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Internet of Things (IoT) and its Challenges for Usability in Developing Countries

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ABSTRACT

In the recent years, Internet of Things (IoT) has acquired a remarkable attention. IoT projects a world where billions of smart, interacting things are able to offer various services to near and remote entities. This innovative technology enables users to identify and control services. Customers can benefit from the functional guidance. Therefore, the voice of customers is transmitted to manufacturers. The benefit and welfare that the IoT brings about are undeniable; on the other hand, there are some challenges to apply IoT. The main objective of this study is to reveal the usability challenges of IoT in developing countries through a detailed literature survey.

Keywords—*Internet of Things (IoT); innovation; cyber physical systems (CPS); security*

I. INTRODUCTION

Internet of Things (IoT) has acquired a remarkable attention in the last decade. This phenomenal innovation designs a world where billions of smart, interacting things are able to offer wide range of services to near and remote entities. There is a comfort has shown up with IoT. First advantage is the fact that smart products are intelligent items. They are able to recognize their production process and they can communicate with smart machines. Secondly, smart planner can optimize the process in real time. Finally, the innovative information and communication technologies (ICT) enable humans as smart operators to control and supervise activities.

Smart products are highly intelligent to plan and dispose tasks. Machine learning, machine to machine communication, human machine interaction, visualization and data analysis allow cyber physical systems to create self-learning. They can change production methods when it is necessary in the factory (Wittenberg, 2016 & Neugebauer et al., 2016).

Kevin Ashton defined IoT for the first time in 1999. This definition claims that ordinary objects can be combined with the sensors and Radio Frequency Identification Technology (RFID) thereby; things evolve into internet of things (Ashton, 2009). Despite of this definition, the first application of IoT has shown up in 1991 with the “Trojan Room Coffee Pot” (Ashton, 2009 & Santucci, 2009). A video camera was inserted into a coffee machine in order to pursue emptiness. In this way, the liquid level of the coffee machine was observed. (Lopez de Armentia et al., 2012). RFID plays a key role for IoT with its pursuit ability through Electronic Product Codes (EPC). Besides, large scale embedded sensors with 2D codes, common sensor devices and barcodes are well-known tools of IoT. Since these tools can be addressable and connected to the internet, their data can flow over the computers connected to internet. These items are able to solve the confusion by perceiving the environment and communicating with each other. Also, they can provide autonomous response in difficult scenarios without requiring human intervention (O’Leary, 2013 & Kopetz, 2011).

IoT represents the immense digitization of several items in the network structure. Cyber physical systems (CPS) such as artificial intelligence, robotics and clouds are assigned by IoT in order to eliminate the gaps between the digital and physical domain. IoT enables integration of numerous devices, even semi-finished goods. IoT applications are designed to create real time decision making processes by eliminating central control conditions of analysis. The novelty of this technology is that there is no need for integrated data process within standard technology. By this way, an ordinary object can evolve to an intelligent device and equipment in the smart factory can easily and rapidly communicate with the central control system.

IoT implementations are not just in use at the smart factory, it also influences the daily life of people in different areas such as agriculture, health, security, logistics, transportation, smart home and cities (Jing et al., 2014). IoT helps the plant breeding by the scale of humidity and temperature providing the best conditions for the plant growth (Sato et al., 2016). Automatic climate control systems and automatically working household appliances are some examples for smart home applications (Mayer, 2009 & Atzori et al., 2010). Especially, wearable technology makes the health track easier. Through the data obtained from a patient, wrong dose and timing of drugs can be detected. Wearable technology are transmitted this data to the closest healthcare organization so that prevents life-critical case. Based on the electronic medical record system, medical image processing analysis and biomedical signal processing are being used to diagnose possible illness in the future (Fan et al., 2014 & Ukil et al., 2016). The Blind Navigation System support visually impaired people in the shopping. According to this system, supermarket separates into cells and RFID tags locates predetermined places and these tags pin into navigation system. Therefore, WLAN and Bluetooth technologies can help people (Domingo, 2012 & Lopez de Ipina et al., 2011). IoT contribute the smart transportation by assigning sensors and actuators on the roads. This makes pursuit of transportation vehicles possible. Also, sensor technologies benefit from camera and pressure sensors in order to find and control parking space. Required directive is sent out to driver with SMS or a similar technology (Tsai et al., 2014).

IoT influence future business network by self-organizing ability and transmission feature of real time responses among various factories, companies, suppliers, resources, customers and every sort of organizations. Whole actors can reach maximum profit with limited resources by optimizing their configuration in real time (Qin et al., 2016).

IoT not only provides innovative changes for daily life of individuals but also makes the life easier and decreases the restrictions. New approaches and experiments are conducted in order to improve integration, object recognition and communication.

II. Challenges of IoT Applications in Developing Countries

The benefit and welfare that the IoT brings about are undeniable; however, there are some challenges to apply IoT. While the world is taking a digital shape, the countries import technology instead of producing. This approach makes them dependent on designers of digital world. For this reason, developing countries have to suitable for adoption of new technology. The main objective of this study is to reveal the usability challenges of IoT in the developing countries.

The speed and method for implementing IoT differs from country to country. The priority of countries holding high product range is to benefit from flexibility to increase productivity. On the other hand, quality-focused approach is adopted by countries in order to decrease deficient products. This approach requires IoT in order to optimize systems through data mining. Contrary to this, developed countries are focused on increasing automation rate due to the high labor force.

There are some structural hurdles for developing countries to implement IoT. Limited labor force skill is one of them. This obstacle slows down to adopt new technology. Also, the quality of labor force differs from industry to industry. Considering that the demand for value-added products increases rest of the world, low share of value-added products creates another drawback.

IoT practitioners suffer from lack of standardization. Standards evolve day after day so that makes the implementation of technology complicated. Also, lack of mobility is another challenge faced by IoT practices. This innovative technology delivers its many services to mobile users (Al-Fuqaha et al., 2015). Infrastructure is a crucial challenge for developing countries. It is obligatory for IoT applications to have a higher infrastructure. Therefore, interconnected devices can work efficiently and rapidly (Botta et al., 2016). Poor internet connectivity shows up as a challenge for developing countries. IoT uses internet; and for this reason internet network has to spread over whole nation.

Security issues are critical to implement IoT safely. This challenge is important due to the billions of devices connected through IoT, it requires an efficient security mechanism. IoT uses all kind of information and this need to be protected. This issue is more problematic for developing countries due to the vulnerable systems (Li et al., 2016, Gubbi et al., 2014 & Li et al., 2014). Considering the connected devices can be easily traced, privacy issues are another challenge (Whitmore et al., 2015).

In this new digital period, developing countries need to have talented engineers. Because of the fact that comprehensive knowledge of software, design of smart systems, production and design of intelligent robots are necessary. Thus, talented labor force enables developing countries stronger and provides the fundamental precaution.

IoT changes the features of workers in the industrial sectors. Companies need to have more competent labor force in order to manage new production technology and increase their revenue in the integrated digital world. Automation systems take places of unqualified workers in the production. Quality and maintenance process are conducted by automation. Due to the changing structure of labor force, departments integrated with customers such as marketing, sales, automation, information technologies and R&D should become widespread in the all sorts of companies. Especially, demand will increase for skillful employers who have comprehensive knowledge on software and competence on digital systems.

III. Conclusion

The benefit and welfare that the IoT brings about are undeniable; on the other hand, there are some challenges to apply IoT. The main objective of this study is to reveal the usability challenges of IoT in developing countries through a detailed literature survey. Thanks to this study, developing countries can detect structural hurdles to implement IoT. Lack of standardization and mobility, weak infrastructure, security and privacy issues, poor internet connectivity, limited labor force skill and low share of value-added products are main challenges for usability of IoT in developing countries. The novelty of this study is to present obstacles to implement high technology in developing countries. It may help to policy makers and practitioners in understanding and removing challenges in order to achieve successful IoT adoption.

In the near future, old style factories will be disappeared and smart factories will take place of them. Smart factory has a conscious and intelligent structure so that enables information exchange. Smart products are able to connect the whole factory through intelligent actors such as sensors, robots, conveyors, actuators. Developing countries have to eliminate challenges and adopt new technologies in this new era. IoT practices are crucial to provide automation and competitive advantage.

Ongoing improvement process of IoT technologies makes the lives of individuals easier. IoT is important for the comfort of nations but also it is important for the daily life within different perspectives. This technology proportionally grows based on the market demand and the needs of customers.

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