AN INNOVATIVE APPROACH FOR MASS-SCALE CAPACITY BUILDING IN GEOSPATIAL TECHNOLOGY AND ITS APPLICATIONS USING ONLINE ACTIVE LEARNING PLATFORMS

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ABSTRACT:

Capacity building in the field of geospatial technology and its applications at different levels of the society is critical for effective utilization of a large number of value-added geospatial products and services towards governance, development and informed and decision making. Given the large geographic extent and increased number of potential users across the country, a mass-level capacity building approach using online learning platforms becomes the need of the hour. With this in mind, Indian Institute of Remote Sensing (IIRS), a Unit of Indian Space Research Organisation (ISRO), has started its outreach programme in 2007 through online *live & interactive* classroom based courses. Twelve (12) universities were connected through satellite-based interactive terminals in this maiden attempt. In 2012, the programme was extended to internet domain to connect more users using interactive Learning Management System (LMS). The programme has grown manifold over time. Currently, a network of 685 institutions is established in the country and a large number of participants from these institutions attend the *live and interactive* courses. Over 52,000 students, professionals and researchers from various academic institutes, user departments and industry in India are benefitted so far with these courses. IIRS also offers *e-learning* courses in multi-lingual environment with a concept of 'learning anytime anywhere.' The interactive *e-learning* contents are created for about 100 *e-learning* hours with customized LMS using Moodle. More *e-learning* contents in different application domains and a web-based knowledge repository are being developed to further strengthen the outreach programme focused towards geospatial capacity building and skill development. This paper presents the experiences of IIRS-ISRO in mass-level capacity building in the field of geospatial technology and its applications using online learning platforms.

1. INTRODUCTION

Developing countries like India can use space technology and its applications for effective governmental planning and decision making exercises. Geospatial technology which integrates Remote Sensing, GIS and navigation technology provides an excellent platform to enable geospatial-governance (g-governance) for effective planning and decision making. ISRO with its vibrant and active Earth Observation Programme, is jointly working with government agencies for effectively utilizing space technology in governance and societal development.

Indian Institute of Remote Sensing (IIRS), a constituent Unit of ISRO, Department of Space, Government of India, has been engaged in capacity building among the user community in the field of Remote Sensing, Geoinformatics and GNSS technology for Natural Resources, Environmental and Disaster Management for the last five decades. In the initial phase, the training focused on traditional face-to-face teaching targeting mid-career government professionals. With time, the institute has enhanced its capability and evolved many training and education programmes in the field of Remote Sensing, Geoinformatics and GNSS technology for natural resources, environment and disaster management. These programmes are tuned to meet the requirements of various target user groups, ranging from fresh graduates to planners and decision makers. Till 2006, the focus of the institute was limited to face-to-face classroom based training and education programmes.

To widen the scope of applications of ISRO's Earth Observation (EO) missions at grassroots level, IIRS initiated capacity building through outreach programme (http://iirs.gov.in/IIRS-Outreach-Programme) in 2007. The

programme is an innovative initiative to train professionals from academia and user departments in the field of geospatial technology and its applications. The initial focus was to strengthen the academic programmes of various universities and academic institutions in the country by using satellite based interactive terminals (SIT). ISRO's EUDSAT satellite was utilized to connect remote locations with teaching centre at IIRS, enabling them to receive live and interactive programmes. The programme became popular as IIRS EDUSAT programme among the user community.

The first programme was conducted with the participation of 250 participants from 12 universities in India. Over the time, the programme has grown significantly and until July 2017, IIRS has successfully conducted 22 outreach programmes through live and interactive classrooms and also launched five online courses under its *e-learning* initiatives. The initial focus of IIRS outreach programme was to use EDUSAT and INSAT-4CR satellite for distance learning by targeting students of Indian universities and academia to enhance their knowledge in remote sensing and geospatial technology. Further, the connectivity with user segment was extended by using Internet and broadband technology for linking professionals, user departments and ministries in the country to develop their skills in geospatial technology.

This paper presents the experiences of IIRS-ISRO in online mass scale capacity building in the field of geospatial technology and its applications.

2. COURSE DELIVERY THROUGH ONLINE LEARNING PLATFORMS

The IIRS outreach programme aims towards capacity building among various user segments in the field of geospatial technology and its applications. The courses are delivered through two modes:

- *Live and Interactive* classroom based courses (http://iirs.gov.in/EDUSAT-News), and
- *e-learning* based online courses (https://elearning.iirs.gov.in/).

2.1 Live and interactive courses

The live and interactive classroom based courses started in 2007 and have become very popular among the students, researchers and professionals from academia, government departments and industry. During the last decade, IIRS has successfully established a network of major academic institutions in the country under this programme. The programme utilizes state-of-art *information and communication technology* (ICT) for enhancing the outreach. The live and interactive mode of distance learning is through Internet and A-VIEW platform developed by Amrita *e-learning* Lab in collaboration with the Ministry of Human Resource Development (MHRD), Government of India. Under the *live & interactive* mode, IIRS conducts a long duration programme on Basics of Remote Sensing, GIS and GNSS technology and applications every year during August to November. Apart from the basic course, short duration courses on technology topics such as Geo-web services, Advanced GIS, Unmanned Aerial Vehicles and theme oriented courses such as Carbon Forestry, Urban Planning, Water Recourse Management, etc. are also conducted. The live classroom sessions are being conducted in the evening on daily basis from state-of-art studio set up at IIRS. The courses are very popular among the student community and researchers where 5000 to 8000 participants register in each programme.

During last three years, the number of participating institutes and participants has increased manifold. In the year 2017, IIRS has planned ten courses of different duration targeting academia and user departments in the country. In addition to this, monthly webinar series on advanced topics covering geospatial technology and applications are also initiated for mass awareness in the society.

There is no fee for attending these courses.

2.2 e-learning courses

To further enhance the outreach, IIRS has also developed *e-learning* contents in geospatial science and technology along with the Learning Management System (LMS). The *e-learning* courses are self-paced and learner centric and targets professionals, academia and research community to enhance their knowledge in remote sensing and geospatial technology. The syllabus of the courses is as per latest developments and trends in geospatial science and technology with specific focus on Indian case studies for geospatial applications. The learning is made available

through interactive 2D and 3D animations, audio, video for practical demonstrations, software operations with free and open data sources.

Following *e-learning* courses are offered under this initiative:

- Four (4) months comprehensive certificate course in 'Remote Sensing and Geo-information Science'
- One (1) month fundamental certificate courses in:
  - Basics of Remote Sensing
  - Photogrammetry and Cartography
  - Geographical Information System and Global Navigation Satellite System
  - Digital Image Processing.

The *e-learning* courses are available free of cost to all the participants. However, to get a certificate from IIRS the participant has to appear in an examination for which a nominal fee is charged. Further, there is no course fee for government sponsored candidates.

3. APPROACH

3.1 Live and interactive courses

The live classroom sessions are organized on daily basis during 16:00 hrs to 17:30 hrs. The course contents are delivered through LMS developed by IIRS in bi-lingual environment. The complete course management starting from registration to certificate generation is being carried out in digital mode through LMS. Any academic institution or organization can register for the courses anytime through IIRS LMS. The proposal of registration needs to be forwarded to IIRS through head of the institution by nominating one senior faculty or officer as a coordinator. The complete workflow for live and interactive courses is presented in figure 1.

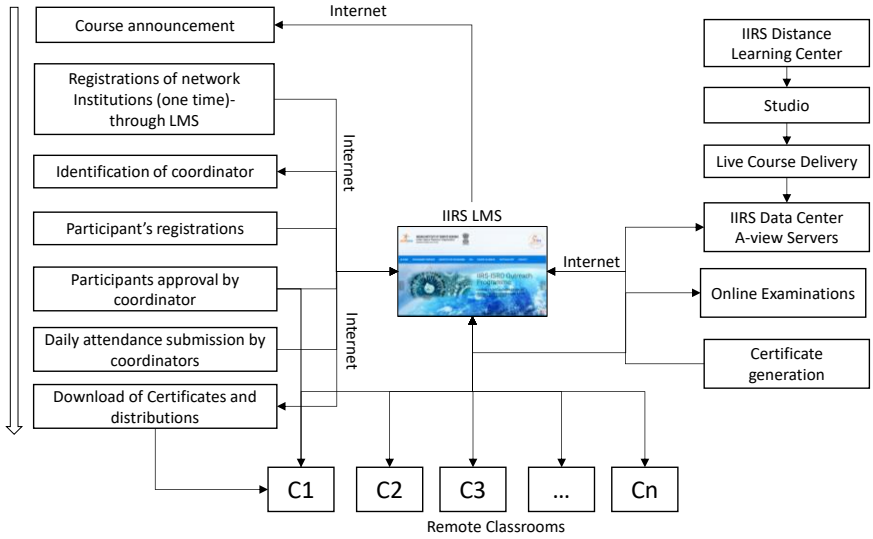


Figure 1: Workflow for delivery and management of *live & interactive* courses

3.2 e-learning courses

In the *e-learning* courses, the learning methods are implemented in such a way that the course contents are delivered in a more interactive manner with practical examples of real world problems. The learners spend 32 to 102 learning hours per course including participation in online activities like quiz, assessments, projects and online practical exercises. The expert faculty is also available for interaction with the participants.

Open source software architecture is used in the development of IIRS *e-learning* web portal to make it an interoperable system. The *e-learning* contents are created as interactive multimedia application and integrated with

customized LMS based on Moodle (Fig. 2). The user registration and admission module is developed outside Moodle LMS for proper user management and linking the participants with IIRS *live & interactive* courses. The adopted *e-learning* objet standard and other technical details are shown in Table 1.

Figure 2: Home page of IIRS *e-learning* portal (http://elearning.iirs.gov.in)

Table 1: Technologies and standards used in developing and delivering *e-learning* contents

Component	**Technology/Standards**
Operating System	Linux
Database Server	MySQl/ mariadb
Application Development	PHP, Javascript and HTML, Flash
LMS	Moodle
Web Server	Apache
Object standard	SCORM 2004, 4th edition
Online classes	Apache OpenMeeting
URL	http://elearning.iirs.gov.in

4. MAJOR ACHIEVEMENTS OF IIRS OUTREACH PROGRAMME

The IIRS outreach programme has emerged as an innovative approach for mass awareness and to train large number of participants using ICT under distance learning mode. IIRS has successfully established interface with academia and user departments of state and central government. The network has grown from 12 universities in 2007 to 685 institutions in 2017 and is continuously growing with time. The distribution of networked institutions in the country, which are participating in the *live & interactive* courses, is shown in figure 3. The participation of different institutions in the country as well as the number of participants has increased considerably during last few years (Fig. 4 to Fig. 6). Over 52,000 participants from 685 networked institutions in the country have taken benefit of this programme.

On the other hand, in the *e-learning* courses offered under the IIRS outreach programme, about 3500 participants have registered for five courses. Out of these 3500 participants, about 800 participants have opted for Certificate till July 2017 and the rest have joined as learners.

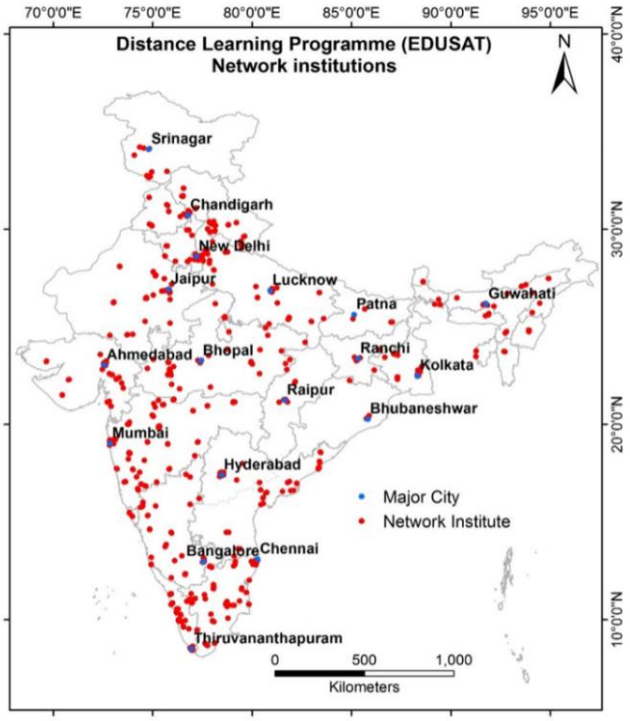
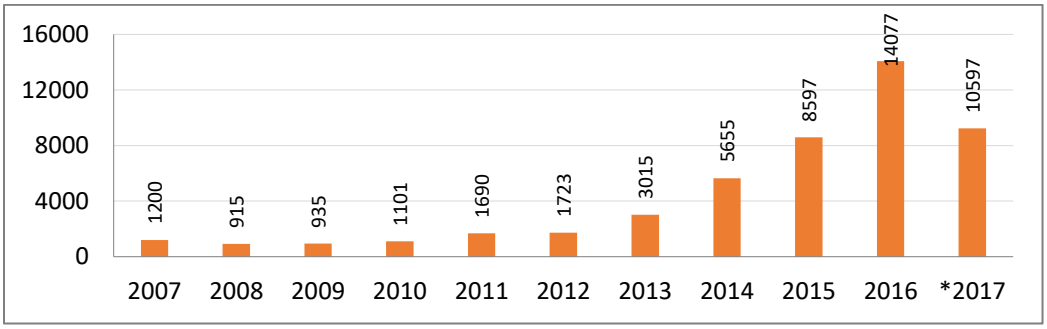


Figure 3: Spatial distribution of IIRS outreach network in India (685 institutions as in September, 2017)

IIRS outreach programme is very popular among its users and also well appreciated at various forums. The Department of Personnel and Training (DoPT), Government of India and United Nations Development Programme (UNDP) have conferred two national awards for excellence in training for year 2015 to IIRS for contributions towards: (i) *e-learning* initiatives for innovative training contents and delivery, and (ii) *live & interactive* courses (EDUSAT courses) for innovative pedagogy.

An online survey is conducted recently within its networked institutions to understand the impact of the programme. A total of 446 networked institutions have participated in the online survey out of which 62.6% users are working professionals, 32.3% are students and rest are non-working (Fig. 7). The online survey statistics suggest that about 96% users find that *live & interactive* courses conducted under the IIRS outreach programme are useful in their professional career (Fig. 8).



*courses under progress

Figure 4: Year-wise distribution of participants

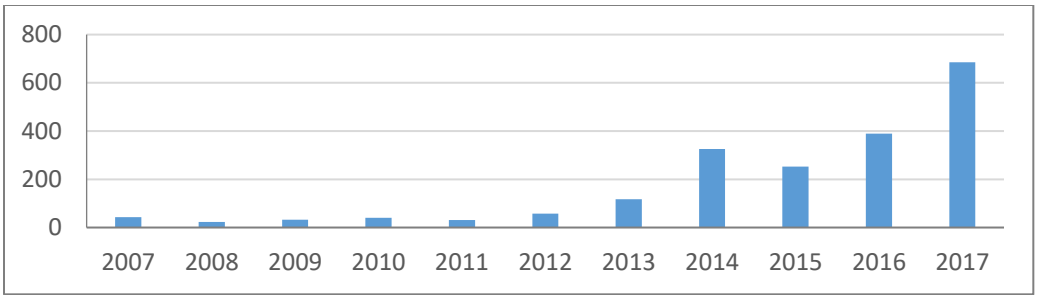


Figure 5: Year-wise distribution of participating institutions

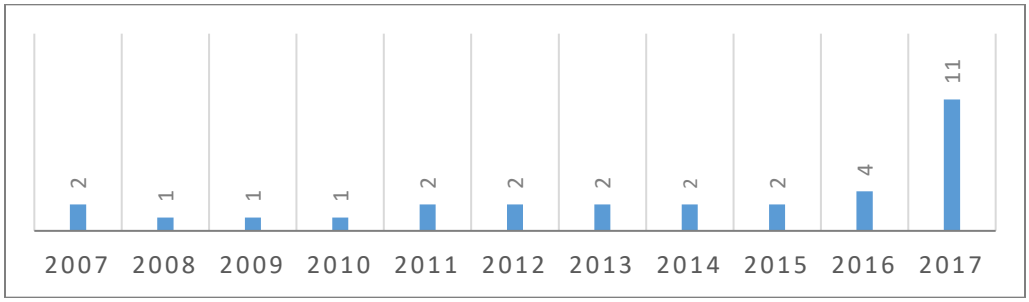


Figure 6: Year-wise number of *live & interactive* courses

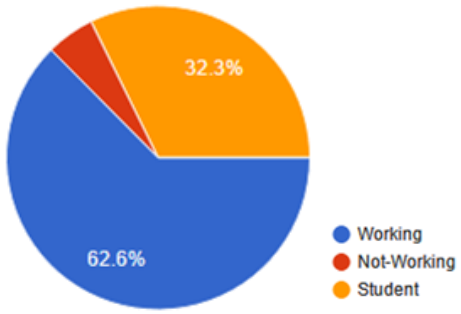


Figure 7: Current employment status of users of online survey

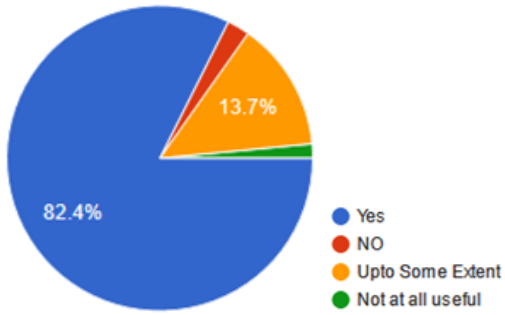


Figure 8: Impact of IIRS outreach programme in career growth of the participants

5. CONCLUSIONS

IIRS outreach programme to build capacity in the area of geospatial technology and its applications was initiated in 2007. The programme has successfully completed one decade and has become populate in the country over time. Two modes of online learning platforms namely, *live & interactive* classroom based courses and *e-learning* courses, are being used to transfer the knowledge and build skills in this field. The programme has gone through the transition from using satellite-based interactive terminals to internet platform based dissemination. Under the *live & interactive* classroom based courses (also known as EDUSAT courses), a network of institutions across the country is setup and a large number of participants from academia and user departments are getting benefitted. The *e-learning* courses are available in English and Hindi languages. More *e-learning* contents in different application domains and a knowledge portal are under development. IIRS-ISRO intends to further expand its network even at international level to meet the large geospatial capacity building requirements at different levels. Setting up a country-wide network of *learning centers* with the help of academic institutions having trained professionals/ trainers and development of *virtual laboratory* for online practical sessions are also planned.

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