ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 2, February 2018

Internet of Things (IoT) for Smart Cities

[1]Gaurav Bhardwaj, [2]Jeba Shiney
[1] [2]Department Of Electronics and Communication Engineering, Galgotias University, Yamuna Expressway Greater Noida, Uttar Pradesh
[1] gaurav.bhardwaj@Galgotiasuniversity.edu.in

Abstract: The recent Internet of Things (IoT) boom will turn Smart Cities and Smart Homes (SH) from speculation into reality. SH is Smart Cities ' major building block and has been a dream for decades, hobbyists in the late 1970s made Home Automation (HA) possible as personal computers began to invade home spaces. While SH that share most of the IoT technologies, there are unique features that make SH different. This paper defines the main requirements for building SH as a result of a recent research survey on SH and IoT technologies. Seven unique recommendations for requirements are defined and classified according to the specific quality of the building blocks in the SH. A smart city is a developed urban area with strong human capital, social capital and ICT infrastructure that excels in the fields of economy, governance, people and life. It is a modern approach to managing city life's complexities, increasing efficiency, reducing costs, and enhancing residents ' quality of life. This paper addresses potential applications for smart cities in the fields of smart transport, smart tourism and recreation Smart Health, Urban Assisted Living, Crime Prevention and Community Safety, Governance, Control and Services, Disaster Management, Environmental Management, Smart Homes and Smart Power Such smart city technologies help the cities ' future vision, which aims to leverage ICTs for value-added service delivery, namely Internet of Things Technologies (IoT). In addition, the paper provides a technical solution for energy control and comfort in a smart city network technology home for proof of concept. The example presented here is how smart systems can handle energy efficiency and comfort in a room with a varied number of people and electrical appliances, each of which is a heat source.

Keywords: Internet of things, Smart cities, Smart homes, Sensor network

INTRODUCTION

The term " Internet of Things " first appeared in 1999, when Ashton presented Procter and Gamble with a report on Radio Frequency Identification (RFID)[1]. The idea of automatic data collection using RFID and sensing technology, along with the ongoing development of Wireless Sensor Networks (WSNs), Machine-to-Machine (M2M) architectures, Artificial Intelligence (AI)[2] and semantic technologies, has made it possible for IoT[3] to flourish. Cisco has estimated that 50 billion Things will be connected to the Internet by 2020, potentially 6.58 times higher than the world population estimate. Holler et al. pointed out that IoT's biggest reason for taking off was the need to allow technology at the right cost.

IoT is viewed as an extension of the current Internet where the everyday network connectivity has been dominated by human-to-human (H2H) interaction. Examples of common H2H are text message, voice and video conferencing, and social networking. Interaction between Human-to-Machine (H2M) has become another essential part of Internet communication as machines are getting smarter with AI. A smart machine, or smart computer server, can customize content to a dynamic web page and display it to a specific user based on their browsing history. Miniaturization of electronic components according to Moore's law allows the integration of networked computers into whatever we want. While Things are computerized, intelligent and also connected to the Internet. Computers will be everywhere, linked to the network, and invisibly live with humans: a situation which Weiser defined over two decades ago as Ubiquitous Computing. IoT is a term for linking items to the internet, the core IoT technology is the Thing-to-Thing or M2 M contact. In many ways, IoT technologies on a global scale have been identified from domestic to manufacturing and from national to international.

By adopting IoT technologies, Cyber Physical Systems (CPS)[4] integrates physical components seamlessly with cyber space through modern computing and networking technologies. In the physical world the real-time process determines the distinction of CPS from today's abstraction

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 2, February 2018

within computing and networking. Typical CPS implementations are SH and Ambient Intelligence where the functions tracking, controlling and automating are carried out by means of linked sensors and actuators. Tele-care services allow elderly people and people with disabilities to connect directly to health care monitoring services offered by medical institutions Tele-care services allow elderly and disabled people to connect directly to health care monitoring services provided by medical institutions.

In order to collect usage data from devices, Smart Grid[5] focuses mainly on energy saving for homes and businesses focused on the power grid. IoT technologies help power balancing algorithms from power plants and in-house power sources, such as solar panels, and give users a better energy consumption decision.

Smart Cities[6] extend the technology to a much wider scale by linking people in a city to all the above-mentioned " Smart Technology " to provide real-time information at the right time for selected users with correct details. Figure 1 shows a typical integration of smart technologies in Smart City architecture.

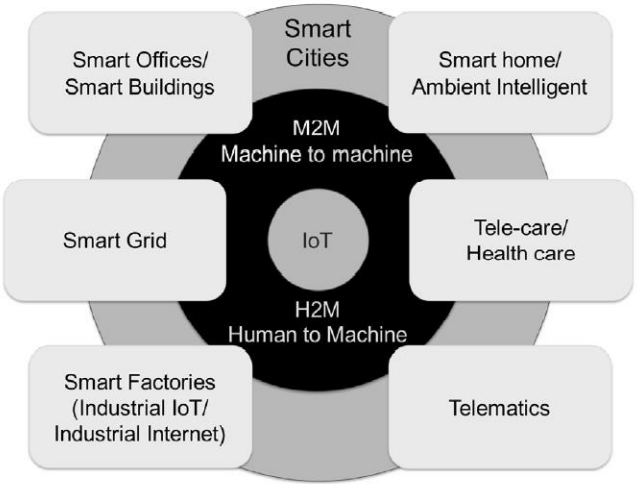

Figure 1: Typical Architecture of a Smart City

SMART HOME (SH) AND SMART CITIES

SH is the basic building block for Smart Cities and a key enabler for rapid global urbanization is the establishment of Smart Cities. In 2050, 66 % of the world's population will live in urban areas while the number of ' ' mega-cities " with 10 million or more inhabitants will rise in the same rate. When designing Smart Cities, however, a people-centric design approach is followed when order to share resources effectively and intelligently By capturing and learning personal behavior in public spaces such as smart workplaces, smart factories and public transport, it is impossible to provide tailor-made services to individual people. SH is the best venue to help Smart Cities obtain personal data when adequate privacy protection is enforced.

The story of SH began in the late 1960s when computer amateurs started installing computers at home, and one of the famous home computers at that moment called ECHO-IV was installed by Sutherland for family bookkeeping, inventory taking, as well as house temperature control. When PCs appeared in the mass-market in the late 1970s, on-site controlling and automating of home appliances became Do-It-Yourself (DIY) projects by hobbyists. Remote control was achieved by decoding Dual-Tone Multi-Frequency (DTMF) signals through telephone lines when a domestic Internet service was not yet generally available. Research in SH has been progressing but the real adoption is still very low. Nowadays, after passing another decade from we have not seen significant SH adoption yet and the high cost, difficult installation and unfriendly operations are still the main obstacles transforming the hype to reality.

Sensor Networks for Smart Homes:

As important enabler for M2M networking, objects such as sensors and actuators may be networked. Objects can be linked via wired or wireless technology[7], depending on the home environment. Short range and long range radio networks have two different communication paradigms to suit a wireless connection to different system architectures.

Wired sensor networks link items to fixed wires that aren't convenient for deployment and extensibility for future upgrades. For the transfer of the control data, Cabling can involve the creation of a home network and usually takes the form of a bus system such as CEBus, KNX, and LonWorks. Data transmission over power lines removes the need to run physical wires separately and is suitable for the retrofit industry. Typical examples are Home Plug, Insteon and X10 in this group. Pico Electronics has been inventing the protocol using power lines as the data transmission medium since 1975, making X10 popular in the DIY sector.

Owing to its ease-of-use, easy-to-install, and easy-to-upgrade, this technology has become a defacto standard in SH for many years by plugging into any power outlet to form the SH net. Due to power line interference, the notoriously unstable performance prevents X10 from succeeding in the SH industry, but the high cost-performance ratio keeps X10 goods in demand. Ethernet and video streaming at home. Many wired networks also provide wireless options to cope with Except for the use of Local Area Network (LAN)[8] for computer-to-computer communication; a good candidate for SH networking requires high bandwidth, such as high-end audio, physical wiring constraints, for example. X10 Mobile, and KNX Wireless.

Bus-based SH technologies like KNX and LonWorks have not entered the home market except for building management and luxury properties due to their high cost, but KNX, for example, remains one of the best options because of SH's stability and reliability. KNX's main goals were to separate the transmission from the control logic and allow compatibility between function modules from various manufacturers regardless of the underlying transmission technology. KNX depends on the OSI protocol stack and uses its own application-based addressing space to communicate with one device and community addresses to jointly run similar devices. In KNX systems, the function module is controlled by a small microprocessor which implements the upper layers and the entire module is connected to the bus coupler which implements lower layers according to the desired transmission technology which can be low-power buses, Power line, Infrarot and RF. The number of devices is limited by the length of the wires and the transmitting technology. Though IoT opens up a number of new possibilities for SH Because of their isolation and reliability these buses are particularly interesting for HVAC systems and essential infrastructures. Between SH specifications, IoT should provide equal protection for becoming an alternative within a home environment in the sense of essential equipment management. In addition, system interworking, which is assured in KNX, is still one of IoT's major problems due to a lack of standards.

Major Requirements for Building Smart Home:

High degree of heterogeneity, low repetitiveness, polarization[9]of user experience, demands of security and privacy protection, are all typical and critical characteristics of SHs. Human-in-the loop demand is higher than any other IoT applications since humans are the ultimate owners of all Things in the home space. The complexity escalates when there are multiple owners in a single home space where multiple but different rules must be applied at the same time, in the same place, for the same Things.

This paper summarizes the main requirements of preceding SH and IoT studies. Although SH has been studied and introduced for decades, SH's implementation is still in its infancy. This paper defines the major requirements and proposes the essential elements with IoT technologies for building SH. While more requirements are expected to be discovered in the future as SH becomes more mature, the key requirements resulting from this research are found to be:

1. Heterogeneity:

Heterogeneity is the ability to allow different types of connected Things in a given network to exchange information. Things are usually electronic devices embedded with network-connected computers; they may have different processing capacity, different input – output facilities, and different resource size, different networking technologies, and different communication protocols.

2. Self-configurable:

Self-configurable refers to the ability to dynamically connect and remove Things in SH networks by modifying the meaning of Things or the topology of the Network. Items in SH are sometimes non-permanent residents, such as consumables (e.g. a light bulb, an ink cartridge, etc.), or mobiles (e.g. a mobile heater, a trolley, etc.) or wearable (e.g. a smart watch, a heat rate monitor, etc.) and may come and go from time to time. The processes of registration and re-registration should be done quietly and autonomously without user intervention. To this requirement, self-installation for brand new Things in contributes to anothermeasurement. Usually new technology innovations or new homeowners' requirements gain new members to the current SH network, a simple implementation allows the market to grow. Installing SH systems for the first time usually includes professionals. The ultimate goal for non-technical users will be easy setup or auto-setup as SH technology becomes more mature.

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 2, February 2018

3. Extensibility:

Extensibility is an SH system's ability to expand the connected Things functions or configurations, the network size, and the adoption of new technologies. In terms of device upgradability and network scalability WSN is always a better choice over wired network for SH networking. Data over power lines increases extensibility to some degree, but usually the bandwidth is not adequate to update the connected device functions. For many WSN technologies, over-the-air (OTA) software updating has long been a feature, including Zigbee, Z-Wave, 6LoWPAN, BLE, and many other WSN protocols. Brown and Sreenan have studied the different device upgrade approaches in WSNs, and any issues that may affect the efficiency of the code transfer process. As a post-deployment technique, autonomous device and configuration update is a critical feature for WSNs; Current technology weakness with regard to upgrading error detection, feedback and configuration will disclose further work in the near future.

4. Context Awareness:

Context Awareness concerns the ability to detect and react when a Thing itself is changed (e.g. moving to a different location or altering its property, etc.), or the surrounding environment is changed (e.g. adding or removing new Things or Services from the surrounding environment, etc.). In 1994 Schilit et al. proposed the idea of Context-Aware Computing. The writers believed the three important aspects of the context were: "where you are, with whom you are, and surrounding resources." Mobile computer proliferation created a new Mobile Distributed Computing Paradigm when mobile computing devices reached stationary. Mobile device background identification allows timely, reliable, and appropriate services to be delivered in ubiquitous computing. A simple IF-THEN rule activates proper actions when context changes, but it requires a more advanced algorithm, or even intelligence when multiple context changes occur in the same environment. The major problem the authors faced was the provision of a timely and correct response to contextual information.

5. Usability:

Usability includes easy-to-use and easy-to-learn quality in a given SH system for non-technical users. Since all Things in a SH are built-in computing devices, the usability requirement in SH is closely related to the Human Computer Interaction (HCI)[10] technologies and theory. Technological advancement will aim at improving the quality of human life, and the usability of new technology plays an essential role in its success. Usability development, User Experience (UX) and many other areas within HCI are major studies for enhancing technology usability. The design goal has always been a user-friendly interface. A failure to synchronize technological advancement with the creation of the UI can transform user-friendliness into user-unfriendliness. Corn found out that people are bound to the treadmill of technology, and that engaging with technology has become a daily activity. SH and IoT are nowadays big innovations that more than anything else connects strongly with humans.

6. Security and Privacy Protection:

Security and privacy relate to the level of protection against malicious attacks and any unauthorized use of private information, and in cyber space they have always been a huge challenge. Stealing sensitive materials from company servers, private cloud personal images, IP-connected home cameras video content are typical examples of Internet hackers who breach protection. Sharing personal shopping habits, disclosing people's whereabouts and exposing personal details to unauthorized third parties are common conducts that impact privacy. SH will certainly exacerbate the challenge's effect by multiplying the number of connected devices and services over the Web. Although protection at link-level is useful, security end to end is most desirable.

7. Intelligence:

Intelligence at SH is the ability to predict human behavior from raw data collection, information management, learning from past experiences, understanding the environment and adapting to dynamic environments. The term derived from Knowledge Management theory and the sense of Human Intelligence is " Human Intelligence, mental quality consisting of the ability to learn from experience, adapt to new circumstances, understand and manage abstract concepts and use knowledge to exploit one's environment '

CONCLUSION

This paper has proposed a list of key SH building system requirements. The seven main proposed criteria were based on the taxonomy of architectures and technologies

introduced in previous research. Complying with these criteria is not a framework that everyone will be using, but it offers a common platform for creating stronger SH applications. SH adoption rate is still poor since consumers are not encouraged to upgrade from ordinary homes to SHs, remote control of office heaters is speculation rather than a requirement. Nonetheless, there are real benefits in saving energy through smart automation, remote health monitoring for the elderly through tele-care services, and operating devices for the disabled through gesture interface or BCI.

Smart cities have become a necessity because of the rapid urbanization that addresses the challenges. The approaches illustrated in this chapter illustrate how the cities addressed these issues in order to improve the quality of life for their inhabitants. Worldwide the number of cities undertaking smart development is increasing rapidly. Nevertheless, there are many challenges to these initiatives in the political, economic and technical aspects. Until going forward, there are several variables and problems which are taken into account. Initiatives for smart cities also require thorough planning, financing and continued support. There has to be a return on investment which poses another challenge as well. Another barrier to ensuring security and privacy is the technological obstacles Furthermore, managing a convergence of capital and infrastructures are very critical in all smart city projects over the long run.

REFERENCES

[1] J. C. Debouzy and A. Perrin, "RFID," in *Electromagnetic Fields, Environment and Health*, 2012.

[2] N. Ford, "Understanding AI," *Innovations in Pharmaceutical Technology*. 2018, doi: 10.4324/9781315193021-6.

[3] S. Li, L. Da Xu, and S. Zhao, "The internet of things: a survey," *Inf. Syst. Front.*, 2015, doi: 10.1007/s10796-014-9492-7.

[4] A. A. Letichevsky, O. O. Letychevskyi, V. G. Skobelev, and V. A. Volkov, "Cyber-Physical Systems," *Cybern. Syst. Anal.*, 2017, doi: 10.1007/s10559-017-9984-9.

[5] H. Farhangi, "Smart Grid," in *Encyclopedia of Sustainable Technologies*, 2017.

[6] S. Borlase *et al.*, "Smart cities," in *Smart Grids: Advanced Technologies and Solutions, Second Edition*, 2017.

[7] O. Ur-Rehman and N. Zivic, "Wireless communications," in *Signals and Communication Technology*, 2018.

[8] J. Amoss, "Local area networks," in *The CRC Handbook of Modern Telecommunications*, 2010.

[9] H. J. Eichler, J. Eichler, and O. Lux, "Polarization," in *Springer Series in Optical Sciences*, 2018.

[10] D. Brodić and A. Amelio, "Human-Computer Interaction," in *Smart Innovation, Systems and Technologies*, 2020.

[11] Ishleen Kaur, Gagandeep Singh Narula, Ritika Wason, Vishal Jain and Anupam Baliyan, "Neuro Fuzzy—COCOMO II Model for Software Cost Estimation", International Journal of Information Technology (BJIT), Volume 10, Issue 2, June 2018, page no. 181 to 187 having ISSN No. 2511-2104.

[12] Ishleen Kaur, Gagandeep Singh Narula, Vishal Jain, "Differential Analysis of Token Metric and Object Oriented Metrics for Fault Prediction", International Journal of Information Technology (BJIT), Vol. 9, No. 1, Issue 17, March, 2017, page no. 93-100 having ISSN No. 2511-2104.

[13] Basant Ali Sayed Alia, Abeer Badr El Din Ahmedb, Alaa El Din Muhammad,El Ghazalic and Vishal Jain, "Incremental Learning Approach for Enhancing the Performance of Multi-Layer Perceptron for Determining the Stock Trend", International Journal of Sciences: Basic and Applied Research (IJSBAR), Jordan, page no. 15 to 23, having ISSN 2307-4531.

[14] RS Venkatesh, PK Reejeesh, S Balamurugan, S Charanyaa, "Further More Investigations on Evolution of Approaches for Cloud Security", International Journal of Innovative Research in Computer and Communication Engineering , Vol. 3, Issue 1, January 2015

[15] K Deepika, N Naveen Prasad, S Balamurugan, S Charanyaa, "Survey on Security on Cloud Computing by Trusted Computer Strategy", International Journal of Innovative Research in Computer and Communication Engineering, 2015

[16] P Durga, S Jeevitha, A Poomalai, M Sowmiya, S Balamurugan, "Aspect Oriented Strategy to model the Examination Management Systems", International Journal of Innovative Research in Science, Engineering and Technology , Vol. 4, Issue 2, February 2015