Iot based Smart Waste Management System for Smart City

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***Abstract*—** Due to India's very high population and its direct proportional increase with the quantity of garbage and lack of new land for landfill, there is a very big need for a smart system for waste management and collection is desperately needed. The efficiency of the current system will be raised at the ward level by utilizing IoT and a smart garbage processor. IoT usage in waste management is still in research level. For a developing nation like India, using the internet and allocating a sizable percentage of the money for this infrastructure upgrade may appear like extravagances. However, it is necessary and essential to implement this infrastructure transformation with increased funding for waste management in order to prevent serious health risks for the next generation. The existing methods like bins kept in the major streets of the city can be easily converted into IoT by implanting sensors and internet connectivity unit.

Keywords*—: IoT, LCD, ESP 32, Wi-Fi, MQ4 Sensor,UHV sensor, Internet.*

I. INTRODUCTION

The amount of waste produced everyday by the industries and the house holdsis at an appalling rate, and the major reason for this is soaring use of packaged items, textiles, paper, food, plastics, metals, glass etc. Consequently, handling this garbage becomes essential to our daily existence. Many effective methods are employed in the majority of industrialized nations for the appropriate management of this waste, but in certain nations, particularly the emerging ones the careless attitude of people towards maintaining clean Surroundings, along with this many issues such as no stringent laws For biodegradable materials, no proper environ policies, no laws for sustainable development is the first cause of waste management's deadly outcomes.

Because to the growing amount of waste, the public containers used to collect this The neighborhood is overflowing with waste and litter, which not only makes the streets smell bad but also has a detrimental effect on the environment and public health. Waste management is a critical issue that requires careful attention. In order to make recycling and processing easier, we separate our waste at home. We saw garbage trucks arriving at residences on a sporadic basis, depoliticizing residential areas. As a result, a large number of citizens empty their full dustbins in public areas.This in turn increases environmental pollution.

Waste has a terrible lot of negative consequences on the environment and human health. Bacteria, insects, and flies the same flies that swarm around edibles and release their young breed on trash. As a result, they raise the risk of food poisoning, typhoid, gastroenteritis, salmonella, dengue, malaria, and other illnesses caused by insects. In addition to these flies and insects, other creatures that benefit from the waste include rats and stray canines that carry diseases. The garbage also contributes to a number of respiratory ailments. In addition to harming human health, harmful pollutants including CO2, methane, and nitrous oxide also pollute the air and water. When hazardous trash, such as electronics and plastics, are disposed of the water, aquatic life is negatively impacted.

Everyone wants to visit fresh clean cities. A malodorous city with trash all around. The location loses out on chances and financial rewards since it does not draw tourists. India is currently the third-largest garbage generator in the world, with 377 million people living in metropolitan areas producing 62 million tonnes of waste per day as the country's affluence soars.

However, it's not the amount of waste generated that's as much of an issue as the fact that more than 45 million tons or 3million trucks worth, garbage is unprocessed and daily disposed of in an unsanitary manner by municipal officials..

II. LITERATURE SURVEY HEARDWARE COMPONENTS

We have analysed various existing works in the field of "IoT based smart waste management system for smart city." A novel technique "Smart Waste Collection Monitoring and Alert System via IoT" is proposed in [1]. By reading this paper we found that the system is developed using an Arduino UNO and ultrasonic sensor. Dustbin depth level is sent via Arduino Ethernet Shield using internet connection to the Ubidots IoT Cloud. The event manager has got the notification of employee through a SMS when the dustbin is full and it is filled for immediate waste collection. So, waste collection became more systematic.

In [2] authors proposed "Efficient IOT Based Smart Bin for Clean Environment." In this paper main focus is on the dustbins placed outside every corner within the streets so on stay environment clean. Road side dustbins don't seem to be monitored and cleaned properly most of the times. During this paper propose a fresh brand-new system for managing garbage within Smart Cities. This Efficient Waste disposal or Management System is taken into consideration as vital for contemporary Smart Cities. Both IS and MSC frequently use the Internet of Things, which results in a highly developed proposal for the future operations. The device is a smart bin with an automated alert system that notifies the company or the garbage

disposal team in the area. By using this system, they are able to monitor the total waste disposal in specific manner.

A serverless Internet of Things architecture called "A Serverless IoT Architecture for Smart Waste Management Systems" was proposed in [3]. For improving the recycling and disposal behavior for waste management systems. Using recycle.io, it's then possible to enter real-time the categories of source material violations before the waste collection. During this fashion, waste management systems can identify sources of violations and rectify this by bringing awareness to the public or issuing fines to forestall violations from occurring. We demonstrate usefulness of our approach throughout the paper.

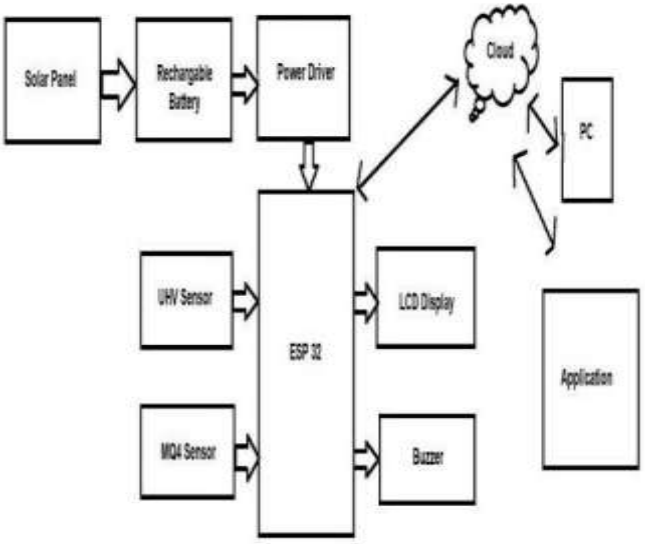

Fig.1. Block diagram of proposed system

The waste management system consist of Esp32. Espressif32, a development board created by Espressif Systems, [4] is known by the acronym ESP32. ESP32 is a 32-bit microcontroller equipped with a wireless or wi-fi network and Bluetooth Low Energy (BLE) using the 802.11 b/g/n wifi network protocol that works at a frequency of 2.4 GHz and bluetooth v4.MQ4 Gas sensor is a Metal Oxide Semiconductor (MOS) type gas sensor mainly used to detect the methane gas concentration in the air either at home or in industry [5-7]. The block diagram is shown in fig.1

UHV sensor is used to measure the bin level or distance. Power driver is used to convert any DC voltage to 5v. A solar panel is a device that which it converts sunlight into electricity by using photo voltaic (PV) cells [8-9]. Materials used to make PV cells produce electrons when exposed to light. Direct current (DC) electricity is created when electrons go through a circuit. This electricity can be stored in batteries or utilised to power a variety of devices [10].

Other names for solar panels include PV modules, solar electric panels, and solar cell panels. A buzzer is a simple audio device that produces sound when an electrical signal is received. Piezo buzzers and magnetic buzzers are the two main types of buzzers. Those are internally connected in a smart dust bin and can't see outside.

III. HEARDWARE COMPONENTS & WORKING PRINCIPLE

1.ESP 32:

Fig. 2. ESP 32

Espresso Systems designed the ESP32 shown in fig.2 is a low-cost, low-power consumption family of SoC and modules. The well-known ESP8266 has been replaced by the new ESP32. The ESP32 is equipped with Bluetooth and Bluetooth Low Energy in addition to built in wi-fi.

2. Buzzer:

Fig. 3: Buzzer

A sounding device that can translate audio signals into sound signals is a buzzer. It is usually powered by DC voltage. The buzzer shown in fig.3 can produce a variety of sounds, including music, sirens, buzzers, alarms, and electric bells, depending on its design and intended application.

3. Solar Pannel:

Solar panels are typically made of silicon or similar semiconductor material, mounted in a metal panel frame, and covered in glass shown in fig 4.

Fig.4. Solar Panel

4. LCD Display:

LCD display shown in fig. 5 is a type of electrically modulated optical device that is similar to a flat-panel display. Liquid crystals do not emit light directly but instead use a backlight or reflector to produce images in color mono chrome.

Fig. 5. LCD Display

5. MQ4 Sensor:

Fig. 6. MQ4 Sensor

Measuring the amount of methane gas in the air in residences or commercial buildings is done with the MQ4 methane gas sensor, a MOS (metal oxide semiconductor) type sensor shown in fig 6.

6. Power Driver:

The power driver is used to convert any high dc voltage to Low dc voltage shown in fig.7. The low dc voltage is 5v. The components Operating voltage is 3.3v to 5v more than 5v we can give. The components are damaged. So we can use power driver.

Fig.7. Power Driver

Working Principle

The smart waste management system use the concept of IoT, where the proposed system is placed all over the cities, with an embedded system monitor the level of the bin. The locations of the bins are tracked online, and the status of the bins is reported to the relevant authorities for evacuation. If the bins are filled, an LCD will notify the user that the bin is full and the municipality will receive messages to evacuate the bin as soon as possible. The MQ4 sensor are used to check the odour in the bins respectively. If any odour is detected it sends a message to the municipality based on the concentration of the gases present.

When the dust bin is filled above 90% then the dust bin makes the buzzer sound and also sends message signals to the user who cleans it. We connect more dustbins to user right, so it also shares its location to user and also it can detect the smell it produces through MQ4 Sensor. The bin level is detected by the UHV Sensor.

IoT Based smart waste management system for smart city is helps to keep our cities clean. This system for waste collection in smart cities. The result is that waste collection trucks use the fastest routes, only when necessary which saves time, resources and money not to mention the positive environmental impact. The system includes reduced emissions from fewer vehicles, noise pollution, and street clutter.

IV. RESULTS

IoT Based smart waste management system for smart city is helps to keep our cities clean. This system for waste collection in smart cities. The result is that waste collection trucks use the fastest routes, only when necessary which saves time, resources and money not to mention the positive environmental impact. The system includes reduced emissions from fewer vehicles, noise pollution, and street clutter.

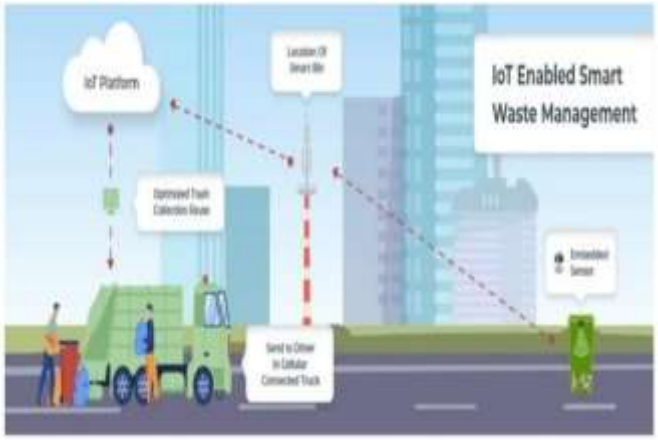

Fig. 8. Smart Waste Management System

Fig. 9. Empty Bin

Fig. 10. LCD display bin and gas level

Fig.9 & 10 shows that the bin is empty so the bin level is 0. It isdisplay in the LCD display and gas level also 0.

Figure11: Bin level above 90%

In the above fig.10 the bin is fill above 90%. The bin level is display in the LCD. The buzzer makes sound and notification and location is also shared to the user.

V. CONCLUSION

The incorrect handling and disposal of household garbage can lead to environmental contamination and public health problems. For this reason, this article aims to offer a workable solution for waste management that integrates the Internet of Things. Offering free internet access for a set period of time after the trash is placedin the container. The suggested strategy would undoubtedly aid in resolving any significant waste-related problems and maintaining a clean environment.

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