Design And Implementation Of A Remote Refuse Bin Monitoring System With Sms Alert

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Abstract—**In waste management systems, there exist a lot of constraints that tends to reduce hamper smooth waste disposal. Most refuse bins are remotely located a bit far and scattered, so most times before the waste management agencies can come and empty this large bins, the refuse collector may have been overfilled and thus cause pollution. This paper introduces a system that can automatically check the level of refuse in a refuse collector and send an alert by SMS to a local waste management office and notify them. This way they can make arrangements and have it emptied before it is even fully filled up. This system employs an SMS module, arduino and a transducer which detects the refuse level in the refuse collector.**

Keywords—Transducer; Sms Module; Arduino ;Refuse level

1. INTRODUCTION

Waste management is a task which occurs in a great, variety of domains and contexts. It is an important requirement ,for ,ecologically sustainable development in many countries. The impacts of poor solid waste management within the, urban settlements, particularly cities and big municipalities can be disastrous (National Environment Management Authority, 2014). A major, difficult task is the process of checking waste bins for the collection of waste. [1] Waste, has beendefined under Resource Conservation and Recovery Act as; any semi liquid or contained gaseous materials discarded

From industrial, commercial, mining or agricultural operations and from community activities. In order to protect human health and the environment from the potential hazards of delayed waste disposal and environmental pollution a systematically supervised and controlled handling of these wastes is must . [3]

During the mid-1900s, Flintoff and Millard (1969) describe the design and manufacture of over 20 bins differentiated in terms of material components, capacities, shapes, and handles. New design criteria continue to enter the market. One current manufacturer describes over 30 different bin designs for the 1990s home, including waste baskets for easy carrying and mini wheelie bins with telescopic handles for the elderly.[2].

Generally, manual waste collection and management approach has problems such as lack of information about the collecting time and place resulting to lack of proper monitoring system to follow all activities related to waste management and lack of smart monitoring of the condition of the bin [4].

This paper is aimed at designing and implementing a prototype(pedal bin) remote refuse bin monitoring system with sms alert to completely stop the occurrence of over filled dumpsters and, thus eliminate the pollution and health hazards caused by unmanned dumpsters. This is achieved by giving the various waste management agencies early information which will afford them more control of various refuse disposing sites. When this is properly implemented, dumpsters will be emptied right on schedule and never will garbage fill part of the cities, streets and major junctions as a result of over filled and unmanned refuse collectors.

II. MODE OF OPERATION

The device works by means a constant watchdog like effect that consistently checks for a signal or interrupts on a particular pin of the arduino analogue pins. Whenever an interrupt in the form of a negative voltage is detected there at that pin, internal communication will commence. This communication will be between the Arduino and the GSM module. AT commands will then be sent, to search for network, to establish a connection, to send the receivers phone number, to send the associated text . This is so because on power up, the GSM module

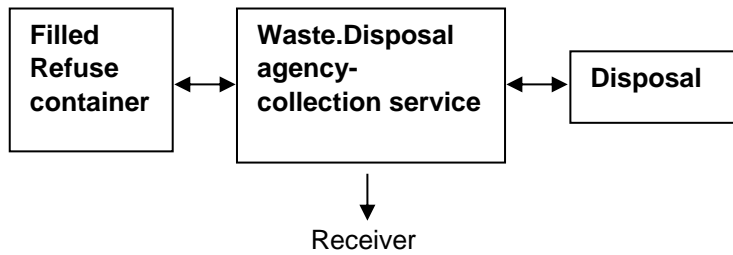on its own, ensures that it gets connected to a network and establish a link to the local GPRS.

Figure 1: Block diagram of the system

III.   IMPLEMENTATION

This work can be fully implemented on a large giant dumpster typically found or sited at the ends of streets or alleys. Even at comfortable and less obvious junctions or road ends. The body material which is always made of iron or steel, the LDR and the Led can be firmly fixed on the walls facing each other. The system can be powered by means of an inbuilt 5v battery which can be recharged by a low wattage solar panel so that the system will be on for at least 24 hours. Regularly the phone line used in it, can be recharged monthly or weekly. And at the Waste disposal central office in the city, a staff should be on hand to man or oversee or simply check for incoming alerts from different refuse containers stationed around the city. So whenever there's an alert, personnel from the collection service will get the nearest unit informed and have them empty the dumpster and reset the system.

Figure 2: Side view of the prototype system.

IV.   HARDWARE COMPONENTS.

The hardware components that are required for the implementation of the remote refuse bin monitoring system are enumerated .

A. GSM Module (Sim 8001)

GSM/GPRS module is a module that can be integrated within an equipment. It is an embedded piece of hardware. A GSM mobile, on the other hand, is a complete system in itself with embedded processors that are dedicated to provide an interface between the user and the mobile 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.

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. It's functions include:

- Read, write and delete SMS messages.
- Send SMS messages.
- Monitor the signal strength.
- Monitor the charging status and charge level of the battery.
- Read, write and search phone book entries.

B. C1815

This is an NPN transistor used to drive the various relays. It is all connected in sink configuration so as to achieve voltage amplification.

C. Crystal Oscillator.

This is a piezo crystal that is used to set the speed of program execution of the microcontroller. It is usually rated in mega hertz , in the design an 8 Mhz crystal oscillator was used.

D. PCB.

A printed circuit board (PCB) of the unit was prepared so as to enable mass production. Also a PAD2PAD software was used to design the pcb before it was printed on the board then later etched and ready to use.

E. ARDUINO UNO BOARD

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. The board has 14 Digital pins, 6 Analog pins, and 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.

The ATmega328 on the board comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

F. RESISTOR

Resistors are one of the common components in an electronic circuit. The basic operation is to limit the flow of current in the circuit. Many resistor values were used in this project. Some of them include; 10k, 100k.

G. CAPACITOR

Capacitors store electric charge. They are used with resistor in timing circuits because it takes time for a capacitor to be fill with charge. In this work capacitor was used in different segment like the power supply output, the output section of the ADC to filter the output of the rectified and attenuated voltage in order to prevent spikes and ripples in the voltage been measured.

H. POWER SUPPLY

Arduino board, GSM modem operates with a 12V DC, and sensor circuit operates with DC 5V supply and this supply is provided by regulator of LM7805. 12V step down transformer with rectifier and filter is used to give power supply.

I. LDR.

V. POWER REQUIREMENT

The system can be properly powered by a 5v, at least 1.2A power supply. So for remote setting, a 5v battery of say of 10AH can power the system for hours without running down, but then a 50 – 100watts solar pv module can be put in place to recharge the in built battery.
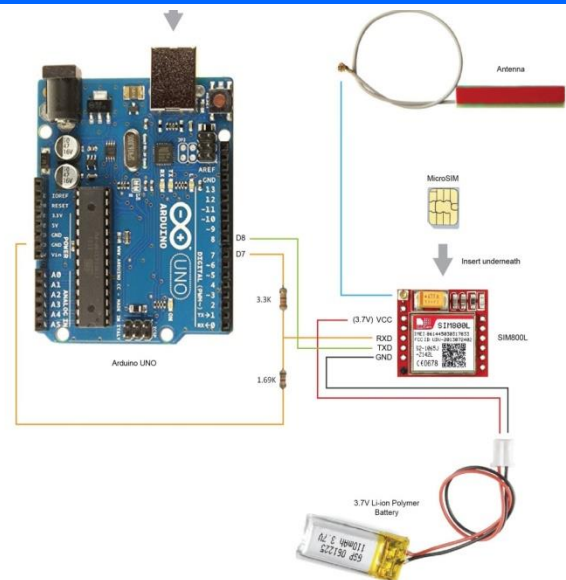

Figure 3: CIRCUIT FOR INTERFACING ARDUINO UNO WITH A GSM MODULE (SIM800)

VI. Programming Of The Microcontroller

The language used is BASIC language and the compiler used is Mkrobasic .   Before you start programming your SMS application, you may want to check if your mobile phone, GSM/GPRS modem and SIM card are working properly first. The MS HyperTerminal is a handy tool when it comes to testing your GSM devices. It is a good idea to test your GSM devices beforehand. When a problem occurs, sometimes it is difficult to tell what causes the problem. The cause can be your program, the GSM device or the SIM card. If you test your GSM device and SIM card with MS HyperTerminal and they operate properly, then it is very likely that the problem is caused by your program.

For Linux users, minicom can be used instead of HyperTerminal. The Procedure for Sending AT Commands to a Mobile Phone or GSM/GPRS Modem Using MS HyperTerminal is state below:

1. Put a valid SIM card into the mobile phone or GSM/GPRS modem. You can obtain a SIM card by subscribing to the GSM service of a wireless network operator.
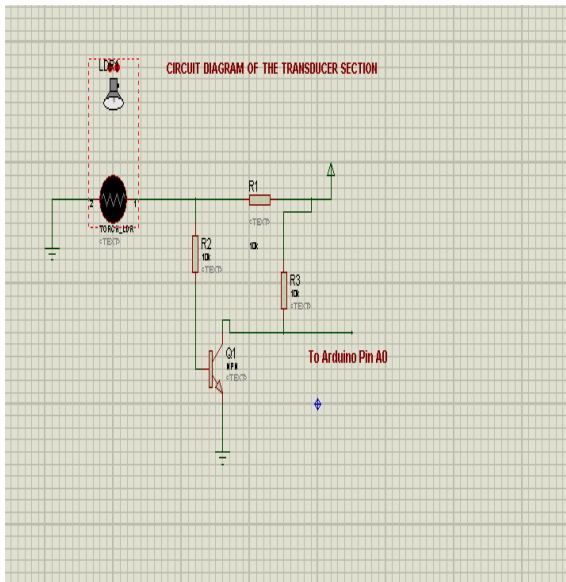
Figure 4: CIRCUIT DIRAM OF THE TRANSDUCER AREA

2. Connect your mobile phone or GSM/GPRS modem to a computer and set up the corresponding wireless modem driver. You should find the wireless modem driver in the CD or disk that was provided by the manufacturer. If the manufacturer does not provide such CD or disk with your mobile phone or GSM/GPRS modem, you can go to the manufacturer's web site and see whether the wireless modem driver can be downloaded there. If the wireless modem driver cannot be found on the web site, you can still use Windows' standard modem driver.

3. Run MS HyperTerminal by selecting Start -> Programs -> Accessories -> Communications -> HyperTerminal.

4. In the Connection Description dialog box, enter a name and choose an icon you like for the connection. Then click the OK button.

The microcontroller used here is the Arduino Uno, unlike other controllers , Arduino board is an open source project. It has an in built boot loader which enables it to be self programmable. So a user need not pull out the chip on the arduino board to program it outside, it will be programmed in the board. All needed is to just plug in the board to the pc, open up the arduino IDE , open the source code and then clip compile and upload. The progress bar will the progress and display: upload complete. Then the board can be unplugged from the Pc.

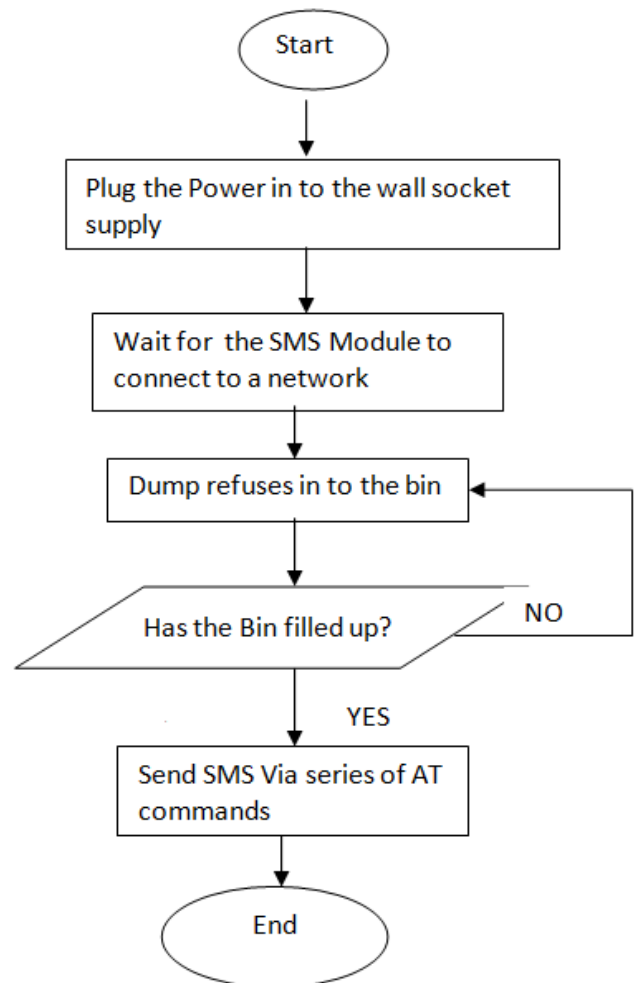FLOW CHART DESCRIBING THE PROCESS

Figure 5: System flowchart

Figure 6: PCB configuration of the system.

VII.   SYSTEM RESULT

The results aimed at the beginning of the construction work, was for us to make the refuse bin to be able to send an Sms alert to the waste disposal unit office with the number and address of the dumpster that got filled up. Fortunately, at the end of the construction work. The bin was able to sent messages to the numbers with the details via, its location.

Figure 7: Screenshot from a GSM phone showing systems result.

That was the text received at the end each time the refuse bin got filled up for that particular sitting. So we succeeded.

CONCLUSION.

A remote refuse bin monitoring system with sms alert has been design to help monitor garbage through every part of the city. The flexibility of a wireless reporting system cannot be over emphasized; this is because one cannot be in more than one place at a particular time. The SMS reporting system can greatly be used to report crimes, pass information automatically thereby eliminating the difficulty involved in manually moving around to passing information, with respect to cleaning up the environment. To the government we recommend they adopt this system and encourage the production of this work.

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