

Smart Waste Management System For Metropolitan Cities

Abstract:

At present, solid waste management is a major concern in the metropolitan cities of the developing and developed countries. As the population is growing, the garbage is also increasing. This huge, unmanaged accumulation of garbage is polluting the environment, spoiling the beauty of the area and also posing a health hazard. In most developed countries, there are many efficient techniques which are used for the proper management of waste. In this paper, a system is introduced to manage waste in big cities effectively without having to monitor the parts 24/7 manually. Here, the problem of unorganised and non-systematic waste collection is solved by designing an embedded IoT system that will monitor each dumpster individually for the amount of waste deposited. The IR sensor is used for detecting the presence of any waste the IR sensor used. The device is connected to the cloud. Whenever the bin gets filled, the message will be sent to the municipal office.

Introduction:

Today, big cities around the world are facing a common issue: managing the city's waste effectively without making the city unclean. As the population is increasing, solid waste is also increasing in urban and rural areas, and waste management has become a global concern. A certain number of employees need to be appointed to attend to a certain number of dustbins. This is done every day periodically. This leads to a very inefficient and unclean system in which some dumpsters will be overflowing while others might not be even half full. This is caused by variation in population density in the city or some other random factor. This makes it impossible to determine which part needs immediate attention. Here, a waste management system is introduced in which each dumpster is embedded in a monitoring system that will notify the corresponding person if the dumpster is full. In this system, it is also possible to separate wet and dry waste into two separate containers. This system provides an effective solution to the waste management problem.

The garbage produced in the residential area can be collected directly from homes or by it is making an arrangement for mass collection in that area and can be lifted using vehicles. In the case of restaurants, malls, and other commercial establishments, garbage can be collected directly from the unit using vehicles. Industrial garbage, which includes waste produced in construction sites and various industries, can also be disposed of in different ways. For effective handling of these wastes, like collection and disposal, the Internet of Things (IOT) concept is being used, which mainly deals with sensing, actuating, data gathering, storing, and processing by connecting physical and virtual devices to the Internet.

Existing System:

- Manual systems in which employees clear the dumpsters periodically
- No systematic approach towards clearing the dumpsters
- unclear about the status of a particular location.
- Employees are unaware of the need for a particular location.
- much less effective in cleaning the city.

Proposed System:

- In this system, a 24/7 monitoring system is designed for monitoring dumpsters.
- Here, a smart and organised system is designed for selective clearing.
- The ultrasonic sensor is used to measure the level of waste in the dumpster.
- An IR sensor and moisture sensor are used for separating wet and dry waste.
- If either of the containers is full, then an alert message is sent from the dumpster.
- In turn, employees can clear the corresponding dumpster.
- All these sensors are connected to an Arduino Uno board.
- It can be used for controlling all mechanical setups based on current conditions.

Requirements:

1. Software Requirements:

- Python IDLE
- Node Red
- Arduino IDE

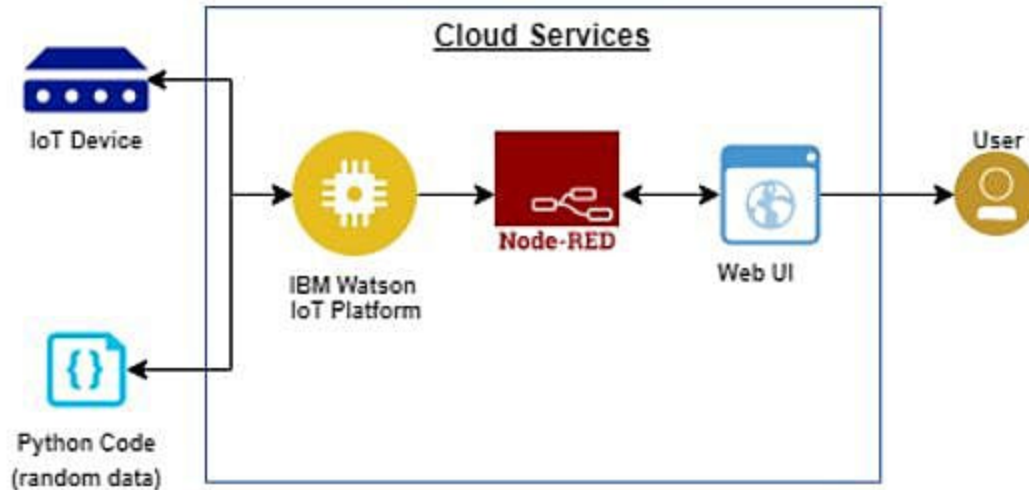
2. Hardware Requirements:

- Arduino UNO
- Ultrasonic Sensor
- IR Sensor
- DC Motor
- Weight Sensor

3. System Requirements:

- RAM-Minimum 4GB
- Minimum Processor
- Configuration OS -Windows/Mac/Linux

Architecture Diagram:



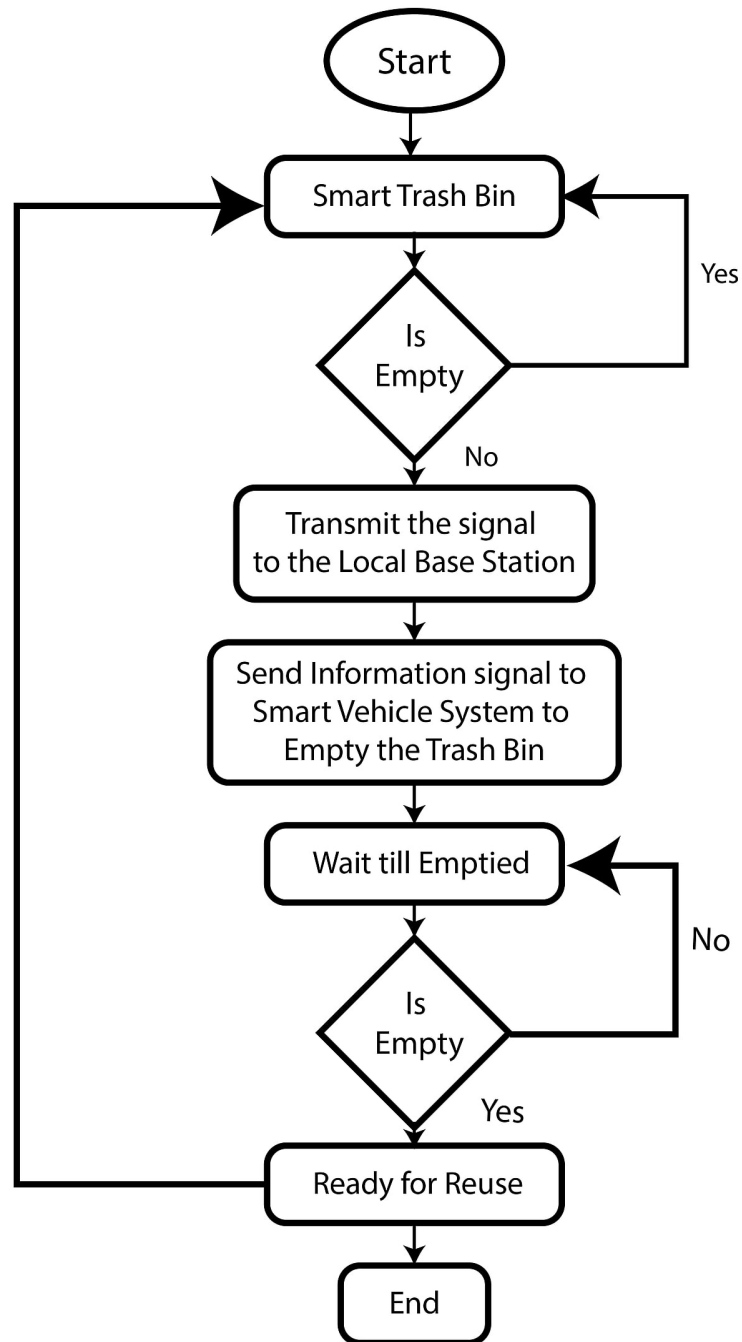
Methodology:

The bin with an ultrasonic sensor, PIC controller, GSM and GPS will notify the coordinates and bin status to the database. Here, GSM is used by the user to communicate with the server, which will contain the SIM with the basic speed internet. The ultrasonic sensor, which uses ultrasonic waves, will check the bin status. The PIC controller board is used to control ultrasonic sensors, GSM, and GPS. The ultrasonic sensor uses radio waves to identify the quantity of trash inside the dumpsters. The IR sensor uses infrared light to determine the presence of trash. The weight sensor is fixed to ensure the garbage level in the trash can. When the three sensors' values match, the information about dumpsters is sent to the cloud. The ultrasonic sensor identifies the wet and dry waste. The DC motor is used to separate the dry and wet waste for recycling and reuse process. The server will maintain the details of the unfilled bins, filled bins, and authority registration. Whenever the normal user or authorised user collects or requests information from the database, the information will be given to them. The information to the normal user is about the nearest unfilled bin, and an authorised person will be given the coordinates of the filled bins. The user end will contain the Android app, which works on any Android-compatible phone. The user will notify the unfilled nearest bin with a path, and the authorised person will be notified by the filled bin with a path. The work is as follows: The bin checks for the threshold level. The bin sends the status and coordinates to the control centre on reaching the appropriate level. The control centre uses the coordinates sent by multiple bins

and provides an optimal path to the garbage vehicle. When the bin is emptied by the vehicle, a notification is sent by it to the control centre. This helps in easy monitoring.

Objectives:

- To ensure the protection of the environment through effective waste management.
- Ensure separation at source in all metropolitan and local municipalities.
- preventing pollution and ecological degradation.
- To protect the health and wellbeing of people by providing an affordable waste collection service.
- Overflowing of trashcans is avoided.



Data Flow Diagram

Conclusion:

This project is very effective in managing waste in any big city. Rather than using conventional periodic collection methods, a priority system is used to ensure the city is clean all

the time without any overflowing dumpsters. It has been tested and verified properly to ensure all the different parts work together for a smooth function of the whole system. In most of the metro cities globally poses a challenge to effective waste management and maintenance of the waste bins. In this work, an IOT enabled Smart Waste Bin with real-time monitoring is designed and presented. In addition to the waste level measurement by using ultrasonic sensors, a sensing mechanism based on simple parallel plate capacitance is also developed and presented.

Reference:

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