

Research challenges in IoTs for Smart Grid, Home Automation and Health Care System

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Abstract— *Internet of Things (IoT) is one of emerging technology in IT and it offers a promising opportunity to establish influential industrial systems and applications by emerging the growing ubiquity of Radio Frequency Identification(RFID), wireless, mobile and sensor devices. The current research gives the development of IoT in industries, and identifies different research and innovation challenges. Wireless Sensor Networks (WSNs) are playing major key role in smart grid, healthcare, home automation, environment monitoring, agriculture, and smart metering. In this paper, we present research and innovation challenges of Internet-of-Things for smart grid, home automation and health care system.*

Index Terms— *IoT, smart grid, health care, home automation, sensor, WSN*

I. INTRODUCTION

The Internet of Things (IoT) [1] [2] is a dynamic global network of physical objects or "things" embedded with electronic devices, software technologies, sensors, and network connectivity, which allows these objects to collect and exchange data for availing various services. It is an idea demonstrating a connected set of anything, any one, any time, any place, any service and any network connection. The RFID and WSN are initial foundation technologies for IoT and later researchers relate IoT with extra technologies such as actuators, sensors, global positioning system (GPS) devices, and mobile devices. Nowadays IoT is a dynamic world network infrastructure with self-configuring capabilities supported standard and practical communication protocols. There is a growing interest in exploitation of IoT concept in various industries [2][3] The utilities industry can also significantly benefit since the IoT can considerably improve the development and operation of smart grids, which is the latest trend in developed economies. With the introduction of Smart Grids, seamless connection of homes and businesses became possible. Smart grids are built to provide sustainable solutions for all your energy needs [7]. The idea is to provide the highest quality energy at low costs, and with smart grids, this dream has been turned into a reality. A Smartphone can be used for communication along with several interfaces like Bluetooth for interfacing sensors measuring physiological parameters [11]. An extension of the personal body area network is creating a home monitoring system for aged-care, which allows the doctor to monitor patients and elderly in their homes thus reducing hospitalization costs through early intervention and treatment. Control of home equipment such as light, fan, air conditioners, refrigerators, washing machines etc., will allow better home and energy management [10]. Certain uses of healthcare IoT are mobile medical applications or wearable devices that allow patients to capture their health data. Hospitals use IoT to keep tabs on the location of medical devices, personnel and patients. There are a few known enemies to the expansion of IoT in healthcare.

II. ROLE OF INTERNET OF THINGS (IOT)

2.1 Role of the Internet of things in Smart Grid:

The data generated in a smart grid is more than that generated in a traditional grid due to the continuous two-way communication between the parent utility and the smart meter at the customer's home or business setup. If the infrastructure isn't ready for such communication, it can be a barrier to smart grid deployment. Here, IoT technology plays an important role in streamline the transfer of high volume data over an internet protocol [9]. The IoT is also needed to establish seamless and effective communication between context aware sensors and the smart meter installed at the user site for automatically switching the devices on or off based on load patterns. The IoT is also required to realize the desired benefits of the smart grid technology such as energy conservation and cost reduction. This indicates that consumers, manufacturers, and utilities have to find novel ways to efficiently manage appliances through the use of home gateways, smart plugs, connected appliances, and smart meters.

2.2 Role of the Internet of things in Home Automation:

Home automation refers to handling and controlling home appliances by using micro-controller and IoT[10][11]. It also provides remote interface to home appliances to provide control and monitoring on a web browser. If user is far away from home, he can access and change status of appliances i.e. switches it on/off. User can use local PC with internet. Secures home through IoT increases convenience through temperature Adjustment, save time, save money and increase convenience. Also IoT allows to appliances control when out of town. IoT based home automation system help handicapped people. The accessing of devices is done using website, we can also access it even if we are far away from home where the Wi-Fi is available.

2.3 Role of the Internet of things in health care system:

The health care applications using [12]-[14] IoT are increasing day by day and more because of sensor devices. The IoT has the potential to give rise to many medical applications such as remote health monitoring, physical fitness programs, Alzheimer's diseases, and elderly care. The IoT healthcare system mainly tries to work on the existing wireless sensor networks, embedded device technologies and ubiquitous computing. IoT systems need to provide the services to any one at anytime and anywhere.

III. Research and Innovation in IoT

The new idea of the Internet of Things (IoT) brings an opportunity for the design of innovative applications [4] [5] that incorporate the all too familiar traditional digital technologies. It has been widely accepted that the IoT technologies and applications are still in their infancy. There are still many research challenges for industrial use such as technology, standardization, security and privacy. Future efforts are needed

to address these challenges and examine the characteristics of different industries to ensure a good fit of IoT devices in the industrial environments.

A sufficient understanding of industrial characteristics and requirements on factors such as cost, security, privacy, and risk is required before IoT will be widely accepted and deployed in industries [5][6]. IoT technology is not free from challenges.

1. Lack of support of the regulatory bodies, Government agencies and ubiquitous connectivity are barriers to integration of device. Even quality and cost of receiving data from multiple sources are still with issues.
2. Due to lack of a generic governance, there are number of confusions and inconsistencies. Absence of a universal numbering system is a bane for providing a true IoT environment. In the current situation, systems like EPC Global and ubiquitous ID systems are used to report the issue of global ID systems.
3. Further there is a challenge of implementing common security protocols. So, interoperability is an issue while interacting among IoT objects developed by different manufacturers.
4. There is also challenge of controlling hardware devices through software, the world community is now moving towards creating opportunity to live in a "connected life" environment.

3.1 Smart Grid:

Implementation of the IoT in smart grids comes with its own set of challenges, and it is these challenges that open up opportunities for IT service providers [4]-[8]. To tap into the full potential of IoT-enabled smart grids, a clear understanding of the following challenges is a must. These challenges are further treated as research and innovation.

- i. Data leakage
- ii. Cyber-attacks
- iii. Unreliable internet connectivity

IoT Implementation increases grid capability and efficiency in following ways

1. Remote monitoring: under the single console remote monitoring of large scale power lines, hundreds of substations and other parameters are considered.
2. Smart energy metering: Precise energy metering to measure power parameters & track energy consumption head end point for demand planning.
3. Fault management: Detects breakages in power lines, transformer issues & circuit breaker flaws, power inequality, fluctuations, equipment faults, over heating of lines and natural calamities.
4. Predictive maintenance: proactive monitoring enables timely maintenance and repair.
5. Mobile app: data is easily accessed on mobile, this ensure the proper connection with the grid all the time.
6. Periodic reporting: all the operation are periodically recorded and reported.
7. Integration capability: integration of renewable energy is possible, for example windmill can be integrated with solar.
8. Escalations: any fluctuation, overheating, abnormal voltage and current is been notified quickly.

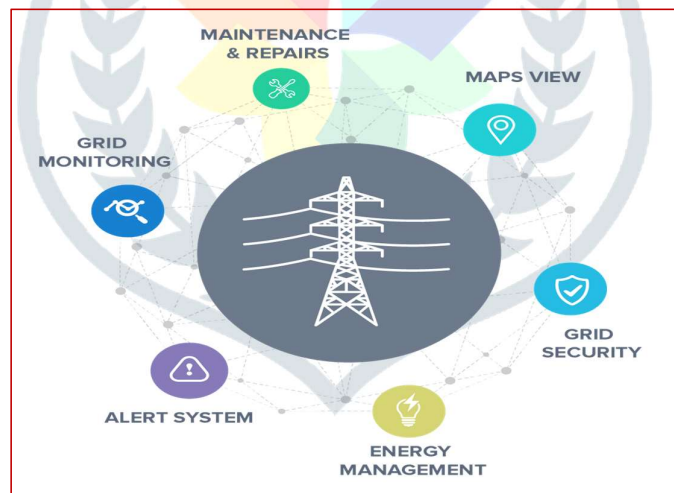


Fig.1. shows the IoT based smart grid

3.2 Home Automation:

1. The main research challenge [4][5] is to design of IoT based wireless real time home automation system using Arduino and raspberry pi
2. The most challenging task is to design and implement a cost effective home automation system using IoT.
3. The innovation challenges in home automation [6] is to control and monitoring the home appliances from anywhere over the world using cellular phone through Wi-Fi.
4. Another challenging research and innovation [8] is to design self-automated mode system that makes the controllers to be capable of monitoring and controlling different appliances in the home automatically in response to the signals comes from the related sensors.
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6. Further the challenging task is to design a user friendly and a safe system to control home appliances especially aimed to aid the elders and handicapped.

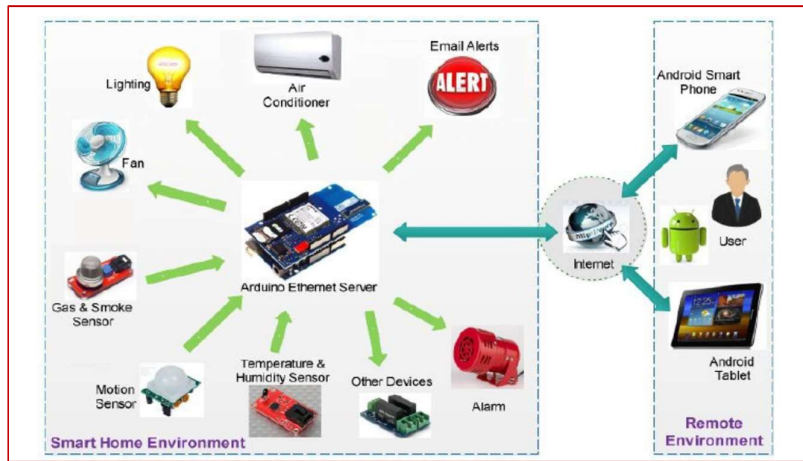


Fig.2. shows the IoT based smart home automation system

3.3 Health care system:

1. The possible research challenge [4]- [6] is to enhance the performance of healthcare system by using more sensors and setting to android apps so the person can have easily user friendly environment and will be able to do task automatically instead of manually.
2. The challenging task in wireless identifiable embedded healthcare systems is to have and utilise standard web services functionalities.
3. IoT technologies are still in supporting stage in the healthcare system.
4. Further there is a challenging [8] task in designing the IoT based health care system which make sure that the privacy and quality of life of every person has to take care.
5. Another challenging area is real time health status and predictive information to assist practitioners in the field or policy decisions in pandemic scenarios.
6. In future highly enhanced security in IoT based health care system is a major issue.

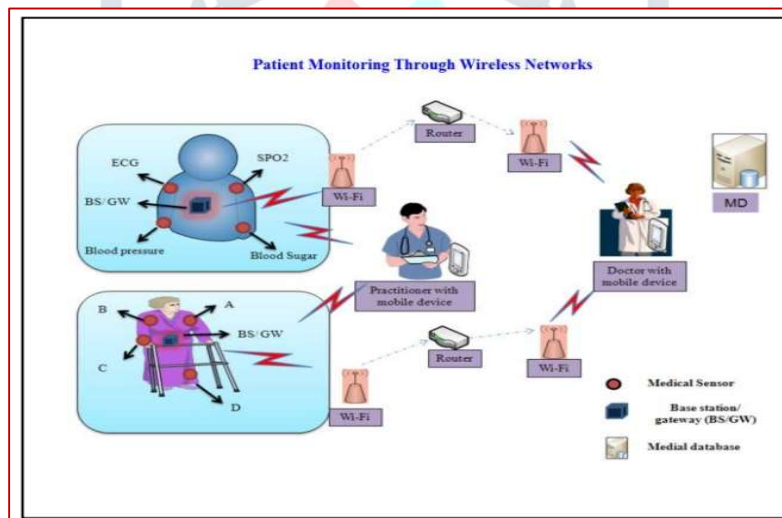


Fig.3. shows the IoT based health care system

IV. CONCLUSION

Measures and required prevention techniques are discussed in this paper. Detection of attackers at different levels can be the future scope of research. In this paper we have describe the role of IoT for smart grid, home automation and healthcare system. We also present the research and innovation challenges and future trends associated with IoT are analyzed. It concentrated on industrial latest IoT applications and highlights the challenges and possible research opportunities for future researchers.

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