Int J Sens Netw Data Commun 2019, Volume 08
DOI: 10.4172/2090-4886-C1-015

Study of bandwidth and link budget requirements in Earth observation satellites

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Satellite industries have advanced to provide services in areas such as telecommunications, security, navigation and localization, meteorology, and entertainment. For more than 50 years, Earth observing satellites have been used to collect, process, and distribute data from these satellites to provide life-saving weather forecasts, measure ocean temperatures, and monitor hazards worldwide - helping to protect lives and improve livelihoods. Research and development in satellites sector is huge and vital in our current. The main focus of international studies is the quality of imaging relation with process timing and complexity. Therefore, in order to sketch the better relation, a comprehensive understanding of components, operations, cost, and calculation is a must before any optimizing methodology can be achieved. This research outlines the basic operation and structure of both synthetic aperture radar (SAR) and optical satellites extensively. Later, a full comparison is constructed to highlight the major differences in operation, applications, and imaging quality. In order to better understand the basic features of both satellites, signal frequency, wave propagation, and bandwidth are studied in depth to determine the effect on telecommunication processes. Furthermore, the medium traveler (electromagnetic waves) are classified into types, applications, and employed to demonstrate the uses of each depending on the satellite functions. The cabling system is as well explained in terms of shape, material, and losses factor with figure for each item. Finally, sample calculation of gains and losses of the communication process is illustrated with equations. In conclusion, optical images are found to have a better quality and resolution than the SAR's. The SAR resolution if affected much by the range and weight resolution, in which both work separately, wherein in optical cameras they work simultaneously. Thus, the operation of optical cameras can be much simpler and produce better quality images. Also, the fields of development for both SAR and optical satellites are compared and allocated for each application. Optimization sectors are identified for each and various recommendations are presented to launch better operation.