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Smart Trash Bin based on Internet of Thing and Machine Learning

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Abstract - *In the everyday growing community, health and hygiene is an important domain which can not be ignored or compromised for the well-being of human societies. This project presents Smart Dustbin-Separation of Biodegradable and Non-Biodegradable by using IoT. Now a day, due to the busy work schedule people are not able to Separate Biodegradable and Non-Biodegradable waste.*

As we know, metals get corroded due to moisture, these moisture's are naturally obtained by the decaying process of fruits and vegetables. This leads to diseases. Finally, we are stepping forward to keep the environment hygienic and clean. In this project, we are using a tensor flow image labeling technique for separating metals and non -metal wastes. The dustbin consists of a capacitive ultrasonic sensor, which can detect how much percentage of the dustbin is full and intimates with SMS when it is full. These wastes are stored in different bins. Therefore, the atmosphere gets free from air pollution. This process is done by using IoT. Our primary purpose of the project is to design a machine that can detect the trash object and classify it accordingly into the subsystem of trash-bin i.e. the system should be able to distinguish between biodegradable and non- biodegradable. Knowing the importance of waste management, it has become important if we could manage our waste on an individual scale. It will be useful and reliable to implement in residential societies, gardens, and playgrounds, schools – colleges as well as corporate and government offices

Key Words: Arduino Nano, NodeMCU, Ultrasonic sensor, Android studio, android app, ML Kit Image Labeling, java

1. INTRODUCTION

India's trash age remains at 0.2 to 0.6 kilograms of waste per head every day. Isolation at the source is significant for clean urban areas. India's per capita waste age is high to the point, that it makes an emergency if the junk jockey doesn't visit an area for two or three days. Squander has been heaping up in many dumping grounds all over India. The greater part of this waste is in blended structure and subsequently can't be discarded adequately.

The most ordinarily utilized waste taking care of systems is consuming waste or utilizing it as a landfill. It should be basic with respect to regions to isolate the degradable from non-degradable waste. Degradable squanders would then be able to be exposed to treating the soil. Squanders like plastic, metal, paper, and so forth can likewise be exposed to reusing. Here and there, the waste can really fill in as an asset. By isolating waste into various classes, we can actualize forms that will prompt viable asset usage. Presently the Municipal Solid Waste (MSW) squanders as one of the fundamental urban way of life (MSW) materials. The yearly strong waste is about 1.3 billion tones and it appears that this limit will rise to 4.3 billion tones constantly of 2024, which will cover half of the all-inclusive community around the world Furthermore, the dealing with the waste gathering forms is a standout amongst the most muddled assignments in the rustic territory on the grounds that the measures of strong squander produced by private and business modern site are colossal. These because of the colossal amounts of various sorts of strong squanders are delivering each day, which makes a disturbing issue of their transfer. Along these lines, a powerful way is required for the accumulation of strong waste and usage of strong waste instead of focusing on transfer alone.

Along these lines, strong waste administration incorporates the board of exercises identified with creating, to store, to gather, to dislodge and to transport, to reuse and to reuse, to process and to arrange, which ought to be ecologically good, tolerating to the standards of economy, feel, and vitality preservation. A careful review of waste management and the board is made because of the quick increment in the populace development just as monetary development, there is a wonderful increase in the wastage's which is made by us. Here, in the biological community, it makes a noteworthy issue and difficulties the city company of the city. This paper introduces an effective strategy for distinguishing and isolating the strong squanders. Utilizing IoT checking of hardware was made to play a critical role. As in the earlier days, strong waste gathering and management were proposed by numerous individuals in India and different nations.

However, it created just the aftereffect of refuse gathering and observing of the container limit and however the current was not compelling for usage in urban areas and country regions to control the rubbish contamination, unavoidable infections, and asset consumption. In order to conquer this, the present structure carried with a leeway of detachment procedure to maintain a strategic distance from the current issues. with the assistance of sensors like capacitive nearness and ultrasonic the plastics are recognized, and the receptacle levels are checked and overseen by getting fitting information to the city company in the city and in the provincial areas. This outline work can be executed for any urban communities and just as country areas.

2. Requirements

2.1 Hardware Components

2.1.1 Arduino Nano

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is the smallest, complete, and breadboard-friendly. It has everything that Diecimila/Duemilanove has (electrically) with more analog input pins and onboard +4V AREF jumper. Physically, it is missing power jack. The Nano is automatically sensed and switch to the higher potential source of power, there is no need for the power select jumper.

Fig -1: Arduino Nano

2.1.2 NodeMCU: ESP8266

NodeMCU is an open-source LUA based firmware developed for ESP8266 wifi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board.

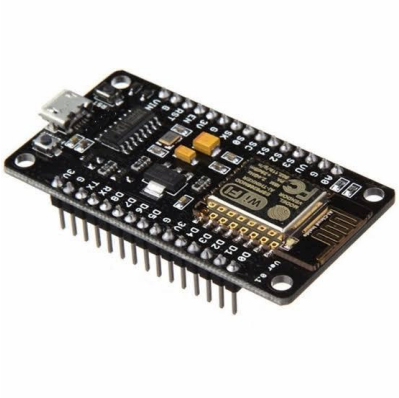

Fig -2: NodeMCU

2.1.3 Ultrasonic sensor

An ultrasonic sensor can convert electrical energy into acoustic waves and vice versa. The acoustic wave signal is an ultrasonic wave traveling at a frequency above 18kHz. The famous HC SR04 ultrasonic sensor generates ultrasonic waves at 40kHz frequency.

Typically, a microcontroller is used for communication with an ultrasonic sensor. To begin measuring the distance, the microcontroller sends a trigger signal to the ultrasonic sensor. The duty cycle of this trigger signal is 10µS for the HC-SR04 ultrasonic sensor. When triggered, the ultrasonic sensor generates eight acoustic (ultrasonic) wave bursts and initiates a time counter. As soon as the reflected (echo) signal is received, the timer stops. The output of the ultrasonic sensor is a high pulse with the same duration as the time difference between transmitted ultrasonic bursts and the received echo signal.

Fig -3: Ultrasonic Sensor

2.1.4 Servo motors

Servo motors are utilized in many applications. They are small in size and energy-efficient. Servo motors are used to operate radio-controlled toys or remote-controlled cars, airplanes and robots, etc. The servo circuitry is built right inside the motor unit and has a positionable shaft, which usually is fitted with a gear (as shown below). The motor

is controlled with an electric signal which determines the amount of movement of the shaft. We have used a 90-degree rotation motor to swipe the trash in a separate compartment.

Fig -4: Servo Motor

2.1.5 Android Smart Phone

Nowadays smartphones are used for multipurpose. Smartphones are handy and provide long-lasting battery. Warp-speed processing, Crystal-clear display, great camera, etc. In this project, we have used an android app that uses the camera of the phone and clicks the picture then segregates it into biodegradable and non-biodegradable.

Fig -5: Smartphone

2.2 Software component

2.2.1 Android Studio

Android is a mobile Operating System which is based on Linux Kernel that is developed by Google. In android, the user interface is user friendly. Android is designed mainly for touch screen mobiles such as smartphones and tablets. Android is not only designed for touch screen input but also it has been used in games, digital cameras, electronics, etc. The main goal of the Android project is to create a successful real-world product that improves the mobile experience for end-users. Android is a software platform developed by Google. It allows developers to write and manage code in a Java language, that uses Java libraries which are developed by Google. Java is a platform-independent language as it can run on any operating system. Also, java is portable and robust in nature. In this paper, we are using mobile applications in android and desktop applications in Java.

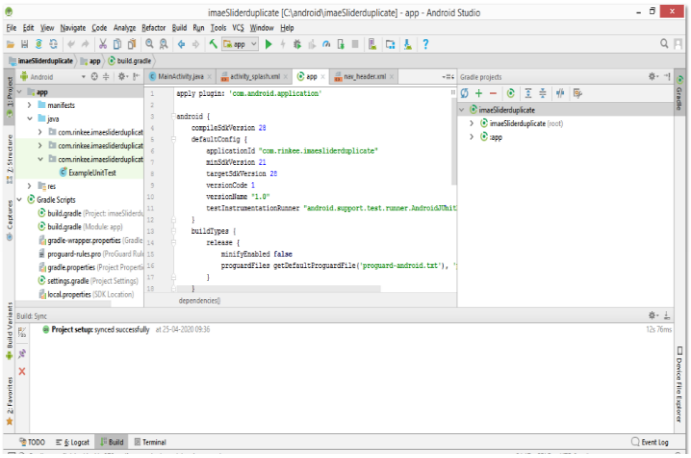

Fig -6: Android Studio

2.2.2 Arduino IDE

The Arduino Integrated Development Environment is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.[12] The Arduino IDE employs the program avrdude to convert the executable code into a text file in a hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. In our project, we have used the Arduino IDE for NodeMCU and Arduino nano.

Fig -7: Arduino IDE

2.2.3 ML Kit Image Labelling

ML Kit's Image Labelling is an API and model that can recognize entities in an image, and supply information about those entities in the form of labels. Each label has an accompanying score indicating how certain ML Kit is about this particular label. For example, if you provide ML Kit with an image of a fancy latte, then it might return labels such as "gelato," "dessert," and "coffee," all with varying confidence scores. Your app must then decide which label is most likely

to accurately reflect the image's content — hopefully; in this scenario, "coffee" will have the highest confidence score.

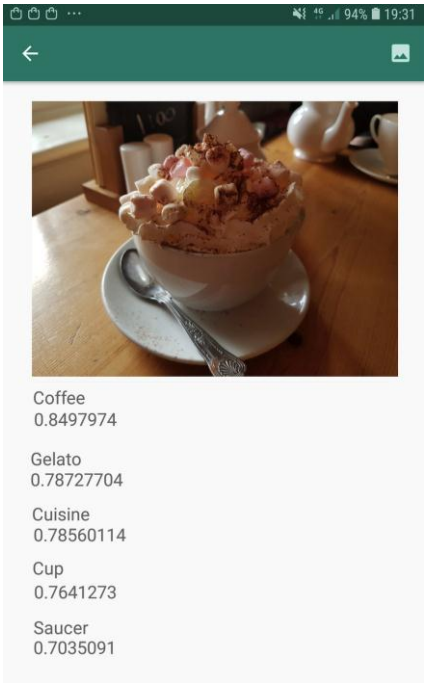

Fig -8: Image Labelling

2.2.4 Firebase: Real-time Database

The Firebase Real-time Database is a cloud-hosted. Data is stored as JSON and synchronized in real-time to every connected client. When you build cross-platform apps with our iOS, Android, and JavaScript SDKs, all of your clients share one real-time Database instance and automatically receive updates with the newest data.

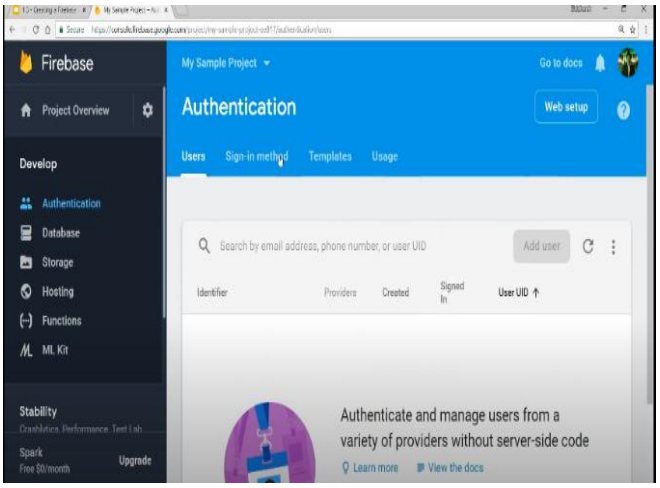

Fig -9: Firebase

2.2.5 Android app

We have made an android app for the segregation of trash. The name of the app is "Waste segregation". In this app first, we need to log in with username and password then the camera will get on. This app is connected with firebase for database activities. Firebase is an online database. The app is already trained with images. When an app in place in front of the trash then an image of garbage is captured through the camera and this captured image is compared with the data which is already present in our firebase data center. After that trash will get identified whether it is biodegradable on non-bio degradable and accordingly app segregate the trash. When the trash bin will reach to its threshold level a message is sent to the respective manager.

Fig -10: Android app

3. Use case Diagram

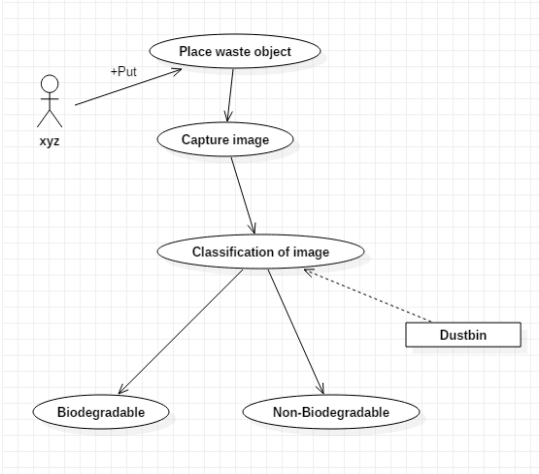

Fig -11: Use case Diagram

4. Flow Chart

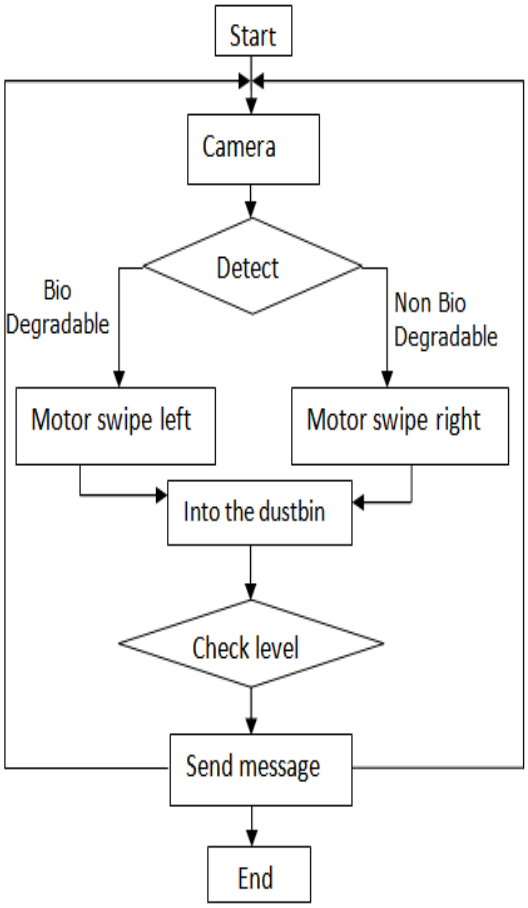

Fig -12: Flow Chart

5. Testing & Result

Table -1: Test Cases

Test Case ID	Objective	I/P data	Expected O/P	Actual O/P	Status
TC1	Login	Enter ID &Password	ID & Password Entered	Valid ID & Password	**Pass**
TC2	Checking for login detail	Enter Wrong user ID and password	User is invalid	User is Invalid	**Pass**
TC3	Checking for Biodegradable	Image	Labelled image	Successfully identified	**Pass**

	items				
TC4	Checking for Non-biodegradable items	Image	Labelled image	Successfully identified	**Pass**
TC4	Check SMS received	Dustbin Should be full	SMS received	SMS received to operator	**Pass**

6. Implementation Methodology

The proposed system is based on broad areas of sensors in IoT, programming in ML, and required hardware-software for implementation purposes.

Motion detection:

A motion sensor is a device that notices moving objects, mainly people. A motion sensor is frequently incorporated as a component of a system that routinely performs a task.

It will sense the nearby human activity and the garbage container will open up allowing a person to drop the waste item.

Object Detection:

Object Detection is the process of finding real-world object instances like car, bike, TV, flowers, and humans in still images or Videos.

It allows for the recognition, localization, and detection of multiple objects within an image which provides us with a much better understanding of an image as a whole.

It is commonly used in applications such as image retrieval, security, surveillance, and advanced driver assistance systems (ADAS).

Fig -13: Prototype

7. Advantages

1. The wastes can be categorized and segregated separately.
2. Almost every Non-Biodegradable wastes can be separated and can be sent to another recycling process.
3. Biodegradable wastes can be converted into organic Fertilizers. The source for Electricity can be provided by the emitted Methane gas.
4. There will be a promotion of organic Fertilizers among artificial Fertilizers.
5. Eco-friendly.
6. Reduces manpower.

7. Easy garbage collection.
8. Better & healthy lifestyle.

9. Future Scope

- The machine should able to segregate the products even when they are entered in bulk.
- Biodegradable waste products are useful in the process of creating ethanol which is extensively used as a solvent in many manufacturers.
- Electricity generation from waste is exciting as well as the profitable use of segregated products.
- The waste products can be used in the process of converting waste into fuel.
- Fertilizers can be produced and are useful in the agricultural field.
- Proper waste management may turn out to be beneficial to the ecosystem making earth cleaner and healthier.

9. CONCLUSION

The proposed system described in the paper is based on broad areas of sensors in IoT, programming in Machine Learning, and required hardware-software for implementation purposes. It works will be carried out in three phases: Object detection followed by waste segmentation and then informing the person in charge when the dustbin is full via text message.

Testing the product will be done by entering the waste items directly. The proposed machine would be able to detect and drop the waste items into biodegradable and non-biodegradable bins in the smart trash bin correctly.

There are only a few obstacles such as communication delay, waste coming in the bulk, response time, and placement of objects to be detected.

REFERENCES

[1] Eriksson, Ola, M. Carlsson Reich, Björn Frostell, Anna Björklund, Getachew Assefa, J-O. Sundqvist, J. Granath, A. Baky, and Lennart Thyselius. "Municipal solid waste management from a systems perspective." Journal of Cleaner Production 13, no. 3 (2004): 241-242.

[2] Henry, Rotich K., Zhao Yongsheng, and Dong Jun. "Municipal solid waste management challenges in developing countries–Kenyan case study." Waste management 26, no. 1 (2006): 92-100.

[3] Hazra, Tumpa, and Sudha Goel. "Solid waste management in Kolkata, India: Practices and challenges." Waste management29, no. 1 (2009) pp.470-478.

[4] Hoornweg, Daniel, and Perinaz Bhada-Tata. What a waste: a global review of solid waste management. Vol. 14. World Bank, Washington, DC, 2012.

[5] Guerrero, Lilliana Abarca, Ger Maas, and William Hogland. "Solid waste management challenges for cities in developing countries." Waste management 33, no. 1 (2013): 220-232.

[6] Plata-Díaz, Ana María, José Luis Zafra-Gómez, Gemma Pérez-López, and Antonio Manuel López-Hernández. "Alternative management structures for municipal waste collection services: The influence of economic and political factors." Waste Management 34, no. 11 (2014): 1967-1976.

[7] Patidar, Virendra, and Ritu Tiwari. "Survey of robotic arm and parameters." In 2016 International Conference on Computer Communication and Informatics(ICCCI),pp.1-6.IEEE, 2016.

[8] Purcaru, Dorina, Ioan Mircea Gordan, and Anca Purcaru. "Study, testing and application of proximity sensors for experimental training on measurement systems." In 2017 18th International Carpathian Control Conference (ICCC) , pp. 28v 63-266. IEEE, 2017.

[9] Shyam, Gopal Kirshna, Sunil kumar S. Manvi, and Priyanka Bharti. "Smart waste management using Internet-of-Things (IoT)."In 2017 2 nd International Conference on Computing and Communications Technologies (ICCCT),pp.199-203.IEEE, 2017.

[10] Rohit, G. Sai, M. Bharat Chandra, Shaurabh Saha, and Debanjan Das. "Smart Dual Dustbin Model for Waste Management in Smart Cities." In 2018 3rd International Conference for Convergence in Technology (I2CT) ,pp. 1-4. IEEE, 2018.

[11] Chaudhari, SangitaS., and Varsha Y. Bhole. "Solid Waste Collection as a Service using IoT -Solution for Smart Cities." In 2018 International Conference on Smart City and Emerging Technology (ICSCET), pp. 1-4. IEEE, 2018.

[12] "Updated: Arduino announces FPGA board, ATmega4809 in Uno Wi-Fi mk2, cloud-based IDE and IoT hardware". Electronics Weekly. 2018-05-18. Retrieved 2018-06-14