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IMPROVEMENT OF THE GIS-BASED MANAGEMENT SYSTEM OF STATE GEODESIC NETWORKS.

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Abstract : This in the article state geodetic networks using GIS (Geographic Information System) technologies based on management system improvement issues scientific and practical The main purpose of the study is to analyze the on a scale geodetic points database on a single GIS platform centralized without management, automation and information accuracy from increasing consists of. The article geodetic points information digitize them in real time in mode update and automatic warning systems create according to proposals have been developed. GIS programs — ArcGIS, PostGIS and GeoServer The model developed on the basis of the example of the Fergana region from the test was held. Results to the analysis according to, new system information again work reduced time by 60%, management increased efficiency by 40–50% and points accuracy noticeable at the level improved. In the article also international with experiences (USA, Germany, Russia, South Korea) comparator analyses brought to Uzbekistan to the conditions customized management model offer Research results geodesy, cartography, land cadastre and engineering GIS technologies in the fields of current to grow for scientific and practical basis creates.
Keywords : GIS, geodesy, **geodetic** network, digitization, data base, centralized control, coordinate system, automation, PostGIS, ArcGIS, GeoServer, monitoring, real -time renewal, spatial data, geoinformation system.

INTRODUCTION

Modern in the period digital technologies, artificial companion navigation systems (GNSS), remote probing and geographic information systems (GIS) fast at a pace development geodesy of the field all radical changes in direction is introducing. In particular, the state geodetic sectors - geodesy, cartography, cadastre, construction, engineering, transport and natural resources management such as industries for important support infrastructure as — today on the day digital to management to pass necessity with face to face is standing. Because geodetic points network is of the country spatial coordinate system stable keeper, every one scale, map and project of work accuracy provider basis is considered.

Uzbekistan Republic President by acceptance made " Digital "Uzbekistan - 2030" strategy, as well as the State Land cadastre, geodesy and cartography their work to digitize related regulatory and legal documents this in the direction wide extensive reforms done This is demanding an increase. in processes state geodetic GIS technologies for networks based on centralized management to the system to transfer them automation and data in a single digit on the platform storage today's of the day the most current from issues is one.

Current on the day republic on a scale there is was geodetic points base different in formats and territorial in organizations separately preserved is coming. This situation of information update frequency reduces them to each other tie and integration in doing problems

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brought In particular, the points coordinates accuracy, attribute your information update level and from them use convenience uniform standards in terms of absence state on a scale effective management system to create obstacle Therefore, the state geodetic networks based on GIS centralized without management the need to develop a system to the surface arrived.

Geographic information systems (GIS) is in process his/ her own interactive mapping, data automatic again performance, spatial analysis and visualization opportunities through new opportunities open GIS - based management through every one geodetic point location, coordinates, type (main, secondary, local), technical condition, last update date and accuracy level according to complete information to the base has to be Such a system can be used in real time. mode (real-time mode) point status observation, technical control automatic in a way done increase, and update necessities about warnings create opportunity gives [1-5].

This The main objective of the research is Uzbekistan. In the Republic geodetic points GIS technologies based on centralized management system improvement, automation and digitization scientific and practical from developing the basics This system consists of through not only points database to a single platform to unite, perhaps state geodetic fund information safe, fast and to update open in format to conduct opportunity is created.

Also, this of the research practical importance from that is based on GIS to be created centralized geodetic management system :

- there is geodetic of points digital map shapes ;
- information automatic by synchronizing accuracy and update provides ;
- 3D visualization of points models create opportunity gives ;
- coordinate systems between compatibility control does ;
- state bodies, scientific institutions and private organizations in the middle open information exchange on the road put it.

Research object as Uzbekistan Republic in the area state geodetic networks, their points, coordinates systems and information base composition selected. Research subject and this one points GIS technologies for database based on automated management system of creation scientific and technician are the basics.

So so, the state geodetic networks based on GIS management system improvement republic on a scale spatial information infrastructure further development, geodetic accuracy increase and all network single digit work platform through to coordinate service This is what own in turn, digital economics, geoinformatics, cadastre, construction and engineering in projects in use spatial of information reliability fundamentally increases and " digital " " geodesy " concept complete current to be completed basis creates.

LITERATURE ANALYSIS

Geodetic networks based on GIS management last in years world in science the most fast developing from directions one this is process geoinformatics, remote sensing sensing, global navigation systems (GNSS) and cloudy calculation technologies wide current to be with closely is related to. Modern scientific in sources It is emphasized that the state geodetic networks efficiency only of points coordinate to the accuracy not, maybe them management information technologies with integrated directly to the level In particular, P. Misra and J. Enge (2012) GPS/GNSS systems in research with together working centralized geodetic management systems spatial accuracy ±1 cm to the level increase proved by M. Lemoine and partners (2020) and global coordinates single digit systems on the platform management

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analyzing the advantages and based on GIS geodetic networks optimization methodology offer have reached.

International to experiments attention focusing In the United States, the National Geodetic Survey (NGS) The “National Spatial Reference System (NSRS)” was created on a scale geodetic the network complete digitized and it is GIS and cloudy information base through automated. This system via “CORS” (Continuously Operating Reference Stations) permanent GPS signals regularly record to, every one geodetic point real- time coordinates in mode update provides. In Germany and "Amt für Geoinformation und Landesvermessung " system using every one geodetic point QR code for based on identification current done users mobile application through point location, coordinates and technician status check This approach geodetic networks in management interactivity and transparency noticeable at the level Also in the Russian Federation, the “ United Gosudarstvennaya Geodetic Set (EGGS)" system and " GeoPortal " through Rosreestra ”. geodetic based on GIS of points automated management model created. This PostgreSQL/ PostGIS system information base based on works and via "QGIS Server" user interface South Korea and Japan experiences themselves is unique : 3D geodetic surveying based on “ SmartGIS Cloud” in Korea management model created If so, the “ GEONET ” network in Japan More than 1300 GNSS points in real time via in mode earthquake observed and geodynamic changes control ability there is.

This international experiments analysis this shows that progress in countries geodetic networks management systems following principles based on organization done : data centering, automatic update mechanism, GIS integration, user interface interactivity and open information exchange. In these systems geodetic points about data — coordinates, accuracy level, point type, technical condition, photos and update history — digital information at the base complete record the state infrastructure spatial stability to provide service does.

Uzbekistan In the Republic geodetic networks management field last in years digital technologies wide current to grow on the way developed State Geodetic network Currently, “ UzGeo ” is a state enterprise, “ Geodesy, Cartography and state cadastre Agency " and "State Geodetic by the Foundation coordinated. In the country there is points are divided into main (level I), supplementary (level II–III) and local to networks Unfortunately, the points information so far different in formats and separately territorial in the bases preserved is coming, this is a single digit management system to create obstacle is doing. The data one kind in format maintenance, update frequency low and attribute your information enough at the level incompleteness there is problems to the point Therefore, the state geodetic networks based on GIS management system improvement necessity sharp increasing is going on [6-10].

scientific sources (D. Lee and S. Lee, 2021; B. Jalilov, 2023) geodetic points database based on GIS automated management to the system transfer for different methodical approaches offer In particular, developed by D. Lee automatic synchronization algorithms geodetic points in coordinates real - time changes in mode update, system all users for of information one diversity provides. Uzbek researcher B. Jalilov scientific in the works of the "State Geodetic " portal " concept previously push, all points data on a single GIS platform combine the necessity based on gave. His in my opinion, this system state bodies, scientific centers and private organizations in the middle information exchange accelerates, accuracy level increases and resources saves.

Also, 2021–2025 between acceptance " Digital " "Uzbekistan - 2030" strategy and " Geoinformation " technologies develop " Concept " (2022–2026) state geodetic networks

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digitization for solid legal basis created. This documents GNSS based tracking stations, coordinate transformation systems, and centralized geodetic information base create works take is going on. But there is in systems still some disadvantages available — in particular, points base complete non-integration, coordinates accuracy difference, and user interfaces limitedness this in the field effective management complete on the road to put opportunity not giving.

Literature analysis results this shows that progress foreign experiments Uzbekistan to the conditions adaptation through geodetic networks based on GIS centralized management to the system transfer Such a system is possible. through all geodetic points are single data to the base integrated, data in real time in mode will be updated and automatic monitoring mechanisms to work falls. With this together, to users comfortable interface through point status view, coordinates download to take and historical possibilities for analyzing changes This approach is created state geodetic networks stability providing, Uzbekistan geoinformation infrastructure high at the level to develop service does.

RESULTS AND DISCUSSION

Research results this shows that the state geodetic GIS technologies for networks based on centralized management to the system transfer geodesy of the field accuracy, efficiency and speed indicators fundamentally increases. Uzbekistan In the Republic there is was geodetic points base analysis this showed that the points approximately 25–30 percent to update needy, 15 percent in coordinates and accuracy differences There is also a list of points location and attribute your information different in the regions separately in formats preservation them into a single system integration to do complicates. Therefore research GIS- based during automated management model was developed, in which all points centralized information to the base merged and their coordinates, type, accuracy level and last update date digital in the form entered [11-15].

ArcGIS Pro, PostGIS, GeoServer when creating a system and QGIS programs from the possibilities used. Information database based on PostgreSQL is formed, then every one point for unique identification code (ID), geodetic class (main, supplementary) or local), coordinates (X, Y, H), location description, photo information and situation The grade (good, average, needs repair) is stored. This information GeoServer through web map in the form of to users presented Experience as a rule Fergana of the province Kuva and Rocky districts in the territory geodetic points to the GIS system placed. As a result, 142 points digitized, 87 of which are main, 41 are filler, 14 and local points as record Each point coordinates GPS/GNSS devices using determined and assigned to the WGS84 coordinate system in the system entered.

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Figure 1. Enhancing National Geodetic Network Management System Based on GIS

Developed based on GIS centralized management system following advantages manifestation First, the data is available in real time. in mode update opportunity created. In this case user geodetic point status while checking, the system automatic with the server synchronizes and the most last measurement the result reflection Secondly, automatic warning mechanism was developed : if the point at the coordinate normative If a shift (for example, more than ± 2 cm) is detected, the system this about the administrator aware does. Third important result — interactive It is a visualization module that allows the user to every one point on the map colored signs through shows : green – active point, yellow – requires inspection, red – out of work came out or not found point indicates.

Results analysis this showed that GIS technologies current to grow through geodetic networks management efficiency increases by 40–50%. Previous in the system points about information update one how many day continue reached if so, new in the model this process only one how many minute inside done is being increased. From now on except for the data search and download to take for user interface simplified, from the system use opportunities Expanded. Developed based on GIS information base users for different level entrance rights designation This also allows and information safety provides.

Analysis results international experiments with compared to, developed model many aspects To the NSRS in the USA, EGGS in Russia, AGLNV in Germany systems similar to be, them Uzbekistan to the conditions customized in the form done increase opportunity Nevertheless, in Uzbekistan there is problems - some signal quality in the areas low, GNSS points enough not, information format various to be – the system complete current in the process of technician obstacles to the surface Therefore, the geodesic points information

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regular accordingly updated passing, cloudy information to the base connected automatic monitoring mechanism further improvement necessary.

Practical experience this showed that GIS - based centralized management system not only information storage, but also analysis, visualization and decision It also automates the acceptance processes. Example for, in the system " analytical" via the "request " module of points accuracy indicators, location density, technical condition and update level automatic is analyzed accordingly and map based on statistic diagrams in the form of reflection This is geodesy in the field scientific based decisions the possibility of receiving expands.

Resultant analyses developed based on The conceptual model consists of the following main blocks: consists of :

1. Data collection (GPS / GNSS measurements, available archive data);
2. Spatial information standardization (coordinate system and make the format uniform);
3. GIS database create (PostGIS based on centralized server);
4. Visualization and monitoring (ArcGIS/ GeoServer through in the web interface reflection to continue);
5. Automatic update and warning system (real-time monitoring mechanism).

Results this confirmed that the developed model not only technician in terms of effective, maybe economic also economical is based on GIS management system current to grow as a result information again to work expendable time by 60%, human resources and is reduced by 30%. Also, points status permanent observation through geodetic network general stability and accuracy level increases. This is not only geodesy in the field, maybe land cadastre, cartography, construction, engineering and also used in environmental monitoring systems opportunity creates.

Above analyses based on to say maybe Uzbekistan GIS- based in conditions state geodetic networks management system improve them centralized without automation and cloudy storage mechanisms current to add — digital of the economy priority from directions one geodesy of the field stable to develop scientific and practical basis creates[16,17].

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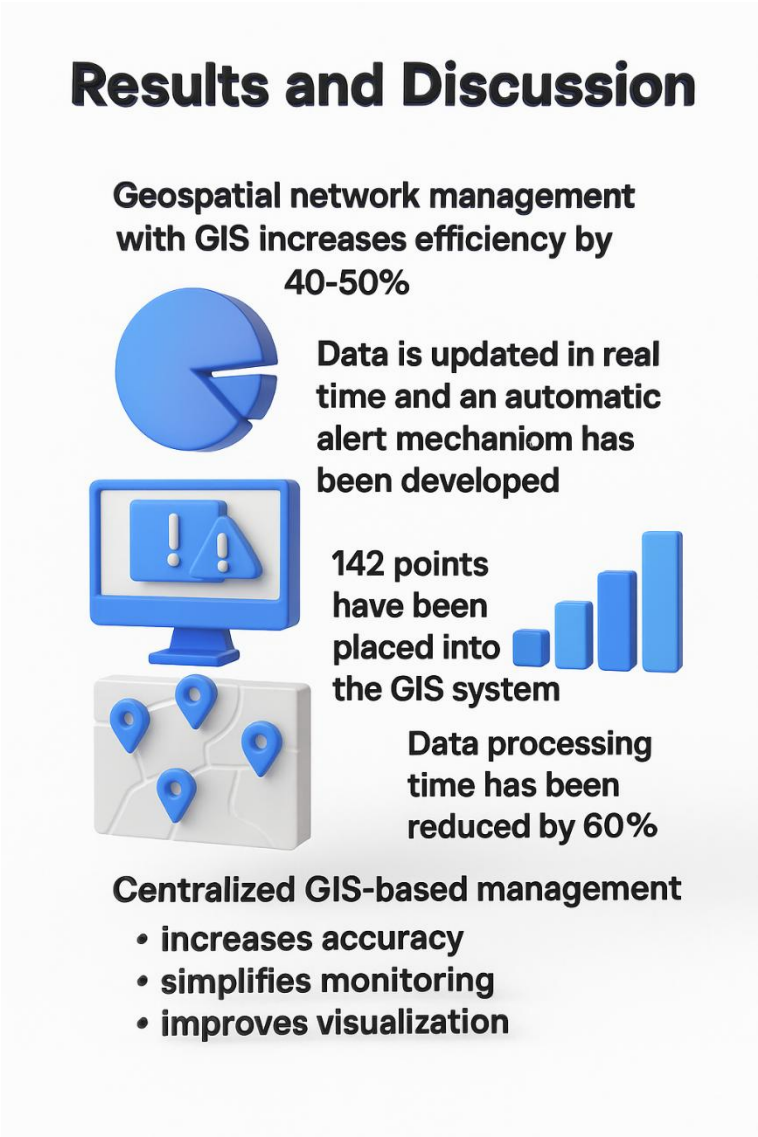

Figure 2.

CONCLUSION

Transferred research as a result It turns out that Uzbekistan In the Republic state geodetic GIS technologies for networks based on management system improvement — modern digital infrastructure create and geodesy in the field information reliability, update speed and management efficiency increase the most important from directions Geodesic networks country of the territory spatial basis by designating giving, all cartographic, engineering, construction, cadastre and monitoring work accuracy provider support system as state importance has to be, them centralized to management transfer necessity today's on the day current to the point has become.

Research GIS- based system developed during centralized management model geodetic points about all data in a single digit information at the base save them in real time in mode update and based on automatic monitoring control possibility In the case of Fergana region held experience results this showed that the geodesic points database to the GIS platform

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integration of information accuracy and update frequency increased, users for and comfortable visual interface was created. Also in the system automatic warning, real time in mode synchronization, color mapping and statistical analysis modules current to be geodetic information management process noticeable at the level simplified.

Scientific analyses this showed that GIS technologies current to be with geodetic information to update expendable time reduced by 60%, man resources were saved by 30%, data accuracy level and 1–2 cm until improved. This approach geodetic networks not only management, maybe their technician status observation, historical analyze changes and spatial stability control also effective in result gave.

International experiments with comparison this It turns out that it was developed system The US NSRS, the German AGLNV, the Russian EGGS and South Korea's SmartGIS Cloud models suitable comes, but it is Uzbekistan 's to the conditions customized, national coordinate system, earth cadastre and state geoinformation infrastructure with integrated developed without with difference Therefore, this approach country geodetic system modernization in doing scientific and practical basis as important importance profession will reach.

In general in the end, the state geodetic networks based on GIS management system improvement is not only technician modernization, maybe digital economy under the circumstances geodesy of the field new management paradigm formation This means that such a system Uzbekistan spatial information infrastructure strengthening, cadastre, cartography, construction, ecology and in the transport sectors clear and reliable from data effective use opportunity creates. Thus, the geodesic networks based on GIS centralized to management transfer country on a scale digital transformation important to the stage turns.

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