

Internet of things limitation and application in Eastern and Southern Africa: A Study

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ABSTRACT

The Internet of Things (IoT) lets people and things to be linked together in a network. It creates the smart environment, smart homes, healthcare and industrial internet. East and Southern Africa countries have adopted fast internet speed since 2009 when they were connected with fiber optic through SEACOM project (Africa cable system). The speed of the internet has been upgraded also the cost of internet surfing has been reduced compared to the previous years, therefore the implementation of IoT in urban areas is possible. The Internet of Things) will add so much value to individuals, groups and the government. This paper introduces the concept of the internet of things, application and challenges in East and Southern Africa.

Key Words: *Internet of things (IoT), Eastern and southern Africa (ESA), Wireless sensor network.*

1. INTRODUCTION

The Internet is now widely used by a billion people for a many services like information retrieval, video streaming, file sharing, online shopping, banking and social networking.

The underlining vision of the IoT is to create a world where the real and the virtual realms are converging to create smart environments that make energy, transport, cities and many other areas more intelligent. Proponents of the IoT envision enablement of things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service. It means enablement of communication via the Internet to all the things that surround us. The IoT is much more than Machine to Machine (M2M) communication, wireless sensor networks, 2G/3G/4G and Radio Frequency Identification (RFID). These are the enabling technologies for IoT applications. Future storage and communication services will be highly pervasive and distributed: people, smart objects, machines and the surrounding space which is getting smart due to technologies like wireless/wired sensors, M2M devices, and RFID tags will create the highly decentralized common pool of resources connected by dynamic inter-networks. The communication will be based on interoperable protocols, working in diverse environments and platforms [20].

2. APPLICATIONS

A. Smart city

Public safety: There is a bigger demand for public safety, by using IoT weakness places will be frequently monitored by cameras.
Smart parking and disaster recovery: By using wireless network drives will be able to get parking directions also a road which has accidents will be reported. Also, rescue operations can be conducted when the disaster occurs [12].

B. Smart homes

IoT can improve energy efficiency and safety in a home. When different things are connected together the user can control all devices in the house then consumption of energy can be adjusted to the actual use. For example, air conditioning and light, of empty rooms can be turned off when you are away from home also gates and security cameras can be monitored. The consumption of energy can be reduced to the availability [12].

C. Smart Health

Family Member Monitoring. This application helps the elderly to move around safely outdoors, with family members being able to monitor their situation on the other hand by using wireless body area network remote patient conditions such as heartbeat, temperature and sugar level can be monitored continuously. This process examines the current state of the patient's health for any abnormalities and can predict if the patient is going to encounter any health problems [11]. Moreover, patients can be reminded to take their medication, or even to recommend to increase or reduce their prescribed amounts according to the current value of some monitored metrics [22].

D. Education

In ESA the integration of Information and Communication Technology (ICT) is a low priority when related to other objectives, like increasing enrolment rates, decreasing the proportion of out-of-school children and ensuring an adequate number of trained teachers [1, 9]. In urban areas, teachers and students are still carrying the books in their bags while in rural areas they don't have access to books [9]. Therefore by using IoT, the books will be available in the database where students and teachers can access them any time anywhere.

E. Agriculture

On average, agriculture contributes 15% of total GDP, however, it ranges from 3% in Botswana and South Africa to more than 35% in Malawi, inferring a different range of economic structures [4]. In ESA agriculture employs more than half of the total labor force especially in the rural areas [5]. Smallholder farms constitute approximately 80% of all farms in Sub Sahara Africa and employ about 175 million people directly [6]. Therefore by using IoT, sensor nodes collect different information like temperature, humidity, gas concentration, more over prediction of plant disease and insect pests will increase the quality crop production [7].

F. Forest

ESA countries have laws to govern the forest but people still cut down trees for agriculture and charcoal. In Eastern, Western and Southern Africa more than 90% of rural households are estimated to depend on fuelwood and charcoal for energy [13]. Moreover a manmade fire which is caused by illiterate people destroys the forest. As explained in [14, 15]. by using wireless sensor network (ZigBee and GPS) fire and deforestation can be detected before causing more damage.

G. Game reserves and animal controlling

ESA countries have many game reserves and many people conduct poaching. IoT can reduce this habit by planting sensor nodes in endangered species like elephants and rhinos, also GPS and sensors can help to monitor the all-area [16].

H. Energy Smart Grid, Smart Metering

ESA countries are still suffering from the source of power and more energy is being wasted because of the poor infrastructure. IoT will improve measurement of water flow, energy consumption (smart grid) and monitoring water, oil and gas levels in storage tanks [20].

3. LIMITATIONS

A. Source of power

Most countries in this region have average electricity access rates of about 20%, and two out of three people lack access to modern energy services [3]. The International Energy Agency (IEA) estimates that electricity demand in sub-Saharan Africa grew by about 43% from 2012 to 2014 and believes the total demand for electricity in Africa to increase up to 59% until 2030 [2]. This makes difficult in the implementation of IoT because many electronics devices need the source of power in order to work for a long time.

B. Cost of devices.

Many people cannot manage to pay for the technology because of the cost IoT connect different physical objects to the internet. For IoT to improve in Africa, the cost of components that are required to support tracking, sensing and control mechanisms need to be reasonably low-cost in the coming years [11].

C. Internet connectivity

The average internet penetration is 54.4%, in Africa the internet penetration is 35.2% this conclude that many people in Africa still don't have access of internet [17], 75% of individual users in Africa do not have access to the internet [19]. Users in countries with more international bandwidth and national coverage are having improvement in access and enjoying a wide range of online services/ IoT, while those in countries that lack sufficient international bandwidth are considerably controlled in their Internet access and usage. But not only does inadequate bandwidth obstruct Internet access, it also keeps prices high and the quality of services low. Even where access is available, relatively high prices for international connectivity can be very unpromising, which makes the user lose interest in Internet services. Users in Africa have to pay more for Internet access than those in developed countries [18]. Therefore the cost of implementation of IoT will be high in EAS countries because of the internet cost.

D. Security and privacy

The IoT is the largest network infrastructure ever deployed. Unlike the traditional networks, IoT consists of more number and forms of networks and linked things. Being the largest network of different networks and therefore is difficult to defend all attacks, some information may leak. Security issues caused by the new network structure, equipment and other factors of the IoT cannot be resolved with old Internet security architectures different solutions are required [20]. Therefore more investment in security is essential in order to use, benefit and deploy this technology.

E. Data management

The main advantage of the internet of things is the capacity to offer real-time data from many different scattered sources to other machines, smart entities and people for a diversity of services. The major challenge is the primary data from different resources are really heterogeneous, can be very noisy, and are always very large and scattered. Therefore, it is hard for other objects to use the data effectively, without a clear description of what has to be processed [9].

4. CONCLUSION

In this study, we have discussed applications and limitations of IoT in ESA countries. This technology has a lot of applications in these countries, once applied will make life easier and increase productivity. Finally, the limitation which seems to be critical make this technology to be more difficult in implementation in recent years especially in rural areas.

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