SDR

NOAA SATELLITE DATA STREAMING USING RTL-SDR, RTL-TCP AND RASPBERRY-PI

By Sajith Variyar V V

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SDR-Term Work

Sajithvariyar
CEN
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1. Introduction

The rationale of this project was to tract the NOAA satellite and streams the satellite data to a remote system using the rtl-tcp server. The RTL-SDR TV DVB dongles allows to get the signal from the antenna and that sample the receiving signal in the given sample rate and send the data to any signal processing software. In this project we use SDR-SHARP that can be installed in any remote system to get the signal from rtl-tcp server and record the receiving signal as a wave file and later the wave file will be decoded to get the image file.

2. Module Description

A. Satellite tracking

The satellite tracking is necessary to get the satellite pass over our location. In this work we use the Orbitron software to track and predict the satellite pass time above our location. The orbitron supports for dynamic data exchange so that it helps to exchange the tracking data between different applications. The software allows setting the latitude and longitude for our location and then we predict the time for particular NOAA satellites. Once the satellite enters our location the software will give indication by some warning sound.The Orbitron will exchange the following tracking information to the SDR-SHARP software

- Azimuth-Elevation angles
- Downlink-Uplink frequencies

B. Satellite tracking Antenna

In this project we are using a QFH (Quadra Felix Helical) antenna to get the satellite data.QFH is Omni directional antenna with reasonable gain. The antenna will be connected to a pre-amplifier to boost the signal. The rtl-sdr can't boost the signal over a certain limit. The LNA (Low Noise Amplifier) connected before the rtl-sdr dongle increase the signal strength and we will input that signal directly to RTL-SDR dongle.

C. RTL-SDR DONGLE

RTL2832U RTL-SDR dongle using custom SDR drivers. Since then tens of thousands of hams, security researchers, hackers, makers, tinkerers, students and electronics enthusiasts have purchased RTL-SDR dongles to use as a very cheap software defined radio. In this project we feed the amplified signal from QFH antenna to the rtl-sdr dongle connected to the system. The rtl-sdr receives the signal and remotely sends the signal to other client system.

D. RTL-TCPServer

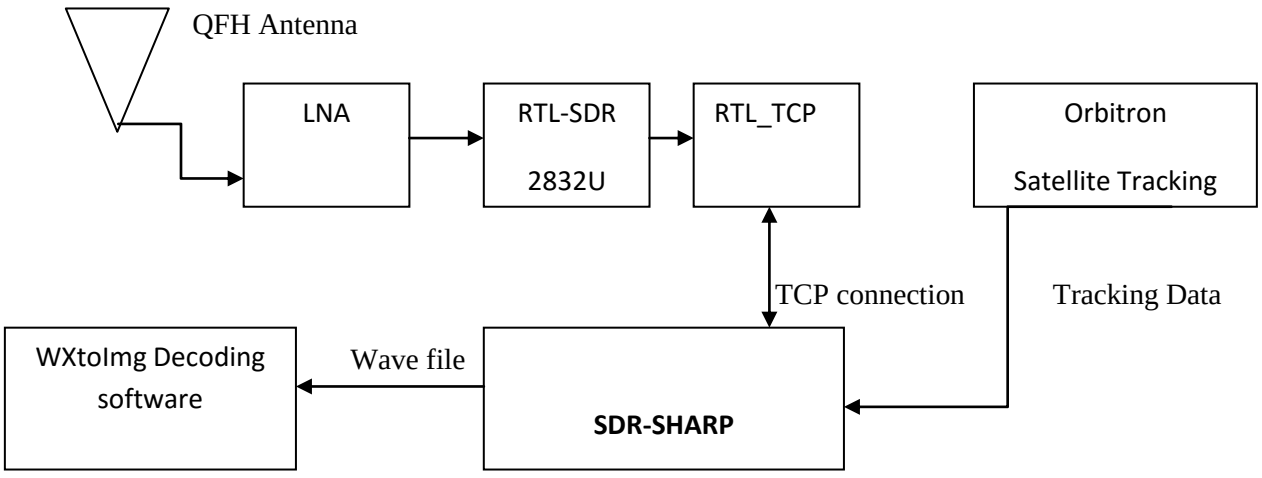
The rtl-tcp is an added feature with rtl-sdr. The feature allows streaming the received data in rtl-sdr dongle to remote system as tcp packets. In this project we use RASPBERRY-PI B+ as a server system to which the dongle will be connected and the pi will be connected to a network using RJ45 cable, so that this allows remote access and configuration of the system from anywhere within that network. The raspberry-pi will be configured with RTL2832U driver software and all the TCP packages need for the rtl-sdr. Now we can connect to this server using SDR-SHARP software from any remote system. This SDR-SHART software allows tuning to desired signal frequency and the server will push the sample back to SDR-SHARP. The SDR-SHARP will record the signal from the antenna and save it as a wave file and later fed to decoding tool.

We can automate certain steps mention above. The server program will run continuously in pi and wait for events to happen. Now we have a DDE (Dynamic Data Exchange) client program that can glue Orbitron and SDRSharp, so that the SDR-SHARP will auto tune to the desired satellite frequency as we selected from the orbitron. The Orbitron can tell the SDR-Sharp when the satellite enters our location and at what time it leaves that place. Until it leaves the place the system will record the data and save it as a sound file.

E. Decoding the Received signal

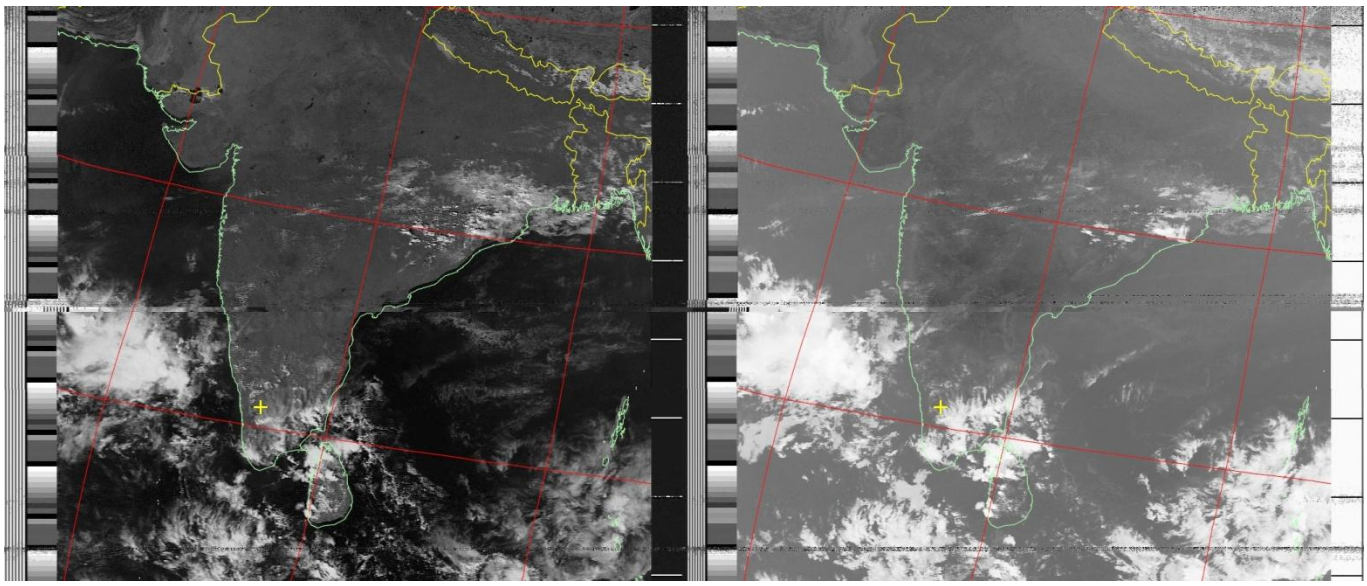
We save the received signal as a wave sound file. The wave file can be decoded to get the image taken by the satellite. The satellite takes both visible and infrared range images.In this project we use the WXtoImg software to decode the file. The configuration needed for decoding is very important. The **WXtoImg** can be configured with SDR_Sharp, so that it will start decoding as soon as sdr-sharp starts recording the satellite data.

3. Architecture Block Diagram



4. Result

The below given picture shows the decoded image from NOAA-19 satellite. The data was streamed and recorded from a system placed in a remote lab.



VISIBLE RANGE IMAGE

INFRA RED RANGE IMAGE