

On-Premises Platform for LoRaWAN Transceiver modules

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Abstract - This research demonstrates an on-premises platform for Long Range Wireless Area Network (LoRaWAN) transceiver modules. The modules can be used to transmit or receive any data via LoRaWAN such as Global Positioning System (GPS) coordinates, temperature or humidity data of the sensors with low-power consumption. The data of GPS and sensors can be transmitted from the LoRa node to the coordinator and eventually to the on-premises server. The platform is designed and developed on the server to be able to access and pull the data and display the data on any browsers with internet access. The GPS coordinates can be collected from the GPS device and plotted as the Road Map Route like Google Map Route but on our server and the temperature and humidity can be displayed on the platform.

Keywords - LoRawan network system, GPS, Sensor, positioning system, wireless low power data communication network

I. Introduction

Since Thailand has widely used of IT equipment, most of them are imported from other countries such as China, the United States, Europe, etc. Therefore, the manufacturers designed that such IoT equipment shall be compatible with the manufacturer's platform, which has servers located abroad and only supports English as the main language. Previously, IoT devices are transmitted using cellular networks to transmit data to the display system via GPS [1,2] and temperature sensors in short messages.

Currently, the IoT equipment in Thailand allows to be used at frequencies of 920–925 megahertz that have been licensed by the National Broadcasting and Telecommunication Commission (NBTC). Most of IoT equipment is in smart farms, smart factories, and

military uses such as providing location coordinates through the network system such as LoRaWAN relying on foreign platforms where the servers are not located in Thailand. There is a risk that, if the overseas servers are closed and unavailable, the entire display/control systems will fail.

LoRaWAN is a system created to support the M2M and IoT markets. There are many prototypes demonstrating a low-power data connection for long-distance communications with very low signal level can achieve the transmission of low-power signals over the desired distance.

Based on this principle, this work has solved the problem by creating its own platform and server in Thailand that supports almost all industrial sectors commercially. The developed system supports both Windows and Raspberry-Pie Operation System (OS) to transmit and receive data for commercial and military applications in Thailand. To be connected with our own system, the IoT LoRaWAN devices as signal transceivers (LoRa devices) are developed.

II. LoRaWAN

Long-distance communication technology, or LoRa, is an abbreviation of Long-Range, developed by the Semtech company LoRa Technology in Thailand [3]. It is allowed to be used in the frequency band of 923 MHz, which is the ISM-band band. LoRa technology has a bandwidth (BW) [4] of 125, 250, or 500 kHz, depending on the frequency band that is allowed to be used in each country [5]. LoRa technology works on the LoRaWAN Stack protocol, as depicted in Figure 1, which is regulated by the LoRa Alliance. The working principle is a tracking device. The location sends data to the destination through the gateway, which can generally communicate at least 10

kilometers away, while the gateway will act as an intermediary, sending client information to the server using the TCP/IP network system through the LAN system or the mobile phone network system.

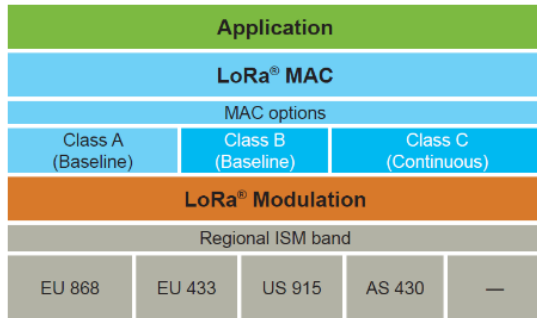


Fig.1 Protocol LoRaWAN Stack

LoRa is a new and emerging technology that plays a key role in today's smart IoT architecture. A spike-based spread spectrum modulation technique is used in LoRa [6], which is still prone to interference and noise. Therefore, LoRa technology is interesting in areas where it is studied, developed, or applied.

III.SYSTEM DESIGN

A. Working Principles of Nodes

The transmitter will send the first set of data as blank data to test the signal [7]. After that, it will receive the values of the GPS sensor and the temperature sensor after the Arduino has received the values of both sensors. It will send data through the Lora Chip, but in the case that neither sensor can receive the data, the code will loop in waiting for the value of each sensor. The data can be sent further, as depicted in Figure 2.

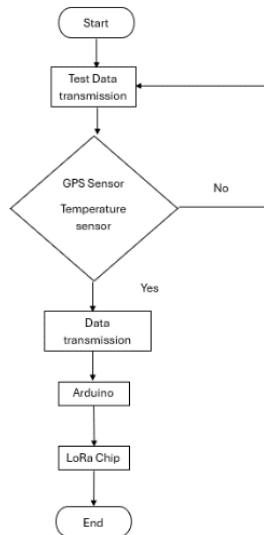


Fig. 2 Diagram Design of System Structure

B. Working Principles of Gateway

The receiver will receive the signal through the LoRa chip on the Raspberry-Pi to import data into the ChirpStack program. After receiving the value, it will be decoded. To forward the received data via MQTT to Node-red after receiving the data, the data will be separated to import data into SQL Server, as depicted in Figure 3.

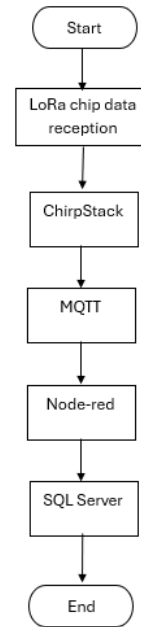


Fig. 3 Diagram Design of System Gateway of LoraWAN

C. Chirpstack working principle

It is to receive data from the transmitter through the RFM95W chip and check whether the transmitter has been activated or not. After detecting that it has been activated, the data will be filtered, and the transmitter will send the data. Once filtered, the data will be displayed through the Device Data page and exported via MQTT, as depicted in Figure 4.

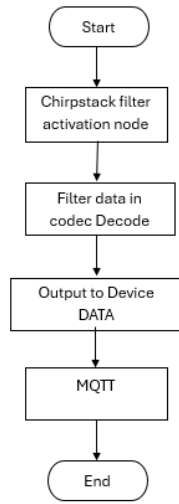


Fig. 4 Diagram Design of ChirpStack

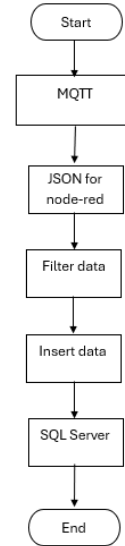


Fig. 6 Diagram Design of Node-RED receive

D. Node-red working principle [8]

It is to receive ChirpStack values through MQTT [9] to enter to the Node-Red. After converting the entered values, it will convert the Node-Red's JSON data to filter the data and import it into SQL Server by filtering the required data. After that, SQL will be written to be imported into the SQL Server, as depicted in Figure 5 and 6.

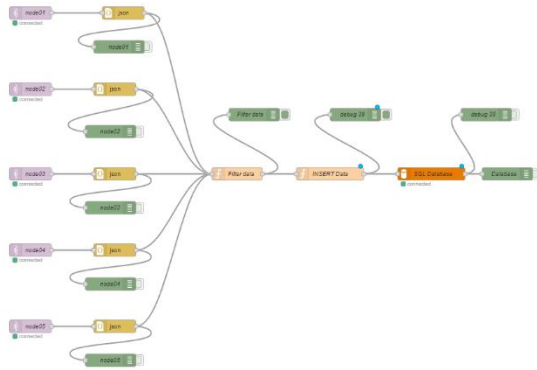


Fig. 5 Diagram of Node-RED

E. Working Principles of Dashboards

The dashboard will be enabled through the Node-RED system. The Node-red will retrieve data from SQL Server. After that, Node-red will send the data to the programmed as depicted in Figures 7 and 8.

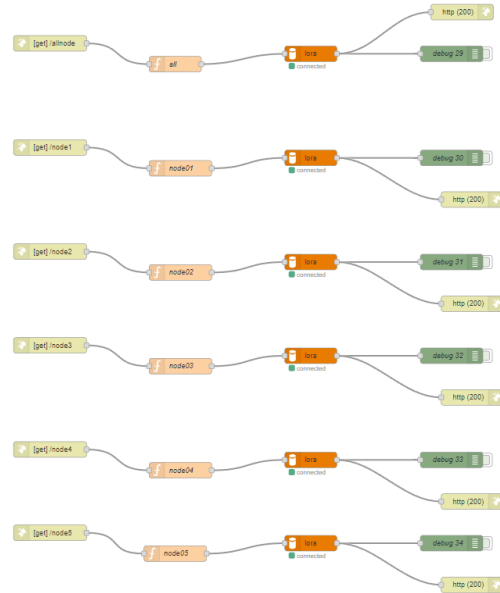


Fig. 7 Diagram of Node-RED Dashboard


```

6:52:49 AM      uplink

applicationID: "2"
applicationName: "Kmutnb-001"
deviceName: "node01"
devEUI: "70b3d57e005f3d7"
rxInfo: [] 0 items
txInfo: [] 3 keys
  frequency: 923200000
  modulation: "LORA"
  loRaModulationInfo: [] 4 keys
    bandwidth: 125
    spreadingFactor: 7
    codeRate: "4/5"
    polarizationInversion: false
adr: true
dr: 5
fcnt: 1
fPort: 1
data: "MJQuMjAsNTcuMTAaMTAwLjUwOTMzMCwzMy45MTU3MjMMAAAAAAAAAAAAAAAAAAAAAAA="
objectJSON: [] 4 keys
  hum: "57.10"
  latitude: "13.915723"
  longitude: "100.509330"
  temp: "24.20"
  tags: [] 0 keys

```

Fig. 12 Details within the data frame displayed on ChirpStack Application Server Filter data

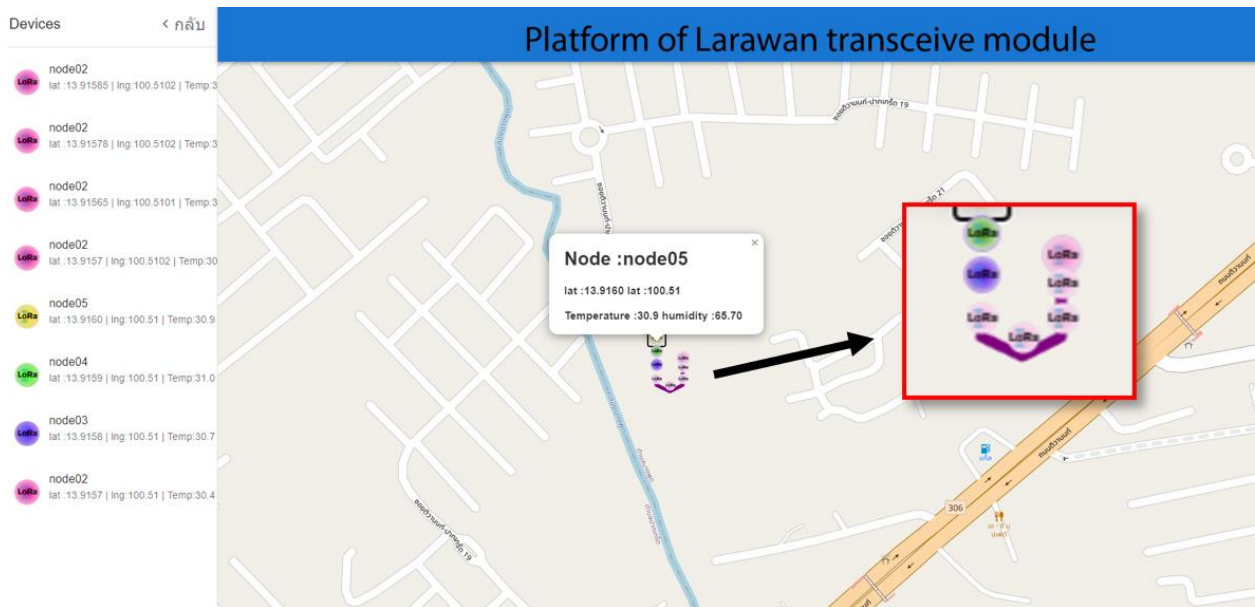


Fig. 13 Dashboard on web site

B. Web dashboard

Displayed on the web dashboard, there are (1) Name of the device (2) the location of the device and (3) the temperature values. Relative humidity can be displayed on the Web Dashboard, as depicted in Figure 13.

VI.CONCLUSION

This paper presents the design and development of a platform of LoRaWAN Transceiver module for transferring the data of GPS location and temperature and humidity system using LoRaWAN technology. The LoRaWAN modules could be any

IoT devices. With this platform, we can demonstrate the successfully transmission of data with historical log-file. This can confirm the use of this Platform for replacing any cloud server platform by any manufacturers without the concern that the manufacturers from abroad will terminate their services.

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