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Internet Role in Remote Sensing and Geo Informatics System

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Abstract*: Remote sensing and geo informatics system (GIS) are difficult to find the source and accessibility of various applications by end users such as students, scholars, scientists and professionals. The overall objective of the learning is to compare as well as analyze the various applications of remote sensing by end users particularly in Tamilnadu. In this technical survey, total 114 people have participated, among them males and females are about 61.2% and 38.8% respectively, most of the people are at age group of 17-27. It is observed that students are the highest of about 36.9%, professional are 31.1%, research scholars are 26.2% and finally professors by 5.8% took the survey. Remote sensing and GIS applications are mostly used in the fields of survey/planning (51.5%), disaster management (49.5%), climate change (43.7%) and followed by agriculture/forestry (45.6 %.). The most generally used software's are identified as ArcGIS, ENVI, ERDAS and QGIS in remote sensing and GIS users. It is revealed that, 37% of people have moderate usage of cloud mapping and 21% of people have never used of cloud mapping. From ANOVA results, there is no significant difference in remote sensing and GIS role among location, educational qualification, type of sector, type of data and web GIS. There is a significant difference in remote sensing and GIS role among the age, gender, occupation, experience and software groups. The survey leads to the conclusion that the above groups have an effect on internet role in remote sensing and GIS. It is concluded that Internet plays a major role in geographic information systems and remote sensing by 95.1% of people and only 4.9% said internet have insignificant role.

Keywords : Remote sensing, geographic informatics system (GIS), cloud mapping, internet, online survey, ANOVA

I. INTRODUCTION

A. Remote sensing

Remote sensing is a technology; it provides information about an object, without having any direct physical contact.

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It is used in agriculture to classify crop types, forestry to study deforestation, geology, mineral mining, coastal management, climate change studies, disaster management etc [1, 3].

B. Geographical Information System (GIS)

GIS is a tool. It is designed to analyze, manipulate, capture, visualize, interpret and understand the geographical data. General applications of GIS are Thematic layer preparedness, Urban Sprawl/urban planning, Land use/ Land cover changes, Traffic/Transportation, Terrain analysis, Hydrology, Environment assessment, Town planning/city planning and etc [5,6,9].

C. Geographical Information System (GIS) and Remote sensing

Geographical Information System (GIS) and Remote sensing are the newly emerging technologies that act as a powerful tool that has ability to coordinate complex spatial environment with tabular relationship. GIS is a computerized system that helps in maintains geographic space data. Emphasis placed on developing digital database using the datasets derived from real time facts. The database concept is central to GIS, which be at variance from a computer based cartographic system that produces good quality maps [8].

Database Management System (DBMS) is an important GIS component for visualizing, modeling, analyzing and querying the database [2 ,16]. GIS and remote sensing tools can be used to solving real-world problems and complex issues concerning climatic change, water, urban planning, health care, food security and land scarcity, irrigation, traffic management, disaster monitoring etc. [4,10,11]. GIS is an important tool that uses remotely sensed data for disaster management information which helps in identifying escape routes and locations for storage of temporary housing, and analyzes the damage assessment incurred during disaster. Web-technology have prompted the educators scientists and experts to start developing web-based decision making tools which agree to planners and other government decision makers to use GIS data layers for making disaster management decisions [7,12-15]. Weather forecasts are based on satellite-captured images that can be accessed via the Internet. Forecasting and warning of natural disasters can definitely be made available on the Internet. When any disaster seems to be occurring at one geographic location, Internet devices aid other places in the world, where people and properties may be impacted by the same disaster in due course of time, take precautionary actions. Cyclones, forest fires and volcano lava flows can be monitored and observed in real time using Internet devices [16]. Internet technology has thus become a vital tool for disaster management through the sharing of information.

The Internet facility has tremendous power to share database and to process data in real time, which is vital to emergency management. Information sharing over the Internet reduces data acquisition time and thus provides an efficient way to make real-time disaster predictions (floods, forest fire, tsunami and hurricane etc) [10, 14]. In case of climate change, RS/GIS and field investigations are vital for producing base information on glacier changes and for improving our understanding of the complex linkages between atmospheric, lithosphere, and glaciological processes in tracing climate change trajectories and their impact on human survival. [12].

D. Remote sensing education and Internet

GIS and remote sensing are play a key role in ensuring global food safety that helps researchers, policy makers, and stakeholders improve food security and livelihoods that provide access to geospatial data with spectral, spatial, as well as temporal attributes at medium to coarse resolutions (Solh, M. *et al.*, 2013). Internet has now providing access to powerful new devices (pocket GIS) that allow the delivery of online maps, animation, and virtual reality, not only on the desktop but also in the field [5,8].

The present study is divided in to three parts. First part deals with the demographic questionnaires. Second part deals with the questionnaires on the various applications of remote sensing and GIS, which they focused for specific interest of the research. Third part deals with the questionnaires about the online and off-line software's, which they are being used for particular application. The present studies illustrate the uses of internet role in remote sensing and GIS by using real time responses from the user through online survey. This work is used as the basis for a discussion of some of the advantages of conducting social surveys within a GIS network.

II. MATERIALS AND METHODS

A. Survey questionnaires

Around twenty four questions are designed for this study. These questionnaires are classified into three parts. First part deals with the demographic questionnaires. Second part deals with the questionnaires on the various applications of remote sensing and GIS, which they focused for specific interest of the research. Third part deals with the questionnaires about the online and off- line software's, which they are being used for particular application. Here, the lists of questionnaires are mentioned:

First part: Demography questionnaires (1-7)

1) Gender
2) Age
3) Location Type
4) Educational Qualification
5) Educational Background
6) Current Occupation
7) Which type of Institute/University/Job sector you reside in

Second part: Questionnaires based on application of remote sensing and GIS (8-15)

8) What is your GIS and Remote Sensing skill at present?
9) If employed, what is your current salary status?
10) Your experience in remote sensing and GIS field
11) In your Point of view which field utilizes Remote Sensing and GIS the most?
12) What are all the software's you are familiar in remote sensing and GIS?
13) What type of software you use?
14) Which task you find it more difficult in RS and GIS?
15) What is the main issue that often you experience while working in RS and GIS?

Third part: Questionnaires based on software's used in remote sensing and GIS (16-24)

16) How good is Internet connection in your College/University/Company?
17) How often do you access online services/Tutorials for your work?
18) Which type of RS data you use?
19) Which satellite data you use in your work/project?
20) Which is the entire domain, you use as main source for Remote Sensing and GIS data?
21) In your opinion, Web-GIS is
22) What are all the other software's you use other than RS and GIS software's?
23) How often you use online/cloud Mapping services?
24) Does Internet play a major role in Remote Sensing and GIS?

B. Method

- ***Google forms***

The application of online survey website (Google forms) has been used for the survey of twenty four questions. Figure 1 shows the research design for the study of internet role in remote sensing and GIS applications used by various end users. The online link is available at http://goo.gl/forms/Cr5SDQ1ZdN.

- ***IBM SPSS -ANOVA Statistics***

IBM SPSS Statistics is an integrated family of products that covers the entire analytical process, from preparation to data collection to analysis, reporting and deployment. SPSS Statistics is loaded with powerful analytical techniques and time-saving capabilities to help quickly and easily find new insights into data [17]. A one-way variance analysis (ANOVA) is used to assess if there are any significant differences between the means of two or more independent (unrelated) groups. It is significant to realize that the one-way ANOVA is an omnibus test statistic and cannot determine which specific groups are significantly different from each other; it only provides that at least two groups are different. Since there may be three, four, five or more groups in study design, determining that of these groups differ from each other is significant. Methodology flow chart 1 shows the Survey research design for this study.

III. RESULTS AND DISCUSSION

Google form is used to collect the data from various sources. Analysis is performed based on bar charts and pie charts. Bar charts and pie charts provide better visual interpretation of the data.

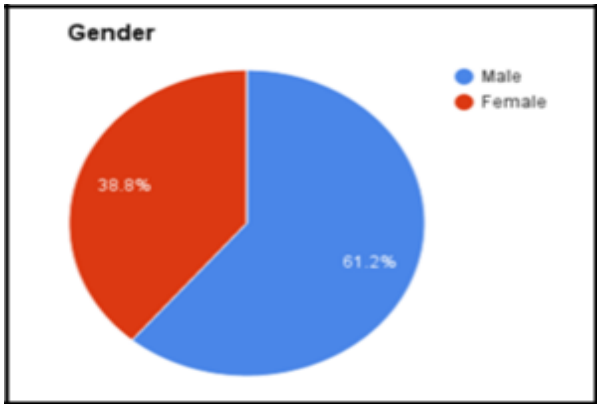

Fig. 1.Gender distribution

Fig. 2.

From Fig.1, the survey shows that males are more when compared with females. About 61.2% are males while the data shows female accounts for 38.8% percent only.

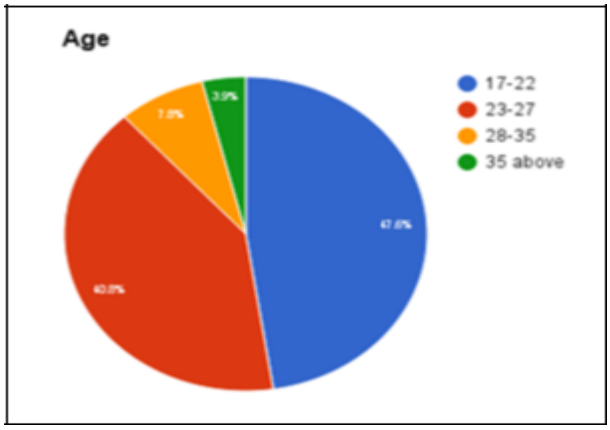

Fig.2: Age distribution

It is observed from Fig.2 that most people took the survey are from age group of 17-22 followed by 23-27, which shows that most of the people from Remote sensing and GIS field has been increased in past two decades.

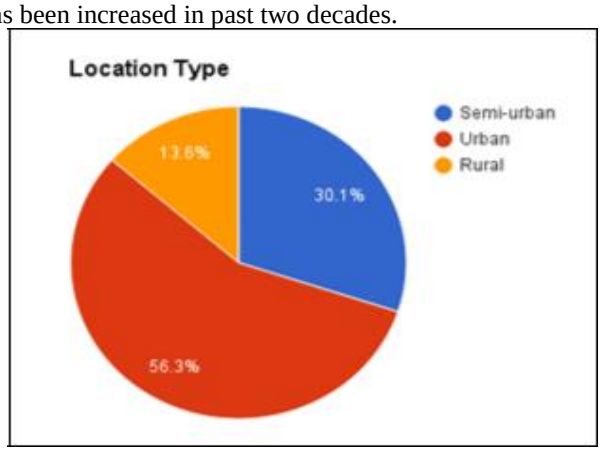

Fig. 3. Location details

Remote sensing and GIS is a fast growing field. From Fig.3 As presumed, urban area have highest percent of people about 56.3%. Semi-urban ranks second by 30.1%. Remote sensing and GIS have also reached some of rural parts of Tamilnadu with percent of 13.6.

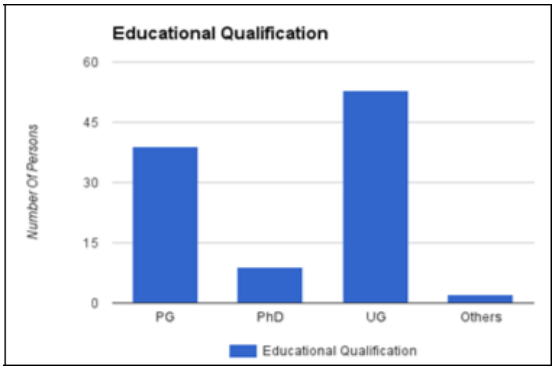

Fig.4: Educational level

Remote sensing and GIS education is offered by very few institutes in the state of Tamilnadu. Under-graduates are more when compared with other educational levels, followed by post graduates and PhD's. Other field includes diploma certificate courses and online courses. This shows that people having various form and level of remote sensing and GIS education took the survey regarding internet usage.

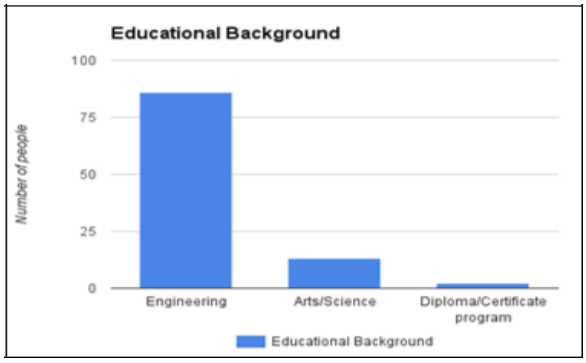

Fig.5. Educational background

From Fig.4 we have seen about level of remote sensing and GIS education. Fig.5 shows the details about the type of education stream. Engineering is the most preferred form of education in Tamilnadu. Followed by Arts and Science and diploma programs.

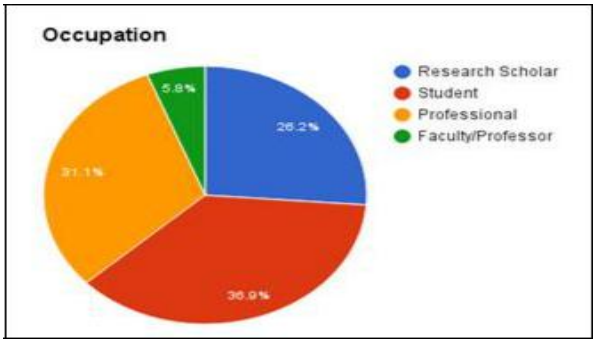

Fig.6: Occupation

Fig.6 illustrates the occupation of the people who took the survey. It is observed that students are the highest of about 36.9% then comes professional with percent of 31.1. Research scholars by 26.2% and finally professors by 5.8% took the survey.

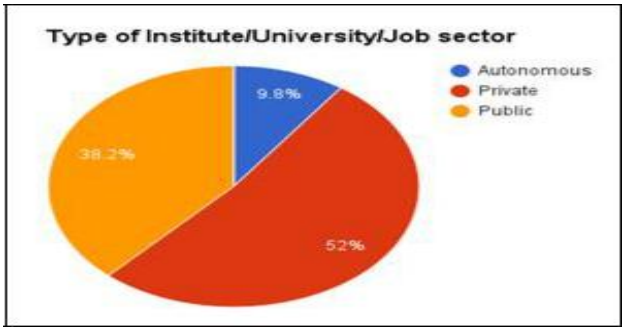

Fig.7: Sector type

Remote sensing and GIS jobs and education mostly found in private sectors in Tamilnadu. From the Fig.7, 52% of jobs or education lies in private sector where only 38.2% lies with public sectors.

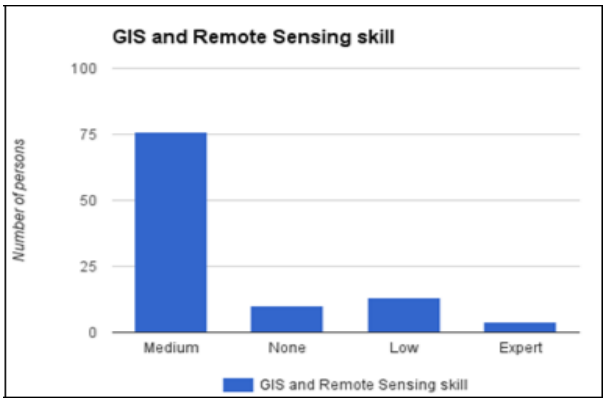

Fig.8: Remote sensing and GIS skill level

Recent developments in the field of remote sensing and GIS led to higher form of education and jobs thus creating skilled professionals. It is observed that more than 70% of people took survey are medium skilled persons. Yet experts are lower in this field of study.

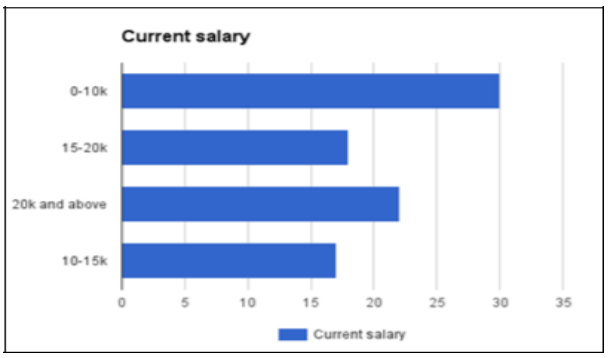

Fig.9: Salary status

From Fig.9 Entry level persons are more in this field of study. It is observed that other category of salary range is in similar levels. This ensures the constant development of RS and GIS field in terms of economy.

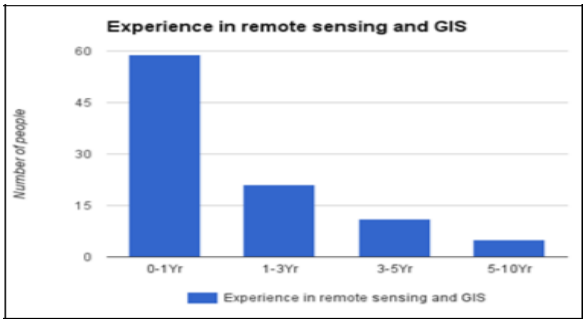

Fig.10: Experience level

Fig.10: shows that less experienced persons are at higher rates. More than 50 percent people took the survey have less than one year experience. Higher the experience level, lower the persons

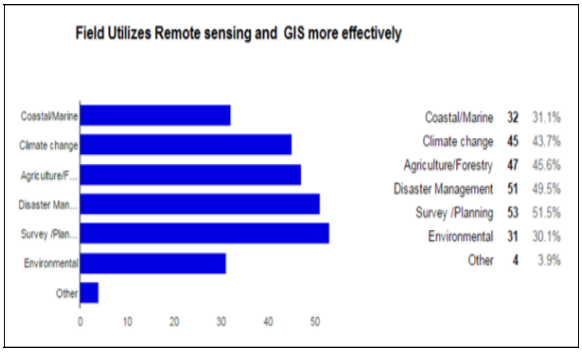

Fig.11: Field uses remote sensing and GIS efficiently

From Fig.11, we may conclude that survey/planning (51.5%) field widely uses Remote sensing and GIS followed by Disaster management (49.5%). Climate change and agriculture/forestry are next in the list having about 43.7% and 45.6%. Coastal and Environmental having percent of 31.1 and 30.1 respectively.

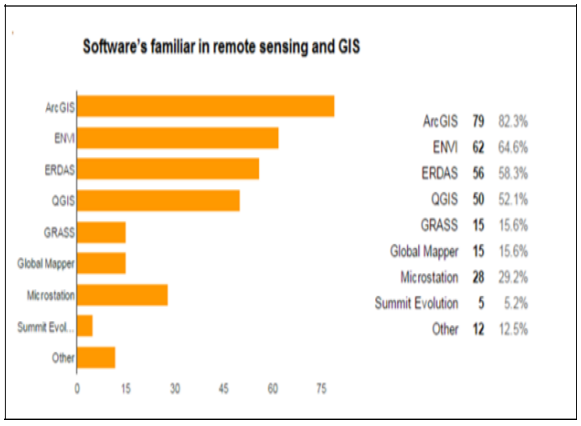

Fig.12: Popular software's in RS and GIS

From Fig.12 ArcGIS is the most popular software among remote sensing and GIS users. Next to ArcGIS, ENVI is second most used software. Followed by ERDAS, QGIS tops the list.

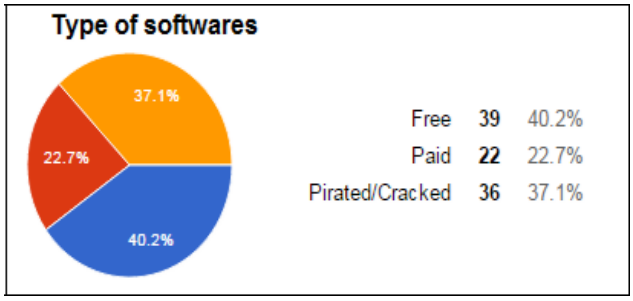

Fig.13: Type of software

From Fig.12, we got data about software's used in remote sensing and GIS field. Here Fig.13, shows type of software's used by people. Most of them use free software's about 40.2% and cracked software's about 37.1%. Only 22.7% of people use paid software's.

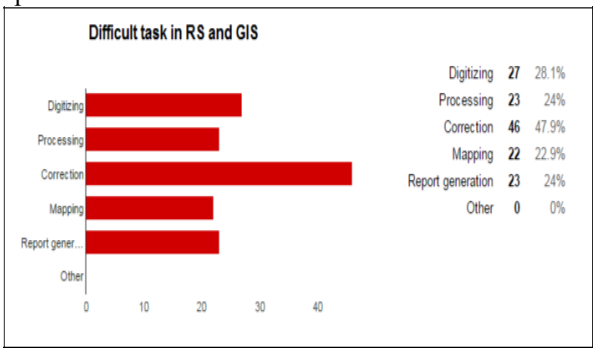

Fig.14: Difficult task in remote sensing and GIS

Fig.14, illustrates the difficult tasks in remote sensing and GIS. Correction is the considered as one of the difficult task among all other tasks according to the survey. Digitizing, processing report generation and mapping are ranged under similar level of difficulty.

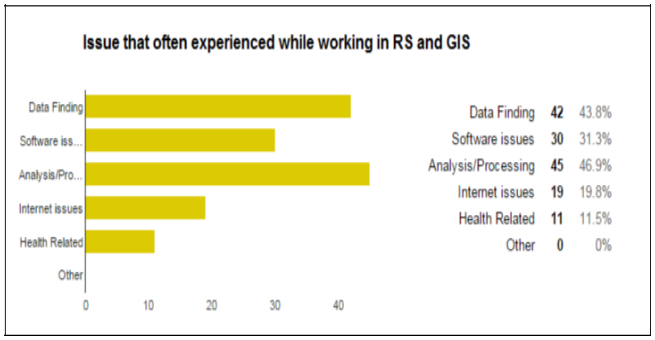

Fig.15: Issues while working in RS and GIS

While engaging in remote sensing and GIS tasks several issues arises, Fig.15, shows most people took the survey found issues while Analysis/processing and followed by data finding. Software related issues also experienced by some of the people. Internet Issues and Health related issues also takes considerable role.

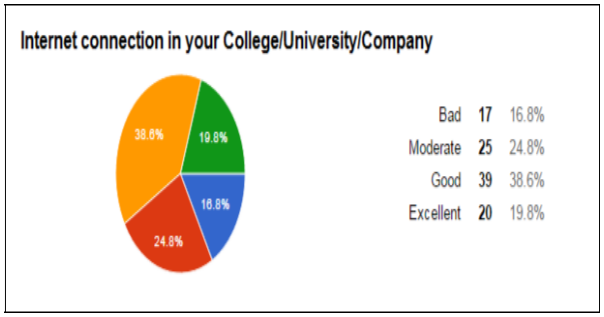

Fig.16: Internet connection

Internet plays a major role in accessing data from remote providers. About 38.6% of the people have good internet connection and 19.8% have excellent access to internet. Moderate internet connection is about 24.8% but 16.8% of the people who took the survey have bad internet connection.

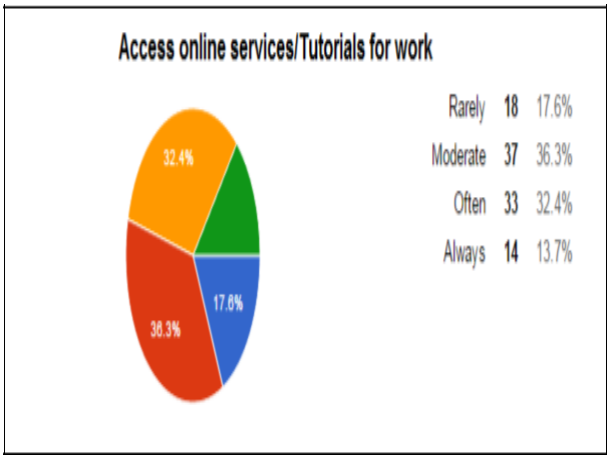

Fig.17: Online services/Tutorials

Fig.17: shows the results of percent of people accessing online services/tutorials. 36.3% of people moderately have access to online services and tutorials. While 32.4% percent uses often. 13.7% of people are always connected to online services and tutorials. 17.6 percent of persons rarely uses online tutorials.

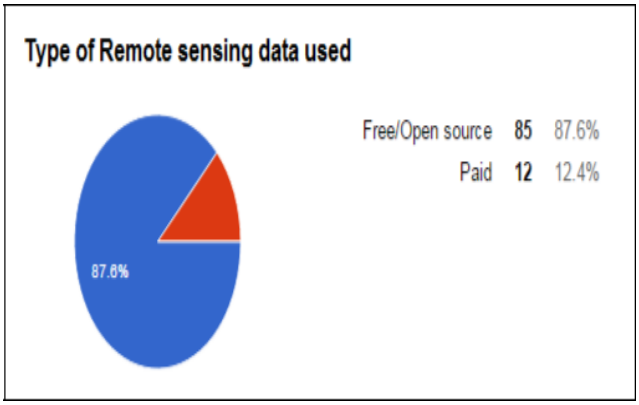

Fig.18: Type of Remote sensing data

Based on the availability there are two major types of remotely sensed data.

One is free or open access data and other is paid or restricted data. 87.6% of people took the survey uses free or open access data because paid/restricted data are very expensive and civilians can't afford to access those data. Also for security purpose some of the data are restricted. 12.4% of people have access to paid data.

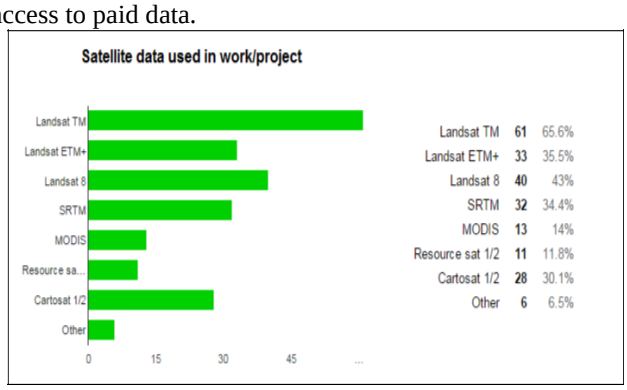

Fig.19: Satellite data

Free access data such as Landsat TM, Landsat ETM+, Landsat 8and SRTM are highly accessed satellite data. Landsat TM tops the list of data. Cartosat 1/2 is the most accessed paid data according to survey report.

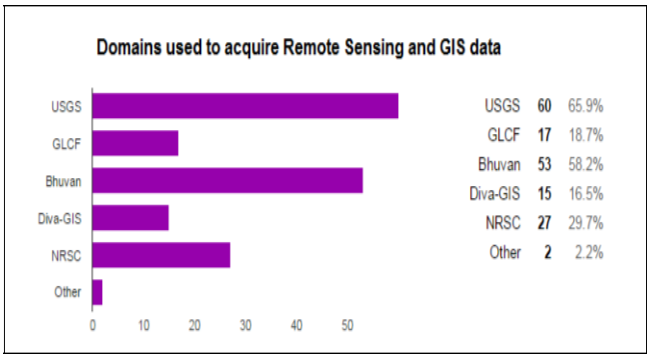

Fig.20: Domains for accessing satellite data

Several sites provide free access to remote sensing data. USGS and Bhuvan are the most accessed data providers. Paid data are accessed from NRSC India which placed third from the survey.

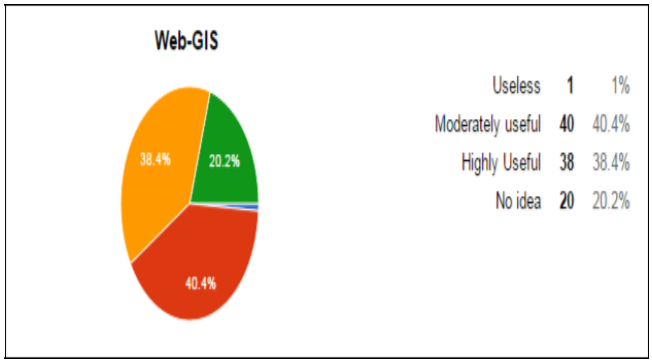

Fig.21: Web-GIS

Geographic information systems can be accessed by web using Web-GIS module. From Fig.21, 20.2of people does not have any idea of Web-GIS. 40.4 % of people have moderate use of Web-GIS. From the survey

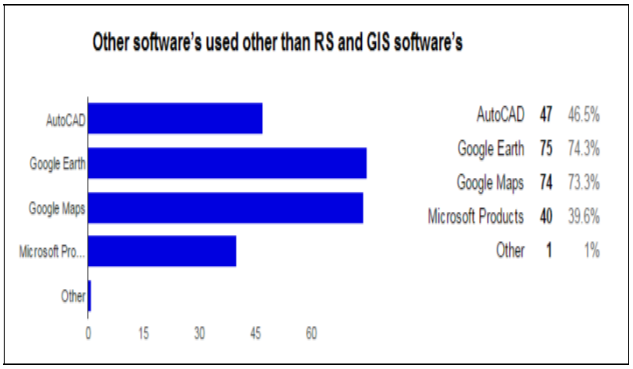

Fig.22: Other important software's

Apart from remote sensing and GIS software's, some other software's are also used for reference, analysis and designing. From Fig.22, Google earth and maps are mostly used software's for reference purpose. For designing AutoCAD is preferred software.

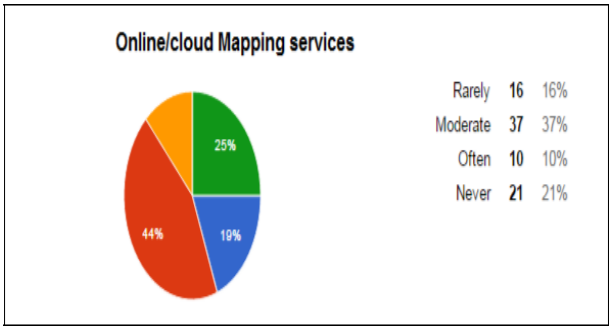

Fig.23: Cloud mapping

Cloud mapping is recently developing technology. This survey results shows that cloud mapping has moderate access. 37% of people have moderate usage of cloud mapping, while 21% of people have never used of cloud mapping.

Table-I : One way

Independent variables	Unstandardized Coefficients		Standardized Coefficients	T-value	P-value	Significant
	B	Std. Error	Beta			**P-value < 0.05**
Gender	0.416	0.125	0.288	3.337	0.001	Significant
Age	0.26	0.122	0.291	2.124	0.037	Significant
Location Type	0.049	0.08	0.05	0.604	0.547	Non-Significant
Educational Qualification	-0.047	0.134	-0.049	-0.354	0.724	Non-Significant
Current Occupation	-0.154	0.07	-0.195	-2.209	0.03	Significant
Type of Institute/University/Job sector	-0.096	0.119	-0.086	-0.809	0.421	Non-Significant
Your experience in remote sensing and GIS field	-0.256	0.082	-0.32	-3.138	0.002	Significant
Type of software	-0.34	0.091	-0.369	-3.741	0	Significant
Type of RS data used	0.359	0.185	0.189	1.937	0.056	Non-Significant
Web-GIS	0.086	0.057	0.132	1.517	0.133	Non-Significant
Dependent variable: Remote sensing and GIS role						

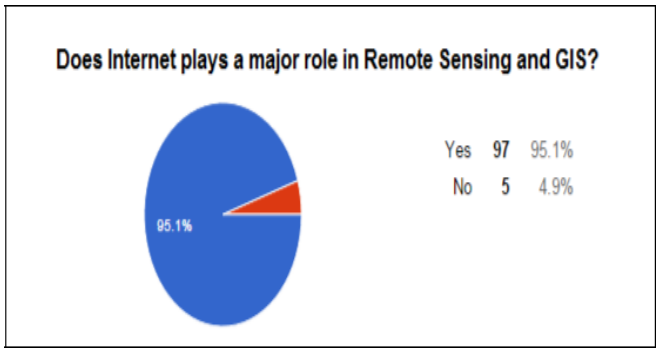

Fig.24: Internet Role

95.1% of people concluded that Internet plays a major role in remote sensing and geographic information systems. Only 4.9% concluded that internet have insignificant role in remote sensing and GIS(Fig. 24).

A. ANOVA results

Table 1, shows the ANOVA result analysis. As the p value is less than 0.05, there is a significant difference in remote sensing and GIS role among the age, gender, occupation, experience and software groups. As the p value is not less than 0.05, there is no significant difference in remote sensing

ANOVA Results

and GIS role among location, educational qualification, type of sector, type of data and web GIS. The survey leads to the conclusion that the above groups have no effect on internet role in remote sensing and GIS.

IV. CONCLUSION

In this technical survey, total 114 people have participated, among them males and females are about 61.2% and 38.8% respectively, most of the people are at age group of 17-27. It is observed that students are the highest of about 36.9%, professional are 31.1%, research scholars are 26.2% and finally professors by 5.8% took the survey. Remote sensing and GIS applications are mostly used in the fields of survey/planning, disaster management, climate change and followed by agriculture/forestry .The most generally used software's are identified as *ArcGIS, ENVI, ERDAS and QGIS* in remote sensing and GIS users. From ANOVA results, there is a significant difference in remote sensing and GIS role among the age, gender, occupation, experience and software groups. The survey leads to the conclusion that the above groups have an effect on internet role in remote sensing and GIS. It is concluded that Internet plays a major role in remote sensing and geographic information systems by 95.1% of people and only 4.9% said internet have insignificant role.

In this survey the total number of participants are not up to expectation because remote sensing and geographic information system is an emerging field in south India particularly in Tamilnadu. We suggest that, the further survey for India will provide clear idea about internet role in remote sensing and GIS.

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