INFORMATION SYSTEM FOR RESEARCH OF SOLAR-TERRESTRIAL COUPLING

DANYLO IVANTYSHYN

Lviv Polytechnic National University

The work presents architecture of the information system for research of solar - terrestrial coupling based on the "client-server" model. The information system ensures the entry of information into the database; processing of data on manifestations of solar activity, data analysis and establishment of connections between indicators of helio- and geo-activity.

Keywords: information system, architecture, database, solar activity, solar-terrestrial coupling

Introduction. Solar activity and related processes in near space are manifested in the form of certain cyclical changes, which are superimposed by powerful and difficult to predict sporadic disturbances.

The study of the solar-terrestrial coupling is an urgent problem today, because extreme phenomena occur in the Sun-Earth system, when flares and mass ejections that occurred on the Sun affect the near-Earth space, technological systems and human health [1]. An example of how solar activity can have significant practical and financial consequences is SpaceX's loss of 38 of 49 satellites due to a geomagnetic storm on February 3–4, 2022 [2, 3].

With the growing demand for high-tech electronics, the vulnerability of society to the risks associated with solar activity will increase, and this requires a deeper study of the physics of the Sun and the impact of solar activity on the near-Earth space.

The architecture of the information system for the study of space weather parameters. The information system for the study of solar-terrestrial coupling is constructed using a two-level "client-server" model (Fig. 1). The data of solar activity indices are obtained from Internet. And the data of sporadic radio emission of the Sun, atmospheric infrasound and electric field are registered in the PMI of the National Academy of Sciences of Ukraine and the LC ISR of the National Academy of Sciences of Ukraine and the NSA of Ukraine. After preliminary processing, data is entered into the created database of the information system.

To obtain the necessary information about the state of solar activity and geophysical fields, the user interacts with the information system through the system web page. Once User made a request for the necessary information, a corresponding REST request is sent to the Server, which in turn processes the request and forms a request to the database. Later on, Server wraps response from database into JSON and forwards it to the User. As a result, the User of the

information system for the research of solar-terrestrial coupling receives the necessary information about the parameters of helio- and geo-physical activity.

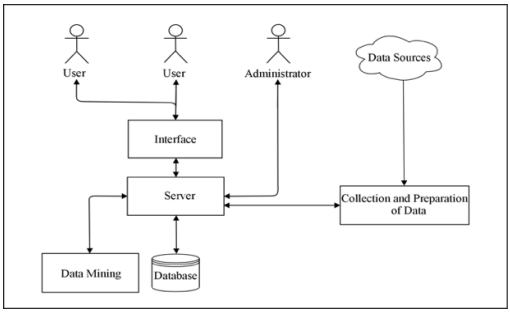

Fig. 1. Architecture of the information system for research of solar-terrestrial coupling.

To carry out scientific research with the aim of identifying new helio-geophysical connections, the User through the System Server by means of Data mining, based on the analysis of the data array, receives the necessary information.

The client-server information system consists of three main components: server software; end user software; application software. The server is responsible for storing, modifying, selecting and deleting data related to the solution of the applied task, accepts and processes requests, and then transmits the received results to clients. The applied component of the information system is a set of rules and algorithms for implementing the system's functionality.

Conclusions. The study of solar-terrestrial coupling concerns physical processes in space, starting from solar phenomena to their impact on near-Earth space and on the Earth's surface. Physical understanding of the chain of processes involved is based on a combination of observation, data analysis and interpretation, theoretical and empirical modeling. The developed information system makes it possible to study the relationships between indicators of helio- and geophysical phenomena, in particular, based on data on atmospheric infrasound and electric fields, to study the influence of solar activity on the Earth's lower atmosphere. Thus, the creation of an information system is an urgent problem and has practical significance.

1. *Buzulukova N. and Tsurutani B.* Space Weather: From solar origins to risks and hazards evolving in time // Front. Astron. Space Sci. – 2022. – 9. – No. 1017103.
2. *Hapgood M., Liu H and Lugaz N.* SpaceX-Sailing close to the space weather? // Space Weather – 2022. – 20. – No. e2022SW003074.
3. *Fang T.-W., Kubaryk A., Goldstein D., et al.* Space weather environment during the SpaceX Starlink satellite loss in February // Space Weather. – 2022. –20. – No. e2022SW003193.