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USAGE OF INFORMATION TECHNOLOGIES TO PREVENT METEOROLOGICAL RISKS

Without even thinking about it, most people rely on the weather to some extent. Everyone has wondered at least once whether predicting what causes headaches, joint pain, and many other symptoms caused by weather dependence is possible.

The web-based information platform will help weather-dependent people prepare for weather anomalies. This, in turn, leads to a sense of human security because, for example, if a person knows that a deviation from normal atmospheric pressure is expected tomorrow, he is prepared for a particular threat. In general, due to the predictability of these threats and their effects on the human body, there is no need to worry about meteorological hazards that will positively impact human well-being, as they will reduce unnecessary anxiety and prevent the risks of unexpected deterioration of well-being or well-being.

Therefore, creating an information-oriented web platform for forecasting meteorological risks is the need of the hour. Without exaggeration, it can be said that this is the only way to calculate the possible development of certain diseases in a weather-dependent population to not only the negative consequences of chronic diseases, including preventing death.

Therefore, building an information network platform for forecasting meteorological risks is crucial.

The first part explains the importance and significance of forecasting meteorological anomalies. It also describes and compares existing software products for forecasting certain data types proportional to meteorological anomalies.

The second section describes information technologies used to create information-oriented web platforms. A comparative description of two popular programming languages and their frameworks for web applications: Python (Django framework) and Javascript (Node.js framework). The main Python libraries, distributions, and web editors for building web solutions are also covered. In particular, the resources for developing the user part (interface) were considered.

The third part describes the process of developing an information-oriented web platform. Developed a database scheme and implemented integration with one of the services listed in the second part. Development results are published in the cloud and available on the Internet under a registered domain name.

Keywords: information network platform, programming languages

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ВИКОРИСТАННЯ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ ДЛЯ ЗАПОБІГАННЯ МЕТЕОРОЛОГІЧНИМ РИЗИКАМ

Навіть не замислюючись про це, більшість людей тією чи іншою мірою покладаються на погоду. Кожен хоча б раз замислювався над тим, чи можливо передбачити, що викликає головний біль, біль у суглобах та багато інших симптомів, спричинених метеозалежністю.

Інформаційна веб-платформа допоможе метеозалежним людям підготуватися до погодних аномалій. Це, в свою чергу, призводить до відчуття безпеки людини, адже, наприклад, якщо людина знає, що завтра очікується відхилення від нормального атмосферного тиску, вона готова до тієї чи іншої загрози. Загалом, завдяки передбачуваності цих загроз та їх впливу на організм людини, немає потреби переживати про метеорологічні небезпеки, які позитивно впливатимуть на самопочуття людини, оскільки зменшать зайву тривогу та попередять ризики неочікуваного погіршення самопочуття чи самопочуття.

Тому створення інформаційно-орієнтованої веб-платформи для прогнозування метеорологічних ризиків є потребою часу. Без перебільшення можна сказати, що це єдиний спосіб прорахувати можливий розвиток тих чи інших захворювань у метеозалежного населення, щоб не тільки запобігти негативним наслідкам хронічних захворювань, але й попередити летальні випадки.

Тому побудова інформаційної мережевої платформи для прогнозування метеорологічних ризиків є вкрай важливою.

У першій частині пояснюється важливість і значення прогнозування метеорологічних аномалій. У ньому також описуються та порівнюються існуючі програмні продукти для прогнозування певних типів даних, пропорційних метеорологічним аномаліям.

У другому розділі описано інформаційні технології, що використовуються для створення інформаційно-орієнтованих веб-платформ. Наведено порівняльну характеристику двох популярних мов програмування та їх фреймворків для веб-додатків:

Python (фреймворк Django) та Javascript (фреймворк Node.js). Також розглянуто основні бібліотеки, дистрибутиви та веб-редактори Python для створення веб-рішень. Зокрема, розглянуто ресурси для розробки користувацької частини (інтерфейсу).

У третій частині описано процес розробки інформаційно-орієнтованої веб-платформи. Розроблено схему бази даних та реалізовано інтеграцію з одним із сервісів, перелічених у другій частині. Результати розробки опубліковані в хмарі та доступні в Інтернеті під зареєстрованим доменним ім'ям.

Ключові слова: інформаційна мережева платформа, мови програмування

Materials and Methods

Although weather changes are considered a natural phenomenon, sharp shifts in daytime temperatures are a common anomaly and a problem for the human body. Sudden temperature transformations can lead to a sharp drop in atmospheric pressure, which presents severe pain for the 80% of the world's population that is believed to be dependent on the weather. Patients with asthma, hypertension, neurological diseases, and diseases of blood vessels, joints, kidneys, and others are most often faced with the problems of weather changes.

A person's temperature from 16 to 18 degrees Celsius is optimal for fully functioning all his body processes. When the temperature drops by 10 degrees or more, histamine is released into the body's blood, which causes many allergic reactions. At this time, the level of protective proteins immunoglobulins A and M in the blood of healthy people decreases, which has a protective effect on mucous membranes and respiratory tracts.

High humidity, more than 80%, is highly harmful to people with chronic respiratory diseases. In periods of high humidity, there is a tendency to increase the number of colds and inflammatory processes in the joints and kidneys. At this time, people with cold symptoms are advised to limit activity in the fresh air.

When the humidity decreases, dry air irritates the nose's mucous membrane, which ceases its protective functions and allows pathogenic malignant viruses and microorganisms to enter the body. At this time, allergy sufferers are at risk.

Normal atmospheric pressure for the human body is 750 mm Hg. Art. Even if there is a deviation of 10-15 units, the patient's well-being will deteriorate. Low atmospheric air pressure can put hypotensives, people with heart failure, vascular diseases, and respiratory diseases at risk. People with high blood pressure, asthma, and allergies react negatively to increased atmospheric pressure.

Cyclones and anticyclones are formed due to changes in atmospheric pressure. Cyclones are atmospheric movements that cause a drop in atmospheric air pressure. Cyclones are usually accompanied by high humidity, precipitation, and cloudiness. Anticyclones are accompanied by high atmospheric pressure and predict clear, windless, and dry weather. People with different medical conditions react differently to approaching cyclones and anticyclones, so weather forecasting is essential. That is why they are often called "living barometers." During a cyclone, there is less oxygen in the air, which leads to a deterioration in general health as the cells of the body experience oxygen starvation. This, in turn, can lead to a heart attack, an asthma attack, or a hypertensive crisis. As for anticyclones, the most vulnerable population group during this period are hypertensives, i.e., people with overtime blood pressure. Studies have shown that changes in atmospheric pressure have the most significant effect on changes in blood pressure. The critical point is that anticyclones are dangerous not only because of the difference in atmospheric pressure. If an anticyclone hangs over an active industrial center, there is a good chance that smog will form from chemical emissions from industrial plants and cars. It is at this time that mortality from cardiovascular and pulmonary diseases increases. In addition, people who do not have any of the above diseases are also at risk of developing lung diseases.

The general condition of people with rheumatoid arthritis can worsen due to low atmospheric pressure, high humidity, and sudden temperature changes. Bones and joints are often the weakest points during this weather change. Joint pain before rainy weather is usually caused by swelling of the nerve endings in the damaged joint. Changes in air temperature can cause pain, while changes in atmospheric pressure can change the pressure in the joint cavity. Older adults are most often at risk of adverse effects on bones and joints due to degenerative changes in their musculoskeletal system.

It is difficult for the human body to cope with such abnormal situations as magnetic storms. They harm the respiratory, cardiovascular, and nervous systems. They can also cause changes in blood viscosity. They interfere with the work of the cardiovascular, respiratory, and nervous systems and change blood viscosity. A person with thrombophlebitis and atherosclerosis has a thickening of the blood and an increase in its coagulation. Bleeding may occur in healthy people.

Risk Management

A solid understanding of using information technology to avoid weather risks is critical for those in the field. Here are some notable examples:

Early warning system

The early warning system is one of the main ways to use information technology to prevent meteorological risks. These systems use a variety of data sources, including satellite imagery, weather radar, and ground-based sensors, to detect and predict severe weather conditions. This information is then disseminated to the public through various channels, including television, radio, and mobile applications. By providing timely and accurate alerts, these systems can help individuals and communities prepare for extreme weather events and minimize the damage they cause.

Climate modeling

Another way to avoid meteorological risks using information technology is through climate modeling.

These models use complex algorithms to simulate Earth's climate system and predict future climate scenarios. By analyzing the data generated by these models, meteorologists can identify trends and patterns in weather patterns and develop strategies to manage the risks associated with extreme weather events.

Geographic information systems (GIS)

Geographic Information Systems (GIS) are another essential tool for avoiding meteorological risks. These systems use satellite imagery and other data sources to map the geographic distribution of weather patterns and identify areas particularly vulnerable to extreme weather events. By visualizing this data, meteorologists can develop strategies to mitigate the risks associated with these events, such as B. Build dikes or develop evacuation plans.

Social media monitoring

Finally, social media monitoring is becoming increasingly crucial for preventing weather risks. By monitoring social media platforms such as Twitter and Facebook, meteorologists can quickly identify and respond to emerging weather-related issues. For example, they could track the spread of weather-related rumors and misinformation to inform the public and avoid panic and confusion.

It is critical to recognize the many ways in which information technology is used to avoid meteorological risks. By understanding these tools and technologies, people can contribute to the ongoing effort to protect communities from the catastrophic effects of severe weather.

Analysis of Web Sources

Open-Meteo

Free weather forecast service with API access. Open-Meteo provides a large amount of data for further processing the weather forecast. The service offers an opportunity to construct a request to the API with the help of its own constructor and receive only the data needed for further work and analysis.

Open-Meteo combines local (2 km resolution) and global (11 km) weather models from national metrological services. Open-Meteo APIs are designed to be as fast and scalable as possible. All weather data is stored on high-speed NVMe drives in optimized time series formats. API requests typically take less than ten milliseconds.

All weather variables, such as clouds, fog, rain, or thunderstorm probability, are combined into an interpreted weather code. Codes follow WMO (World Meteorological Organization) criteria, including codes for fair weather, cloudy, drizzle, rain, shower, snow, and thunderstorm.

Weather API (Open Weather API)

Weather forecasting service and weather factors with API access. Open Weather API supports hourly and minute weather forecasts for more convenient data processing. The service does not provide access to the radar; this option is available only upon payment of the appropriate tariff. The Open Weather API provides a graph of temperature changes for a more straightforward analysis.

To work with the API, we provide the following input data: coordinates (longitude and latitude), date, time, and API access key. We send an HTTP request, and as a result, we receive a mark in "JSON" format, which contains all the information about the weather state according to the request data. Open Weather offers a wide range of paid services, including access to a historical weather forecast database, hourly forecast by the minute, hourly forecast for four days, and others.

With the help of the data received from the API request, we can obtain data on humidity and atmospheric pressure and warn the user about deviations from the norm. From the user's point of view, the Open Weather API provides an opportunity to obtain and independently analyze weather forecast data without knowledge of programming and the principles of working with the API. From a developer's perspective who receives data using the API, the Open Weather API service provides comprehensive information for further analysis of meteors and anomalies. Summing up the review, the service offers a relatively large array of free data, making it easy for analysis without obstacles.

Gismeteo

Gismeteo is one of the most popular weather forecast services. Provides information about the amount of precipitation, atmospheric pressure, and humidity according to the location. The service is registered on the territory of Ukraine and receives data from many Ukrainian hydrometeorological centers. Gismeteo also provides a forecast of magnetic storms and depicts them in geomagnetic activity using the Kp-index, where 0...4 - Small disturbance, 5 - Weak storm, 6 - Moderate storm, 7 - Strong storm, 8 - Storm, and 9 - Extreme storm.

Gismeteo provides access to data via API only under a cooperation agreement and exclusively to legal entities under a bilateral financial agreement.

Technical Stack Analysis

Python

Python is an object-oriented programming language. Python is very popular among developers and algorithm enthusiasts. Currently, Python is considered one of the most popular programming languages because the barrier to entry to understanding the language is much lower than that of similar programming languages. The language has a reasonably clear syntax, so even mathematicians use this programming language to find solutions to many problems. Python supports modules and module packages that promote modularity and code reuse.

It is also worth noting that Python has the largest community, which is expanding daily, contributing to language development. This programming language is suitable for many tasks, such as web programming, neural

networks, and machine learning, solving complex mathematical and physical problems using standard modules.

JavaScript

JavaScript is a scripting language used to create and manage dynamic website content—anything that moves, updates, or changes in any way on the screen without requiring a manual reload of the web page. Features include animated graphics, slideshows, photo galleries, autocomplete suggestions, and interactive forms. The best way to understand the power of JavaScript is to consider some of the features of the web you use every day and may take for granted — like when Facebook's timeline automatically updates the feed on your screen or when Google provides services based on multiple search terms, both of which is JavaScript.

Django

A high-level, open-source Python framework for developing various types of web systems. This framework is the most popular solution for writing the backend of a website in the Python programming language. Django differs from similar tools in that a site written in Django consists of one or more parts that are recommended to be modular. Django has one of the most popular Model-View-Controller (MVC) frameworks. But what does "controller" mean in the classic MVC model, Django means "view," and when it should be "view" in Django, it is "template." For this reason, MVC developers writing programs on Django call models MTV ("Model-Template-View" or "Model-Template-View").

Node.js

Node.js is an open-source, cross-platform application runtime environment for server development and networking. Node.js applications are written in JavaScript and can run in the Node.js runtime on OS X, Microsoft Windows, and Linux.

Node.js also provides a rich library of different JavaScript modules, which makes it much easier to develop web applications using Node.js.

Redis

Redis is an in-memory data structure store used as a distributed key-value database, cache, and message broker with added durability. Redis supports abstract data structures, such as strings, lists, maps, sets, sorted sets, HyperLogLog, bitmaps, streams, and spatial indexes.

Redis popularized the idea of a system that can be considered both storage and cache, using a design where data is continually being modified and read from the computer's main memory but is also stored on disk in a format unsuitable for random data. Access to data, but only to recover data in memory after a system reboot. At the same time, Redis provides a data model that is very unusual compared to a relational database management system (RDBMS).

When data durability is not required, the in-memory nature of Redis allows it to perform well compared to database systems that write each change to disk before considering a transaction that has been committed.

Celery

Celery is an asynchronous or open-ended task queue code based on the distributed transmission of messages. Although it supports scheduling, it focuses on real-time operations.

Blocks of execution, called tasks, are executed simultaneously on one or more worker nodes using multiprocessing. Tasks can be completed asynchronously (in the background) or synchronously (waiting for readiness). Celery is used in production systems like Instagram to process millions of daily tasks.

Celery is written in Python, but the protocol can be implemented in any language. It can also work with other languages using webhooks.

Recommended message brokers are RabbitMQ or Redis. Additionally, MongoDB, Amazon SQS, CouchDB, IronMQ, and databases (using SQLAlchemy or Django ORM) are supported in Experimental status.

Results

With the help of this study, a web-oriented platform for forecasting meteorological risks and warnings was developed as a web-oriented application.

The application's main functionality involves receiving personal data from the user, such as average humidity, atmospheric pressure, temperature, and maximum temperature deviation, for individual processing of the weather forecast and further notifications about deviations from the norm.

The web-oriented platform receives data using an application software interface and forms an individual weather forecast based on the data entered by the user. Also, with the user's consent, the platform sends a notification every three hours about deviations from the user's norm in the form of a push notification in the browser.

The use of colored highlights is thought out for convenient reading of the forecast - this is done for users who perceive visual information more efficiently and provides an opportunity to find the information required quickly utilizing colored highlights on the forecast page.

The result of this study is a developed and tested web-based platform for forecasting meteorological risks and warnings in the form of a web-based application.

Conclusion

1. An overview of sources of information describing commonly accepted methods of meteorological warning and forecasting is given.
2. A comparative analysis of information technologies and programming languages that can be used to forecast and track meteorological risks is presented.

3. The structure and algorithm of the web-based network platform, which can be used for forecasting and monitoring meteorological risks, are introduced.
4. Using the Python programming language, the JetBrains PyCharm integrated development environment, the Django framework, and supporting technologies Celery, Redis, and Docker to create an information-driven web platform for weather risk prediction and risk prevention.
5. As a result of the work, a web-oriented platform for forecasting meteorological risks and warnings was developed as a web-oriented application.

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