan to control the latencies. RTOS defines the way the system works. It sets the rules during the execution of application program. A small scale embedded system may not have RTOS. So we can define an embedded system as a Microcontroller based, software driven, reliable, real-time control system.

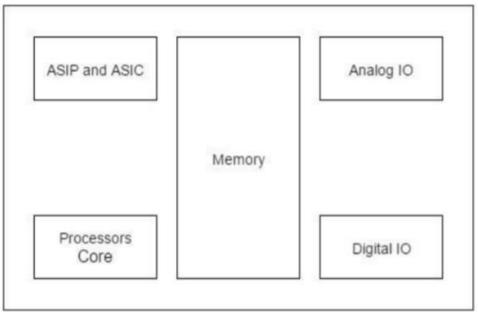


Figure 1: Embedded System

2. Methodology

WORKING PRINCIPLE: The sensor emits an ultrasound of 40,000Hz and travels in air when it hits an obstacle it is detected by the receiver and time taken is taken as the base for calculating the distance. The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board. In order to generate the ultrasound we need to set the Trig on a High State for 10 µs. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo pin. The Echo pin will output the time in microseconds the sound wave traveled. For example, if the object is 10 cm away from the sensor, and the speed of the sound is 340 m/s or 0.034 cm/µs the sound wave will need to travel about 294 u seconds. But what we will get from the Echo pin will be double the number because the sound wave needs to travel forward.

The list of components used and their working principles is as follows:

1.Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. 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.. You can tinker with your UNO without worrying too much about doing something wrong. orst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means “one” in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform, for an extensive list of current, past or outdated boards see the Arduino index of boards as shown in fig

Figure 2:Arduino UNO

2. **ATMEGA 328:**

The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2- wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed as shown in figure below

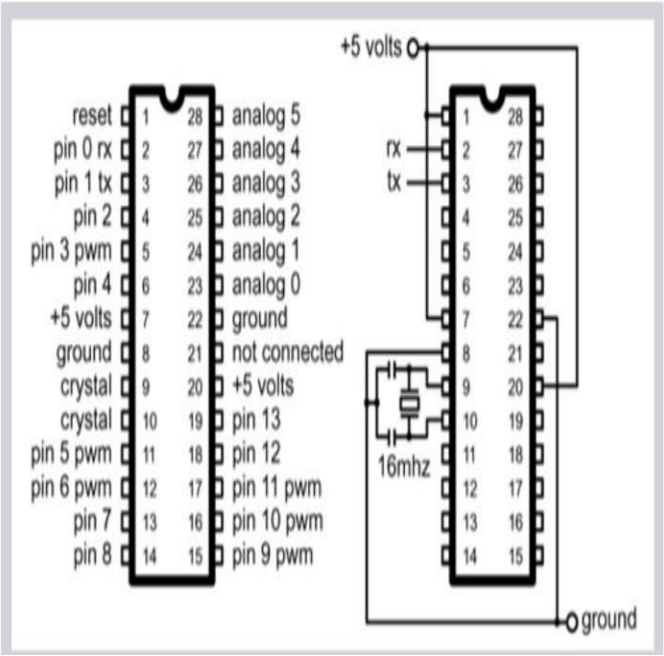


Figure 3: ATMEGA 328

3.HC-SR 04 UTRASONIC SENSOR

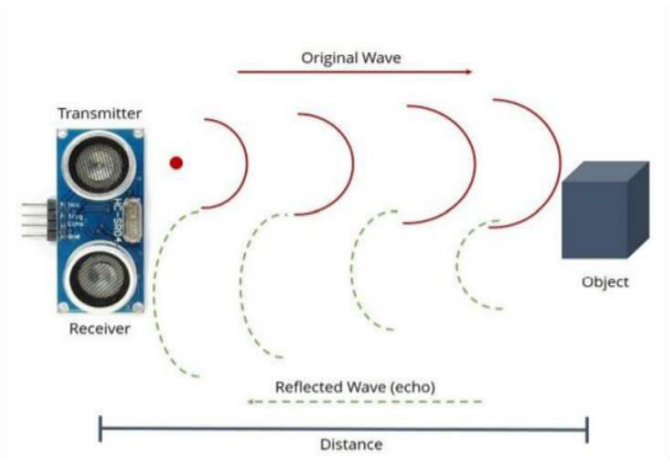
The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easyto-use package. From 2cm to 400 cm or 1" to 13 feet. Its operation is not affected by sunlight or black material like sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with ultrasonic transmitter and receiver module as shown in figure

Features

- Features
  - Power Supply :+5V DC
  - Quiescent Current :<2mA
  - Working Current: 15mA
  - Effectual Angle: <15°
  - Ranging Distance : 2cm – 400 cm/1″ – 13ft
  - Resolution : 0.3 cm
  - Measuring Angle: 30 degree
  - Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

The ultrasonic sensor uses sonar to determine the distance to an object. Here's what happens:

The transmitter (trig pin) sends a signal: a high-frequency sound 2. When the signal finds an object, it is reflected and 3. The transmitter (echo pin) receives it.



-

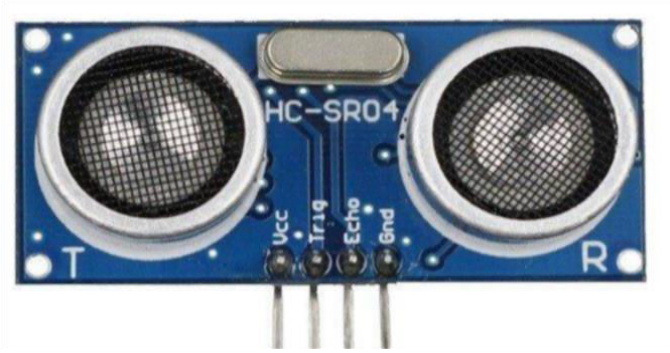


Figure 4: HC SR 04 UTRASONIC SENSOR

4.ESP8288 WIFI Modem:

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. • This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a selfcalibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

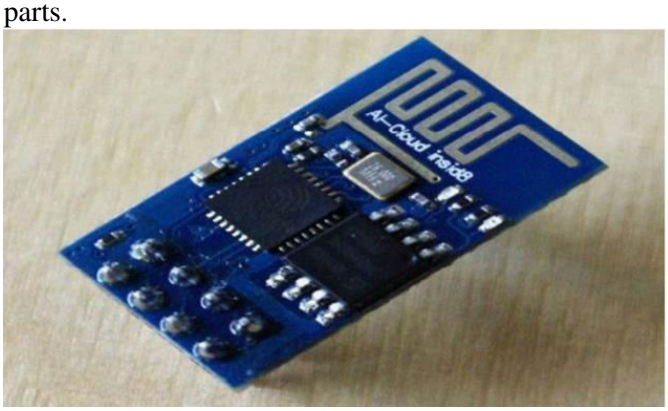


Figure 5: ESP8288 WIFI Modem

3. System Analysis

1. Moisture Sensor - The sensor mainly used for this purpose contains two conducting metal probes which consist of a pair of electrodes to measure the resistance in the bin. These probes sense the moisture content in the bin. Greater the moisture content value smaller the resistance.
2. Pump - A 12V DC motor is used which is fully controlled by the Arduino board. These motors can be turned off and on according to the needs.
3. Relay - For switching on and switching off the pump according to the water needs.
4. UV Sensor - This sensor is mainly used for sensing the garbage at different intervals of time.
5. Water Level Depth Detector - These are used for knowing the amount of water present in the bin.

4. SYSTEM IMPLEMENTATION

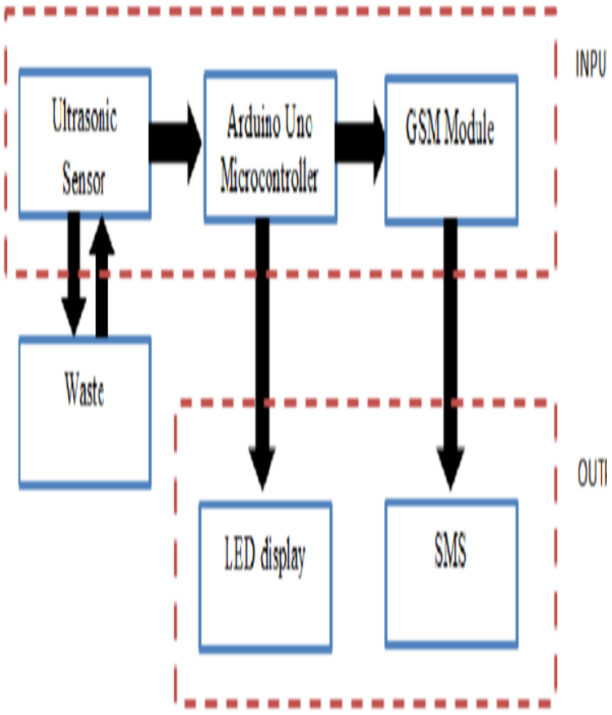


Figure5 :Block diagram of the project

GSM: The Global System for Mobile Communications (GSM) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets. It was first deployed in Finland in December 1991. By the mid-2010s, it became a global standard for mobile communications achieving over 90% market share, and operating in over 193 countries and territories. 2G networks developed as a replacement for first generation (1G) analog cellular networks. The GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony. This expanded over time to include data communications, first by circuitswitched transport, then by packet data transport via General Packet Radio Service (GPRS), and Enhanced Data Rates for GSM Evolution (EDGE).Enhanced Data Rates for GSM Evolution

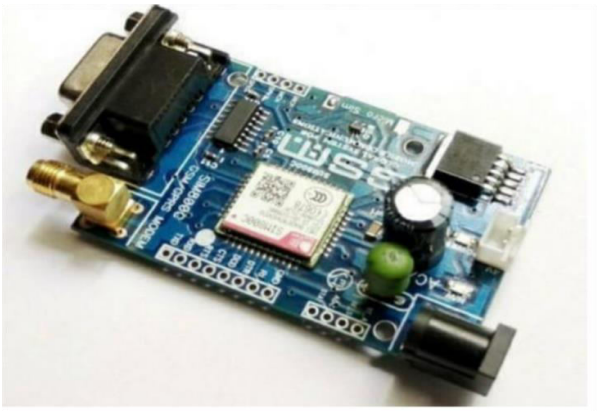


Figure 6.GSM

GSM ADAPTER: The main function of the GSM Adapter Mini is to interface to GSM network an alarm system that can report to security monitoring station through PSTN telephone line. The GSM Adapter makes possible the installation of alarm systems in places where landline (PSTN) is not available, but it is necessary to send report to security monitoring station. By means of GSM transmission, the adapter improves the reliability of alarm reporting in cases when the PSTN alarm transmission does not work or fails (e.g. when the phone lines are tampered or the telephone service is suspended due to technical reasons)

Arduino UNO: The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9- volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

Figure 7: Arduino UNO

ULTRA SONIC SENSOR: The ultrasonic sensor (or transducer) works on the same principles as a radar system. An ultrasonic sensor can convert electrical energy into acoustic waves and vice versa. The acoustic wave signal is an ultrasonic wave traveling at a frequency above 18kHz. The famous HC SR04 ultrasonic sensor generates ultrasonic waves at 40kHz frequency. Typically, a microcontroller is used for communication with an ultrasonic sensor. To begin measuring the distance, the microcontroller sends a trigger signal to the ultrasonic sensor. The duty cycle of this trigger signal is 10µS for the HC-SR04 ultrasonic sensor.

Figure 8: Ultrasonic Sensor

Advantages:

1. We can save time and money by using smart waste collection bins and systems equipped with fill level sensors. As smart transport vehicle go only to filled containers or bins. It reduces infrastructure, operating and maintenance costs by upto 30%.
2. It decreases traffic flow and consecutively noise due to less air pollution as result of less waste collection vehicles on roads. This has become possible due to two way communication between smart dustbins and service operators.
3. It keeps our surroundings clean and green and free from bad odour of wastes, emphasizes on healthy environment and keeps cities more beautiful.
4. Applying smart waste management process to the city optimizes management, resources and cost which makes it a "smart city".
5. It further reduces manpower requirements to handle the garbage collection process.

Disadvantages:

1. System requires more number of waste bins for separate waste collection as per population in the city.
2. Wireless technologies used in the system such as zigbee and WIFI have shorter range and lower data speed.
3. It reduces man power requirements which results into increase in unemployment for unskilled people.
4. The training has to be provided to the people involved in the smart waste management system.

5. RESULTS AND DISCUSSION

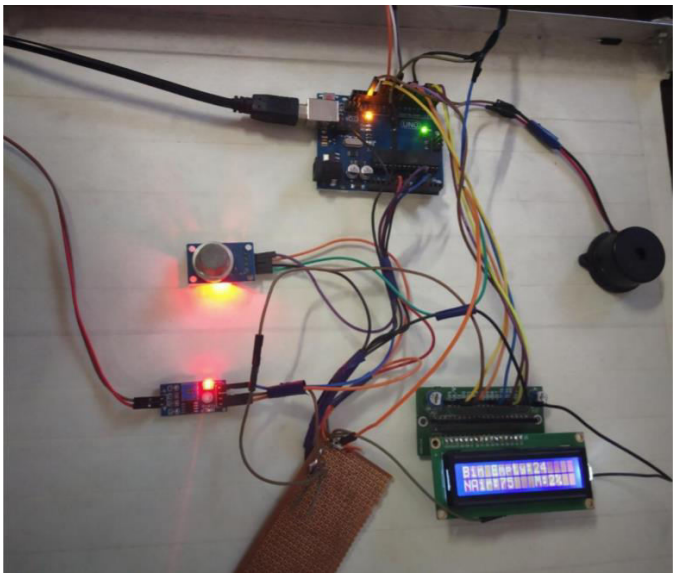


Figure 9: Working process of smart waste management

6. CONCLUSIONS

A practical system for monitoring the level of garbage is being presented in this paper. This project can be implemented in real time waste management system by using sensors to check the level of garbage in dustbin. In this system, the information of the dustbin can be accessed from anywhere and anytime. This system will help us to inform the status of each dustbin in the real time. So, waste management system can send the garbage collector to pick up the garbage when the dustbin is full. The range of ultrasonic sensor can detect distance is between 2cm until 40cm. The sensor will compare the depth of the dustbin to show the level of garbage in the bin. The sensor will collect the data and send to microcontroller to display on LCD at the same time, the sensor will send to thinkspeak via ESP8266 WIFI module. The data in thinkspeak via show the data in real time. Therefore , waste management can be monitor. By implementing this proposed system, it will reduce cost , man power, and indirectly reducing traffic in that place. We recommend this system to be used in real time waste management to keep our cities clean.

ACKNOWLEDGEMENT

The satisfaction that implies the successful completion of our work would be incomplete without the mention of people who made it possible. We wish to place gratitude to our beloved HOD and all the staff of Computer Science Department and our guide who motivated us and guiding us for final year-project work. Theymade entire task simple with their valuable suggestions. Finally, no words be sufficient to express our acknowledgement to our parents, We thank for their inspiration, moral support.

REFERENCES

1.Prof. S.A. Mahajan, AkshayKokane, ApoorvaShewale, MrunayaShinde , ShivaniIngale,Smart Waste Management System using IoTInternational Journal of Advanced Engineering Research and Science (IJAERS) [Vol-4, Issue-4, Apr- 2017

2. Barriers to smart waste management for a circular economy in China, Journal of clear publication volume 240 december 2019.
3. K lata Singh IOT BASED SMART WASTE MANAGEMENT SYSTEM USING WIRELESS SENSOR NETWORK AND EMBEDDED LINUX BOARD 2016.

4https//:www.researchgate.net

5.https//:www.wikipedia.org.https//:www.schematics.com https//:www.thingspeak.com . https//:www.youtube.com

6. IoT-Based Smart Waste Management System in a Smart City International Conference of Reliable Information and Communication Technology springer 2019