UDC

MODERN WIRELESS INFOCOMMUNICATION TECHNOLOGIES AND INFRASTRUCTURE ANALYSIS FOR IOT IMPLEMENTATIONS IN SCOPE OF SMART HOME AND SMART CITY CONCEPTS

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АНАЛІЗ ІНФРАСТРУКТУРИ ТА СУЧАСНИХ ТЕХНОЛОГІЙ БЕЗПРОВОДОВОГО ЗВ'ЯЗКУ ДЛЯ ІНТЕРНЕТУ РЕЧЕЙ В МЕЖАХ КОНЦЕПЦІЇ «РОЗУМНИЙ БУДИНОК» ТА «РОЗУМНЕ МІСТО»

У статті наводиться аналіз інфраструктури та сучасних технологій безпроводового зв'язку для Інтернету речей в межах концепції «Розумний будинок» та «Розумне місто».

The Internet of Things (IoT) trend has wide scope of applications today [1, 2]. Number of sensors that connected to the network is continuously growing. IoT is a network concept that consists of physical devices that have sensors, as well as hardware and software that allow transmission and data exchange between physical world and Internet.

The infrastructure of any IoT system, regardless of concept, can be characterized by the logical model with levels as presented on Fig. 1, where each level is realized depending on applied problem for which the IoT network is implemented. Some levels may be absent, depending on the task and implementation of the IoT network.

7 Public work and processes (people, business processes, technical effect)	
6 Applied use of received information (reports, analytics, control)	
5 Data abstraction and getting information (aggregation, authorization, authentication)	
4 Saving data (databases and management systems)	
3 Initial data processing (receiving, analysis and data transformation)	
2 Communication (telecommunication component)	
1 Sensors and controllers (physical IoT objects)	

Fig. 1. Logical levels of IoT architecture

Fig. 2 represents a generalized IoT infrastructure for various concepts and applications. Depending on the task, architectural components may be present or

absent; at the same time, each architecture component can be realized by different technologies and approaches. For example, the choice of telecommunication technology for transmitting data from sensors to the data center can be made based on the chosen concept, the number of sensors and location, frequencies of data transmission, the nature of data and its volume, etc.

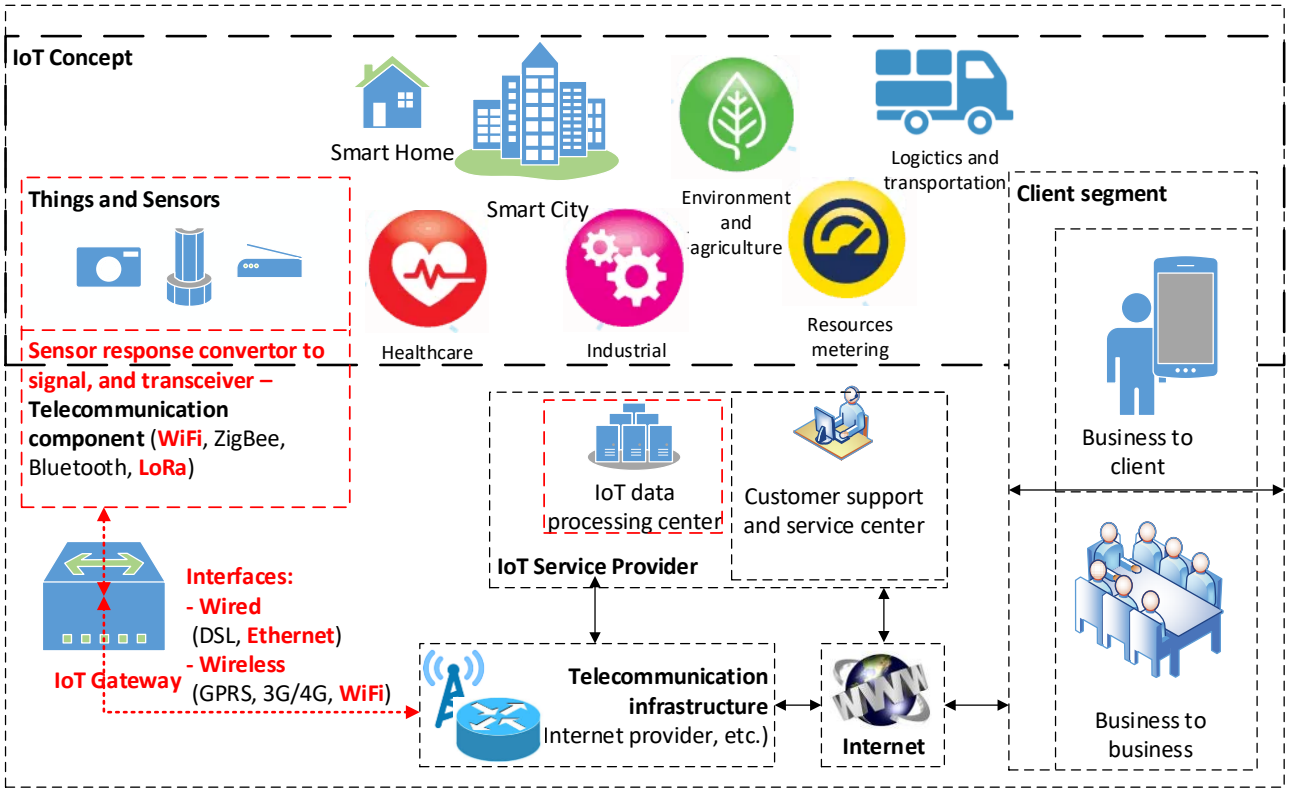

Fig. 2. Generalized IoT infrastructure

Telecommunication component. IoT implementations use wired technologies, but the most often – they use wireless low-power data transmission technologies, which include small-, medium- and long-radius technologies (WPAN, WLAN, LPWAN), for instance [3]:

- LPWAN: LoRaWAN, SIGFOX, Cellular Internet of Things (CioT) – EC-GSM, LTE-M, NB-IoT;
- WLAN: WiFi (IEEE 802.11);
- WPAN: 6LoWPAN, ZigBee, Z-Wave, Bluetooth.

Depending on the IoT concept, a certain telecommunication component implementation is being selected. For example, for implementation the concept “smart home”, the Bluetooth, ZigBee or WiFi can be selected, while for the “smart city” concept it is better to choose technologies like LoRaWAN, SIGFOX, for the possibility to cover areas with a significant radius what WLAN technologies are not able to cover due to known technical reasons.

It’s important to bring attention that the **Infocommunication** term is relevant and valid for telecom technologies used for IoT network and applications, because data from sensors is not only transmitted, but also is being used for analysis, research, processing and obtaining certain information, what brings a certain result and benefits, and promotes the adoption of decisions on control of network objects,

adjusting business processes, and so on.

Data transfer protocols. For data transfer in the IoT use cases, the following application-level protocols are used: DDS, MQTT, XMPP, AMQP, JMS, CoAP, REST/HTTP – depending on the features of the solution and the necessary functionality and software compatibility, which is realized for transmitting, receiving and processing data from IoT sensors.

IoT concepts. The most common concepts and applications are "Smart House" (SH), and "Smart City" (SC). There are many other IoT concepts and applications, such as manufacturing, agrarian industry, logistics, environmental monitoring, medicine and many more [4]. **SH** is a system of home devices that connect to the data network and perform certain daily tasks with or without user's involvement: turning on the light, regulating the air conditioning, monitoring the unauthorized invasion, informing about fire or water leakage, etc. **SC** is a city that uses modern technologies to improve the life quality in it. There are five main components of SC: Energy, Water, Buildings, Government, Transportation.

IoT issues. It's possible to highlight couple major problems in IoT. **Compatibility** – compatibility of systems, interfaces and data transfer protocols. There is no single system or regulator that defines common development rules currently, what creates a large number of different solutions and compatibility problems when things are being integrated into a single network [5]. **Security** – the problem of protecting IoT networks from unauthorized third-party interference or information falsification. Thus, there are many developed technical solutions for authentication, authorization, encryption, secure sessions on hardware and software levels in hands of IoT, but still there are cases of unauthorized penetration to IoT systems with consequent brought harm of various sizes. **Readiness for IoT implementation** – readiness for innovations acceptance in the form of IoT, and their implementation in life. SH or SC concepts can be implemented and operate for the benefit purposes only when there is understanding of the specific such a need, the feasibility of such systems, and therefore – it is necessary to have a willingness to make such innovations real and get a positive impact of their work, which is not always takes place.

Saying all above, we can confidently say that IoT have a place in our life, but what kind of IoT will have a place and how quickly in time metrics – that's a reasonable question. IoT opens up many possibilities for us, and it is necessary to wisely use it. At the same time, infocommunication technologies play an essential role in the construction of the IoT, so far as without the infocommunication component there neither Internet not IoT would existing today.

References

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