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Smart Garbage Monitoring and Waste Maintenance System using Internet of Things

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ABSTRACT: In the present day scenario, many times we see that the garbage bins or Dust bin are placed at public places in the cities are overflowing due to increase in the waste every day. It creates unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness, to avoid such a situation we are planning to design "Smart Waste Management System using IoT". In this proposed System there are multiple dustbins located throughout the city or the Campus, these dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and an unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concern authorities from their place with the help of Internet and an immediate action can be made to clean the dustbins.

KEYWORDS: IoT, Ultrasonic sensor, Raspberry pi, Garbage bin, cloud.

I. INTRODUCTION

Things that are connected to Internet and sometimes these devices can be controlled from the internet is commonly called as Internet of Things. The Internet of Things (IoT) is a concept in which surrounding objects are connected through wired and wireless networks without user intervention. In the field of IoT, the objects communicate and exchange information to provide advanced intelligent services for users.

An indiscriminate and illegal discharge of waste, an absence of waste disposal and management systems, and inefficient waste management policies have caused serious environmental problems and have incurred considerable costs for waste disposal.

There are multiple dustbins are located throughout the city or the Campus In our system, the Smart dust bins are connected to the internet to get the real time information of the smart dustbins. These dustbins are interfaced with raspberry pi based system with ultrasonic sensors. Where the ultrasonic sensor detects the level of the dust in dustbin and sends the signals to raspberry pi the same signal are encoded and send to the application and it is received.

The concerned authority get alert about dustbin is full and informs person whoever is responsible for collecting garbage from the particular areas. The garbage trucks collect the garbage from the completely full dustbin and dispose it.

II. LITERATURE SURVEY

1. SOLID WASTE MANAGEMENT ARCHITECTURE USING WIRELESS SENSOR NETWORK TECHNOLOGY

Authors: SauroLonghi, DavideMarzioni, EmanueleAlidor, Gianluca Di Bu' o, Mario Prist, Massimo Grisostomi and MatteoPirro

The literature surveyed some different papers to get information about the existing work which have been done SauroLonghi, DavideMarzioni, EmanueleAlidor, Gianluca Di Bu' o, Mario Prist, Massimo Grisostomi and MatteoPirro

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proposed, garbage collector supported by using sensor motes which is providing information and status about the bin and also sending the retrieved data through DTN (Data Transfer Nodes). This bin has a custom prototype instead of basic installation of sensor nodes. The whole system is designed for allowing heterogeneous sensor for communication. A wireless sensor network is helped for controlling bin by gathering data from motes. The limitation here is that the information about the bin is not directly transferred to the server or to the client; it needs to be sent through the Data Transfer Nodes.

2."SMART GARBAGE MANAGEMENT SYSTEM"

Authors: Vikrant Bhor, PankajMorajkar, AmolDeshpandey

The authors of this paper Vikrant Bhor and AmolDeshpandey have proposed a system that detects the level of garbage in the dustbins with the help of sensor systems and send this information to the authorized control room through the GSM system. Weight sensor determines the weight of the garbage in the dustbin and Infrared (IR) sensor is used to detect the waste level in the dustbins. To automatically control the embedded devices authors have used microcontroller Atme1328 and also used GSM for communication instead of ZigBee because ZigBee provides short range, low complexity and low data speed. This system assures the cleaning of dustbins as soon as possible when it reaches the maximum level and also helps to monitor the fake reports. Hence it indirectly reduces the corruption in the management system. Authors have mentioned the future work is to use solar panels to reduce the energy consumption.

III. EXISTING SYSTEM APPROACH

Limitations of the Existing System

- Time consuming and less effective.Trucks go and empty containers whether they are full or not.
- High costs.
- Unhygienic Environment and look of the city.
- Bad smell spreads and may cause illness to human beings.
- More traffic and Noise.

IV. PROPOSED SYSTEM APPROACH

Basically our proposed system includes sensor part to sense environmental variable with respect to this application, controller part to process the sensors, processor (IP Enabled device) to connect the sensor data to the internet, and the cloud services to deploy our data, and some services on cloud like Software as a service to manage and control our application.

From the ultrasonic sensor we can get the status of garbage level of the bin, controller process the data, and by using Wi-Fi enabled devices we can connect those data to the cloud. Once the data is available on cloud platforms, we'll do the analytics and analysis so that we can monitor and control the garbage system by sending the messages or control signals to end devices of the consult persons/ authorities.

Advantages of Proposed System

- Real time information on the fill level of the dustbin.
- Deployment of dustbin based on the actual needs.
- Cost Reduction and resource optimization.
- Improves Environment quality.
- Fewer smells.

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V. SYSTEM DESIGN AND METHODOLOGY

Basically it includes sensor part to sense environmental variable with respect to this application, controller part to process the sensors, processor(IP Enabled device) to connect the sensor data to the internet, and the cloud services to deploy our data, and some services on cloud like Software as a service to manage and control our application.

The fig 1 describes the block diagram of the smart garbage system. The system includes the sensor part, controller, processor (Wi-Fi enabled device), cloud part and finally the end devices like mobile, personal systems and garbage maintenance office like corporation offices.

From the ultrasonic sensor we can get the status of garbage level of the bin, controller process the data, and by using Wi-Fi enabled devices we can connect those data to the cloud. Once the data is available on cloud platforms, we'll do the analytics and analysis so that we can monitor and control the garbage system by sending the messages or control signals to end devices of the consult persons/ authorities.

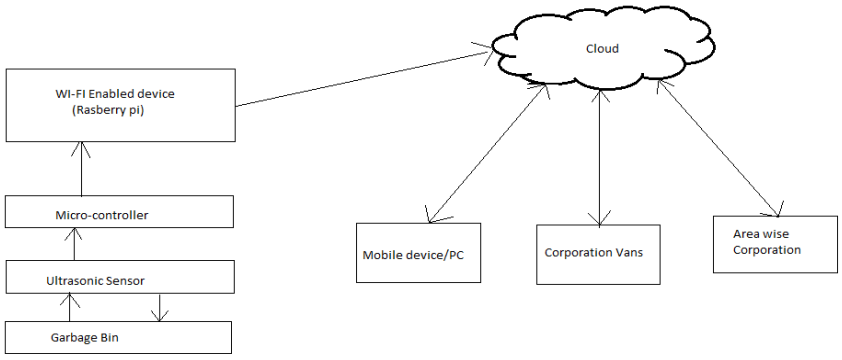

Fig.1.Block diagram of Proposed System

VI. SIMULATION AND RESULTS

Table 1: Testing Ultrasonic sensors used with garbage bin

SL. NO.	Name of test case	Feature tested	Sample input	Expected output	Actual output	Remarks
1	Ultrasonic Sensor-1	Checking whether the garbage bin is empty or not	Reads the distance of the bin measured in cm.	Sensor measures the total distance of the bin in cm.	Distance of the bin measured in cm.	Pass
2	Ultrasonic Sensor-1	Checking whether the bin has still	Dump the waste to the garbage bin	Distance of the garbage level	Distance of the garbage level	Pass

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		some space.	and it reads the level of the bin.	measured by the sensor in cm.	measured by the sensor in cm.	
3	Ultrasonic Sensor-1	Checking whether the garbage bin is almost full.	Reads the level of the garbage in the bin.	Distance is measured and LED light will glow indicating bin is almost full	Distance is measured and the LED light glows.	Pass
4	Ultrasonic Sensor-2	Checking whether the garbage bin is empty or not	Reads the distance of bin measured in cm.	Sensor measures the total distance of the bin in cm.	Distance of the bin measured in cm.	Pass
5	Ultrasonic Sensor-2	Checking whether the bin has still some space.	Dump the waste to the garbage bin and it reads the level of the bin.	Distance of the garbage level measured by the sensor in cm.	Distance of the garbage level measured by the sensor in cm.	Pass
6	Ultrasonic Sensor-2	Checking whether the garbage bin is almost full.	Reads the level of the garbage in the bin.	Distance is measured and the LED light will glow indicating bin is almost full	Distance is measured and the LED light glows.	Pass

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Table 2: Testing cloud services used with Raspberry pi

SL. NO.	Name of test case	Feature tested	Sample input	Expected output	Actual output	Remarks
7	Ubidots cloud	Checking the user login credential.	User-id and password	Login successful	Login successful	Pass
8	Ubidots cloud	Checking the unauthorized access.	User-id and password	Login unsuccessful	Login unsuccessful	Pass
9	Ubidots cloud	Checking the graphical view of the garbage.	User-id and password	Graphical representation of the levels of garbage for analytics purpose.	Graphical representation of the levels of the garbage for analytics purpose.	Pass
10	Ubidots cloud	Checking the SMS/E-Mail sent indicating that the garbage is almost full	User-id and password	Message sent to the concerned authority person.	Message sent to the concerned authority person.	Pass

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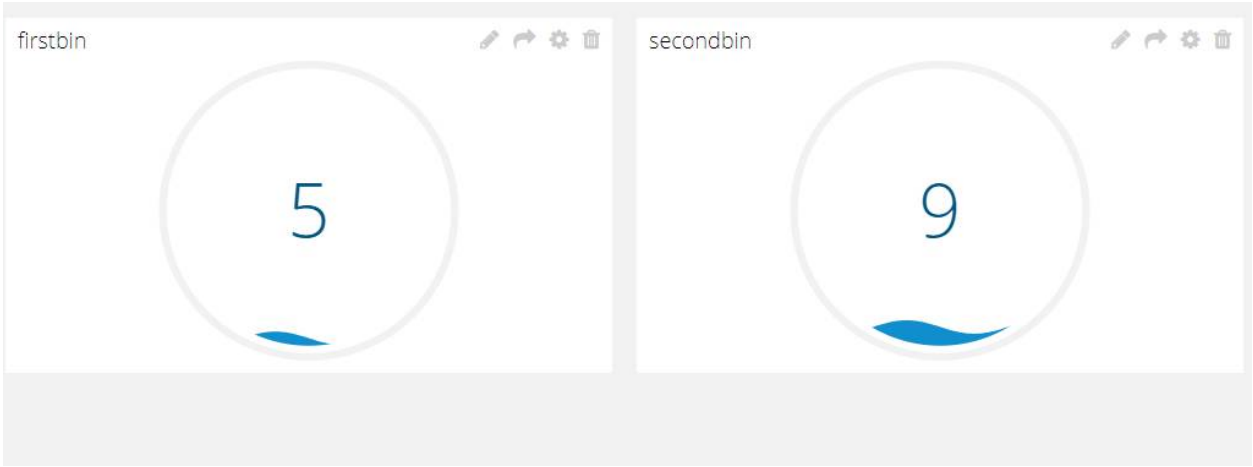

Fig 9.4: Real time data uploaded to the cloud

Fig 9.5: Second bin reached the threshold limit

VII. CONCLUSION AND FUTURE WORK

We have implemented real time waste management system by using smart dustbins to check the fill level of smart dustbins whether the dustbin are full or not. In this system the information of all smart dustbins can be accessed from anywhere and anytime by the concern person and he/she can take a decision accordingly. By implementing this proposed system the cost reduction, resource optimization, effective usage of smart dustbins can be done.In major cities the garbage collection vehicle visit the area's everyday twice or thrice depends on the population of the particular area and sometimes these dustbins may not be full. Our System will inform the status of each and every dust bin in real time so that the concerned authority can send the garbage collection vehicle only when the dustbin is full.

By using this method the collection of waste in the city becomes easier. It helps in reducing air pollution, traffic flow, man power, time and money. With the help of proper technology we can guide the trucks in selecting the shortest path for garbage collection. This project can add an edge to the cities aiming to get smart and people-friendly.

The scope for the future work is this system can be implemented with time stamp in which real-time clock shown to the concern person at what time dustbin is full and at what time the waste is collected from the smart dustbins.
This system can be implemented for segregation of waste into metallic, dry and wet waste. This can be achieved with the help of capacitive sensing and metallic waste with the help of inductive sensing.

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Blower mechanism can also be used to segregate dry and wet waste. Plastics can be segregated from the collected waste and also be processed based on their types, grades and colors. In order to provide solution for irregular waste disposal, make use of biosensor sensor, weight sensor and height sensor.

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