CONTROL AND MONITIRING OF MAIN CLIMATIC PARAMETERS

Kabanov A.A., Nikonova O.A.

Omsk State Technical University
Tomsk Polytechnic University
Scientific supervisor: Nikonova G.V. Candidate of Engineering Sciences, Associate Professor at the Department of Radio engineering faculty

INTRODUCTION

Cultivation of agricultural products in terms of greenhouse farming is a daunting technological challenge. The quality of the crop is influenced by many factors.To optimize the work associated with the control, management and monitoring of greenhouse offered an automated system of agricultural greenhouses constructed in accordance with the concept of Internet of Things (IoT) [1].

IoT-management solution «Smart greenhouse» is a system that should be able to identify specific situations that occur at the facility, and accordingly respond to them, one of the subsystems can control the behavior of others in advance worked out algorithms. The basis for intelligent industrial premise is to combine the individual subsystems into a single manageable complex, as the most progressive concept of human interaction with the living space.

When a person with a single command sets the desired setting, and have equipment in accordance with the external and internal conditions sets and monitors the operating conditions of all engineering systems and appliances – is an important feature and the feature «smart greenhouses», distinguishing it from other modes of organization on the production of living space. In this case, eliminating the need to use multiple remote controls (TV, audio, video equipment), dozens of light switches, separate ventilation Control Unit, heating, irrigation, etc.

The room equipped with an intelligent system enough to choose one by pressing one of the scenarios of behavior, and it will adjust the operation of all systems in accordance with the program intelligent automation system requires a completely new approach to the structure of the life-support organization, which through a combination of software and hardware significantly increases the efficiency of the management and reliability of all systems and actuators.

PROBLEM DEFINITION

Designing livelihood greenhouses began with the lighting project. Lighting in greenhouses is one of the most energy-intensive components.

Project lighting design and calculation of light exposure was performed using DIALux program (fig.1). It is an integrated system that combines 3-D modeling of the technical design and electrical calculation [2].

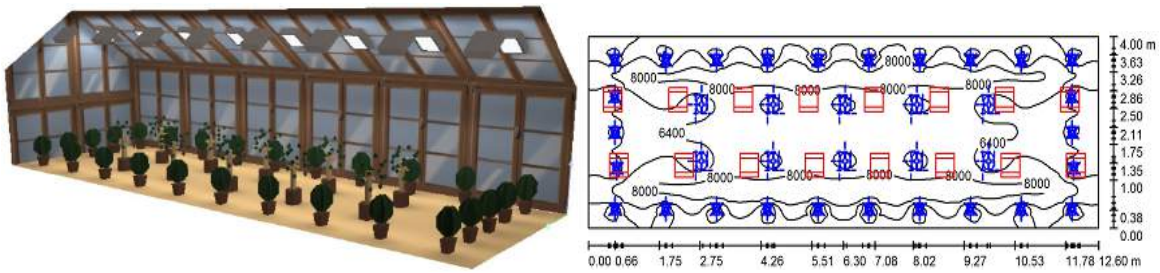

Fig. 1. «Smart greenhouse» and electric lighting calculation (DIALux program)

The IP-technology 1-Wire was chosen for the project realization. The reason is available, ease of implementation, management easy and low cost. The master for USB-port: DS9490R was used as a master of the network. Nowadays most of the diagnostic devices, removal and storing data are made with a USB interface, therefore the reason for choosing the USB master is evident.

As a method for transmitting information by 1-Wire line, we are using conventional telephone cable, and hence the exchange rate is low. However, if you carefully analyze the majority of real-world objects that require automation, then more than 60% limiting speed of service 16.3 Kbit / s is more than satisfactory.

Minicomputer Raspberry PI was used as a management and data storage server. It is directly connected with the master of 1-Wire network with connected devices are included in automatic greenhouse system [3].

Raspberry PI is a cheap computer, of a credit card size, created by David Breben. Raspberry PI is launched at the beginning of 2012. Raspberry PI runs by different operating systems (OS): Debian, Fedora, Gentoo, Arch Linux, RISC OS, AROS and FreeBSD. Standard delivery Raspberry PI is made with the operating system Raspbian, which is a special Debian Linux assembly adapted for Raspberry PI.

All this software is free and few demanding to resources. Additionally, it supports playback of videos in Full HD. However, if you do not require active work with video, you can make a rebalance of available memory allocating to the video playback functions 8-16 MB of RAM, and the rest set aside for applied problems [4].

THEORY AND EXPERIMENTS RESULTS

Automatic greenhouse system is a set of sensors for different purposes and actuators. Temperature and humidity sensors are inside and outside the greenhouse. The temperature sensor is connected directly to the master of network, which will interrogate him.

Data from sensors are processed by minicomputer. If the temperature and humidity exceeds the permitted limit, the signal is sent to the actuators, which in turn open windows to ventilate the greenhouse or turn on a cooling system. If the temperature falls below acceptable limit, then the heating system turn on.

It is installed a light sensor connected with the master of network. Special lamps for different kinds of plants turn on if it is inadequate lighting. A timer programmed for a particular type of plant carries out watering, the signal is sent to the electromagnetic valves, which open the flow of water. Watering is carried out of the tank inside the greenhouse (to raise the water temperature and economy of means on water heating), the filling of the tank is from the water supply system or from the well with the pump. The tank filling is controlled by means of two float sensors located in the upper and lower part and minicomputer processing the information. Security alarm work is directly interrogated the sensors which open the main door to prevent illegal access to the greenhouse. In the future, you can connect video observation for monitoring in the operation of automatic greenhouse online [5].

Also, the system includes a remote monitoring «IoT greenhouse» for this purpose the router is installed. Monitoring is carried out by data base with the web page or special application all of the data are transmitted from the minicomputer are showed on the website or display of application. Having access to the data base, we can anywhere and using any device (smartphone, tablet, laptop and others) with our application monitor and manage the automatic greenhouse progress (fig. 2).

SUMMARY

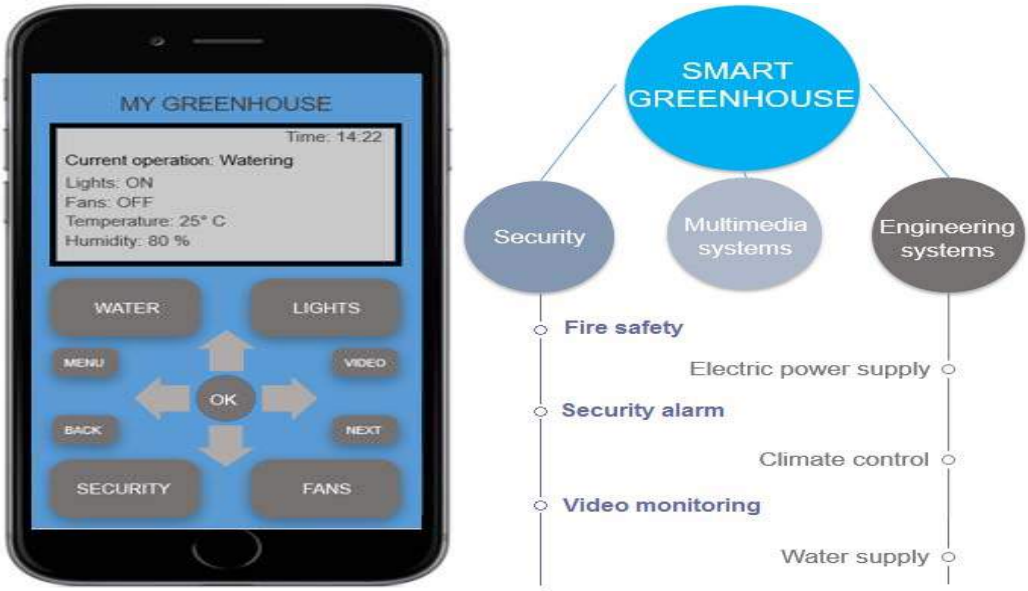

Fig. 2. Interface of application «My greenhouse» and block diagram of it

Installation of the system is automated greenhouses cost-effective, as the actual production process is controlled without human intervention, leaving him a remote control function. The concept of the system «Smart greenhouse» in the interpretation of IoT implies better integration of real and virtual worlds in which communication is made between a man and devices through a global network. This system is very flexible, creating new opportunities in the field of security, intelligence and control, it opens new and wider perspectives in the field of production and improve the quality of human life.

References

1. Nayidich A. Internetofthings – realityorprospect // Computerpress #12, 2013. [Electronic Source]. – Access mode: http://compress.ru/article.aspx?id=24290 01.10.2016.
2. Kozlov A. Experience in the development of computer automation of the design process of an electric program (DIALux) and cable layout (ElectriCS 3D) at the operating enterprise // Cadmaster #3-4. – 2014. – P. 54–57.
3. Kabanov A.A., Nikonova G.V. Automatic system «smart greenhouse» // VIII International scientific-practical conference of students, postgraduates and young scientists – 2015. – P. 185–186.
4. [Electronic Source]. – access mode: http://raspberrypi.org
5. [Electronic Source]. – access mode: http://elinux.org/RPi_Screens