Green Technology for avoiding E-waste with the help of GIS

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Abstract: **Electronic waste or e-waste is one of the fast growing problems of the world. E-waste consists of variety of components, containing toxic substances which lead to environment and health hazards if not handled properly. It is important to find out what is the main source of this e-waste with the help of GIS and how we can minimize the e-wastage through green technology. This paper provides a concise overview of Mumbai's current e-waste scenario, namely to locate the source of e-wastage, environmental and health hazards, green technology methods to reduce the e-wastage.**

Keywords: **E-waste, Economical officers, HOTSPOTS, GIS**

I. INTRODUCTION

Electronic products like Television, Mobile phones and Computers have made our life easy; it saves time and increases the efficiency of the work. Now it has become difficult for us to operate things without these electronic equipments. Communication has become easy through mobile phones. Entertainment electronic products like television and music system have added things for our enjoyment. Household electronic appliances like refrigerator, microwaves have brought a comfort and luxurious to the present lifestyle.

These electronic appliances are been used everywhere, in rural as well as urban areas. The places which do not have electricity still manage to operate the electronic appliances with the help of batteries. Increase in the use of these products has resulted in increase of their production, and thus a new waste also, which is termed as Electronic waste

or E-waste. Today, E-waste is one the rapid growing problem in the world. There is a lack of awareness among people and its impacts on human health and the environment.

E-waste is the term used to describe old, end-of-life electronic appliances. The E-waste includes computers, laptops, TVs, DVD players, mobile phones, mp3 players, Computer Scrap, Electronic Scrap, Circuit Board, PCB, Secondary Computers, Printers, Fax, CD, DVD, Floppy, Tapes, Pen drives, EPBX, Wires, Cables, Entertainment Device, Mobile phones, Telephones, Television, Refrigerators, Air Conditioners, Lithium ion Batteries, Nickel Cadmium Batteries, Lead Acid Batteries, Compressors, SKADA/PLC Systems, Logic Controllers, Control Panel, Fans, Lights, Bulbs, CAT5 / CAT6 cables,

which have been disposed by users .E-waste is hazardous to health. The Central Processing Unit has lead, hexavalent chromium, beryllium into it. Lead, consumed at low level is harmful for children mental development. For adults it causes damage to kidney and reproductive system. Chromium damages lungs, a reason for bronchitis, liver. Mercury, damages fetus, harms brain. Brominates flames are a reason for thyroid. Beryllium, a long exposure to it causes lung disease. Cadmium causes damage to bones. The computers when not in use are normally destroyed and considered as a scrap, and are burnt leading to a toxic substance in the environment. A polycyclic aromatic hydrocarbon affects lung, skin and bladder. Epidemiological studies in the past on occupational exposure to PAH provide sufficient evidence of the role of PAH in the induction of skin and lung cancer
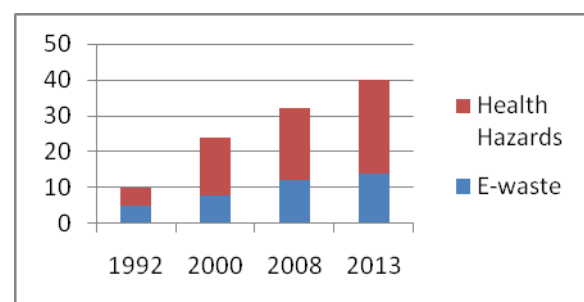

Fig 1: Health hazards caused by E-waste
Reference:Ewaste in India(RajyaSabha Secretiat Unit)

As per the study conducted by Greenpeace research center, Mumbai tops the country with around 50,000 tons of e-waste every year. The figure is projected to increase to 5 lakh ton per annum by 2014. Apart from that, the manner in which e-waste is presently being recycled is highly harmful for the environment and human health as well currently, the total e-waste generation in Mumbai is 5 lakh metric tons per annum.

So it is important to understand where does this E-waste is produced .E-waste has been categorized into three main categories, i.e., Large Household Appliances, IT and Telecom and Consumer Equipment. Refrigerator and washing machine represent large household appliances; PC, monitor and laptop represent IT and Telecom, while TV represents Consumer Equipment.
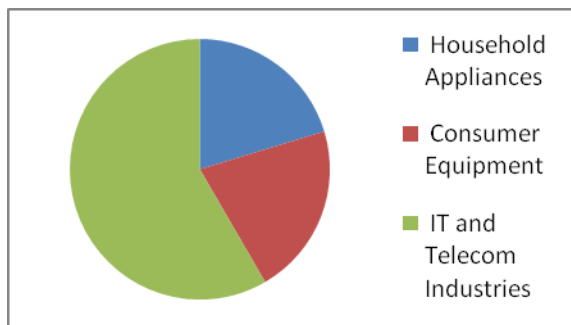

Fig 2: E-waste categorization

As we can see from the chart that the maximum e-wastage is been produced from IT and Telecom companies as it is the place where the maximum use of PC's, laptops, and n number of electronic gadgets are used. The main motivation of this paper is based on how the e-wastage can be minimized from these companies by Green technology. Also, it is important not just to solve the problem of e-wastage but to recognize the areas with the help of GIS and make them aware of green technology to avoid e-wastage for near future. Thus, to start by locating the area with the GIS technology as where in near future the maximum e-wastage can occur and how are we going to implement the green technology into it.

The growth rate of e-waste in India as it has emerged as an IT giant, thus also producing E-waste. Facts and Figures about E-waste:-

- The total e-waste generated in India amounts to 1, 46,180 tons per year.

- Sixty-five cities in India generate more than 60% of the total e-waste generated in India.

- Ten states generate 70% of the total e-waste generated in India includes Maharashtra, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab.

- Among top ten cities generating e-waste, Mumbai ranks first followed by Delhi, Bangalore, Chennai, Kolkata, Ahmadabad, Hyderabad, Pune, Surat and Nagpur.

- In India, increased demand for the key products like PC, TV, and Telephones in last 5-10 year has been responsible for the increasing amount of e-waste generation.

- In India, Among the 10 states, Maharashtra ranks first in the e-waste generation. The total e-waste generation in Maharashtra accounts for 20,270.6 tons per year. It shows that Greater Mumbai and Pune generates maximum amount of e-waste. This is due to the presence of a large number of Info Tech Parks & electronic products manufacturing companies situated in these areas, which plays the main role in e-waste generation.
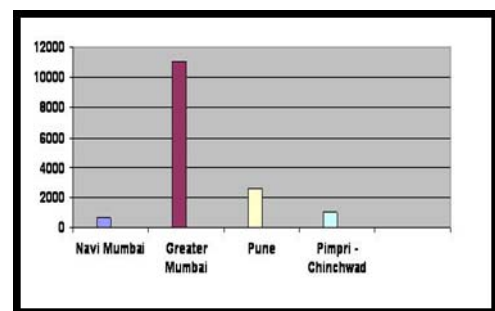
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Fig3: Chart for e-waste In 2007 (Tones per year) Reference: ENVIS CENTER, Environment department, Govt Maharashtra

2. ALGORITHM -RESEARCH METHOD

The aim of this paper is to find out the locations which are majorly responsible for e-wastage in Mumbai and implement the green Technology over those locations for betterment of human beings future. The location of e- wastage by the companies can be identified by GIS-Geographical information System MAP Geographic information system (GIS) is a system designed to Capture, store, manipulate, analyze, manage, and present all types of geographical data. A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.

All the electronic appliances function on a common source Electricity, with the help of GIS we can find out the total energy consumed in Watts is used in maximum in which area, lets term this as HOTSPOT, if the consumption of the energy is maximum than that particular location is using max electrical energy, since its been using this energy extensively, here it implies in this area there are maximum electronic

appliances been used and in future this area will have maximum e-waste.

A Geographic Information System, or GIS, integrates data, hardware, software and GPS to assist in the analysis and display of geographically referenced information.

- GIS is a general term that refers to any scientific effort integrates data to help researchers visualize, analyze, and explore geographically referenced information. For example, GIS is helping researchers measure the speed of glacier melting in Greenland and Antarctica. GIS can assist in the analysis of small-scale and localized data, as well, such as development trends, or watershed analysis.

- The acronym GIS refers to Geographic Information Systems - a tool that allows geographers and analysts to visualize data in several different ways in order to see patterns and relationships in a given area or subject. These patterns generally appear on maps but they can also be found on globes or in reports and charts.

- Latitude and longitude are usually used for this and the locations to be viewed are attached to their points on the geographic grid.

Algorithm for finding the e-wastage location /HOTSPOTS

Assumptions:

I. Energy distribution Data is stored in ArcGIS server
II. Application is connected to OLEdatabase
III. Area and city is selected through application and corresponding data is fetch from ArcGIS server.
IV. As per data 4500 Kwatts is required electricity, beyond that there is used in IT and Telecom areas.
V. As per data between 4500 watts and 2000 watts residential areas.
VI. Area can be ANDHERI or AIROLI or VIKHROLI and City can be MUMBAI
VII. Convert function is used to get Latitude and Longitude values
VIII. Red spots shows high E-wastage/HOTSPOTS
IX. Green spots show residential areas.

Pseudo code for locating E-wastage

1. Declare variable altitude
2. Declare variable longitudinal Function OleDbDataReader connectGIS(Parameter: strQry, connString)
3. Create OleDbConnection object using connection string as connString
4. Create OleDbCommand object using query string as strQry and OleDbConnection object Open database using ODBConnection object using open function.
5. Initialize variable strQry using sql statement
6. Create OleDbDataReader object for executing the query
7. Call function Convert_lat_long(Parameter: Location_Name)
8. If Power_Distribution greater or equal to 4500 watts
9. Declare and initialize variable map using esri.Map function to create map using lat long values of IT and Telecom industry
10. Else If Power_Distribution less than 4500 watts and greater or equal to 2000 watts
11. Declare and initialize variable map using esri.Map function to create map using lat long values of residential areas
12. Else Declare and initialize variable map using esri.Map function to create map using lat long values of Mumbai area.
13. End if.*End function* OleDbDataReader connectGIS
14. function Convert_lat_long(Argument: Location_Name)
15. Initialize variable latitude using lat(parametet: Location_Name)
16. Initialize variable longitudinal using long(Parameter:Location_Name)
17. End function Convert_lat_long.
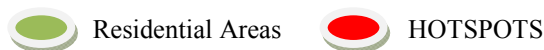
3. RESULT AND ANALYSIS

[3.1]HOTSPOTS

[3.1.1] HOTSPOT 1 IN MUMBAI [ANDHERI]

From the above algorithm we can find out where the maximum electricity is used and in particular we can inform the Industries and Companies how much energy is consumed and by what equipment.

[3.1.2] HOTSPOT 2 IN MUMBAI [VIKHROLI]

[3.1.3] HOTSPOT 2 IN MUMBAI [AIROLI]

 Residential Areas   HOTSPOTS

In the above diagram we can see that how these areas are located which consume above 6000 watts of energy; these are the HOTSPOTS and they fall under IT and Telecom companies are been located, and these are also the areas where e-wastage is maximum produced.

Table 1.Metrics for Electrical Energy Consumption used by Office electrical equipments

No.	Appliances	Approximate Load (Watts)	No. of Equipments	Avg Hrs/Day	Approximate Units
1	Desktop	200	10	12	720
2	Laptop	150	10	12	540
3	Printer	185	10	8	444
4	Fax	120	10	8	288
5	Scanner	100	10	5	150
6	Tube lights	40	10	14	157
7	AC	1700	3	14	2412
8	Phone	10	10	5	15

The above equipments are been widely used in offices and Industries. The working hours are 9.the employees mainly require systems as well as phones and AC's .In 1000 sq ft. office area, around 25 people can sit with their Pc's. The above table gives us an approximation of units used 6752 [I unit = 1000 Watts]. We will now compare units consumed by the appliances at residential places

Table 2.Metrics for Electrical Energy Consumption used by Residential Equipments

No.	Appliances	Approximate Load (Watts)	No. of Equipments	Avg Hrs/Day	Approximate Units
1	Mixer Grinder	60	1	1	18
2	Water Purifier	38	1	1	1.125
3	Tube Lights	38	3	5	16.875
4	Electric Iron	800	1	1	24
5	Refrigerator	550	1	24	396
6	Ceiling Fan	80	1	24	57
7	Exhaust Fan	115	1	1	3.45
8	Washing M/c	700	1	1	21
9	T.V	225	1	1	67.5

The above table depicts the units consumed by household appliances is 3245 .We can see the energy Consumption is much more in offices than in residential areas. On an average the electricity

supplied to areas is of 4500 Watts. Through GIS energy distribution model we can find out which areas are actually consuming max energy .That is these hotspots will produce e-waste in near future. Here we can implement green technology to increase the product longevity.

We need to do something about it, and to do something about it we must start at a grass root level. Many of the offices like IT companies, Telecom companies, and e.t.c. would require using the systems for their business. Here we need to implement Green Technology. The main reason on why the concept of Green Technology got recognition was due to the statistics revealed by the Energy Star about the consumption of energy by computers.

Green Technology is the environmentally responsible and eco-friendly use of computers and their resources. In broader terms, it is also defined as the study of designing, manufacturing/engineering, using and disposing of Technology devices in a way that reduces their environmental Impact [Definition: techopedia].It is also referred as Green Computing.

[3.2] Methods to overcome the e-wastage by Implementing Green Technology:

To implement green Technology we need to work in two ways; firstly the awareness about it in IT companies and second methods to implement it. It took almost a decade to realize the importance of Green Technology. Till now, this awareness has not been brought down in certain countries. The level, one should start working for, is to target the IT companies. Here's how the basic awareness must be created;

- Seminars about the Green Technology in the organization.
- Live Demonstration as how energy can be efficiently used.
- By introducing the terminology in the fresher's induction course to create an interest of employees.
- The organization owner should themselves be aware of this so they actually create awareness among the Employees.
- Intranet is a strong medium through which all can be informed.
- Emailing, Newsletter, Magazines in Office Campus can be used to spread awareness.
- Green Technology information available on company's Websites.
- As the employee is about to complete his task a message should be displayed on his screen to shut the monitor until not in use, this will make them habitual.

- Employees should be motivated to publish articles which should be included in their corporate Annual Booklet.
- Green Technology is the Need of time to secure our future; word of mouth publicity should be done by the Employees themselves.
- Conduct workshops for employees to explain importance of Green Technology.
- Companywide campaigns should be held to promote it in big campus offices.
- All the company's websites should create pop-ups so that will work as a motivator for the employees.
- Separate programs for Green Technology must be labeled and branded for companies so as to give Recognition for practicing it successfully.
- Promote and encourage initiatives that support Green Technology and use the company's event as a platform to showcase and spread awareness by demonstration (play) of the current programs.
- During Lunch hour's employee must practice these measures .

[3.3] Implementation methods for Green Technology:

Second important issue is that how the employees will contribute to implement Green Technology at the campus level .The key revolves around the green Technology is how to save the energy. This will also make offices economical.

- Monitors: If the monitor or the computer screen is not been used, then put it off. The screen, pixels uses a lot of energy.
- Method for using Printers or scanners: When not in use, they can be simply put off. Also possibly try to take print on double sides if need arises.
- Use of Internet: Whenever possible, try to avoid the use of printer if the process of work does not demand a Hardcopy. Try and imbibe the habit of emailing it to person. This causes lot of Carbon to be saved. Along with, heat generated by the printer.
- Online Learning: use of e-learning techniques, such as video conferencing can bring down the traditional method of classroom teaching decreasing travel cost and carbon dioxide emission.
- Power Management Settings: keep system, monitor into a sleep mode of 15 minutes so in absence of person the system is not been used up thus saving the energy.

- Select your computer hardware system by being an environment conscious person: When you select a computer hardware system for your campus, make sure the vendor is selling you a product for longevity.
- Use laptops instead desktop machines. When they have to be discarded it will be less scrap.
- Place a small plant in your office cubical and college computer laboratories which will consume the toxic substances and keeps a fresh atmosphere.
- A green Meter which will allow a certain amount of energy watts to offices and they have to work in that limit only.

Thus, by implementing these awareness and measures we can make Economical offices by consuming less energy resulting into less power bills.

4. CONCLUSION

The E-waste problem is a major threat to the health and the environment. This paper focuses on the issue as from where the E-waste is generated, how it is depleting the energy resources and causing various health hazards to humankind, also what can be done to avoid it.GIS techniques is been used to analyze the data to find out the areas where the E-waste will be produced in near future and to implement Green Technology in those areas to reduce the hazardous materials, maximize the energy efficiency of the product. This concept can be further improved and implemented on larger scale as by developing energy specific application which will generate a statistics report for individual companies as by which specific equipment the energy is used is maximum and which measures of Green Technology can be implemented.

ACKNOWLEDGEMENTS

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