User Manual

Group: I-TT-4N2, I-IT-4N2

Version	Date	Author	Change
1.0	12.12.2017	Apurva Ganoo	-
1.1	15.12.2017	Apurva Ganoo	Additional Info.

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Summary

This user manual is designed to provide a concise overview of the City Atmospheric Measurement System (CAMS) Project that was undertaken by the Information Technology students from the Finnish and English side at the Vaasa University of Applied Sciences.

The idea of the user manual is to help familiarize the potential user about the system, and identify the most important aspects. This includes information about the functions embedded in the nodes, the components utilized, the maintenance issues regarding the nodes, and other such important parameters.

The nodes, which measure and monitor the data, are designed to automatically and periodically transmit data to the Things Network Gateway; after which, the user can access the information from the official website, provided that they have signed in with the correct credentials to access the right gateway.

The goal of the project was to design a scalable environment, beginning with a single node, where multiple nodes send various measured environmental data to the Things Gateway automatically. The information is first read through the Things Network webpages, but is also then saved onto a secure database. In the future, to further increase the range of the network, smaller forwarding gateways could be added in to the system. The overall system architecture can be seen in the chart below (see fig.1).

Introduction

The goal of the project was to deliver a working prototype, or a node, which was capable of measuring at least 3 environmental variable using different sensors, which would then push data using the LoRaWAN network to The Things Network gateway which was hosted at our university.

This project, if undertaken, will require a basic understanding of electronics and electrical components, some programming knowledge; particularly in C, and an understanding of LoRaWAN technology and protocol along with knowledge about the Things Network.

The general system architecture can be seen below (see fig.1).

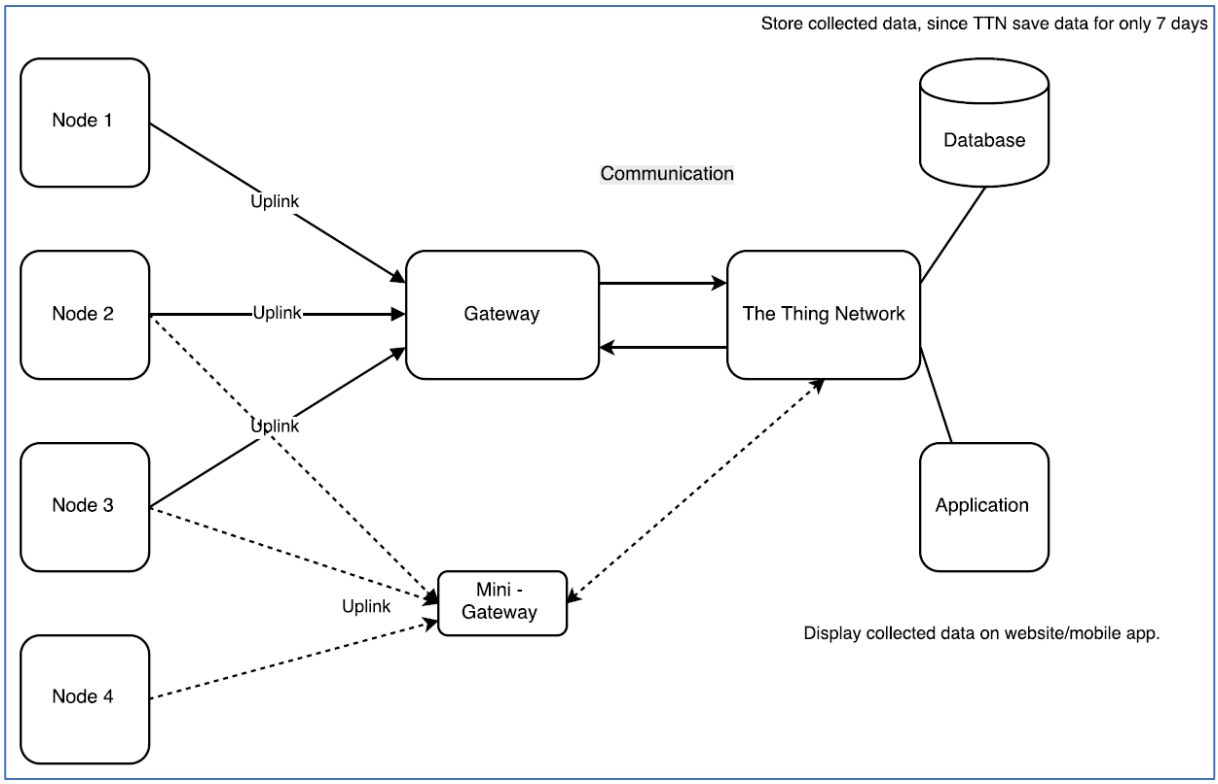

Fig.1 – System Architecture

Accessing the Data:

From a general user point-of-view, the data sent by the nodes can be read from the Things Network web-based platform.

A step-by-step guide of The Things Network can be seen below:

Fig.2 Main Dashboard of The Things Network

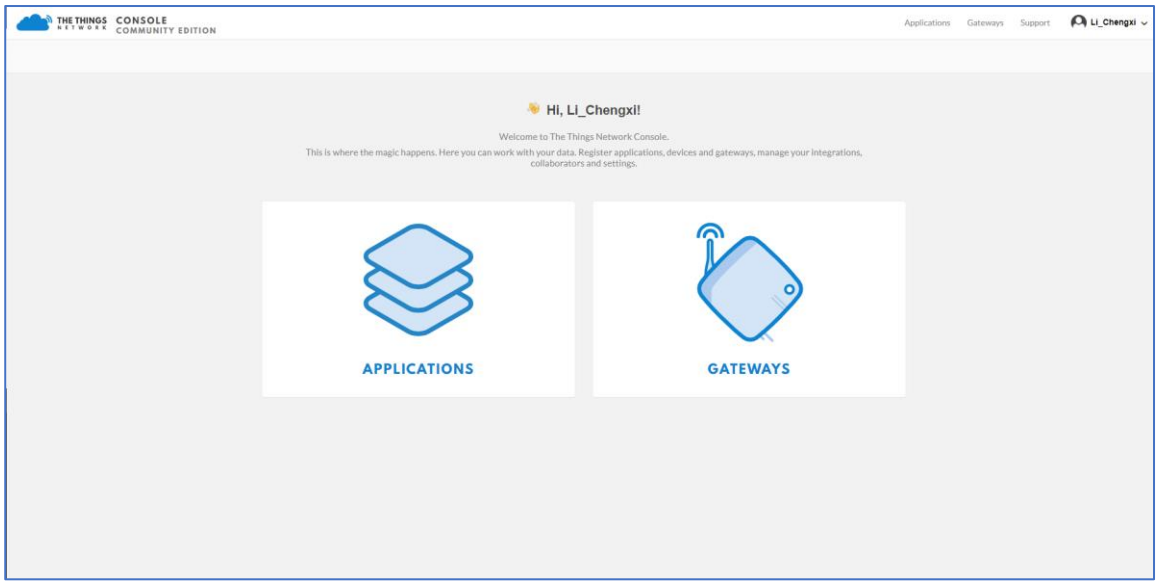

Fig.3 Interface for choosing the right Things Gateway

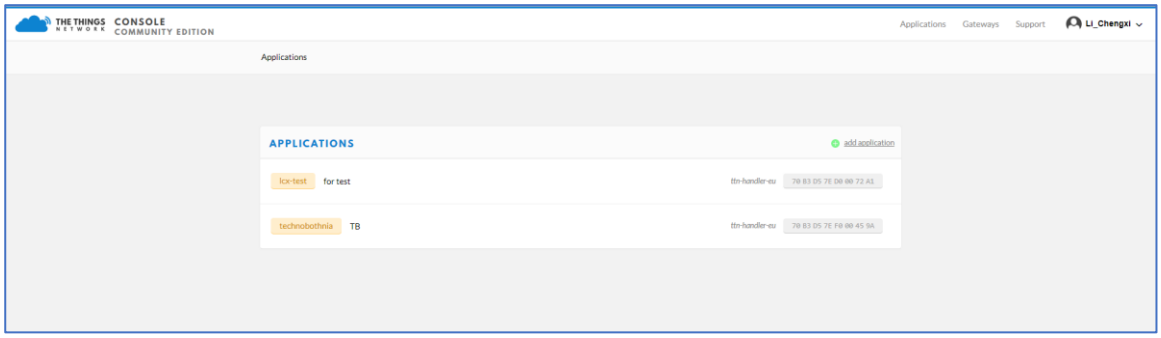

Fig.4 Interface for configuring the application layer.

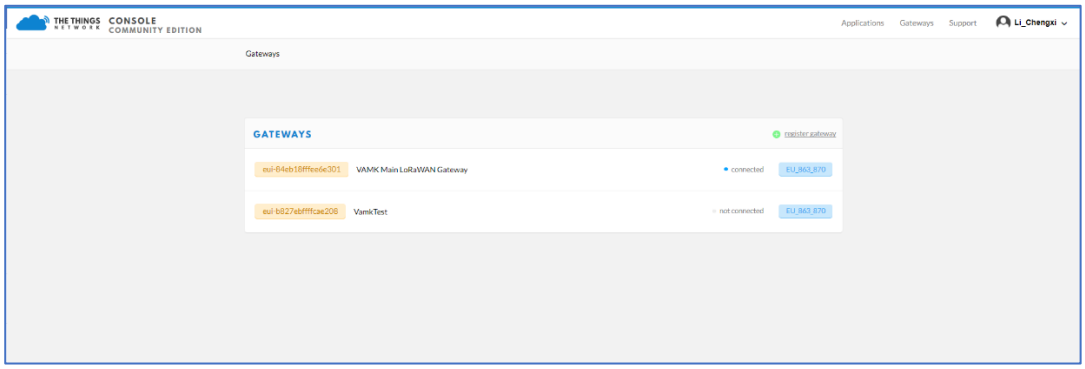

Fig.5 Interface for configuring the Things Gateway.

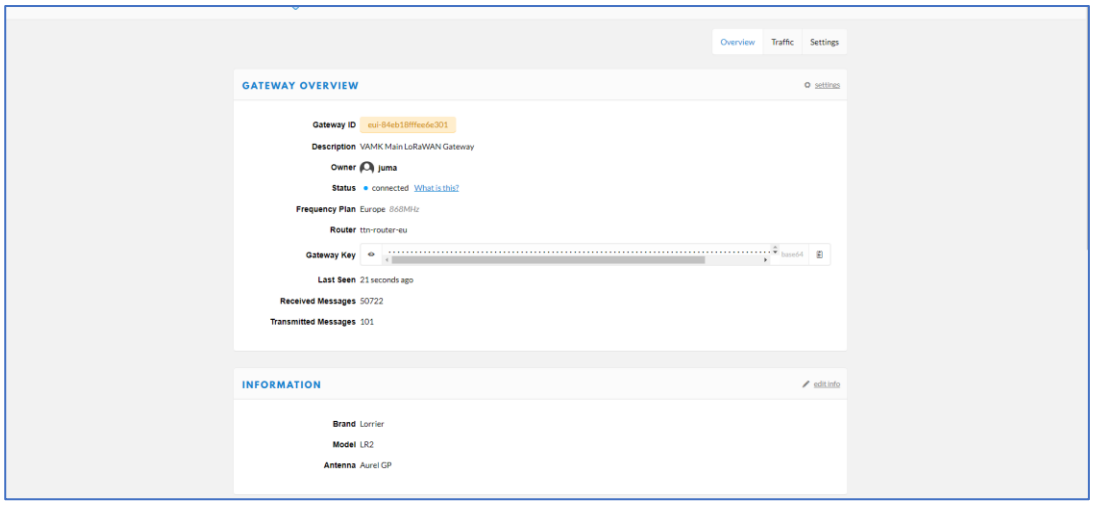

Fig.6 – Gateway work status

Fig.7 – Sample Payload and its individual components

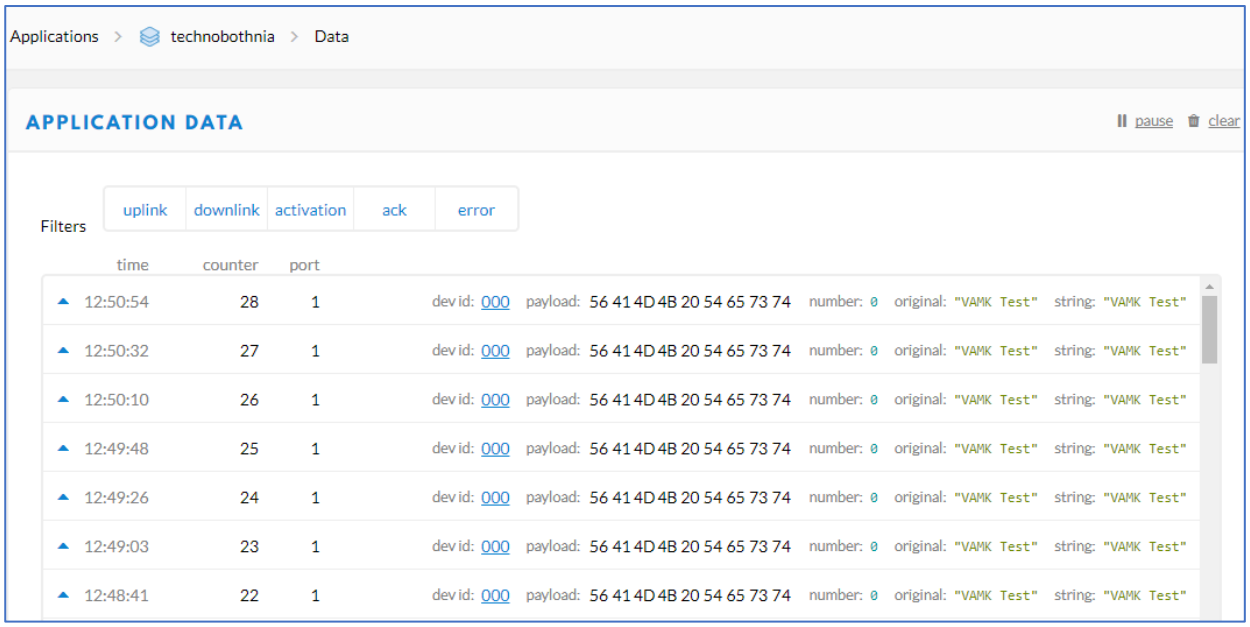

Fig.8 – Packets received by the Things Gateway

The functions created, and utilized for the project can be seen below:

Functions:

Function Name	***Function Description***
IR Sensor	Check if Infrared sensor is blocked by something or not.
Change_Resolution	Change resolution of measurements
get_humi	Obtain humidity values from sensor
get_temp	Obtain temperature values from sensor
main	Saving obtained values of temperature and humidity
read_byte	Reading values
send_byte	Sending values forward
send_start	Sending initial signal to sensor to begin measuring
write_register	Write values to register on microcontroller

Fig.9– Function Descriptions

Problem Situations & Maintenance

It was estimated by our team that without recharging the batteries, the node is expected to last, on average, 16 days. As such, it would be important to maintain and check up on the nodes on a fortnightly basis.

Furthermore, it will be important to keep in mind the operating temperatures of the various components and sensors that will be present in the nodes (see fig.9).

Component/Sensor	Operating Temperature (Theoretical)
Atmel ATMEGA 128/L Microcontroller	-40 to 85 °C
Temperature Sensors	-40 to 124 °C
Wind Sensors	-40 to 60 °C
Infrared Sensor	-25 to 85 °C

Fig.10 – Operating Temperatures of Sensors

Other maintenance issues, in terms of the hardware, may lie around ensuring a safe environment, and protecting the electronic components from environmental hazards such as water.

Moreover, it will also be important to know the maximum range of the nodes which, depending on the weather and other factors, may be less than 1km. As such, it is important to keep the node within a 1km radius of the Things Gateway, in order to ensure that the data is received by the gateway. In the future, additional smaller gateways could be designed to forward data from nodes, and to extend the overall range of the coverage.