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Author: Dr. Mohamed Elhady Keshk
Egyptian Space Agency (EgSA), Egypt, mohamed.keshk@egsa.gov.eg

SMART COMMUNICATION SYSTEM FOR EARTH OBSERVATION, RELAY AND
INTER-SATELLITE LINK SATELLITES**Abstract**

Developing a smart communication system for LEO and Relay satellites is the scope of this research. This smart system has several civilian and military applications where it shall overcome communication channel congestion by automatically changing the existing modulation scheme by another more efficient bandwidth modulation scheme. It also, secures the received and transmitted signal, and removes the interference and unwanted signals from the received signal. In addition, it can be used onboard relay satellites where the demodulation and re-modulation processes are performed onboard the satellite. Smart means this system using machine learning in the modulation and demodulation processes of the communication system by automatically selecting one of the modulations and demodulation schemes stored externally on a flash memory onboard satellite during runtime. The system uses BPSK and QPSK modulations for the demonstration of the research point. A SVM classifier is implemented on Kintex-7 FPGA to classify BPSK and QPSK modulations and then trigger the partial reconfiguration controller to reconfigure the demodulation reconfigurable partition with the corresponding demodulation without affecting the functionality of the static part of the design. The system is tested by connecting it with the KYUTECH institute, Japan, ground station and receiving modulation from Hyuru-4 satellite. The obtained results indicated the system succeed to recognize the modulation scheme of the received modulated signal by a percentage of 93