УДК 51-74; 62-782
https://doi.org/10.47533/2020.1606-146X.215

G. Z. ZIYATBEKOVA[1,2] *, L. S. KOPBOSYN[2], A. K. SAMBETBAYEVA[2], ZH. DUISENBEKKYZY[2], E. B. MURATOV[2], A. D. BURGEGULOV[2]

[1]RSE Institute of Information and Computational Technologies MSHE RK CS, Almaty, Kazakhstan,
[2]Al-Farabi Kazakh National University, Almaty, Kazakhstan

PREDICTING ABIOTIC FACTORS TO DEVELOP A SMART OFFICE SYSTEM

The article deals with the prediction of abiotic factors for the Smart Office system. Scientific research in the field of forecasting is given. This article discusses the technology for installing an energy-saving system and its operating principles. Methods of building and managing smart systems are used. Also describes the increase in comfort, thanks to the Smart Office technology. User-friendly interface is used. Affects functions such as: optimization of lighting, heating, protection and control of the house remotely, using mobile devices and special key fobs. Mainly considered the system of automation of business structures depending on the scale. All currently available methods were suggested, which are key factors in the optimization of all business processes. And also considered options for modeling and system development, taking into account all the current problems of automation of smart systems. The importance of the scientific topic affects the high potential for the development of smart home systems and the lack of uniform standards for devices included in these systems. The hardware-software complex under development can be used both in ordinary homes, offices and production facilities. The system is scalable, allowing it to be used for almost any purpose. The article deals with the creation of an autonomous microprocessor-based climate data transmission system. In this paper, we developed a microprocessor-based climate measurement system designed to measure relative humidity and air temperature. The measuring system of climatic parameters is designed to collect measuring information, its further processing, storage and display in a form convenient for the operator's perception.

Keywords: *smart office, smart systems, smart switch, automated home, controller, microprocessor system, temperature and humidity sensor, Raspberry microcomputer, Arduino UNO platform.*

Introduction. "Smart office" – control system in the office, apartment or building. Automated system integrated into engineering tools with intelligent multimedia complex and information systems to create an effective and efficient workflow of the company and specialists. This is relevant to companies in different fields, making optimal use of all resources and achieving modern comfort in everyday work. It includes sensors, control elements and actuators. Technology is advancing so rapidly these days that it consequently affects the office environment and operations. That's why the Smart Office is becoming popular in terms of energy-saving systems and automation. So, let's delve into this modern system and understand why office and business owners should apply such automation processes to their business [1-2].

The main task of the system is to ensure comfort, safety, and energy savings. The relevance of the topic of research due to the high potential for the development of smart home systems and the lack of uniform standards for devices included in these systems.

* E-mail корреспондирующего автора: ziyatbekova@mail.ru

Experimental. The hardware-software complex under development can be used both in ordinary homes, offices and production facilities. The system is scalable, allowing it to be used for almost any purpose.

Results and Discussion. One of the effective methods of forecasting is the method of group accounting of arguments (MGAA). The MGAA is based on the principle of multi-row selection of self-organization models, and the MGAA algorithms reproduce the scheme of mass selection. The MGAA algorithms synthesize and select the terms of the generalized Kolmogorov-Gabor polynomial in a special way. This synthesis and selection is performed with increasing complexity, and one cannot predict in advance what the final form of the generalized polynomial will be. First, we usually consider simple pairwise combinations of initial features, from which the equations of decisive functions are composed, as a rule, no higher than the second order. Each equation is analyzed as an independent solving function, and the values of the parameters of the composed equations are found one way or another by the training production. Then some of the best functions are selected from the resulting set of solvers. Verification of the quality of individual solving functions is carried out on the control sample. The selected partial solver functions are further considered as intermediate variables serving as initial arguments for a similar synthesis of new solver functions, etc. The process of such hierarchical synthesis continues until an extremum of the quality criterion of the solver function is reached, which in practice manifests itself in the deterioration of this quality in attempts to further increase the order of the polynomial terms relative to the initial features [3].

MGAA algorithms based on the principles of self-organization allow to synthesize different filters: smoothing or predicting, algebraic or differential, linear or by full power polynomial. The accuracy of the latter is the highest, usually the error on the verification sequence is on the order of 1% [4].

Due to the development of neural networks and the expansion of their applications, they have found wide application in predicting various dynamic processes [5-7].

The above approaches are included in the software of many statistical data processing packages have been developed in the form of application software packages or procedure libraries [8].

Overview of control sensors. Temperature and humidity sensors can be used to automate control of these parameters. The following is an overview of the types of sensors [9].

Any type of temperature sensors that are used for automatic control work based on the principle of converting the measured temperature value into an electrical physical quantity. This principle is related to some of the advantages of electrical measurements: 1) the reception and transmission of electrical quantities over distances is easily accomplished at high speed; 2) universality of electrical quantities (any physical quantities can be converted to electrical quantities and vice versa); 3) their precise conversion into a digital code, which allows to achieve high accuracy, sensitivity and speed of measuring instruments [10-12].

Temperature sensors can be used wherever parameters that characterize the system under study depend in some way on temperature factors. Due to the development of microelectronics and nanoelectronics, the following types of temperature sensors exist: thermocouples and thermistors, as well as thermoresistive sensors, which have a linear dependence of the output signal, along with these and semiconductor sensors, which have a digital output.

Autonomous microprocessor data transmission system. Modern opportunities for the development of various sensors [13] and the cheapening of microprocessors have also opened a wide opportunity for the introduction of hardware and software for monitoring climatic parameters. In particular, it has found wide application in applied tasks of relatively cheap Arduino controller, which has a large base of developed sensors and means of their communication with the computer он [14-18].

To create an autonomous microprocessor-based climate data transmission system, we used a Raspberry Pi 3 B+ single-board microcomputer. Power is provided by a solar panel.

The system includes a set of necessary sensors and software. The measurement modules are connected to the computer via a USB adapter. The software presents the measurement results in tabular and graphical form, and allows you to view and print the accumulated database archive of measurements for any period of time. It is possible to view data from sensors both on other computers in the local network and via the Internet.

Figure 1 shows the elements of the block for obtaining climate data and transferring them to the Raspberry microcomputer. The specified block is implemented on the basis of the Arduino controller, the characteristics of which are given in Table 1.1.

Arduino UNO is a device based on the ATmega328 microcontroller. It includes everything you need for easy microcontroller operation: 14 digital I/Os (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal pickup, a USB connector, a power connector, an on-chip programming socket (ICSP) and a reset button. To start using the device, simply power it up with an AC/DC adapter or a battery, or connect it to a computer via a USB cable.

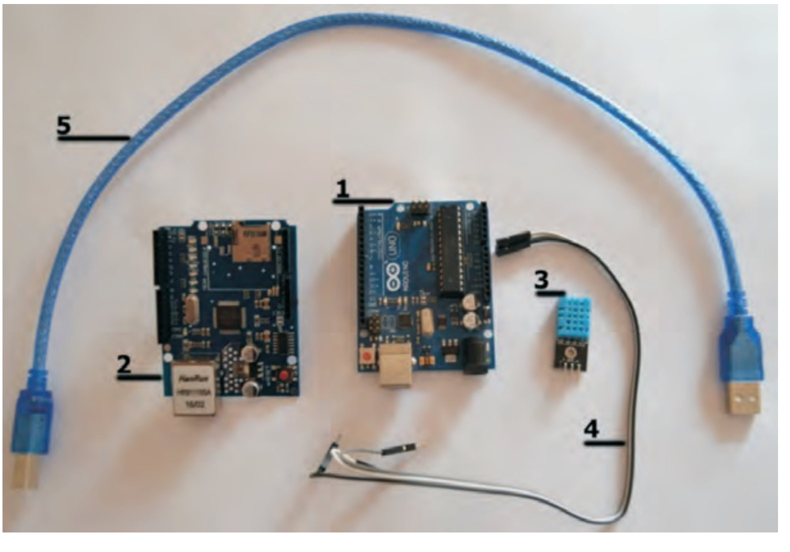

Figure 1 – Temperature and humidity sensor: 1– Arduino UNO; 2 –Ethernet Shield W5100; 3 – DHT11 Temperature and humidity sensor; 4 - 3 wires to connect the DHT11 sensor to the Arduino; 5 - USB cable for Arduino

Table 1.1 – Characteristics of Arduino UNO

Microcontroller	ATmega328
Operating voltage	5В
Supply voltage (recommended)	7-12В
Supply voltage (limit)	6-20В
Digital inputs/outputs	14 (of which 6 can be used as PWM outputs)
Analog inputs	6
Максимальный ток одного вывода	40 мА
Maximum output current output 3.3V	50 мА
Flash memory	32 KB (ATmega328), of which 0.5 KB are used by the loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock frequency	16 MHz

The Ethernet Shield is an expansion card that is installed on top of the Arduino itself. It allows you to act as a network device and communicate over a wired network with similar devices, with ordinary computers, printers, services on the Internet and other network resources. This is the latest version of the board: Ethernet Shield Rev3, it is fully compatible with Arduino Mega 2560, unlike its predecessor and a number of unofficial clones.

The board is based on the Wiznet W5100 chip, which supports both TCP and UDP protocols. Up to four connections can be open at the same time.

The board has a standard 8P8C ethernet port for networking with twisted-pair patch cord and a set of pins for connecting to the Arduino. The Ethernet Shield and Arduino use pins 4 and 10 through 13 to communicate with each other, so their use for other purposes in the presence of the expansion card is not possible. All other pins are connected directly to the base board, so they are essentially «extensions».

The «Ethernet» library from the standard distribution is used to program the network communication. In addition, sample programs are also built into the Arduino IDE.

The board has a slot for a micro-SD flash card, which can be used to store resources distributed over the network. The sdfatlib library can be used to interact with the SD card.

The following indicators are built into the board:

– PWR lights up when power is applied;

– LINK lights up if the network is available. Flashing when receiving and transmitting data;

– FULLD is lit when a duplex connection is established. That is, simultaneous reception and transmission is possible;

– 100M illuminates if the connection is at 100 Mbps (not 10 Mbps);

– RX blinks when receiving data;

– TX blinks when transmitting data;

– COLL flashes when there is a collision in the network. That is, when in half-duplex mode two devices try to transmit a packet at the same time;

there is also a reset button connected to the base board so that when pressed it resets both devices.

The sensor consists of two parts - a capacitive **temperature sensor** and a hygrometer. The first is used to measure temperature, the second to measure air **humidity**. The chip inside can perform analog-to-digital conversions and produce a digital signal which is read out by a microcontroller.

он DHT11 is a small sensor in a small plastic case. At the sensor output there is a digital signal, and two parameters at once and temperature and humidity. The point of communicating with an Arduino controller is:

– The microcontroller asks for a reading and changes the signal from 0 to 1.

– The sensor sees the request and responds by changing the bit signal from 0 to 1.

– Then the sensor gives out a data packet of 5 bytes (40 bits), whereby in the first two bytes temperature, in the third and fourth humidity. The fifth byte is a checksum to exclude measurement errors.

Figure 2 shows a view of the RaspberryPi microcomputer and the display.

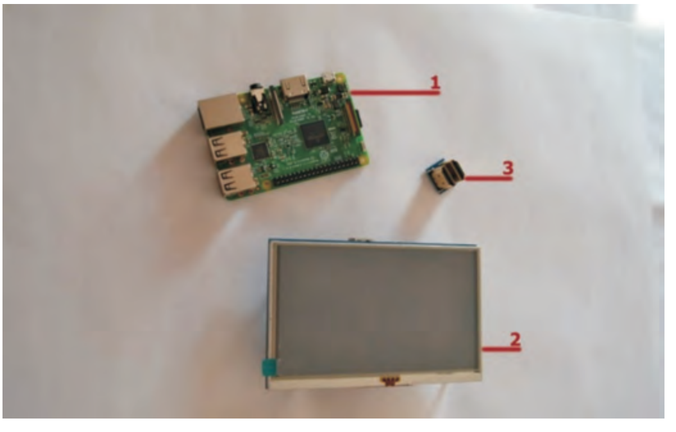

Figure 2 – Raspberry Pi: 1 – Raspberry Pi 3 B+; 2 – 5inch HDMI LCD; 3 – HDMI Connector

The Raspberry Pi is a single-board computer the size of a bank card, which means that the different parts of the computer, which are usually on separate boards, are presented here on one. The Raspberry Pi runs mostly on operating systems based on the Linux kernel. It is also possible to install Windows 10 IOT.

5inch HDMI LCD is a five-inch LCD display with a resistive touch panel designed for use with the Raspberry Pi minicomputer. The display module has 800x480 resolution and connects directly to the Raspberry Pi with the included compact HDMI connector. The exception is the very first Raspberry Pi model B, which cannot be connected with a compact HDMI connector and requires a standard HDMI cable.

The 5inch HDMI LCD display module is connected to the Raspberry Pi expansion slot, and the I/O pins are not used for image transfer. However, the SPI interface is required to communicate with the touch panel controller and the corresponding I/O pins are used. Battery-powered solutions have the ability to control backlighting to reduce power consumption.

Figure 3 shows the components of the autonomous power supply unit.

Figure 3 – Standalone power supply unit: 1 – rechargeable battery (MHB); 2 – solar panel; 3 – charge controller for the solar panel; 4 – car charger providing 5V current

On the basis of the above-mentioned blocks an autonomous microprocessor data transmission system is assembled (Figure 4).

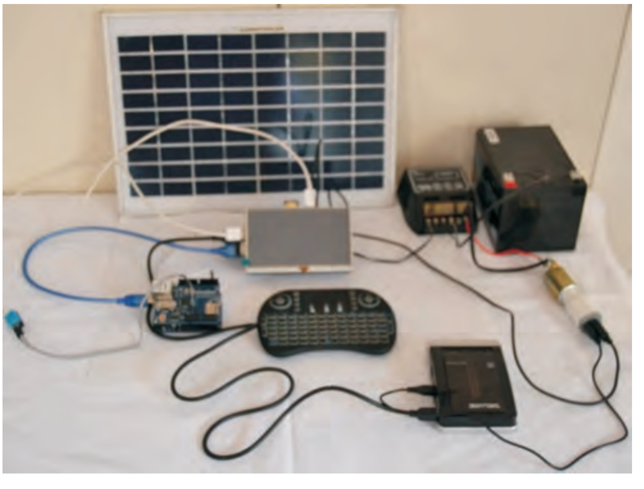

Figure 4 – Autonomous microprocessor data transmission system

The computing center of the system is the Arduino UNO platform, and the Ethernet Shield is used to communicate with the network. Using the Raspberry Pi, the sketch is sent to the Arduino UNO, which sends temperature and humidity data to the web browser via the Ethernet Shield. The Raspberry Pi uses a rechargeable battery for autonomous power, which is charged via solar energy. n addition the figure shows a USB hub with external power supply and a wireless mini keyboard. Figure 5 shows the connection diagram of the sensor, their characteristics are shown in the table.

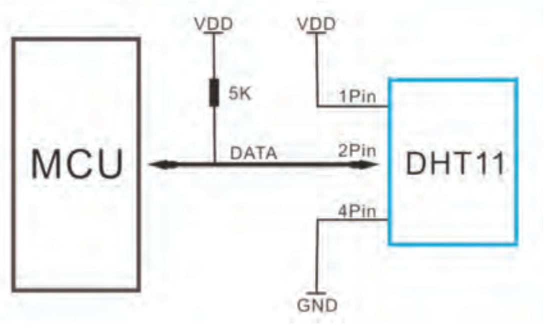

Figure 5 – Diagram for connecting the sensor to the Arduino

Table 1.2 – Characteristics of the elements of the Arduino connection scheme

MCU	Microcontroller or single board computer	Arduino / Raspberry Pi etc.
DHT11	Temperature and humidity sensor	Pins 1Pin, 2Pin and 4Pin are involved in the circuit, one of the sensor pins - 3rd pin 3Pin - is not connected to anything.
DATA	Data bus network	If the length of the connecting cable from the sensor to the microcontroller does not exceed 20 meters, then it is recommended to pull this bus to the power supply with a 5.1 kOhm resistor; if more than 20 meters - then another suitable rating (smaller).
VDD	Sensor power supply	Voltages from ~3.0 to ~5.5 volts DC are acceptable; if a ~3.3 volt supply is used, it is advisable to use a supply wire no longer than 20 cm.

Figure 6 shows the operation of the stand-alone microprocessor data transmission system.

Figure 6 – Receiving temperature and humidity data on the screen

For Arduino operation with DHT11 and DHT22 sensors there is a ready-made library (DHT).

The sketch for receiving data from the temperature and humidity sensor DHT11 and outputting the received data to the serial port is given in listing 1.

Listing 1.

```
#include "DHT.h"
#define DHTPIN 2 // номер пина, к которому подсоединен датчик
 // Инициируем датчик
DHT dht(DHTPIN, DHT11);
 void setup()
 {
  Serial.begin(9600);
  dht.begin();
Serial.println("DHTxx test!"); }
 void  loop()
  {
  delay(2000);
  // Задержка 2 секунды между измерениями
 float h = dht.readHumidity();
 //Считываем влажность
 float t = dht.readTemperature();
 // Считываем температуру
 if (isnan(t) || isnan(h))  {
 Serial.println("Failed to read from DHT");
 } else {
Serial.print("Humidity: ");
Serial.print(h);
Serial.print(" %\t");
Serial.print("Temperature: ");
Serial.print(t);
Serial.println(" *C");
}
}
```

Then the specified sketch is loaded into the Arduino board and the port monitor opens to view the received data (Figure 7).

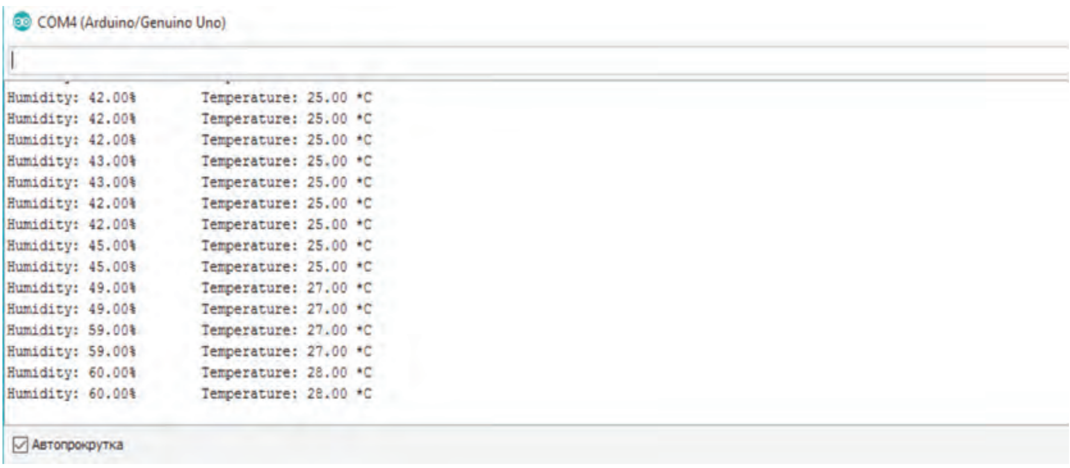

Figure 7 **–** Port monitoring in Arduino

The Ethernet Shield connects the Arduino to the server using the Internet or a Wi-Fi router. Currently using a Wi-Fi router to transmit information from the sensors. The sketch for receiving data from the temperature and humidity sensor DHT11 and displaying the received data in a web browser is given in listing 2.

Listing 2.

```
#include <DHT.h>

#define DHTPIN 3
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);

#include <SPI.h>
#include <Ethernet.h>

byte mac[] = { 0xDE, 0xAD, 0xBE, 0xEF, 0xFE, 0xED };
IPAddressip(192,168,0,20);

EthernetServerserver(80);

void setup()
{
dht.begin();

Serial.begin(9600);
Serial.println("DHT11 test!");

Ethernet.begin(mac, ip);
server.begin();
Serial.print("server is at ");
Serial.println(Ethernet.localIP());
}

void loop()
{
int t = dht.readTemperature(); // reading the sensor on pin 3
int h = dht.readHumidity();

EthernetClient client = server.available();
if (client) {
Serial.println("newclient"); // The http request ends with an empty string
boolean currentLineIsBlank = true;
while (client.connected()) {
if (client.available()) {
char c = client.read();
```

```
Serial.write(c);
// if you have reached the end of the line (received a newline character),
// and the line is empty, the http-request is over,
// then you can send a reply
if (c == '\n' &&currentLineIsBlank) {
// send a standard http response header
client.println("HTTP/1.1 200 OK");
client.println("Content-Type: text/html");
client.println("Connnection: close");
client.println();
client.println("<!DOCTYPE HTML>");
client.println("<html>");
// add a metarefresh tag so that the browser refreshes every 5 seconds:
client.println("<meta http-equiv=\"refresh\" content=\"5\">");
client.println("<title>");
client.print("Temperature and Humidity");
client.println("</title>");
// DHT11 temperature and humuidity results output
client.println("<center>");
client.println("<h1>");
client.print("Data Center");
client.println("</h1>");
client.println("<h2>");
client.print("Server Room Temperature and Humidity");
client.println("</h2>");
client.println("<h4>");
client.print("Temperature : ");
client.print(t);
client.print("<sup>0</sup>");
client.print("C");
client.println("<br />");
client.print("Humidity : ");
client.print(h);
client.print("%");
client.println("</h4>");
client.println("</center>");

client.println("</html>");
break;
}
if (c == '\n') {
currentLineIsBlank = true;
}
else if (c != '\r') {
```

```
currentLineIsBlank = false;
}
}
} // allow time for the web browser to retrieve data
delay(1);
 // close the connection:
client.stop();
Serial.println("client disonnected");
 }
}
```

The data from the temperature and humidity sensor can be viewed on the web browser of the computer (figure 8) and any device connected to the internet network to which the Arduino is connected by writing 192.168.0.20 in the browser line.

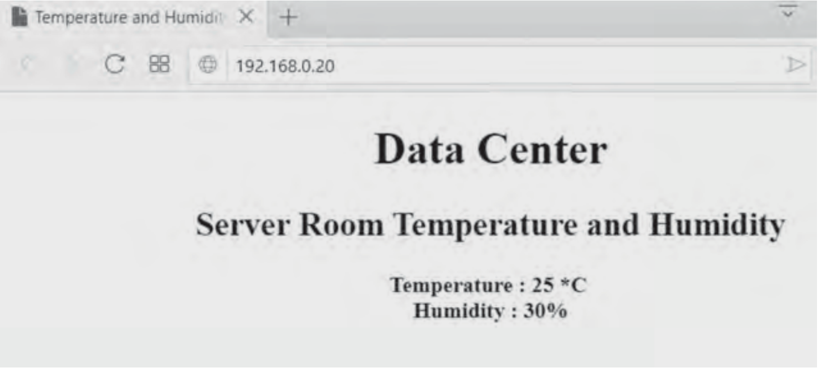

Figure 8 – Displaying temperature and humidity data on the RaspberryPi web browser

Conclusions. This paper analyzes the capabilities of a prototype "smart office" system. Partial use of resources is convenient for reducing the cost of office maintenance. Smart Office can even be controlled via smartphone, as long as the device is connected to the local network. In this paper, an autonomous microcomputer system for climate data transfer is developed, a general characteristic and the task of abiotic factors forecasting is given. A program was developed for the regression model to predict the value of the output parameter in real time, by eliminating the recalculation of data from the beginning of the count and the lack of the need to turn the matrices. Based on the solution of the model problem, the effectiveness of the developed program is shown. The results of this work are the basis for the research and implementation of a comprehensive solution to the problem of expert evaluation of climate data.

ЛИТЕРАТУРА

1 Г.З. Зиятбекова, А.Т. Мазакова, А.Д. Бургегулов, Е.Б. Муратов. Разработка энергосберегающей системы «Умный офис» и его принципы работы // Вестник КазУТБ. – Астана, 2022. – № 1(14). – С. 13-18.

2 Е.А. Тесля. «Умный дом» своими руками. Строим интеллектуальную цифровую систему в своей квартире / Тесля Е.А. – СПб., 2008. – 224 с. (in Russ)

3 К. Эсбенсен. Анализ многомерных данных. – Черноголовка: ИПХФ РАН, 2005. – 140 с. (in Russ)

4 В.И. Иваненко, В.А. Лабковский. Проблема неопределенности в задачах принятия решений. – Киев: Наукова Думка, 1990. – 132 с. (in Russ)

5 Т. Рашид. Создаем нейронную сеть. – СПб.: ООО «Альфа-книга», 2018. – 272 с. (in Russ)

6 Р. Каллан. Нейронные сети. Краткий справочник – М.: ООО «И.Д.Вильямс», 2017. – 288 с. (in Russ)

7 С.В. Аксенов, В.Б. Новосельцев. Организация и использование нейронных сетей (методы и технологии). – Томск: Изд-во НТЛ, 2006. – 128 с. (in Russ)

8 Бизнес-моделирование и анализ данных. Решение актуальных задач с помощью Microsoft Excel. – СПб.: Питер Пресс, 2018. – 864 с. (in Russ)

9 К.Е. Климентьев. Системы реального времени. – Самара: Самар.гос. аэрокосм. ун-т, 2008. – 45 с. (in Russ)

10 А.Ф. Котюк. Датчики в современных измерениях. – М.: «Радио и связь», 2006. – 96 с. (in Russ)

11 Дж. Фрайден. Современные датчики. – М.: «Техносфера», 2005. – 592 с. (in Russ)

12 А.Ф. Алейников, В.А. Гридчин, М.П. Цапенко. Датчики (перспективные направления развития). – Новосибирск: НГТУ, 2001. – 176 с. (in Russ)

13 Ч. Платт. Электроника: логические микросхемы, усилители и датчики для начинающих. – СПб.: БХВ-Петербург, 2015. – 448 с. (in Eng)

14 Т. Карвинен, К. Карвинен, В. Валтокари. Делаем сенсоры: проекты сенсорных устройств на базе Arduino и Raspberry Pi. – М.: ООО «И.Д.Вильямс», 2017. – 432 с. (in Russ)

15 В.А. Петин. Arduino и Raspberry Pi в проектах Internet of Thigs. – СПб.: БХВ-Петербург, 2017. – 320 с. (in Russ)

16 В.А. Петин. Проекты с использованием контроллера Arduino. - СПб.: БХВ-Петербург, 2016. – 464 с. (in Russ)

17 Т. Иго. Arduino. Датчики и сети для связи устройств. – СПб.: БХВ-Петербург, 2015. – 544 с. (in Eng)

18 Дж. Бокселл. Изучаем Arduino. 65 проектов своими руками. – СПб.: Питер, 2017. – 400 с. (in Eng)

REFERENCES

1 G.Z. Ziyatbekova, A.T. Mazakova, A.D. Burgegulov, E.B. Muratov. Razrabotka energosberegayushchej sistemy «Umnyj ofis» i ego principy raboty // Vestnik KazUTB. – Astana, 2022. – № 1(14). – S. 13-18. 52 Vestnik Nacional'noj inzhenernoj akademii Respubliki Kazahstan. 2022. № 1 (87)

2 E.A. Teslya. «Umnyj dom» svoimi rukami. Stroim intellektual'nuyu cifrovuyu sistemu v svoej kvartire / Teslya E.A. – SPb., 2008. – 224 s. (in Russ)

3 K. Esbensen. Analiz mnogomernyh dannyh. – CHernogolovka: IPHF RAN, 2005. – 140 s. (in Russ)

4 V.I. Ivanenko, V.A. Labkovskij. Problema neopredelennosti v zadachah prinyatiya reshenij. – Kiev: Naukova Dumka, 1990. – 132 s. (in Russ)

5 T. Rashid. Sozdaem nejronnuyu set'. – SPb.: OOO «Al'fa-kniga», 2018. – 272 s. (in Russ)

6 R. Kallan. Nejronnye seti. Kratkij spravochnik – M.: OOO «I.D.Vil'yams», 2017. – 288 s. (in Russ)

7 S.V. Aksenov, V.B. Novosel'cev. Organizaciya i ispol'zovanie nejronnyh setej (metody i tekhnologii). – Tomsk: Izd-vo NTL, 2006. – 128 s. (in Russ)

8 Biznes-modelirovanie i analiz dannyh. Reshenie aktual'nyh zadach s pomoshch'yu Microsoft Excel. – SPb.: Piter Press, 2018. – 864 s. (in Russ)

9 K.E. Kliment'ev. Sistemy real'nogo vremeni. – Samara: Samar.gos. aerokosm. un-t, 2008. – 45 s. (in Russ)

10 A.F. Kotyuk. Datchiki v sovremennyh izmereniyah. – M.: «Radio i svyaz'», 2006. – 96 s. (in Russ)

11 Dzh. Frajden. Sovremennye datchiki. – M.: «Tekhnosfera», 2005. – 592 s. (in Russ)

12 A.F. Alejnikov, V.A. Gridchin, M.P. Capenko. Datchiki (perspektivnye napravleniya razvitiya). – Novosibirsk: NGTU, 2001. – 176 s. (in Russ)

13 CH. Platt. Elektronika: logicheskie mikroskhemy, usiliteli i datchiki dlya nachinayushchih. – SPb.: BHV-Peterburg, 2015. – 448 s. (in Eng)

14 T. Karvinen, K. Karvinen, V. Valtokari. Delaem sensory: proekty sensornyh ustrojstv na baze Arduino i Raspberry Pi. – M.: OOO «I.D.Vil'yams», 2017. – 432 s. (in Russ)

15 V.A. Petin. Arduino i Raspberry Pi v proektah Internet of Thigs. – SPb.: BHV-Peterburg, 2017. – 320 s. (in Russ)

16 V.A. Petin. Proekty s ispol'zovaniem kontrollera Arduino. - SPb.: BHV-Peterburg, 2016. – 464 s. (in Russ)

17 T. Igo. Arduino. Datchiki i seti dlya svyazi ustrojstv. – SPb.: BHV-Peterburg, 2015. – 544 s. (in Eng)

18 Dzh. Boksell. Izuchaem Arduino. 65 proektov svoimi rukami. – SPb.: Piter, 2017. – 400 s. (in Eng)

Г. З. ЗИЯТБЕКОВА[1,2], Л. С. КОПБОСЫН[2], А. К. САМБЕТБАЕВА[2], Ж. ДҮЙСЕНБЕКҚЫЗЫ[2], Е. Б. МУРАТОВ[2], А. Д. БУРГЕГУЛОВ[2]

[1]Қазақстан Республикасы ғылым және жоғары білім министрлігі Ақпараттық және есептеуіш технологиялар институты, Алматы, Қазақстан
[2]әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан

«АҚЫЛДЫ КЕҢСЕ» ЖҮЙЕСІН ДАМЫТУ ҮШІН АБИОТИКАЛЫҚ ФАКТОРЛАРДЫ БОЛЖАУ

Мақала «Ақылды кеңсе» жүйесі үшін абиотикалық факторларды болжауға арналған. Мұнда болжау саласындағы ғылыми зерттеулер де келтірілген. Бұл мақалада энергия үнемдеу жүйесін орнату технологиясы және оның жұмыс істеу принциптері қарастырылады. Жұмыста смарт жүйелерді құру және басқару әдістері қолданылды. Сондай-ақ, «Ақылды кеңсе» технологиясының арқасында жайлылықтың артуы сипатталған әрі пайдаланушыға ыңғайлы интерфейс қолданылды. Осы жүйеде келесі функциялардың қолданылатынын атап айтуға болады: жарықтандыруды оңтайландыру, жылыту, үйді қашықтан қорғау және басқару, мобильді құрылғылар мен арнайы кілттердің көмегімен басқару. Негізінен ауқымына байланысты бизнес-құрылымдарды автоматтандыру жүйесі қарастырылады. Бұл жұмыста қазіргі уақыттағы барлық бизнес-процестерді оңтайландырудың негізгі факторлары болып табылатын барлық қол жетімді әдістер ұсынылды. Сондай-ақ, ақылды жүйелерді автоматтандырудың барлық өзекті мәселелерін ескере отырып, жүйені модельдеу және әзірлеу нұсқалары да қарастырылған. Ғылыми тақырыптың маңыздылығы ақылды үй жүйелерін дамытудың жоғары әлеуетіне және *осы жүйелерге енгізілген құрылғылардың бірыңғай стандарттарының болмауына әсер етеді. Әзірленіп жатқан бағдарламалық-аппараттық кешенді қарапайым үйлерде, кеңселерде де, өндірісте де қолдануға болады. Қарастырылып отырған жүйе масштабталады, бұл оны кез-келген мақсатта пайдалануға мүмкіндік береді. Мақалада климаттық деректерді берудің автономды микропроцессорлық жүйесін құру басты назарда қарастырылады. Бұл жұмыста салыстырмалы ылғалдылық пен ауа температурасын өлшеуге арналған климаттық параметрлерді өлшеудің микропроцессорлық жүйесі жасалды. Климаттық параметрлерді өлшеу жүйесі өлшеу ақпаратын жинауға, оны әрі қарай өңдеуге, сақтауға және оператордың қабылдауына ыңғайлы түрде көрсетуге арналған.*

Түйін сөздер: *ақылды кеңсе, смарт жүйелер, смарт қосқыш, автоматтандырылған тұрғын үй, контроллер, микропроцессорлық жүйе, температура мен ылғалдылық сенсоры, Raspberry микрокомпьютері, Arduino UNO платформасы.*

Г. З. ЗИЯТБЕКОВА[1,2], Л. С. КОПБОСЫН[2], А. К. САМБЕТБАЕВА[2], Ж. ДҮЙСЕНБЕКҚЫЗЫ[2], Е. Б. МУРАТОВ[2], А. Д. БУРГЕГУЛОВ[2]

[1]Институт информационных и вычислительных технологий КН МНВО РК, Алматы, Казахстан
[2]Казахский национальный университет имени аль-Фараби, Алматы, Казахстан

ПРОГНОЗИРОВАНИЕ АБИОТИЧЕСКИХ ФАКТОРОВ ДЛЯ РАЗРАБОТКИ СИСТЕМЫ «УМНЫЙ ОФИС»

Статья посвящена прогнозированию абиотических факторов для системы «Умный офис». Приведены научные исследования в области прогнозирования. В данной статье рассматривается технология установки энергосберегающей системы и его принципы работы. Использованы методы построения и управления смарт-систем. Также описывается повышение комфортности, благодаря технологии «Умный офис». Использован удобный интерфейс для пользователя. Затрагиваются такие функции, как оптимизация освещенности, отопления, защита и управление домом дистанционно, при помощи мобильных устройств и специальных брелков. Главным образом, рассматривается система автоматизации бизнес-структур в зависимости от масштаба. Были предложены все доступные методы на данный момент, которые являются ключевыми факторами в оптимизации всех бизнес-процессов. А также рассмотрены варианты моделирования и разработки системы, учитывая все актуальные проблемы автоматизации умных систем. Важность научной темы влияет на высокий потенциал развития систем умного дома и на отсутствие единых стандартов устройств, включенных в эти системы. Разрабатываемый программно-аппаратный комплекс может быть применён как в обычных домах, офисах, так и на производстве. Система является масштабируемой, что позволяет использовать её практически для любых целей. В статье рассматривается создание автономной микропроцессорной системы передачи климатических данных. В данной работе разработана микропроцессорная система измерения климатических параметров, предназначенная для измерения относительной влажности и температуры воздуха. Система измерения климатических параметров предназначена для сбора измерительной информации, дальнейшей ее обработки, хранения и отображения в форме удобной для восприятия оператором.

Ключевые слова: *умный офис, смарт-системы, интеллектуальный выключатель, автоматизированное жилище, контроллер, микропроцессорная система, датчик температуры и влажности, микрокомпьютер Raspberry, платформа Arduino UNO.*