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DEVELOPMENT OF THE SYSTEM TO INTEGRATE AND GENERATE CONTENT CONSIDERING THE CRYPTOCURRENT NEEDS OF USERS

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Досліджені процеси аналізу, інтеграції та формування контенту з врахуванням криптовалютних потреб користувача. Використовуючи розроблену формальну модель та проведений критичний аналіз методів і технологій прогнозу курсу криптовалюти, побудовано загальну архітектуру системи опрацювання контенту з різних криптовалютних Інтернет-бірж.

Також сформульвані загальні функціональні вимоги до інтелектуальної криптовалютної системи, орієнтованої на Інтернет-користувачів. Досліджено методи, моделі та інструменти для удосконалення ефективнішої підтримки розроблення структурних елементів моделі системи підтримки прийняття рішень з керування контентом згідно потреб користувача. Розроблено загальні архітектури backend та fronted частин інтелектуальної криптовалютної системи. Також розроблено програмне забезпечення системи інтеграції та формування контенту з врахуванням криптовалютних потреб користувачів. Проведений аналіз результатів експериментальної апробації запропонованого методу інтеграції та формування контенту з врахуванням криптовалютних потреб користувачів. Особливість системи полягає у аналізі інформації з соціальних медіа та створення прогнозу курсів на основі зібраної інформації. Дана система дозволяє вгадати тренд напрямку курсів. Конференції певної криптовалюти, нові впровадження, державні укази різних країн задають теж напрям тренду, тому це теж треба враховувати. Для того щоб врахувати більшість випадків, потрібно постійно накопичувати інформацію по темі та сортувати по таблицях в базі даних. Даний процес відбувається за допомогою спеціальної програми бота, яка збирає та індексує інформацію. Одними з кращих можливостей системи, порівняно з аналогами, є швидкість генерації сторінки; присутність SSL сертифіката та шифрування TLS; більш якісніший контент, так як він оновлюється щохвилини; відсутні неактивні розділи сервісу; мобільна верстка сайту без дубляжу контенту на піддомені; автоперевірки проти засмічення пошти повідомленнями про курс. Основний акцент системи робитися на частоті оновлення на швидкості агрегації даних з Інтернет-бірж та соціальних мереж

Ключові слова: криптовалюта, прогнозування, Інтернет-біржа, інтелектуальний аналіз даних, Інтернет-маркетинг, Web-Mining, Data-Mining, Machine Learning, біткоїн, токен

1. Introduction

Cryptocurrency is a kind of currency, which makes it possible to transfer coins from one client to another without intermediaries, by using a public key as the address to a purse and a private key to access the open address [1]. Cryptocurrency is divided into bitcoin and altcoin, derivatives from the bitcoin with their features. Certain currencies are

created as platforms for anonymous investment and issue of tokens [2]. The bitcoin (cryptocurrency) has a number of positive features that attract more and more different types of users that apply a given technology for their own specific purposes [3]. Tokens are a sort of monetary substitutes for those who do not use fiat currency for financing [4]. As a rule, tokens are employed by the virtual world figures, specifically the founders and organizers of ICO-startups [5]. With the advent of a blockchain technology these tokens, through the Bitcoin network and its analogs, have been in use for different purposes [6], namely:

1) the process of crediting different users [7];

2) sale of shares related to the property of a company or to its profit. Shares-tokens are sold over a specially allotted period in the process ICO (primary placement of coins) [8];

3) Monetizing the service embedded in a network. In this case, one can buy tokens at a specialized internal system store. The tokens received are spent on the products proposed by different projects [9].

The most interesting feature of any cryptocurrency is the lack of administration or a system that would monitor the issue of any virtual coins [10]. Decentralization makes it possible for programmers to get unlimited opportunities to create new payment systems based on the blockchain platform (chain of blocks) [11]. If a transaction is executed to the wrong address, there is no way to cancel it, as the system is not programmed to return [12]. This means that when a mistake is made when writing the number of a purse, the user will lose the money when sending to another person or to a non-existent, or not yet created, purse [13]. Money cannot be returned, it is lost alas forever. In order to avoid trouble when using electronic purses with bitcoins and other cryptocurrencies, it is necessary to copy the already completed specified address to the clipboard and paste it into the address line when it is needed [14]. An intelligent system for content integration and generation that takes into consideration the user's cryptocurrency needs is a system that would help find out: to buy or sell a currency, building projections based on human behavior [15]. The word integration is understood as an open API for all who want to acquire data in the formats json and xml on currency exchange rates and announcements of events in the Internet market [16]. A given issue is relevant because the world of today requires standardization in the development of intelligent cryptocurrency systems (ICS) for the end user according to his needs, as well as requirements of the international Internet market. This work reflects the need for general requirements and a typical architecture for the ICS integration for the cryptocurrency needs of users. The proposed typical architecture of ICS should provide for improved reliability in the search for information about cryptocurrencies. Another issue that must be resolved relates to the centralized storage of information about exchange rates and fluctuations of cryptocurrencies. That in turn would provide the end user with a swift access to the up-to-date cryptocurrency information at any time, thereby saving his time and resources required to search for it and to analyze it.

2. Literature review and problem statement

There are many systems that specialize in collecting information about cryptocurrencies (Table 1) [17]. The main disadvantage of analogous systems of this type is the issue on the speed and accuracy of importing exchange rates from the Internet stock exchanges and information from social networks [18]. The Internet exploits three types of traffic to a web site [19]. First, the traffic from search engines [20], second, transitions from web sites [21], third, transitions from bookmarks and direct visits to the web site via a browser's URL ribbon [22]. We shall focus on the first type of traffic. To this end, we shall create ICS that would promptly update all the necessary data and add relevant information only. We shall also develop and promote the project at the Internet through thematic forums [23].

Considering the advantages and disadvantages of existing ICS, in order to improve a typical architecture of similar systems, they should be supplemented by the following features [24]:

– create an automated system to collect exchange rates through API;

– a list of Internet stock exchanges and information on trading;

– subscription to exchange rates;

– forecast the exchange rate based on human behavior;

– search engine optimization;

– aggregate data from social media;

– a book of orders for sale and purchase;

– characteristics and features of cryptocurrencies;

– open API to integrate a system with other systems.

Every transaction that is carried out inside the system is completely anonymous [25]. A transaction log records only that a transaction was completed, as well as a purse number [26]. This circumstance ensures total anonymity of users when transferring funds from one account to another [27]. Thus, no organization can keep track on where from and who sent money [28]. It is impossible to transfer fake money because the process is "being watched over" by miners [29] (analogs of a central bank [30]). Owing to miners, transactions are confirmed several times until the required number, preset in a transfer's settings, is achieved [31]. The number of transactions is infinite [32]. Services can in no way track the purse either geographically or individually [33].

When registering a new purse, there is no need to enter any data, including passport [34]. This is exactly how the maximum level of security for a payment is achieved, as well as anonymity of payments [35]. None of the currently existing virtual coins can be fake, because to do this it would be necessary to recalculate the entire blockchain, by replacing the required data on all computers [36]. This is physically impossible, which is why nobody has dared to forge a cryptocurrency as yet [37]. Based on cryptocurrencies, it becomes possible to organize anonymous investments, that is create tokens to exchange coins [38].

ICS is the base system, which imports exchange rates from cryptocurrency Internet stock exchanges and exchangers [39]. It must integrate the functions of forecasting and chart construction, and implement the aggregation of information from social media such as Twitter. It is necessary to keep importing news related to cryptocurrency from reliable sources. Open developer's API to integrate with other applications in the network should be designed in a modern style with the required functionality, must be optimized for search engines and services, distributed across servers. A given system acts to inform about fluctuations in currency exchange

rates depending on the news informational background. This must employ methods of prediction. One can make a prediction based on the trend and information from Internet users. The main objective of this work is to design and implement ICS that would operate independent of humans. The tasks that should be solved by ICS are:

– aggregation of information from API at cryptocurrency Internet stock exchanges [40];

– aggregation of information from social media [41];

– aggregation of data from exchange systems [42];

– data on cryptocurrencies, features and characteristics [43];

– sorting exchange rates, assignments, agreements of purchase and sale [44];

– the timestamp at the time of the beginning and ending of trading and the volume of trading [45];

– functionality for adding exchangers and new coins [46];

– search based on coins, Internet exchanges and exchangers [47];

– charts for exchange rate fluctuation over a specific period [48];

– selection of news items imported from social media [49];

– e-mailing the fluctuating rates and information for the user, selected according to his interests on the topic of cryptocurrency [50];

– storage of historical changes in exchange rate, historical lows and highs [51];

– forecasting based on people's posts [52];

– forecasting based on trend [53];

– forecasting a correction of the rate [54];

– open API for developers [55];

– export data to social networks based on hashtags [56];

– multilingual service [57];

– feedback for troubleshooting [58].

Table 1

Main advantages and disadvantages of services at similar cryptocurrency systems

Analogs	Advantages	Disadvantages
coinmarketcap.com	The oldest cryptocurrency system, containing historical snapshots of currencies and their exchange rates. Referenced by most services. API for developers is available. The chart of dominance of certain coins to the total capitalization.	Neither messages about changes in exchange rate nor descriptions of coins' features. There is no detailed information in API about trading, there is only a current exchange rate.
bitcoinwisdom.com	The system works in real time, no need to update it for more information about exchange rates.	The system has not been updated for a long time, there are exchange rates from Internet stock exchanges that no longer exist.
bitmakler.com	Description of technical features of different coins. Catalogue of mining equipment and pools for mining. Multilingual.	The system is rarely updated, there is much non-relevant information. The system is characterized by low performance.
bitinfocharts.com	The browser of blocks makes it easier to search for transactions. Night and day view of the site is available. Multilingual.	Not all browsers of blocks are available for currencies. There is no API for developers.
cryptocompare.com	Extended API for developers, detailed statistics of cryptocurrency exchange rates. A forum to create communities. Directories of purses for cryptocurrencies and equipment mining.	Not a very user-friendly interface, there are sections with outdated information.
cryptocoincharts.info	Embedded calculator of cryptocurrencies. There is a section with ICO.	Certain sections are raw and not complete. Displaying all materials on a single page is rather inconvenient.
cryptocurrencychart.com	One can create a chart for selected currencies.	Only one type of charts, no data about opening and closing the trading.
coinranking.com	Embedded exchanger of rates.	Similar to coinmarketcap.com. No complete data on cryptocurrencies.
coingecko.com	Section with ICO, detailed information about coins. Many languages for the interface of the site.	Registration makes no sense since it does not provide any additional functions, except a subscription to currencies. There is no API to integrate with other services.
tradingview.com	Developed social component, advanced chart editor, one can navigate through the users' texts and make a prediction.	Complicated navigation; one can easily get lost at the site. Some sections are empty and not filled.
cryptowat.ch	API, automated bidding via the site, information about all the orders in the book, hot keys.	Not all Internet exchanges and currencies are present.
cointradeanalysis.com	Accuracy and update in real time. A possibility to view the volume at various Internet exchanges in a graphical form.	No additional functionality, such as messages about fluctuating rates. There is no API to integrate with other services.

The system works with the following Internet stock exchanges:

– Binance (Chinese);
– BitBay (Polish);
– Bitfinex (American, one of the biggest in terms of trading);
– BitFlyer (Japanese);
– BitSquare (anonymous decentralized);
– Bitstamp (English);
– BitTrex (American, one of the biggest in terms of trading);
– Bleutrade (anonymous);
– BTCMarkets (Australian);
– Cexio (English);
– Coinbase (American, headquartered in California, one of the first);
– Coinfloor (English);
– Cryptopia (New Zealand, great amount of coins);
– Exmo (English, intended for the market of the CIS, a feature is trading pairs of US Dollar, Euro, RUR, and UAH to cryptocurrencies);
– Gatecoin (Hong Kong, created by bankers);
– Gemini (American);
– HitBTC (anonymous Internet stock exchange, one of the first);
– itBit (a platform to exchange fiat currencies to digital cryptocurrencies);
– Kraken (one of the first);
– LakeBTC (anonymous);
– Liqui (Ukrainian);
– LiveCoin (anonymous);
– LocalBitcoins (a service to buy and sell digital currency);
– Lykke (Swizz);
– Novaexchange (American);
– Poloniex (American, one of the biggest in terms of trading);
– QuadrigaCX (Canadian);
– Quoine (offices in Singapore, Japan, Vietnam);
– TheRockTrading (Malta);
– Tidex (American);
– TuxExchange (Canadian);
– WavesDEX (based on Waves cryptocurrency);
– Yobit (anonymous to change cash for digital currency);
– Zaif (Japanese).

Each of the listed Internet stock exchanges has API for developers that makes it possible to acquire information about trading, exchange rates, and other details of trading, based on the methods of intelligent data analysis, Web-Mining, Data-Mining, Machine Learning [59]. Most Internet stock exchanges have put in place a thorough check of documents, especially those based in Europe [60].

ICS has to import data from social media such as Twitter based on methods of Web-Mining and Data-Mining [61]. Given that this social network is quick and informative in terms of messages, using it makes it easier to understand the mood of people and their attitude to different particularities in their life [62]. By importing short messages according to selected hashtags, one can see almost all the announcements of news from around the world [63]. The disadvantage of this approach is the introduction of a system to restrict information from bots that fill popular hashtags with spam [64]. The latter is filtered using an additional bot based on the methods of Machine Learning. The basic requirements to the proposed structure of the system are the factors outlined below [65].

– Create a catalog of exchangers, where one can exchange currency among different payment systems. Exchange rates at exchangers usually differ, and a commission for changing is taken into consideration. The Internet exchangers are used by all Internet public figures that create projects. Some exchangers were created by banks to exchange monetary mass at a particular payment system. A base of cryptocurrencies would contain the following information: algorithm, method for generating blocks, the number of built coins, the total number of coins, a logo, title, code, link to the site, a link to the browser of blocks, page at the Forum Bitcointalk, the number of created coins at the start of a currency [66].

– Informative and rapid search for the required material at the site based on Web-Mining, sorting out tables with exchange rates and currencies [67].

– Possibility to add new cryptocurrencies, exchangers by users and to mark crooks to remove them from the directory [68].

– Charts should be constructed in the style of Japanese candles based on data acquired from Internet stock exchanges. There must be a built-in feature to sort and sample exchange rates for certain periods of time, such as the entire period, year, month, hour, and minute [69].

– Selection of information from social networks based on Web-Mining and Data-Mining, posts, short messages by users, selection of messages from thematic forums, news sites, for the category of cryptocurrency [70].

– A system of messages to users that contains information about fluctuating rates, instantaneous information at the preset parameters for a minimum and a maximum price. Automated selection of dispatches about the coins of interest to the user of service [71].

– History and dates of historical highs and lows in changes in exchange rates of cryptocurrencies.

– The system has to work with three types of forecasting, based on the posts of people, on the basis of information noise from specialized sites that set the trend for an exchange rate, forecasting an exchange rate correction in accordance with different events [72]. To this end, it is necessary to apply methods of intelligent data mining, Web-Mining, Data-Mining, and Machine Learning.

– Creating REST API for developers, writing documentation related to API. Generation of answers on API in the formats JSON and XML.

– Export of data to social networks such as Twitter, Facebook, and the automated generation of hashtags to promote information messages about the fluctuating rates in social networks.

– Multilingual service implies the automated choice of the user's language depending on where he resides and whether he uses such services as VPN for the sake of anonymity. The basic language of the service would be English. Users would be given the choice of languages such as Ukrainian, Polish, French, etc.

– Development of communication between service's users and service's developers to correct possible errors in their work.

3. The aim and objectives of the study

The aim of this work is to develop a general architecture of the intelligent system of content integration and gener-

ation, taking into consideration the cryptocurrency needs of users, which would contain all relevant information on cryptocurrencies for users.

To accomplish the aim, the following tasks have been set:

– to form general functional requirements to an intelligent cryptocurrency system aimed at Internet users;

– to construct a method of content integration and generation considering the cryptocurrency needs of users;

– to develop general architectures of the backend and frontend parts of the system;

– to develop software for the system of content integration and generation taking into consideration the cryptocurrency needs of users;

– to conduct experimental research related to the content integration and generation considering the cryptocurrency needs of users.

4. General functional requirements to the intelligent cryptocurrency system aimed at the Internet users

ICS focuses on the Internet users, so the place of its application is naturally the Internet. The type of such a system is a service that facilitates the task on buying and selling currencies for sellers at the Internet. Assume the following scenario: a client of the hosting wants to pay for a service using a cryptocurrency in order not to make public any data on him, in this case a seller needs a good calculator of exchange rates, to not sell goods at a loss. One can also consider another situation when an Internet user is miner and has a huge number of coins and wants to profitably sell them; this is exactly why such services are needed. The popularity of this subject is contributed to by a huge number of services that use it for completely different purposes, digital economy, you know. It involves a large number of different Internet users and services:

– Miners – they help gather new coins, using computational power to select a hash for a block;

– Traders – they trade at the Internet stock exchanges, make money on exchange rate fluctuations;

– Hosters – they sell servers and other hosting services, hosting also includes web domain registrars, proxy services, VPN services;

– Developers – they create alternative coins and services to those already existing;

– Fraudsters – they steal someone else's property at the Internet, these include carders and other unscrupulous Internet users;

– Hackers – they are engaged in obtaining unauthorized access to certain systems;

– Spammers send out spam messages and pay anonymously mainly by cryptocurrency;

– Investors – they invest their money in various projects, some of which are risky;

– Exchangers – they change cryptocurrency to fiat and vice versa. Many exchangers were created by banks to exchange some assets to others;

– Internet-stock exchanges are specialized services for traders that make money on exchange rate fluctuations; they are also used by everyone who has to deal with cryptocurrency;

– ICO is the initial placement of coins, created to raise funds for a specific project. In this field there is quite a lot of scams at present.

One can specify the following features and aspects of ICS under development:

1. Automation – the system must operate without human intervention, the automation underlies almost all processes: data acquisition, analysis, distribution, sorting, selection of information. A pressing issue relates to that information is growing exponentially and people find it difficult to process information, so they started to use automated services that filter out all that is unnecessary based on certain algorithms. However, a human factor is still required to register errors that occur in the system, and fixing bugs of technical nature in the system.

2. Accessibility – the system should be accessible from anywhere in the world and from any device, not to lose a single user. There must be a mobile version of the system. Deployed among servers at different points of the world to ensure a high uptime and fewer technical problems with the availability of the service. Correctly distributed system so that in case of malfunctions the entire system could function, that is a scanner of data from the Internet stock exchanges at one server, static information that is generated from a database is at another one, a second mailing server – at another, etc.

3. Convenience is one of the main important factors when using systems. The system must be easy to use and designed for an average user. The interface should not have unnecessary and incomprehensible details; it should be intuitively simple.

4. Effectiveness – this feature of the system would be provided to the user through quick updates of databases with very accurate data on exchange rate fluctuations and automated selection, as well an option to unsubscribe from the mailing list at any time. Do not create annoying messages to users.

5. Adaptability – this feature implies the automated setting of the system to the language of the user, to the user's screen extension, the type of a browser. In addition, a possibility to choose the language by users to facilitate use of the system.

6. Benefit from the implementation of the system would be received in the form of service attendance. Highly-focused projects have higher conversion of target buyers, that is, it is easier to promote products that are associated with cryptocurrencies.

7. The value of the system is the audience that uses the system on purpose. In order to reach the greatest number of geeks, we shall introduce a multilingual service, in order to circumvent a language barrier and engage the multilingual audience from different countries. In addition, to reach out to the audience of mobile users whose number at this moment is considerable.

8. Propose and use the API of our system in other services, the integration of data from our service to add to other services.

9. Reference to the service at thematic sites, feedback and non-stop attendance by users and using the service for its purpose.

10. A possibility to integrate data from the service with other services in our group of sites, export of exchange rates, export of volumes and trading (Fig. 1, *a*).

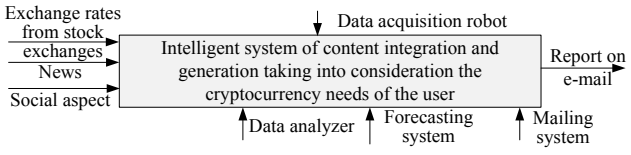
The operation of ICS is enabled by the following components:

1. Data Analyzer is a program that would analyze all incoming data and sort it for all tables in the database. Incoming data are composed of news, social aspect, exchange rates at the Internet stock exchanges.

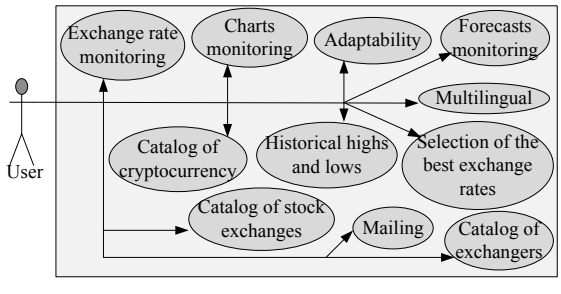
2. Forecasting system is a management system that would analyze the posts by users, select materials on cryptocurrency dependency, predict the trend, and inform about a possible correction of an exchange rate.

3. Mailing system is a script for the automated mailing and sending push messages to the browser if possible. The system would be designed for a large number of users; therefore, the spam would not be delivered all at once, but gradually, based on the sample of subscribed users at a specific time.

The relationships among actors and precedents within a given ICS, as well as all variants of activities, are given in the diagram of precedents (Fig. 1, *b*). The class diagram shows components and their dependences (Fig. 2).



a



b

Fig. 1. Diagram of the system functionality: *a* — IDEF0; *b* — Use Case

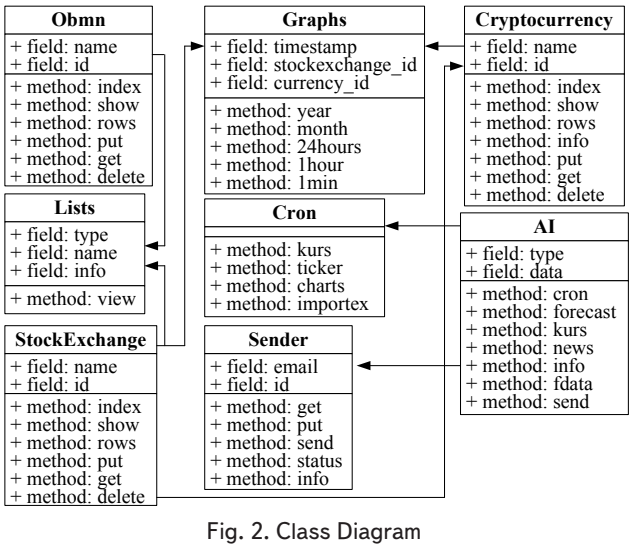


Fig. 2. Class Diagram

The diagram shows the classes and attributes of the intelligent system of content integration and generation taking into consideration the cryptocurrency needs of the user.

$S=<Obmn, Cryptocurrency, StockExchange, Graphs, Lists, AI, Cron>,$

where *Obmn* is the class for manipulating the data imported from exchangers; *Cryptocurrency* is the class for manipulating data on cryptocurrencies; *StockExchang*e is the class for manipulating the data imported from the Internet stock exchanges; *Graphs* is the class for manipulating graphs; *Lists* is the class to display information; *Sender* is the class for the organization of mailing; *AI* is the class with an intelligent element of the system; *Cron* is the class to import data from third-party services.

$$Obmn=<O_{name}, O_{id}, f_{index}, f_{show}, f_{rows}, f_{put}, f_{get}, f_{delete}>,$$

where O_{name} is the technical name of the exchanger in a database, O_{id} is the ID of the exchanger in a database, f_{index} is the method to construct the custom and added tasks, f_{show} is the method to monitor data, f_{rows} is the sampling method for the number of rows in a database, f_{put} is the method to insert data, f_{get} is the method to sample data, f_{delete} is the method to sample data.

$$StockExchange=$$
$$=<S_{name}, S_{id}, f_{index}, f_{show}, f_{rows}, f_{put}, f_{get}, f_{delete}>,$$

where S_{name} is the technical name for the Internet stock exchange in a database, S_{id} is the ID of the Internet stock exchange in a database.

$$Cryptocurrency=$$
$$=<C_{name}, C_{id}, f_{index}, f_{show}, f_{rows}, f_{info}, f_{put}, f_{get}, f_{delete}>,$$

where C_{name} is the technical cryptocurrency name in a database, C_{id} is the ID of a cryptocurrency in a database, f_{info} is the method to sample information in an array on cryptocurrency.

$$Graphs=$$
$$=<G_{timestamp}, G_{currency\_id}, f_{year}, f_{month}, f_{24hours}, f_{1hour}, f_{1min}>,$$

where $G_{timestamp}$ is the time tag, $G_{stockexchange\_id}$ is the ID of the Internet stock exchange in a database, $G_{currency\_id}$ is the ID of a cryptocurrency in a database f_{year} is the method to sample exchange rates over a year, f_{month} is the method to sample exchange rates over a month, $f_{24hours}$ is the method to sample exchange rates over a day, f_{1hour} is the method to sample rates over an hour, f_{1min} is the method to sample exchange rates over a minute.

$$Lists=<L_{type}, L_{name}, L_{info}, f_{view}>,$$

where L_{type} is the type of the list, L_{name} is the technical name of the list, L_{info} is the array of data from other classes, f_{view} is the method to compile lists.

$$Cron=< f_{kurs}, f_{ticker}, f_{charts}, f_{importex}>,$$

where f_{kurs} is the method to import exchange rates from exchangers and the Internet stock exchanges, f_{ticker} is the method to sort the exchange rates, f_{charts} is the method to sort the exchange rates for graphs, $f_{importex}$ is the method for a mass data import from exchangers and the Internet stock exchanges.

$$Sender=<R_{email}, R_{id}, f_{rget}, f_{rput}, f_{rsend}, f_{rstatus}, f_{rinfo}>,$$

where R_{email} is the email from a database, R_{id} is the email's ID from database tables, f_{rget} is the method to sample data, f_{rput} is the method for inserting data, f_{rsend} is the method for sending messages, $f_{rstatus}$ is the method for receiving the status of the mailed message, f_{rinfo} is the method to sample data in the form of an array.

$$AI= =<A_{type}, A_{data}, f_{cron}, f_{forecast}, f_{kurs}, f_{news}, f_{info}, f_{fdata}, f_{send}>,$$

where A_{type} is the technical code, A_{data} is the array with data, f_{cron} is the method to work with the class "Cron", $f_{forecast}$ is the method for forecasting exchange rates and other data, f_{kurs} is the method to process exchange rates, f_{news} is the method to process and analyze informational messages, f_{info} is the method to sample information, f_{fdata} is the method to sample information in arrays, f_{send} is the method to work with the class "Sender". Table 2 gives basic modules of information system. The main package within information system is the database that includes all the functionality of the service (Table 3).

ICS has the following problems: lack of information, outdated information, incorrect results of data collection, issues with sending letters, a problem with the user's access to the resource. That is eliminated by periodic renewal of data from reliable sources such as the Internet stock exchanges of cryptocurrencies.

5. Method for content integration and generation taking into consideration the cryptocurrency needs of users

For each cryptocurrency, ICS must contain actual information about exchange rates, a sample of informative messages to users from social networks and thematic forums. To resolve this problem, we use a scanner bot that periodically scans over short intervals the data on exchange rates through open API at the Internet stock exchanges and exchangers. A state diagram shows dynamic features of ICS (Fig. 3, *a*). Table 4 gives a state transition matrix, which makes it possible to better understand the diagram. Assuming that the system is designed for the Internet user, the generation of pages for him takes place through the transfer of _GET or _POST parameters; user activities at the service would depend on these parameters (Fig. 3, *b*).

Table 2

Modules within an intelligent cryptocurrency system

Module	Description
Browser	Web-viewer of sites from electronic devices
Web-interface	Generated dynamic page, a page of API response in the json format for integration with other sites
Static files	Cascading style tables and javascript files, ico and png files
Web-server	Program for processing program files
DB server	Processing of SQL queries, data storage system
DB interface	Type of database and interface for connection
MySQL	Database for information storage
Analyzer	Responsible for relevance and content of data
Scanner	Application to import data from the Internet stock exchanges, news sites and social networks, thematic forums
Forecasting	Using data imported from social networking and other thematic sites
Sorting	A special robot to sort information about exchange rates, data from the Internet stock exchanges, data on projections
Planner	A program, which makes it possible to execute commands and programs automatically at a specified time
Mailing	A script for sending email to users of the service, sending works via cron, so as not to load the servers of the service with redundant load

Table 3

Packages within an intelligent cryptocurrency system

Package	Description
Cron	Scripts that are run at a specified time
The Internet stock exchanges	The listing, which is used for scanning
Social networks	Listing for importing information
List of exchangers	Listing of exchangers to search for best rates
Scanner	The program, which works with API in automatic mode
Forecasting element	Forecasting based on posts and texts
Analyzer	Program to sort texts and exchange rates
Database	Data warehouse for storage of dynamic information
Processing	Processing of SQL queries, work with text, etc.
API	API for integration with other services at the Internet
Page generator	Generator of pages based on GET and POST requests
Cleaner	Program for cleaning spam information in a database
Charts	Generator of charts based on collected data

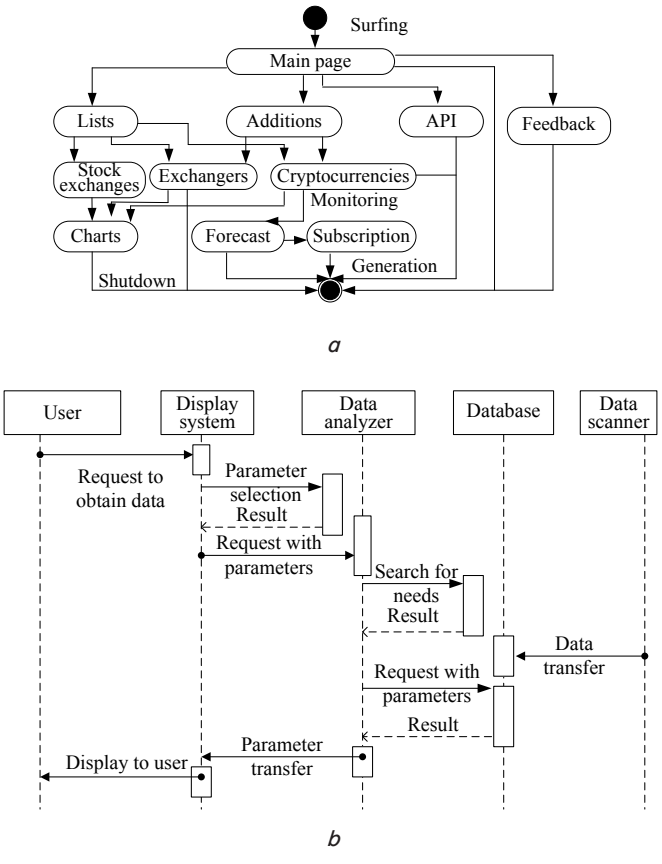


Fig. 3. Diagram: *a* — State Diagram; *b* — Sequence Diagram for an intelligent cryptocurrency system

Table 4

State transition matrix for an intelligent cryptocurrency system

Current state	Condition	Action	Next state
Initial state	–	Main page	Lists, additions, feedback, API
Additions	Cryptocurrencies or exchangers	Send a filled-in form to database	–
Lists	If a section is chosen	Transition	The Internet stock exchanges, exchangers, cryptocurrencies
The Internet stock exchanges	If parameter _GET, contains a selected code symbol for the Internet stock exchange	Generation of page about the Internet stock exchange	Charts
Exchangers	If parameter _GET, contains a selected number for an exchanger	Display a list of its exchange rate directions	Charts
Cryptocurrencies	If parameter _GET, contains a selected code symbol for a cryptocurrency Internet stock exchange	Display data on a coin, characteristics, and supplemented info	Charts, forecast
Charts	If parameter _GET, contains a command to build charts and a period	Automated construction of charts based on data collected from the Internet stock exchanges over a certain period	–
Forecast	If a user visits a page of cryptocurrency	Forecasting based on collected and sorted data	Subscription
Feedback	If parameter _GET, contains a type of the page	E-mail template to send to the developer	–
Subscription	If the request for a mail subscription is filled in	Send data to a database for further processing	–
API	If page with _GET parameter API	Display of docs to integrate the service with other Internet services	–

Activity diagram (Fig. 3, *b*) is the kind of a state graph of the finite state automaton, where vertices are activities and transitions take place only after the completion of the action. The diagram shows an example of an exchange rates scanner from stock exchanges through a cron task. A cycle is organized via the data array from stock exchanges. When scanning, somebody initiates a request for the verification of API accessibility. If the result is null, then the data are ignored and the timestamp of the last check of data from a stock exchange is recorded, if a server replies with a result in the json format, the exchange rates are sorted and stored in a database, a timestamp is recorded to avoid data duplication at repeated request (Fig. 4, *a*). After a cycle is over, someone enters a timestamp to the database, which indicates the last time the exchange rates were scanned (Fig. 4, *b*).

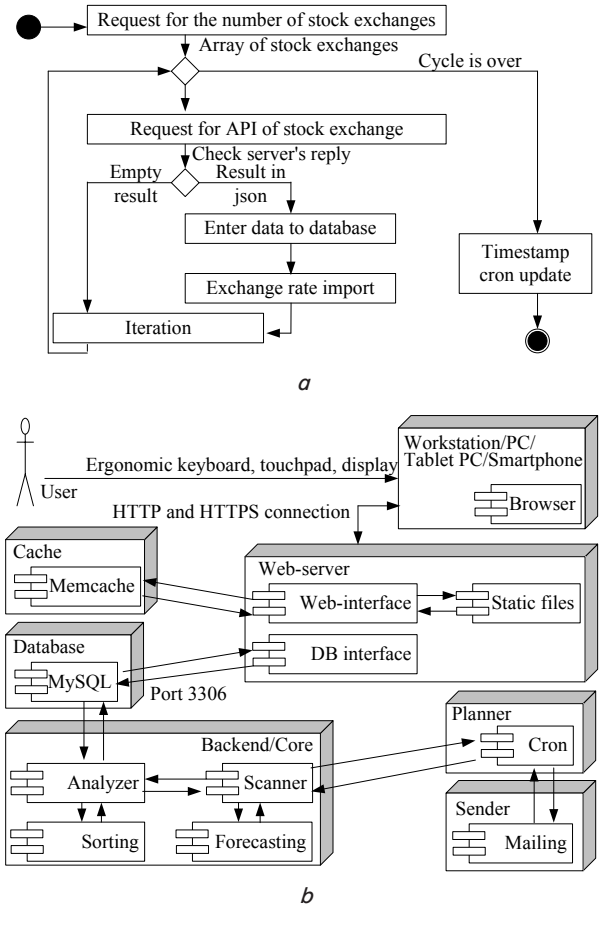


Fig. 4. Diagram: *a* — Activity Diagram; *b* — Deployment Diagram for an intelligent cryptocurrency system

ER-model is given by the following tuple:

$$M_{ERDB}=<V_{ci\_charts\_historical\_days}, V_{ci\_charts\_historical\_hours}, V_{ci\_charts\_historical\_minutes}, V_{ci\_currency}, V_{ci\_email}, V_{ci\_email\_list}, V_{ci\_exchange}, V_{ci\_exchange\_currency}, V_{ci\_info}, V_{ci\_kurs}, V_{ci\_obmn}, V_{ci\_send}, V_{ci\_settings}, V_{ci\_ticker\_days}, V_{ci\_ticker\_hours}, V_{ci\_ticker\_minutes}, V_{ci\_valuta}>,$$

where $V_{ci\_charts\_historical\_days}$ is the relation to preserve historical exchange rates over days; $V_{ci\_charts\_historical\_hours}$ is the relation to preserve historical rates over hours; $V_{ci\_charts\_historical\_minutes}$ is the relation to preserve historical exchange rates over minutes; $V_{ci\_currency}$ is the relation to the list of cryptocurrencies; V_{ci_email} is the relation to save mail boxes of subscribers; $V_{ci\_email\_list}$ is the relation to record request for subscription; $V_{ci\_exchange}$ is the relation to the list of stock exchanges; $V_{ci\_exchange\_currency}$ is the relation to communicate with other relations (link the relations $V_{ci\_exchange}$, $V_{ci\_currency}$ and $V_{ci\_ticker\_*}$); V_{ci_info} is the relation to save the imported information; V_{ci_kurs} is the relation to store data on exchange rates from exchangers; V_{ci_obmn} is the relation to a list of exchangers; V_{ci_send} is the buffer relation to create a queue for sending messages; $V_{ci\_settings}$ is the buffer relation to register the system's settings; $V_{ci\_ticker\_days}$ is the buffer relation to register and store daily data on rates from stock exchanges; $V_{ci\_ticker\_hours}$ is the relation to register and store hourly data on exchange rate from stock exchanges; $V_{ci\_ticker\_minutes}$ is the relation to register and store minute-based data on exchange rate from stock exchanges; V_{ci_valuta} is the relation of values for currencies.

The essence of $V_{ci\_charts\_historical\_days}$, $V_{ci\_charts\_historical\_hours}$ and $V_{ci\_charts\_historical\_minutes}$ is used for constructing exact charts of the exchange rates. For rapid operation of the service, each relation contains indexes at fields that define the *id* of the record to search when working with a database.

The essence of $V_{ci\_settings}$ is given by the following tuple:

$$V_{ci\_settings}=<A_{setting\_name}, A_{setting\_text}>,$$

where $A_{setting\_name}$ is the name of the parameter, $A_{setting\_text}$ is the text of the parameter.

The essence of $V_{ci\_currency}$ is given by the following tuple:

$$V_{ci\_currency}=<A_{currency\_id}, A_{currency\_symbol}, A_{currency\_algo}, A_{currency\_diff}, A_{currency\_diff\_count}, A_{currency\_gentype}, A_{currency\_coins}, A_{currency\_name}, A_{currency\_day}, A_{currency\_hour}, A_{currency\_minute}, A_{currency\_24h}, A_{currency\_1h}, A_{currency\_1m}, A_{currency\_site}, A_{currency\_explorer}, A_{currency\_board}, A_{currency\_thread}, A_{currency\_marketcap}, A_{currency\_supply}, A_{currency\_tsupply}, A_{currency\_timestamp}>,$$

where $A_{currency\_id}$ is the serial number of a cryptocurrency, $A_{currency\_symbol}$ is the symbol representing a cryptocurrency, $A_{currency\_algo}$ is the hashing algorithm of blocks, $A_{currency\_diff}$ is the difficulty of selecting the hash-code for blocks, $A_{currency\_diff\_count}$ is the recalculation of complexity of hashing, $A_{currency\_gentype}$ is the type of issue of new coins, $A_{currency\_coins}$ is the maximum number of coins, $A_{currency\_name}$ is the name of the cryptocurrency, $A_{currency\_day}$ is the timestamp of the last scan on exchange rate over a day, $A_{currency\_hour}$ is the timestamp of the last scan on exchange rate over an hour, $A_{currency\_minute}$ is the timestamp of the last scan on exchange rate over a minute, $A_{currency\_24h}$ is the daily rate, $A_{currency\_1h}$ is the hourly rate, $A_{currency\_1m}$ is the exchange rate per minute, $A_{currency\_site}$ is the link to a cryptocurrency site, $A_{currency\_explorer}$ is the link to the block viewer, $A_{currency\_board}$ is the link to the community of cryptocurrency, $A_{currency\_thread}$ is the link to the topic at the forum Bitcointalk, $A_{currency\_marketcap}$ is the total capitalisation of currency, $A_{currency\_supply}$ is the number of issued coins in circulation, $A_{currency\_tsupply}$ is the maximum number of issued coins in circulation, $A_{currency\_timestamp}$ is the timestamp of update in technical information.

The essence of V_{ci_info} is given by the following tuple:

$$V_{ci\_info}=<A_{info\_id}, A_{info\_text}, A_{info\_type}, A_{info\_currency\_id}, A_{info\_timestamp}, A_{info\_keywords}, A_{info\_lang}, A_{info\_data}>,$$

where A_{info_id} is the serial number of the imported data record, A_{info_text} is the text of imported news and information records, A_{info_type} is the type of text: a post, article, news, $A_{info\_currency\_id}$ is the serial number of the cryptocurrency addressed in the text, $A_{info\_timestamp}$ is the timestamp of text publication, $A_{info\_keywords}$ is the text keywords, A_{info_lang} is the language of the text, A_{info_data} is the technical array of data for a text analyzer, json format.

The essence of V_{ci_send} is given by the following tuple:

$$V_{ci\_send}=<A_{send\_id}, A_{send\_subject}, A_{send\_text}, A_{send\_toname}, A_{send\_toemail}, A_{send\_fromname}, A_{send\_fromemail}, A_{send\_type}>,$$

where A_{send_id} is the serial number of the message, $A_{send\_subject}$ is the message header, A_{send_text} is the generated text of the message, A_{send_toname} is the name of the recipient, $A_{send\_toemail}$ is the recipient's mail, $A_{send\_fromname}$ is the name of the sender, $A_{send\_fromemail}$ is the mail of the sender, A_{send_type} is the type of the message.

The essence of $V_{ci\_charts\_historical\_days}$ is given by the following tuple:

$$V_{ci\_charts\_historical\_days}=<A_{chart\_id}, A_{chart\_high}, A_{chart\_low}, A_{chart\_open}, A_{chart\_close}, A_{chart\_time}, A_{chart\_currency}, A_{chart\_volumefrom}, A_{chart\_volumeto}>,$$

where A_{chart_id} is the serial number for a quick search, A_{chart_high} is the highest price over a day, A_{chart_low} is the lowest price over a day, A_{chart_open} is the price that opens trading, A_{chart_close} is the closing price of trading, A_{chart_time} is the timestamp, $A_{chart\_currency}$ is the serial number of a cryptocurrency, $A_{chart\_volumefrom}$ is the initial volume, $A_{chart\_volumeto}$ is the volume over a day after the start of trading.

The essence of $V_{ci\_charts\_historical\_hours}$ is given by the following tuple:

$$V_{ci\_charts\_historical\_hours}=<A_{chart\_id}, A_{chart\_high}, A_{chart\_low}, A_{chart\_open}, A_{chart\_close}, A_{chart\_time}, A_{chart\_currency}, A_{chart\_volumefrom}, A_{chart\_volumeto}>,$$

where A_{chart_id} is the serial number for a quick search, A_{chart_high} is the highest price over an hour, A_{chart_low} is the lowest price over an hour, A_{chart_open} is the price that opens trading, A_{chart_close} is the closing price of trading, A_{chart_time} is the timestamp, $A_{chart\_currency}$ is the serial number of a cryptocurrency, $A_{chart\_volumefrom}$ is the initial volume, $A_{chart\_volumeto}$ is the volume over an hour after the start of trading.

The essence of $V_{ci\_charts\_historical\_minutes}$ is given by the following tuple:

$$V_{ci\_charts\_historical\_minutes}=<A_{chart\_id}, A_{chart\_high}, A_{chart\_low}, A_{chart\_open}, A_{chart\_close}, A_{chart\_time}, A_{chart\_currency}, A_{chart\_volumefrom}, A_{chart\_volumeto}>,$$

where A_{chart_id} is the serial number for a quick search, A_{chart_high} is the highest price over a minute, A_{chart_low} is the lowest price over a minute, A_{chart_open} is the price that opens trading, A_{chart_close} is the closing price of trading, A_{chart_time} is the timestamp, $A_{chart\_currency}$ is the serial number of a cryptocurrency, $A_{chart\_volumefrom}$ is the initial volume, $A_{chart\_volumeto}$ is the volume over a minute after the start of trading.

The essence of $V_{ci\_ticker\_days}$ is given by the following tuple:

$$V_{ci\_ticker\_days}=<A_{ticker\_id}, A_{ticker\_high}, A_{ticker\_low}, A_{ticker\_open}, A_{ticker\_close}, A_{ticker\_time}, A_{ticker\_exchange\_currency}, A_{ticker\_volumefrom}, A_{ticker\_volumeto}>,$$

where A_{ticker_id} is the serial number for a quick search, A_{ticker_high} is the highest price over a day, A_{ticker_low} is the lowest price over a day, A_{ticker_open} is the price that opens trading, A_{ticker_close} is the closing price of trading A_{ticker_time} is the timestamp, $A_{ticker\_exchange\_currency}$ is the serial number from relation $V_{ci\_exchange\_currency}$, $A_{ticker\_volumefrom}$ is the initial volume, $A_{ticker\_volumeto}$ is the volume over a day after the start of trading.

The essence of $V_{ci\_ticker\_hours}$ is given by the following tuple:

$$V_{ci\_ticker\_hours}=<A_{ticker\_id}, A_{ticker\_high}, A_{ticker\_low}, A_{ticker\_open}, A_{ticker\_close}, A_{ticker\_time}, A_{ticker\_exchange\_currency}, A_{ticker\_volumefrom}, A_{ticker\_volumeto}>,$$

where A_{ticker_id} is the serial number for a quick search, A_{ticker_high} is the highest price over an hour, A_{ticker_low} is the lowest price over an hour, A_{ticker_open} is the price that opens trading, A_{ticker_close} is the price that closes trading, A_{ticker_time} is the timestamp, $A_{ticker\_exchange\_currency}$ is the serial number from relation $V_{ci\_exchange\_currency}$, $A_{ticker\_volumefrom}$ is the initial volume, $A_{ticker\_volumeto}$ is the volume over an hour after the start of trading.

The essence of $V_{ci\_ticker\_minutes}$ is given by the following tuple:

$$V_{ci\_ticker\_minutes}=<A_{ticker\_id}, A_{ticker\_high}, A_{ticker\_low}, A_{ticker\_open}, A_{ticker\_close}, A_{ticker\_time}, A_{ticker\_exchange\_currency}, A_{ticker\_volumefrom}, A_{ticker\_volumeto}>,$$

where A_{ticker_id} is the serial number for a quick search, A_{ticker_high} is the highest price over a minute, A_{ticker_low} is the lowest price over a minute, A_{ticker_open} is the price that opens trading, A_{ticker_close} is the closing price of trading, A_{ticker_time} is the timestamp, $A_{ticker\_exchange\_currency}$ is the serial number from relation $V_{ci\_exchange\_currency}$, $A_{ticker\_volumefrom}$ is the initial volume, $A_{ticker\_volumeto}$ is the volume over a minute after the start of trading.

The essence of $V_{ci\_exchange}$ is given by the following tuple:

$$V_{ci\_exchange}=<A_{exchange\_id}, A_{exchange\_name}, A_{exchange\_flag}, A_{exchange\_desc}, A_{exchange\_site}>,$$

where $A_{exchange\_id}$ is the serial number of a stock exchange, $A_{exchange\_name}$ is the name of a stock exchange, $A_{exchange\_flag}$ is the language of a stock exchange interface, $A_{exchange\_desc}$ is the description of a stock exchange, $A_{exchange\_site}$ is the link to the service.

The essence of V_{ci_kurs} is given by the following tuple:

$$V_{ci\_kurs}=<A_{kurs\_id}, A_{kurs\_from}, A_{kurs\_to}, A_{kurs\_in}, A_{kurs\_out}, A_{kurs\_amount}>,$$

where A_{kurs_id} is the serial number of an exchange rate, A_{kurs_from} is the buy exchange rate, A_{kurs_to} is the sell exchange rate, A_{kurs_in} is the buy exchange rate, A_{kurs_out} is the sell exchange rate, A_{kurs_amount} is the balance for exchange, A_{kurs_obmn} is the serial number of an exchanger from V_{ci_obmn}.

The essence of V_{ci_valuta} w is given by the following tuple:

$$V_{ci\_valuta}=<A_{valut\_id}, A_{valut\_shifr}, A_{valut\_obmen}, A_{valut\_num}, A_{valut\_order}>,$$

where A_{valut_id} is the serial number of a currency, A_{valut_shifr} is the code of a currency symbol in the payment system, A_{valut_obmen} is the full name of the payment system, A_{valut_num} is the character code value of the currency, A_{valut_order} is the order of display at the site.

The essence of $V_{ci\_exchange\_currency}$ is given by the following tuple:

$$V_{ci\_exchange\_currency}=<A_{exchange\_currency\_id}, A_{exchange\_id}, A_{currency\_id}, A_{exchange\_currency\_day}, A_{exchange\_currency\_hour}, A_{exchange\_currency\_minute}, A_{exchange\_currency\_24h}, A_{exchange\_currency\_1h}, A_{exchange\_currency\_1m}>,$$

where $A_{exchange\_currency\_id}$ is the serial number of the record, $A_{exchange\_id}$ is the serial number of a stock exchange from $V_{ci\_exchange}$, $A_{currency\_id}$ is the serial number of a cryptocurrency from $V_{ci\_currency}$, $A_{exchange\_currency\_day}$ is the timestamp of the last scan of the exchange rate over a day, $A_{exchange\_currency\_hour}$ is the timestamp of the last scan of the rate over an hour, $A_{exchange\_currency\_minute}$ is the timestamp of the last scan of the rate over a minute, $A_{exchange\_currency\_24h}$ is the exchange rate over 24 hours, $A_{exchange\_currency\_1h}$ is the exchange rate over an hour, $A_{exchange\_currency\_1m}$ is the exchange rate over a minute.

The essence of V_{ci_obmn} is given by the following tuple:

$$V_{ci\_obmn}=<A_{obmn\_id}, A_{obmn\_name}, A_{obmn\_ref}, A_{obmn\_xml}, A_{obmn\_rub}, A_{obmn\_usd}, A_{obmn\_eur}, A_{obmn\_uah}, A_{obmn\_btc}, A_{obmn\_click}>,$$

where A_{obmn_id} is the serial number of the exchanger, A_{obmn_name} is the name of the exchanger, A_{obmn_ref} is the referral link to the exchanger, A_{obmn_xml} is the link to the XML file of the currency exchange rate, A_{obmn_rub} is the balance of the exchanger in rubles, A_{obmn_usd} is the balance of the exchanger in US Dollars, A_{obmn_eur} is the balance of the exchanger in EUR, A_{obmn_uah} is the balance of the exchanger in UAH, A_{obmn_btc} is the balance of the exchanger in bitcoins, A_{obmn_click} is the conversion rate from the service to the exchanger.

The essence of V_{ci_email} is given by the following tuple:

$$V_{ci\_email}= A_{email\_id}, A_{email\_mail}, A_{send\_hash}, A_{send\_last}>,$$

where A_{email_id} is the serial number of the mail, A_{email_mail} is the e-mail addresses, A_{send_hash} is the hash of the sent email, $A_{send\_subscribe}$ is a tag for subscription, A_{send_last} is the additional information on sent messages.

The essence of $V_{ci\_email\_list}$ is given by the following tuple:

$$V_{ci\_email\_list}=<A_{list\_id}, A_{list\_currency}, A_{list\_buy\_low}, A_{list\_sell\_low}, A_{list\_buy\_high}, A_{list\_sell\_high}, A_{list\_email}, A_{list\_data}>,$$

where A_{list_id} is the serial number of subscription, $A_{list\_currency}$ is the serial number of a cryptocurrency, $A_{list\_buy\_low}$ is the minimum purchase price, $A_{list\_sell\_low}$ is the lowest price sale, $A_{list\_buy\_high}$ is the maximum purchase price, $A_{list\_sell\_high}$ is the maximum selling price, A_{list_email} is the serial number of the addresses from table V_{ci_email}, A_{list_data} is the array of additional information on mailings.

6. General architectures of the backend and frontend parts of the system

ICS is implemented by using the following technologies: PHP 7, Nginx, HTML 5, CSS 3, Apache, MySQL, Javascript, Google Charts, UIKit. Servers employ the operating system Debian 9.

To filter requests, the servers are operated using software ipTables and fail2ban, which makes it possible to filter all the unnecessary requests to servers.

To manage the files, we use the FTP server vsftpd, as well as a panel file manager developed by ISP System, ISP Manager 5 Lite.

The frontend server uses the web-server Nginx, because this web server can withstand the tremendous number of requests and quickly handle them. This web server was created for sites with large loads.

The backend server, which would process the PHP files, will be use the web server Apache. A feature of such a link makes it possible to simultaneously maintain up to 2 thousand connections without creating excessive load on the server. We have chosen the programming language PHP for generating dynamic pages at the service and for processing _GET and _ POST requests. Mailings exploit the mail server Exim4 with a customized record of DKiM, a SPF and DMARC signature. Dynamic information is stored using the relational database management system MySQL. The intelligent system of content integration and generation taking into consideration cryptocurrency needs of the user is dominated by operations to insert of information and to sample it. Differences between InnoDB and MyISAM are given in Table 5.

Table 5

Differences between InnoDB and MyISAM

Capabilities	MyISAM	InnoDB
Support to external keys	No	Yes
Requests to different parts of table	Slower	Faster
Mixed operations	Slower	Faster
Operation INSERT	Faster	Slower
Operation SELECT	Faster	Slower
Request	Faster	Slower
Support to full-text search	Yes	Yes
File storage	File to each table	One large file
Binary copying	Yes	No
Table size	Smaller	Larger

Based on the differences above, we selected the data storage system MyISAM. The design is built on the light and modular UIkit framework to develop fast and powerful web interfaces. There is support for CSS 3 and HTML 5. This framework supports cross-browserness and adaptive markup for mobile phones and tablet PCs. Using Javascript to quickly search and sort data, ease of page loading. To build online charts, we used the library Google Charts. To obtain dynamic technical information about cryptocurrencies such as complexity and hash rate, etc., it is necessary to download a blockchain to each cryptocurrency and run the program in the background to organize API requests. To build this system, we used such hardware solutions as servers. The configuration of the servers and running tasks are described in Table 6.

Table 6

Hardware configurations of an intelligent cryptocurrency system

Task	Server configuration
Page generation	E3-1225v2 32GB RAM 3x120GB SSD Thus, ft raid
API module and documents	i5-2400 16GB RAM 2TB SATA
Database	E3-1245v2 32GB RAM 2x240GB SSD Thus, ft raid
Processing cron tasks	i7-920 16GB RAM 2TB SATA
Forecasting and sorting	W3520 16GB RAM 2TB SATA
Mail server	Atom N2800 4GB RAM 2TB SATA
DNS servers	i3-2320 8GB RAM 2TB SATA
Blockchain nodes	Atom N2800 4GB RAM 2TB SATA

When constructing a given ICS, we used, for each task, a certain hardware configuration of the server to avoid problems related to the performance of the system. The description of tasks and their configurations:

– generation of pages – this functionality ensures quick generation of dynamic pages for the service, saving static files, etc. This task is executed by a powerful server with SSD drives for fast access to files;

– API module and documentation – a functionality that is created for developers to integrate into individual services at the Internet. This functionality works mainly with _GET requests. For this task, we used a server with an average configuration, since API is not a very loaded element in the system;

– a database – the system's database employs a powerful server with SSD disks to quickly retrieve data from the database;

– processing of cron tasks – this task is executed by the server configuration of average configuration. The functionality of cron tasks executes a request to API of the Internet stock exchanges and queries to social networks to collect information about users and to record data to the database;

– forecasting and sorting – this functionality uses a server with Xeon processor for multitasking. Forecasting is built on the assigned rules, which are recorded to the database;

– a mailing server for creating mailings exploits the mail server exim4, which operates at a physical server with processor Atom N2800;

– DNS servers – to organize DNS servers, we used two physical servers at different data centers;

– Blockchain nodes extract information about the complexity, the number of issued blocks, hash rate, transactions, and other important information about cryptocurrency – we use servers that run, under background tasks, programs of cryptocurrencies. As each currency is running on different ports, there are no conflicts.

7. Software for the system of content integration and generation taking into consideration the cryptocurrency needs of the user

ICS (https://abcd.money/) is a website service for the Internet users at which one can get the necessary information about cryptocurrencies (Fig. 5).

A language of the interface depends on the user's sub-domain, so for the sake of convenience we added a link to language sections at the bottom column of the site. A cryptocurrency need of users refers to exchange, using fiat money, for services and goods. To provide these opportunities, one requires a catalog of exchangers and the Internet stock exchanges with relevant information. A DataTable module for CSS of the framework ui-kit makes it possible to quickly search and sort. The section "list of cryptocurrencies" shown in Fig. 6 demonstrates in a tabular form the following data on cryptocurrencies: name, code, algorithm, market capitalization, exchange rate over the last twenty-four hours, exchange rate over the last hour, and the last minute, based on time UTC±0:00.

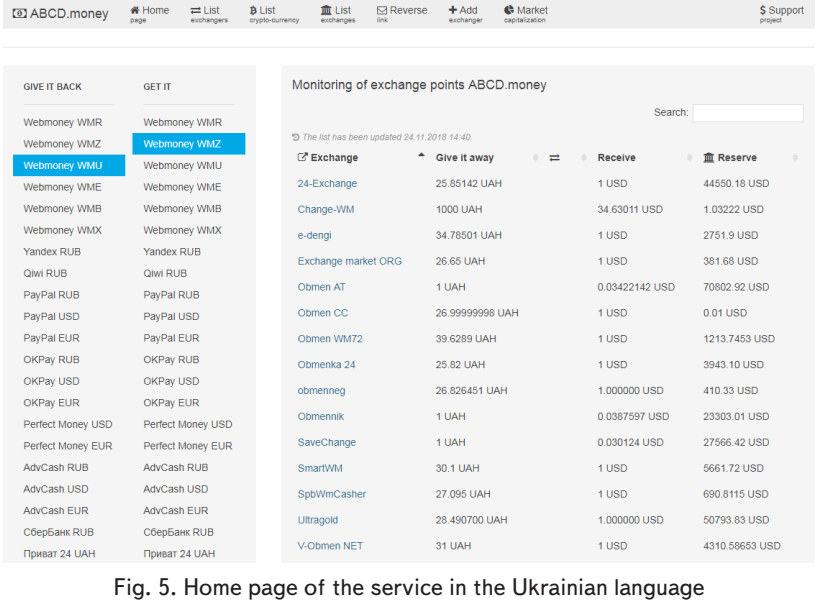


Fig. 5. Home page of the service in the Ukrainian language

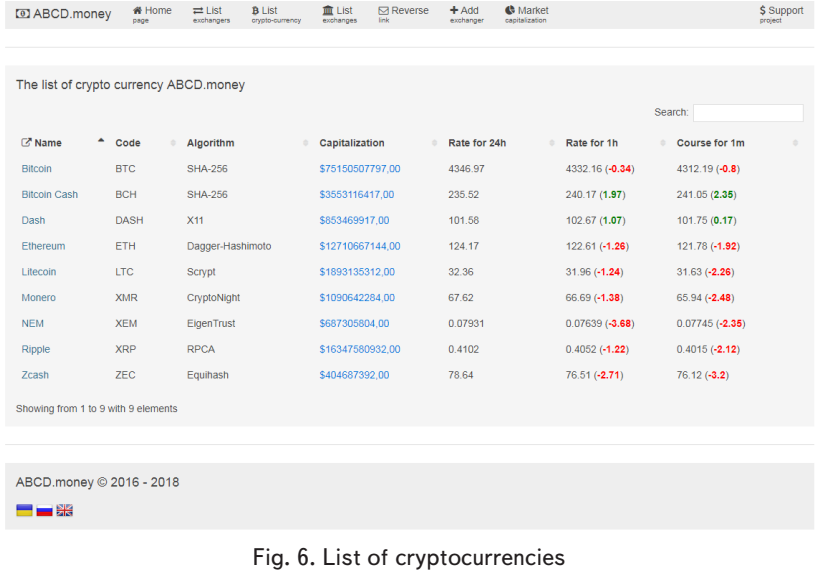


Fig. 6. List of cryptocurrencies

Each cryptocurrency represented in the service has a page with technical information: name, currency symbol, algorithm, a type of generation of new blocks, the maximum number of coins issued, the number of coins in circulation, the maximum number of coins in circulation, previous issue of coins – preyman, hash rate, complexity. The page also contains links to the official community of coins, official sites of coins. Information about the number of issued coins, hash rate, complexity is taken from the node servers that are running on a dedicated server via RPC API.

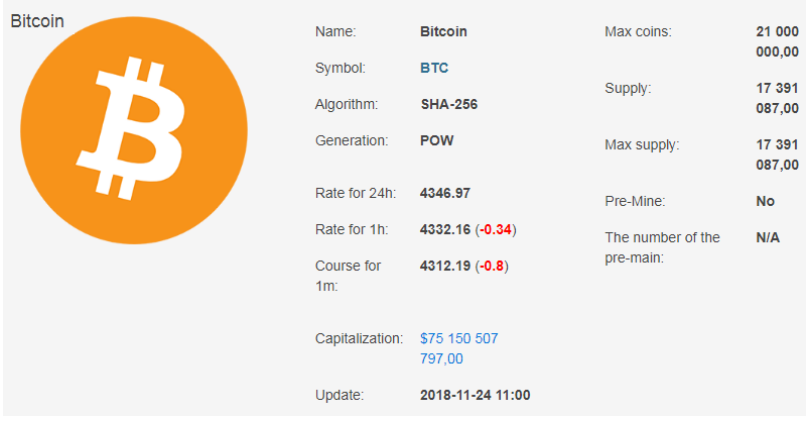
8. Testing content integration and generation taking into consideration the cryptocurrency needs of users

Data on the capitalization of a certain coin are formed based on the volumes of trading at the Internet stock exchanges, one takes the mean exchange rate during trading and multiplies it by the number of issued coins in circulation; this is the technique to form the basic capitalization for a specified coin. There is also a timestamp displayed for the last recalculation of capitalization in the system. Data on exchange rates are formed based on the information imported from cryptocurrency Internet stock exchanges; calculation of fluctuations and changes in the exchange rate is derived from formula:

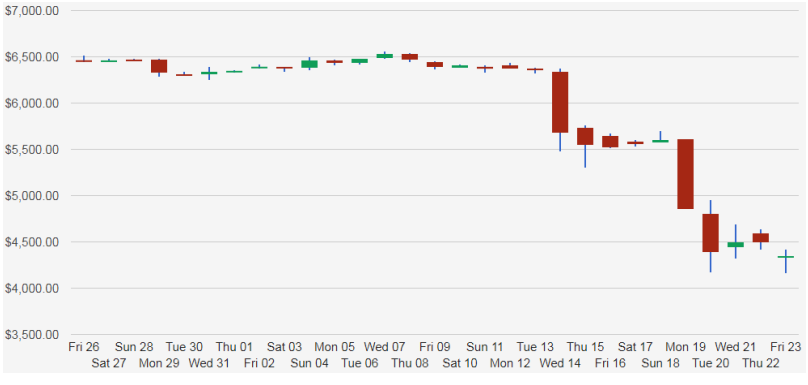
round((-1*($row->currency_24h-$row->currency_1h)*100)/($row >currency_24h),2).

The page of a currency contains a subscription form to fluctuations in exchange rates and selection of information messages on the topic. A graph is drawn in the style of Japanese candles, which makes it possible to demonstrate the price at the beginning and end of trading, as well as a trading minimum and a maximum of prices (Fig. 7). There is a possibility to sort the graph for one hour, twenty-four hours, one month, and one year.

The service acts as an aggregator of data from the Internet stock exchanges; to better navigate prices, the page shows, below the graph, a dynamic table of data from trading over a certain period of time. The following data are displayed: date, lowest price, highest price, price that opens trading, the price that closes trading, volume at the start of trading and volume after the end of trading (Fig. 7). The service needs a feedback (Fig. 8) so that users report problems related to the service and write about their wishes to the admin, propose promotional offers, etc.



a



b

Schedule for 1 year | 1-Month Schedule | Schedule for 24 hours | Graph for 1 hour

Date	Low	High	Open	Close	Volume From	Volume To
2018-11-23 03:00	$4419.48	$4157.19	$4320.68	$4346.97	$116541.69	$499211834.91
2018-11-22 03:00	$4640.72	$4410.43	$4593.04	$4488.3	$69114.05	$312907597.29
2018-11-21 03:00	$4689.55	$4315.58	$4441.81	$4501.06	$139907.17	$629926550.52
2018-11-20 03:00	$4953.56	$4168.25	$4809.62	$4384.4	$291371.53	$1329770621.82
2018-11-19 03:00	$5615.98	$4854.69	$5615.26	$4854.69	$183528	$953884655.22
2018-11-18 03:00	$5701.35	$5567.95	$5567.95	$5605.85	$37828.37	$211726087.34
2018-11-17 03:00	$5602.01	$5524.7	$5586.97	$5554.05	$27340.85	$152024928.32
2018-11-16 03:00	$5676.54	$5511.37	$5647.5	$5517.61	$63298.97	$354315749.76
2018-11-15 03:00	$5767.06	$5300.75	$5740.51	$5543.88	$140197.05	$778084559.07
2018-11-14 03:00	$6375.7	$5469.93	$6339.17	$5678.15	$164113.41	$964107952.77
2018-11-13 03:00	$6389.43	$6315.58	$6375.08	$6357.66	$33230.15	$211603174.24
2018-11-12 03:00	$6435.41	$6364.18	$6408.18	$6364.18	$23743.79	$152202999.22
2018-11-11 03:00	$6411.73	$6326.38	$6396.39	$6371.82	$18130.09	$116021417.63
2018-11-10 03:00	$6419.92	$6376.17	$6377.99	$6412.79	$12741.19	$81962590.46
2018-11-09 03:00	$6457.97	$6358.82	$6446.06	$6385.78	$33480.43	$214847208.95
2018-11-08 03:00	$6542.42	$6438.27	$6530.94	$6461.05	$37595.1	$244195929.23
2018-11-07 03:00	$6562.79	$6476.59	$6479.72	$6533.66	$50771.21	$331780510.58
2018-11-06 03:00	$6482.81	$6412.56	$6433.53	$6479.72	$37162.36	$239808254.25
2018-11-05 03:00	$6475.8	$6406.69	$6467.05	$6433.74	$24142	$155758902.3
2018-11-04 03:00	$6498.16	$6351.92	$6376.55	$6461.51	$24245.49	$155902093.98
2018-11-03 03:00	$6398.09	$6336.96	$6394.65	$6376.32	$28808.38	$183565304.27

c

Fig. 7. Page with the results of Bitcoin trading: *a* – characteristics of cryptocurrency; *b* – trading dynamics diagram; *c* – trading statistics

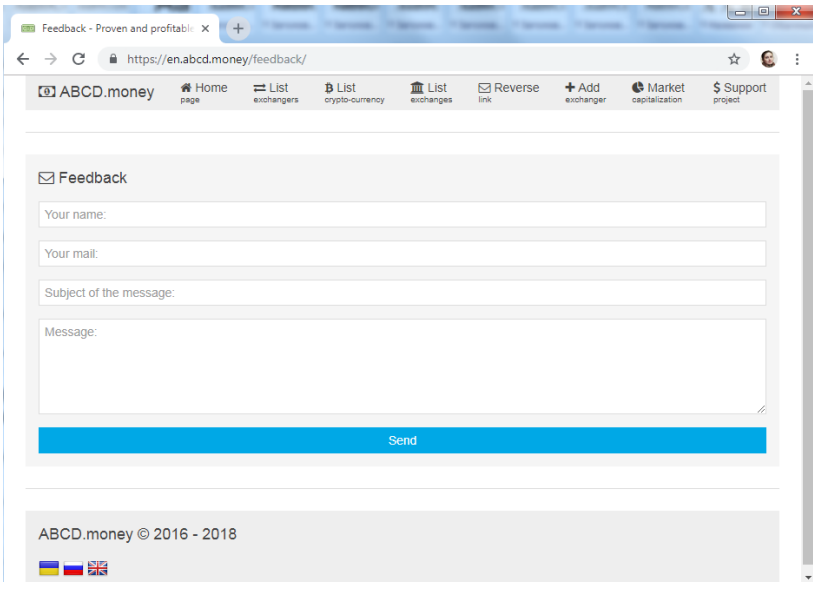


Fig. 8. Page with data on the Internet stock exchange

The server provides information about the cryptocurrency Internet stock exchanges, which contains the following data: name, language of the Internet stock exchange interface, currency trading pairs at the Internet stock exchange (Fig. 9, *a*).

List of exchanges ABCD.money

Search:

Name	Language	Site	Currency pairs
Binance		https://www.binance.com/	ETH LTC BCH
BitBay		https://bitbay.net/	BTC ETH LTC BCH
Bitfinex		https://www.bitfinex.com/	BTC ETH LTC DASH ZEC XMR BCH XRP
bitFlyer		https://bitflyer.jp/	ETH
BitSquare		https://bisq.network/	BTC ETH LTC DASH ZEC XMR
Bitstamp		https://www.bitstamp.net/	BTC LTC XRP
BitTrex		https://bittrex.com/	BTC ETH LTC DASH ZEC XMR BCH XEM XRP
Bleutrade		https://bleutrade.com/	ETH LTC DASH BCH
BTCMarkets		https://www.btcmarkets.net/	ETH LTC
BTER		https://bter.com/	BTC ETH LTC DASH ZEC XMR BCH XEM XRP
Cexio		https://cex.io/	BTC ETH LTC
Coinbase		https://www.coinbase.com/	BTC ETH LTC
Coinfloor		https://www.coinfloor.co.uk/	BTC
Cryptopia		https://www.cryptopia.co.nz/	ETH LTC DASH ZEC XMR BCH XEM

a

Exmo

Name: Exmo Language:

Stock Code: Exmo Website: https://exmo.com/ru/trade

Code	Rate for 24h	Rate for 1h	Rate per 1m
Bitcoin	$4434.91	$4447.31 (0.28)	$4449.4 (0.33)
Ethereum	$125.8	$125.64 (-0.13)	$126.01 (0.17)
Litecoin	$32.57	$32.94 (1.14)	$32.85 (0.86)
Dash	$100.82	$103.55 (2.71)	$103.36 (2.52)
Zcash	$77.6	$78.57 (1.25)	$78.55 (1.22)
Monero	$66.27	$67.2 (1.4)	$67.24 (1.46)
Ripple	$0.4153	$0.4163 (0.24)	$0.4132 (-0.51)

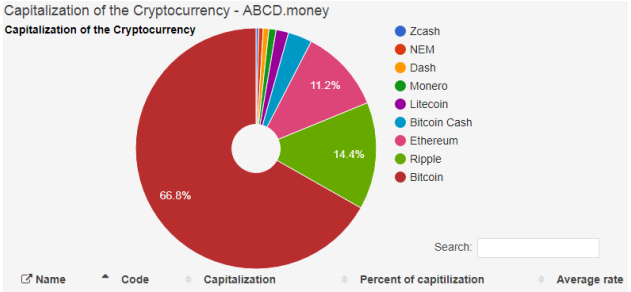
b

Fig. 9. List of: *a* — cryptocurrency Internet stock exchanges; *b* — data about the Internet stock exchanges

Search and sorting make it possible to quickly find the required Internet stock exchange among all those given in the directory. For each Internet stock exchange, we form a dynamic page with data on the Internet stock exchange, as well as a table of exchange rates and their change over a day, hour, and minute (Fig. 9, *b*).

9. Discussion of results of the integration and generation of content taking into consideration the cryptocurrency needs of users

Each currency has a certain capitalization (Fig. 10): the capitalization is calculated every hour not to load the server.



Search:

Name	Code	Capitalization	Percent of capitilization	Average rate
Bitcoin	BTC	$75 029 358 290,00	66.79%	$4314.14
Bitcoin Cash	BCH	$3 618 266 086,00	3.22%	$207.05
Dash	DASH	$847 174 681,00	0.75%	$100.12
Ethereum	ETH	$12 600 875 430,00	11.22%	$121.87
Litecoin	LTC	$1 888 640 748,00	1.68%	$31.85
Monero	XMR	$1 085 413 258,00	0.97%	$65.41
NEM	XEM	$683 775 065,00	0.61%	$0.08
Ripple	XRP	$16 181 600 733,00	14.4%	$0.4
Zcash	ZEC	$403 847 114,00	0.36%	$76.14

Fig. 10. Cryptocurrency capitalization page

The page that shows capitalization displays a pie chart and a table that gives the total capitalization, namely: coin name, coin code, capitalization that is calculated from a certain formula, the percentage of ratio of the total capitalization to the capitalization of a certain coin, and the average

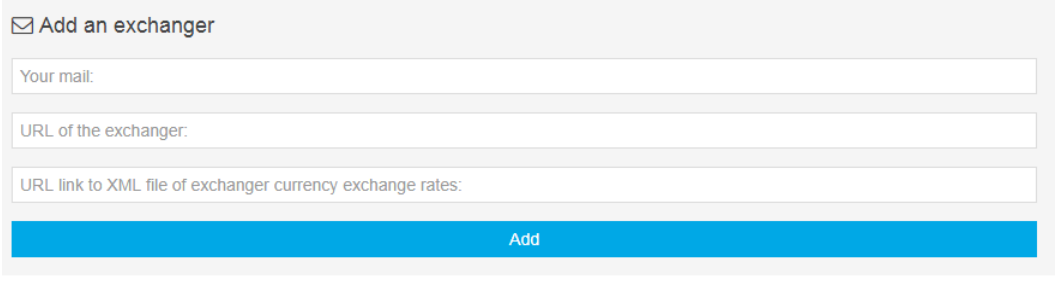
weighted exchange rate. The chart is constructed based on the javascript library from Google Charts.

Owners of exchangers are given a form to add an exchanger to the catalog of exchangers. To automatically scan data, it will suffice to add only a link to the website and the link to the file of exchange rates; everything else would be handled by a bot that works via a cron task under an automated background mode. A form to add an exchanger is depicted in Fig. 11*a*. Assume a situation when a user must change his cryptocurrency for money from payment systems; most payment systems do not accept cryptocurrency while smart guys who create exchangers for changing currencies do it, taking a certain percentage, and enable the exchange to the user.

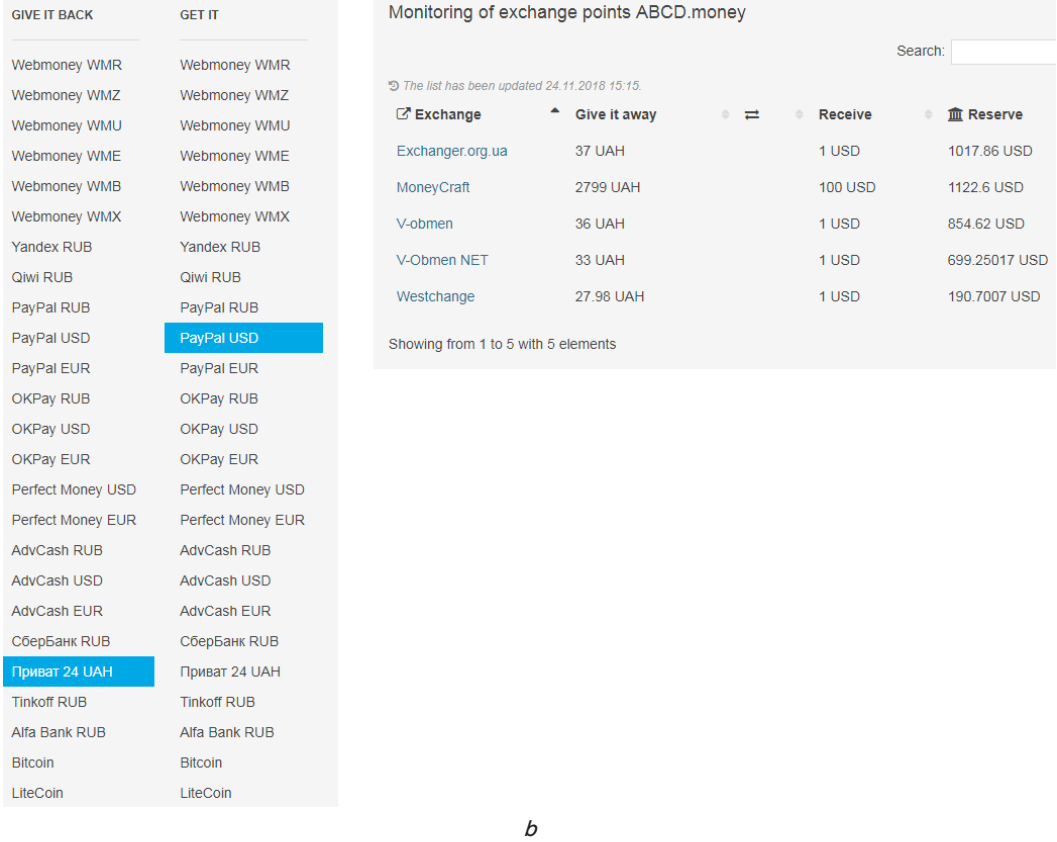
The directory of exchangers lists the most popular payment systems: Webmoney, Yandex.Money, Qiwi, PayPal, ADVcash, OkPay, Payeer, Skrill, Neteller, Privat24, Perfect Money, and the most popular cryptocurrencies in terms of capitalization volume: Bitcoin, Litecoin, Monero, Ethereum, zCash, Dash. A user can specify an exchange direction and the service will automatically pick available exchangers in the form of a table that contains four columns: name of the exchanger, offer of the user, offer in the equivalent of exchange currency, and reserve of the exchanger. Quick search and sorting make it possible for users, based on keywords, to find the data created (Fig. 11, *b*). For more information about currency exchangers, we formed a list of such data as the name of the exchanger, reserve in UAH, reserve in US Dollars, reserve in EUR, reserve in rubles, and reserve in bitcoins. The page contains the timestamp of the last collection, a recalculation of exchange rates from the database, and updates of reserves at exchangers. A list of exchangers and their reserves are depicted in Fig. 12, *a*; quick search is in Fig. 12, *b*.

For exchangers' owners, we designed a form to add an exchanger to the directory of exchangers. A user can subscribe for exchange rates, indicating the buy-sell price. In addition, a user can subscribe to news (13).

After submitting a request for subscription, a user must confirm subscription via e-mail, to verify the identity and the existence of e-mail. An example of a mailed letter is shown in Fig. 14, *a*.



a



b

Fig. 11. Page: *a* — to add exchangers; *b* — to filter exchangers

a

b

Fig. 12. Page: *a* — list of exchangers; *b* — quick search results*a b*

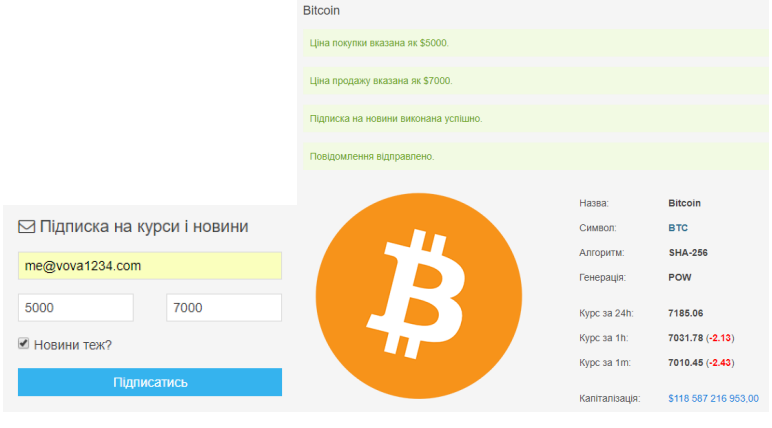


Fig. 13. Page: *a* — to subscribe; *b* — message about subscription*a b*

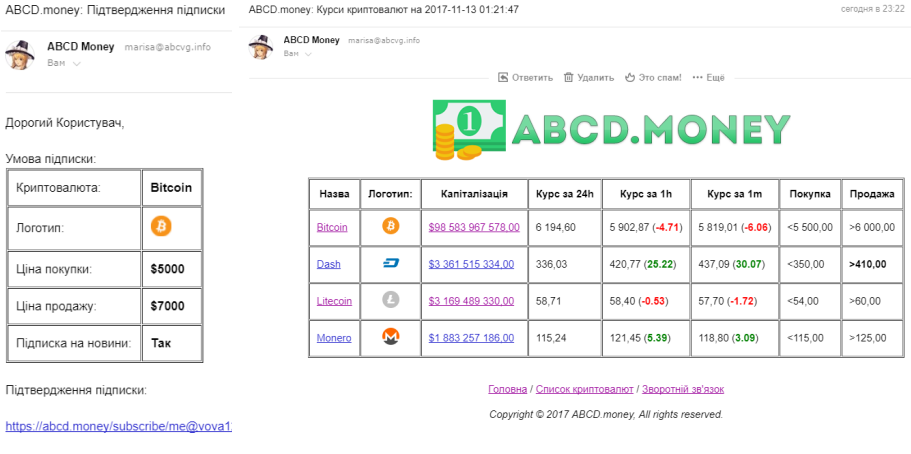


Fig. 14. Information page: *a* — regarding the subscription; *b* — on exchange rates

To receive exact exchange rate fluctuations, an automated program defines and sorts all of the available data for a period of one minute, and also disables the task on double mailing (Fig. 14, *b*). The integration of a given intelligent system relies on open API to integrate data from the service into other Internet services and mobile applications. Using the advanced API, one can receive information about exchange rates, trading, information about coins, historical exchange rates, and other important information in the format of JSON and XML. We even embedded a possibility to automatically restrict requests in the case of intentional creation of excess load on the service's servers. For API queries, we created a subdomain as an alias to the primary domain, so in case there are problems with load, we can easily scale the system. An example of page with API queries is depicted in Fig. 15 more details are given in Table 7.

The intelligent element relates to analysis of information from social media and to forecasting exchange rates based on the collected information. This system makes it possible to guess the trend in the exchange rate direction. Conferences for a certain cryptocurrency, new implementations, and government decrees in different countries, all set the trend's direction, so this must necessarily be taken into consideration. In order to account for the majority of cases, it is necessary to constantly accumulate information on the topic and sort for tables in the database. This process is enabled by means of a special programmed bot that collects and indexes information. From Twitter, this activity is enabled by a query via API based on hash tags and importing the information to the database; from Facebook, just the same via API. Collecting news from respective sites is enabled through RSS feeds. After capturing a text, we calculate for each post in tables a checksum of the message and select keywords for the further organization of quick search. Checksum prevents the duplication of information (Fig. 16).

Table 7

API queries

Query	Result
/json/cryptocurrency/btc	Info on cryptocurrency
/json/cryptocurrency	List of cryptocurrencies
/json/data/ltc/1334707200/1510511200/hours	Trading data result
/json/stockexchange	List of the Internet stock exchanges
/json/stockexchange/livecoin	List on a specific Internet stock exchange
/json/kurs	Info on exchange rates
/json/kurs/in/out	Info on exchange directions
/json/obmn	List of exchangers and their reserves
/json/info	Latest news
/json/info/btc	Latest news on cryptocurrency
/json/info/btc/1334707200/1510511200	News over a time interval
/json/val	List of cryptocurrencies supported by service

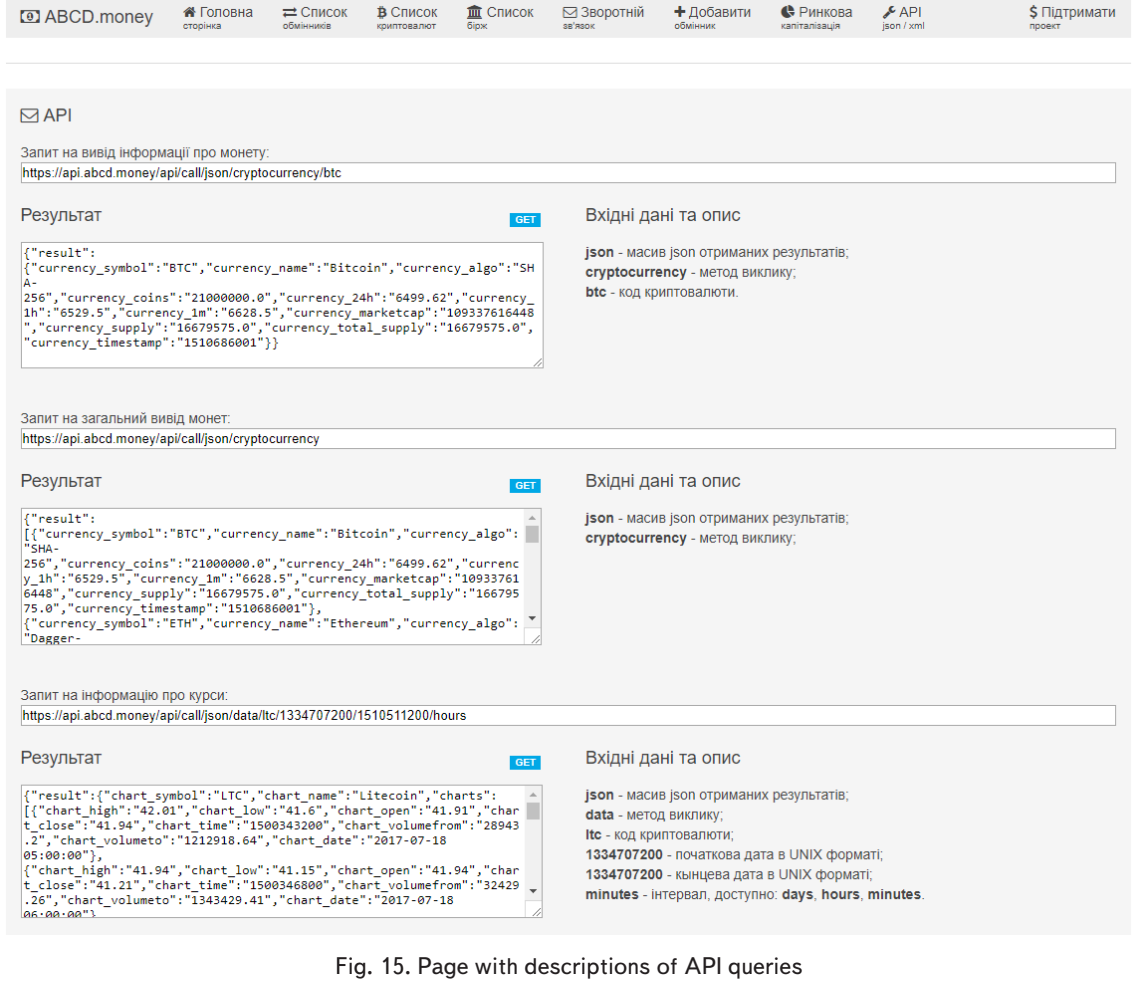


Fig. 15. Page with descriptions of API queries

info_text	info_type	i	info_timestamp	inf	_data	info_hash
The Weakonomist: OH: hedge funds have been buying ...	tweets	1	1510006937	en	NULL	d03ea50443acd7cbb6a0d695f01a463e
Retweeting bitcoinpoet: Exchange groups CME and Cb...	tweets	1	1510006937	en	NULL	7c259133c2b08462f2368ea0d25b39e7
Zed Chamaa: Is #bitcoin the Elite's backup solutio...	tweets	1	1510006936	en	NULL	18d7e3021a298b322dd2c222bf8b414a
https://t.co/rWmSj9ZPF5 Co-Owner: I Will Support N...	tweets	1	1510006936	en	NULL	0fdaa1ef95e7e7c032303cecaba98698
Retweeting bitcoinpoet: SAN FRANCISCO — The chief ...	tweets	1	1510006936	en	NULL	58b07c2e8e7aa35142a7e11b0af9a4c5
RT @gabriellejhanna: I DO NOT UNDERSTAND BITCOIN	tweets	1	1510006936	en	NULL	bee392c60cc2ee35e73fa1d1d51a85a5
#Bitkoyn latest news: £80,000 or 18 bitcoin: I'll ...	tweets	1	1510006936	en	NULL	5b786131489614cdef4ba9c20897a375
RT @lopp: The NYA's just a precursor for the f...	tweets	1	1510006936	en	NULL	9b6ed881832cf99443ef851dd02420e5
Stampery Demonstrates Timestamping on Public Block...	tweets	1	1510006935	en	NULL	295b2f7cfee433fce50c8861b40bec80
K I N G.: My potna just hit 3 Gs in bitcoin	tweets	1	1510006935	en	NULL	1754c5167376f728ab914c74e7e6340f
Quotes.addict: #CredenceCoin People who will rese...	tweets	1	1510006935	en	NULL	49c9ad544a1794119e9652e6b719f1eb
#Bitkoyn latest news: How to get a job working wit...	tweets	1	1510006934	en	NULL	f60c6cbbca14dce707607e46f389a943
BTC to USD Price $7,168.22 https://t.co/jL4dnyCYjB...	tweets	1	1510006934	en	NULL	28c2d152defe1a71c35191dba121627d
Bitcoin Ticker: Bid: $7150.85 Ask: $7153.81	tweets	1	1510006934	en	NULL	6bdfcd64e161e5da788c23f1afa270eb
Andre: Dapet call dr uncle and he said that i shou...	tweets	1	1510006934	en	NULL	eb52579c90106c1d82ef60ba7a7abb04
RT @MrTokke: Bitcoin faucet multi-player game site...	tweets	1	1510006933	en	NULL	0a8a8deda1d2c5caadb6e503df902b0c
BigBlockers: The current price of Bitcoin is $7182...	tweets	1	1510006933	en	NULL	e74b78bdd18af61ca8cad55d4259bfea
BrAiNiAc !$!: Finally jumped in the #BitCoin world...	tweets	1	1510006933	en	NULL	7affe66c60a84c1657f9500203d7971d
RT @mBTCPizpie: Today #bitcoin crashed to $9,200 i...	tweets	1	1510006933	en	NULL	531d0bc330ab1aecf93c6a53f8897353
ali butt: Crypto markets don't care about what's t...	tweets	1	1510006932	en	NULL	48dcd5259c00e608212054dca8ab1de0
RT @BourseetTrading:	tweets	1	1510006932	en	NULL	ee9036dc697d9a51d0816c53a6add50f
RT @BitcoinWrld: GOLDMAN SACHS: #Bitcoin could get...	tweets	1	1510006932	en	NULL	bac10777de9103e340eb3ce596ef9374
Big Baller Karl: Most illegal transactions done on...	tweets	1	1510006932	en	NULL	babc1b6e51c01ec13f7dc1eb699fba20
TopFiveTraders: RT StakepoolCom "These 2 comp	tweets	1	1510006931	en	NULL	ee4a6d2aeed8d0977168deb7b75e31e9

Fig. 16. Information from V_{ci_info}

Once a day, a robot, via the cron task, samples the materials collected and generates content in the form of a report (Fig. 17) for all signed users to load them with a selection of news, volume of trading at the Internet stock exchanges over a day, possible direction of the trend, and projected chart of exchange rates regarding the information at the Internet, associated with the cryptocurrencies chosen by the user.

The sample is generated in an array and is sent to the queue for the bot that sends out letters to all signed users of the service (Fig. 17).

The lack or absence of relevant information is resolved by the periodic daily automated updating of dynamic data from the blockchain of cryptocurrencies, working under a background mode at servers that can be accessed by API through RPC. To solve the problems of outdated information, we built a bot that removes all the unnecessary and outdated information over a specific period from the database. Different data are updated based on different time (daily, every hour, every 10 minutes, etc.). In addition, to provide frequent data updates, with no participation of the admin and users, we created a program that works based on the assigned algorithms of search, aggregation, and selection of information for the user. To resolve the bug related to incorrect results, users are given an opportunity to specify wrong data and submit own version, correct in their opinion. To solve the problem of sending letters and their receipt by an end user, we employ own mail server that operates based on SMTP protocol. To solve the task on providing the users with an uninterrupted access to the resource, in order to prevent problems related to inaccessibility of the service, we split the transactions of operations among servers.

CBOE Releases New Details on Bitcoin Futures Contracts

CBOE has released early specifications for its planned Bitcoin futures product in a blog post. The company published s futures contract, which will be listed under the symbol XBT, pending approval from U.S. regulators.

Although the exact listing date isn't available, CBOE's website had other points of interest related to the XBT listing, incl and quarterly contracts will be available. Additionally, CBOE's Russel Rhoads wrote that readers may want to avoid tryi relate to today's price. Rhoads stated:

> "The question I am constantly hearing is, 'How will the futures prices relate to spot bitcoin pricing,' and the best (and most honest) answ Personally, I think the best strategy is to see what the market tells us when bitcoin futures are available for trading."

Read more here

CME Says Bitcoin Futures Are Coming This Year, But Date Not Set

CME Group Inc, the world's biggest futures exchange, said on Monday it still plans to launch a futures contract for Bitcc website stating the contract would begin trading on Dec. 11 was posted in error. The new statement on the CME websit

> "Effective Q4 2017, and pending all relevant regulatory review periods, please be advised that CME will launch Bitcoin futures."

Read more here

$30 Million Tether Treasury Wallet Hack

The company behind the Tether project has announced a few hours ago that it suffered a cyber attack in which an alleg worth of USDT. Tether is currently working on possible solutions to freeze the stolen USDT. The announcement reads:

> "Yesterday, we discovered that funds were improperly removed from the Tether treasury wallet through malicious action by an external a from the Tether Treasury wallet on November 19, 2017, and sent to an unauthorized bitcoin address."

State of the Crypto

Bitcoin is up 1.97% at $8,214.460 with a volume of $109.5k - $889.2M on the USD pairs.

Litecoin is down 0.61% against the dollar for the day at $71.23 and down 2.71% to Ƀ0.008645 on volumes of Ƀ5.6k.

Ether is up 0.27% against Bitcoin at Ƀ0.04452 per Ether and up 2.27% against the dollar to $365.65 with average volun

Fig. 17. Example of an intelligent mailed report on cryptocurrencies

10. Conclusions

1. In the course of development of the system for content integration and generation taking into consideration the cryptocurrency needs of the user, we identified competing services and analyzed their functionality. Owing to this, we have defined basic requirements to a general structure of similar systems, underlying the general architecture of ICS aimed at the Internet users. We have also stated general functional requirements to an intelligent cryptocurrency system focused on the Internet users. The proposed standard architecture of ICS ensures enhanced reliability in the search for information about cryptocurrencies. In addition, it solves the issue on the centralized storage of information about exchange rates and fluctuations in cryptocurrencies. This in turn provides the end user with a swift access to the up-to-date cryptocurrency information at any time, thereby saving time and resources needed to search for it and analyze it.

2. A method for the integration and generation of content taking into consideration the cryptocurrency needs of users has been constructed, which resolves a whole lot of tasks. The lack or absence of relevant information is solved by the periodic daily automated updating of dynamic data from the blockchain of cryptocurrencies, working under a background mode at servers that can be accessed by API through RPC. To solve the problems of outdated information, we have built a bot that removes all the unnecessary and outdated information over a specific period from the database. Different data are updated based on different time (daily, every hour, every 10 minutes, etc.). In addition, to provide frequent data updates, with no participation of the admin and users, we created a program that works based on the assigned algorithms of search, aggregation, and selection of information for the user. To resolve the issue related to incorrect results, users are given an opportunity to specify wrong data and submit own version, correct in their opinion. To solve the problem of sending letters and their receipt by an end user, we employ own mail server that operates based on SMTP protocol. To solve the task on providing users with an uninterrupted access to the resource, in order to avoid problems related to inaccessibility of the service, we split the transactions of operations among servers.

3. General backend and frontend architectures for the information resource ICS have been suggested. We have described and selected methods to implement and ways to solve the task on building such systems; the benefits of these means are given. ICS faces the following problems: lack of information, outdated information, incorrect results of data collection, issues with sending letters, a problem related to user access to the resource. This is eliminated by the periodic updating of data acquired from reliable sources such as the Internet cryptocurrency stock exchanges. When constructing a given ICS, each task is executed by a certain hardware configuration of the server to avoid problems associated with the performance of the system.

4. We have implemented the developed software for the system of integration and generation of content considering the cryptocurrency needs of users. A given intelligent information system can be scaled. ICS (https://abcd.money/) is a website service for the Internet users, where one can obtain the required information about cryptocurrencies. It can be easily scaled for any site and any topic. The developed modules of ICS are optimized for the maximum performance of the system, as well as for work with large arrays of data. An end user that actively works with ICS would not even notice that the periodic automated updating of data from respective Internet stock exchanges is enabled in parallel. It would suffice to scan currency exchangers for the fluctuations in cryptocurrencies each morning, the Internet stock exchanges should be scanned every minute. At present, there are more than 30 such Internet stock exchanges. And the list is constantly updated. Using modern methods for data mining, Web-Mining, Data-Mining, Machine Learning significantly improves results of ICS operation, thereby accelerating the processing of large arrays of data in a short period of time.

5. We have analyzed the results of experimental verification of the proposed method for the integration and generation of content taking into consideration the cryptocurrency needs of users. A feature of the system is analysis of information from social media and forecasting the exchange rates based on the collected information. A given system makes it possible to guess the trend in exchange rates. Conferences for a certain cryptocurrency, new implementations, government decrees in different countries, all set the trend's direction, so this must necessarily be taken into consideration. In order to account for most cases, it is necessary to constantly accumulate information on the topic and sort to tables in the database. This process is enabled by means of a specially programmed bot that collects and indexes information. Thus, the capabilities of the system that favorably distinguish it from analogs include:

– page generation speed;
– the existence of SSL certificate and TLS encryption;
– better quality of content as it is updated every minute;
– there are no inactive sections of the service;
– mobile markup of the site without duplicated content at a subdomain;
– autochecks against spamming the e-mail with messages about exchange rate.

The focus of the system is on the frequency of updates at the speed of data aggregation from the Internet stock exchanges and social networks.

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