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Modern Waste Management System using IoT Sensors

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ABSTRACT

Waste management is one of the serious challenges of cities.This includes the collection, transport, treatment and disposal of waste, as well as the monitoring and regulation of the waste management process.In the proposed method,we use the QR code to track and monitor the waste collection procedure and public get the acknowledgement from the admin for disposal of waste. The workers put the collected waste in the trash bin. When the bin is full, it will automatically close the bin using an ultrasonic sensor and servo motor.It can notify the admin using GSM. The admin sends a truck to collect the trash bin from a particular area.

Keywords: QR Code, Ultrasonic Sensor, Servo Motor, GSM

1. INTRODUCTION

Every day, households produce a lot of trash as a result of living activities including cooking and eating. For the sake of human health and safety, waste must therefore be managed properly. In the typical municipal garbage management system, it is the responsibility of the household to sort and handle the garbage created at home. However, it is challenging to provide the proper trash management at the source based purely on public awareness.Garbage collection and increased home surveillance for senior anomaly identification and healthy living.

Waste is a major problem that requires thoughtful solution. We separate our household waste to make it easier to process and recycle.Due to this, a lot of citizens empty their stuffed trash cans in public areas. Consequently, environmental contamination rises.The repercussions of trash on our health and the environment are terrible, and there are many of them. Trash serves as a breeding habitat for bacteria, insects, and flies—the same flies that fly around edibles and lay their eggs.

Thus, they raise the danger of food poisoning, typhoid, gastroenteritis, salmonella, and other illnesses brought on by insects like malaria and dengue.For waste collection in the old system, they employed SGBS, wifi modules, and blockchain technology. In the proposed system, we used QR codes, GSM, ultrasonic sensors, and servomotors to dispose of waste properly and solve problems.

2. EXISTING TECHNOLOGIES

Many methods, algorithms and techniques are available to analyze the data collection level of smart garbage bin Each paper has its advantages and disadvantages. Various existing models are useful in developing a modern waste management system.

2.1 Smart garbage bin system and SGBS

To address the issue, a new smart waste bin system called SGBS is equipped with numerous sensors [1]. In order to monitor the environment and determine the type of trash being disposed of, we installed temperature, humidity, and gas sensors. Then, by combining daily collected fusion sensor data along with in-depth domestic garbage contents annotations to train a machine learning model to execute garbage categorization tasks, we introduce a new garbage content estimation approach.

2.2 IR sensor, Microcontroller and Wi-Fi module

Wi-Fi module, microprocessor, and IR sensor are used in a smart garbage management system [2]. When the rubbish level reached its peak, this method guaranteed that dustbins would be cleaned as quickly as possible. There was a passive infrared sensor in the dustbin. The signals were checked by the router, which also produced random codes before sending the information once more to the microcontroller. The signals were read by the microcontroller and sent to the LCD Display. That was displayed on the LCD screen. On the PHP interface that was hosted on the server, the user typed the random code

created by the router. The shredder and the load sensing plate make up the mechanical components, while the Arduino load cell, LCD display, IR sensor, amplifier, relay module, and Wi-Fi router make up the electric ones.

2.3 Systematic Literature Review (SLR) Method

A Systematic Literature Review (SLR) is approached as a method to review and analyze current Smart Waste Management (SWM) [3]. SLR uses data from previously published studies to synthesize studies. SLR proposes the use of information and communication technology (ICT) in waste management, improves the energy efficiency and environmental safety of solid waste exports, improves the quality of life of citizens and reduces resource consumption.

2.4 Block Chain Technology

BlockChain technology is used to manage various waste collection, transfer, sorting, disposal and recycling in smart cities [4]. Based on an immutable record of data and events, BlockChain can verify and identify missing waste by comparing the weight of received and shipped waste. BlockChain can help ensure that hazardous waste is not mixed with normal waste during transport to ensure the safety of people through sensors attached to garbage bags. Lastly, due to the transparency and immutability features, BlockChain can track the amount of waste sent, received and recycled at a recycler, the authority and activity of the waste picker, and the storage location of the waste when it is separated, sorted and recycled.

2.5 Optimal Route Recommendation for Waste Carrier Vehicles

The waste carrier vehicles offer an optimal route recommendation system for waste vehicles to collect solid waste efficiently based on the profile of the given area [5].The historical data of waste generation for residential networks are used for prediction the behavior of people in relation to waste management and consequently ensures optimal waste collection. The raw data had some important missing features, e.g the whole waste of time and was missing values. Therefore, the data was processed as usual and mandatory fields required for the waste profile certain squares were derived.

2.6 IoT-Based Route Recommendation

The proposed IoT-based model is based on integrated algorithms, including GA(genetic algorithm) and an ANN(artificial neural network) [6].All bins are built on a microcontroller-based platform embedded with sensors that report the amount of waste using an application programming interface (API). In this work, a solution based on the internal characteristics of the given problem is developed using evolutionary algorithms. The problem is formulated and modeled under two different scenarios, viz. discrete optimization and continuous scenario. Spatial constraints are integrated can be known using the API by querying the interface. In the second step, the best route is planned, considering the bins defined in the previous step. Spatial optimization problems are more difficult to solve than non-spatial problem into the implemented models. Topological constraints should be taken into account when solving the spatial optimization task.

3. PROPOSED SYSTEM

Public will not receive any acknowledgement from the administrator after disposing of the waste. In our project, the workers scan the QR code, then collect the waste, after that they inform the admin whether the waste is collected in a particular area. The administrator will send a confirmation message to the public after the workers report.

3.1 Working principle

This project uses the QR Code scanning.QR codes are usually very small. It can be scanned with our mobile phone camera and does not require special equipment to interpret the message. It has proven useful for sharing large amounts of information with multiple people in a single portion.

The administrator (Municipality) sends an alert message to the public and workers. The workers go to 100 houses a day to collect waste. If there is public in the houses, they dispose of the waste, the workers scan the QR code, then the waste is collected, after that they inform the admin whether the waste is collected in each house or not. The administrator will send an acknowledgement message to the public after reporting by the workers.

The collection of waste is disposed of in the trash bin. The bin had a sensor that detected the level of the bin and then another sensor was used to close the bin. If the bin is not full, continue the trash bin collection. When the trash bin is full, the lid closes automatically and sends a warning message to the system administrator. The administrator sends the location to the waste collection team, which removes the waste in the bin. Finally, the waste collection team updated the system administrator that the waste collection disposal was successfully completed.

3.2 Flow Diagram

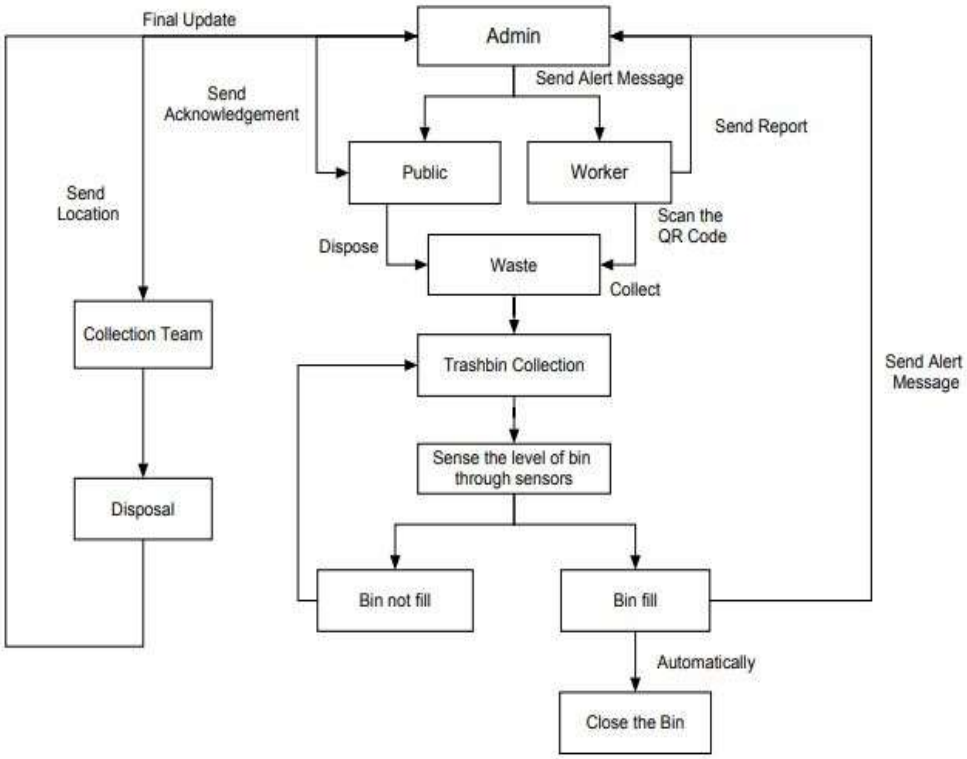

Fig 1. Flow Diagram of the Proposed System

3.3 Hardware Implementation

Fig 2. The Proposed Sysyetm

3.4 Hardware Requirements

1. Arduino UNO
2. Ultrasonic sensor
3. Servo motor
4. GSM

3.4.1 Arduino UNO

Fig 3. Arduino UNO

A microcontroller board called the Arduino Uno is based on the ATmega328P. It features an ICSP header, a 16MHz quartz crystal, six analogue inputs, a USB connector, a power jack, and a reset button (of which 6 can be used as PWM outputs). There are 14 digital inputs and outputs as well.

3.4.2. Ultrasonic sensor

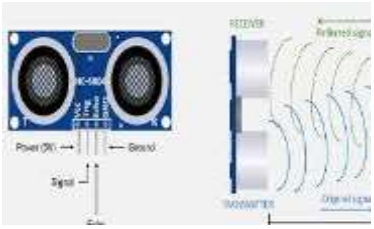

Fig 4. Ultrasonic sensor

An ultrasonic distance sensor called the HC-SR04 is used to determine how far away an object is. It consists of two pieces, one of which produces ultrasonic sonar to gauge a target's distance. The receiver, which looks for the echo, is the other component. The distance of the item being measured is determined by the amount of time it takes for the wave to return.The signals are subsequently transmitted to Arduino Uno. The Servo Motor opens the flap on top of the trash can after the Arduino recognises the signal and sends a signal to it.Here, the race is only intended to be open for three seconds before it automatically closes. Simply by making little modifications to the code in the Arduino IDE, you can change that time.

3.4.3. Servo motor

Fig 5. Servo motor

A servo motor is an electrical device that can precisely push or spin an item. Use a servo motor if you wish to spin an object at a specified angle or distance. It is only composed of a straightforward motor that uses a servo mechanism.Servo rotates around 180 degrees (90 in each direction) and functions similarly to larger types of servo. To control these servos, you can use any servo code, hardware, or library. The servo motor that lifts the dust bin lid is used.

3.4.5.GSM

SMS transmission is controlled using an Arduino Uno and the GSM (Global System for Mobile Communications) module. When the trash can is full or about full, it is supposed to generate and send SMS warning messages to the municipality so that the trash can be picked up right away.

Fig 6. GSM

The GSM modem is activated by the HC-SR04 ultrasonic sensor whenever the waste reaches the maximum level, and it will continue to alert the necessary authorities until the garbage is emptied from the trash can.

3.4.6. QR CODE

A QR code (quick response code) is a type of matrix barcode (or two-dimensional barcode) QR codes often contain information about a locator, tag or tracker pointing to a website or application. QR codes use four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) to efficiently store information.The smartphone is used as a QR code reader, which displays the code and converts it into some useful form (such as a regular website URL, so the user does not have to type it into a browser).In our project, workers scan a QR code to give acknowledgement to public after collecting the waste or reporting the visits when people are not at home.

4. CONCLUSIONS

In this paper, we used a QR code scanner for acknowledgement, a servo motor to automatically close the bin, and an ultrasonic sensor to detect the collection level of the bin. The proposed method is proven to be useful for sharing a large amount of information with many people through a single share.

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