Ways to Improve and Implement Satellite Network (SGN) Systems

Bozorov Maxmud Muminovich
Karshi Engineering Economics Institute, dotsents

Bozorov Malik Muminovich
Karshi Engineering Economics Institute, assistants

Fayziev SHoxrux SHamsi o'g'li
dotsents of the Karshi Institute of Engineering Economics

A B S T R A C T

The main goal of the article is to increase the demand for topographic and geodetic data required for the detection and application of satellite geodetic receivers in the improvement of geodetic topographic work and the study and evaluation of agricultural land, processing of materials obtained in the update of topographic maps.

R T I C L E I N F O

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Relevance of the topic. After the independence of the Republic of Uzbekistan, like all other spheres, geodesy and cartography are developing. Increased demand for topographic and geodetic data required for the detection and application of satellite geodetic receivers in the improvement of geodetic topographic work and the study and evaluation of agricultural land, the processing of materials from remote drones carrying out topographic maps. In order to further improve the current scientific and practical work, great importance is attached to the implementation of new techniques and technologies in the field.

First of all, it should be noted that in order to carry out the work of updating and creating topographic maps, the State Geodetic Networks (SGN) must be built to meet all requirements. In this regard, scientific and practical work is being carried out in our country.

In particular, a large amount of funds has been allocated for the improvement of the State Geodetic Network in the territory of the Republic of Uzbekistan, the technology of the Earth's satellite system, and great attention is paid to the development of this work.

The point is that all lands, buildings, state boundaries, and total existing objects on the ground are found and identified on the basis of DGT. Provision of location information and topographic maps with clear and up-to-date information will increase the efficiency of movement in the troops.

In the regions, the state serves the preservation of geodetic points, the signs of the objects of primary orientation and the coordinates of the objects in it. In this case, its area is calculated by the coordinates of the boundaries of the regions. Hence, the accuracy of area calculation is directly related to the accuracy of coordinates.

Recently, the demand for updating topographic maps has been growing due to the increase in the number of settlements, the construction of new roads and bridges, the creation of new industrial zones on the ground. This can be explained by the increase in urban population, resulting in an increase in industrial area. This requires improving and increasing the accuracy of geodetic measurements.

At present, the coordinates of boundary markers and objects on the ground are determined by passing the theodolite path, as well as using the polar coordinate method. Modern geodetic instruments and technologies (electronic tacheometers, satellite

technologies), which have been widely used in geodetic production in recent years, ensure that topographic surveys can be performed in a short time, with minimal labor and, most importantly, with high accuracy.

Using satellite technology, it became possible to find point coordinates in millimeter accuracy in a short time.

Therefore, the development of methods for the combined use of satellite and ground measurements to use the capabilities of satellite technology in the geodetic support of surveying in the regions, especially in the development of the geodetic basis for topographic surveys, is one of the current issues. This is due to the fact that a large number of points of geodetic networks, built on the basis of traditional methods, do not meet the requirements of the time when conducting topographic surveys due to loss, lack of mutual visibility and a number of other factors.

The relevance of the topic to the priorities of scientific research in the country. Resolution of the President of Uzbekistan dated 25.09.2013 No 2045 "On the implementation of investment projects in the creation of a geographic information system" and the Resolution of the Cabinet of Ministers dated 26.12.2017 No 1022 "On the use of international geodetic coordinate system in the territory of the Republic of Uzbekistan" to increase accuracy, to obtain fast, accurate and visual geoinformation.

The purpose of the research is to analyze the current satellite geodetic network (**SGN**) using scientific and practical sources, and to review and justify the coordinate systems for topographic work for the territory of Uzbekistan.

The object of research is topographic maps of all regions, cities, districts and settlements of the Republic of Uzbekistan.

The subject of the research is the consideration and substantiation of coordinate systems that allow digital representation of information about the territory of the republic and their inclusion in the computer database in the maintenance of automated geographic information systems in Uzbekistan.

Research Hypothesis: Improving the use of satellite geodetic network (**SGN**) in the creation of topographic maps.

The degree to which the problem has been studied. Many scientists are currently working around the world, for example, in Russia (G.V. Demyanov, V.P. Gorobets, G.G. Pobedinsky, E.G. Gienko), Belarus (N.I. Rudnitskaya), Australia (R.Harvey, W.Featherstone), in Spain (L.Zurututa, M.Sevila), P.Cheng , H.Wen H. from Asian scholars. A. Moxamed, M.G.Godjamanov, A. V. Gordeev, A. V. Maslov, Yu. K. Neumyvakin, M. Ya. Bryn, T. M. Pimshina, A. V. Voytenko, M. A. Monakhova, as well as at the enterprises of the State Committee of the Republic of Uzbekistan UZGEODEZKADASTR and Doctor of Physical and Mathematical Sciences, Professor Fazilova D.Sh. conducts scientific and practical work.

Objectives of the research:

Coordinates the creation and updating of topographic maps, including the study of general coordinate systems, the use of coordinate systems in topographic surveys, including local coordinate systems, as well as the study and analysis of the state of coordination in topographic and geodetic work in the country ;

analysis of methods and accuracy of coordinates of surface objects, analysis of traditional and modern methods of coordinate determination, analysis of accuracy of depiction of state borders and objects, and analysis of theoretical issues of local coordinate systems for topographic surveys;

devoted to the problems of satellite coordinate systems and their application in topographic surveys. Coordinate systems used in satellite technology, remote sensing drones using satellite geodetic receivers to update topographic maps, as well as the efficiency of traditional and modern surveying, reshaping coordinate systems, and transferring coordinates from one product to another. usage issues.

Research methods: System analysis, information theory, mathematical methods (statistical processing of data, graphical representation of results, etc.) were used as a method of theoretical research. As an experimental method, the transition from the local coordinate system to a single state coordinate system is carried out using special programs.

Scientific novelty of the research:

Automating the process of updating topographic maps, providing digital representation of the coordinates of objects using a satellite geodetic network using modern tools and technologies;

The development and substantiation of practical recommendations for the systematic application of remote sensing using unmanned aerial vehicles, including drones, and the stitching and generalization of ready-made matrix images in the updating of topographic maps is scientifically new.

One of the key factors in the economic development of many countries is the rational use of natural resources available to them. Land is the main source of such resources. The use of land data can help to create a plan to increase its productivity and then prevent a decline in land quality.

In order to increase the efficiency of land use, it is worth noting the following information about it. First of all, the right to own land, the availability of the right to use it, the value of land and other real estate, the amount of tax levied on them, and even the development plan of the region where the land and real estate are located.

A land or real estate cadastre system will be set up to collect a large amount of information about land and other real estate, process it, store it and, if necessary, solve the problem of its use. The modern cadastral system has its own characteristics in each foreign country.

Today, almost all developed countries use global navigation satellite systems (GNSS) to build geodetic reference networks for the maintenance of state cadastres. Consider the construction of a geodetic foundation using GNSS on the example of Sweden.

In Sweden, GNS technologies have been used since 1989 in the construction of state geodetic networks and their adequate compaction. Based on experimental experiments, guidelines for design methods and strategies, observation, data processing and analysis, use of GPS and its application in geodetic practice have been developed. In Sweden, GPS measurement technology is well mastered and is used to solve a wide range of geodetic problems.

Sweden has a nationally planned geodetic network, which covers 70% of the total area. The average distance between national network points is 10 km. The network was built between 1967 and 1982 by a trilateration method with a relative error of 1-2 ppm.

Currently, the construction and development of geodetic reference networks in Sweden is based solely on GPS technology. The geodetic base is a new structure in the network system, consisting only of regular satellite GPS reference stations (SWEPOS) based on satellite methods. GWES Resources in Northern Sweden created on the basis of the project. The main purpose of creating this network is:

- provision of single and double frequency data for relative GPS measurements;
- provision of differential corrections for real-time (DGPS) GPS measurements;
- providing data for the study of tectonic and geodynamic processes;
- Use of SWEPOS points as a basis for high-precision GPS measurements;
- To monitor the integrity of the GPS system.

The SWEPOS network consists of 21 stations (Figure 1).

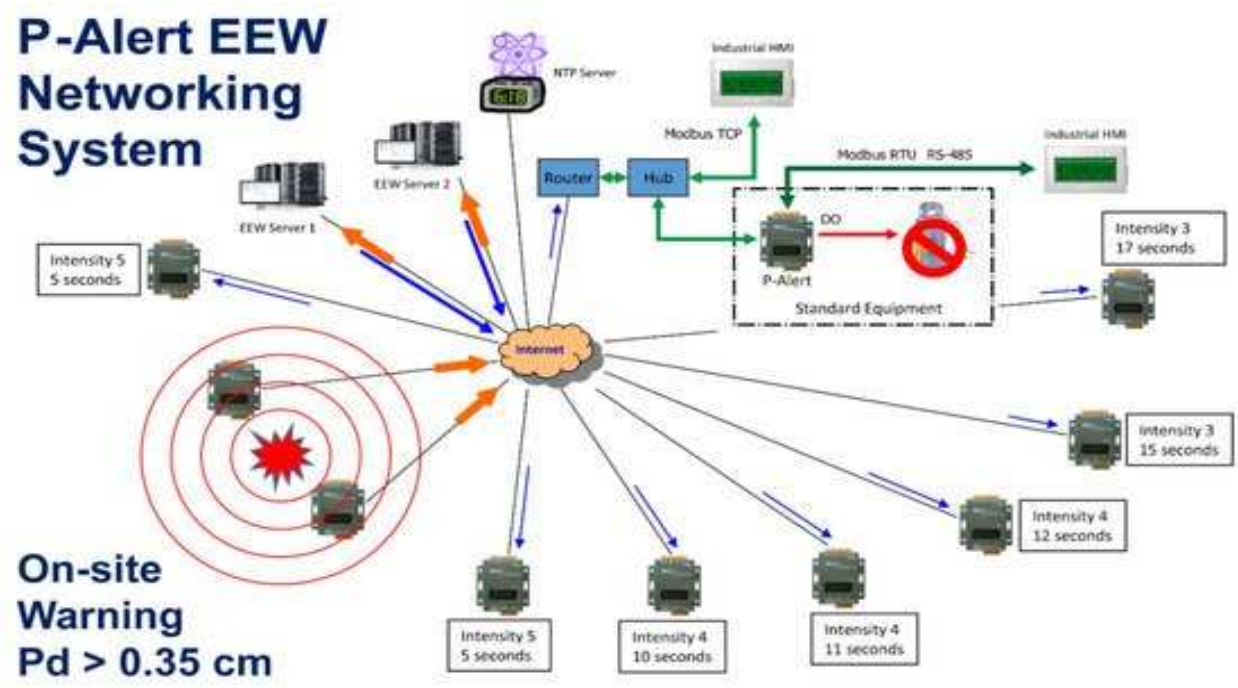


Figure 1. Location of the SWEPOS network throughout Sweden.

All stations are monitored at the NLS Control Center in Gevle. Sketched data - two-frequency coded and phase GPS measurements - are sent from the stations 5 times a day via a modem from the telephone network. The control center converts the "rough" data from GPS measurements into a common exchange format - RINEX and stores them on the server. Receipt of "sketched" or converted data for processing is carried out by Novell Netware, TCP / IP protocol (Internet) and BBSorqali. Usually the data is ready within 24 hours. As a result of the involvement of high-speed network lines, it became possible to obtain data as soon as the measurements were made.

Differential corrections for users are provided in DGPS real-time via TERACOM Svensk Runradio's FM network (radio network). This commercial service is called EPOS. EPOS has been operating in Sweden since December 5, 1994. EPOS offers two types of accuracy: basic - accuracy in positioning less than 10 m and high - accuracy less than 2 m.

The SWEPOS station will also act as a high-precision checkpoint for the new SWEREF-93 geodetic reference system.

The application of DGPS technology in the conduct of cadastral surveys in small settlements is convenient and preferable.

In Germany, the construction of geodetic bases on the basis of GNSYT technologies is well established.

In Germany, the National Positioning Service (GNS) Satellite Positioning Service SAPOS was created and operates on a

regular basis.

The basis of the system is a network of GPS tracking base stations. SAPOS includes 4 subsystems that differ in their capabilities and accuracy.

- EPS - real-time positioning service;
- HEPS - high-precision positioning service in real time;
- GPPS - positioning service with geodetic accuracy;
- GHPS - positioning service with high geodetic accuracy.

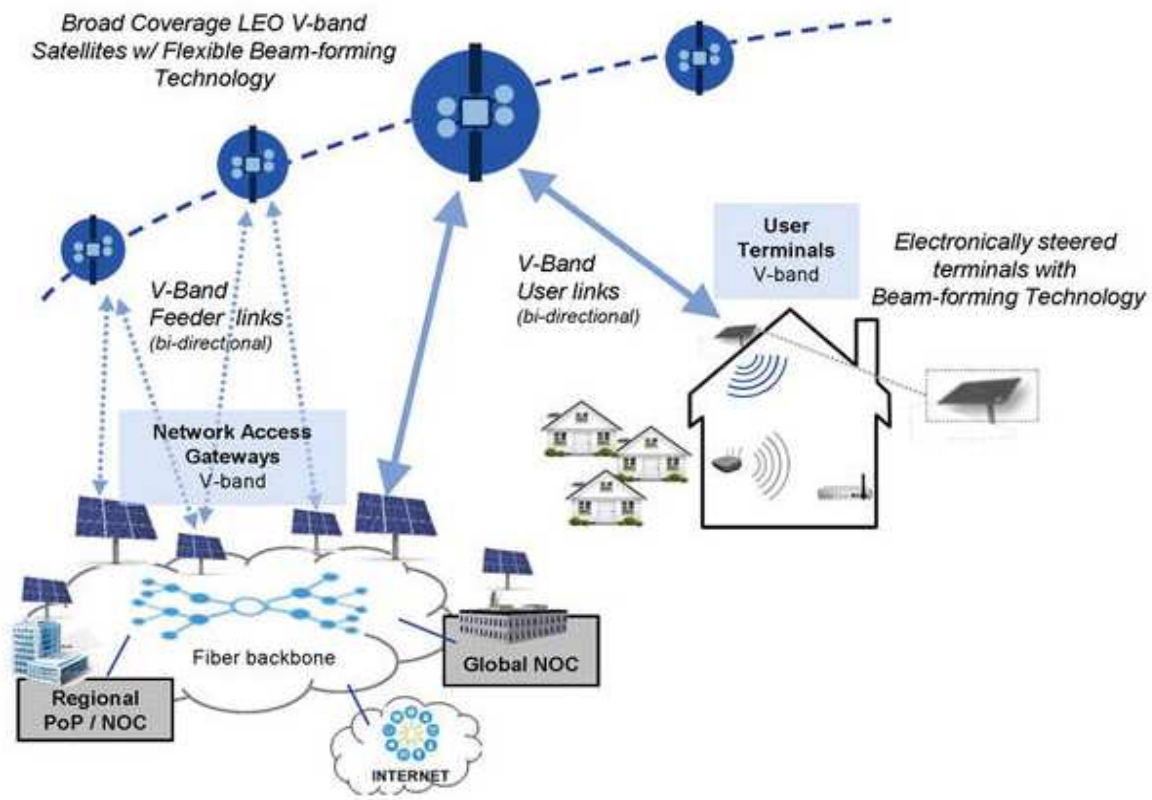
Tracking of GPS satellites is performed simultaneously at both points (base and detectable) in relative differential positioning, which in turn allows high-precision coordinate transmission. SAPOS reference stations were identified in the ETRS-89 spatial geocentric coordinate system, which calculated the realization of WGS-84 in centimeter accuracy.

EPS allows you to find coordinates in real time with an accuracy of 1-3 m. At base stations, the distance to GPS satellites is constantly measured and coded differential corrections are calculated, which allow users to receive in real time using small-sized auxiliary devices. Field of application:

- vehicle navigation;
- traffic control system;
- fleet management;
- public security services;
- agriculture and forestry;
- environmental protection;
- Geographic Information Systems (GIS);
- hydrography and water resources.

HEPS provides positioning in real time with an accuracy of 1-5 cm. In addition to coded corrections, phase corrections are also given, which serve to increase the accuracy of coordinate finding. Field of application:

- in geodesy, topography, cadastre and construction;
- aerial photography;
- Geographic Information Systems (GIS);
- fleet management;
- public security services;
- agriculture and forestry;
- hydrography and sea surveysaviati



Picture. Operation of the satellite navigation system.

GPPS provides 1 cm accuracy and allows you to get coordinates online. To find the coordinates, it is enough to make measurements on a single receiver. Field of application:

- high-precision geodetic works;
- cadastral surveys;
- aerial photography;
- engineering surveys.

In GHPS, the coordinates are taken in millimeters. To obtain such accuracy, observations should be made over a long period of time and accurate orbital data (ephemeris) should be used. Field of application:

- special fundamental geodetic works;
- GNS reference stations;
- Fundamental scientific geodetic surveys;
- monitoring issues (coastlines, sea levels) [44].

Analyzing the above, it can be concluded that developed foreign countries conduct the construction of their geodetic networks, as well as urban geodetic bases on the basis of GPS technologies. This, in turn, serves as a high-precision, wide-ranging geodetic basis for cadastral surveys of urban areas.

In general, the main task of the automated system is to collect, store and process information about all land plots, real estate.

The main differences between the cadastral system introduced in the United States and the cadastral system adopted in other countries are:

- Legal description of existing lands in the country, their boundaries, description of land plots is carried out on the basis of the state system of geodetic coordinates;
- the market value of each real estate, when, where, by whom it was valued, by whom, for how much, the rental price;
- information on where and how much real estate is subject to property taxation, information on taxpayers, their address, amount of tax;
- description of land plots, presence of other buildings or structures in them, natural descriptions, location of property, bar and if the land is intended for agriculture, productivity in several years, if it is a building or structure, then all information about construction, level of demolition, etc. . all work is done on high-level computers;

Conclusion

To take measures to address specific issues, ie cadastral users, taking into account their requirements in advance, to prepare in advance to solve problems in cadastral management, to address the issue of funding, to reform the legal norms of cadastre, to attract qualified specialists, assistance from political organizations In addition, one of the main and current indicators in the improvement of geodetic topographic work and the study and assessment of agricultural lands, the updating of topographic maps is the detection, application of satellite geodetic receivers in the processing of materials from drones.

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