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PINOAA: AN INDEPENDENT DAILY EARTH OBSERVATION SERVICE USING A RASPBERY-PI DATA PROCESSING PLATFORM

Abstract

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The National Oceanic and Atmospheric Administration (NOAA) weather satellites are the generation of weather satellites prior to the Geostationary Operational Environmental Satellite (GOES) satellites. The four NOAA satellites (NOAA-15, -18, -19 and -20) are located in polar orbits and thus have daily passages over any geographic region. They transmit in VHF and L band frequencies simultaneously and are therefore suitable (low cost and ease of setup) to implement a daily Earth Observation service and space education activity. We used a custom-made VHF quadrifilar helical antenna, a software-defined radio (SDR) USB Dongle and a Raspberry Pi (RPI) based platform to implement `piNOAA`, an independent daily meteorological service publishing in social networks the atmosphere status activity over Portugal and much of the Iberian Peninsula, North Africa and its Atlantic adjacent area. The radio frequency block is fitted with a Low Noise Amplifier (LNA) and a bandpass filter. Together they present a very high attenuation outside of the 5MHz bandpass region, centered around 137.5MHz, and a minimum of 30dB of gain within the bandpass region to avoid interference and saturation from other sources. The data acquisition is performed by an SDR receiver RTL-SDR, using RTL2832 ADC chip, 0.5 PPM TCXO, with a bandwidth between 25 MHz and 1760 MHz. This device provides the digital data to the RPI where the data is processed and posted in a social network. The procedure consists on several tools, namely: Predict, to predict NOAA satellite orbit; noaa-apt image decoder to decode the images; Rtl-fm to capture the received audio. A Python script combines the previous tools and creates an automated process that limits the system observations according to the NOAA satellite elevation (>30°) in order to increases the quality of the received images. To share the obtained images automatically to Twitter the script executes the interface commands from Twitter to make API calls to make tweets with the captured images. `piNOAA` will also be used to assess meteorological data and assist operations at the Pampilhosa da Serra Space Observatory (PASO) and may be integrated into a visual assistance tool to aid operations of other observatory sensors. In the future, this tool will be expanded to detect and receive image data from GOES satellites.