

Efficient E-Wastage Management in Information Technology for Sustainable Growth

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ABSTRACT

The exponential growth of manufacturing industry is mainly driven by electronic industry which in turn produces e wastage as a by-product. The term "waste" is defined for materials, objects which is dumped by the customer rather than recycled, which includes residue from reuse and recycling operations. Electronic waste [1], or e-waste, is a term coined for electronic products that have turned as unnecessary, non-working, unusable or have become obsolete, and have effectively reached the end of their functional life. As the technology is growing at high speed, much of electronic devices become e-waste after a very short period from the day when the product is manufactured. In fact, the collection of old electronic substances is the largest contributor to the e-waste. E-waste consists of computers, laptops and mobile phones with obsolete hardware and software, monitors, printers, TVs, CD players etc. The management of e-waste is essential and need of the hour as electronic devices often contain dangerous substances which can be life threatening and environmental unfriendly. Solving the e-waste management problem begins with schooling and the habit changes as a result of gaining the knowledge. In this paper an attempt is made to address the problem by an efficient work flow model.

1. Introduction

The electrical devices which are not currently being used can be considered as e-waste. It may be the good old phone one has stopped using because of the change due to the arrival of advanced hardware or new version of the software. The following are some of the sources which adds e-waste to the environment in partial or in totality.

- Computers and peripherals
- Audio/Stereo Equipment
- VCRs
- DVD Players
- Video Cameras
- Telephones
- Fax and copy Machines
- Cellular Phones
- Wireless Devices
- Video Game Consoles
- Televisions - CRT, LED, LCD.



Fig 1. Examples of E waste

E-waste [3] contains dangerous materials such as mercury, lead and hexavalent chromium, in all the screens of televisions, laptops, CRT, LED, and LCD monitors, and batteries and in printed circuit boards. An average of four kilograms of lead is present in televisions and CRT monitors and weight of lead increases based on the size and make of the monitors. The improper handling of these toxics can cause many health hazards which can be life threatening [4]. The summary of various E-waste components, their toxin contents and effect on man and environment is listed below.

Table 1
Chemical Hazards Found in E-waste

| E-waste and components | Potential hazards | Potential health effects from long term exposure |
|--|----------------------|--|
| Cathode Ray Tube, Batteries, Older printer, Printed Circuit Boards. | Lead Dust | Anemia, Kidney damage, High blood pressure, Nerve and brain damage, Miscarriage and Birth defects. |
| Batteries, Switches, Thermostats, Fluorescent tubes. | Mercury Vapour | Nerve and Brain damage, Birth defects |
| Nickel-cadmium batteries, Printed circuit boards, Phosphor coating on CRT glass. | Cadmium Dust | Kidney disease, Bone problems, Lung cancer. |
| Printed Circuit Boards | Beryllium Dust | Lung disease |
| Plastic cases and Components. | Flame retardant dust | Thyroid hormone problems |

2. Management of E-waste

The management e-waste [5] in developing countries has is no unique model, as each country may have their own environmental, technical, financial and cultural conditions. Based on the climatic and financial conditions, e- waste can be managed in three ways viz.:

1. Reduce
2. Reuse and
3. Recycle.

This can be termed as three R’s of e-waste management.

Reduce: The purpose of using these three main aspects is to reduce the growth of e-waste at the stage manufacturing itself with the help of prototyping and smart manufacturing and judicial maintain. Prototyping and smart manufacturing are observed in developed countries and in MNCs of developing countries. In developing countries many small scale and medium scale industries are major contributors of e-waste due to lack of prototyping and smart manufacturing which is a result of stringent environmental policies.

Reuse: In reuse process, the components of e-waste and recycling of the electrical and electronic components which cannot be reused is carried out. To adhere to this process, the countries are requiring an adequate, comprehensive e-waste management system which will measure and track the e-waste in each of the electronic product. Below is the proposed intelligent e-waste management system work flow.

The above figure shows how intelligently e-waste can be managed. [6] The customers who wish to purchase new goods or components can return the old goods during the purchase. They can use the new goods or components till works as desired. Once the device is no more in use, may be due to out dated model or if it has reached it’s end of life, (as electronic goods gets older, the functionality may reduce) then the consumer can return old goods or e-waste to the manufacturer or reseller who accepts for recycling or reusing. The person will collect and remove the hazardous e- waste and then goes for shredding. In most of the cases, the e-waste can be recycled and re engineered to market them as refurbished and is introduced back in the market.

2.1. Proposed work

The Proposed work is based on the process management of e-waste throughout the lifecycle of any electronic product. When a customer purchase an electrical device from the seller, the seller collects the details of customer as well as products such as product name, type of product, life span of product etc.. sold to the particular customer and stores in the database. The proposed work automatically gives an alert message or intimation to the customer when the product’s life is near to expire and newer version of the product is available in the market, so that the customers can return the electronic device to the same seller to recycle or for reuse. The aim proposed system is to develop a workflow model for the manufacturer, assembler and for reseller. When customer returns the old device to reuse/recycle, the manufacturer, assembler or reseller has to examine the conditions of the devices and has to analyse and process the device and device components by reusing or by recycling.

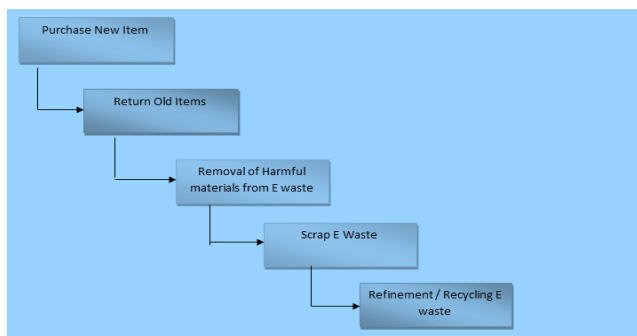


Fig 2. Flow Diagram for Smart E Waste Management

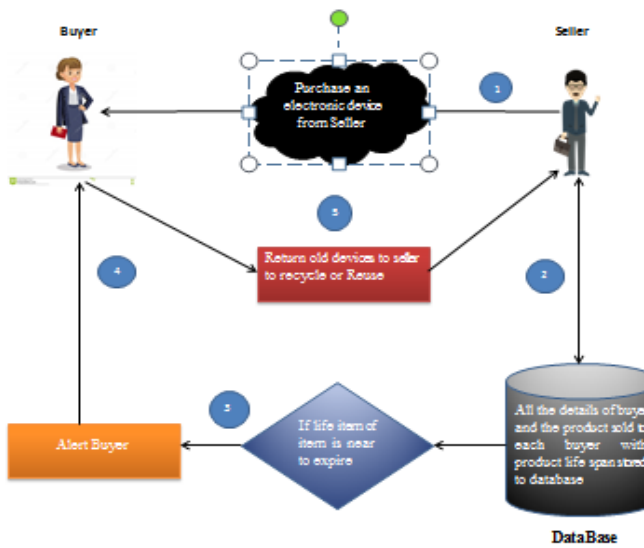


Fig 3. System Architecture

2.2 Proposed Algorithm:

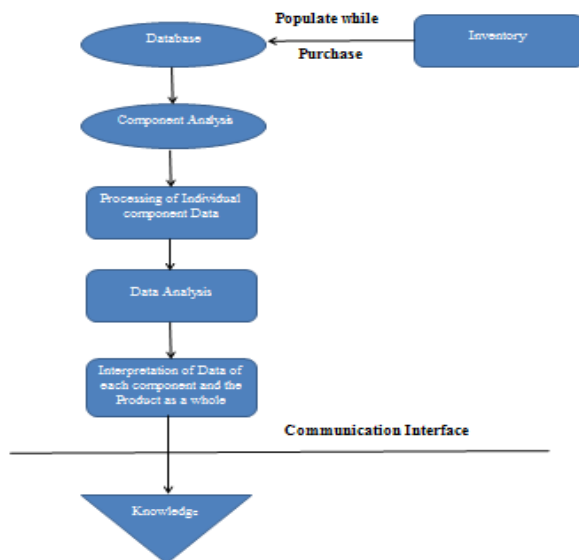


Fig 4. Overview of e-waste management process algorithm

Following are the advantages of the proposed algorithm.

1. Preservation of natural resources such as copper, nickel etc.. which can be segregated from the
2. E-waste and the same metals can be reused in the manufacture of new components.
3. Eradicating the harmful and hazardous effects on the climate and environment.
4. Helps the society by donating the old unused electronic devices to the needy, which in turn benefit the society at large.
5. Employment of man power. As e-waste collection, segregation and reuse requires huge man power which in turn creates jobs.
6. Saves the cultivable land. As of now, in many areas e-waste is being dumped on to the cultivable land which will alter the soil eco system by releasing the harmful chemicals.

Conclusion

The proposed work flow system is comprehensive and might be first of its kind in e-waste management strategy. As the algorithm and process are lined out in this paper, development of the software tool can be considered as future scope.

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