AKADEMIA TECHNICZNO - HUMANISTYCZNA
W BIELSKU-BIAŁEJ

Przetwarzanie, transmisja i bezpieczeństwo informacji

Akademia
Techniczno-Humanistyczna
w Bielsku-Białej

Tom 2

Monografia

WYDZIAŁ BUDOWY MASZYN
I INFORMATYKI

Przetwarzanie, transmisja i bezpieczeństwo informacji
Processing, transmission and security of information

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PROJEKT INTELIGENTNEJ SZKLARNI Z ZASTOSOWANIEM INTERNETU RZECZY

Streszczenie: W niniejszym artykule omówiono problem badań oraz praktycznego zastosowana technologii Internetu Rzeczy (IT). Technologia ta jest niezbędna w tworzeniu modeli obiektów inteligentnych oraz w ich szybkim prototypowaniu. Opisano to na przykładzie oraz wyeksponowano najważniejsze aspekty. W szczególności, uwagę skupiono na opracowaniu projektu "Inteligentnej Szklarni", który jest realizowany na Uniwersytecie w Tarnopolu tj. Volodymyr Hnatiuk Ternopil National Pedagogical University. Autorzy omówili pewne specyficzne problemy związane z zastosowaniem nowych technologii IT w procesie dydaktycznym na uniwersytecie pedagogicznym.

Słowa kluczowe: Internet Rzeczy, inteligentne czujniki, inteligentna szklarnia, edukacja

DEVELOPMENT OF SMART GREENHOUSE ON THE BASIS OF IOT TECHNOLOGY

Summary: The article deals with the problem of research study and practical application of Internet of Things technology. The technologies necessary for the creation of models of intelligent objects and their rapid prototyping are highlighted and described. Special focus is on the creation of the "Smart Greenhouse" project at the Volodymyr Hnatiuk Ternopil National Pedagogical University. The authors identify the peculiarities of implementing new approaches to IT training when studying and using the IoT during the educational process at a pedagogical university.

Keywords: Internet of Things, intelligent sensors, smart greenhouse, education

1. Urgency of the research.

Effective development of the agro industrial complex in Ukraine requires constant re-equipment and implementation of new technologies for increasing production of value-added products.

Precision agriculture involves smart agriculture and animal farming, GPS-monitoring and navigation, using drones and robotics, agricultural equipment of new generation,

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innovations in breeding and food technology, bioengineering agriculture, vertical farming, smart logistics, smart packaging technology, block chain technology, bigdata technology, energy-efficient technologies, and the Internet of Things technology.
Internet of Things (IoT) is rapidly expanding due to the wide spread of wireless networks and cloud technologies, cheaper processors and sensors, and the development of energy-efficient data transfer technologies. The implementation of Internet technology in various areas of human life requires new approaches to IT education concerning the use of IoT in education.

2. Presentation of basic material of the research.

The modern IoT industry is one of the main world trends. The development of Internet devices is based on:

- Production engineering for information collection and processing;
- Data transfer technologies;
- Creating opportunities for devices to make decisions and implement them;
- Designing and constructing smart devices [2].

As it is known from scientific sources, to create smart object models and to quickly prototype them, it is necessary to identify each object in the first place [4]. Given that there is a unique identification system, you can collect and accumulate information about a particular subject. This functionality can be achieved using RFID chips (Radio-Frequency Identification). They are able to transmit information to readers without their own current source. Each chip has an individual number. An alternative to object identification technology can be the use of QR codes or GPS technology, which is already effectively used today in smartphones and navigation devices.
Data processing is an important component. Built-in computers and cloud-based technologies are used to process and accumulate sensor data. Wireless technology (Wi-Fi, Bluetooth, ZigBee, 6LoWPAN) is used to share information between devices. Smart devices collect data from the environment and then transmit the information via the Internet to other gadgets, and receive information from those gadgets as well. Objects connected to data processing networks acquire "intelligence" through the analysis of data obtained by the program, which makes conclusions and makes decisions. To create IoT objects, controllers, sensors, and, if necessary, executive mechanisms are required.
There are various hardware and software platforms for developing solutions for the Internet of Things [3]. For the development of educational practical-oriented projects in the field of IoT [1] at the STEM center of Volodymyr Hnatiuk Ternopil National Pedagogical University, we use the designer Arduino as a basis.
All other required boards and sensors can be purchased separately. To create a prototype model of a smart greenhouse, in our opinion, it is advisable to create a training kit smart-greenhouse, which may include:

- Arduino Uno R3 board;
- Ethernet W5100 Shield;
- module of temperature and humidity sensor DHT11;
- Ethernet cable;
- digital thermometer DS18B20;
- light sensor module;

- moisture sensor module;
- IO Sensor Shield;
- connecting wires;
- pads;
- network adapter (5V, 1A, 5W);
- box.

We suggest using such a kit in schools for creating models of smart objects and their rapid prototyping. In particular, STEM project "Smart greenhouse" can be implemented by pupils of grades 5-9 with a view to developing a model of an automated greenhouse. This project integrates the following disciplines: computer science, mathematics, engineering, labor training, physics, biology and chemistry.

Students are grouped together and choose plants to grow in a smart greenhouse. To do this, during the biology lessons, they will find out the necessary data about the selected plant: the mode of illumination and irrigation, height and its yield.

The next step is to provide a management system and irrigation system for each particular plant. Since irrigation should occur when the ground is dry, you need to know, specifically for this plant, whether the ground is still dry or wet.

After clarifying exactly what level of humidity should be in the soil, the students set the moisture sensor in the greenhouse. It measures the ground resistance, which varies depending on the humidity. The sensor must necessarily be calibrated. At the chemistry lessons, students study different soil compositions and resistance change, depending on variations in soil composition. During the physics classes, students calibrate the sensor in accordance with the needs of the plant and study the operating principle of humidity and temperature sensors, as well as operating principle of artificial lighting.

After collecting all the necessary data (sensors indicators of temperature and humidity, illumination), students process data at the computer science classes: they program how sensors work. For such a model to become the Internet of Things, you need to create an analytical cloud Internet service, which independently decides to include an irrigation system based on the collected data.

3. Conclusions.

Using intelligent sensors, you can elaborate competent care of plants and effectively implement it. There is an opportunity to not only take care for plants on the ground area, but also to keep watch over the conditions in the warehouse and prevent the harvest from bio degradation.

In consequence of the proposed project, it is possible to modernize Ukrainian agriculture using modern energy-efficient, digital and smart technologies.

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