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Digital Garbage System using Arduino NANO

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Abstract: ***Garbage bins or dust bins are those that are put in public places in cities and are currently overflowing due to an increase in waste every day. It harms people's health by spreading deadly infections. To avoid this, smart bins will be designed with sensors such as an infrared sensor, a weight sensor, a photoelectric sensor, and radio frequency identification (RFID) card reader. If someone throws trash into the smart bins, a photoelectric sensor will identify the clear representation objects, and a weight sensor will be positioned beneath the smart bin to calculate the percentage of garbage present it will forward the information to the authorities in charge of that specific location. As a result, the relevant authorities can get messages until the bin is squished, and each bin is assigned a unique ID, which will appear on the screen of the respected officer, allowing them to take fast action. If a person is within two meters radius of the bin that contains an RFID CARD READER, the RFID reader will read all of that person's information and send a message to him about what they placed into the bin, as well as an appreciation message for using the bin.***
Keywords: Arduino NANO, GSM Module, Smart Dustbin, IoT, Arduino Uno.

I. INTRODUCTION

The GSM mobile SMS and digital card operating systems are used in the digital garbage system project. This garbage can is generally closed, but when the user comes within range of the sensor, the garbage can door will open. The garbage box door automatically closes once the rubbish is deposited in the inbox, and at the same time, the garbage machine transfers a specified amount (for example, 1 Re) to the user's account, and this payment deposit SMS is communicated to the user's mobile phone through SMS.

As a result, this garbage system is both a reward system and a way to raise awareness about the importance of cleaning habits. The next key aspect is that if the garbage can is full, the system will send an SMS to the garbage pickup van and waste disposal facility. As a result, when the garbage can is full, prompt action will be performed. This project also includes a pesticide sprayer, which sprays pesticide every 1 hour to sanitize the area. The idea came to us when we noticed that the garbage truck used to run around the town twice a day collecting solid waste. Although this approach was comprehensive, it was inefficient. Let's say street A is a busy street, and we notice that the rubbish bin fills up quickly, whilst street B's bin isn't even half full after two days. This example is based on real-life events, which led to the "Eureka" moment! We can then use that information to optimize waste collection routes and, as a result, cut fuel use. It enables trash collectors to arrange their daily/weekly collections.

II. SYSTEM OVERVIEW

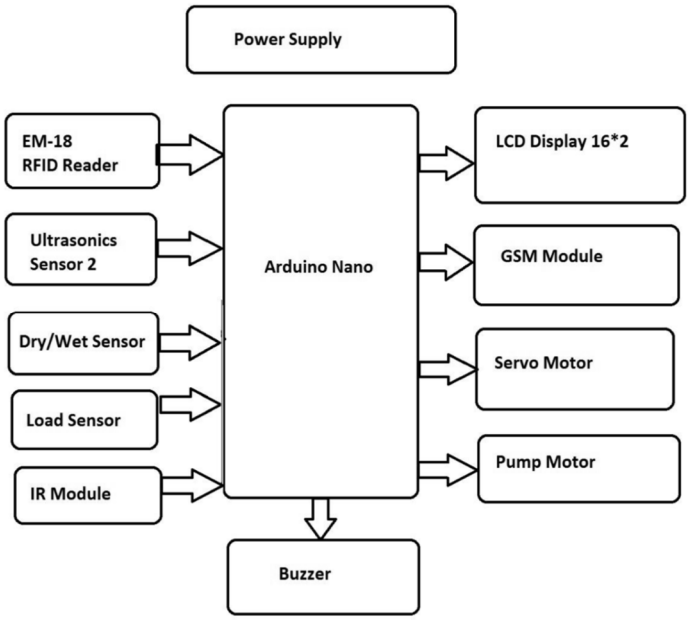
A Digital Garbage system consists of several components and circuits that work together and work according to the requirements of the user. A smart dustbin consists of the following components – a RFID Tag as a tracker and data collector; an ultrasonic sensor to monitor and control the level of the garbage ; motors for movement; a load cell to measure the weight of garbage ; a GSM Module to send SMS to user.

The Garbage System uses IoT, specifically Arduino NANO, as the controller. The Arduino NANO is a compact microcontroller board, which is an extension of Arduino UNO.

The proposed design has a simple working principle. The Microcontroller is connected to the various I/O devices and peripherals such as load cell, motors, sensors, etc.

The input of the various sensors, motor, etc. is displayed to the operator on a User Interface via the microcontroller which then also receives inputs from the user and then gives the command for the motors to move in the given direction thus moving the flap as per the given operation. The basic block diagram of the Digital Garbage System is given below.

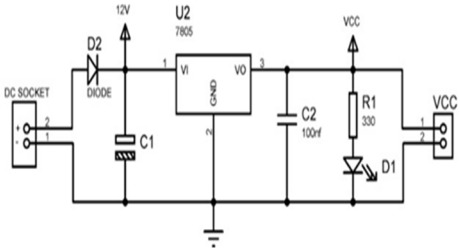
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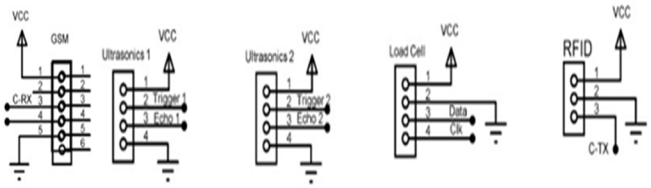
III.SYSTEM HARDWARE

The hardware section is divided into the following parts: connecting the humidity sensor and flap to the servo motor, connecting servo motor and load cell and spray, reader module, LCD screen, GSM module to the Arduino NANO and finally making the dustbin out of the sun board. The body of the system is made out of sun board, this helps us keep the bin eco-friendly and cost-efficient. For making this system on a larger scale stronger material can be used for the body of the system. A small door-like cutout is made on the back of the dustbin to empty the trash of the system. The Arduino and the other wires are secured inside a waterproof box to keep it safe from any kind of water or liquid substance.

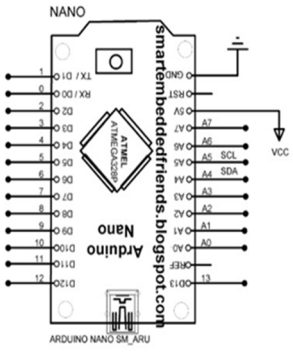
All the connections are made on the Arduino in the following manner as shown ahead:

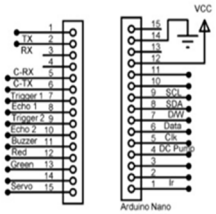


Power Supply Sensor

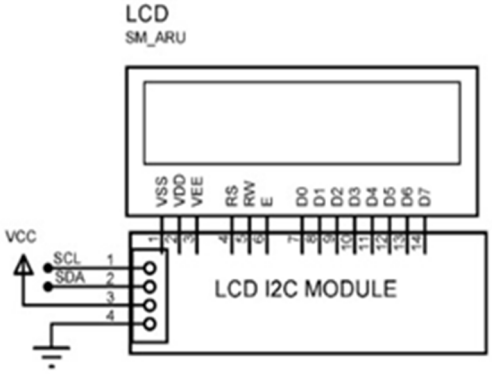


Connection to NANO Board



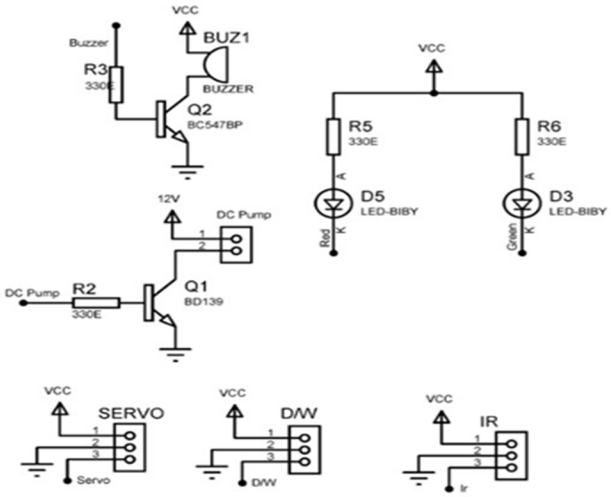


Arduino NANO Pins Connection



LCD Connection

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Connections for Buzzer, Servo motor and Sensor

IV. SYSTEM SOFTWARE

The software section consists of – coding in **Arduino** language for operating all the functions of the system and controlling the operation of the system, here the humidity sensor and the RFID card are used as the input to the system. Firstly the system will detect whether the card is valid or not, if valid only then the user would be allowed to use the system for disposing of the trash. The system works in the following format:

1) Once the system is given a power supply all the I/O sensors are initialized.
2) Create definition functions for different actions- right, left, locking the flap, beeping, spraying of disinfectant, calculating the load of the load-cell, reading of the garbage level of both the containers, displaying the required information on the LCD screen, sending the SMS using GSM module.
a) Starting the device and the timer set for 20sec for the disinfectant spray.
b) Waiting for the user to tap the RFID card on the reader module.
c) Waiting for the system to read the card and check whether the card is valid or not.
d) If input data received is valid then the system will run a specific definition else display the message on the LCS screen that the card is invalid.
e) If the card is valid the system will allow the user to dispose of the trash or else the system will repeat step4.
f) If the garbage level in the system is above 80% the system will lock the flap hence disabling anyone from disposing of any trash and then sends SMS to the concerned person.
g) Repeat step 4
h) Humidity sensor input will enable flap movement.
i) The load-cell will calculate the load of the trash disposed of
j) Displaying of the load on the screen.
k) Displaying the respective reward for the amount of trash disposed of.
l) Sending SMS of the reward point to the user's cell phone.
m) Displaying "Thank You" on the LCD screen
n) Repeat step 4.

• ***System Code:***
https://docs.google.com/document/d/1Jjrqr91iabgjswx9amyJGL1Q2gML2SV4/edit?usp=sharing&ouid=106277818256612186654&rtpof=true&sd=true

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V. WORKING AND IMPLEMENTATION

The project is implemented by using the mentioned hardware and software technologies. The operational flow of the project is fairly simple. The system when started displays the project name i.e. “DIGITAL GARBAGE SYSTEM” on the LCD screen. The spray timer will start which will cause the disinfectant to be sprayed on the inner parts of the trash containers every 20seconds. Then the system will check for any load on the load-cell and if it is above 80% then the system will disable anyone from using the system and then will send an SMS to the trash collector for collecting the trash. Once the system is back to normal the system will wait for any user to tap their RFID card on the reader module, if the card is valid then the system will allow the user to dispose of the trash, or else it will display a message on the LCD screen “Invalid Card”. And will wait for the user to tap the correct card on the module, once the card is valid the user needs to place the trash on the flap. The humidity sensor on the flap will check if the trash is dry or wet. Accordingly, the flap will either turn towards the right or left based on the placement of the dry and wet containers. Once the trash falls into the container the load-cell will calculate the load of the trash and display it on the LCD screen. Then the respective reward points for the trash will be displayed on the LCD screen, A SMS of the reward point will also be sent to the cellphone number associated with the RFID card. “Thank You” message will be displayed on the LCD screen after the completion of the process. The system will go back to waiting for the other user to tap the RFID card on the reader module.

VI. RESULTS

A. RFID Card Reading

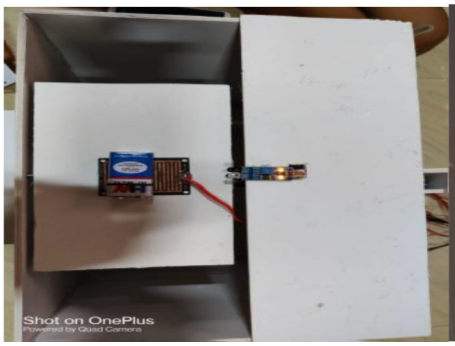


RFID card of invalid user declined



RFID card of valid user accepted

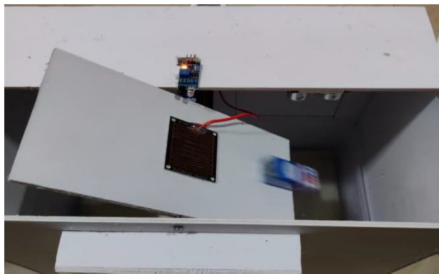
B. For Dry Waste



Placing Dry waste



Flap opening display



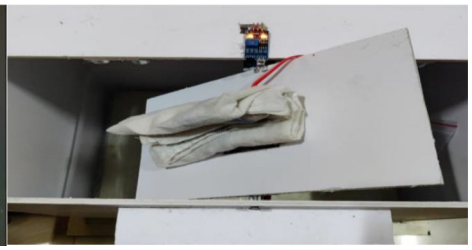
Flap tilting to dry side

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C. For Wet Waste



Flap opening display



Flap tilts toward wet side

D. Level Sensing And Sms Alert



Bin full displayed & indicated by red LED



SMS Alert sent display to the registered number



Spray message display

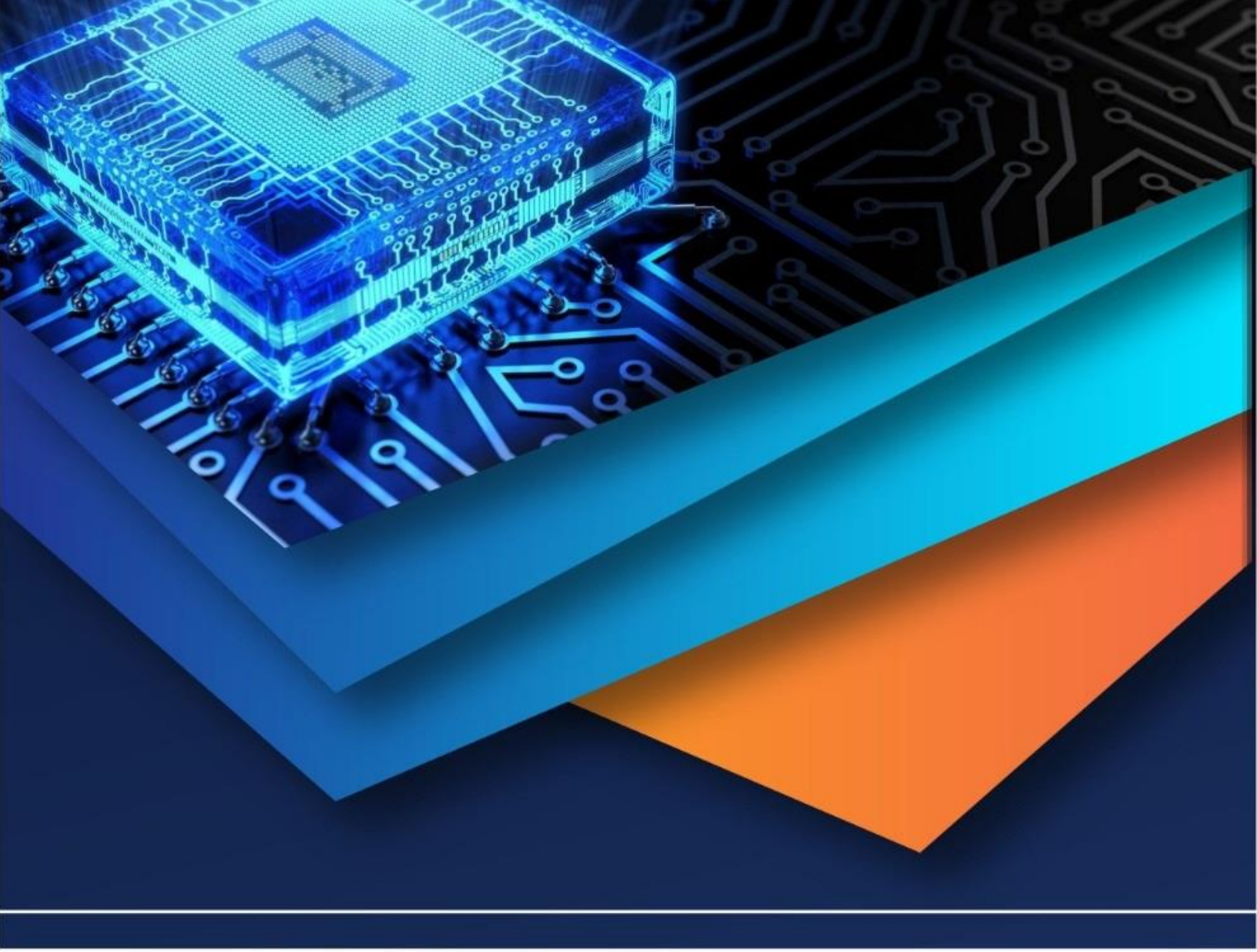
VII. CONCLUSION

This project involves the use of an ultrasonic sensor, an Arduino NANO, and a Wi-Fi module to create a smart garbage management system. When the rubbish level reaches its limit, this method ensures that the dustbins are cleared quickly. In major cities, garbage collection vehicles visit neighbourhoods on a daily basis, depending on the population of the neighbourhood, and these dustbins may or may not be full. Our system will provide real-time information on the status of each and every dust bin, allowing the responsible authority to dispatch the rubbish collection vehicle only when the dustbin is full. It ultimately contributes to society's cleanliness. As a result, the smart garbage management system increases the efficiency of garbage collection. Garbage can is any undesired material that has been left over from a city, a public space, a society, a college, or a home. This project is based on the "Internet of Things" and is related to "Smart Cities" (IOT). So, in order to live a wise lifestyle, cleanliness is required, and cleanliness starts with the garbage can. This initiative will aid in the elimination or reduction of the rubbish disposal problem.

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