

Solar Powered IOT Based Waste Management in Smart City

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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 "Solar Powered IOT Based Waste Management in Smart City". In this proposed System there are multiple solar powered smart dustbins located throughout the city, 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: IR Sensor, IoT, Arduino UNO

I. INTRODUCTION

According to the UN, between now and 2025, the world population will increase by 20% to reach 8 billion inhabitants (from 6.5 today). With this increase in population, the responsibilities towards waste management also increases. Our waste administration frameworks and our economic situations, even taking care of business, are unequipped for taking care of the developing measures of waste universally. So unless a new paradigm of global cooperation and governance is adopted, a tidal wave of uncontrolled dumpsites will be the principal waste management method, especially in Asia. On the west coast of America, San Francisco leads the way with a landfill disposal diversion rate of 72% and the city has set itself a target of zero waste to landfill by 2020.

According to the Pune Municipal Corporation (PMC), Pune alone generates around 1600 metric tons of solid waste daily in the form of organic, inorganic, bio-medical, and industrial Hazardous and e-waste etc. During the monsoon and festive season, the daily waste generation goes up by 15 to 20 percent. In response to this there are only 412 compactor buckets and 1200 garbage containers in the area of 700 km². Moreover, the number of garbage pickers is just around 2300 which is insufficient to cover over 10 lakh households in the city. To encounter this alarming problem, many organizations have come with their solutions like the Swach (Solid Waste Collection and Handling or, officially, the Swach Seva Sahakari Sanstha Maryadit, Pune) and the Adar Poonawala Environment is essential for everyone and present everywhere, that supply all natural needs in an abundant manner but also we have some responsibilities towards our environment. In several urban areas although the dustbins are provided so that it can be used by the people but its proper maintenance is also needed lacking of which unhygienic increases destroying our environment day by day also resulting severe adverse effects for mankind. This project presents some revolutionary remedies in this context. People are more interested to use such technologies which can reduce their time and effort in efficient manner.

Automation is the most demandable feature now a day. For this purpose smart dustbins are the much suitable approach. It will be helpful to develop green and smart city. For this we have to develop a fully automatic dustbin which will first be able to detect the current status and connected to local area network and servers by sending the data to computer system about its current status. Though the world is in a stage of up gradation, there is yet another problem that has to

be dealt with Garbage. Pictures of garbage bins being overfull and the garbage being spilled out from the bins can be seen all around. This leads to various diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management. Hence, smart dustbin is a system which can eradicate this problem or at least reduce it to the minimum level. Our present Prime Minister of India. Mr. Narendra Modi ji has introduced the concept of implementing 100 smart cities in India. “Swachh Bharat Abhiyan” was initiated to ensure a clean environment.

II. BLOCK DIAGRAM DESCRIPTION

In this each dustbin is given a unique ID for easy identification. We continually monitor all the dustbin in our system through an Android App Blynk and also monitor all the events in the system. In this system many number of dustbins are connected through the internet. The ultrasonic sensor is connected to detect the level of dustbin. The dustbin is divided into three level. The Ultrasonic sensor detect the level of the dustbin and send it to the RF transmitter. The availability of waste could be monitored through android app. The ultrasonic sensor will be interfaced to Arduino Mega and will be the input section of the system. Arduino Mega will be programmed to perform the task to measure via sensor and give output. Arduino Mega will be connected to Internet and it will be logged onto the server through the Ethernet shield. This information is then given to the web using internet. The municipality officer get the output in virtualization. This will display the level of all dustbin and display the ID of dustbin which is full. It will also indicate the presence of Toxic gases in the dustbin

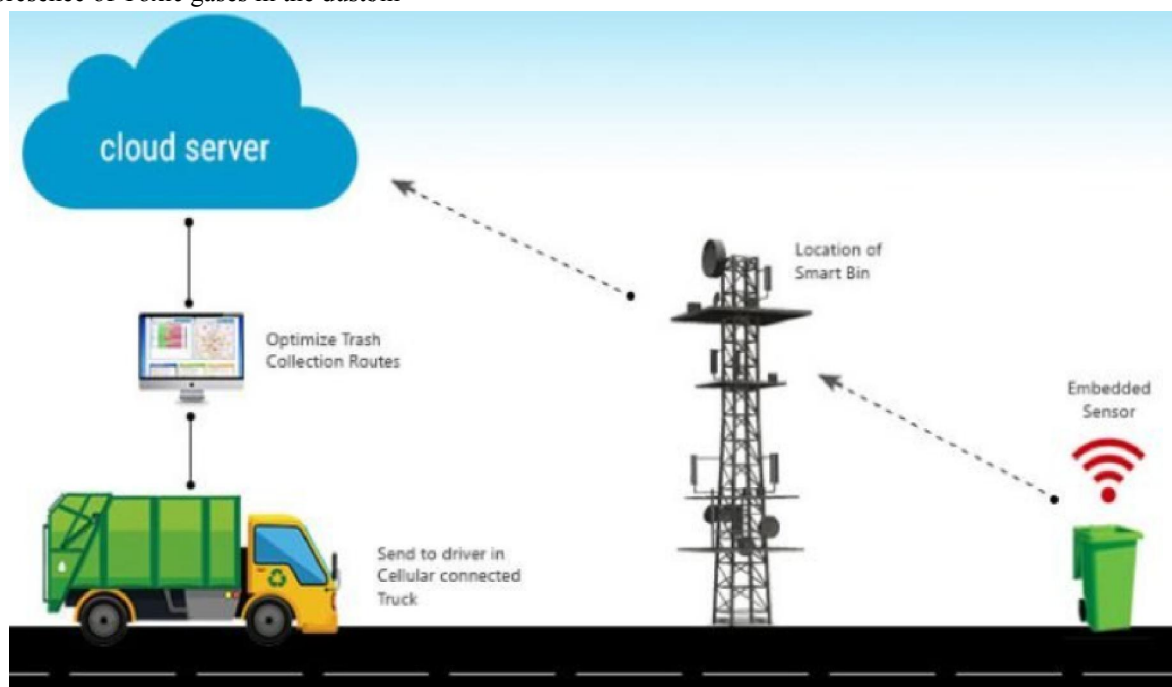


Fig 1 Block Diagram Description

III. EXISTING SYSTEM

In the existing system there is no indication whether the dustbin is over flow. It is more time consuming task and it is less effective. It leads to the wastage of time since the truck will go and clean whether the dustbin is full or empty. This system need high cost. This system will create a unhygienic environment and make the city unclean. In this system the level of the dustbin will not be known and create the bad smell spreads and cause illness to human beings. It also make more traffic and noise.

IV. HARDWARE COMPONENT

ARDUINO UNO Development Board

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based



Fig 2 Arduino UNO

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

Arduino

Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net media's BX-24, Phi gets, MIT's Handy board, and many others offer similar functionality. The Arduino Uno is one kind of microcontroller board based on ATmega328, and Uno is an Italian term which means one. Arduino Uno is named for marking the upcoming release of microcontroller board namely Arduino Uno Board 1.0. This board includes digital I/O pins-14, a power jack, analog i/ps-6, ceramic resonator-A16 MHz, a USB connection, an RST button, and an ICSP header. All these can support the microcontroller for further operation by connecting this board to the computer. The power supply of this board can be done with the help of an AC to DC adapter, a USB cable, otherwise a battery. The ATmega328 is one kind of single-chip microcontroller formed with Atmel within the mega AVR family. The architecture of this Arduino Uno is a customized Harvard architecture with 8 bit RISC processor core. Other boards of Arduino Uno include Arduino Pro Mini, Arduino Nano, Arduino Due, Arduino Mega, and Arduino Leonardo.

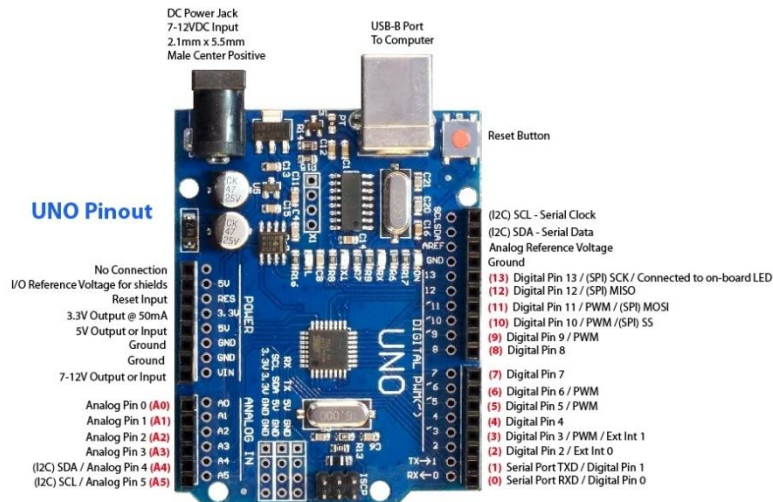


Fig 3 Arduino uno pinout

ESP8266 Wi-Fi module

The ESP8266 will permit us to control it with standard "AT orders", which accompanies manufacturing plant introduced firmware. ESP8266 is enormously strong and adaptable, as we can undoubtedly make and transfer our code and this makes it colossally strong and adaptable. The breakout sheets have become quickly throughout the long term, and a ton of information's will be accessible on the web. As a portion of the exhortation is obsolete or messed up, this is both a gift and a revile.

Ultrasonic Sensor

An ultrasonic sensor (HC-SR04) is utilized to identify how much trash level in a dustbin. Ultrasonic sensors are essentially strong sensors, yet they work at a recurrence above human hearing. The sensor conveys a sound wave at a particular recurrence. It then, at that point, tunes in for that particular sound wave to bob off of an article and return. The speed of sound can be determined in light of an assortment of climatic conditions, including temperature, dampness, and tension.

Battery

An electrical battery is a device consisting of one or more electrochemical cells that convert stored binding energy into electrical energy. Each cell has a positive terminal or negative and a negative terminal or positive electrode. Single utilized batteries are utilized just a single time and disposed of. During release the anode materials are irreversibly different. Models: For spotlights and convenient gadgets, soluble battery is utilized. Auxiliary (battery-powered batteries) can be released and re-energized on numerous occasions; by utilizing reverse current, the first synthesis of the anodes can be reestablished.

Soil moisture sensor

Soil moisture sensors are utilized to gauge the water content in the dirt volumetrically. Since the direct gravimetric estimation of free soil dampness requires eliminating, drying, and weighing of an example, the dirt dampness sensor estimates the volumetric water content by implication by utilizing another property of the dirt, like electrical barrier, relative permittivity or interconnection with neutrons, as a negotiator of the humidity.

IR sensor

An Infrared sensor (ISL29021) is an electronic gadget that radiates to detect a few articles in our environmental elements. In this project an IR sensor is utilized to distinguish the fieriness of an article just as to recognize the movement of the rubbish. In this task, this sensor is utilized when an individual is setting an article in the dustbin.

Relay

A relay is an electrically operated switch. The relay has two switch positions and is a two position switch that can turn the coil current on or off. There is no trace of an electrical connection inside the relay between the two circuits. A 12V relay coil is used here.

Sim800 GSM module

This is a fitting and-play GSM Modem with a basic connection point sequential connection point. We can utilize it to send messages get calls just as to settle on decisions, and by controlling it through straightforward AT orders, we can do other GSM activities. It utilizes the profoundly famous SIM800 module for every one of its tasks. It is a standard RS232 interface which is valuable. The modem comprises of all the necessary outside hardware like the power guideline, outer radio wire, SIM holder, and so on.

Solar Panel

Sun powered charger is utilized to change over sun based energy into electrical energy. The daylight will be consumed by the board and it will be changed over into electrical energy. This creates direct flow (DC) power. The energy might remain in DC structure or it will go through an inverter to change into a substituting current (AC), relies on the intricacy of the framework.

V. PROPOSED SYSTEM DESIGN

Proposed System

In present day the dustbin is overflowed, the proposed system will help to avoid the overflow of dustbin. It will give the real time information about the level of the dustbin. It will send the message immediately when the dustbin is full. Deployment of dustbin based on actual needs. Cost of this system is minimum the resources are available easily. Improves environment quality by reducing the smell and make the cities clean. It has effective usage of dustbins. It will also reduce the wastage of time and energy for truck drivers. It will also indicate the availability of toxic substance in the bin.

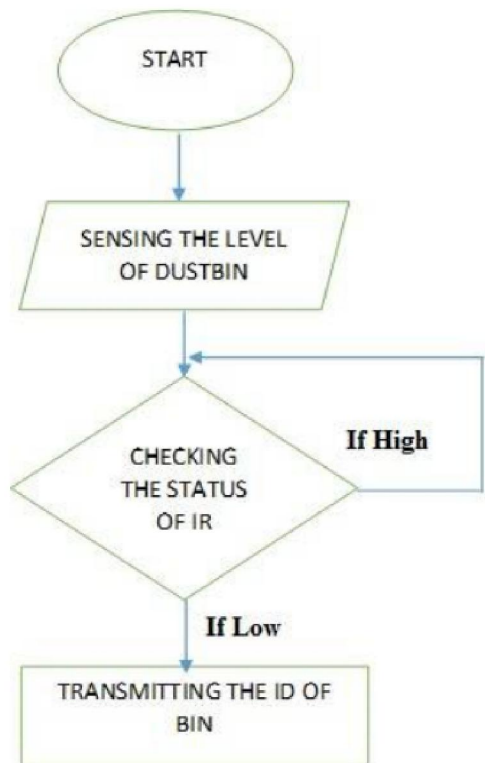


Fig 3 Flow chart for proposed system Design

DOI: 10.48175/568

VI. WORKING METHODOLOGY

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 from 8051 microcontroller to the Intel Galileo microcontroller. The other section 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.

VII. CONCLUSION

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. This system indirectly reducing traffic in the city. 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. 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 dust bin is full and at what time the waste is collected from the smart dustbins.

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