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IOT BASED E-WASTE MANAGEMENT

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Abstract - *With the huge progress in the field of information and communication technology, huge increases in the use of electronic products have observed especially in computers and mobile devices are piling up in our homes and offices. With constant up-gradation of electronic devices, users are discarding the obsolete product, which is leading to huge waste in electronic waste. The electronic waste is considered as one of the important origins of refurbished raw elements but if it is not disposed of properly it can be dangerous to the human and the environment. To know the unfortunate domination of electronic waste in the environment and the society, it is important to initiate relevant master plan for electronic waste management. The detection, monitoring and management of electronic waste are one of the major problems facing in the world.*

This paper mentions about an automatic system that may let the individual proceed with the disposal of electronic waste and in doing getting a reward for it. With the use internet of things (IoT) and cloud computing as a backup, we can manage, detect and monitor the electronic waste which is generated. It helps in managing electronic waste with the use of smart cities. Making proper authority for the disposal of electronic waste, initiation of proper recycling locations and severe authorization of laws on electronic waste which can help to solve the rate of growth of electronic waste which can results in managing electronic waste in save process and also in sustainable manner.

Key Words: Internet of Things (IoT), monitoring and management, smart cities, Android app

1. INTRODUCTION

1.1 Electronic waste

The electronic waste is a modern unit, as electronic device of high performance was only developed in the end of the twentieth century. The term electronic waste has no specific definition for it, but one can define electronic waste as all the equipments of electrical and electronic equipment (EEE) and all the subsequent parts which are abandoned by the individuals as a waste with no purpose of refurbishing. Electronic waste can be defined in different types according to different places in some case, it is known as e-waste, Waste Electrical and Electronic Equipment (WEEE) or electronic scrap. It contains a broad range of equipments – electrical components, household equipments which has electronic chip inside, business equipments.

1.2 Internet of Things (IoT)

The Internet of Things (IoT) is a modern concept and technology which uses the electronic equipments which are connected all together through wired or wireless network in a specific area or a town without the user interacting the electronic device. The devices connected together inside Internet of Things (IoT) can be categorized into three main group consumer, enterprise and industrial. Smart TV, wearable and smart devices are connected devices in consumer device. Smart traffic light system, smart city camera – used to monitor traffic and weather conditions are classified under industrial and enterprise devices. In this field, the electronic device communicates and exchange date between the machines to provide advance services to the user accessing the electronic device in the area. With Internet of Things (IoT), the electronic device informs the administrators or servers regarding about the level of each waste bins in a locality or city at all time, to save time consumption and also to give a short way for the vehicles to extract the electronic waste.

1.2 Mobile app

In order, to collect and recycle the e-waste from the city it is necessary to have the location of the waste, information about the user, information about the waste and also the organization or municipal. Therefore, a mobile application or a website is necessary to carry out this operation for the successful extraction and recycling process of e-waste.

The android application used in this study is created using android studio. Android studio is the official android's IDE. Its purpose is to create android application for every android device. It has an intelligent code editor which helps in writing code better and faster which is benefited in code completion and analyzing the code by providing dropdown list. Android studio has its own build-in Emulator which runs the program faster in real-time and allows the creator to test applications in different devices like: phones, android watch, android TV in different android versions. It also supports Google Firebase which helps in services like analytics, authentication, notification and many more.

It also has layout editor which helps in drag and drop of visual elements which is used in XML layout files. It also has APK Analyzer which is used to inspect the contents of the APK, reveals each size of the overall APK size.

2. METHODOLOGY

The methodology involve in this study uses pay as you throw method, where any user connects to a mobile app to locate to the nearest waste bin or waste truck to dispose off the electronic waste. The implementation for this system is shown in fig.1. This system consists of the user which can be either the depositor or the collector and the waste truck collector. Where, the e-waste truck collector acts a bridge between the users and the waste bins which is installed in the city.

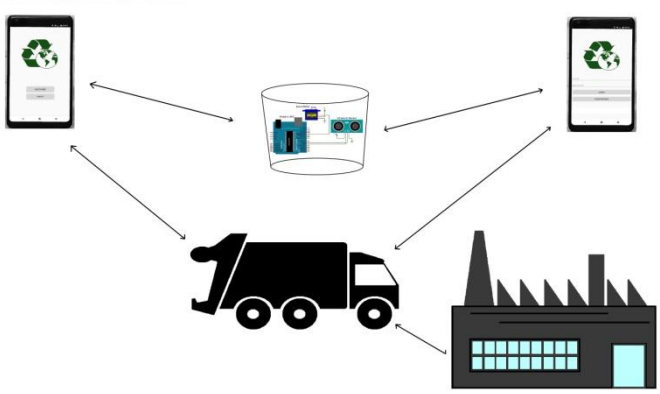


FIGURE 1. Working of e-waste management using IoT

Figure 1, shows how this system works and connected with one another. There are three basic parts which are used in this system they are IoT, Frontend and Backend side. The IoT here refers to the users, e-waste collector and the e-waste bin itself. Where, the waste bin consists of necessary sensors and equipments. This equipments helps in identifying the presence of electronic waste and alerting the users, admin. The frontend side refers to those users who use a mobile application which are installed in their smartphones. The Backend here refers to those android files which are stored in Google firebase servers where there are arithmetic and logic commands which are used to perform certain task and functions and the outputs of the compiled functions are stored in the database for future reference.

2.1 Frontend (Android application)

The android application used in this study is created using android studio which is shown in figure 2. There are three sorts of android application used in this frontend framework. In order, for users to deposit e-waste the user must have access to the mobile app, which includes the users (which can be either the depositor or the collector), the e-waste bin and e-waste collector truck. The frontend user interface is created in a simple design to verify whether the user is e-waste truck or a user. Depending on how the user logs into the application, there are several options which are represented in simple form. The function which are provided for the user includes whether the user wants to collect or deposit the e-waste.

The location of the nearest e-waste bin and also the details of electronic devices stored inside it. It also displays the location of the e-waste collector trucks inside the city or in a specific location. In addition to the functions mentioned above, the waste bin installed in the city is equipped with the microcontroller(Arduino) which is used to check the status of the waste bin and when the waste bin container is full it send an information to the server, where necessary details are collected and stored.

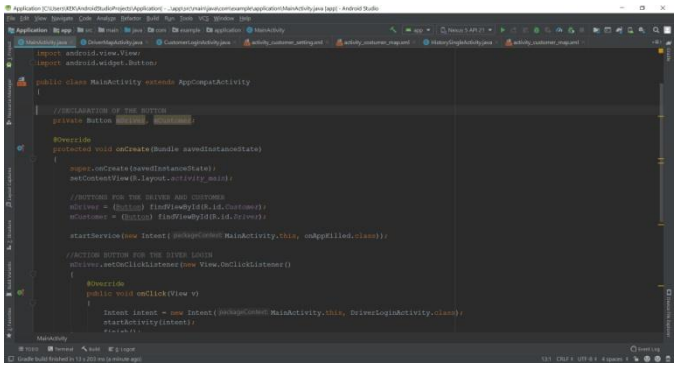


FIGURE2. A snapshot of android studio

2.2 Backend (server)

A server could be a computer which is programmed to provide necessary information(s) to another computer over a web or a local network. The backend used in this system is firebase which is a platform established in the year 2011 by a standalone company for the purpose if creating mobile and web applications and later in 2014, Google acquired the platform which is now their leading product offering services for app development. It stores the databases and the android files which is required to get information 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 suitable feedback. Firebase provides features like email and password authentication, real-time data, built-in security, static file hosting and file storage system which is backup by Google Cloud Storage.

2.3 E-waste bin (IoT)

The e-waste bin consists of hardware like ultrasonic sensor, android gadget, servo motor and microcontroller (Arduino). The objective of the ultrasonic sensor is to detect the completeness of the waste bin. The working of these equipments involves sending numerous signal waves to the adjoining sides of the e-waste bin to the microcontroller than, it analyzes these values and decides whether the e-waste bin is filled or not. Whenever the e-waste bin is full it sends information to the server and the server makes a detail of the electronic device to the mobile app for the purpose of refurbishing or recycling the e-waste product. The servo motor inside the e-waste bin comes into play by closing and opening the e-waste bin, where only those users or e-waste truck driver which get

the authentication from the server is able to access the e-waste bin.

2.4 E-waste collector

E-waste collector acts as a bridge between the users. 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.

3. IMPLEMENTATION

In this research paper, we propose a solution which is supported by an execution. This framework provides an answer to issues which for handling e-waste at home and workplace by fulfilling the nominee with a reward in the form of cash. The users i.e., the collector will have to go through the guidelines given by the server to acquire the e-waste from the e-waste bins by paying for the product. By the usage of technologies like the IoT, Mobile application (Android), Backend (Firebase), we can complete this design. The Implementation for this design is shown in a simple figure 3.

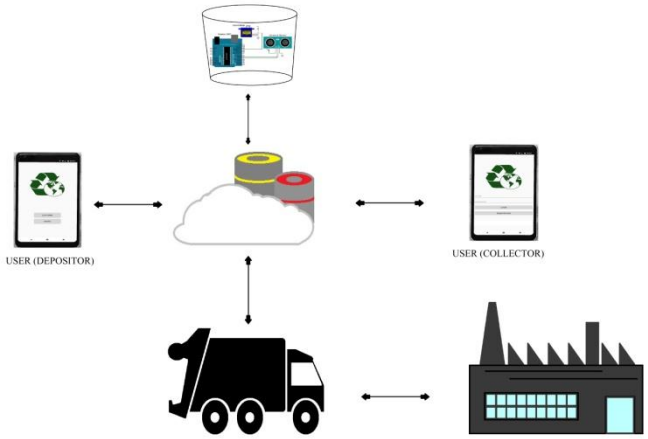


FIGURE3. Implementation of e-waste

1. **Android Application (User)**

A snapshot of the android application used in this study is shown in figure 4. Users can login to their application deciding whether they want to purchase or dispose of their old products. Then, the application provides options for users where the location of the e-waste bin is located, location of the nearest e-waste truck in real-time, live status of the deposited e-waste inside the e-waste bin. For opening and closing the e-waste bin OTP is send to the specific users from the server for authentication. Users can also check the details of the e-waste inside the e-waste bin and also the information on the depositor and also check-in and out.

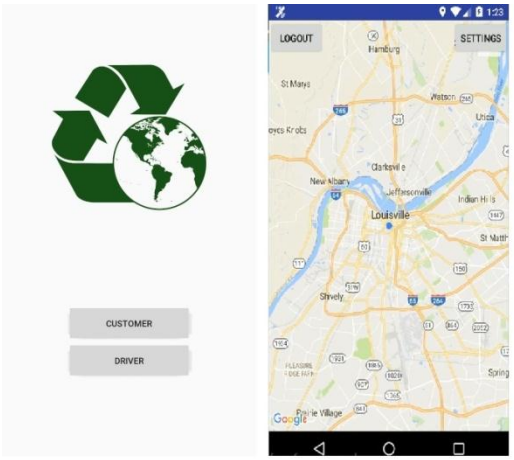
FIGURE4. SANPSHOT OF THE APPLICATION

2. **E-waste bin**

As mentioned in the above, e-waste bin is a part of IoT which consist of hardware equipments and an android application for authentication for the depositor and collector. Besides this, it also sends information to the server whether the e-waste bin is empty or full for the purpose creating a post in the android.

3. **Android application (E-waste driver)**

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.



4. CONCLUSION AND FUTURE ENHACEMENTS

As mentioned earlier, we propose a solution which is supported by an execution. This framework provides an answer to issues which for handling e-waste at home and workplace by fulfilling the nominee with a reward in the form of cash. The users i.e., the collector will have to go through the guidelines given by the server to acquire the e-waste from the e-waste bins by paying the for the product. By the usage of technologies like the IoT, Mobile

application (Android), Backend (Firebase), we can complete this design.

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REFERENCES

1. Md. Abdulla Al Mamun, M. A. Hannan, Aini Hussain "Real Time Solid Waste Bin Monitoring System Framework Using Wireless SensorNetwork" International conference 3740, 2009
2. Simone Capecci, Eduardo Cassisi, Giuseppe Granatiero, Cristiano Scavongelli, Simone Orcioni, Massimo Conti Dipartimento di Ingegneria dell'Informazione, Università Politecnica delle Marche Ancona, Italy "Cloud-based system for Waste Electrical and Electronic Equipment". IEEE 2017
3. Narayan Sharma, "Smart Bin Implemented for Smart City",I nternational Journal of Scientific & Engineering Research, Volume 6, Issue 9, September-2015
4. Issac, R;Akshai,M. "An effective solid waste management system for Thiruvalla Municipality in Android OS" IEEE Conference Publications , 2013
5. Gopal Kirshna Shyam1, Sunilkumar S. Manvi2, Priyanka Bharti3 "Smart Waste Management using Internet-of-Things (IoT)"IEEE 2017.
6. S Vinoth Kumar1, T.Senthil Kumaran2, A. Krishna Kumar3 and Mahantesh Mathapati4 "Smart Garbage Monitoring and Clearance System using Internet of Things". 2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), Veltech Dr.RR & Dr.SR University, Chennai, T.N., India. 2 - 4 August 2017. pp.184189.