

Remote telemetry – By Somnath Bera

Cheap & Efficient way of remote telemetry using low cost ,low voltage LoRa communication system on ESP32

In memoriam



The author dedicates this article to his mother, Sefali Bera, whose death deeply affected him and the community where she lived in Howrah, India. She was a great source of inspiration for his articles.

I dedicate this session to my mom who was an avid follower of my articles & blogs that appeared all over the world



Remote telemetry – cheap yet efficient!

- 2*5 MW mini hydel plant runs on the down stream open cycle circulating water of a few combined thermal units.
- Situated at the outskirts of the GB Panth reservoir where cell phone communication is difficult not to talk of Internet
- To get the effective head , the turbines are situated at the lowest level where cell connections are erratic.
- The IT department tried in vain with SMS based communications!
- Flood damaged OFC cables many places.
- Live data required for RE monitoring.



SX1276/SX1278 LoRa has different limit set country wise.

865 MHz to 867 MHz upto 500 mW is free channel in India.

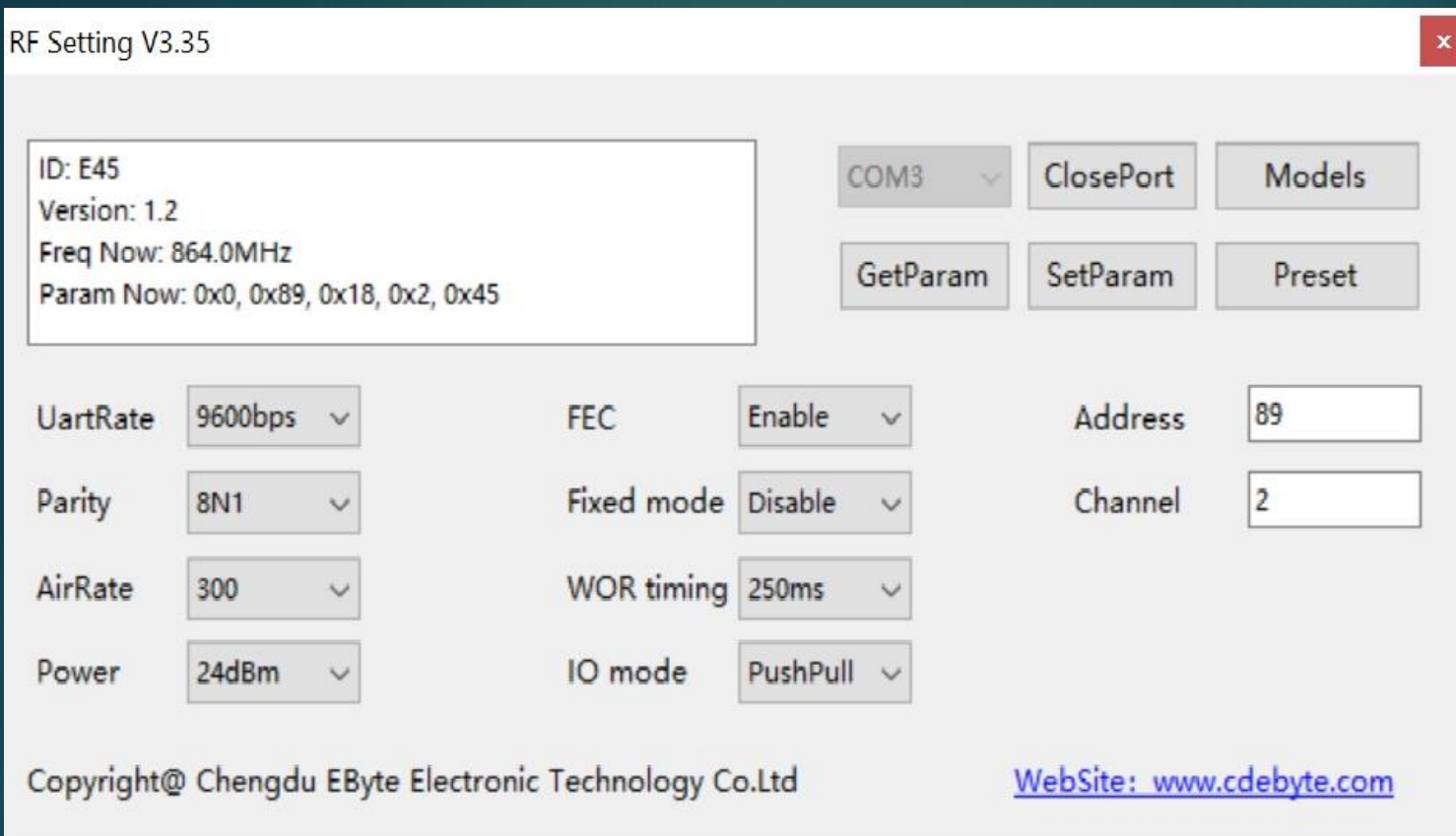
868MHz - channel 0 to 7 is fixed for commercial use in India.

The following channels & more are available in these products.

Channel	Frequency [MHz]
0	865.4
1	865.6
2	865.8
3	866.0
4	866.2
5	866.4
6	866.6
7	866.8
8	865.7
9



868 MHz LoRa UART wireless module



RF_Setting_EN.exe is the windows software to set the module.

Each set can be hard coded in the associated fields.

Each pair to have same address, parity, AirRate & channel to communicate each other



Bill of materials:

Uploader / Sender Unit all prices are in USD

ESP32 - \$4

SSD1306 - \$3

RTC DS3231 - \$3

UART SS Transceiver from ebyte [868 MHz*] - \$6.6 [30 dBm – 1000 mW]

Coaxial – RJ45 cable 120 meter - \$100 [Internally resourced]

Resistors - 6 x 5.6K, 12 x 330 OHM, 1 no 1K

PCB, SMPS – 5V,

3.5 DBi 868 MHz antenna - \$3 [hand crafted from 12 SWG cable]

Receiver Unit all prices are in USD

Arduino UNO - \$3.5

UART SS Transceiver from ebyte [868 MHz*] - \$6.6 [30 dBm – 1000 mW]

ILI9488 TFT 3.5 Inch display - \$8

3.5 DBi 868 MHz antenna - \$3 [hand crafted from 12 SWG cable]

PCB, SMPS – 5V, wires extra from internal resources.

70 Meter Coaxial RJ-45 cable - \$70 [Internally resourced]

Total cost: Less than \$70 USD



4 to 20 mA analog signal

Arduino is not suitable for this mission critical job. Arduino MEGA is OK.

ESP32 is the best. It is a 3.3 volt device so is LoRa.

4 to 20 mA analog signal is converted to 660 mV to 3300 mV by 165 OHM resistor connected across. [2 x 330 OHM is standard resistor available]. Small adjustment can be made in the software portion, using map function.

Also there are modules available to convert mA to mV directly.

Set transmission power to 24 dBm – increase the power up to 27 dBm [500 mW]

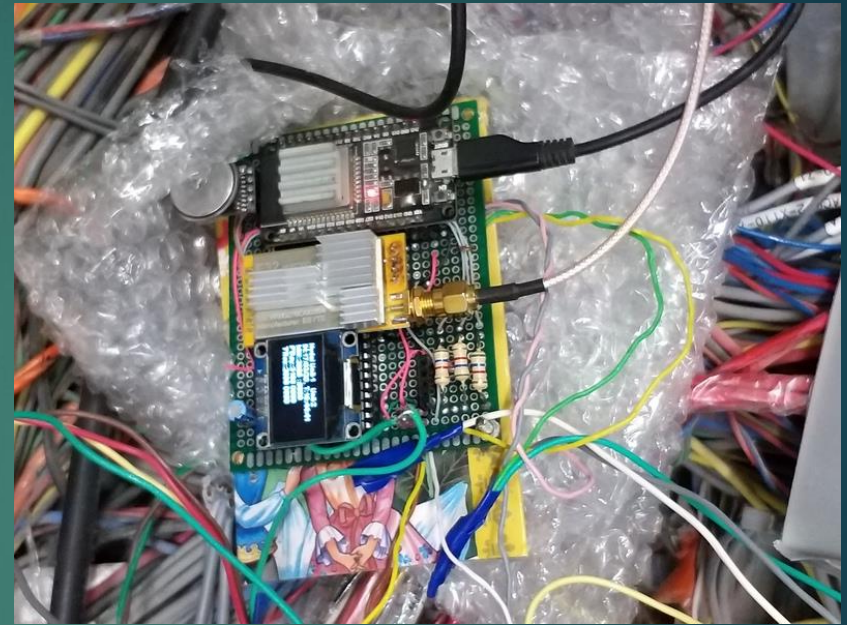
SPI RFM 95 modules can also work up to 24 dBm.

EBYTE UART modules are robust & has better security features [hard coded]

SPI LoRa modules are small & mostly SMPS type, difficult to work with



... antennas are homemade



Antennas are made from strong 12 SWG solenoid winding grade cable to give durability.

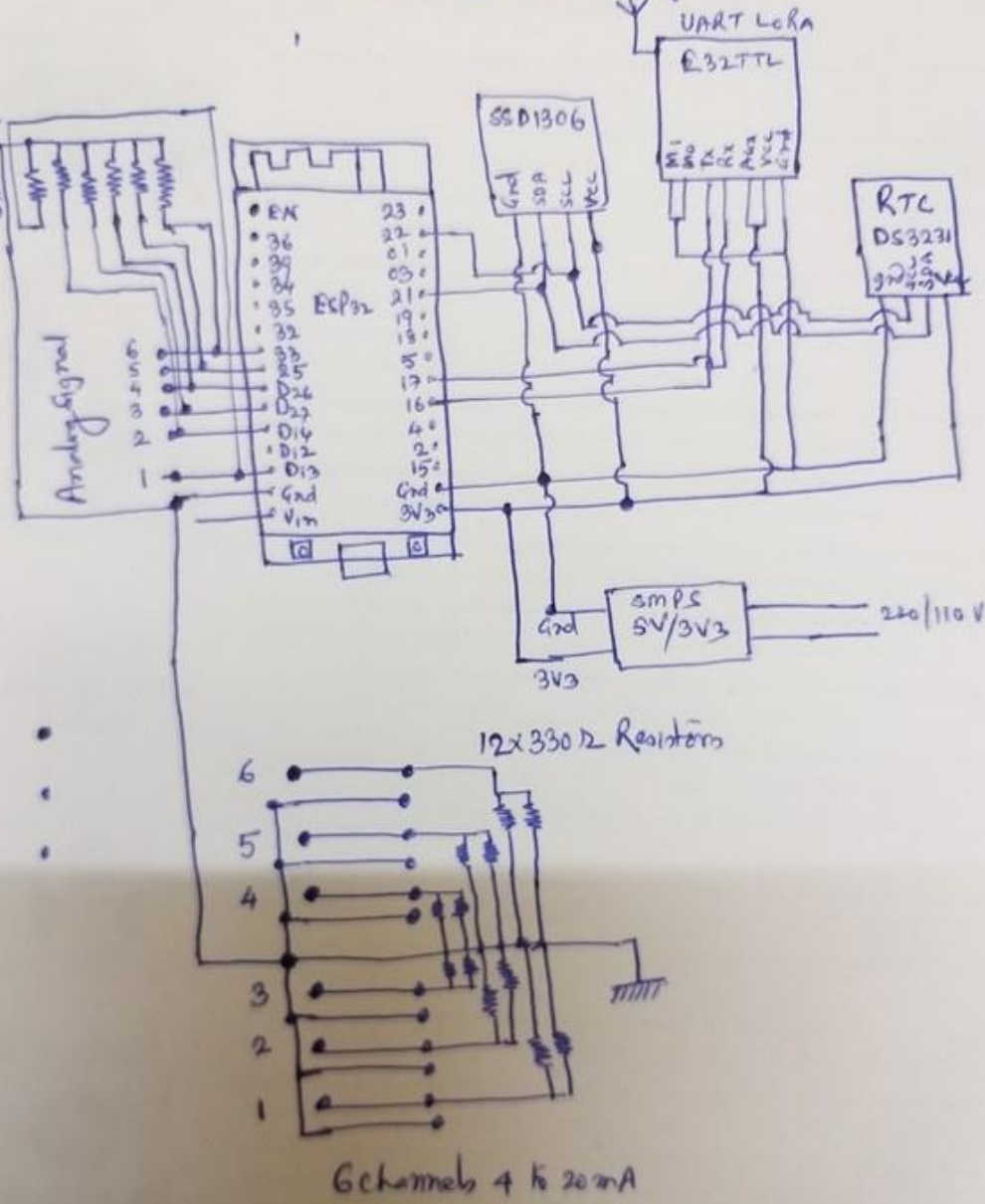
Antenna length for 868 MHz band $\lambda = 299.792.458 / 868.000 = 34,54 \text{ cm}$. $\lambda/2 = 17,27 \text{ cm}$, $\lambda/4 = 8,63 \text{ cm}$.

RJ45 Antenna cable is sourced internally

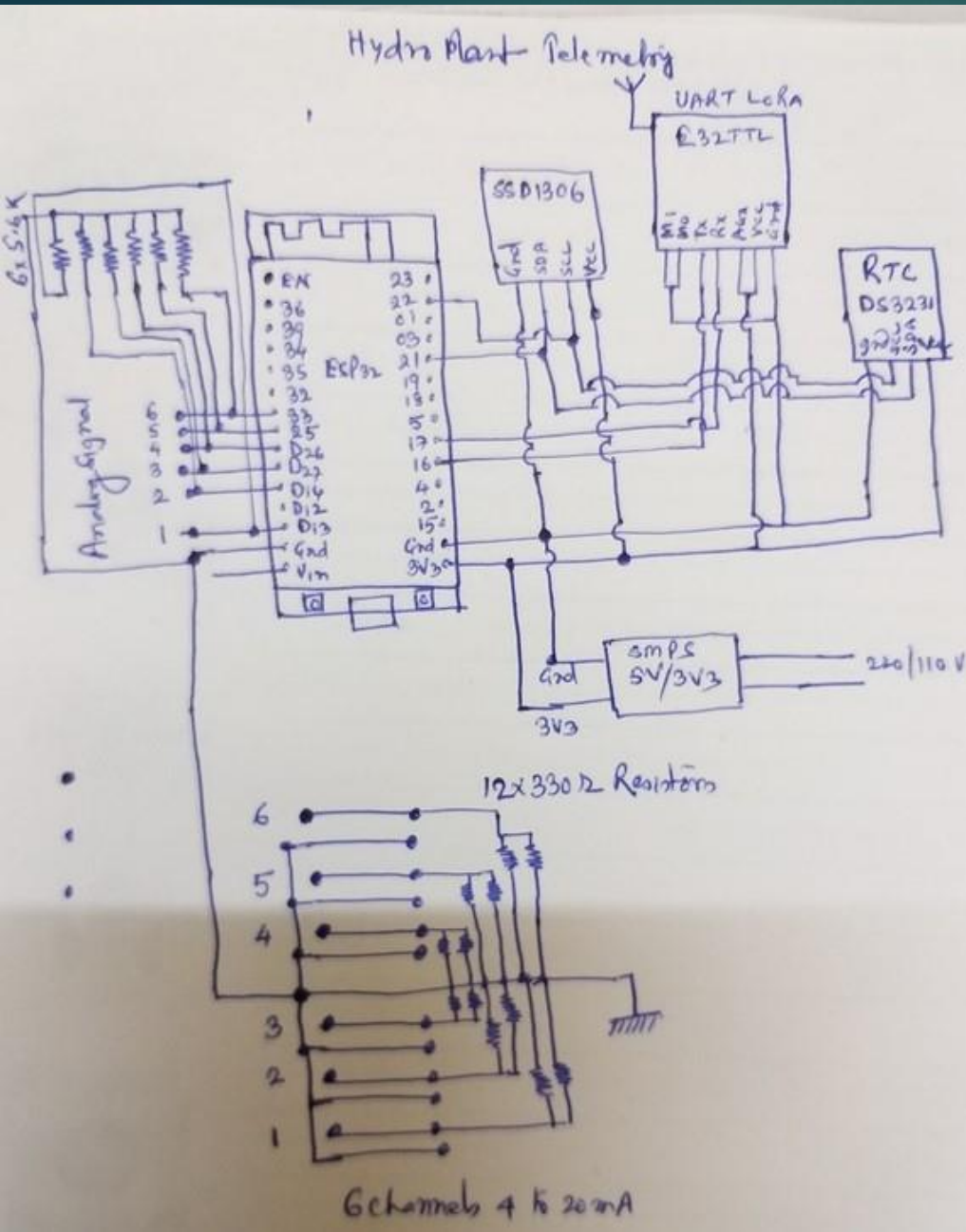


Uploader schematic

Hydro Plant Telemetry



Uploader using ESP32



Date, time, temperature, 6 data arrives in 4 seconds.

Never missed any data stream.

ESP32 is very robust and stable.

1 amp 5 volt charger is used.

No recurring cost.

Soon to be augmented to 20 data.

Cheap yet very efficient.

Can be used for many other areas.



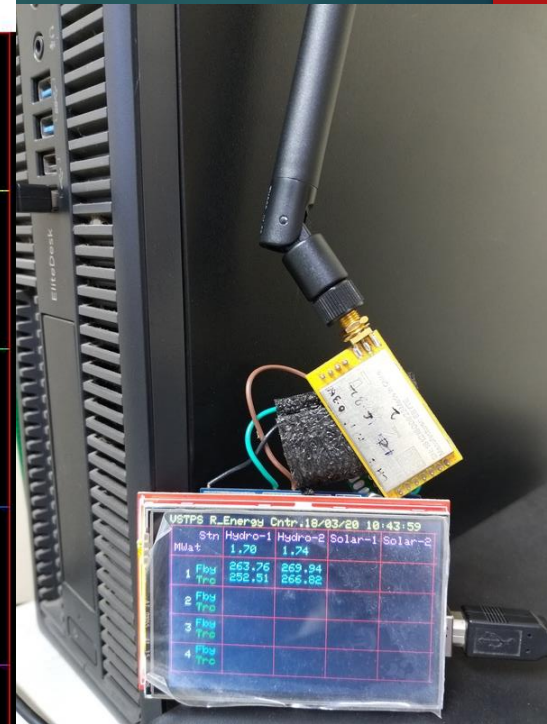
Handheld unit on UNO / Processing output

***** RE Generatio 12/07/20 15:24:11

Unit	Hydel-1	Hydel-2	Total
MW	2.70	2.73	5.42
Forebay	273.49	272.83	
Tailrace	261.37	261.46	

8
12/07/20,15:24:11,2806,3151,1963,2781,3347,1947
1963 1947

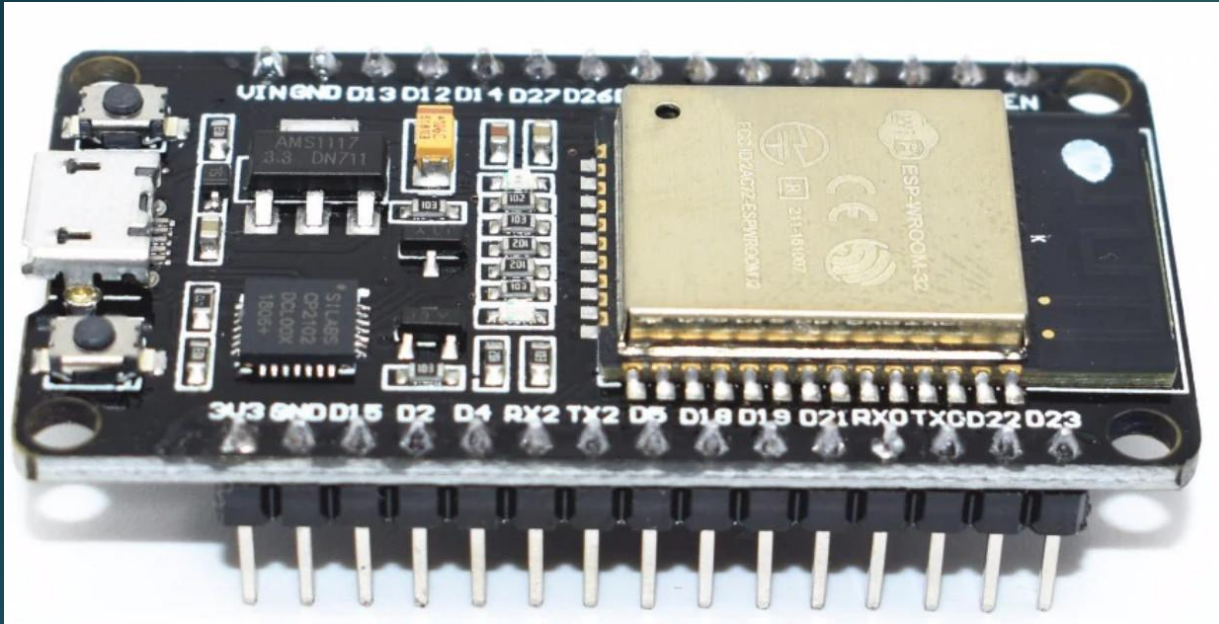
Console Errors



Processing code can be ported easily on other platform.
The processing output is better and can be processed easily
For other associated alarm generations etc.



Output processing...using ESP32



1. Data can be dumped into a MySQL RDBMS.
2. Data can be uploaded to a cloud server – thingspeak.com.
3. Using ESP32 data can be put into a standalone webserver.

Questions ?

