

LÁSZLÓ NYÁRI¹**New Development for Overall Integrated Protection System****Új lehetőségek egy átfogó integrált védelmi rendszer fejlesztésére****Abstract**

The development of wireless networks was first motivated by their military applications, such as using smart networks for battlefield surveillance.

With "smart dust" technology has the potential to create many new things and devices. Especially with a vast range of applications in the fields of medicine, electronics and energy production. The development, more efficient with any technology. Nowadays there has been a lot debate on the future implications of nanotechnology.

The sensors sized about as grain of sand, in tem piezoelectric crystals converts the perceived information's, to ultrasound. Well-known, the smallest thing we can see is around 100 microns sized. When the development started, smart dust had a diameter of around one to two cm, nowadays their size is around 50 microns.

However, scientific advances have moved the smart dust motes from everyday smart technology applications to communication networks devices, and no stopping.

Keywords: science developments, smart dust, nano technology, Internet of Things, smart grid

Absztrakt

Ma már elképzelhetetlen bármilyen védelmi elektronika hatékony hálózati informatikai támogatás nélkül. Világszerte kiépültek a nagy teljesítményű mobil és egyéb kommunikációs hálózatok. Az okos-telefonok és egyéb „okos” eszközök - lakossági elterjedésével együtt – a katonai fejlesztésekben is megjelentek, ma már jelentős védelmi, harci erőt képviselnek.

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A harci és a legkülönbözőbb robotok hasznosságáról ma már nem kell már se a katonaságot, se a civilek nagy részét győzködni. A fejlesztések kezdetekor, az okos por (SMART DUST) 1–2 cm átmérőjű volt, a nano-technológiának köszönhetően ma 50 mikron körül tartunk. (amit még látunk az 100 mikron körüli érték)

Az információs technika rohamos fejlődése pedig soha nem látott új távlatokat, a legmerészebb innovatív elképzelések alapjait terem tette meg. És nincs megállás!

Kulcsszavak: új fejlesztések, okos por, nano technológia, dolgok internete, okos hálózatok

ANTECEDENTS

As future student of the National University of Public Service, Doctoral School of Military Sciences and Military Engineering, I applied to my third research area – defence, electronics, IT and communication, I have not had the chance to think over how complex and at the same time diverse scientific area I had chosen, which will offer me and all my fellow students a lot of new information and knowledge, and not only the past and present of this research area can be studied, but also its fantastic future can be forecast. Primarily – as an IT expert – my first serious task was to focus on supplementing my “lack of knowledge” in the area of defence electronics.

Soon I realised that also with respect to the two other areas, I need to learn significantly more. Very quickly, already at the beginning of my studies I have precisely and clearly noticed how logically built-up a scientific area this was within the defence technical sciences. The established logical sequence of “defence, electronics, IT and communication” is rectilinear, and is one of the most important military (defence, strategic) areas.

Any defence electronics device is unimaginable without effective IT support.² The rapid improvement of the IT area established newly envisaged prospects and the basis for the most during innovative ideas, which, of course, necessarily appeared in military developments.

At the beginning of the 1970's, in the United States of America a handful of scientists, engineers, defence suppliers and a few officers of the American Air Force gathered to establish a professional group. The goal of the group was to elaborate how such machines could be built which were to operate without the intervention of humans, and, furthermore,

² Information Q, “Computer at our Defence”. www.informationq.com/uses-of-computers-in-different-fields-areas-sectors-industries-education Accessed on 15.08.2016.

to find out how they could convince the reluctant Pentagon, about the advantages of using robots on the battlefield.

Since then, in the last decades a new huge industry branch appeared, and as the Association for Unmanned Vehicle Systems International³ turned into significant organisation. Nowadays neither the army nor the majority of the citizens need particular convincing about the unmanned combats, and advantages all of battle robots.

NEW CHAPTER OF GLOBALISATION

BEYOND THE TRADITIONAL IT APPROACH

The appearance of cloud-based solutions, shortly IoT (Internet of Things)⁴ refers to mapping the physical and a virtual world space. We can dynamically make changes to the correlations; we can get rid of traditional limitations also in the real physical world by using the latest digital tools, such as 3D sensors, robots, drones, etc. We are now able to accomplish our ideas independently of space and time. This offers opportunities to anyone which we have never heard of before.

The cost-effectiveness of computer technology capacity has been increasing manifold due to the appearance of cloud-based solutions; nowadays it is not required to invest into the establishment of such capacities, even a smaller sized company is able to use complex digital functions as a service. The way to development and growth is to grow together with a big company by trying to reach higher and higher on the ladder, or by joining a larger network of a bigger, global company.

New technical idea is that communication requirements of the smart grid stakeholders (public utility services, regulators, and consumers), furthermore, that of the telecommunication industry (manufacturers, and SDO service providers) are evaluated and developed directly by intelligent network applications. The transformation is happening in an exponentially increasing manner. High performance optic and mobile networks have been globally installed. With the proliferation of smart phones and other devices nearly all consumers with purchasing power are digitally accessible

The majority of Hungarian companies engage with global companies as suppliers, therefore for them it is crucial to adjust their operation to the virtual models. Only those Hungarian enterprises have the chance to survive, develop, or grow which are able recognise and implement the latest solutions in their business processes and in their supplier and buyer “smart” systems.

³ All things UNMANED, <http://www.auvsi.org/home>, Accessed on 9.01.2017

⁴ The billions of new “things” joining the internet indicate the arrival of an exciting, new era. The is a Internet of Things



Figure 1. The Internet of Things promises a brighter future

(Source: detail of http://www.hitech.at/site/library/frame/hitech_022013.pdf, Accessed on 28.10.2016)

Hungary also has to hold its ground in this more and more intensive global race. Hungary can only be the winner of the above process if it is able to recognise its opportunities in time, if it supports the innovation activities of its companies, and if it increases its “Industry 4.0” initiatives.⁵

INFO-COMMUNICATION DEVELOPMENT

Thanks to the information technology development, an increasing number and more diverse types of devices and information channels become suitable to worldwide (global) communication via smart networks. The main point of communication between the elements of intelligent networks – sensors, meters, service centres, front-pages – is the establishment of a secure, two-way information service and the provision of real-time data supply.

The billions of new “things” joining the internet indicate the arrival of an exciting new era. The IoT transforms not only cities, industries, and companies, but also the lifestyle of human beings.

The aim of my publication is to promote understanding of actual trends, by considering the possible areas of “smart” developments based on future information technology. Applications designed for the measurement and optimisation of energy services offer user-friendly handling for all users.

⁵ Magyar vállalatok az Ipar 4.0 ban, http://gyartastrend.hu/jovogyara/cikk/magyar_vallalatok_az_ipar_4_0_ban, Accessed on 23.09.2016.

Their immanent potential – similarly to the opportunities offered by smart grid networks – opened up new areas at global level which may significantly change the operating procedures for everyday users, and companies in the areas of industry and agriculture. With respect to the development of devices, the new technology is available not only in printing, but also in collaboration within the virtual world (3D virtual lab).

3D mice, mobile phones, laptops, glasses, and establishing a new foundation for motion and sense detection clearly indicate the way towards the establishment of smart networks at an increasingly higher level. Goal for development is the generation of the power required by the ever increasing and expanding high-tech solutions, we will use renewable energy sources in the future.

WILL THERE BE A “CLEAN WAR”? – THE DRONES APPEARED

Naturally – or unfortunately –, every new development may carry a negative impact. In the army of the United States of America already thousands and thousands of robots are in use, such as remote controlled airplanes, mine clearing devices, and transportation devices reminding us of the imperial walkers of Star Wars.

To put it simply, robots are machines which are operated based on the operating principle of “sense-think-act”.⁶ Namely robots, with the help of their sensors, collect data about the world surrounding them. After processing this data, they forward it to additional computer-based processors, or maybe to an artificial intelligence programme which will make the appropriate decisions by the utilisation and assessment of the information. Finally, the mechanical systems called ‘effectors’ execute some kind of physical action in their environment.

Nowadays we are living in the era of drone development dynamic propagation. The scale of development can only be compared to the PC revolution in the 1970’s. The use of drones surpasses by miles the law enforcement and initial military application area. Nowadays they are spreading fast also within the civil sphere. (For example they are used in flood protection, or aerial photography) Their application is basically limited only by the creativity of the developers. No secret, the American army pumps significant capital into robotics research, because by using robots more suitable to perform certain tasks than humans. The majority of the currently used robots are remote-controlled, but there are significant development using artificial intelligence. (New milestone, the unmanned aerial vehicles UAS, UAV and others drones system-level application.

⁶ Sense, Think, Act for Unmanned Robotic System.
<http://sine.ni.com/nievents/app/overview/p/eventId/39641/site/nie/country/us/lang/en>. Accessed on 22.05.2017

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BIG JUMP – DEVELOPMENT OF IT TECHNOLOGY

Within a few decades – as in within maximum fifty years – information technology in parallel with communication technology will have gone through great improvements with respect to all parameters. By now, nearly everyone applies and uses a series of 5+ generation IT devices in their everyday lives.

Let us just see the difference between the technology in the early 1990's and an iPhone5. I am confident that after several generations of iPhone development, Apple will also apply this technology.

We should not forget about nanotechnology developments operating within a domain of 10^{-3} mm, which are able to exceed the knowledge of old large-sized computers. (Their large as a large gym room, with a size of 100-160 m²).

One of the key areas of my research is the currently globally applied Smart Dust, which has been developed exactly within the above indicated order of magnitude. Several reputable universities of the globe, (such as Berkley, Stanford, Brown, etc.) and big companies (Intel, Philips, Shell, HP) turned towards this topic with an unbelievable impetus and started new developments.

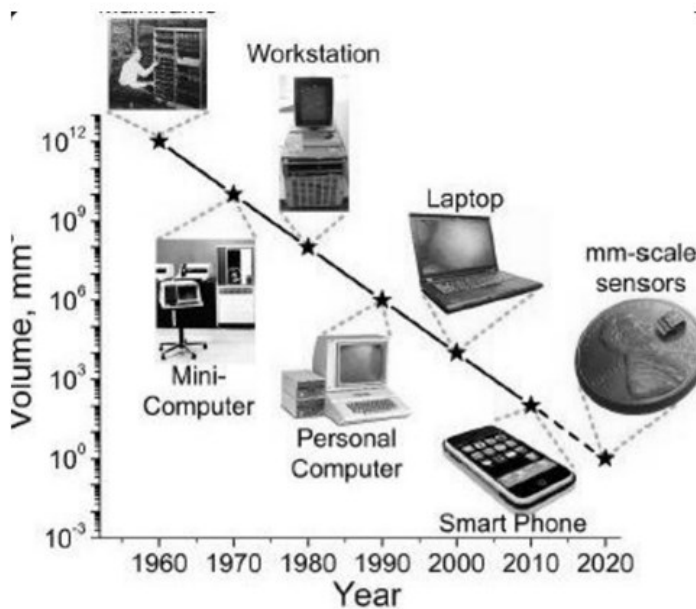


Figure 2. The beginning: IBM 360, ESZ-R-40, -60, etc. The old biggest Computer (both IT and ICT refer to the use of a range of IT)

At the line end of time and technology, nano-sized devices ($2020/10^{-3}$ mm) are already present. One of the key areas of my research is the currently globally applied Smart Dust, which has been developed exactly within the above indicated order of magnitude. Several reputable universities of the globe, (such as Berkley, Stanford, Brown, etc.) and big companies (Intel, Philips, Shell, HP) turned towards this topic with an unbelievable impetus and started new developments.

SMART DUST THE NEW GENERATION OF EXTREMELY SMALL INFO-COMMUNICATION SYSTEMS

But what kind of device does it smart dust, and what can it be used for? When the development started, smart dust had a diameter of around one to two cm, nowadays their size is around 50 microns. (The smallest thing we can see is around 100 microns)

One of these developments involves the so-called “smart dust”, referring to the new generation of extremely small (micro/nano-sized) info-communication systems able to perform wireless communication. Processes which can be tracked from miniature mobile devices, are already available at a residential and industrial level, furthermore, the applications developed for the measurement and optimisation of energy services offer user-friendly handling for all users.

The use of info-communication devices is, of course, not the privilege of the energy sector.

According for the celebrated future researcher Parsons, who delivers design/design-build, program/construction management, systems design/engineering, cyber/converged security, and other professional services packaged in innovative alternative delivery methods to federal, regional, and local government agencies, warned that continuous miniaturisation is one of the largest threats in the coming five to ten years, on the other hand their application may provide significant support for all sectors with smart grids, for example education, or health care.

WE CANNOT IGNORE “CIVIL” APPLICATIONS EITHER

The use of new info-communication devices is, of course not the privilege of the energy sector, their application may provide significant support for all sectors with smart grids, for example education, or health care. The clinical application of smart dust is maybe the most shocking among the implantable developments. Smart dust particles, which are smaller than sand grains, equipped with their own antennas organise themselves in a network within the body and they are able to carry out a whole series of complex processes.⁷

Maybe we could describe them as a “nano-army”, which could also put up a fight against malignant cells, or which could alleviate pain and, of course, is able to store the encrypted storage of the hosts personal data.

⁷ Smart dust future. <http://www.nanowerk.com/news/newsid=8535.php>, Accessed on 19.05.2017.



Figure 3. The clinical applications maybe the most shocking⁸

(Source: About Day1 Health (Pty) Ltd, http://www.day1health.co.za/About_Us.aspx. Accessed on 19.05.2017.)

With the help of smart dust, one day doctors will be able to work within the human body without opening it up, and information will remain confidential until the host makes them accessible within its own nano-network. Maybe an even more futuristic idea: smart dust is spread in the air and after breathing it in, it connects to our nervous system, and when we are standing in front of an ATM, we think of our PIN code, the smart dust detects the thought and forwards it, so our bank account can be accessed immediately.⁹

The new developments us – similarly to the opportunities within smart networks opened up a new area at global level which may significantly shape the operating processes of everyday users, companies, industrial and agricultural areas. Many industry observers predict in micro-grid investment, although these predictions not have a lot of variation in them. These thoughts may seem to be fantasies, but, theoretically, all of this is possible now. The threat of tiny intelligent particles against the security of an organisation is insignificant at the moment. But, in order to avoid the previously mentioned event, first of all we need to imagine how big of a threat this technology poses to everyone. Practically all net-users can become a target.

SMART MILITARY APPLICATIONS

⁸ About Day1 Health (Pty) Ltd, http://www.day1health.co.za/About_Us.aspx. Accessed on 19.05.2017.

⁹ QUORA, "Who controls the world?" <https://www.quora.com/Who-controls-the-world>. Accessed on 15.03.2017

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New rules for new tools not just in terms of war its aim, but the weapons used. The next “dirty” conflict almost certain start on the in the virtual world but will destroy the earth.¹⁰ It is natural that companies specialised in military development also take a share in the largest business enterprises. The battlefield application of new and even newer devices radically changes the concept of information space and the conditions of achieving information-based dominance.

It's no secret either nowadays lot of one billion US dollars were allocated in the classified budget of secret services for strengthening the attack potential within the category of military operations against computer networks. Micro/nano-sized devices (or with even smart knowledge) may constitute determining elements of the information network used by the network-focused warfare established “network” and robot soldiers.



Figure 4. We are able to do anything...

“If required we explore, if required we attack!”

(Source: <http://www.sciencephoto.com/media/348355/view>, with self-made illustration)

¹⁰ World War III will be fought on the internet. <http://theweek.com/articles/441194/why-world-war-iii-fought-internet>. Accessed on 21.04.2017.

Many people – and not without reason – see the process as the creation of an Orwell society, which is controlled by Big Brother, who knows, sees, and controls everything. These of such and similar applications may have unavoidable consequences for all parts of the society.

Despite all this, certain people consider this direction of development to be positive by keeping in mind the efficiency of criminal prosecution, elimination of election fraud, revolutionising medical information handling, and the safety of children.

CONCLUSION

IS SMART DUST THE PINNACLE OF INTERNET OF THINGS CREATIVITY?

The direct linking of our brain with computers is not only a science-fiction fantasy (or nightmare) any more. Nowadays by implanting electrodes of size nano-size that we are able to decode neurons signals in real time, and through this we are able to control external devices. For the purpose of forwarding sensibility data we can use anyone's mobile phones (even those of strangers) on a temporary basis. In this guerrilla war when aimed at the obtainment of information, we can hardly distinguish between civil and military targets. Nowadays secret services are not only local spying, but also want to take control over of the world-wide-web, so are preparing for a digital war. Others believe that it is the first fatal step towards singularity, when humanity hands over the control its future to software-based artificial intelligence.

The emerging Smart Dust technology will become determinative trend, within ten years in our country too. I truly hope that new technologies will support the development of humanity towards the right direction, based on the principles of controlled security and peace-keeping alongside the practice of common sense. According to my friends – and also to me and many others – in the frame of a previous conversation, all would like to sleep peacefully.

We are starting to play God. It will be way off, but if the research same ways goes on, the sad ***destiny it is inevitable***.

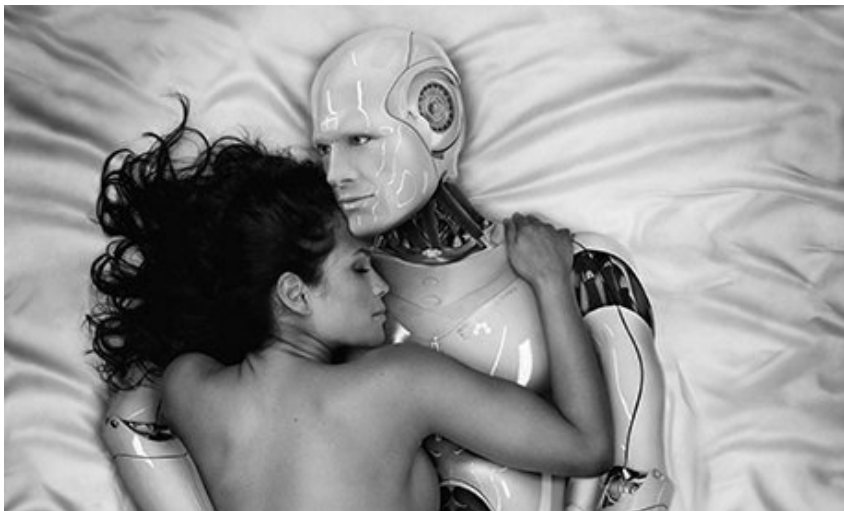


Figure. 5. Maybe just my nightmare

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