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SMART DUSTBIN DISPENSARY SYSTEM IN SMART CITIES

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Abstract

Garbage Overflow is the primary source of contamination in the current situation. It results to unhygienic conditions for the populace and foul odors in the neighborhood, which spreads some deadly diseases & human illness. We are planning to implement a project called IoT Based Waste Management Using Smart Dustbin to prevent all these scenarios. With the aid of the IoT idea, implementation is carried out. Ordinary trash cans need to be opened by pushing a foot against a lever before being filled with trash. In order to empty it and prevent overflow, one must also keep note of when it is full. Here, we suggest a clever trash can that takes care of everything on its own. Our device opens instantaneously by detecting human face. Every trash can in the city will have a distinct ID, making it easy to tell which one is full. Several trash cans are positioned all throughout the city or campus in this arrangement. These trash cans have sensors built in to them that help keep an eye on their depth and level. The device will transmit the reading to a device together with the provided unique ID when the level of the bin exceeds the threshold limit. The user won't have access to the bins once they are full. When this happens, the trash can produce audible alerts and uses an LCD display to reveal the location of other garbage cans nearby. Using the Internet, the relevant authorities can monitor the condition of the bin from any location, and an immediate action will be taken to swap out full bins for empty ones.

Keywords—face detection, level detection, sensors, server.

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I. INTRODUCTION

Nowadays, the main source of pollution is trash overflow. It causes unsanitary living conditions for the populace and offensive scents in the area, which spreads several lethal illnesses & human ailments. We want to deploy the IoT Based Waste Management Using Smart Dustbin project to steer clear of all these potential issues. Implementation is done with the help of the Internet of Things idea. Ordinary trash cans require a foot to be pressed against a lever to open before waste can be placed inside. It is also necessary to keep track of when it is full in order to empty it and prevent overflow. Here, we suggest a smart trash can that takes care of everything on its own. Our technology uses a camera to detect human presence and opens automatically without the need for a button press. Every trash can in the city will have a distinct ID, making it simple to identify which trash can is overflowing. This technique disperses several garbage cans across the city or university. These garbage cans have sensors that allow for the measurement of the depth and level of the trash cans. When the level of the bin exceeds the threshold limit, the gadget will communicate the reading and the specified unique ID so that the trash inside the dustbin does not decompose or become spoilt, water is flushed from inside to outside using a solenoid. The trash can will then be relocated to the proper location along with the extra waste. The user won't be able to access the bins after they are full. If the user drops their garbage on the ground, the bin alerts them with audible notifications and displays the location of nearby dumpsters on an LCD screen. By using the Internet to remotely monitor the state of the bin, the appropriate authorities may take rapid action to replace full bins with empty ones.

II. LITERATURE SURVEY

[1]. Shankar A, Prarthana RJ, Vuayalakshmi B, and Kumar NS are the authors. An IOT-based smart garbage alarm system uses an Arduino UNO. November 22, 2016, IEEE Region 10 Conference (TENCON), pp. 1028–1034. IEEE. In this study, a warning signal is sent to the municipal website server based on the amount of trash to request urgent trash bin cleaning. To eliminate the need for human monitoring, a microcontroller was utilized'/ to monitor the dustbins' information using an Android application.

[2]. Rafeeq M, Alam S. Automated separation of plastic, metal, and glass waste materials in the scrap business. The International Conference on Communication and Electronics Systems (ICCES) took place in 2016 on October 21. (pp. 1-5) IEEE. This article provides a quick and easy method for classifying trash into metallic waste, plastic waste, and glass waste in order to get ready for the following stage of operation. The essential phenomenon for this segregation process is the use of inductive sensors to discriminate between metallic and non-metallic materials and a capacitive sensor to distinguish between liquid and dry wastes.

[3]. IOT Sai PY A successful strategy for promoting smart cities is the use of smart waste monitoring systems in urban areas. 2017 February 7:7 International Journal of Advanced Research in Computer Science and Software Engineering (2). The device does this by detecting the rubbish level and comparing it to the depth of the rubbish bins using waterproof ultrasonic sensors installed above the bins. Arduino Uno, a microcontroller-based platform, on which the smart bin is developed, is connected to a GSM modem and an ultrasonic sensor. At the top of the trash can is an ultrasonic sensor that will gauge the size of the trash can. The liquified trash is very simple to find using waterproof sensors.

[4]. Mahalakshmi P., Dhawan R., Baby C.J., Singh H., and Srivastava A. A machine learning method is used by the smart bin, an intelligent garbage alarm and forecast

system. During the 2017 International Conference on Wireless Communications, Signal Processing and Networking (Wisp NET), which took place on Mar. 22, (pp. 771-774). IEEE. This article investigates how machine learning is being used in this field. Using machine learning principles, information is gathered on the quantity of trash and anticipated waste generation. Also sent to the cloud are the data and an email alert.

[5]. DUSTBIN SMART USING ARDUINO Mamta Pandey, Anamika Gowala, Mrinal Jyoti Goswami, Chinmoy Saikia, and Dr. Dibya Jyoti Bora are all faculty members of the Assam Kaziranga University in Jorhat, Assam, India's school of computing sciences and information technology. The smart garbage can is connected to an Arduino IDE in this investigation in order to identify nearby individuals. The lid opens when the need is satisfied, allowing the rubbish to be thrown within. An ultrasonic sensor is used to track the waste level. There are a couple drawbacks to this strategy, though.

[6]. Using Arduino and LabVIEW, a system for monitoring trash online. In the International Journal of Scientific Research in Network Security and Communication, Zade R, Khadgi N, Kasbe M, Mujawar T. 2018;6(6):5-9. This system uses a webpage to collect, store, and show data about the rubbish generated by the trash cans.

[7]. By Dr. Arvind Chakrapani and Kannapiran Selvaraj, a smart dustbin monitoring system utilizing LAN servers and Arduino has been developed. We may not be able to remotely monitor the trash can with this set-up, but the data can be relayed from the microcontroller to the concerned party via a LAN server. As a result, this smart garbage can have considerably more disadvantages than advantages.

[8]. Trash Management as an IoT-Enabled Service in Smart Cities by Alexey Medvedev, Petr Fedchenkoy, Arkady Zaslavsky, Lheodoros Anagnostopoulos, and Sergey Khoruzhnikov. The association between the population serviced by the present dustbins was quantitatively examined by the writers. Second, the study examines the spatial distribution of garbage cans in certain Dhaka City neighborhoods using average closest neighbor GIS methodologies. Strangely, it appears like the current trash cans are largely gathered in one location. Then it was determined how many extra trash cans would be ideal. It is demonstrated that there are insufficient trash cans in the research region. The spatial analyzer characteristics of GIS were employed to determine the degree of pollution brought on by the current dustbins. Each trash can contain burned waste, damaging the environment.

[9]. Meghana K. C. and Dr. I. R. Nataraj, "IOT Based Intelligent Bin for Smart Cities" The level of garbage filling was measured by the authors by installing ultrasonic sensors in the intelligent skips. Three different layers of rubbish are contained in the container. The sensors are informed of the level of waste every time it passes by. The GSM module subsequently transmits this information to the trash analyzer in an instant. The installation of three ultrasonic sensors at three separate levels of the container may not be desirable due to the sensors' increased cost and risk of damage from users' harsh handling. To prevent food waste, a lol-based smart trash system (SGS) is proposed.

[10]. A Creative Method for Waste Management in Smart Cities Using the Internet of Things, SuryawanshiSmitkumar B, KasliwalManasa F. In order to connect battery-operated smart trash bins (SGBs) to SCs, the authors use wireless mesh networks. A router and server then gather and analyses the data for service

provisioning. Additionally, the SCs offers a variety of user-friendly LOL features that extend battery life by using stand-alone operation and cooperation-based operation, two separate energy-efficient SOB operators. As a test experiment, the suggested SCS was utilized for a year in Seoul's Crogman neighborhood in the Republic of Korea. The trial's findings indicated that food waste may be reduced by 33%.

[11]. Kirrel, Vishesh Kumar. Using the Internet of Things, a smart rubbish collection bin overflow indicator. The authors have developed a system where each point for trash pickup will have a camera and a load cell sensor. The camera will be recording the garbage can continually. The load sensor and camera output can be compared with the threshold level that has been set. The comparison is made with the help of microcontrollers. Image analysis can help identify how much garbage is there, and a load cell sensor can help determine how much trash is present. In order for the controller to assess whether the threshold level has been exceeded, information is processed. This is simple to use but not economically rebranded.

III. PROPOSED APPROACH AND ALGORITHM

In this system, many trash cans are placed throughout the city or region. Each trash can is equipped with a camera to detect human face through face detection system and the trash can lid opens, saving us from having to pull a lever. In order to prevent garbage overflow, this lid turns off when the dustbin's level reaches the threshold limit. An ultrasonic sensor is utilized to track the dustbin's level. A servo motor, which is also connected to the microcontroller, is used to open and close the lid. The data from the ultrasonic sensor and the data from the face detection are transferred to the microcontroller and shown on a led display. The microcontroller is used to implement this recurring flushing characteristic. The microcontroller notifies the concerned person that the dustbin is full and prepared for dispatch at the conclusion of the process when the level has reached its maximum level. Batteries are used to power the complete smart trash can. A GSM module is used to send the message from the microcontroller to the concern person.

A. FACE RECOGNITION SYSTEM'S DESIGN

According to a comprehensive survey, many ways and combinations of these methods can be used to create a new face recognition system. We have chosen to combine knowledge-based techniques for the face detection component with a neural network approach for the face identification part out of the numerous options available. Their easy application and dependability difficulties are the primary factors in our pick. “Fig 3.1.1” illustrates our facial recognition system technique.

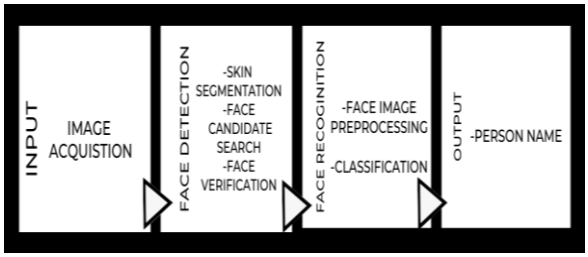

Fig 3.1.1. *Facial Recognition Technique*

An input is required for a face recognition system to work. An image acquisition process is carried out in this portion. For image processing processes, live images are captured and converted to digital data. These captured photographs are provided with this face detection approach.

For face recognition systems, face detection performs tasks including face picture extraction and location. Our experiments demonstrate that the first step in face recognition, known as skin segmentation, reduces the amount of processing time

needed to examine the entire image. Whether or whether there are faces present, just the segmented region is searched when segmentation is applied.

Because of this, skin segmentation is performed as the first step in the detection procedure. The RGB colour model is used to define hues that resemble skin. Variations in white balance result from the environment's shifting lighting conditions during the image acquisition process. This situation causes non-skin objects to develop skin object traits. As a result, before segmenting the acquired image, the white balance must be changed.

The "and operation" on segmented images is followed by a number of morphological procedures on the resulting skin image to search for viable candidates for faces. Noisy, like closing and removing little pieces Getting an Image Dark and Light Correction skin segmentation THE SKIN SEGMENTATION CANDIDATE SEARCH IN FRONT AND MORPHOLOGICAL OPTIONS Facial feature extraction from a face image Facial Feature 5 is used to conduct operations. After that, faces are chosen using two criteria: the bounding box ratio of the candidate and filling in certain gaps inside the candidate zone. The ideal bounding box ratio falls between 0.3 and 1.5.

These criteria are used to determine which face candidates should be extracted from the input picture using a modified bounding box of the original bounding box. The bounding box's height was modified to be 1.28 times bigger than its width as the candidate's chest and neck would be omitted if they were included. Experimentation was used to get this change value. These faces will be given to the unit that extracts facial features in order to verify the applicants.

B. BLOCK DIAGRAM

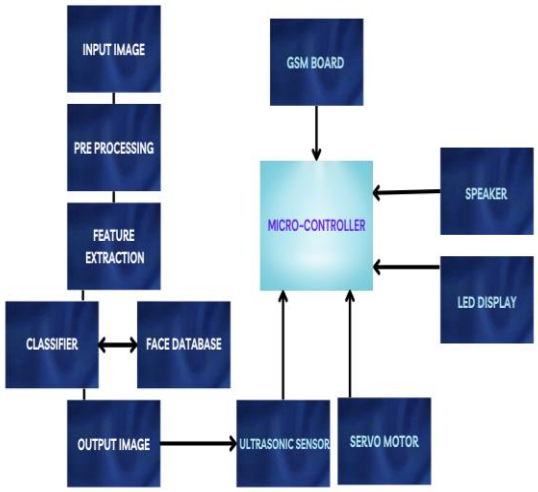

Fig .3.2.1 *Block Diagram*

C. MICROCONTROLLER STM32 F103C8

The Arm Cortex M CPU-based 32-bit STM32 line of microcontrollers aims to give MCU users a degree of freedom previously unheard of. In addition to integrating very high performance, real-time capabilities, digital signal processing, low-power / low-voltage operation, and connectivity, it offers devices with full integration and ease of development.

D. SERVO MOTOR

This motor is used to open the lid when the clap sensor's signal is received. The motor may spin the lid up to 180 degrees depending on the value of the clap sensor. Often, the angle can be altered between 0 and 180 degrees.

E. ULTRAMUSICAL SENSOR

The rubbish in the trash cans is measured by this sensor. It can range in size from 2 cm to 400 cm. The parts of this sensor are the transmitter, receiver, and control unit. With the use of this sensor, each trashcan is assigned a unique identification number, and the sensor also determines and records each dustbin's weight. A message is transmitted to the GSM board through the

microcontroller when this sensor detects that the level has been reached its maximum.

F. Board GSM

Messages from the microcontroller are sent to the administrators or other important parties using this board. As soon as the data from the ultrasonic sensors is received, the microcontroller delivers the message to the user using this board. A SIM card port and a SMA connector with a GSM antenna are both present on this board..

G. LED DISPLAY

This LED screen displays the message that was sent by the microcontroller. The location of the nearby smart garbage can is likewise shown by this LED.

IV. WORKING

Getting a picture from a camera is the initial stage in the face recognition process. Face detection using the captured picture is the second stage. The third phase is face recognition, which uses the facial pictures from the detection part's output. Person identity is the last step after the recognition stage. Numerous sensors, such as weight and proximity sensors, might be included in the smart garbage. The proximity sensors detect the presence of an object or person next to the trash can, while the weight sensors measure the amount of trash within the trash can. The microcontrollers within the garbage can receive and process data from the sensors. They are in charge of controlling the garbage can's numerous components, including the lid. the motor, and the communication module. Data transmission to the cloud-based platform or application is handled by the communication module in the trash can. To communicate data to the cloud, it makes use of a variety of wireless communication protocols, including Wi-Fi, Bluetooth, and Zigbee. The user interface may be a web application or a smartphone app that lets people check on the status of the trash can. Customers may track their garbage disposal habits over time and receive warnings when the dustbin is full.

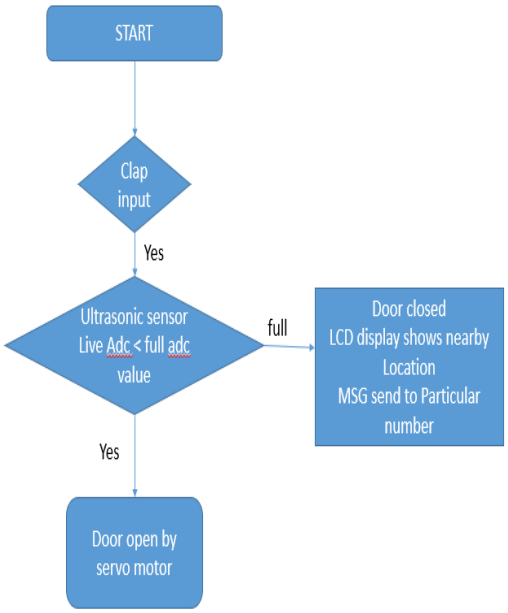

Fig 4.1. *Data Flow Chart*

V. CONCLUTION

The management and disposal of trash is one of the biggest issues facing cities. This paper describes how the autonomous self-navigating garbage can save time and money. The smart dustbin, which enables people to dispose of trash without having to physically contact it, makes the approach sanitary. Garbage is kept from overflowing by keeping an eye on the can's level or weight, which keeps the city clean and pollutant-free. The concerned party only needs to keep an eye on the common disposal point. This has a significant impact on how sanitary and clean the atmosphere is in a smart city.

VI. FUTURE WORK

The strategy described above is only a first step towards IOT implementation. This prototype might undergo a number of improvements that would revolutionize how we keep our surroundings safe and clean. The following improvements can be made: Adding multiple communal trash cans side by side will allow for automated waste type detection and placement in the appropriate

bin colour that corresponds to that type. These trash cans can be installed with GPS trackers so that the trash cans in a certain area may be readily discovered and emptied. This approach may result in a smart waste monitoring system. Together with the data, the current model will also be improved to make it more user-friendly and affordable.

VII. RESULT

When a face is detected, the lid of the dustbin will automatically open with the servo motor, allowing the user to dispose of their waste without touching the bin. The simulation circuit image is show.

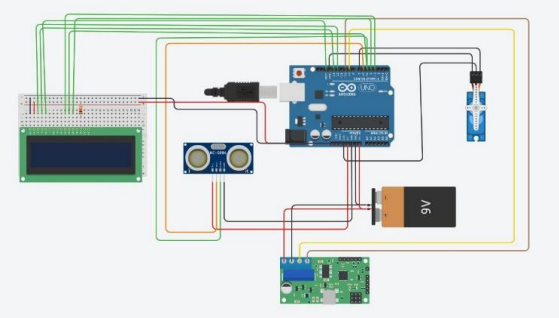

Fig .7.1.0 *Circuit Diagram*

Additionally, the smart dustbin is equipped with sensors that can detect when it is full.

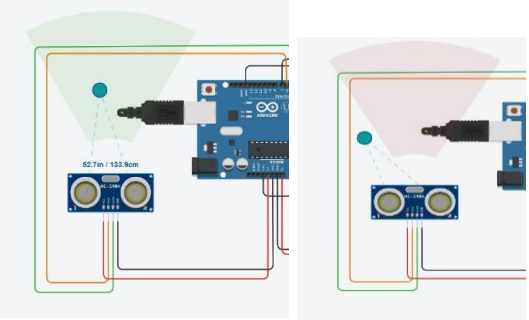

Fig 7.2.0 Working *Of Ultrasonic Sensor*

The gsm will send the information about the garbage in the dustbin is provided by the ultrasonic sensor. Every time the garbage exceeds the threshold value, the status is passed to the local authorities. Overall, the smart dustbin provides a convenient and hygienic way to dispose of waste, while also ensuring security and ease of use.

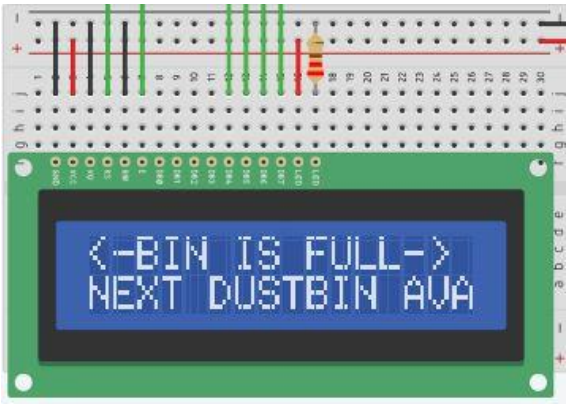

Fig 7.3.0 Working *Of Ultrasonic Sensor*

VIII. REFERENCE

[1]. Shankar A, Prarthana RJ, Vuayalakshmi B, and Kumar NS. Using an Arduino UNO, a smart rubbish alarm system is IOT based. IEEE Region 10 Conference (TENCON), November 22, 2016 (pp. 1028-1034). IEEE

[2]. Rafeeq M, Alam S. Automation of plastic, metal and glass waste materials segregation using Arduino in scrap industry.

[3]. Sai PY. IOT Smart garbage monitoring system in cities-An effective way to promote smart city.International Journal of Advanced Research in Computer Science and Software Engineering. 2017 Feb;7(2).

[4] . Baby CJ, Singh H, Srivastava A, Dhawan R, Mahalakshmi P. Smart bin: An intelligent waste alert and prediction system using machine learning approach. In2017 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET) 2017 Mar 22 (pp. 771-774). IEEE.

[5]. SMART DUSTBIN USING ARDUINO MamtaPandey , AnamikaGowala MrinalJyoti Goswami.MART DUSTBIN USING ARDUINO MamtaPandey , AnamikaGowala MrinalJyoti Goswami, ChinmoySaikia And Dr. Dibyajyoti Bora School of Computing Sciences - Information

Technology The Assam Kaziranga University,Jorhat, Assam, India

[6]. Zade R, Khadgi N, Kasbe M, Mujawar T. Online Garbage Monitoring System Using Arduino and LabVIEW.

[7]. Smart Dustbin Monitoring System using LAN Server and Arduino by Kannapiran Selvaraj and Dr. Arvind Chakrapani .

[8].]. Trash Management as an IoT-Enabled Service in Smart Cities by Alexey Medvedev, Petr Fedchenkoy, Arkady Zaslavsky, Lheodoros, Anagnostopoulos, and Sergey Khoruzhnikov.

[9]Kumar NS, Vuayalakshmi B, Prarthana RJ, Shankar A. IOT based smart garbage alert system using Arduino UNO.

[10]. SuryawanshiSmitkumar B, KasliwalManasa F., A Creative Method for Waste Management in Smart Cities Utilizing the Internet of Things.

[11] .Kumar NS, Vuayalakshmi B, Prarthana RJ, Shankar A. IOT based smart garbage alert system using Arduino UNO. In2016 IEEE Region 10 Conference (TENCON) 2016 Nov 22 (pp. 1028-1034). IEEE.

[12].Reddy PS, Naik RN, Kumar AA, Kishor SN. Wireless dust bin monitoring and alert system.

[13] Smart Dustbin Monitoring System using LAN Server and Arduino by Kannapiran Selvaraj and Dr. Arvind Chakrapani .

[14] . https://circuitdigest.com/microcontroller-projects/iot--smart-dustbin-using-esp8266.

[15]. L. Zhi-fang, Y. Zhi-sheng, A.K.Jain and W. Yun-qiong, 2003, “Face Detection And Facial Feature Extraction In Color Image”, Proc. The Fifth International Conference on Computational Intelligence and Multimedia Applications (ICCIMA’03), pp.126-130, Xi’an, China.