INDIAN EXPERIENCES FOR UNIVERSITY LEVEL CAPACITY BUILDING IN GEOMATICS USING EDUSAT SATELLITE

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ABSTRACT:

Indian Institute of Remote Sensing (IIRS), a premier institute of Department of Space, Government of India plays a leading role in capacity building in the field of geomatics, in India as well as Asia Pacific region. Since 2006 IIRS has taken up distance learning for teaching a basic course on remote sensing, GIS, GPS and its applications to Indian universities spread across India, using EDUSAT satellite (i.e. an exclusive communication satellite launched by Indian Space Research Organization, dedicated for tele-education in India). Live video streamed output generated using public domain free multimedia player, encoder and streamer software VLC (Video LAN Client) so that the universities /technical institutions (classrooms) received it through an Internet Protocol (IP), played with VLC player and projected it with LCD for the benefit of many students. Interactive sessions were conducted immediately after the live lecture / practical demo using Microsoft Net meeting that supports audio and video. Effectively, more than 1000 students were trained through two training programs conducted for more than 25 universities in 2007. Most of the Distance Learning environments are static nature with limited live and interactive activity and whereas this program is completely live and most effective way of interaction and therefore it is unique and innovative.

1. INTRODUCTION

2.1 Role of Distance Education

Distance education**,** or distance learning, is a field of education that focuses on the technology and instructional systems design that are effectively incorporated in delivering education to students who are not physically "on site" to receive their education. Instead, teachers and students may communicate asynchronously (at times of their own choosing) by exchanging printed or electronic media, or through technology that allows them to communicate in real time (synchronously). Distance education courses that require a physical on-site presence for any reason including the taking of examinations is considered to be a hybrid or blended course or program. Modern distance education has been around at least since Isaac Pitman taught shorthand in Great Britain via correspondence in the 1840s (Moore et.al., 2005), since “the development of the postal service in the 19th century. Commercial correspondence colleges provided distance education to students across the country.” Computers and the Internet have only made distance learning easier, just as it has for many other day-to-day tasks (Phipps R. and Merisotis, J., 1999).

One of the oldest distance education universities is the University of South Africa, which has been offering correspondence Education courses since 1946. The largest distance education university in the United Kingdom is the open University founded 1969. In Germany the Fern Universität in Hagen was founded 1974. There are now

many similar institutions around the world, offer distance education with the name Open University (in English or in the local language). There are many private and public, non-profit and for-profit institutions offering courses and degree programs through distance education. (Wikipedia contributors, Distance Education, 2008).

Geomatics is highly specialised discipline that deals with Remote Sensing, Geographical Information System, Global Positioning System and field surveys for assessing, quantification, development and management of resources. Training in this specialised field is essential for its effective utilisation. IIRS, the first of its kind has played a key role in capacity Building of midterm career professionals from in-service institutions of India and many developing countries in its four decades of dedicated service (P.L.N. Raju et. al., 2007; Dadhwal, V.K. and P.L.N. Raju, 2007; IIRS website, 2008).

The EDUSAT based basic training in Geomatics is distance education designed and developed as an exclusive program for universities spread across India. This paper describes about EDUSAT satellite that was dedicated for distance education, present status of its utilisation at national and regional level, uniqueness of capacity building program of Geomatics that was launched using EDUSAT, IIRS experiences in successful organization of two courses in geomatics, feedback from participated institutions, benefits of the course and future plan of action etc.

2.1 Why EDUSAT based training?

Contact based training though advantageous and beneficial; it is not possible for many to attend due to time limitations, financial constraints and importantly day-to-day commitments at work place, as explained under Distance Learning benefits section. The type of distance education can be different depending on technology and tools used. The first among them is distance education (correspondence courses) supported with printed material but with or without study centres. In the present age “Internet based courses” are replacing the conventional correspondence courses. The advanced type of courses are “e-learning” where the student can avail the content of the course through the internet, stream the lectures using the internet and have interaction with teachers on a specified date and time. They can be provided FAQs (Frequently Asked

Questions) and quiz materials for easy learning. The students can appear at examinations on specified date and location.
The EDUSAT based training is following similar like e-learning method but has advantage of live interaction sessions between teacher and the students when the lecture is delivered using EDUSAT satellite communication. It is advantageous because of its good quality reception and interactions are not constrained due to bandwidth problems of Internet.

2.1 EDUSAT Satellite dedicated to education

EDUSAT is the first Indian satellite built exclusively for serving the educational sector since its launch on September 20, 2004. It is intended to meet the demand for an interactive satellite based distance education system for the country, covering entire India including remote and rural areas in particular. EDUSAT satellite weighing 1950 Kg was built indigenously and launched from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota, into a Geosynchronous Transfer Orbit (GTO) by ISRO's Geosynchronous Satellite Launch Vehicle (GSLV). The satellite is co-located with KALPANA-1 and INSAT-3C satellites at 74^0 E longitude. Compared to the satellites launched in the INSAT series so far, EDUSAT has several new technologies. It has a multiple spot beam antenna with 1.2 m reflector to direct precisely the Ku band spot beams towards their intended regions of India, a dual core bent heat pipe for thermal control, high efficiency multi-junction solar cells and an improved thrusters configuration for optimized propellant use for orbit and orientation maintenance. EDUSAT carries five Ku-band (14/11 GHz Tx/Rx) transponders providing spot beams, one Ku-band transponder providing a national beam and six Extended C-band transponders with national coverage beam. It will join the INSAT system that already have more than 130 transponders in C-band, Extended C band and Ku-band providing a variety of telecommunication and television services. (EDUSAT, 2008)

EDUSAT satellite services are wide spread and gaining momentum over the time. So far 45 broadcast and interactive networks have been established by Indian Space Research Organisation (ISRO), Department of Space (DOS), covering 20 states with having more than 30, 000 classrooms under EDUSAT network. (ISRO Press release, 2008 & EDUSAT satellite, 2008). It is likely to expand over the time as more and more users are showing keen interest to utilize the services of EDUSAT.

Indian Institute of Technology. Mumbai is offering EDUSAT based online and offline courses in Engineering disciplines since January 2008 for a minimum of 30 institutions spread all over India. The disciplines offered under the Centre for Distance Engineering Education Program (CDEEP) are soil mechanics, instrumentation and process control, signals and systems, adoptive signal processing, object oriented systems, sheet metal engineering, computation fluid dynamics and HT, wavelets, IT project management, information systems, fibre optics communications, software engineering, solid state microwave devices. (CDEEP Distance Education, 2008)

2. EDUSAT UTILIZATION AT IIRS FOR THE TRAINING

The use of geomatics i.e. Remote Sensing, Geographic Information System (GIS), Global Positioning System (GPS) and associated geo-spatial technologies is increasing rapidly, thereby demand for more capacity building and institutionalization of the technology. IIRS is utilizing the EDUSAT facility for these purposes. Initially the program is offered to twelve universities who have shown keen interest to participate. National Natural Resource Management System, Department of Space, Government of India has funded this unique program to conduct the basic training in geomatics to undergraduate / postgraduate level students of Indian universities. Teaching studio is the prerequisite to broadcast live telecast EDUSAT based training. Accordingly IIRS has established its own Teaching end Studio and Up-linking facility in the campus under national beam coverage of EDUSAT and link with users. IIRS has given opportunity to all the universities with the following guidelines if they are willing to participate in the training program that was proposed using EDUSAT:

- University/Institute supports its own EDUSAT classroom facility for the planned training.
- University/Institute meets its own financial expenditure for the training at their place. IIRS will meet all its expenses at teaching end i.e. IIRS, Dehradun.
- Identified focal point at University to coordinate day to day activity requirements of the planned training program.
- University/Institute will be responsible for arranging the EDUSAT classroom for the scheduled training program, registering students for the training, attendance of students and taking care of all needs as and when required.
- IIRS will be responsible to conduct the training with the support of scientific faculty from the teaching end studio established at IIRS.
- The proposed training will be conducted using Ku band, National Beam of EDUSAT under CEC-UGC (Consortium for Educational Communication – University Grants Commission) network.
- Feedback / end of the program workshop to be conducted at IIRS with the participation of University/Institute foal point/coordinators. IIRS will support the travel cost for a minimum of one person from each centre.

2.1 Course Structure and Curriculum

IIRS conducted basic training course on "Remote Sensing, Geographical Information System and Global Positioning System" spread over 6 weeks for university students. The course dealt the basics in detail supported with simple examples to generate more interest and encourage them to interact more. Outline of the course and curriculum of the program as given in Table 1.

Module Topic	Duration
Remote Sensing & Digital Image Processing (Module 1) - Principles, platforms & sensors, thermal & MW Remote Sensing, spectral properties, atmospheric interactions, satellite data products, pre-processing, enhancement techniques,geometric corrections, supervised and unsupervised classification algorithms	2 Weeks Total 20 hrs (10 hrs lectures, 5hrs interaction /discussion, 5 hrs demonstration/ hands on)
Global Positioning System (Module 2) - Overview of GPS, constellation and functionality, navigation principles, code and carrier measurements, GPS errors, differential GPS, surveying methods, applications and comparison of different navigation systems	1 Week Total 10 hrs (5 hrs lectures, 2.5 hrs interaction /discussion and 2.5 hrs demonstration/ hands on)
Geographical Information System (Module 3) - Overview of GIS, spatial data models (vector & raster), data formats and structures, non spatial data models, inputting, editing and creation of topology, H/W & S/W for GIS, coordinate systems, datum, projection, spatial analysis, network analysis, digital elevation models and applications, cartography, visualisation, output generation and web resources of GIS	2 Weeks Total 20 hrs (10 hrs lectures, 5hrs interaction /discussion, 5 hrs demonstration /hands on)
Applications and advances in RS, GIS and GPS - (Module 4) Operational RS applications in India, crop area, type and yield forecasting, forest inventory, ecosystem and biodiversity characterisation,geology, eomorphology and hydrogeology and engineering geology, water resource assessment, watershed development, irrigation water management, flood and drought monitoring, oceanography and coastal zone management, high resolution satellite data and urban applications.	1 Week Total 16 hrs (12 hrs lectures, 4hrs interaction /discussion,)

Table 1: Course Structure and curriculum

2.2 Approach of IIRS EDUSAT training Program

The training program lectures / practical / software demonstrations are live telecasted from IIRS teaching studio for two hours on a specified time and date as per the announcement in advance to all the participating institutions. Daily programs are flashed in bulletin boards on daily basis at IIRS website. Presentation material and reading material are made available to all registered participants through ftp before commencement of live program.

Presentations are specially prepared on standard template with minimum font size of 24 for clarity and better viewing. Majority of the programs (i.e. 90%) were conducted live. Special care was given with sufficient time for interactive sessions, like 15 minutes interactive time was allotted for 45-minute lecture. All participating universities using Microsoft NetMeeting interactive chatting program normally post questions. Teaching faculty through the video and audio channels answers all the questions interactively.

The programs are streamed using 384 KBPS for transmission of video with public domain audio and video streaming program (i.e. VLC). It is converted from VGA mode to PAL format and up linked to EDUSAT satellite in Ku band. It is down linked back under national beam so that all users equipped with EDUSAT SITs (Satellite Interactive Terminals) / ROTs (Receive Only Terminals). Registered participants from 30 universities received these live lectures / demonstrations and interacted in the question / answer sessions.

There are many others who are having EDUSAT terminals as part of other networks under national beam, such as IGNOU (Indira Gandhi Open University), CIET-NCERT (Central Institute of Educational Technology – National Council for Educational Research and Training), AICTE (All India Council for Technical Education) can also receive our program but with out interaction. Figure 1 describes concept of EDUSAT training program conducted by IIRS.

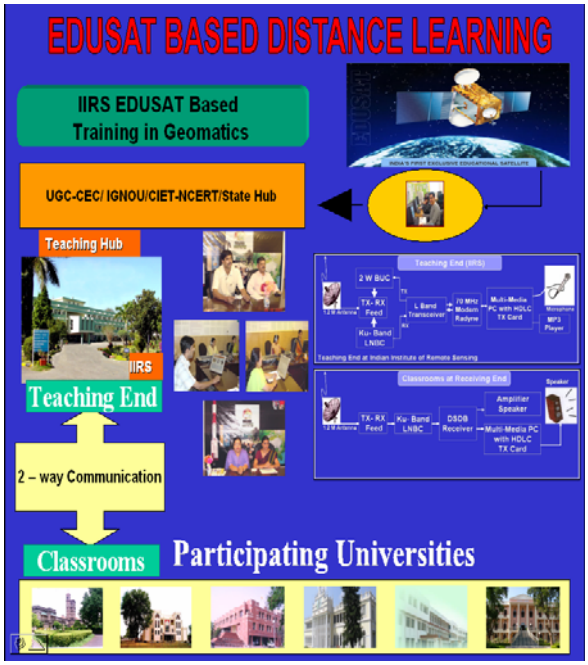

Figure 1: Concept of EDUSAT training in Geomatics

IIRS has utilized EDUSAT satellite for conducting six weeks training course during January 29 – April 19, 2007 for twelve universities with the participation of 349 students in the first course, 218 have appeared in examination process. Out of which 165 have successfully passed, i.e. 75.68% (Table 2). IIRS organized workshop on "EDUSAT based distance learning: experiences & future learning" on June 1, 2007, after the completion of first course with an objective to review experiences of the first course, address the issues on course structure, duration etc. and plan for future programs with wider participation. Total 100 delegates participated in the workshop from 40 universities spread all over India. Majority of the participants expressed satisfaction and provided positive feedback and willing to participate in the future programs. Accordingly the second training program was conducted during September 19 – December3, 2007 with participation of 30 universities and around 1000 students. Examinations were conducted, evaluated and award of certificates to the successful candidates under IIRS outreach. Figure 2 shows distribution of universities participated in the training program.

Universities	Total	Passed / Appeared in Exams	% Success
Pune University	61	44/44	100 %
H. S. G. Univ Sagar	21	10/13	77 %
M.K.Univ Madhurai	26	15/19	79 %
NIT Warangal	21	09/09	100 %
Banasthali Univ	62	52/57	91 %
Anna University	12	08/10	80 %
Tripura University	14	00/09	NIL
Kashmir University	22	21/21	100%
Mysore University	59	00/14	NIL
JNU, Delhi	25	06/21	28 %
Jamia Milia Islamia	12	0	0%
R. G. University, Itanagar	14	0	0%
Total	349	166/218	76%

Table 2: List of Universities and pass percentage of First Geomatics course conducted at IIRS

3. CONCLUSIONS

Distance Education through Education Satellite is like bringing the world into your classroom. It is for the first time in India that the EDUSAT network is utilized twice in 2007 for Geomatics capacity building of university students where we tried to recreate real classroom environment by incorporating audio, video, presentation material and expert

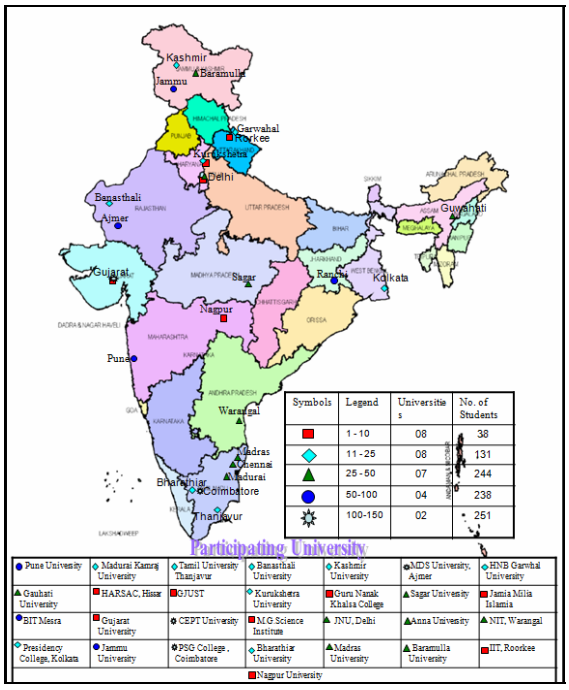

Figure 2: Distribution of Universities participated in Geomatics training program at IIRS

knowledge so that the students sitting at distance place can benefit from the training. This helped students to interact with the expert to clarify their doubles then and there and learn at steady pace. The student has also the advantage to listen to the recorded lecture presentations repeatedly to understand at his/her own pace. Getting hands on experience after the live online demonstration from teaching end was also an added advantage.

Internet based training will help those who have frequent access to web, especially those who are already working professional and who want to improve their knowledge in the field of geomatics. As web access is becoming cheaper, this educational mode will also become a major medium of attention and will enhance mid career development.

IIRS look forward to use this innovative technology and conduct distance learning program in the second half of 2008 with the participation of additional universities. There are further plans to launch many programs emphasising geomatics applications.

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