

AREAS OF USE OF THE MoleNet DEVICE IN WIRELESS SENSOR NETWORKS

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In recent years, wireless sensor networks have become a leading area of research due to their efficient performance and positive performance. With the help of these types of special networks, it is possible to track certain activities and collect and use data grouped by results. In addition, wireless sensor networks offer real-time remote or targeted monitoring and are cost-effective and simple to set up. Specifically, MoleNet device localization methods are not provided.

The importance of the MoleNet device in matters of establishing a wireless sensor network in the territory of Uzbekistan is huge. That is, in the process of designing a wireless sensor network, this system is relevant in the assessment of remote data monitoring and reliability. For this, it is necessary to analyze the network organizers and types. The components of a wireless sensor network include:

- sensor block;
- data processing and storage unit;
- wireless transmission module;
- consists of a power control unit.

A sensor block is a responsive device that detects certain types of parameters from pressure, heat, light, and other similar physical or environmental conditions. The wireless transmission module consists of devices that can transmit data collected from the monitored area. The received data is transmitted through several nodes, and the data is connected to other networks using a gateway. Depending on the location and environment, the types of wireless sensor networks are as follows:

1. Mobile wireless sensor networks (*Mobile*)- The implementation of Mobile Sink (MS) in wireless sensor networks (WSNs) balances the energy consumption in the network and extends the network lifetime. In mobile WSNs (MWSNs), MS moves in a controlled manner with limited time for data transmission. Multimedia wireless sensor networks (Multimedia) is a promising and innovative network of wireless connected devices consisting of video, audio streams, etc. Nodes in the sensor field are connected to each other wirelessly for data compression and data retrieval. Terrestrial wireless sensor networks (Terrestrial) - in this type of sensor networks, hundreds of thousands of sensors are placed randomly or in advance in a specific area, and are mainly used in the field of environmental monitoring. Its main disadvantage is that energy consumption creates a problem for the stable operation of the network. Underwater wireless sensor networks (Underwater) - in such networks, nodes are placed on the water surface and under water. All nodes communicate and exchange information with other nodes and base stations in the same network. Communication systems transmit data using acoustic, electromagnetic or optical waves. Underground wireless sensor networks (Underground) is a specialized type of wireless sensor network, in which sensors are mainly installed in the soil for agriculture or on the walls of a mine to monitor changes in the soil. Sensors aimed at irrigation and environmental monitoring programs are placed underground at a specified depth.[1]

As we mentioned above, the use of wireless sensor networks in various fields gives effective results. Including wireless underground sensor networks to monitor soil conditions, as well as parameters such as water content, mineral content, salinity and temperature. The underground network is very different from the surface network. This creates problems for research studies. The design of MoleNet for wireless underground sensor networks is desirable. MoleNet monitors soil water content and helps improve soil fertility. MoleNet is a specially designed device for wireless underground operation, which is placed completely underground, except

for the base station, all sensor nodes are placed underground. MoleNet sensor nodes meet all requirements for underground placement. (1-rasm). MoleNet is based on Atmega328p microcontroller. MoleNet uses power-efficient components to extend its lifetime.



Figure 1. MoleNet device and underground node view.

MoleNet is based on Atmega328p microcontroller. MoleNet uses power-efficient components to extend its lifetime. It is equipped with an 8MHz external crystal, an MCP1703 power-saving regulator, a 25LC1024 1Mbit EEPROM for data logging, and an RV8523 RTC clock for storing local time and waking the controller from deep sleep mode. In order to maximize the distance between two sensor nodes, the Hope RF RFM69CW 433MHz transmitter operates based on the UG2UG (underground-to-underground) and UG2AG (underground-to-aboveground) communication bands.[2] A 433 MHz receiver is used to test the UG2UG connection at a depth of 20 cm. A MoleNet sensor node with a 433 MHz receiver can achieve a reliable UG2UG communication range of 7.5 m. After testing the underground MoleNet for five days, it was shown to work continuously and withstand the weather. Figure 2 shows the change in the amount of water caused by heavy rain at the experimental site.

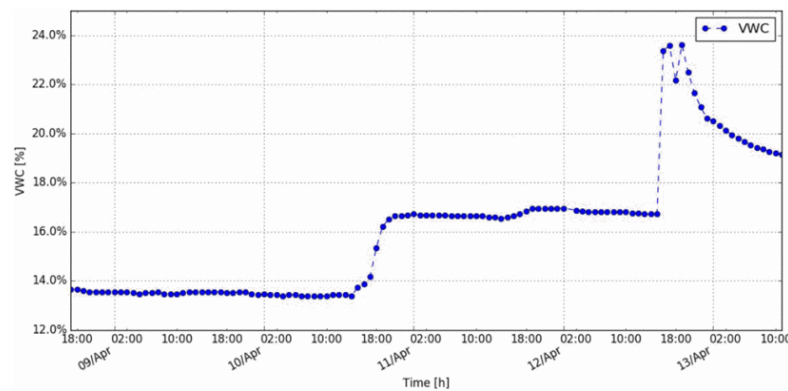


Figure 2. Indicators of changes in water content obtained on the basis of the MoleNet device.

A base station with GSM and GPRS communication capabilities will also be integrated. Techniques such as reactive and adaptive sampling should also be introduced to further increase the lifetime of a MoleNet sensor node. Finding a solution to multi-domain routing problems in wireless underground sensor networks will enable remote monitoring of surface water, groundwater, artisanal water, pressurized or chemical composition of water in the future. [3] Currently, observation wells used in agriculture take up a lot of space, so it is recommended to use the MoleNet device, since their constant monitoring, i.e., the security system, is a problem. The MoleNet device processes data on water content and salinity of agricultural land and transmits it to a centralized database through a wireless sensor network. This not only gives its results, but also helps to solve the problem of security issues.

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