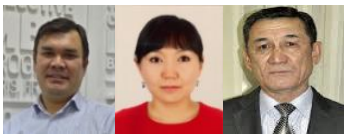
# The concept of monetization of IoT-based project: case of Medical System in Kazakhstan

**Nurbek Saparkhojayev[1], Assel Mukasheva[1*], Pazharbek Saparkhojayev[2]**

*[1]Department "Information Technologies", KazNRTU after K.I. Satpayev, Satpayev Str. 22, Almaty, Kazakhstan*
*[2]Department "Physics and Mathematics", The Korkyt Ata Kyzylorda State University, Kyzylorda, Kazakhstan*

**Corresponding author's e-mail: mukasheva.a.82@gmail.com*



**Abstract**

In fast-growing world where new technologies, services and platforms arise every day, the importance of monetizing projects in proper time is becoming one of the main issues that brings not only financial benefits, but also world fame for their owners. Furthermore, the Internet of Things (IoT) is becoming more and more important in many domains worldwide. By 2017, 90 million people will live in smart homes, and by 2020, there will be 50 billion connected devices. The latest Gartner forecast predicts that by 2020 there will be $309 billion in incremental revenue opportunity for IoT suppliers, mostly in services. Taking into account those numbers, author of this research paper presented concept of acquiring money out of possible implementation and deployment of medical system in Kazakhstan.

*Keywords:* Internet of Things, monetization, medical system, wireless systems and technologies.

## 1 Introduction

The next level in the era of computing will be outside the scope of the traditional desktop. In the Internet of Things (IoT) paradigm, many objects surrounding us will be on the network in specific form. Radio Frequency Identification (RFID) and sensor network technologies will continue developing to meet this new challenge, in which information and communication systems are invisibly embedded in the human environment. All this as a result brings to the generation of enormous amounts of data, which have to be stored, processed and presented in a seamless, efficient, and easily understandable form. Smart connectivity with existing working networks and context-aware computation using network resources is a primary part of IoT. The term Internet of Things was first introduced by English scientist Kevin Ashton in 1999 in the context of supply chain management [1]. However, in the past decade, the definition has been more inclusive covering wide range of applications like healthcare, utilities, transport, manufacturing, etc. [2]. Nevertheless to the fact that the definition of 'Things' has changed as technology evolved, the main goal of making a computer sense information without the direct human intervention remains the same. The radical evolution of the modern Internet into a Network of interconnected objects that not only outputs information from the sensing environment and interacts with the physical world, consisting of actuation/command/control, but also uses Internet standards to provide services for information transfer, analytics, applications, and communications. Fuelled by the popularity of devices enabled by open wireless technologies, like Bluetooth, radio frequency identification (RFID), Near-Field Communication (NFC) Wi-Fi, and telephonic data services as well as embedded sensor and actuator nodes, IoT has stepped out of its infancy and is on the edge of transforming the current static Internet into a fully integrated dynamic Future Internet [3]. The Internet revolution led to tight interconnection between people at an unprecedented scale and pace. The next revolution will be the interconnection between objects to create a smart environment. Only in 2011, the number of interconnected devices on the planet exceeded the actual number of people. Currently there are 22.9 billion interconnected devices and it is expected to reach 50 billion devices by 2020. The rest of this paper is organized as follows: Section II provides description of literature review on IoT and existing systems, which already have popularity and used worldwide by many people. Section III discusses about the concept of medical system and its impact on Kazakhstan. Section IV is presenting possible ways of monetization of medical system in Kazakhstan starting from governmental financial support and finishing with money from the deployment of this system. Finally, our conclusions and future work directions presented in section V.

## 2 Literature review

As identified by Atzori et al. [4], Internet of Things can be realized in three different paradigms: internet-oriented (middleware), things-oriented (sensors) and semantic-oriented (knowledge). Even though, this type of delineation is required due to the interdisciplinary nature of the subject, the practicality of IoT can be released only in an application domain, in which these three paradigms intersect.

The RFID group defines the Internet of Things as "The worldwide network of interconnected objects uniquely addressable based on standard communication protocols", whereas according to Cluster of European research projects on the Internet of Things [2] 'Things' are active participants

in business, info and social processes wherever they're enabled to move and communicate with one another and with the environment by exchanging knowledge and data perceived concerning the environment, while reacting autonomously to the real/physical world events and influencing it by running processes that trigger actions and make services with or while not direct human intervention. According to author of the following research [5], a smart environment is the environment that uses information and communications technologies to make the critical infrastructure components and services of a city's administration, education, healthcare, public safety, real estate, transportation and utilities more aware, interactive and efficient. IoT takes advantage of identification, data capture, processing and communication capabilities of modern technology to allow regular machines to provide new data sources to applications, which in turn can offer more advanced services. In terms of ICT technologies, IoT adds Any Thing communication to Any Time and Any Place as illustrated in Figure 1.

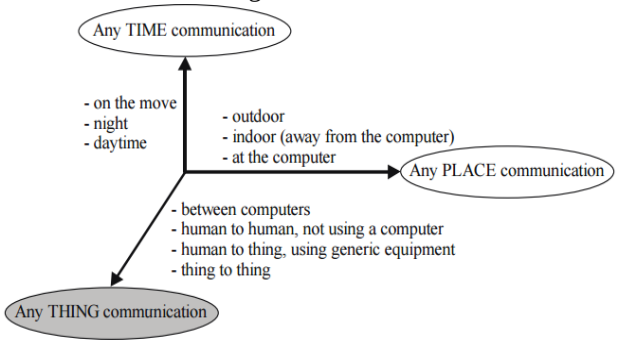



FIGURE 1 IoT compared to other ICT technologies [6]

Internet of Things (IoT) term represents a general concept for the ability of network devices to sense and collect data from around the world, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. The IoT is comprised of smart machines interacting and communicating with other machines, objects, environments and infrastructures. Nowadays every person is connected with each other using lots of communication way. Where most popular communication way is Internet, so in another word we can say Internet, which connects peoples. In educational institutions have a situation where in students can be present in any part of the campus and might miss important updates such as rescheduling of classes, etc. Furthermore, students or customers might not be able to know important information in-time for being useful to them as they might not be able to pass through those noticeboards regularly.

There are three types of technologies that enable IoT:

1. Near-field communication and Radio Frequency Identification (RFID) technologies: in the 2000s, RFID was the dominant and the most used technology, however, after few years NFC became dominant replacing RFID technology in many areas. NFC have become common in smart phones during the early2010s, with uses, such as reading NFC tags, access to public transportation, etc.;
2. Quick response codes (QR-codes) and Optical tags: this is used for low cost tagging. Phone cameras decode QR-code by using image-processing techniques. One important disadvantage in using QR Codes is that only Smartphone users can be targeted as mobile camera and Internet connection is a prerequisite [7-8]. The real limitation of the QR Code is the lack of offline ability to authenticate source of code. For example, anyone can easily generate a bogus QR Code claiming to belong to Ford Motors. This makes the application of QR Codes vulnerable to misuse and fraud;
3. Bluetooth and low energy (BLE): this is one of the latest techniques developed so far. All newly releasing smartphones have BLE hardware already installed on them. This emerging wireless technology has been developed by the Bluetooth Special Interest Group (SIG) for short-range communication. In contrast with previous Bluetooth flavours, BLE has been designed as a low-power solution for control and monitoring applications. BLE is the distinctive feature of the Bluetooth 4.0 specification [9].

IoT has already found its own way in variety of different markets, and predictions indicate possible strong growth in next 15 years. Applications are aimed for consumers and companies alike although a certain trend can be seen in how these target groups are divided among the markets in Figure 2.

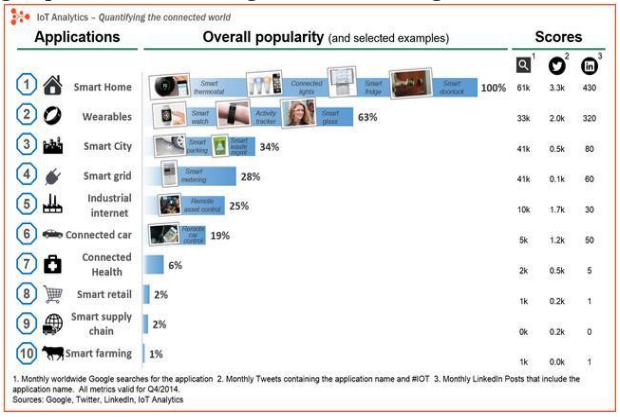



FIGURE 2 IoT application ranking [10]

As it may be seen from this figure, the most popular market in utilizing IoT is smart homes. The term has more than 60,000 search hits monthly and start-up companies have received over 2.5 billion dollars in total from funding. Examples of these companies are Philips, Belkin, Nest and AlertMe. Home automation solutions include light bulbs, home appliances and security devices. The opportunities IoT offers for businesses are huge as the demand and interest are both clearly visible. Companies should now shift their focus to use cases that would allow organizations to get most out of IoT by adapting new business processes and improving effectiveness of operations [11]. Surprisingly majority of organizations have not started to create value from IoT with the biggest challenges being undeveloped business cases and unclear monetization plans [12]. A scheme of objects' interconnection is depicted in Fig. 3, where the application domains are chosen based on the scale of the impact of the data generated. The users span from individual to national level organizations addressing wide ranging issues.

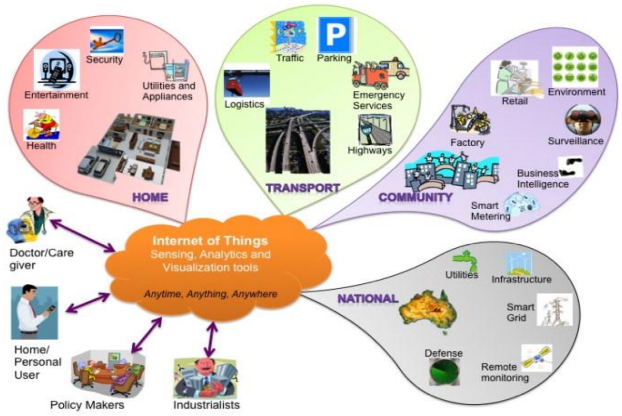



FIGURE 3 Internet of Things scheme [13]

Commercial ventures are thinking about and recognizing a tremendous measure of IoT-related applications, which can be separated into two groups. In first group, the gadgets are connected shaping a base that is automated with M2M communication platform and expecting to simplify humans' lives. In this group IoT can be seen assuming the part of TCC&R (track, command and control). In houses for instance the room temperature, windows, lights and electrical gadgets, etc. can all be able to be controlled remotely from tablet, laptop or cell phone and automated to dispose of manual procedures that individuals face every day in their lives. Keeping track of organizations' assets gets to be less demanding, when machines and resources are continually sending data to servers. Equipment breakdowns turn out to be less regular when they are under ongoing surveillance and their condition is continually watched. Another huge point has been smart homes, in which the cooling, lights, entryways and appliances are controlled through advanced mobile phone applications. IoT is additionally accepted to reform healthcare, for which many researchers developed many different applications and systems. Devices and gadgets can gather patient information, screen vital signs and consequently change medicine [14].

In the second group, the electronic devices and gadgets are data mines that screen patterns and behaviors for providing organizations with marketing data and to create commerce. This class has raised most worry about the privacy questions of the clients, and to what extent they want to share data about themselves is then used to categorize them [14].

## 3 Concept of medical system and its impact on Kazakhstan

The main concept of medical system is to create a new model of universal medical center as an information and service platform for the modern organization of the medical treatment process based on IoT and Internet of Everything (IoE) technologies. Smart healthcare system can be called a system of smart medical home designed based on all known technologies of IoT. Patient-oriented medical homes will coordinate and manage patient care process, take responsibility for the prevention of diseases of patients and their well-being. These homes will have a vertically integrated network and will be responsible for facilitating the management of care in cross - sectoral information exchange. They can also take the role of the Medical Centers for preservation of public health. The principle of the service architecture for IoT technology platform is the access point for customers in different locations of wireless local area sensor networks, connected to the global Internet. Smart Home will have networks that are connected on-line to analysis equipment that provides information to the doctor in order to take decisions in urgent cases. In this case, patients may be in a hospital, take outpatient treatment or be in an active operating mode. In deployment of a Smart healthcare system, change in behavior and communication occurs. These changes allow to improve the quality of patient care: a simple, accurate and rapid information search, rapid exchange of information, faster decision making, reducing the number of medical errors due to electronic notification, increase of data storage and records in electronic form, the improvement of information on screening and reporting, rapid response to specific situations and the transfer of on-line information for personnel to take decisions. Every improvement of quality of medical care leads to a reduction in the cost of health care, reduction of patient mortality, and reduction of the number of patients dropping out of the survey of doctors. The integrated medical system provides an integrated quality improvement since it is a new model of public health and is designed for long-term positive effect. This system may look similar to system Healthcare 4.0, but would have the following differences from existing ones on the following characteristics:

- Distributed monitoring and study of patients;
- The ever-present help in any situation;
- Intelligent decision-making.

Healthcare 4.0 system (Web 4.0) is designed to change the content of personal portals for new video technologies. From the mobile portal of clients some information, like performances of the physical condition of the body and receiving an appropriate response to the aid from public resources of integrated networks will be sent. It can be applied to all types of patients of hospitals and clinics, nursing homes, and childcare centres.

## 4 Possible models of monetization of medical system

Monetization is the process of converting or establishing something into currency. It usually refers to the coining of currency or the printing of banknotes by central banks, but it may also take the form of a promissory currency. According to [15] monetization is to utilize (something of value) as a source of profit. Many small and big companies are working on monetizing IoT-based applications, products or systems. Among of them, few companies need to describe more detailed.

Philips hue connected bulb gives an opportunity for its customers to connect light bulbs to smart phones, which allows geo-fencing, color change and control from anywhere [16]. Their model of monetizing their product is simple: one-time pay for the product, and free app download on customer's smart phone. Famous German automobile

company Audi developed the next IoT-based product. They have implemented Audi Connect system on which 4G/LTE Wi-Fi hotspot navigation system was added, and it utilizes Google Earth and Voice, real-time alerts, weather and traffic. As it was stated by Ricky Hudi, Audi Chief Executive Engineer of Electronics," … takes the lead in innovation of the connected car". All this was developed by the help of Gemalto company and according to [17], this developed technology helped Audi to win 2014 Connected World Award. This Audi product used different monetization approach: they offered hotspot subscription in two different packages, one consists of six months for 99$ and the other one consists of 30 months for 499$.

There are other possible methods of monetizing products, services, and systems. In [18- 19], developers used monetization method that requires customers to proceed one- time payment and download free app, whereas in [20] developers use method that allows them to receive monthly payment by their customers between 69-99 $ per month, depending on package.

All these can help us in preparing our own unique method of monetizing medical system in Kazakhstan.

First possible way of making profit out of deployment medical system is to ask medical centers and hospitals subscribe for this system. In this case, the increased number of medical systems and hospitals involved in this process can increase profit.

Second possible way of acquiring money is to require monthly payment from people, who will be using this system. If this medical system is consistent and offers many different services, then many people will be subscribing. If monthly subscription price will be around 10 $, then many people can use this medical system.

Furthermore, we can offer this medical system to Ministry of Healthcare and Social Development of the Republic of Kazakhstan for buying and using all around the Kazakhstan. It is the easiest way, when medical system can be sold to State and it provides one-time, but high profit.

To summarize monetization methods of medical system, there might be some other innovative methods that need to be learned and analyzed.

## 5 Conclusions

Medical systems are always in demand and these systems can bring high profit if managers can choose and use appropriate method for monetization. This system is still in developing process; however, monetization methods need to be taken into consideration earlier because of input money for developing this system.

After the successful monetization of the medical system, there are many other systems, which were developed, that can be monetized as well. For example, systems that were created previously in [21-25] can be monetized or can be deployed in industrial manner. Those systems were already tested and utilized, however, they need some investments for further work, which can be acquired from many different sources.

## References

[1] Ashton K 2009 *Internet of Things. RFID Journal* Available: http://www.rfidjournal.com/articles/view?4986
[2] Sundmaeker H, Guillemin P, Friess P, Woelfflé S 2010 Vision and challenges for realizing the Internet of Things, Cluster of European Research Projects on the Internet of Things *CERP IoT*
[3] Buckley J (Ed.) 2006 *The Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems* Auerbach Publications, New York
[4] Atzori L, Iera A, Morabito G 2010 The Internet of Things: a survey *Computer Networks* **54**(2010) 2787–805
[5] Belissent J 2010 *Getting clever about smart cities: new opportunities require new business models* Forrester Research
[6] *International Telecommunication Union* URL: http://handle.itu.int/11.1002/1000/11559-en?locatt=for-mat:pdf&auth.Accessed 23 March 2016
[7] eHow 2012 *Disadvantages of Quick Response Bar Code* Available online: www.ehow.com/list_7365813_disadvantages-quick-response-bar-code.html
[8] Matt B 2011 *Microsoft Tag, JagTag, and QR Codes Compared* Available online: www.notixtech.com/blog/microsoft-tag,-jagtag,-and-qr-codes-compared
[9] *Specification of the Bluetooth System, Covered Core Package* Version: 4.0; The Bluetooth Special Interest Group: Kirkland, WA, USA, 2010
[10] *IoT Analytics* Official online website: https://iot-analytics.com/about
[11] *IoT Use Cases: Start Your Connected Journey Here* Available online: http://www.ptc.com/File%20Library/IoT/IoT-Use-Case-eBook.pdf
[12] Sami Näres 2016 *IoT as a Smart Home ImplementationAutomation of Air Humidifier* Helsinki Metropolia University of Applied Sciences, Bachelor Thesis 21 April
[13] Gubbi J, Buyya R, Marusic S, Palaniswami M 2013 Internet of Things (IoT): A vision, architectural elements, and future directions *Future Generation Computer Systems* **29**(7) 1645-60
[14] *Freescale. What the Internet of Things (IoT) Needs to Become a Reality* 2016 URL:https://www.digikey.com/Web%20Export/Supplier%20Content/Freescale_375/PDF/freescale-internet-of-things-reality.pdf?redirected=1
[15] Official website for Merriam-Webster online thesaurus: http://www.merriam-webster.com/dictionary/monetize
[16] Official website for Phillips: http://www2.meethue.com/en-us/
[17] Official website for Gemalto: http://www.gemalto.com/press/Pages/news_1802.aspx
[18] Official website for Jawbone UP product: https://jawbone.com/up
[19] Official website for Jawbone UP product:https://nest.com/
[20] Official website for Belkin We-Mo product: http://www.belkin.com/us/p/P-F7C027/
[21] Saparkhojayev N 2015 RFID-based Staff Control System (SCS) in Kazakhstan *Journal of Physics: Conference Series* **622**(1) 1-6
[22] Saparkhojayev N, Nurtayev A, Baimenshina G 2014 Access Control and Management System Based on NFC-Technology by the Use of Smart Phones as Keys *Middle-East Journal of Scientific Research* **21**(7) 1130-5
[23] Saparkhojayev N, Kurymbayev A 2015 Implementation of RFID - Based Computer Access System (CAS) for Kazakhstani University. In: N. Saparkhojayev, et al (eds.) *Proc. of 5th International Workshop on Computer Science and Engineering: Information Processing and Control Engineering. Moscow: WCSE 2015-IPCE*
[24] Saparkhojayev N, Shakhov E, Mailybayev Y 2016 Mobile Attendance Checking System on Android Platform for Kazakhstani University *Proc. of the 4th International Conference on Science & Engineering. Bali: SCIETECH*
[25] Saparkhojayev N, Kurymbayev A, Akhmetov A 2016 Implementation of RFID - based CAR IGNITION SYSTEM (CIS) in Kazakhstan. *Proc. of the 2016 2nd International Conference on Mechatronics and Robotics Engineering. Nice: IACSIT*