Garbage Collection Using Smartbin

Abstract

The main idea in good pickup of the camera is that they are placed at the side of load cell sensing element of garbage bin. The camera can take continuous pictures of the bin. A threshold is set, that is compared with the output of camera and cargo sensing element, this comparison is assisted with the help of a microcontroller. When analyzing the image one can have a tendency to get a plan concerning the amount of the garbage present within the bin and also with the help of load cell sensing element one can have a tendency to get understand the burden of garbage. Consequently, data is processed and the microcontroller checks if the threshold level is exceeded or not, it then sends a message through GSM module to apprise that the bin has crossed its capability and the garbage disposal is needed. Consequently, the specified authority sends the vehicle for clearing the bin.

Introduction

As our nation is in the stage of developing, there is one problem where all have to deal with it. In day to day life one can see that the bins being overflowing, results in the increase amount of diseases and the absence of good environment. A huge task is disposal of the waste. Here such a system has been got to be introduced which may reduce the problem. This system gives us one of the best efficient way to keep our environment clean.

Smart waste management is a key idea to control these problems. Smart bins plays a major role in preventing the overflow of the garbage thereby preventing the wide spread of diseases. The vehicle for collecting the garbage will have to be frequently used to empty the bin. So, the problem of overflowing can be prevented.

Then comes the last part, which is the disposal of the garbage. In order to overcome the overflowing of the waste, where the garbage disposal system is made completely automatic. There will be two separate smart bins for garbage collection, one for biodegradable waste that is wet waste and another one for non-biodegradable waste that is dry waste. As soon as the threshold level crosses in any of the bins, that information will be sent to the respective municipal office through an android application.

In order to become a developed country, it's time that one can should always use technology for waste management systems. So, in this paper there is an integration of analytics and electronics so as to make changes with the conventional method of waste collection.

Proposed system

There should be digitalized way to make compatible to the current technologies with relatively low cost. So, the best way is to form an IOT system where all the operations will be automatic which improvise the technique of collecting the waste for the bin by adding some sensors to check for the level of waste in the bin. A route optimisation alogorithm will be used to optimize

the path of the tracks and the bins to discharged. By implementing this the cost required and the time taken to empty the bins will be reduced.

Scope of the project

Manually controlled activities takes time to complete the task and also there will be stinking problem. So, we can incorporate the odour control mechanism to reduce foul smell of organic garbage. Also the requirement of smart dustbin, GPS module can be used for path optimization along with ultrasonic sensor.

Design Overview

Each wastebin is given variety id which will be stored in the respective database with its location. A camera will be placed at each smart bin, the camera used is INTEX IE305WC which is used for taking snapshots of wastebin. Database will be maintained for each smart bin and various threshold levels will be set depending on the analysis of the previously taken snapshots. One weighing sensor is used which consists of one point load cell of precision C3 class and is made from aluminum alloy which can sense the weight of the smart bin which will be interfaced with the microcontroller through ADC. The microcontroller present in the smart bin compares the threshold value with the data generated, if the data value is exceeded than the threshold value then a message is sent through the GSM module to the server. The message consists of the id of the smart bin. The server then compares the id with its database.

After receiving the message the server will send the vehicle to dispose the waste and empty the can to the specified location. Later the driver enters the password with help of keypad in microcontroller. When the password matches robot mechanism is activated. In this robot mechanism, machine capable of physical motion that is during the disposal process one can use dc motor which will be fixed on plate on which the smart bin will be mounted. This plate will tilted and the garbage will be disposed to the vehicle.

System Architecture

This has been divided into three different layers:

Dustbin layer: This layer is nothing but a smart bin implemented in different locations for garbage collection which will be connected to the server.

Server layer: Serverlayer is the one to which the message is sent from the smart bin for the disposal of the garbage.

Client layer: Clients requests for the nearest smart bin enabled dustbin will be processed by the server.

Dustbin

layer

Client

layer

Software Requirements

- Kiel Software: The Keil C51 C compiler for the 8051 microcontroller is the most popular 8051 C compiler. The C51 compiler translates the C source files into relocatable object modules which contain full symbolic information for debugging with an in-circuit emulator.
- Embedded C: Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.
- Flash Magic: Flash Magic is a tool for programming flash based microcontrollers from NXP employing a serial or Ethernet protocol while within the hardware.

Hardware Components

- Power supply: It is wont to provide DC voltage to the components used. It supplies 12V of current for DC motor, 3.3V of current for microcontroller and 5V of current for others.
- Web camera: Camera is placed above the garbage can to take snapshots of the garbage present in it,to knwn to which extent the bin is filled. A webcam also acts like a video camera. When the data sent to the server is sent to a remote location, the video stream may be viewedor saved.
- Load Sensor: Load sensor will be placed below the garbage can to sense the weight of garbage present in it. This will give continuous weight readings in voltage format, which is then given to the microcontroller. The microcontroller then converts the signal from analogue to digital format.
- Microcontroller: Microcontroller is used to process the data that is been given by the sensors as in input to the microcontroller. It compares the received data with the threshold level intially set and accordingly the output will be generated. LPC2131/32/34 microcontrollers supports 16/32-bit ARM7TDMI- S CPU with real-time emulation and embedded trace support, that combine the microcontroller of high-speed non-volatile storage.
- LCD (Liquid Crystal Display): LCD is employed to see the output generated. One can use16x2 LCD. So that one can write 16 characters in each line. Totally 32 characters can be displayed. LCD plays a major role as the output will be dispalyed on it and to debug the system in simplified way that is module wise whenever the system fails.
- GSM Module: It is wont to send message to the respective authority if the bin is filled and exceeds the threshold value. GSM module one can send short text messages to the specified authorities.

Implementation and Methodology

Each smartbin will be given variety id which will be stored in the specific server database with its location. A camera will also be placed at each bin. The camera used is INTEX IE305WC which is a 16 megapixel camera used for capturing the snapshots of the bin. This is will adopted along with the microcontroller. And also a weighing sensor is used to weigh the amount of garbage present in the bin which is made up of Aluminum alloy, this will be adopted along with the microcontroller through ADC.

Whenever the input is fed into the microcontroller it compares default threshold level set intially, if the data exceeds the threshold level, then the microcontroller which will be interfaced with GSM module sends a message to the server which contains the id of the smart bin. Later the server compares with its databaseif it matches, the vehicle will be sent to the location by implementing route optimisation algorithm to clear the bin.

Flowchart

Circuit Diagram

The hardware components used are PIC16F73 microcontroller, HC-SR04 ultrasonic sensor, SIM900A GSM module, IC7805 voltage regulator, resister, capacitor and a crystal oscillator. PIC16F73 is a CMOS-FLASH based 8 bit microcontroller along with that it has got two 8 bit and one 16 bit timer/counter. The microcontroller will also be additionally interfaced with Tx and Rx pin for serial communication. Those pins will be connected to the GSM module through the inbuilt MAX 232IC present in the module. MAX 232IC serves to convert the logic from TTL to RS232 logic, as the GSM module operates at RS232 while PIC16F73 microcontroller at TTL logic. The circuit diagram is shown below in the diagram.

The ultrasonic sensors consists of two pins: Trigger pin and Echo pin, used for calculating the time duration of the echo that is generated. Initially a high to low signal by the microcontroller at the trigger pin of the sensor sends eight 40 kHz sound waves, after which the ECHO pin is turned high until echo of the sound waves echoed back to the sensor.

As lots of bins will be present in each locality. The garbage collecting vehicle collects the waste from these bins. The dustbin will be divided into three different levels according to the extent of garbage-filled in the smart bin.

The following variables used in route optimisation algorithm:

i ,k = 1,2 ... n ,unique ID given to the n number of smart-bins Li = Current level of the ith smartbin.

ti = time taken for the ith bin to be filled.

ak1 = Average time of kth smartbin to urge filled.

Tk[Lk, tk] = Array which consists the last updated level and time of each smartbin within the network.

Result: Predicted percentage filled status of each smart-bin and thus estimate the optimal route supported potential-filled Bins.

Use case Diagram

SMS received from the GSM modules of the dustbins is taken in the sort of text files. These text file will be connected to the excel sheets.

Conclusion

In this method of smart waste management using Internet of Things (IoT) with the help of ultrasonic sensor to check the status of the smart bins, where two smart bins will implement for biodegradable waste that is wet waste another for non-biodegradable waste that is dry waste. As soon as the threshold level is crossed, a message will be sent to the specific authorities regarding the smart bin to clearance of the bin so to avoid overflowing of garbage. The local people can also request the authorities for additional smart bins if required.As all the operations happening within the smart bins are updated regular the chances of breaking down of the smart bin will be reduced.

References

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