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SMART MONITORING OF GARBAGE COLLECTION USING AWS AND IOT

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Abstract-The population around the country is increasing and therefore the quantity of garbage generated daily is 600000 MT. The population of the town is diversely opened up with some areas highly populated while others have comparatively less. It makes the method of garbage pickup to be a busy task to all or any City Municipal Corporation. Cities all throughout the world are joining the "smart cities" trend to improve solid waste management efficiency. Smart Trash Monitoring using AWS and IoT helps in smart management of garbage collection. It also assists in determining the most efficient route for garbage collection, so saving time and fuel. An Arduino board with an HC SR04 ultrasonic sensor for sensing garbage level is used to build Smart Trash Monitoring of Garbage Collection. Amazon Web Services (AWS) assists with knowledge storage and notification delivery.

Index terms- **Smart Trash Monitoring, Arduino board, Amazon Web Services.**

I.Introduction

The Internet of Things (IoT) is the interconnection of physical devices, vehicles, and other items that are equipped with software and sensors to collect and exchange data. The smart technology landscape with big data and cloud computing, in which multiple smart apps exchange data utilising embedded sensor devices and other cloud-connected gadgets. [6]. The idea of the web of things initially became in style during 1999, through the Auto-ID Center at MIT and connected market-analysis publications.

operating with web of Things potential. Most attention goes to resolving the utilization of IoT applications in settings like home, health, cities, transport, and so on. The hardware and computer code that lies at the bottom of those applications provides the 'smartness' in and amongst these products. It is a sweeping topic that undoubtedly deserves an excellent deal of attention. These days IoT is indispensable and therefore the future can solely evolve more in this direction. Thus so as to be ready to build connected hospitals, firms and cars, IoT enablers should be used. Smart cities [4] start with a well-designed public infrastructure that provides clean water, reliable electricity, safe gas, and cost-effective public lighting. They also unlock resources by demonstrating intelligence in the delivery of critical services, and they are willing to invest in a variety of services to improve quality of life. The concept of a sensible town is an appealing platform for IT-enabled service innovation. Itprovides a snapshot of the city in which service providers employ data technology to communicate with voters in order to create more feasible urban organisations and systems that could improve people's quality of life. The emerging Internet of Things (IoT) concept is critical to the development of smart cities. For value generation, an integrated cloud-oriented design of networks, software, sensors, human interfaces, and data analytics is required. IoT sensible-connected items, and hence the services they provide, may become critical for smart city development in the long run. This study can investigate the concept of a sensible town and suggest a method development model for implementing IoT systems in a sensible town setting.

The population [5] of states is dispersed, with some sections being densely populated while others are sparsely populated. As a result, CMC's trash collection approach is a time-consuming operation. Overflowing trash cans are hazardous to people's health and emit a foul odour across the environment. As a result, some dangerous diseases and human health issues spread. The present state of affairs for trash collection may be a terribly static answer for a really dynamic downside, as a result the quantity of trash we tend to manufacture isn't continuously constant. The answer to be projected ought to scale back the fuel and time needed for economical assortment of garbage.

II. Literature Survey

Smart Garbage Management in Smart Cities Using IoT offered the following technique in [1]. The term Smart Cities was established to describe technologically advanced cities that have the ability to gather, analyse, and distribute data in order to improve citizen services [7]. Waitkus established a foreign bin monitoring and trash pick-up scheduling system in [11], which monitors container fullness, notifies the waste hauler, and schedules garbage pick-up in accordance with customer requests. The amount of rubbish in the dustbins is measured using ultrasonic sensors and relayed to the permitted control centre via GSM. The GSM framework connects the Arduino microcontroller to the sensor framework. A graphical user interface (GUI) has also been developed to display the best statistics associated with trash for various selected regions. This will make it easier to deal with trash collection in an effective manner. The level finder is made up of infrared sensors that detect the level of rubbish in the trash can. Microcontroller receives the level indicator's yield. Four infrared sensors are used to show the various levels of rubbish gathered in the trashcan, which is placed in an open area. When the trash is filled to its maximum capacity, the yield of the fourth IR receiver drops dramatically. This yield is given to the microcontroller, which uses the GSM module to send the message to the control room. A control room is located at the recipient, where all of the exercises are monitored. A control room is available at the collector, where all of the exercises are monitored. When the trash level reaches its highest

point, this framework ensures that the dustbins are cleaned as quickly as possible. If the trashcan isn't cleaned in a specific amount of time, the record is sent to a higher authority, who can take appropriate action against the project worker in question.

In [2,] a trashcan is connected to a microcontroller- based framework with IR remote frameworks that display current trash status on an internet browser with an html page over Wi-Fi. The status will be updated and a link to it will be added to the HTML page. As a result, HR and efforts will be reduced, but a keen city vision will be developed. Because of the requirement for modern innovation, the smart trash container can be more expensive, but because of the quantity of dustbins necessary in India, they used sensors to reduce the cost and make it more useful in applications. On the sender side, they only used a Wi- Fi module to send and receive data. It will only recognise the weight of waste, not the level of waste. In [8], a Geographical Information System (GIS) transportation model for strong waste collection that explains plans for waste storage and disposal has been proposed in [8] for the city of Asansol in India. An improved routing and scheduling waste collection model is proposed for the Eastern Finland, featuring the usage of a guided variable neighborhood thresholding met heuristic. The point of the exploration was to build up an ideal timetable for trucks on characterized collection routes. The information from the bins are processed inside the DSS and if it's right it's sent to coordinators of waste collection in this specific spot and to the street police. A Geographical Information System (GIS) transportation model for strong garbage collection has been developed in [8] for the city of Asansol in India, and it discusses plans for waste storage and disposal. For Eastern Finland, a new garbage collection routing and scheduling model is presented, which includes the use of a guided variable neighbourhood thresholding met heuristic. The goal of the investigation was to devise an ideal schedule for trucks travelling along well-defined collection routes. The data from the bins is reviewed by the DSS, and if it's correct, it's forwarded to the waste collection coordinators in this area, as well as the local police. The truck driver does not stop to rest; instead, he continues on to the next place, and the trip is retraced in this manner. It is used in conjunction with a dynamic routing method.

Porat et al.[12] used volume sensors, lasers, and photo
detectors to measure the fill volume of bins and relay

the data to garbage collectors so that pick-up could be scheduled properly. In [9], ZigBee, GSM (Global System for Mobile Communication), and ARM7 are used to create an integrated system for remotely monitoring rubbish bins. The sensors are installed in typical garbage cans seen in public areas. When the trash reaches the range of the sensor, an indication will be sent to the ARM 7 Controller. The controller will alert the driver of the garbage pickup truck when the garbage bin is completely full. ARM7 will send an SMS utilising GSM technology to indicate its presence.

In [10], they concluded that it is crucial to understand public concerns about growing resource consumption and trash creation, and that policymakers have pushed recycling and reuse measures to reduce the demand for raw materials and the amount of waste that ends up in landfills.

III. Proposed System

The workflow of Smart trash Monitoring is discussed. To measure the trash level HC SR04 ultrasonic sensor and Arduino board attached to the trashcan. It shows and sends the trash level measurement data as a request through AWS IoT gateway by a MQTT (Message Queue Telemetry Transport). The Lambda rules are runned, and the values in the DynamoDB table are updated. Then, using Amazon Simple Notification Service, an SMS is sent to the client application. The Google map API (Application Programming Interface) calculates the shortest way and displays it.

IoT module

At, the first step is to determine how much trash is in the trash container. An Arduino board is connected to an ultrasonic sensor (HC- SR04) mounted on the top of the garbage can for this purpose. The sensor detects the trash level on a regular basis and sends the data to the Amazon Web Services Cloud. The message is sent using the Message Queue Telemetry Transport (MQTT) protocol [3], which is a publish/subscribe protocol. MQTT is a low-bandwidth protocol that uses less network bandwidth.

AWS (Amazon Web Service) Endpoints AWS(Amazon Web Service) IoT

The message sent by IoT is received by AWS IoT. It connects to the gateway, reads the incoming messages, and sends them to a different destination. AWS IoT has event-triggered rules that are used to integrate other AWS services with AWS IoT.
AWS IoT provides a number of topics to which a "thing" (any IoT sensor, actuator, or device) can publish.
When a device publishes to a topic, it notifies all other devices that have subscribed to the subject. The newly established topic will receive an incoming MQTT message with the trash can ID and message, which will activate an AWS Lambda function.

AWS Lambda

AWS Lambda is a server-side event- triggered function that runs anytime something happens. The message delivered by AWS IOT will be received and processed by AWS Lambda. It is linked to a DynamoDB table that will contain information about all of the city's trash cans. The update procedure is run, and the garbage level is updated based on the ID.

AWS DynamoDB

It's an unstructured NoSQL database for storing non-structured message chunks efficiently. It now supports AWS Lambda using AWS DynamoDB streams. A DynamoDB stream is created whenever new data is added to the table. To attend to objects in the stream, an AWS Lambda function is employed once again. The Amazon Simple Notification Service (SNS) is in charge of sending users notifications.

AWS SNS

The Lambda function will use the data it receives to deliver a notification to the AWS SNS topic. AWS SNS allows developers to deliver transactional and non-transactional SMS/Email messages. AWS SNS allows you to build various subjects, each of which has a list of phone numbers and email addresses to which it must be informed. AWS Lambda responds by sending notifications.

Client Android application

This application is used to keep track of waste levels across the country. It also aids the garbage truck driver by presenting him with the quickest route to all of the city's trash cans. The Google Directions API is utilised to solve the dilemma of the travelling salesman. The app makes use of an AWS DynamoDB table.

The advantages of the smart trash monitoring system are as follows.

- Information about the level of rubbish in the dustbin in real time.
- Trash can placement based on actual requirements.
- Cost-cutting and resource optimization are two things that come to mind when it comes to cost-cutting and resource optimization
- Improves the quality of the surroundings.

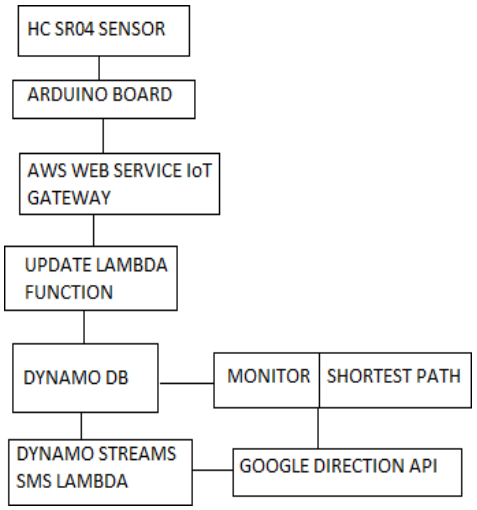

Fig.1 Work Flow of Smart Trash Monitoring System

The application is designed for android platforms. The trash level is stored in AWS cloud. The user can monitor the trash level of all dustbins across the city just by using the app and truck driver can find the shortest route to the destination using the app.

IV. Result

Smart Trash Monitoring using AWS and IoT can help in maintaining the health and hygiene of citizens of a nation. The proposed solution is cost effective and it is

easily implemented. With the nation's plan of moving to smart cities, this application would help in achieving it and also helps to achieve the nation's mission of achieving Swachh Bharat.

When the trash level is deployed in large amounts the garbage collection system can reach higher levels of automation. With the booming rise of self driving vehicles, the current system can achieve complete automation. Data storage is convenient and provides hassle free storage of data since third party cloud service like Amazon Web Services is used. This lessens the government's task of maintaining dedicated servers for this purpose. Additionally a client android application is provided for easy usage. Overall this system is a complete, out-of-the box deployable solution for maintaining a clean city.

The Fig.2 shows the user interface in client application. It has two tabs one to monitor the trash level in different trashcan and the Fig.4 shows the shortest path to the truck driver so that the filled trash can be easily emptied.

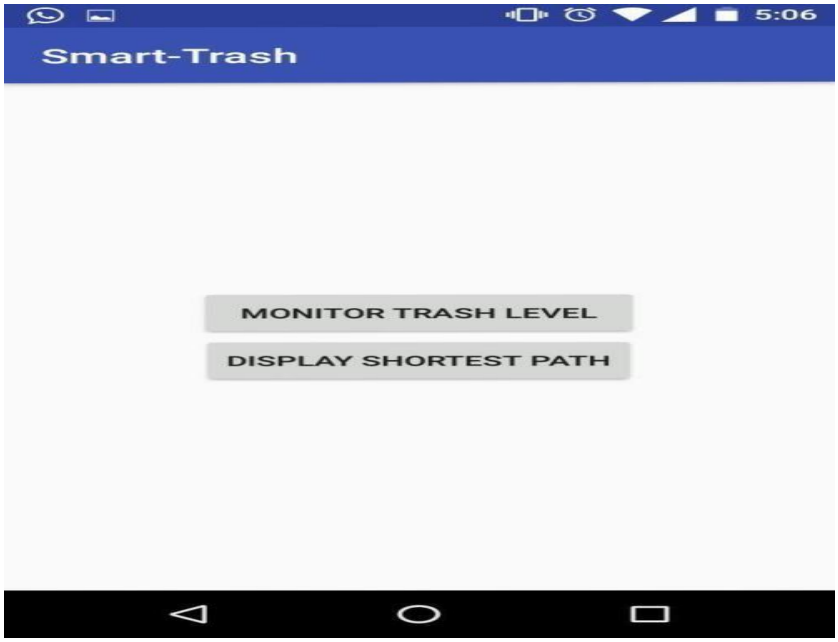

Fig.2 User Interface

On clicking the first tab trash level in different trash cans are shown. With the available details truck drivers

can also predict when a particular trash can is filled. The trash can level is shown in percentage.
On clicking the shortest path location is tracked using Google API. The trash level data is updated in the DynamoDB with the location information. These details keep changing according to the status of the trash cans all over the cities

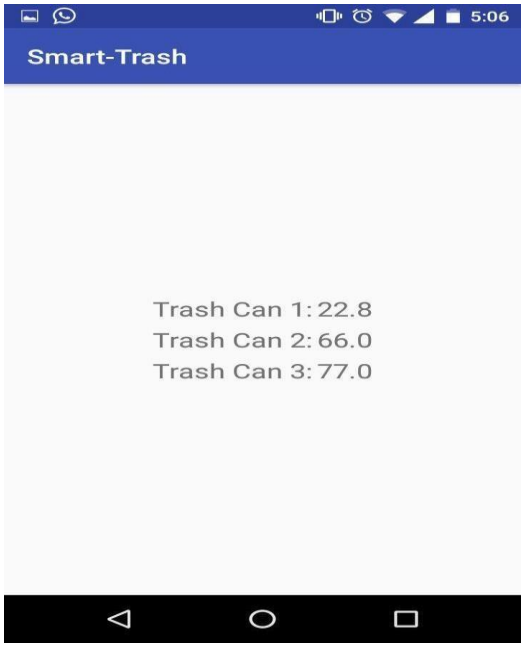

Fig.3 Trash level in all trash cans

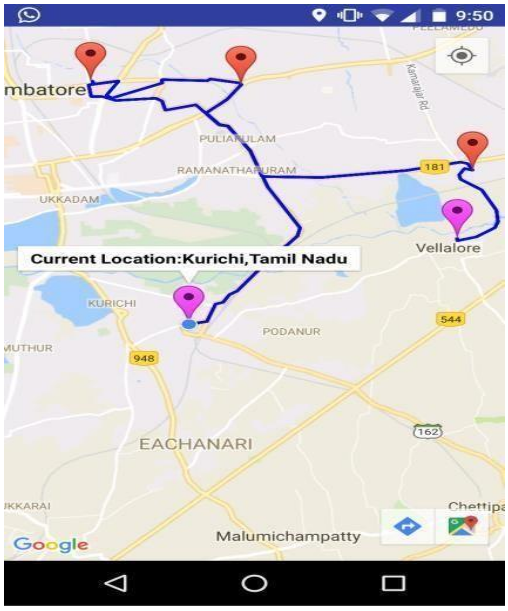

Fig.4 Shortest path to collect the trash

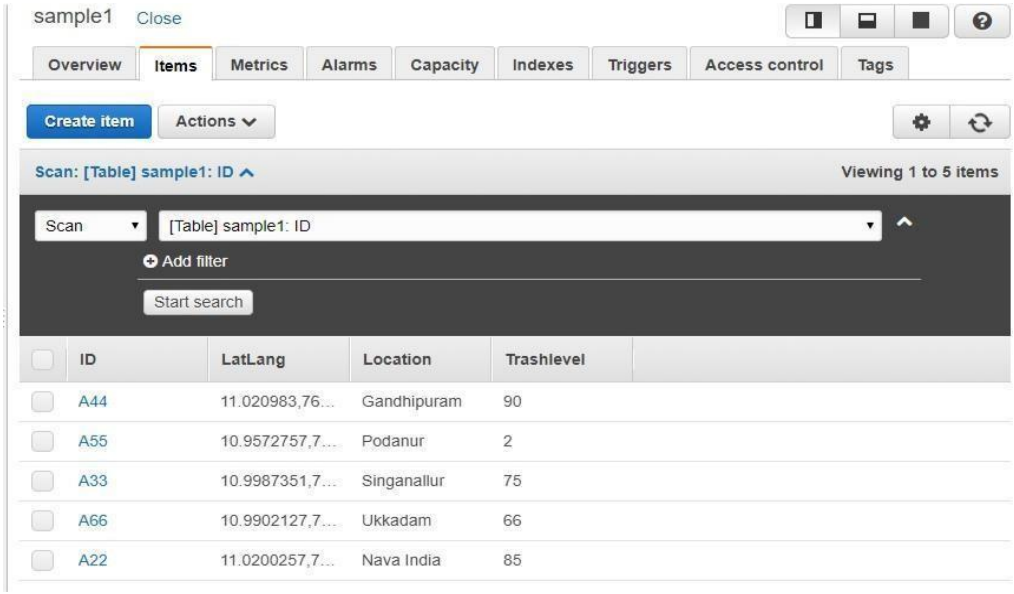

Fig.5 Database Structure

IV. Conclusion And Future Scope

Our country and municipalities will have to collaborate to reach a comprehensive solution that addresses waste management for trash disposal regionally. The smart trash monitoring can play an important role towards that end in proposing policies and techniques that will handle this issue in an innovative and sustainable manner.

In future work, the appliance developed for this answer may be evolved by adding new facilities that can arouse the tip user additional vital interactions with the management system beside integration with a platform, to calculate the simplest path in assortment routes, seeking potency with a lower value of in operation the fleet of trucks. Additionally, the investment and operation prices of this solution are going to be a really fascinating study and may be performed as future work.

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