LORA TECHNOLOGY TO BUILDING LPWAN IN REPUBLIC OF BELARUS

Dmitry Dovgulevich
VSU named after P.M. Masherova, Vitebsk, Belarus

Currently, the concept of the Internet of Things (IoT) is increasingly heard. It is a concept whose essence is the interaction of objects connected to a network for interaction between themselves and the outside world.

Initially, the concept was planned for household items and devices, but at this stage, it is applicable in industry, especially with the development of distributed automated process control systems [1].

Combining devices into a single network can be implemented both through wired data channels and wireless.

The main requirements for communication channels (both wired and wireless) are high work efficiency, fault tolerance in various conditions, and the possibility of self-organization of the network. These requirements are met by energy-efficient long-range networks (LPWAN) - wireless technology for transmitting small-volume data over long distances, developed for distributed telemetry networks, machine communications, and the Internet of things.

The purpose to study the capabilities of LoRa wireless data technology for building LPWAN networks

Material and methods. LoRa Acsip S76G radio communication modules. The main methods used: analysis, systematization, synthesis, experiment.

Findings and their discussion. LoRa is a technology for remote wireless data transmission at frequencies of 433 and 868 MHz (but there may be other frequencies).

LoRa technology is just the physical layer of data transfer that can be used with various data link protocols and in various network architectures: star, point, point-to-point. However, the most popular solution is to use LoRa in LPWAN using the LoRaWAN protocol.

LoRaWAN is an open data transfer standard that provides a high level of network development and is designed for a large number of devices (up to 1,000,000) with a long range and low power consumption, which is standardized by the LoRa Alliance (an association of corporations that promote this technology).

LoRa uses the frequency range allowed for use in the Republic of Belarus. LoRa systems exist for the 433 and 868 MHz bands, but the frequencies of 868 are freer and, therefore, more optimal.

In this range of 1.5 MHz of the unlicensed spectrum - 868.7-869.2. With a power limit of 25 mW. LoRa technology was developed to operate at a power of 25 mW, and, accordingly, these frequencies are excellent for operation on the territory of the Republic of Belarus.

The communication between the gateways and the terminal devices is two-way. Still, it is assumed that the bulk of the data is transmitted from the terminal devices to the gateways. LoRa technology provides wireless transfer rates from 0.3 to 50 kbps.

LoRa provides a large radius of action in an open area (up to 15 km), as well as high penetrating power so that it can receive information from devices used in basements, sewers and other inaccessible places. Under urban conditions, the radius of action decreases markedly and is about 1-6 km, depending on the density of buildings [2].

As of 2019, LoRaWan technology is not widespread in the Republic of Belarus, but it is actively developing in the Russian Federation and the European Union. Several companies produce equipment for creating networks based on the LoRaWan protocol, the most famous of which are Kerlink BS (France), Vega BS (Russia), Cisco BS (USA) [2].

Acsip S76G modules are an integrated solution based on the SX1276 RF module and the STM32F0 protocol. The module is capable of operating in the range from 137 MHz to 1020 MHz. For the module, the manufacturer provides a ready-made library, and programming is carried out similarly to STM32 microcontrollers. It is recommended to use STLinkV2 or similar to software. The module can support LoRa and LoRa-WAN technologies.

When testing the Acsip S76G radio communication modules, the point-to-point mode at a frequency of 868 MHz was used. It was possible to obtain a communication range of ~ 12 km in a direct line of sight. The main problem during testing was the lack of open areas of sufficient length.

Conclusion. When checking communications in conditions of indirect visibility, it was possible to get a reliable connection range of ~5km. The data transfer rate was 1200 bytes / s. This speed is sufficient for polling most devices.

1. The Internet of Things is the basis of the new economy - 2016 - Access mode: https://www.itweek.ru/iot/article/detail.php?ID=182807 - Access date: 02/03/2019.
2. Basics of LoRa and LoRaWAN - 2018 - Access mode: http://lorawan.lace.io/faq/ - Access date: 02/03/2019.

CHESS GAME IN UNITY 3D WITH MACHINE LEARNING

Alexandra Fedorenko
Omsk F.M. Dostoevsky State University, Omsk, Russia

We often hear such verbal constructions as “machine learning”, “neural networks”. These words have already entered into the public consciousness and often associated with pattern and speech recognition, with the generation of a human-like text. In fact, machine learning algorithms can solve many different types of problems.