Smart Waste Bin using IOT

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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 "IoT Based Waste Management for Smart Cities". The system is designed based on three main elements; Master station, Slave station, and Internet of things (IoT) platform. The master pin station gathers the data from the slave stations and transmits it to the IoT application for remote management and monitoring purposes. The system is powered up by using solar panels. Four parameters are used for monitoring and managing the waste: temperature value, level in percentage reading, smoke detection, and the global positioning system (GPS) location. This paper proposes a smart waste management system, by using the IoT (Internet of Things) technology.

Keywords: Internet of Things (IoT), Waste Collection, Waste Management, Smart City, Protect Environment

I. INTRODUCTION

By 2100, it is estimated that the growing global urban population will be producing three times as much waste as it does today. Deploying smart waste bin for real-time waste monitoring system is one of the applications of smart cities. Waste management companies and municipalities need an efficient way to change the full trashes from all public places and these are needed to be accomplished with the minimum cost and the maximum efficiency. The smart trash collecting monitoring purposes. Four types of sensors are used for monitoring and managing the waste: temperature value, level in percentage reading, smoke detection, and GPS location. The level sensor is used for identifying whether the containers are empty or not in the slave station and sends the locations and its measurement collection through nodeMCU controller to the Master station. As a safety feature, smoke and gas detector sensors are included.

Fig. 1:

Industry is still in its rapidly developing phase, but the fast growing applications field of IoT to sensors and smart bins are already gaining attention, especially, from the point of managing resources and optimizing collecting routes.

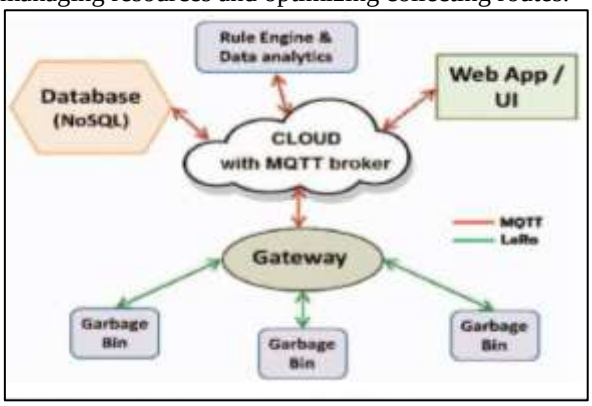

Fig. 2: Proposed System Architecture

There are multiple dustbins are located throughout the city or the Campus (Educational Institutions, Companies, Hospitals, etc.).These dustbins are interfaced with micro controller based system with IR Sensors and RF modules. Where the IR sensor detects the level of the dust in dustbin and sends the signals to micro controller the same signal are encoded and send through RF Transmitter and it is received and decoded by RF receiver at the Central System(Intel Galileo) and an Internet connection is enabled through a LAN cable from the modem. The data has been received, analyzed and processed in the cloud, which displays the status of the Garbage in the dustbin on the GUI on the web browser.

II. SYSTEM ARCHITECTURE

Figure 1 illustrates the system architecture. The IoT device is embedded in the waste containers/bins. The IoT device consists of a MCU (Micro Control Unit), a color LED, a gas sensor, a 3-asix compass, an infrared sensor and a ultrasonic sensor. The sensing data are transmitted to the servers through 802.11 wireless LAN in the indoor environment and LoRa (Long Range) in the outdoor environment. Figure 1. System Architecture the IoT device is an MQTT publisher when 802.11 is used, and the LoRa gateway is the MQTT publisher when LoRa is used as the Radio Access Network (RAN). The sensing data is delivered to the MQTT server and then forwarded to the Data Agent (an MQTT subscriber). The Data Agent then stores the data into the MySQL database. The Alert function periodically checks the status (waste and smell levels) and notifies the manager when the waste level exceeds the threshold. The notification function wakes up the smart phone by making a call and the smart phone identifies the notification by the caller ID. Through this way, the user device can save battery power.

III. PROPOSED SYSTEM

The proposed system is equipped with 3 main segments; Master station, Slave station, and IoT platform. The master station gathers data from the slave stations and transmits it to the IoT application for remote management and all the

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measured data is sent to an IoT platform where decision support user can visualize, analyze and extract, with the ability to collect measures in data analysis tool supported by the platform. Finally, the system is powered by solar panels. The master waste bin is the main station where all readings from other stations (i.e slaves) arrived via NodeMCU module. In this stage, mainly four nodes are attached which are reading the measures of its own sensors, receiving other stations' measures, setting up the mobile data link, and activating the IoT receiving packages (Process 1, 3 and E1). Process 2, presents the initialization of power reading and solar system set up together with advertisement

IV. PROBLEM DEFINITION

As we have seen number of times the dustbins are getting overflown and concern person don't get the information within a time and due to which unsanitary condition formed in the surroundings, at the same time bad smell spread out due to waste, bad look of the city which paves the way for air pollution and to some harmful diseases around the locality which is easily spreadable.

A. Disadvantages 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.

B. Advantages of the Proposed System

1) Real time information on the fill level of the dustbin.
2) Deployment of dustbin based on the actual needs.
3) Cost Reduction and resource optimization.
4) Improves Environment quality
   - Fewer smells
   - Cleaner cities
5) Intelligent management of the services in the city.
6) Effective usage of dustbins.

V. WORKING PRINCIPLE

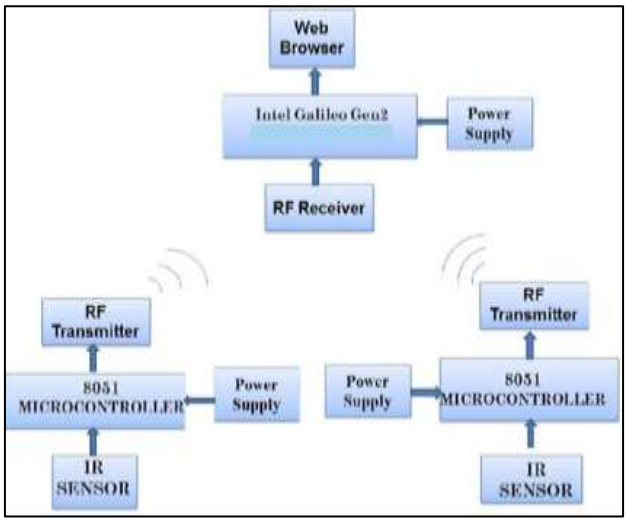

Fig. 3: Block Diagram of the proposed System

The Block diagram shows the different component used in the Smart Dust bin System.IR Sensor, 8051 microcontroller, Power Supply, RF Transmitter, RF Receiver, Intel Galileo microcontroller and the web browser. The project module is divided into two parts Transmitter section and receiver section. Here in the transmitter section we are using 8051 microcontroller, RF Transmitter and sensors these are attached to the dustbin. Where sensor are used to detect the level in the dustbin whether the dustbin is full or empty. The sensor senses the content of the dustbin and sends the signals or the data to the 8051 microcontroller, Power Supply +9V Battery power supply is given to the 8051 microcontroller to drive the system and the 8051 microcontroller reads the data from the sensor and process the data received from sensor, and the same data wirelessly transmitted to the Central system (Intel Galileo microcontroller) using RF Transmitted. RF Transmitter is to transmit the signal form 8051 microcontroller to the asection is receiver section in which RF Receiver, Intel Galileo, and Web Browser is used. Here RF Receiver is used to receive the data sent by RF transmitter to the Intel Galileo microcontroller. The Intel Galileo Gen2 Microcontroller is used to receive the data sent by the multiple transmitters and process the data and the same data transmitted to the Client i.e., Web Browser.

VI. RESULT

The following are the results which obtained from this work,

- Waste Level detection inside the dustbin
- Transmit the information wirelessly to concerned
- The data can be accessed anytime and from anywhere
- The real-time data transmission and access
- Avoids the overflows of Dustbins

This IoT based waste management is very useful for smart cities in different aspects. We have seen that, in cities there are different dustbins located in the different area's and dustbins get over flown many times and the concerned people do not get information about this. Our system is designed to solve this issue and will provide complete details of the dustbin located in the different area's throughout the city. The concerned authority can access the information from anywhere and anytime to get the details. Accordingly they can take the decision on this immediately.

VII. CONCLUSION AND FUTURE WORK

The proposed smart waste bin not only detects the amount of waste but also detects the unpleasant smell. Since the waste in the containers is non-smooth, in this system infrared instead of ultrasonic is suggested to adopt for waste detection. Base on the sensing data, the waste collection company can efficiently obtain the waste status and automatically schedule the waste collection. In this way, the daily waste collection becomes an active service. Through the effective waste collection route, the operational costs such as the fuel and the manpower can be saved. We will evaluate the costs of the proposed system by simulation.

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