

Internet of Things (IoT) in 2016 : The Implementation Roadmap for Nigeria

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Abstract— 2016 looks set to be the year for revolution of Internet-of-Things (IoT) worldwide. Several smart objects or things are now being connected together to communicate to drive business, guarantee collaboration and enhance security and Nigeria cannot be left out. Not with the challenging economy in 2016 as a result of the decline in prices of crude oil which is Nigeria's mainstay of economy and increasing wave of insecurity challenge in the country. In this paper, we present the implementation framework for IoT using intelligent software agents to connect both private sector firms and government agencies to enhance business collaboration. Also, IoT can be used to enhance the environment monitoring and the security situations in Nigeria can be put under control.

Keywords— IoT, Cloud, Server, IoT Server, machine, object, smart, agent, intelligent, things, sensors, actuators, GPS, wireless sensors, RFID, camera, surveillance, monitoring

I. INTRODUCTION

A 2016 looks set to be the year that Internet of Things (IoT) hits the big time. We have already seen a range of new IoT services and products come to the market [1]. IoT has started being applied world over in making services and products customer-oriented and smart.

Now, we have Google using IoT to make completely driverless cars on the road, which use the IoT to help them navigate and avoid obstacles and collisions [1].

Samsung's new smart fridge, which was launched at the Consumers' Electronic Show in Las Vegas USA, allows people to check in on the contents of their fridge via smartphones, and even helps them plan healthier eating regimes for their families [1].

Also Bosch has launched new sensors and devices to help enable automated driving. The list is endless where IoT is making impacts in people's lives and businesses via several flagship products and services released in year 2016 and earlier.

In this digital age, IoT is absolutely essential to delivering exceptional customer experiences. This is a

critical time for IoT, one where the technology is poised to take a central role in our home and work lives.

A. Objectives of this paper

The objectives of this research paper is to examine the potentials of IoT applications in the year 2016 which has already began and to find out where and how Nigeria as a nation can cue in into this innovative technology to boost her economy, security and safety.

II. COMPONENTS OF IoT

IoT is a network of interconnected physical things or objects – people, businesses, machines using sensors, actuators and smart devices for the essence of communication and collaboration. The internet plays a leading role in interconnecting these things or objects.

For example, in Oil & Gas sector, micro wireless sensors and actuators are installed to monitor and control oil & gas processes/productions and facilities in real-time. This real-time data can be routed to the IoT Server of IOCs which in turn is sent to the National IoT Server. The data can also be sent to the IoT Server of National Security Agencies such as the Police, Navy, Joint Military Task Force (JTF), NSCSC etc to take action and nip a security breach from the bud.

Similarly, smart surveillance cameras (IP cameras), RFID transmitters and receivers can be installed everywhere – border posts, streets, markets, dams, rivers, streams, lakes, farm settlements, public buildings, private homes, supermarkets, hospitals, parks, etc to gather environmental and surveillance data and route the data to the National IoT Server and IoT Server for the various security agencies such as the Nigerian Police, Joint Military Taskforce (JTF), Nigerian Navy, Nigerian Air Force, Nigeria Civil Defence Corps and other relevant security agencies.

Millions of vehicles in Nigeria-government-owned, business-owned and privately-owned can be installed with a micro GPS auto tracking devices to monitor movement of workers and to ensure security of the vehicles. The data from these devices can be routed to the appropriate IoT servers to help the owners manage them efficiently.

III. REQUIREMENT OF CLOUD COMPUTING IN IoT

Now that cloud computing is gaining momentum in Nigeria, it can play a significant role in supporting connectivity of smart objects, sensors, actuators, machines, people into IoT at far cheaper costs than before.

IV. THE ROAD MAP FOR NIGERIA

Nigeria, being a developing country still has a long way to go in applying IoT in wide-varying applications to drive business because of a lot of infrastructural challenge such as poor power supply, poor and unaffordable internet and data services. Despite the two major challenges, IoT can still be helpful in delivering customer satisfaction, cost savings and improving efficiency in the following areas- epayment solutions and banking, smart electricity/smart grid and smart metering to save power and reduce costs, smart security – to protect and monitor critical national infrastructure from vandalism, terrorism and economic sabotage.

Also businesses in Nigeria can apply IoT to interconnect their customers, workforce and services in order to drive exceptional customer experience and satisfaction as well as save costs.

Industries and the manufacturing sector can install smart sensors and actuators to monitor industrial processes and productions, installations and the environment. This can help to reduce cost, improve efficiency and increase Return On Investment (ROI).

Already International Oil & Gas Companies (IOCs) operating in Nigeria have already started applying and are still applying IoT in the form of interconnecting smart sensors, actuators and devices to monitor oil wells, oil and gas pipelines and oil productions. They can go a step forward by using IoT to reduce incidences of pipelines vandalism and oil theft by interconnecting their IoT server platforms to the National centralized IoT platform, if when implemented. This will help intelligence sharing and collaboration. Before we consider the proposed framework for IoT application and operation in Nigeria, it will be worthwhile to look at the IoT technology roadmap developed by SRI Consulting Business Intelligence as shown in Fig.1.

Here it can be seen that IoT is already being used now and in the near future (from the year 2020) distant objects can be controlled and monitored using the concept of IoT. Also it can be seen from Fig.1 that IoT is virtually applied in all sector of the economy to monitor the environment and bring about safety.

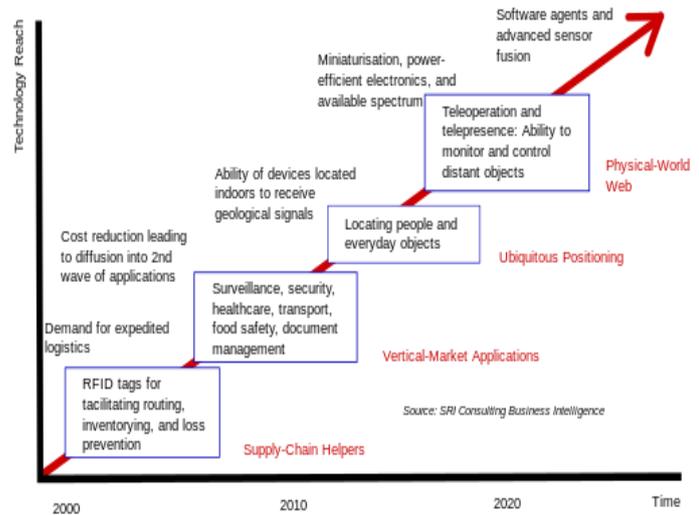


Fig. 1: Technology roadmap for the Internet-of-Things (IoT)s][2]

Section 5 presents the proposed framework for IoT application and operation in Nigeria. In this proposal we considered the fact that IoT is the future of technology in terms of security, surveillance, routing, inventory control and monitoring. Here intelligent software agents of Artificial Intelligence (AI) play a great role in coordinating smart collaboration and control of distant objects.

V. THE PROPOSED FRAMEWORK FOR IoT IN NIGERIA

In this section, we present the proposed operational framework for the interconnection and control of smart objects/things participating in IoT in Nigeria. Here, we have several Servers (for the various IoTs) from several private agencies (banks, ATMs, PoS, etc.) and government agencies (buildings, facilities), border posts, streets, dams, rivers, farm settlements, markets, power stations/plants, foreign embassies, mobile phones of citizens, security agencies such as the Nigerian Police, Nigerian Navy, Nigerian Army, the Military Joint Task Force (JTF), Nigerian Drug Law Enforcement Agency (NDLEA), Directorate of State Security (DSS), Nigerian Defence Corps (NDCS) etc. All these IoT servers are together connected to one another and to the centralized National IoT Server which monitors and controls whatever happens at anywhere and at any time from a single point.

Intelligent distribution software agents are used to collate data from each of these IoT Servers and route the data to the centralized IoT Server as shown in Fig.2. Intelligent software agents facilitate intelligent data collection and distribution to the IoT Servers even without human intervention. From the national centralized IoT Server, the security agencies and government can see the big picture of what is happening everywhere in the country at any time and take appropriate action(s) where necessary.

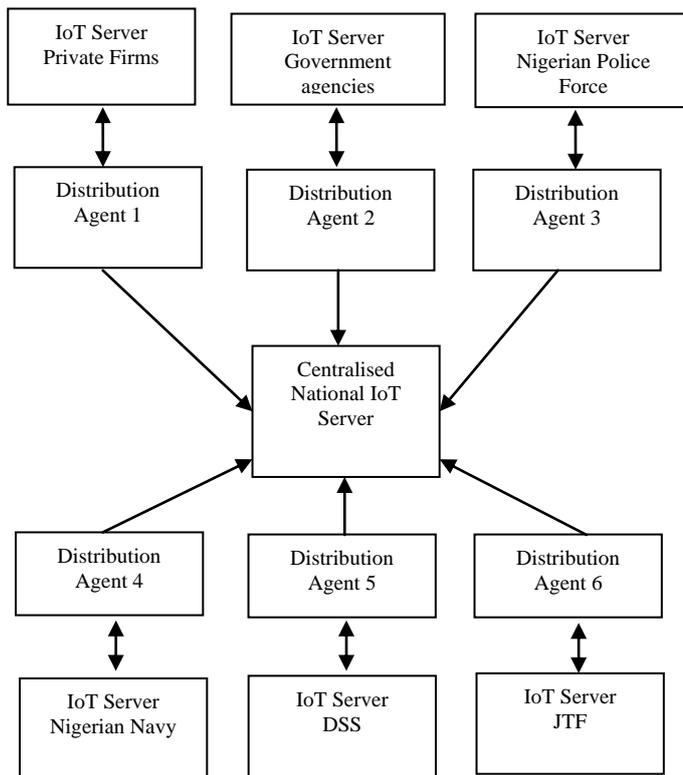


Fig.2. The proposed implementation IoT framework for Nigeria

VI. SUMMARY

Internet-of-Things (IoT) is the future in utilizing technology in driving connectivity and distributivity of data from machines to people, people to people, people to machine and machine to machine to enhance business collaborations, environmental monitoring and people's safety. Many nations have already cued in to this innovative technology, so a developing nation like Nigeria cannot be left out. Nigeria must therefore cue in and harness the potentials of this innovative technology so as to meet her vision 2020-20.

VII. RECOMMENDATIONS

This paper recommends the following points in order for Nigeria to optimize the potentials of IoT to boost business, economy and security. The government must do much to prepare Nigeria to be IoT-ready.

A. Government's Roles

1. There should be legislation or passing of legislative bill in the National Assembly to legitimize the applications of IoT in Nigeria.
2. The Government – the three-tiers of government in Nigeria – Federal, States and Local

Governments must work together with the private sector to develop and drive power supply systems in order to support the applications and operations of IoT. This is because power supply is absolutely necessary to support and drive operations of IoT.

3. Government should reduce taxations and licensing fees on Telecommunication operators as well as cloud services firms so as to reduce the costs/charges for data connectivity and cloud services. This gesture will help lower the cost of ownership (COO) of IoT in Nigeria.
4. Telecommunication companies should also be encouraged by government by means of rebate or incentives to increase internet bandwidth and service efficiency in order to deliver a seamless uninterrupted interconnectivity and operations of IoT.

B. Private sector's Roles

The private sector can augment government's effort in making sure that IoT become a success in Nigeria in the following ways.

1. Encourage massive deployment and installations of smart objects such as wireless sensors, surveillance IP cameras, RFIDs, GPS tracking devices, actuators and other smart machines in business premises and at home fronts.
2. Home owners, business premises owners and other private operators must hook up the data from these smart objects to government's National IoT Server to enhance collaboration and management.

VIII. CONCLUSION

In this paper we examined the prospects of applications of Internet of Things (IoT) in business and environmental safety and security. Internet of Things (IoT) has become possible and commonplace with the proliferation of the data networks such as the internet, (private networks such as intranets, extranets), and smart objects such as wireless sensors, actuators, RFIDs, surveillance cameras, GPS devices, smart phones, and portable computing devices. The interconnectivity of these smart computing devices over public network such as the internet and private networks such as the intranets and extranets have enhanced collaboration in business, environmental monitoring, security surveillance and business logistics and so on. On business front, IoT has boosted customer experiences and satisfaction on products and services. IoT is boosting economy and safety in many countries. Nigeria as a country cannot be left behind in tapping this innovative technology now in 2016 and in some years ahead. This technology can help boost Nigeria's economy and improves public safety and security.

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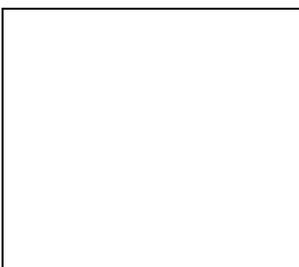
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