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Advancement and Challenges for Satellite Communication Systems

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Abstract:

The communication in the entire world is evolving and revolutionized with the satellite's advent and it has also served mankind in many ways for example to estimate the weather, storm and provides broad range of communication services in the field of television programs. The linkage of satellite communication may be used for the purpose of voice and fax transmission to Aircraft on the international routes. The navigation of GPS, Global telephony , multimedia video and the connectivity of internet, the earth imaging using the remote sensing satellites for monitoring the resources. The system of satellite communication has entered a point of transition of high cost, trunks of high capacity with low cost. In this paper, the advancements in satellite communication, the different applications aspect that is present and has many application and market for our resources came up with innovative and low cost solutions for world community.

Keywords: *Satellite communication, International Aircraft, GPS*

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Introduction

The service industry of satellite communication has grown rapidly with a high speed after 1992 and this rapid growth is considered as a global phenomenon for the world economy. As the economies of world have increased and improved with a great degree, required to increase in communication services for both markets: business and consumer. Then, with the increase in demand, the new opportunities for the purpose of satellite communication are opened for the rapid expansion of business, consumer, terrestrial mobile and internet communications.

The access of mobile and internet transport businesses encouraged the demand for new multi-state constellation of satellite to serve this market on both the levels of national and international scale. The satellites based business opportunities are large and growing rapidly have attracted the government attention and industrial interests of many countries and then then these nations are making important investment of new capital that enables them to participate in the growth market. For the purpose of satellite research and development projects, many countries have allocated funds to ensure their long term. According to Vanzara , Sharma and Bhatt 2015 , the current research on satellites shows that there many kinds of issue that needs to be solved such as internetworking using other access technologies such as LAN & Wi- Max, QoS enhanced version provisioned over multi segment networks, security and on board satellite processing that is used for challenging applications over satellites. On the basis of altitude, satellites are classified into three categories: Geo stationary Earth orbit (GEO), Medium Earth Orbit (MEO) and Low Earth Orbit (LEO). MEO and LEO satellites have a round trip that is short and GEO satellite have a round long trip time.

For the purpose of development of seamless nomadic networks, the requirements of NASA Research & Education Network (NREN) as well the association with other projects based on space such as the Protocol Testbed and EOS that necessitates NREN staff who has a working knowledge of basic technology of satellite. As the satellites are the objects present in orbits about the Earth and orbit is basically a trajectory that maintains gravitational equilibrium to circle the earth without power assist. The very first satellite was the Moon and the idea of the satellites introduced by Sire Arthur C. Clark in 1945. In the scenario of modern life, the satellites have become essential along with the important applications of satellite technology which are voice, video, radio, space and Earth observations, micro gravity science and other related factors.

According to the studies of many researchers, it is reported that various channels of satelite experience long delays and have high rates of error that may sometimes cause the loss of security synchronization. So, the encryption systems require careful evaluation to prevent quality of service degradation due to the security processing.Satellite communication also protects the satellite and integrity, confidentiality of the downlink earth stations and information systems of the control systems (Jamil Shah, Nasir and Ahmed 2014).

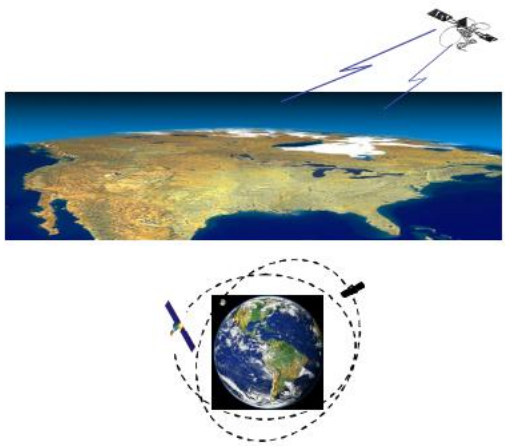

Figure 1 – Satellite System

Elements of Satellite Communication

Satellite communication is comprises of two major elements which are:

The space segment – Satellite is known as space segment and comprises of complex or compound structure which has some of the major subsystems such as TTC system, Transponder, Fuel tank called thursters tank. The transponders of the satellite includes the receiving antenna for the purpose of receiving signals from ground stations. The role of satellite is to transpond the signal that is received in other forms of signal to re transmit it to the ground stations. The other kind of usage of satellites is obse5rvation where the satellite is equipped with cameras, sensors and downlinks any information.

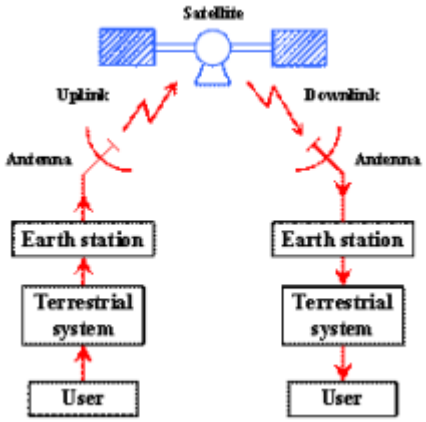

Figure 2 – Overview of Satellite Communication

The Ground Segment – The ground segment of satellite communication includes the earth stations which has two types of role of Earth station. At the time of uplink or transmitting station, the terrestrial data is generated in the form of base band signals which is pass4ed through a base band processor.

Whereas in case of down link or receiving station, the job is performed and then convert the signals that is received through the parabolic antenna to base band signal (Misra, Misra and Tripathi, 2013).

Requirement of Satellite Image Classification

The image classification of satellite plays a vital role in extracting and interpreting the valuable information from the massive satellite images. This classification is required for:

Extracting information for the application processing

Spatial data mining

Thematic map creation

Field surveys

Decision making

Disaster management

Satellite Image Techniques

There are various types of methods and techniques for classifying satellite image which are widely classified into three of the categories,

Automated

Manual

Hybrid

Automated Image classification method that includes algorithms which are applied systematically on the whole satellite image that groups pixels into the meaningful categories. This type of classification is further classified into two categories,

Supervised – This classification method requires the input from an analyst which is known as training set.

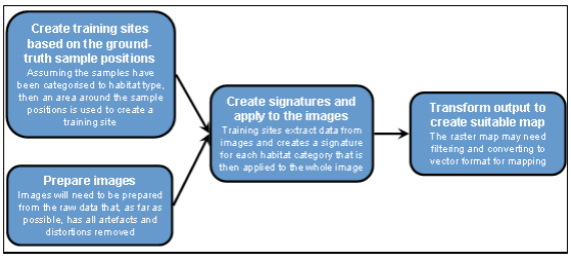

Figure 3 – Supervised Satellite Image Classification method

Unsupervised methods- This technique uses the mechanism of clustering that groups the satellite images pixels into unlabeled classes or clusters.

Manual

Manual types of classification method for satellite image are robust, effective and efficient.The major drawback for this classification is that it consumes more time. In this, the analyst is required to be familiar with the area that is covered by the satellite image.

Hybrid

This Hybrid classification methods combines the advantages of both the methods: automated and manual. This approach uses the image classification of automated satellite for doing initial classification and then manual methods are used to refine the classification and correct errors (Abburu and Golla, 2015).

Satellite image classification methods

S. Muhammad et al proposed a method for classification of satellite image and uses the decision tree technique that extracts different kinds of features from satellite image on the basis of its color and intensity. The features which are extracted are then used to determine objects that resides in the satellite images whereas J Shabnam et al introduced the classification of satellite imaging into specific classes by using fuzzy logic.This method majorly classifies the satellite images into five major classes which are shadow, vegetation, road , building and bare land. The image segmentation is used in the first level that identifies and classifies the shadow, vegetation and

road but in second level of segmentation the buidings are identified. Then A. Selim also introduced a model of satellite image classification that uses Bayesian technique that uses spatial information for classifying high resolution satellite images. This method basically perform the classification in two parts: spectral and textural; iterative split and merge algorithm.

Review of Literature

As stated by Cola et al 2008, the objective of satellite network of excellence project is to provide community, the scientific views that operates on the basis of satellite communications having measurement, results and tools for evaluation.

Prakash, A. and Rao 2012, explained the importance of direct and diffuse signal power loss and delay in time in signal receiving on the antenna of aircraft. Then, Ray tracing models are designed for the simulation results that produces the carrier to noise ratio that is less than 100dB and below 17 degree of aircraft elevation angle.

According to **Misra, Misra and Tripathi 2013,** that the GPS navigation, global telephony , internet connectivity , earth imaging is performed through Remote sensing satellites for monitoring of resources, Telemedicine, Tele-education services etc. and other related features in the applications of satellitre communication. This paper discussed about the advancements in the satellite communication and on the basis of different applications.

Vaishnav and Diwan 2013, obtained the assessment using the design and the construction of a resonant inductive powering system of wireless network that is suited to supply a primary satellite between the power ranges from 480-1920 watts having efficiency 80-90%.

Devabalan 2014, worked on the satellite image processing on the basis of grid computing environment. In this particular study, CSF4 is considered as a meta- scheduler in the collective layer for such a network environment. The transmission of message is basically implemented by protocol that is defined by Grid Middleware GRAM i.e., Globus Resource Allocation Manger are used in the fabric layer of the grid environment.

Shah, Nasir and Ahmed 2014, surveyed on security issues in satellite communication Network Infrastructure in which they have explored the security importance , trivial and deploying security tools and the considered limitations at the time of deployment such as security techniques and the protocols for securing the satellite communication. For the optimization of t5he security tools and for the measurement of appropriate security framework over the infrastructure of satellite communication is optimized.

Abburu and Golla 2015, studied the satellite image classification methods and techniques. This paper compares works of various researcher's and provide comparative results on satellite image classification method. In this, the automated satellite image classification methods are classified into supervised and unsupervised which differs in the way of grouping pixels into the meaningful categories.

Vanzara, Sharma and Bhatt 2015, focused on the satellite based data communication along with the parameters such as quality of service, interplanetary internet, Mobile management, explicit load balancing and the issue of packet reordering. This paper concludes that can bring to differentiate the architectural services over satellite system. Minimum number of satellites are needed for the global coverage and overlapped coverage areas of the nearby satellites do not explore the coverage of satellites.

Aapaoja et al 2017, explained the small satellite solutions for land transport monitoring whose one possibility is the extension of the sensor and support network to space where the small satellites can provide unprecedented observation frequency having the price lower than that of the traditional satellite solutions. The needs according to the various industries for small satellites in land transportation were identified and then classified into three categories which are operability and reliability of transport system.

Conclusion

This paper reviews the satellite communication, the advancement of its constituent in the satellite communication in the present and future applications. Several reviews done by various researchers on satellite communication and the automated satellite image classification are classified into supervise and unsupervised and they both differ in the way of pixel grouping into meaningful categories. This paper summarizes the various reviews on satellite image classification methods and techniques. This summarized way of paper helps the researchers to select appropriate satellite image classification method or techniques on the basis of requirements.

References:

Abburu, Sunitha, and Suresh Babu Golla . “Satellite Image Classification Methods and Techniques: A Review.” International Journal of Computer Applications, vol. 119, no. 8, June 2015, pp. 20–25.

Aki, et al. “Small Satellite Solutions for Land Transport Monitoring.” 12th ITS European Congress, June 2017.

Cola, T de., et al “Communications and Networking over Satellites: SatNEx Experimental Activities and Testbeds.” INTERNATIONAL JOURNAL OF SATELLITE COMMUNICATIONS, vol. 27, no. 1, ser. 33, July 2008, pp. 1–33. 33.

DEVABALAN, P. “Satellite Image Processing On A Grid Based Computing Environment.” International Journal of Computer Science and Mobile Computing, vol. 3, no. 3, Mar. 2014, pp. 1039–1044.

Misra, Dipak, et al. “Satellite Communication Advancement, Issues, Challenges and Applications.” International Journal of Advanced Research in Computer and Communication Engineering, vol. 2, no. 4, 2013, pp. 1681–1686.

Muhammad, S., Aziz, G., Aneela, N. and Muhammad, S. 2012. “Classification by Object Recognition in SatelliteImages by using Data Mining”. In Proc. Proceedings of the World Congress on Engineering (WCE 2012), Vol I, July 4 - 6, London, U.K.

Prakash, B L, et al. “Design of Aeronautical Satellite Communication System Using Ray Tracing Modeling Technique.” International Journal of Engineering Research and Applications (IJERA), vol. 2, no. 1, 2012, pp. 1179–1183.

Selim Aksoy. 2006. "Spatial Techniques for Image Classification," in C. H. Chen, ed., Signal and Image Processing for Remote Sensing, CRC Press, pp.491-513.

Shabnam Jabari and Yun Zhang, 2013. “Very High Resolution Satellite Image Classification Using Fuzzy Rule-Based Systems”, Algorithms, vol.6, no.4, pp. 762-781.

Shah, Syed Muhammad Jamil, et al. “A Survey Paper on Security Issues in Satellite Communication Network Infrastructure.” International Journal of Engineering Research and General Science, vol. 2, no. 6, 2014, pp. 887–900.

References:

Vaishnav, Divya, and Ritesh Diwan. "Wireless Powering Of Solar Power Satellite." International Journal of Scientific and Research Publications, vol. 3, no. 7, July 2013, pp. 1–5.

Vanzara, Rakesh D, et al. "SATELLITE BASED DATA COMMUNICATION: A SURVEY." Onal Journal of Electronics and Communication Engineering & Technology (IJECET), vol. 6, no. 1, Jan. 2015, pp. 86–99.