GARBAGE ZERO (GARB0): SMART GARBAGE MONITORING AND CLEARING SYSTEM USING THE INTERNET OF THINGS

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Abstract
Nowadays in big cities and urban areas waste disposal has become herculean task to civil authorities. Huge manual labor and a large landfill is required for the disposal of garbage that is generated daily. Formal the method is lacking in some specific areas such as waste overflows causing environmental damage pollution and unsanitary living conditions and more importantly is the amount of time and workforce requires extensive in this area. Today there is a significant trend of blending optimized waste management strategies with low-cost IoT solutions. The proposed system is an advanced waste management method more likely to be automated and save time as well as costs. Using this advanced method, a Smart Bin was designed and coined as Garbage Zero (Garb0). This system discusses and investigates Garb0 is an indigenous product developed for outdoor waste bins. The system collects the waste level in real time on each basket using ultrasonic sensors. Garb0 focuses on the development of an energy-efficient Internet of Things real-time solid waste monitoring solution helps cities optimize waste collection, waste management and keeping clean and green Environment. Garb0 smart bin module can be designed in a medium and scale that can later needs of individual houses, hotels or housing complexes.

Keywords: IoT; smart Bin; Garbage zero; waste management; Solid waste; waste treatment; waste clearance.

Introduction

Garbage is unwanted material such as waste that is disposed of from households, cities, public centers, schools, markets, industries, etc. It is considered as waste material that people throw away mainly due to lack of utility. The rapid increase and accumulation of waste in our society is a serious concern, especially when monitoring and control measures are not properly followed. Currently, our environment is polluted by massive deposits of global waste. This will have a catastrophic impact on human life and the environment. According to a World Bank report, global waste was predicted to increase by 70% by 2050 if the necessary monitoring and control measures are not implemented immediately. In addition, the volume of waste generated worldwide is expected to increase to 3.4 billion tons in the next three decades due to high growth in global population and urbanization. The use of modern and innovative technologies will pave the way for better tracking and control of waste compared to the traditional approach that uses human labor, dustbins and disposal trucks. The high increase in industrialization and human population has led to higher levels of garbage generated in urban areas. Therefore, the number of trash cans should be increased and placed at strategic locations for real-time monitoring and collection to save the environment. Without proper waste collection and disposal, the bins would fill up or overflow and spill into the surroundings, which can cause health problems for people and the environment. As the volume of solid waste is increasing rapidly, waste management is becoming a big challenge for the authorities and governments that deal with it, thus it becomes imperative to tackle this problem with modern technologies that provide the necessary solutions. Waste management is a major environmental challenge in smart cities around the world. To maintain a clean and green environment, an effective waste management solution is needed. The solution should include all the activities necessary to monitor the waste from its level inside the bin to the collection of the waste. Currently, the mechanisms used

in urban areas include a garbage collector that goes through different bin zones and checks the waste. Garbage trucks/trucks follow a certain route, where they pick up garbage from garbage cans and possibly dump it in various landfills by evening. This traditional process of detecting, monitoring and collecting garbage is complex, cumbersome and requires a lot of manual effort, cost and a large landfill. There are also many problems in choosing a landfill because many of them are against dumping around their locality, even dumping waste pollutes the land and can also pose a health risk to people in that locality.

There are many traditional methods of recycling waste into organic manure in villages. In cities, however, the collection, transportation and disposal of garbage have become the main task of civic bodies. It involves huge manual labor, dumping soil to dump the collected garbage. This method has shortcomings in some specific areas, such as waste overflow causing environmental pollution and unsanitary living conditions, and more importantly, the amount of time and manpower required in this area is extensive. Keeping all these factors in our mind, there is a need to upgrade the existing method. With the development of smart cities around the world, there is a growing need for the use and deployment of advanced technologies, namely Internet of Things (IoT) solutions for solid waste management to help promote a clean and sustainable environment. Today, there is a significant trend of combining optimized waste management strategies with low-cost Internet of Things (IoT) solutions. The proposed system is an advanced method in which waste management is more likely to be automated, saving time and cost. Using this advanced method, a Smart Bin called Garbage Zero (Garb0) was designed and implemented. This system discusses and examines Garbage Zero (Garb0), the original product developed for outdoor trash cans. Garb0 aims to develop an energy-efficient real-time IoT-based solid waste monitoring solution that helps cities optimize waste collection and maintain a clean and green environment. The system collects the waste level of each bin in real time using ultrasonic sensors. The system takes care of wet and dry waste separately by designing two separate modules. Both modules take appropriate actions when the waste level threshold is exceeded. Both modules are automated and all actions are automated. The goal of our system is to convert waste into a useful product such as manure.

Literature Survey

[1] "Garbage Zero (Garb0): IoT A framework for efficient waste management in Smart Cities": It focuses on the development of an energy-efficient Internet of Things real-time solid waste monitoring solution helps cities optimize waste collection and maintain a clean and green environment. The Garb0 the sensor module can be installed in public waste bins providing real-time fill level data. Related information regarding the current fill the trash can level will be transferred to a cloud using Low Power Wide Area Networks Long Range (LoRa) technology based on LPWAN, which will be further processed and transmitted garbage collector mobile application and municipal status update dashboard. Optimized schedule and route for collection garbage will be generated from the bins in the garbage collector application and accordingly guides the driver to follow the most efficient route.

[2] "IoT-Based Smart Waste Liquidation Monitoring and Support System": Smart Garbage Monitoring and Liquidation Support System (SGMDSS). Since the advent of the mobile phone communication and the spread of the Internet anywhere and anytime, there are many options control devices from remote locations. This the system uses an advanced approach in which waste monitoring and disposal support are automated. SGMDSS monitors garbage bins located at different places and informs about the level trash piled up in bins through android mobile app for cleaning personnel to disposal and provides the shortest the path to the place of the trash can, which is almost filled out. This information is also sent to the website and all data are stored and accessible through the cloud. A warning message is also sent to the worker.

[3] "Intelligent waste management System for Bangladesh": Using this advanced method, Smart Bin has been designed and implemented. Microcontroller is used to form the heart of this system

interface with waste level detection sensors and GSM for data transmission and reception purposes. This the proposed system would have automated waste level detection process and also smart monitoring and overall management process. The Smart Bin embodies an electrical device that consists of sensors and a microcontroller and a GSM as transmitter. Zone control unit tracks all smart bins in its region and provides services as the stack requires. Zone the control unit will receive all the data that will be sent by smart basket. Trash status for different conditions could be observed LCD display and data will be sent via GSM.

[4] "IoT Assisted Waste Collection and management system using QR codes": The proposed method uses Quick Response (QR) codes for tracking and monitoring waste collection procedure. QR codes are used as they are safe and can be printed on any surface and can be easily scanned with a smartphone. The QR code feature is used on device a method of protecting confidential data by hiding it, only certain details are made available to the general a user who uses a regular scanner, while for authorized personnel using specially designed scanner, confidential data is also produced available. QR is more resistant to attacks. Based on QR tracking and monitoring of household waste taken away. The proposed system includes QR generator, scanner, mobile app and cloud server for database maintenance. Quick Response (QR) code is a two-dimensional barcode that can be easily printed on any surface. It is safe as once unable to generate code content changed unless a new code is generated. Initially, The QR code is generated based on the customer registered mobile number. This QR code is stuck to the bin in the customer's home. A mobile application is created for tracking garbage collected from the household. Barcode the scanner is used to scan the QR code, hours is added that takes the system date and time and a location indicating latitude and longitude. Storage is provided via a cloud server. The cloud allows you to store large amounts of data which can be easily obtained with the right one authorization. The Google Firebase database was used for this purpose. For the customer notification feature, the app's messaging feature is used. Application sends a pre-written message to the given mobile phone number once the feature is enabled. On scan QR code, date, time and location to which have been garbage collected are updated in cloud storage. At the same time, the customer will receive information about the status of the basket collected through an alert message sent by him/her registered mobile number. This allows for both the customer and the waste management company monitor the collection process. Knowledge the company/corporation can easily trace the location places where the collection was not made for the day from data stored in the cloud database and do the necessary. The customer is too immediately informed about the status of the basket and thus allow them to follow. QR codes they are safe and durable, which is why they are much less common maintenance costs and not much effort is required change even if the QR is damaged. System will allow you to follow the progress exactly worker and garbage removal.

[5] "Smart Garbage Monitoring A system using the Internet of Things (IoT)": The proposed framework includes Arduino microcontroller, ultrasonic sensor, Wi-Fi module and a bunch of batteries. Using ultrasound sensor, waste depth in separation is resolved and gravity the waste container from the heap cell is as well estimated. To provide information, An LCD screen is used. The Wi-Fi module sends to the website previously displayed information. ThingSpeak and open discussion about the Internet of Things are used comply with the basket framework. Within this framework the manager can adequately monitor and plan waste management. In this research paper, there was a model produced and assessed.

[6] "Designing smart waste management within wireless communication System": The purpose of this research is to design a smart wireless waste management communication system. The proposed method allowed to the entire municipality, waste officials and local government to handle and control waste levels in smart bins. Design smart waste management system, four systems are synchronized by the control system. These four systems are: smart bin, control system, mobile phone and server. an ultrasonic sensor was used to measure the position or level of waste stack. The task of the control system is not only that measure the level or find out the waste in the bin,

but also send message directly to mobile phone andwebsites through the Android app.
[7] "Supporting technological growth using innovative IoT solutions: Smart Bin project" The design of the system allows for a low-price production of the final product and use at the same time state-of-the-art technology such as neural networks and the Lora WAN protocol. They have implemented eco- friendly and low-cost Smart Bin prototypes where users can track each stack and get notified of incidents requiring their attention. we suggest smart a recyclingbin that accepts any type of bottle, glass, plastic, paper, etc. and automatically classifies them. Prototype of a smart bin consists of two partitions: a space for waste to enter upper and identification unit that contains electromechanically operated seal on bottom.
[8] "Garbage collection system using IoT for Smart City": The proposed system collects information in real time each bin's trash level with help ultrasonic sensors. This data is then used generate dynamic routes for garbage trucks considering several factors such as truck capacity and compartments, distance between compartments and level garbage. Sole responsibility of back-office function is with admin. Predicts the number of trucks required on a particular day. It is responsible for generating routes for trucks based on the dynamic level of collected waste from the bins.
[9] "IoT Based Integrated Technology forwaste tracking system": Use and deployment of advanced technology, namely the Internet of Things (IoT), Cloud computing and image processing can help authorities manage garbage in a timely manner and keep the environment clean. Proposed the architecture acts as a tracking system monitor waste overflow and deliver a report to the concerned authorities for adoption necessary and immediate action. This system will transfer the position and status of the bin cloud database and also to Dustman. A low-cost camera is installed at a certain inclination relative to trash can. Using image processing camera recognizes the colours painted inside the bin. The two thresholds – 50 percent and 100 percent if GSM-GPRS sends a message to of the authorities concerned along with the location basket.
[10] "IoT and ML based Smart A system for effective waste tracking": Next comes the disposal of waste in landfills with an uncertain risk of landfill fires. In the event of a fire, fire alarm systems are activated state of emergency,thereby informing the authorities about situation with the exact location at the landfill yard along with fire sprinklers on fire area to prevent a serious fire. This is meant to ease the situation for everyone possible preventive measures, warning of the surroundings residential areas about the dangers. System also includes that trash cans do not overflow. The system alerts you to the collection of waste office well in advance to avoid confusion around the bins due to overflow. When a fire has occurred, it is detected by the flame sensor. Firefighting is initiated by a submersible water pump that starts sprinkling water in the fire area. The authorities are informed about fires in the exact location landfill via the GPS module in the system.

Existing System

In the current system, they only monitor the level of waste and think about cleaning the waste when filling. Some systems use level sensors to monitor the tank, regularly collect information from the tank and save the data for further processing, also indicate the filling statusto the user. Some make use of a camera to check the level ofthe bin with different colored bands indicating the waste level, for example a yellow band indicates that the bin is empty, a green band indicates that the bin is filled to the appropriate level and a red band indicates that the bin has reached its optimum level.

Proposed System

In this system, waste is the main target of monitoring, waste removal and waste treatment. The main role is played by the place of waste processing identification and design of this system. The designed system contains two modules to solve with wet and dry waste separately. This too focuses on waste sorting. System consists of two reservoirs operating on wet and dry wastes. The system is a home product developed for outdoor waste bins. System goals in developing an energy-efficient real-time IoT-based solid waste monitoring solution that helps cities to optimize theirwaste collection, waste

treatment and keeping it clean and green Environment. The system collects data in real time each bin's trash level with the help of ultrasonic sensors. The collected data is used to check whether the threshold capacity of the bin achieved or not. If the threshold value is not reached, the system continuously monitors the reservoir. If the threshold capacity is reached, suitable waste management actions are carried out by wet and dry wastes by wet and dry modules respectively. The main goal of the system is conversion waste to a usable product such as manure.

Methodology

The system consists of two so-called wet modules and a dry bin. The model is equipped with ultrasound sensor in front, this sensor helps in tracking opening and closing the top door. Sensor calculates the distance from it if the user comes closer to the sensor, which means when the sensor detects a distance less than 15 cm, it will start servo motor to rotate from 0 degrees to 80 degrees this move opens the top door, waiting for some time to dispose of the waste and close the door again turning from 80 degrees to 0 degrees. Both magazines an ultrasonic sensor is installed in each module, step revolving door and sliding door. Figure 1 shows the block diagram and Figure 2 shows the architectural design of the proposed system. There is another ultrasonic sensor near the top door connected detects the level of waste filled in the bin when the threshold level reaches both modules appropriate measures for waste management.

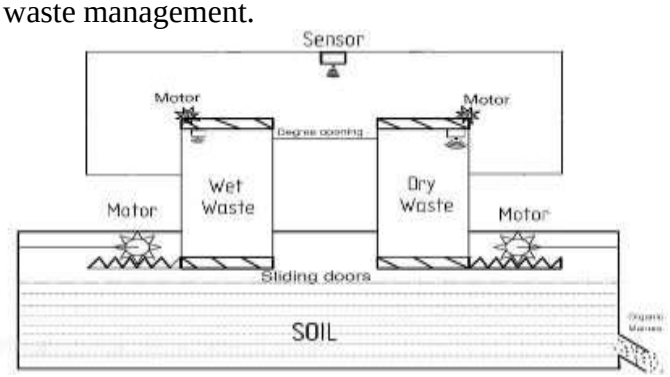

Figure1: Block diagram

Wet Module

The wet module overlooks wet waste. The ultrasonic sensor is located on the upper door. Monitors the amount of waste filled in the bin. And threshold value if present by the module. If the waste level is within the threshold value, the bin continuous to monitored in real time. When the waste level reaches a threshold value, the bottom door will slide to open and waste falls into the layer of soil present in the bottom of the container. When sliding back into close the door, the layer of soil is mixedwith mud so as to create quality manure waste recycling.

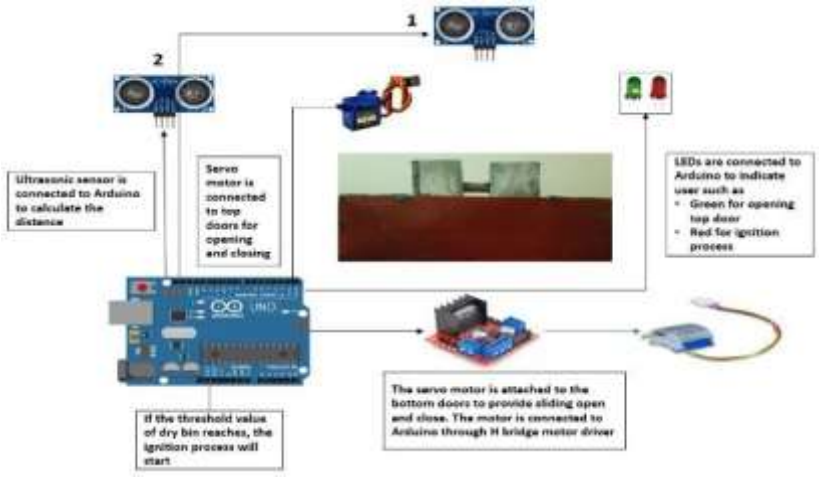

Figure 2: Architectural design

Dry Module

Dry module overlooks the dry waste. Ultrasonic sensor isplaced on the top door. Sensor monitors the level of waste filled in the bin. A threshold value if prefixed by the module. If the level of waste is within threshold value, thebin continuous to monitored in real-time. When the level of waste reaches the threshold value, the ignition process will start. The inductor (coil) of 1000 Watt is used to burn the dry waste. The coil is connected to Arduino through 5v Relay module, this assists in switching the coil automatically when the ignition process starts. The relay automatically switches the coil, it takes very less time for coil to get heat up and burns the dry waste in less time period. Also, the advantage of the coil is that it takes very less time to get cool since it is spiral in nature. After some pre-set delay period, the as produced by burning the waste is dropped soil layer present in bottom of the container. By using this approach, we can monitor the garbage in real time and the waste is treated using different methods for wet and dry waste. Both the modules perform their functions in their own domain and there is no confusion between these modules. The proposed helps in monitoring, clearance and treating the waste. The system aimed at producing useful product from the waste such as manure. The produced manure further can be used by farmers as fertilizer for their crops. Thus, this system converts the garbage into useful product. Thus, this is named as Garbage Zero (Garb0) as no garbage is left inthis process.

Results and Discussion

A solid waste improvement management system is developed. The system will receive an input form ultrasonic sensor. The input from this sensor is used to check whether the threshold capacity of the bin is reached or not. If the sensor value drops above the threshold, appropriate action will be taken to waste processing. The Wet waste falls into the soil layer present on the site at the bottom of the container, slowly it gets mixed with the soil and begins to decompose and turn into manure. The Dry waste is completely burned using a coil and the ash is also fell into the soil layer.

Conclusion

The ultimate goal of any technology is cost reduction, time and labour in any area and on improve the quality of life. Technology adopted in our system is user-friendly, ecological and cost effective. Garbage disposal, which is currently a big problem with high costs work and dump area and is expected to grow even further at a very rapid rate due to the increase in population and consumption. Proposed system is an advanced method in which waste management is more likely to be automated and saves time and costs. By introducing this system, waste disposal will be cheaper and easy matter. Garb0 focuses on strength development efficient real-time IoT-based solid waste monitoring solution that helps cities with optimization their waste collection, waste processing and maintain a clean and green environment. It also targets in the production of manure from this waste. Every household can dispose of/recycle garbage at their respective levels. This system can be produced in small, medium or large size depending on the requirement. By scaling down or scaling up this system can be used in individual houses, housing complexes and industries. This will help the people to keep their surrounding clean with Zero waste.

Future Scope

In future, system can be made to operate with solar panels used as power supply. It can be implemented togenerate bio-electricity.

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