

# IOT BASED SMART WASTE MANAGEMENT SYSTEM

HASID ISLAM , SAZZAD KABIR SAGOR

**Abstract**—The main goal of this project is to develop a smart trash can that helps keep our environment clean and green. Today, technology is getting smarter by the day, and to clean up the environment, we are designing smart trash cans with Arduino. This smart trash management system is based on a micro controller-based system with ultrasonic sensors in trash cans. Unmaintained trash cans can lead to unhealthy environments and pollution, which can affect your health. In this proposed method, we used ARDUINO UNO with ultrasonic sensors, servo motors and battery jumper cables to design a smart trash can. Once all hardware and software connections are complete, the smart dustbin program will run. The trash can lid waits for the user to put down the trash can and close it when someone approaches from a distance. does it work correctly? From a social point of view, it contributes to health and hygiene, and from a business point of view, we try to make it affordable for as many people as possible.

**Index Terms**—Dustbin, Smart Dustbin, Arduino, NODEMCU, Servo Motor, Ultrasonic Sensor, Blynk, Smart Waste Management System.

## I. INTRODUCTION

We live in a society where tasks and systems are merging with IoT for a more proper system to work and get tasks done quickly. With all the energy at your fingertips, it's what we've imagined. The Internet of Things (IoT) must be able to seamlessly and transparently integrate a large number of disparate systems while providing data that millions of people can use and exploit. Therefore, building a common architecture for IoT is a very complex task, mainly because there are so many devices, link layer technologies, and services that can participate in such a system. One of our main environmental concerns is solid waste management that has an impact on society's health and the environment. The detection, monitoring and management of waste is one of the major problems of the present era. The traditional way of manually monitoring trash in bins is a cumbersome and labor-intensive process, time and human cost that can be easily avoided with our current technologies. The trash can is just an ordinary trash can where people can throw their garbage but the integration of some hardware components is done for more efficient use. The smart trash can is integrated with several hardware parts such as ultrasonic sensor and Arduino, Servo Motor. These components help open lids, detect human hands and trash cans, and send notifications in LEDs.

## II. LITERATURE SURVEY

Today, there are tons of apartments and condos built in rapidly urbanizing areas. In everyday life, disposal includes opening the lid of the trash can and throwing the waste in it, then cleaning or emptying the trash when it is become full. The same is done in a residential area, the garbage becomes more

tough to handle, and if the bin is full, people started to throw garbage around the trash, which creates other diseases. The official companies who has to empty the trash will not empty the bin as often, and the garbage will sit on this street for weeks, creating an unhealthy environment and leading to many diseases. The trash can also not be properly maintained when the lid is damaged resulting in the trash can overflowing from the dustbin. If the tank is not maintained properly, the tank will have a bad smell. If the trash is not emptied immediately after the bin is full, many flies, mosquitoes and other insects will be around the trash can, which will create a various type of diseases. The idea came to us when we observed garbage trucks going around town picking up solid waste.

What our machine does is it offers a real-time indicator of the rubbish stage in a garbage can at any given time. Using that information we will then optimize waste series routes and in the long run lessen gasoline consumption. It lets in trash creditors to plot their daily/weekly pick-up schedule. An Ultrasonic Sensor is used for detecting whether or not the trash can is packed with rubbish or not. Here Ultrasonic Sensor is hooked up on the pinnacle of the Trash Can and could degree the gap of rubbish from the pinnacle of the Trash are we able to can set a threshold price in step with the scale of the trash can. If the gap might be much less than this threshold price, method that the Trash can is complete of rubbish

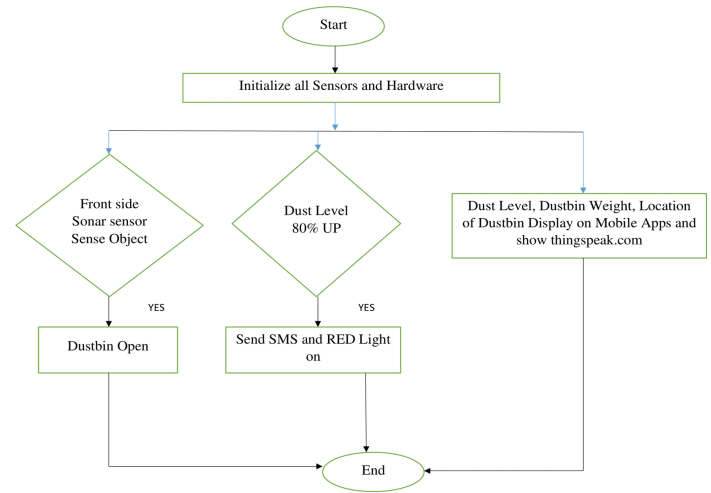


Fig. 1. Flow chart

### III. PROPOSED SYSTEM

In this section, we design the structure of the system before implementing the circuit. It uses an advanced microcontroller called Arduino (ATmega8). It incorporates many components such as analog-to-digital converters, 16MHz clocks and shift registers. For this project, I attached an ultrasonic sensor to the trash. The final result of the ultrasonic sensor is created by the hardware named Arduino, and the result is sent to the GSM, which will send an update details to the infected person. In other words, if the distance from the top of the trash to the sensor is less than 5 cm, the bin is full message is output. Take a plastic trash can or trash can and place an ultrasonic sensor in the front part of the trash can. The lid of the dustbin is made of cardboard and a servo motor is placed on the lid. Another ultrasonic sensor is placed inside the barrel. The code for this project is divided into two parts. The header code indicates the operation of the recycle bin, i.e. mainly the operation of opening the lid of the trash can. The second part code indicates the portion of the message received on the mobile device using the Blynk app.

Arduino is an open-source stage utilized to construct electronic ventures. Arduino comprises both a physical programming board (commonly known as a microcontroller) and a program, or IDE (coordinates advancement environment) running on your computer, utilized to type in and transfer machine code charged on the physical board. The Arduino platform has become very famous with novices electronically and for good reason. Unlike most previous programming boards, Arduino does not need a separate piece of hardware (called a programmer) to load the new code into the board - you can simply use a USB cable. More, The Arduino IDE uses a simplified version of C++, making it easier to learn to program.

NodeMCU is an IoT-based platform. This is used to make things work using Wi-Fi. This board includes firmware running on the ESP8266 Wi-Fi SoC Express system and hardware based on the ESP-12 module. A second ultrasonic sensor is connected to this card and a second coin code is loaded into this card. Before rendering the code, in the Arduino IDE, the correct board must be selected. This uses many open-source projects like Luacjson and SPIFFS.

The ultrasonic sensor is hardware that finds out the litter distance by ultrasonic sound waves. This sensor has a transducer that sends and receives ultrasonic pulses based on the proximity of the object. The ultrasonic sensor catches objects and wastes. The integrated circuit in the module calculates the time it takes for the US wave to return and activates the high echo pin at this same time, this way we can also know how long it takes.

Servo motor helps to open the trash can lid. The Arduino is programmed in such a way that after the ultrasonic sensor detects the trash, the lid opens automatically and this is done

by this servo motor.

The GSM module is used to establish communication between the computer and the GPRS GSM system. The Global System for Mobility (GSM) is an architecture used for mobile communications in most countries. Global Packet Radio Service (GPRS) is an extension of GSM that allows higher data rates. The GSM/GPRS module consists of a GSM/GPRS modem assembled with a power circuit and communication interfaces (such as RS-232, USB, etc.) to the computer. GSM/GPRS MODEM is a type of wireless MODEM device designed for computer communication with GSM and GPRS networks. It requires a SIM (Subscriber Identity Module) card like a mobile phone to be able to communicate with the network. In addition, they have the same IMEI (International Mobile Equipment Identity) number as a mobile phone for identification. A GSM modem is a wireless modem that works with GSM wireless networks. One wireless modem works like a dial-up modem. The main difference between them is that dial-up modems send and receive data through landline phone lines while wireless modems send and receive data through radio waves. The GSM modem can be an external device or a PC. Like GSM cell phones, GSM modems require a SIM card from a wireless service provider to function.

Blynk is a platform with IOS and Android applications to control Arduino, Raspberry Pi and other applications over the Internet. It's a digital dashboard where you can create a GUI for your project by simply dragging and dropping widgets

ThingSpeak is open source software written in Ruby that allows users to communicate with Internet-enabled devices. It facilitates data access, retrieval, and logging by providing APIs for both devices and social networking sites. ThingSpeak allows you to publish your sensor readings to a website and view them in graphs with time stamps. You can then access your measurements from anywhere in the world. ThingSpeak is an IoT analytics service that allows the aggregate, visualization, and analysis of live data streams in the cloud. ThingSpeak instantly visualizes data sent from your device to ThingSpeak. You can run MATLAB code in ThingSpeak, so you can perform online analysis and process incoming data. ThingSpeak is commonly used for prototyping and proof-of-concept IoT systems that require analytics. You can send data directly to ThingSpeak from any internet-connected device via Rest API or MQTT. Additionally, cloud-to-cloud integrations with The Things Network, Senet, Libelium Meshlium Gateway, and particle. ThingSpeak lets you store and analyze data in the cloud without configuring a web server. You can also create advanced event-based email alerts that are triggered based on incoming data from connected devices.

### IV. WORKING

Take a plastic trash can or trash can and place an ultrasonic sensor in the front part of the trash can. The lid of the dustbin is made of cardboard and a servo motor is placed on the

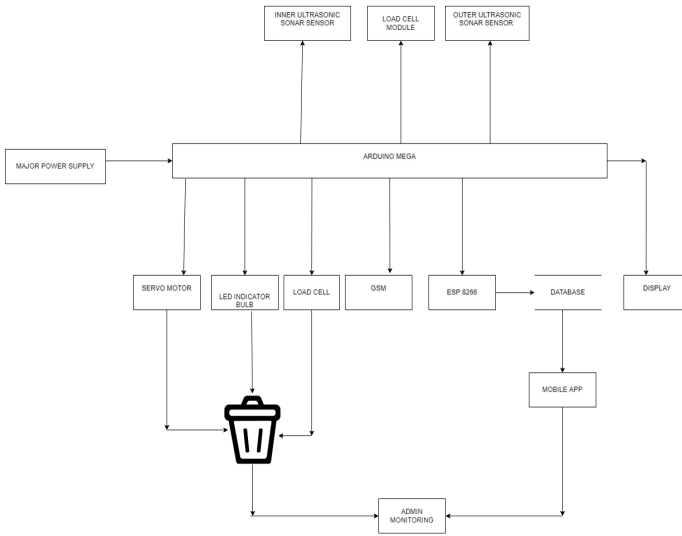


Fig. 2. Data flow diagram

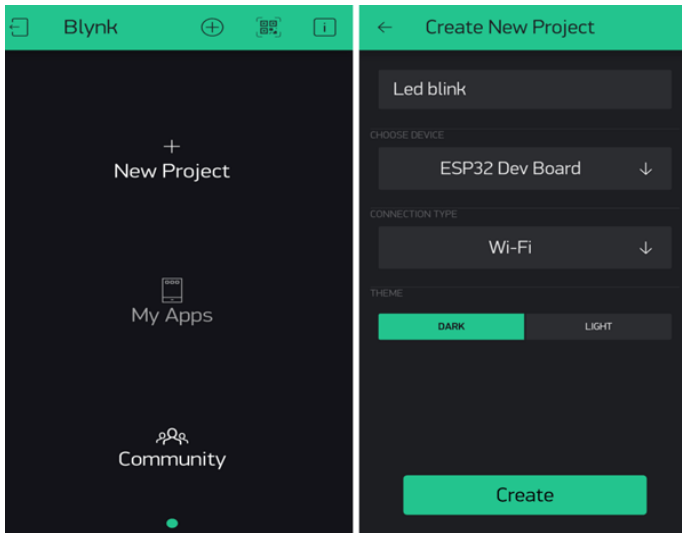


Fig. 3. Use case diagram

lid. Another ultrasonic sensor is placed inside the barrel. The code for this project is divided into two parts. The header code indicates the operation of the recycle bin, i.e. mainly the operation of opening the lid of the trash can. The second part code indicates the portion of the message received on the mobile device using the Blynk app.

## V. ANALYSIS

To test the project, we need a tool called the Arduino IDE to test the necessary Arduino program software. This way you can check if the program is working properly. Hardware testing requires a power supply and a suitable range measurement and tape measure. A landfill can only contain solid waste. The Nodemcu should connect to the Blynk app and the app should display the output. To do this, the node MCU first needs to connect to a WiFi hotspot. In ThinkSpeak website we

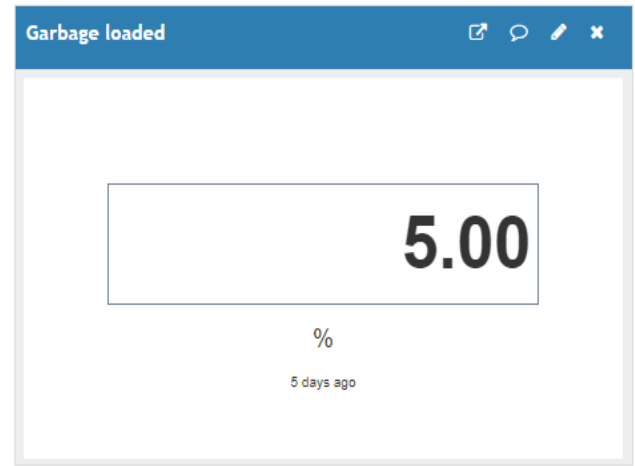


Fig. 4. Garbage loaded percentage

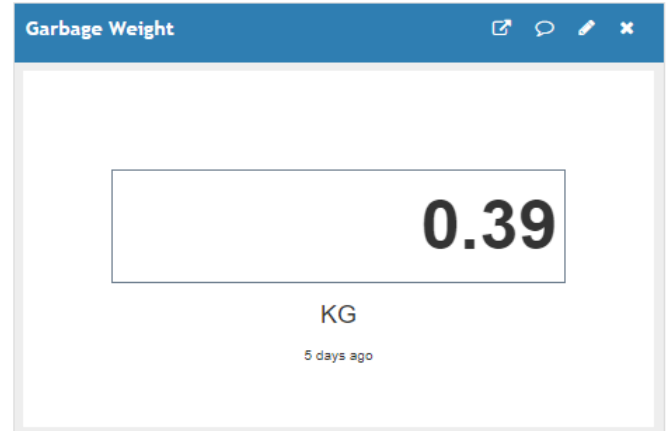


Fig. 5. Garbage loaded weight

can determine the current situation of smart dustbin. We can see the percent and weight of a garbage with date.

## VI. CONCLUSION

IoT-based trash cans help people dispose of their waste. It's easy and helps reduce phone calls and waiting work. Designated area cleaners and a healthier environment to live in, you are nothing. Diseases and people become healthier and less vulnerable. Diseases caused by these waste products. This system ensures trash cans are cleaned as soon as they reach trash level reach the maximum. It takes over power with the help of battery. If you don't clean the trash can within a certain amount of time, for appropriate action to be taken, recordings might be transmitted to a sweeper or higher authority for affected contractors. This finally, keep the environment clean and waste management becomes much easier.

The above approach is only a stepping stone for the implementation of IOT. There may be many improvements accomplished to this the prototype which may be a progressive extrade in

maintaining our surroundings is smooth and healthy. A few improvements may be accomplished are: The implementation of extra collective bins located aspect via way of means of aspect in which it automatically recognizes the waste kind and places it in the corresponding bin color that is designated for that type.

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