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Analysing and Implementing Spatial Distribution of Cyber Crime Trends in India

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*Abstract***:**This paper shows the spatial distribution trends of cyber-crime analysis of various years with its practical implementation in ArcGIS. The first section of this paper describes the different types of cyber-crime with their punishment against cyber-crimes in India. In the next section it demonstrates spatial database maps of cases registered under IT Act 2000 for the years 2010, 2011,2012 and 2013, dot density maps of IT Act case according to age group and bar maps according to age group for the previous years 2011 to 2013are explained. These maps are compared with the registered IT companies in the state, IT companies per area of the state,cyber-crime /area of state. At last the trends of cyber-crime over state wise distribution is analysed so that proper action can be taken by the government or administrators.

Keywords:Geographic information systems;Cyber Security; Cyber-crime; IT Act 2000

I. INTRODUCTION

Internet has grown exponentiallyworldwide. Increase in the number of web users madesignificant rise in cyber space users in India.Social sites and IT revolution in India increases the usage of internet so much that it is not only the major IT destinations in the world but it has also become the third largest web users country after United States of America and China.Every coin has two sides. On one side new IT companies empowersgrowth of the country but on the other side the risk of information security and cyber-crime in India has risen with an exponential rise of cyber users.So there are some new challenges for policy makers for cyber-crime[1][2].

There are various types of cyber-crimes which includes Cyber StalkingIntellectual Property Crime, Salami Attack(Theft of data or manipulating banking account), E-Mail Bombing, Phishing, Personal Data Theft, Identity Theft, Spoofing, Data Theft, Worms Trojan Horses, Virus etc., Sabotage of Computer, Denial of Service, DDOS Demat of Service, Web Defacing, Spam and spoofing, Publishing or transmitting obscene material, Pornography, Child Pornography, Video Voyeurism and violation of privacy, Offensive messages, Hacking of Protected Systems.

Cyber security is a complex issue;it has no physical boundary of nationwide. It cuts the national boundaries and makes it difficult to find the origin of cyber-attacks[1].The Information Technology Act 2000 was passed by the Parliament of India in May 2000. Indian IT-Act 2000, section 65 is for Tampering with computer source code, section 66 is for Hacking and computer offences and section 43 is for tampering of electronic records etc. Legal framework to support cyber security in India consists of four acts i.e. Indian ITAct2000, Indian Copyright Act, Indian Panel Code and Indian contract Act, 1872[3].

GIS is a computer based tool that are used to capture, store, update, manipulate, retrieve, analyze, display, print and otherwise large amounts of geographic and attribute data.GIS is an emerging technology of IT which explains the spatial distribution of data on the map very easily so that a layman also can understand the message conveyed through the map.[4][2]

ArcGIS is ESRI's software for GIS implementation which provides a wide range of mapping, analyzing and developing environment to the user so that a customized solution can be obtained.

In this paper the trend of spatial distribution of cyber-crime with IT-Act 2000 is explained through various chloropeth maps, dot density maps and bar maps of 2010 to 2013.

II. LITERATURE REVIEW

Cyber-crimewas formulated in statistical form by National Crime Records Bureau,Ministry of Home Affairs,India[5][6]NCRB published reports namely "Crime in India 2011 Statistics","Crime in India 2012 Statistics" and web reference of table "Persons Arrested Under IT Act By Age Group During 2013",[7][8][9] where it gives tables for 2010, 2011, 2012 and 2013.

"Persons Arrested Under IT Act By Age Group During 2013 (States & UTs)" is a web reference created by NCRB[7]

Standing committee onInformation technology(2013-14), fifteenth loksabha published a report"Cyber Crime, Cyber Security and Right to Privacy"[1]. It includes challenges and constraints, policies and right to policy of Cyber Security.

Prashant Mali[10]published an article in Security Corner, where he explains basic concepts and terminology on cyber-crime.

Chaturvediet.al.[3]explains the Cyber Security Infrastructure in India. It explains initiatives at international level, challenges for India and initiative taken in Indian context.

Byres et.al.[11]emphasizes on the SCADA & control protocols should also be improved to include security features.

Bhargava et.al.[4] (2013) explains the GIS analysis of rainfall data.

Bhargava et.al.[2] (2013) explains the spatial database handling in GIS.

III. PURPOSE AND OBJECTIVE

The purpose and objective of this paper is to highlight the cyber-crime trends on the map so that the spatial distribution of

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cyber-crime according to cyber-crime type, according to age group for the previous years can be analyzed.

Various types of cyber-crimes with their punishments from the report "Cyber Crime, Cyber Security and Right To Privacy, Fifty Second Report" by National Crime Records Bureau, Ministry of Home Affairs, Govt. of India,are compiled in the table 1. to aware the public about these crimes and government policies[1].

Only data are not sufficient to analyses any fact. To Understand the spatial distribution of these cyber-crime data, analysis in context to geographic location is required.

Table 1. Types of Cyber Crime and Punishment

S.N	*Crime Type*	*Compensation*	*Punishment*	*Fine*
1	Cyber Stalking	Yes	3 Years	Yes
2	Intellectual Property Crime	Yes	3 Years	Yes
3	Salami Attack(Theft of data or manipulating banking account)	Yes	3 Years	No
4	E-Mail Bombing	Yes	3 Years	No
5	Phishing	Yes	3 Years	Yes
6	Personal Data Theft	Yes	3 Years	Yes
7	Identity Theft	Yes	3 Years	Yes
8	Spoofing	Yes	3 Years	Yes
9	Data Theft	Yes	3 Years	Yes
10	Worms Trojan Horses, Virus etc.	Yes	3 Years	Yes
11	Sabotage of Computer	Yes	3 Years	Yes
12	DOS, DDOS Demat of Service	Yes	Upto Life time Imprison ment	
13	Web Defacing	Yes	3 Years	Yes
14	Spam and spoofing	Yes	3 Years	Yes
15	Publishing or transmitting obscene material	No	3 Years	Yes
16	Pornography	No	5 Years	Yes
17	Child Pornography	No	Up to 5 Years	Yes
18	Video Voyeurism and violation of privacy	No	3 Years	Yes
19	Offensive messages	No	3 Years	Yes
20	Hacking of Protected Systems	No	10 Years	Yes

IV. METHODOLOGY

Data collection:

Crime Data has been collected from various reports like "Crime in India Statistics 2011", "Crime in India Statistics 2012", "Persons Arrested Under Cyber Crimes (IT Act + IPC Sections) By Age Group During 2013 ", "Persons Arrested Under IPC Sections for Cyber Crimes By Age Group During 2013 (States & UTs)", etc reports of National Crime Records Bureau, Ministry of Home Affairs, Govt. of India and .

Create a table

Manipulate are arrange the collected data according to requirement In this paper "Crime.dbf" has been created and the attributes for this file areState_id,IT_Companies, IT_Act_Reg_2010, IT_Act_Reg_2011, IT_Act_Reg_2012, IT_Act_Reg_2013, Age_2011_below_18, Age_2011_18_30, Age_2011_30_45, Age_2011_45-60, Age_2011_60_above, Age_2012_below_18, Age_2012_18_30, Age_2012_30_45, Age_2012_45_60, Age_2012_60_above, Age_2013_below_18, Age_2013_18_30, Age_2013_30_45, Age_2013_45_60, Age_2013_60_above,Tempering_Doc,Hacking_Loss_Damage, Hacking,Obsecence_Pub,Failure_of_Compliance,Failure_to_assist_in_decryptingetc.
Data

Digitizing

1) *Scan the map and georeference it.*
2) *Create a geodatabase India_states in ArcCatalog*
3) *Digitize the map using ArcGIS*
4) *Create a common attribute, State_id in the attribute table of the geodatabase(which is further used to join it to State_id attribute of Crime table)*

Joining tables

Add Crime.dbf file to the ArcMap project and join it with the attribute table of India_State using the common attribute State_id.

Visual Analysis of the Data

Create chloropeth map , Bar Map and Dot Density Map from the above joined data.

Create Layout of the above Map

Insert map, legend, chart, table, scalebar, title etc. on the Layout.

V. EXPERIMENTS AND RESULTS

Chloropeth map of IT Act cases registered in 2010 , 2011, 2012, 2013, in various states of India, are shown in Fig. 1, fig. 2, fig. 3 and fig. 4 respetively.This shows that the cybe crime is spreading over the india drastically from southern part of india (mostly Andhra Pradesh, Maharashtra, Kerala) to the various states of the country, year over year. The main reason behind this is the most IT companies and IT users reside there.

Number of IT Companies registered in India are shown in fig. 5.It is clear from the map that the same result as of cyber-crime in fig.1,fig.2 and fig.3 from south to north is found.

Now an another experiment for the same data by normalizing the number of IT companies by area of states (as shown in fig. 6) and normalizing the cyber-crime data of 2013 by area is shown in fig. 7. It shows that mostly thenumber of companies /area are registered in Delhi, Kerala and Tamil Nadu

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but cyber-crime/area is mostly found in Delhi and Kerala only not so much in Tamil Nadu, as shown in fig. 7.

Cyber-crime type wise number of persons arrested in 2013 from various states of India with bar chart on the map is shown in fig. 8 which shows that most of the cyber-crime cases are of hacking with loss and damage. One Interesting result that has been noticed in this figure is that the most persons arrested for the tempering of document are from U.P. (as shown by violet color bar) and most persons arrested for obscene publication are from Kerala then Maharashtra is on the second place.

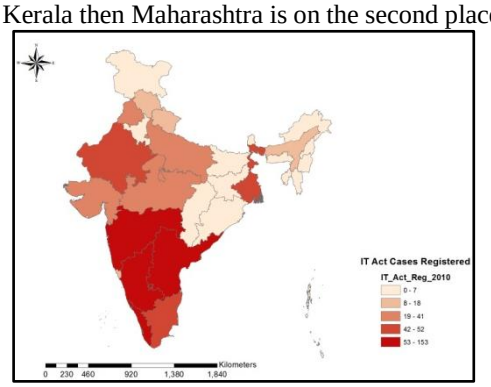

Fig. 1 Chloropeth map of IT Act cases registered in 2010 for various states of India

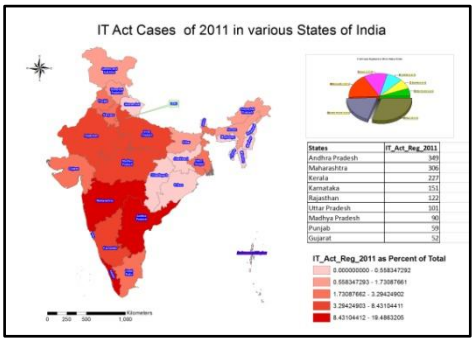

Fig. 2Chloropeth map of IT Act cases registered in 2011 for various states of India

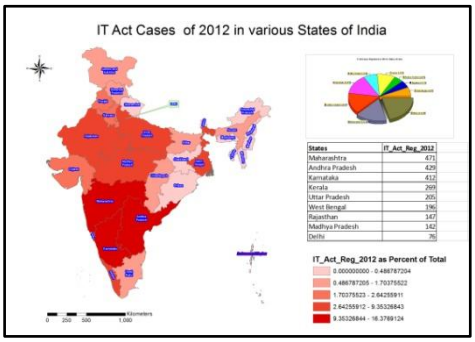

Fig. 3Chloropeth map of IT Act cases registered in 2012 for various states of India

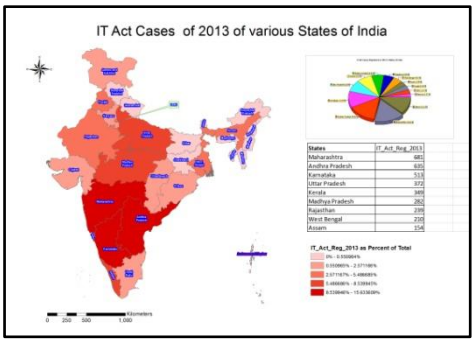

Fig. 4Chloropeth map of IT Act cases registered in 2013 for various states of India

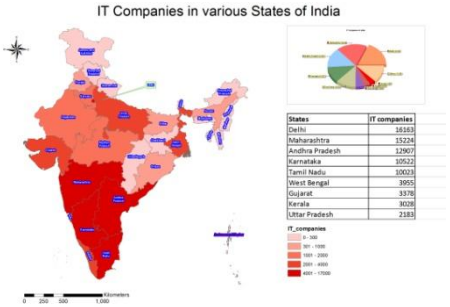

Fig. 5Chloropeth map of IT Companies in various states of India

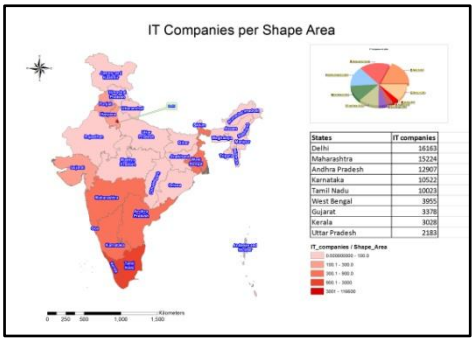

Fig. 6Chloropeth map of IT Companies normalize according to area of various states of India

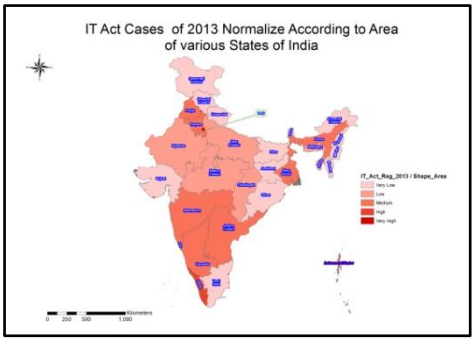

Fig. 7Chloropeth map of IT Act cases of 2013normalize according to area for various states of India

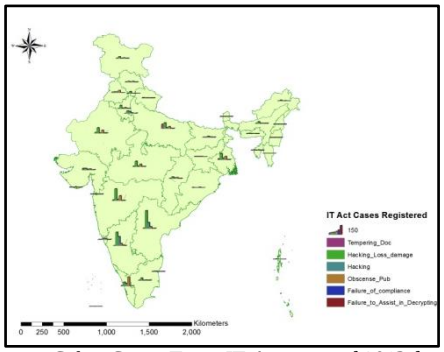

Fig. 8According to Cyber Crime Type IT Act cases of 2013 for various states of India with bar chart on the map

Tamil Nadu is the only state where the cyber-crime is very low inthe southern region (fig. 7).

West Bengal is the only state where most of the cyber-crime occurs in the eastern part of India, (fig. 7).

Delhi and UP has most of the cyber criminals in the Northern partof the country (fig. 7).

Bar graph map of the cyber-crime of various states according to age group in the year 2011, 2012, 2013 are shown in fig. 9, fig. 10, and fig. 11, which shows the comparative criminals study of various age group in various states of India. The result shows that most of the users in each state are of the age group 18 to 30 then they are of age group 30 to 45.

Dot density map of cyber criminals of various age groups in 2013 is shown in fig. 12. The color of most of the dots is green showing the criminals age group is 18-30. Dense dots are shown in Delhi, Kerala, Maharashtra, Andhra Pradesh, UP and West Bengal.

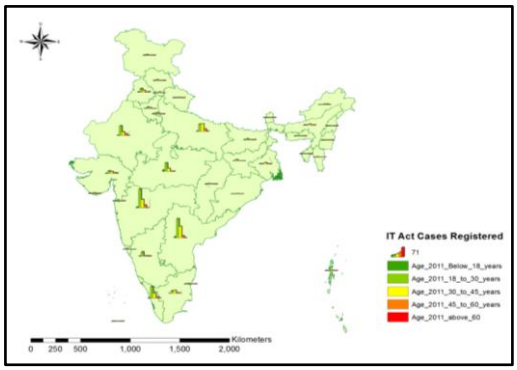

Fig. 9 According to age group IT Act cases of 2011 for various states of India with bar chart on the map

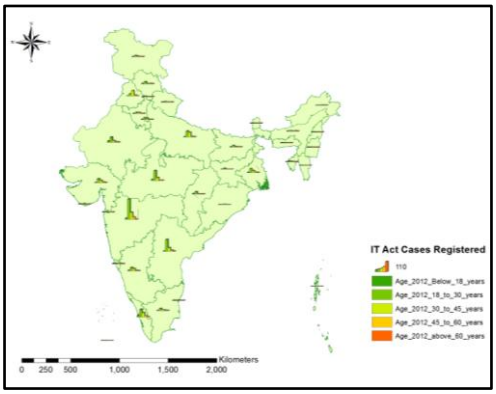

Fig. 10According to age group IT Act cases of 2012 for various states of India with bar chart on the map

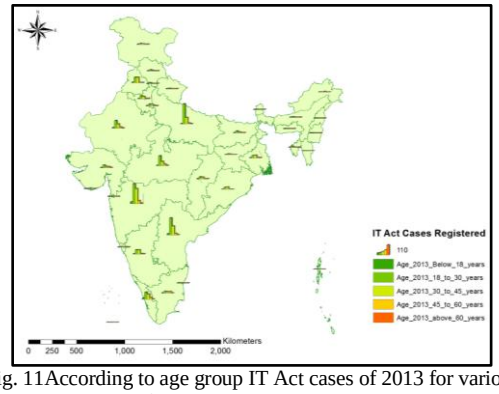

Fig. 11According to age group IT Act cases of 2013 for various states of India with bar chart on the map

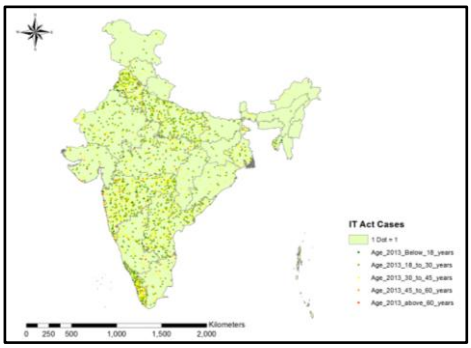

Fig. 12Dot Density map according to age group IT Act cases of 2013 for various states of India

VI. CONCLUSION

This paper shows that how chloropeth maps, dot density maps and bar chart maps concludes the spatial distribution of crime analysis results better than the tabular data.

Spatial distribution of cyber-crime spreading over the whole country from southern part of India (mostly Andhra Pradesh, Maharashtra, Karnataka, Kerala) to the other part of the country.

The criminal analysisrelated to IT Act 2000 of various age groups in various states of India shows that most of the users in each state are of the age group 18 to 30.It means the college users are frustrated so much to be fall in crime. So they must have to train in such a way that they can do some creative work instead of destructive work.

According to cyber-crime type, the numbers of persons arrested in 2013 are mostly from the 'Hacking with loss and damage' category. The maximum numbers of persons arrested for the tempering of document are from U.P. and most persons arrested for absence publication are fromKerala and Maharashtra. In Southern region only Tamil Nadu is the only state where the cyber-crime is very low.

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