Smart Electric Meter using LoRA Protocols

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***Abstract*—LoRA stands for Long Range communication. The main aim of the LoRA is to target the Internet Of Things requirement and also Bidirectional communication. In order to prove the proof of concept , here we are creating a smart prepaid electric meter which will consist of lora module along with it. All the data related to the meters i.e voltage , energy power etc will be send to a LoRa. LoRa is the central unit or router which collects all the data from all the meters and it is connected with the local storage device or PC which will create the database for all the data, Now this data is again uploaded to the cloud by this pc to the public network, which can be accessed from any of the place. The most important part of this is that this concept of communication can be extended to other application in which the data transmitted bits is less. As a result of this we can overcome the disadvantage of the 3G/4G GSM modules and low power WAN i.e. LORA can be used for communication.**

Keywords— LoRA, Semtech,

I. INTRODUCTION

There are scenarios where the usage of the data network can be considered 1) Consider a car going on the road with heavy traffic, now this card can use the data connectivity for many purpose such as for GPS maps, for infotainment purpose,to upload the car engine real time data on the clouds.

2) Consider another example of the smart electric meter or smart water meter or smart home technology, where the data to transmitted is very less and less frequently then the previous example. Now in the first example the amount of data to be transmitted is very high, as a result it is necessary for us to use 4g/GSM network, where as in the other example the data to be transmitted is very less, now if we use the 4G network for these small purposes, then there would be huge power loss and would not br economically viable As per the research up to 2020 more than 20 Billion devices will be joined by the coluds and most of them would not have huge data transmission as a result of which we need to use the different communication protocols to over come the huge cost by 4G All the huge telecommunication companies have recorded less income in previous years due to advance in android apps which leads to free calling, messaging, ISD etc as a result of which They are moving to the alternate and efficient communication protocols named LPwan protocol.

The main advantage of the Lora protocols are mentioned below Long Range, Free frequency Band, Low power, 256 bits AES encryption, Higher life for end nodes, Requires far fewer base stations than 4G, This can be also integrated by the 5G networks

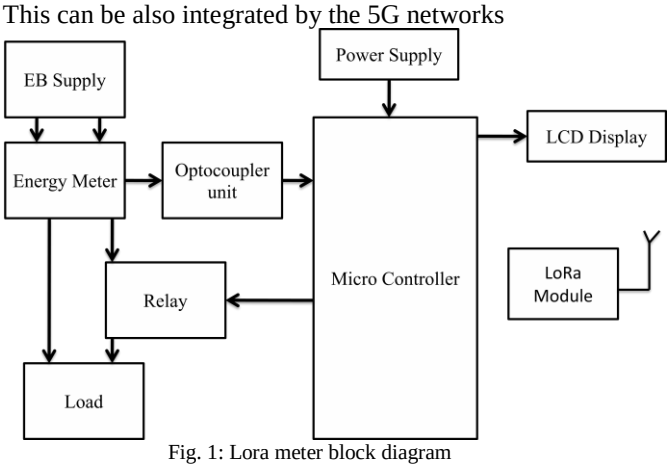

Fig. 1: Lora meter block diagram

A. *Advantages*

1) Long Range: The claimed range by Semtech for Lora is 10 kms with line of sight and it has been tested for 3kms practically.

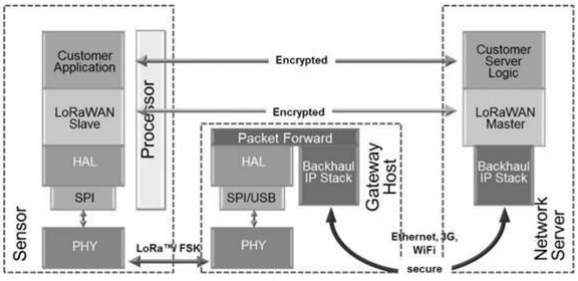

Fig. 2: Schematic Of Internal Lora Communication

2) Low Power: The power consumed by the Lora protocols is extremely less which results In the extended life of the end nodes. The data rates for the Lora application is 50Kbps.

3) Frequency range: Lora uses the free or the unlicensed frequency as a result the Of which the communication cost would be very less.

4) AES encryption: The lora module uses 256 AES en- cryption in order to protect the user data.

B. *Lora communication Classes*

Lora Provides 3 different classes for communication, those are 1) Class A: This class of the communication is for the bidirectional communication where two downlink windows are opened for every one uplink transmission. This Class A provides the minimum transmission of the power and is considered to be the most effective.

2) Class B: This class has the same properties as the Class A but the only difference is that this class provides the open window for downlink at the scheduled times. This allows the to know the server whether the device is listening or not.

3) Class C: End devices with the Class C is having nearly continuously open windows, only closed while transmitting, class C.

II. REGISTERING THE LORA END NODES

Each of the lora end nodes will be having the unique Mote ID, app key and App eui. This details of the mote should be registered in the Gateway, so as soon as the motes are powered on they start posting to the gateway.

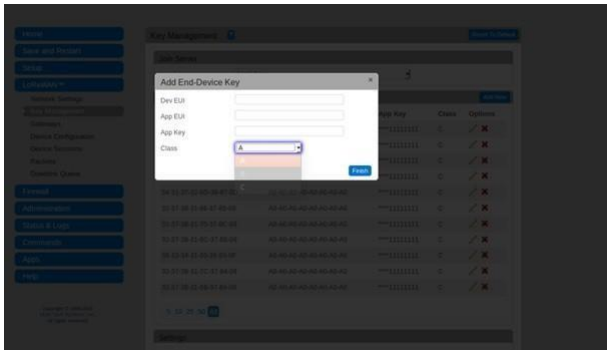

Fig. 3: registering Lora Node

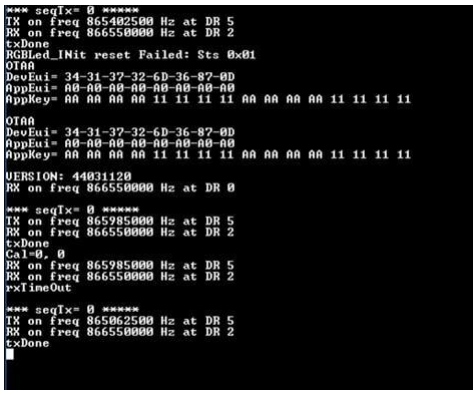

Fig. 4: Joining Of Lora node in UART

III. DEVICE CONNECTION

Once the device is connected, it can bee seen from the UART terminal and verified the uplink transmission. The following data can be acquired from the above Data Rate, app key, app eui etc

IV. DATA FROM THE Microcontroller

Once the data is transmitted the data can be posted and collected in the multitech gateway.

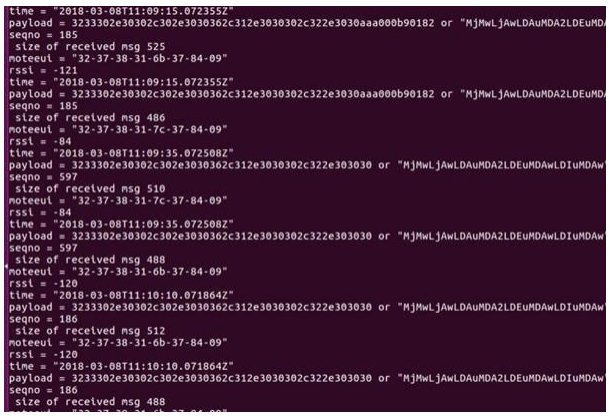

Fig. 5: Gateway receiving the Payload

The above data consist of the RSSI, Time, Payload or the transmitted message, size of the message received, Date etc. This is Linux based programming and the above data can be created database and stored. Also this above data can be used to create the text file so that the statistics can be analysed for our own purpose. The above data can be also seen from the multitech network:

V. HARDWARE/SOFTWARE REQUIREMENTS

A. *Controller*

STM32l072CZ arm m0+ controller

Ultra-low-power 32-bit MCU ARM-based Cortex-M0+ up to 192KB Flash 20KB SRAM, 6KB EEPROM, 4 Uarts 12 bit ADC DACs 256-bit AES encryption

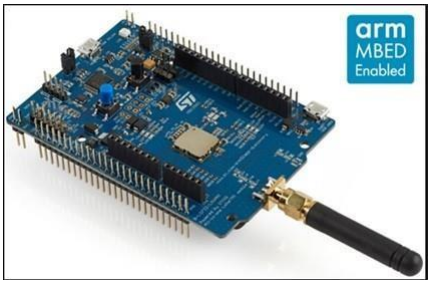

Fig. 6: STM32L072CZ

B. *Multitech Gateway*

VI. SOFTWARE

1) IAR embedded workbench 2) Eclipse Oxygen version 3) Ubuntu

VII. CONCLUSION

The Lora module is effectively able to transmit the mes- sages over the range of 5 km with the least usage of power and data loss is also very negligible.

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