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E-WASTE MANAGEMENT WITH IOT DIVICES

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ABSTRACT
The use of electronic products has increased dramatically as a result of the rapid advancements in information and communication technology, particularly with regard to computers and mobile devices, which are becoming increasingly common in our homes and workplaces. Users are discarding outdated products due to the continuous upgrading of electronic gadgets, resulting in a significant amount of electronic trash. Although electronic trash is regarded as one of the major sources of reconditioned raw materials, improper disposal of it can pose a risk to both human health and the environment. It's critical to start in order to understand the regrettable dominance of electronic waste in the environment and society. appropriate comprehensive plan for managing electronic trash. Identifying, tracking, and handling electronic waste is one of the biggest issues the world is currently facing.This paper discusses an automated method that could enable the person to dispose of electronic garbage and receive payment for it. Utilizing With the help of the internet of things (IoT) and cloud computing as a backup, we are able to manage, identify, and keep an eye on the generated electronic trash. Smart city management of electronic trash is aided by it. Establishing appropriate regulations for the disposal of electronic waste, setting up suitable recycling facilities, and strictly enforcing existing laws regarding it can all contribute to slowing down the rate at which electronic waste is growing and, ultimately, to managing it sustainably and with minimal impact

1. INTRODUCTION

1.1 Electronic waste

Given that high-performance electronic devices were only produced towards the latter of the 20th century, the electronic waste is a modern unit. The phrase "electronic" Although there is no precise definition for waste, electronic waste can be defined as any electrical and electronic equipment (EEE) and its component parts that are discarded by people as waste that cannot be repaired. Different sorts of electronic trash might be classified based on different locations. It is sometimes referred to electronic scrap, WEEE, or waste electrical and electronic equipment. It includes a wide variety of equipment, including electrical parts, home appliances with electronic chips, and office equipment.

1.2 Internet of Things (IoT)

The Internet of Things (IoT) is a contemporary idea and technology that makes use of electronic devices connected to one another via wired or wireless networks. network without the user interacting with the electronic gadget within a town or specified area. The three primary groups of linked devices inside the Internet of Things (IoT) are consumer, enterprise, and industrial. Smart devices, wearable technology, and smart TVs are all connected consumer electronics. Under industrial and enterprise devices are things like smart traffic signal systems and smart city cameras, which are used to monitor traffic and weather conditions. To give the user accessing the electronic device in the area advanced services, the electronic device in this field exchanges data and communicates with other machines. The Internet of Things (IoT) allows electronic devices to communicate with administrators or servers about the status of waste bins in a city or neighborhood at all times. This saves time and provides a convenient method for vehicles to remove electronic garbage from the area.

1.2 Mobile app

The location of the waste, user information, waste information, and organizational or municipal information are all required in order to collect and recycle the e-waste from the city. Consequently, in order to successfully extract and recycle e-waste, a website or mobile application is required to carry out this procedure. Android Studio was used to construct the Android application used in this investigation. The official Android IDE is called Android Studio.Its goal is to develop Android applications for each and every an Android gadget. It contains an intelligent code editor that makes writing code easier and faster. This helps with code completion and code analysis by offering a selectable list. The built-in emulator in Android Studio enables developers to test apps across various Android versions and devices, including phones, Android TVs, and watches. It also speeds up program execution in real time. Additionally, it is compatible with Google Firebase, which aids in many other features such analytics, authentication, and notifications.

Additionally, it contains a layout editor that facilitates the drag and drop of graphic elements used in XML layout files. Additionally, it contains an APK Analyzer that allows you to view the contents of the APK, each size of the total APK size is seen.

2. METHODOLY

Pay as you toss is the mechanism used in this study, in which users connect to a mobile app to find the closest trash can or garbage truck to dispose of the trash made of electronics. Figure

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1 depicts the system's implementation. The garbage truck collector and the user, who may be the depositor or the collector, make up this system. The e-waste truck collector serves as a conduit between the city's installed garbage bins and its customers.

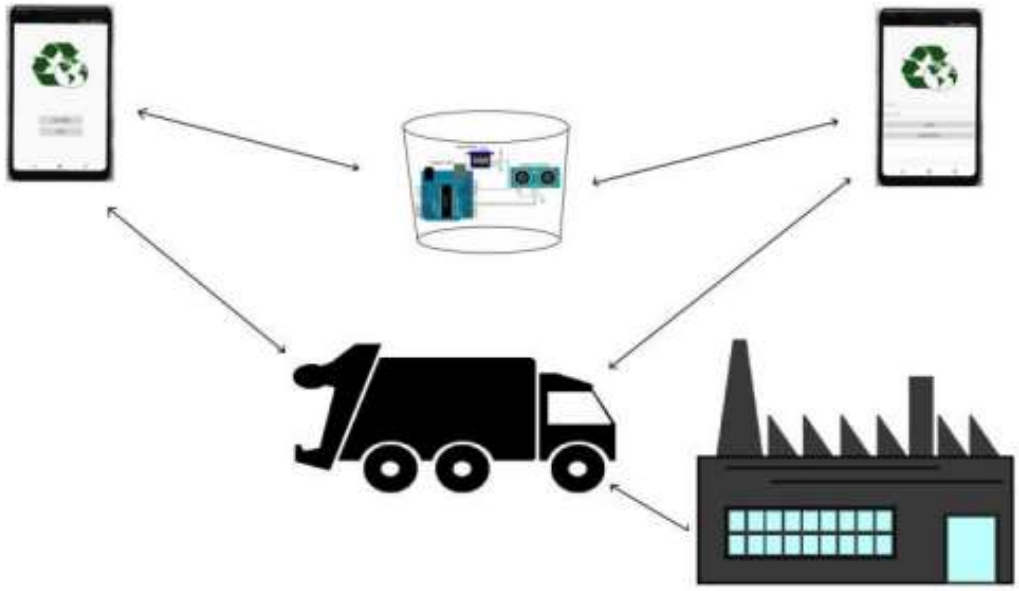

Figure 1: IoT-based e-Waste Management in Operation

Figure 1 illustrates the operation and interconnectivity of this system. This system consists of three fundamental components: the Internet of Things, the front end, and the back end side. Here, the terms "IoT" refer to the users, the e-waste collector, and the actual e-waste container. where the required sensors and equipment are included in the waste bin. This gadget assists in locating electronic garbage and notifying administrators and users of its presence. The people using mobile applications that are installed on their smartphones are referred to as the frontend side. Here, "backend" refers to the Android files kept on Google Firebase servers that contain logic and arithmetic commands necessary to carry out certain tasks and functions, as well as the results of the built functions.

2.1 Frontend (Android application)

Figure 2 illustrates how Android Studio was used to construct the Android application utilized in this study. This frontend uses three different kinds of Android applications. structure. Users need to have access to the mobile app, which contains the e-waste container and e-waste collector vehicle in order to deposit e-waste. Users can be either the depositor or the collector. To determine if the user is an e-waste truck or a user, a straightforward front-end user experience is designed. A number of options are available, each with a straightforward representation, contingent upon the user's method of application login. One of the functions offered to the user is the option to deposit or collect their e-waste.

The details of the electrical equipment kept within the closest electronic waste can, together with its location. Additionally, it shows where the e-waste collection vans are located within cities or in a particular place. Apart from the aforementioned features, each waste bin placed throughout the city is fitted with an Arduino microcontroller, which is employed to monitor the waste bin's condition and transmit an alert to the server when the container is full, storing and gathering the relevant data.

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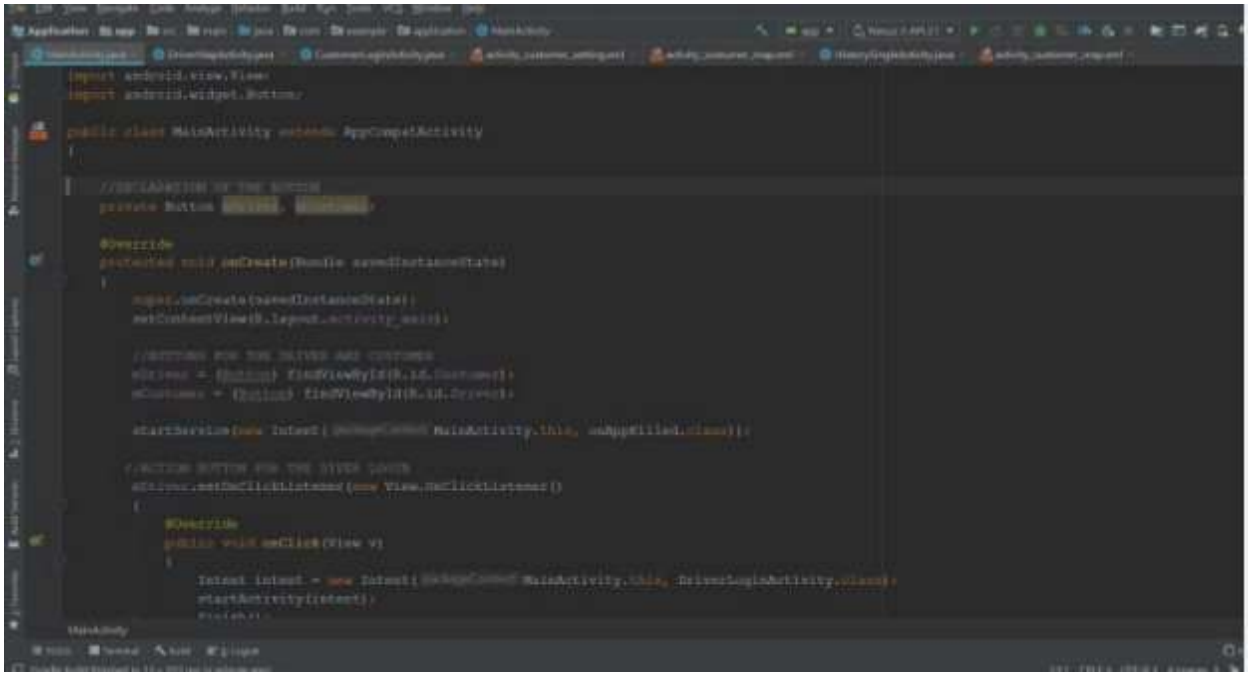

FIGURE2. A snapshot of android studio

2.2 Backend (server)

A computer that has been configured to send data to another computer via a local area network or the internet could be referred to as a server. The backend utilized in this system is firebase, a platform created in 2011 by a stand-alone business to facilitate the building of online and mobile applications. Google purchased the platform in 2014, and it is currently their top offering for app development services. It keeps the Android files and databases that are needed to retrieve data from them. The frontend which can either be the user or the e-waste truck driver makes a request to the backend server, and the server reacts to the request with appropriate criticism. Features offered by Firebase include email and password authentication, real-time data, integrated security, storing static files, and a file storage system with Google Cloud Storage backups.

2.3 E-waste bin (IoT)

The e-waste bin consists of hardware like ultrasonic sensor, android gadget, servo motor and microcontroller (Arduino). The ultrasonic sensor's purpose is to check if the trash can is filled to the brim. The way these devices operate is by sending a series of signal waves to the adjacent sides of the e-waste bin, which are then analyzed by the microcontroller, which determines whether or not the e-waste bin is filled. When the e-waste bin is filled, it sends data to the server, which then uses that information to create a mobile app that contains information about the electrical equipment and can be used for recycling or refurbishing. The e-waste bin's servo motor is responsible for opening and closing the bin; only users or the drivers of e-waste trucks who receive authentication from the server are permitted access.

2.4 E-waste collector

The e-waste collection serves as a conduit for users. It receives requests regarding the depositors and collectors in the city or region from users and the server. It also obtains authentication from the server to validate the e-waste and authorized user. Additionally, it is used to transmit information about the e-waste to the server in order to verify the product's endurance and quality.

3. IMPLEMENTATION

In this study report, we offer a solution that is backed up by an implementation. This framework offers a solution to problems with managing e-waste at home and workplace by providing the nominee with a financial prize at work. In order toUsers, or the collector, must follow the instructions provided by the server in order to obtain the e-waste from the e-waste bins and make payment for the item.

We can finish this concept by utilizing technologies like Firebase for the backend, Android for mobile applications, and the Internet of Things. A straightforward figure 3 depicts the implementation of this idea.

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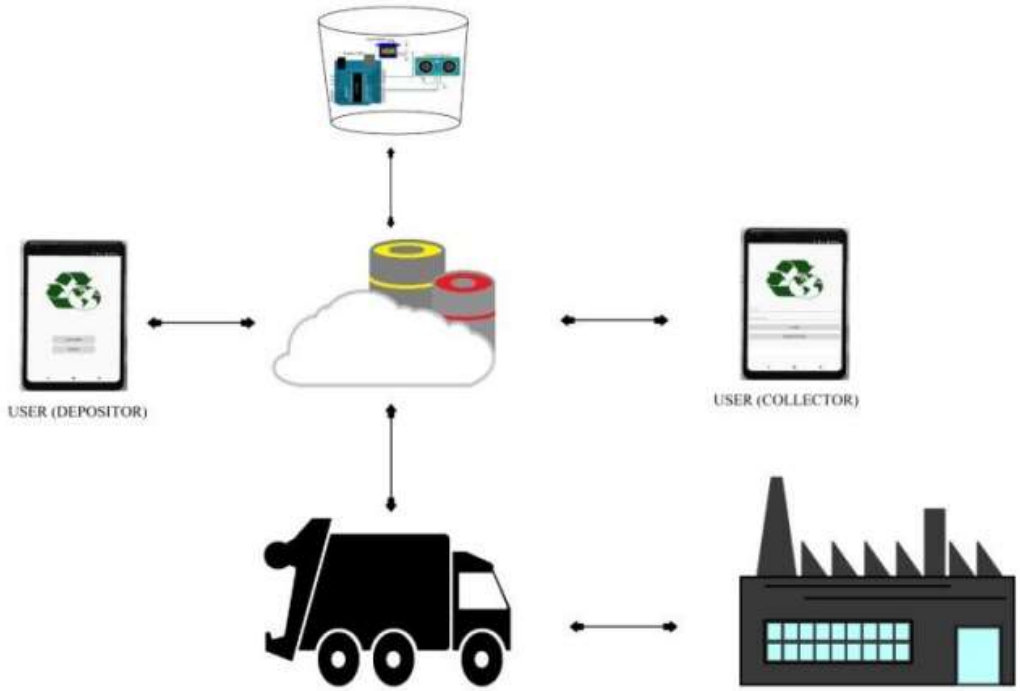

FIGURE3. Implementation of e-waste

1)Android Application (User)

Figure 4 displays a screen grab of the Android app that was utilized for this investigation. Users can access their application by logging in and selecting whether to buy or discard their previous offerings. Next, the program gives users options such as the position of the closest recycling truck, the location of the e-waste bin in real-time, and the current state of the e-waste that has been dumped within the recycling bin. An OTP is sent to the designated users from the server for authentication in order to open and close the e-waste bin. Additionally, users can verify the specifics of the electronic waste within the electronic waste container, as well as the depositor's details and check-in and check-out times.

FIGURE4. SANPSHOT OF THE APPLICATION

2. E-waste bin

As was previously noted, an e-waste bin is a component of the Internet of Things and is made up of hardware devices as well as an Android software that allows depositors to authenticate themselves. gatherer. In addition, it notifies the server as to whether the e-waste bin is full or empty in order to create an Android post.

3. Android application (E-waste driver)

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E-waste truck driver can log in using their required information and password. It gets request from the users and server about the depositors and collectors in the city or area. It also gets authentication from the server for confirming the authorized user and e-waste. It also use to send details about the e-waste to the server for confirming the durability and quality of the e-waste product to the server.

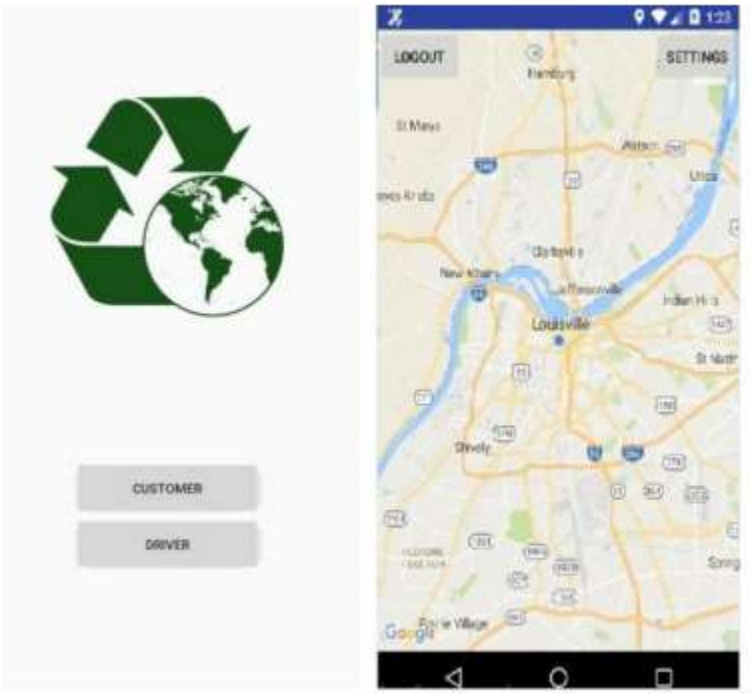

Fig.5-Output

4. CONCLUSION AND FUTURE ENHACEMENTS

As previously said, we put up a solution that is backed by an execution. This framework offers a solution to problems with managing e-waste at home and workplace by providing the nominee with a monetary prize. In order to obtain the e-waste from the e-waste bins and pay for the product, the users, or the collector, must follow the instructions provided by the server. Through the use of technologies such as the Internet of Things, Android mobile applications, and Firebase backend, we may finish this design.

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