Internet of Things IoT Applications

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A general research study for the internet of things

June 2020

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Abstract

The computer and internet started in 1969 and from this time the evolution in progress till our day. The machines and the internet became an essential part of our lives. Ordinary life consists of a mobile phone connected to the internet. The internet of things invaders everywhere, and everyone started to talk about the new technologies which ultimately does not exists before. The significant software and hardware house sold billions of smart devices based on unique challenges. The internet of things and the application covered homes, trucks, buildings, cities, and everything will support the new technologies. The web of ideas and the challenges made critical decisions to many applications, which can help us make many things automated. Health is a big part of our lives; computer-assisted surgery will and patient follow-up will make an impact on our lives. The smart cities will help to keep humanity to grow in a clean world with new natural support to the environment. The article will help by providing a closer look at the types of the internet of things and what can do.

Index Terms – internet, internet of things, future, technology

1 Introduction

The internet invented in the united states of America at the American army, and later on, it started to cover universities for educational purposes; the American network began to grow to cover all the united states and to cover the whole world. The information technology before was not known enough to the people if there are no computers at home or work. The computer revolution started to invader houses, companies, and games. Computers and mobile devices became essential in our lives. "the IoT can be defined as a large number of data points brought into a cloud environment in which analytics can apply to influence outcomes." (WALDEN, 2016).

The internet became more popular than before because people are using automated emails and mobile phones. The social media websites started to grow every day, and now many people have, for example, Facebook, Twitter, Instagram, WhatsApp accounts. The reasons behind social media are to make the people cooperate, share their ideas, or ask about each other. The social media became recommended by everyone to use social media websites. Companies are using social media to market their products. The internet of things designed to provide three goals 1) reduce cost, 2) reduce risk, and 3) improve the occupant experience. (WALDEN, 2016).

A new term became more famous because of the internet, like an internet service provider, online service provider, web browser, search engine, email. (Jamison, E 2001). The following diagram represents the internet growth from the period 1989 to 1997.

INTERNET GROWTH

DATE	HOSTS	DATE	HOSTS	NETWORKS	DOMAINS
12/69	4	07/89	130,000	650	3,900
06/70	9	10/89	159,000	837	
10/70	11	10/90	313,000	2,063	9,300
12/70	13	01/91	376,000	2,338	
04/71	23	07/91	535,000	3,086	16,000
10/72	31	10/91	617,000	3,556	18,000
01/73	35	01/92	727,000	4,526	
06/74	62	04/92	890,000	5,291	20,000
03/77	111	07/92	992,000	6,569	16,300
12/79	188	10/92	1,136,000	7,505	18,100
08/81	213	01/93	1,313,000	8,258	21,000
05/82	235	04/93	1,486,000	9,722	22,000
08/83	562	07/93	1,776,000	13.767	26,000
10/84	1,024	10/93	2,056,000	16,533	28,000
10/85	1,961	01/94	2,217,000	20,539	30,000
02/86	2,308	07/94	3,212,000	25,210	46,000
11/86	5,089	10/94	3,864,000	37,022	56,000
12/87	28,174	01/95	4,852,000	39,410	71,000
07/88	33,000	07/95	6,642,000	61,538	120,000
10/88	56,000	01/96	9,472,000	93,671	240,000
01/89	80,000	07/96	12,881,000	134,365	488,000
		01/97	16,146,000		828,000
		07/97	19,540,000		1,301,000

Information provided by Computer Museum History Center

Figure 1 Internet growth (Jamison, E 2001).

The following picture represents the increased usage of the Internet-based on the user type and years. "The number of Internet hosts was initially a measure of how much content was being put on the Internet. However, with the growth of broadband connections, which usually has an IP address, the Internet host count grows with the number of broadband connections." 1 (Chapter 2.1: What is Internet User?' 2008).

Table 2.4 Internet User Forecast Content

Forecast Content	Definition
Internet User	• 1990 to 1994: Adults over 16 years old • 1995 to 2002: People 12+ years old • 2003 to 2012: People 8+ years old
Weekly Internet User	• 1995 to 2002: People 12+ years old with a weekly usage pattern • 2003 to 2012: People 8+ years old with a weekly usage pattern
Internet Host	• IP addressable domain names
Computers-in-Use	• Installed base of computers including mainframes, midrange, workstations, desktop and mobile PCs (Excludes Smartphones/PDAs)
Wireless Internet Users	• Internet access via mobile wireless devices: mostly cell phone & PDA. Only available for main geographic regions and a few countries
Broadband Subscribers	• Subscribers to high speed Internet access (cable modem, DSL & others) • Many broadband connections have more than one user

Figure 2 (Chapter 2.1: What is an Internet User?' 2008)

The internet became addictive because of the published information and the ease of reaching this information by the www world full web search engines. Many topics are famous for reaching by many countries. They are categorized into six categories “The six needs he identifies include

- sexual needs,
- the need for an altered state of consciousness,
- for achievement and mastery,
- for belonging,
- for relationships, and
- the need for self-actualization and the transcendence of self.”

(Chou, nd.). The following diagram represents the internet addiction.

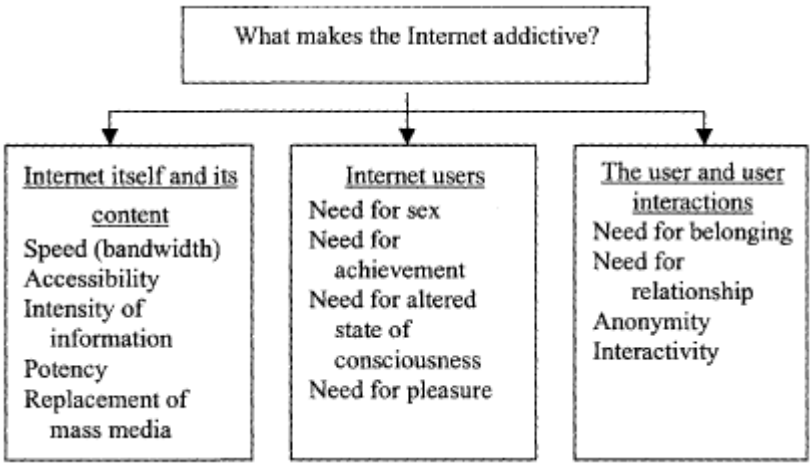

Figure 3 The internet addiction analysis structure (Chou, nd.).

The technologies never stopped because everyday people need to increase to cover areas of interest. The internet, as a source of websites, information, and network devices, people started to think of the surrounded environment like a kitchen, bathroom, TV, watches. The need for technology makes people change everything to a new level of maturity. Mobile phones became a touch screen and with specifications like computers. The original watch manufacture added a new production line to satisfy the latest technologies like Sony, Samsung, and apple. Smartwatches became popular with many people because they can make many functionalities more than just ordinary watches, like installing applications, connecting to your mobile phone, and seeing who is calling.

The challenges covered many areas like hospitals, vehicles, disabled people, and smart cities. The article will provide an overview of many perspectives of the internet of things and how we can see the future from the internet of things' points of view to achieve a new level.

Cloud computing is a technology the main goal is to host services, application over a dedicated machine, and make the computer accessible through the internet. The cloud is "A set of hardware, networks, storage, services, and interfaces which enable the on-time delivery of demanded services is a Cloud" (Bhatt, 2012). The cloud consists of three categories 1) public cloud, 2) private cloud, and

3) hybrid cloud. The primary purpose of cloud computing is to host an internet of things and use them later on through the smart watch or any other device that connect to the internet. There are three types of cloud

1) SaaS: software as a service this type help the software applications to connect with each other's, "provider hosts business applications and delivered them as a service." (Bhatt, 2012).
2) PaaS: platform as a service, this type provides a complete system but as a service, "the provider delivers more than infrastructure." (Bhatt, 2012).
3) IaaS: infrastructure as a service, this type provides a complete infrastructure for renting to another company, "is the hardware delivery (such as servers, networking technology, storage, and data center space) as a service by Cloud Computing e.g. operating systems and virtualization technology manages the resources and then installing of resources in their own data center which are paid services as per usage." (Bhatt, 2012).

The internet of things consists of "The IoT architecture for the system consists of three stages: physical, communication, and application. The first layer features a multiple-sensor network that evaluates the patient's vital readings such as nutrition, medical intakes, and physical activities." (Avsystem.com. 2020). The following diagram represents the smart health care system, which consists of smart devices like smartwatches. It provides the gathered data to the other connected primary device like computer, and the computer will communicate with the servers hosted at somewhere over the internet.

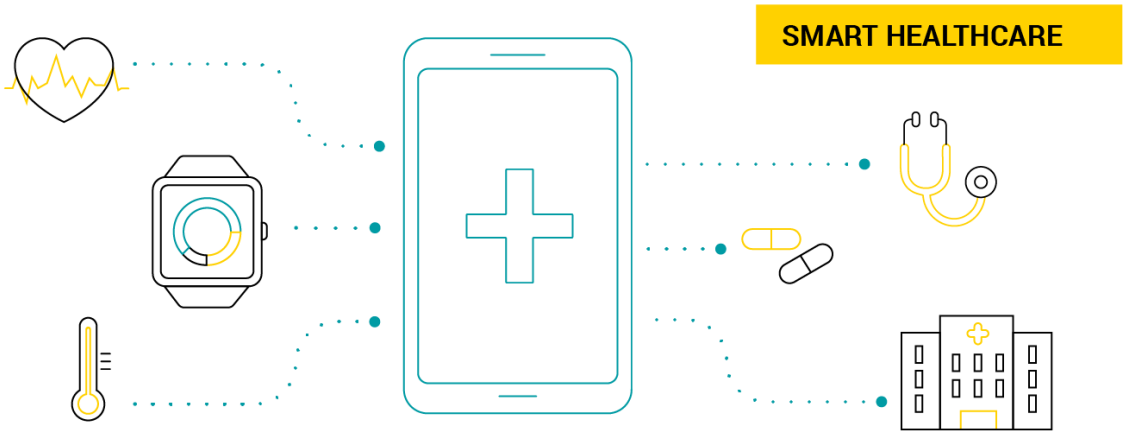

Figure 4 Smart Health care (Avsystem.com. 2020).

The following another explanation for the internet of things scenario. The diagram represents the connectivity between many devices, and all connected to the central computer/server to manipulate

the gathered data.

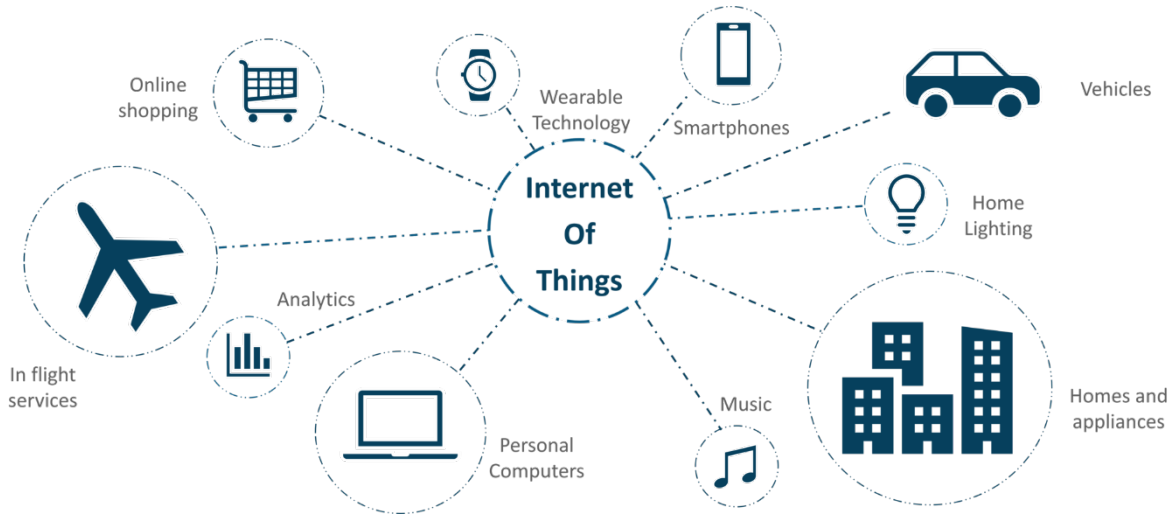

Figure 5 (Internet of things and smart devices Edureka. 2020.)

2 Applications

The internet of things as a new technology in both hardware devices and software applications designed to help people in their daily life to make everything easy to use and easy to understand. The internet of things invader everything in our everyday life, starting from looking at the smartwatch to remind us of the meetings to the fully automated planet with hologram and augmented reality features.

There are hundreds of applications to the internet of things like eye lens that can make you see something in front of your eyes, augmented reality, which makes you see things in addition to the truth. The article will help you to mention many applications of the internet of things as an indicator of technology capability.

The internet of things applications summarized in the leading ten types, grouped and presented in the picture below. the models are “Smart Home, Wearables, Smart City, Smart grids, Industrial internet, Connected car, Connected Health, Smart Retail, Smart supply chain, Smart farming” (Lueth, 2015)

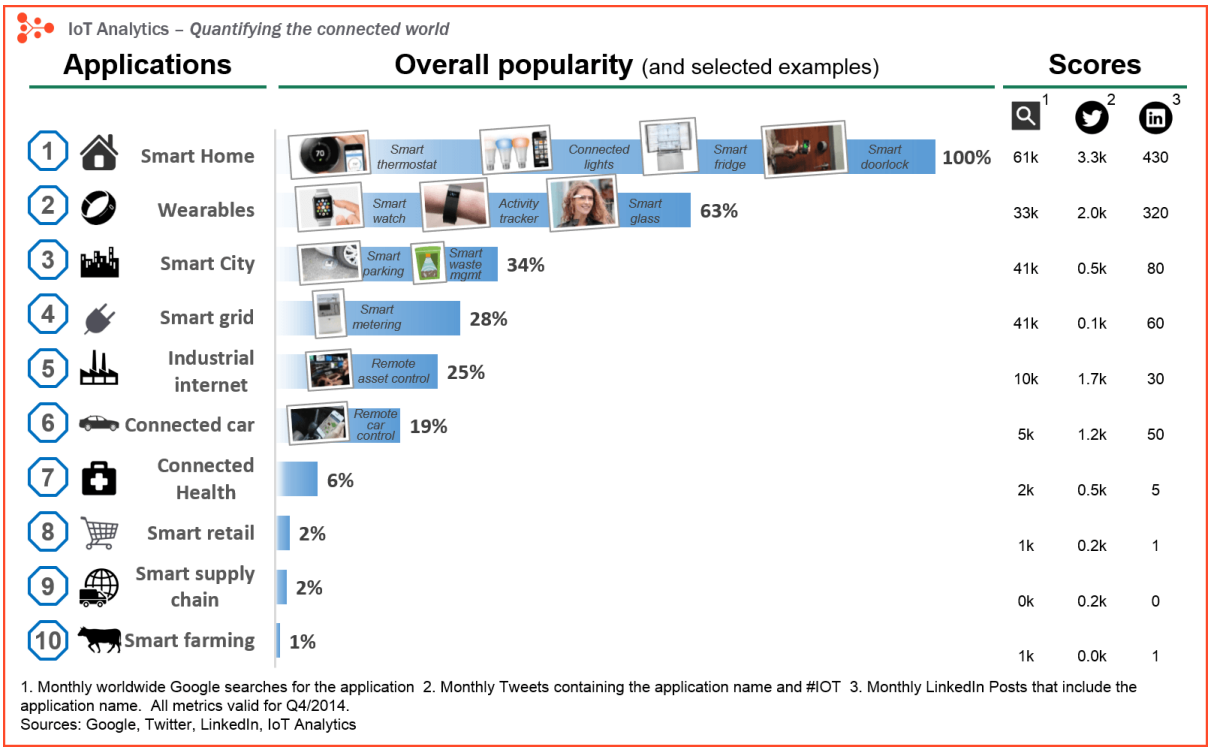

Figure 6 The Internet of Things applications ranking (Lueth, 2015)

The following table represents the evolution of the internet of things IoT technologies in all areas starting from before 2010 and beyond 2020. “Network technology is moving to unobtrusive wire-free communication technology that allows device-to-device applications to deployed more flexibly. Network technology is evolving toward a context-aware autonomous network.” (Lee and Lee, 2015).

Table 1. Evolution of key IoT technologies

	Before 2010	2010–2015	2015–2020	Beyond 2020
Network	• Sensor networks	• Self-aware and self-organizing networks • Sensor network location transparency • Delay-tolerant networks • Storage networks and power networks • Hybrid networking technologies	• Network context awareness	• Network cognition • Self-learning, self-repairing networks
Software and Algorithms	• Relational database integration • IoT-oriented RDBMS • Event-based platforms • Sensor middleware • Sensor networks middleware • Proximity/ Localization algorithms	• Large-scale, open semantic software modules • Composable algorithms • Next generation IoT-based social software • Next generation IoT-based enterprise applications	• Goal-oriented software • Distributed intelligence, problem solving • Things-to-Things collaboration environments	• User-oriented software • The invisible IoT • Easy-to-deploy IoT software • Things-to-Humans collaboration • IoT 4 All
Hardware	• RFID tags and some sensors • Sensors built into mobile devices • NFC in mobile phones • Smaller and cheaper MEMs technology	• Multiprotocol, multistandards readers • More sensors and actuators • Secure, low-cost tags (e.g., Silent Tags)	• Smart sensors (biochemical) • More sensors and actuators (tiny sensors)	• Nanotechnology and new materials
Data Processing	• Serial data processing • Parallel data processing • Quality of services	• Energy, frequency spectrum-aware data processing • Data processing context adaptable	• Context-aware data processing and data responses	• Cognitive processing and optimization

Source: Adapted from Sundmaeker, Guillemin, Friess, and Woelfflé (2010, p. 74)

Figure 7 Evolution of IoT technologies (Lee and Lee, 2015)

2.1 Intelligent Facilities Management

Facility management is a sophisticated device integrated to make sustainability because of the delay of response from the FM. (Shi, Y., Du, J., Levy, S. and Zhao, D., 2016). The facility management can provide support to many areas of our life and categorized into the following categories

> *"Planning, Organizing, Staffing, Directing, Controlling, Evaluating, Lease Administration, Space Management, Architectural / Engineering Planning and Design, Security and Life-Safety Management, General Administrative Services Workplace Management, Budgeting, Accounting, and Economic Justification, Real Estate Acquisition and Disposal, Sustainability, Construction Project Management, Operations, Maintenance and Repair, Technology Management, Facility Emergency Management" (Roper and Payant, 2020).*

Figure 8 samples of facility management

The facility management can provide help in the construction field of "industry, the term intelligent buildings describe facilities equipped with devices and systems that can be remotely controlled and programmed and that can communicate and collaborate to ensure convenient building environment and effective operation." (Kučera and Pitner, 2013).

Facility management can provide benefits to the organization like "Ensure Regulatory Compliance, Capture Information Automatically, Fast and Accurate Reporting, Synchronize Preventive Maintenance Actions, Employee Insight, Integration Capabilities" (Admin, 2020).

The following picture represents a sample from the facility management software from IBM.

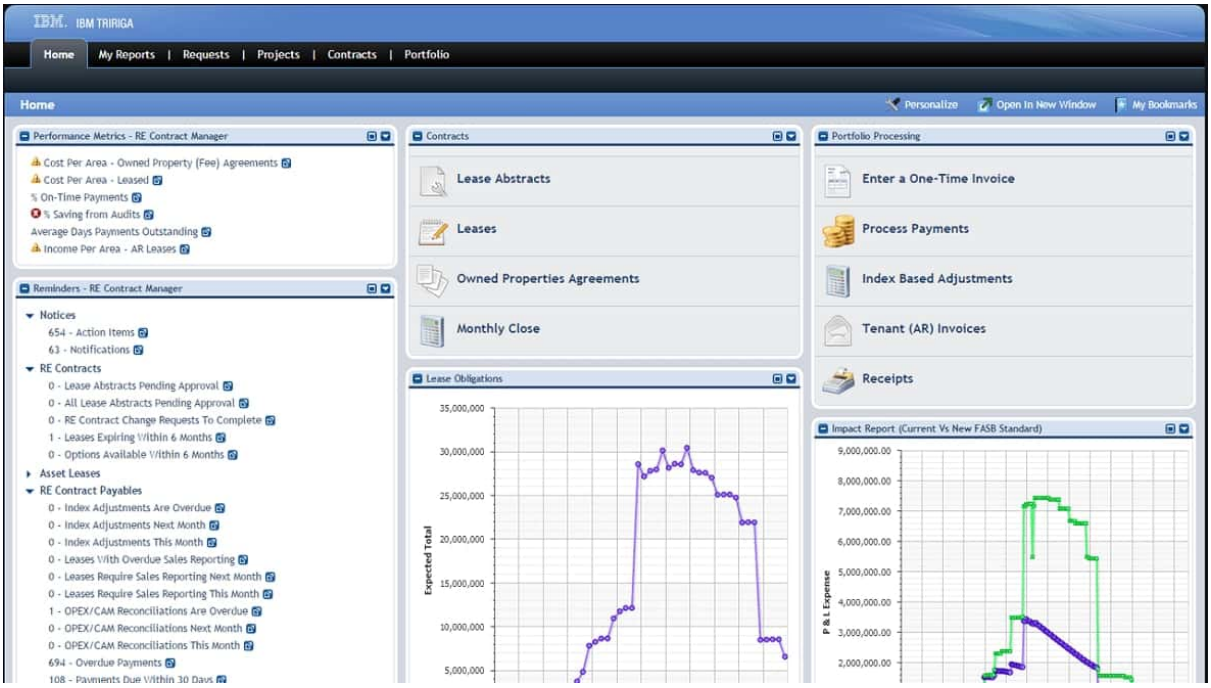

Figure 9 IBM facility management software (Ibm.com. 2020)

Facility management is a big part of our life, and it covers many areas, as I mentioned in the previous, like project management, operations management, and more. Everyone can benefit from getting the right system based on his organization's needs and strategic plans and the current international move in his area of specialization.

2.2 Wearable devices

Wearable technology or devices is an electronic device that can make a specific function, and we can wear it in our clothes or our body. The wearable is part of the internet of things because its main feature provided and tracked from the internet. Wearable technology helps us to do daily exercise. “Bluetooth headsets, smartwatches, and web-enabled glasses all allow people to receive data from Wi-Fi networks.” (HAYES, 2020).

There are many types for the wearable devices such as

- Kentucky to monitor local air quality, measure pollution.
- Medical alert monitors to monitor sick or elderly people
- Smart tattoos to monitor heart and brain activity or sleep problems
- Smart watch to monitor people neuro issues like Parkinson illness
- Kids monitoring device equipped with GPS device to help portent to track kids’ locations (HAYES, 2020).

Google invented a glass can help people to record video or display information directly to the glass. “The Google glasses function as a hands-free smartphone, allowing users to access the mobile internet browser, camera, maps, calendar, and other apps by voice commands.” (Wordstream.com. 2020)

Figure 10 Google glass (Glass. 2020)

Google glass helped many manufacturing companies and packaging to provide an accurate and speedy service. The top customers who used the device are AGCO, DHL, GE venture, Sutter Health. "Glass allows us to pick faster than normal and reduces the number of errors that can happen. It's quite easy to learn to use. Every piece of information you need is available on one screen, DHL associate" (Glass. 2020).

> *“At DHL, there is a supply chain process called ''order picking” where employees fulfill customers’ orders by scanning items from racks before moving them into totes or bins on carts. Using Glass with a partner software solution from Ubimax, pickers now receive all picking instructions directly from Glass, right in their line of sight. With “Vision Picking” freeing their hands of paper*

instructions, real-time picking instructions, and the scanning function of Glass, pickers can work far more efficiently and comfortably." (Glass. 2020).

Google glass will provide three features:

1) **Stay focused**: integrate with organization workflow and help you to be more focused in the production lines. The glass offers voice command or touch the glass for more actions.
2) **Improved accuracy**: watch educational google videos to get more information's of how to use the product.
3) **Collaboration in real-time: connect** the glass with other co-workers to share new information's and troubleshoot the issue in real-time.

(Glass. 2020).

3 Internet of things security challenges

The security concern is a nightmare for everyone; I'm one of the people who is complaining from grey hackers who are trying to make me feel harmful toward my computers and information. The security in the internet of things or any other device connected to the internet is essential for us. The internet of things is a significant challenge in the safe since everything with us connected to the internet and collecting our information. The internet of things smart devices can record, listen or make any other provided function from the provider and transfer this information's from our smart tool to other companies or people to make decisions like marketing or something else. There are five types of security tasks that can make everyone think of the security of the provided smart devices.

1) **Data privacy**: all smart devices are connected to the internet and this can make hackers more active to hack the amiable devices. The smart TV are collecting data from home or office. (Singh and Singh, 2015).
2) **Insurance concerns**: the smart vehicle can drive automatically from place to another place. The ordinary insurance companies are used to provide insurance for the normal accidents, but the automated driving cars is new. The insurance companies must make a new pricing insurance model for the automated cars. (Singh and Singh, 2015).
3) **Lack of Common Standards**: the standardization is respectable in all levels of communication, the IoT still has the lack of standardization and this will cover many industry areas. (Singh and Singh, 2015).
4) **Technical Concerns**: the IoT devices can record or generate big numbers of data because of the installed sensor, the challenge here is to store the collected information's and manipulate these information's. The device "should be capable to identify & discriminate between permitted and rogue devices." (Singh and Singh, 2015).
5) **Social and Legal Concerns**: the legal of information considered one form the issues since incase of a website provide video streaming and the question is who own the video the company or the owner or there is someone else. The second challenge what happen when

the device run out of control and the video streaming transfer the video to another company or person. (Singh and Singh, 2015).

4 Internet future

The internet is an integral part of our life before it was not necessary, and it's nice to have an internet connection, but the people addictive and the daily use considered essential to everyone. The internet will cover everything possible to us and this based on the internet of everything and the internet of things. The massive increase in the need to connect to the internet made the people think of how to find a reasonable cost of hosting their information. "The problem is the network operators aren't making any money from public Internet service." (McKeown, 2007).

The challenges of how to trust the information over the internet and how to protect your valuable data may include "security Denial of service, viruses, worms, and to some extent, spam is consequences of the Internet architecture." (McKeown, 2007). There is a need to remove the ethernet access from the local network and make it to the public system. The router is an essential part of the internet connection and the need to enhance the device mandatory to connect the internet easily by replacing this device with another device. (McKeown, 2007).

The conclusion is the current devices must be completely replaced with another new tech ology devices to make sure that the internet is more stable, more speed, and cheaper than before. The current technologies must replace to make people's life easier.

5 Conclusion

The Internet of things is the main gateway to us now to connect. The smart devices at work or home can help you to make your life better. There are issues, but people can stay to make life better with the first provided services. Many companies provided the internet of things services to humanity to help them. The big companies invented a new device with innovative ways like google glass and Microsoft glass. There are other companies made smartwatches or other devices. The future is promising for the internet of things because people need will never stop looking for something new.

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7 Index

7.1 About Mahmoud

I am an expert in Information's systems, project management, and strategic management consultant with over 15 years of experience in the software industry, IT consultation, business analysis, system analysis, systems integrations, strategic management analysis and strategic management performance management. My previous experience in leading success stories with big companies in the middle east, and I have an excellent project management skill to lead significant programs. I have experience in the leadership skills to lead small team or medium groups. I had lead projects from failure to success in many occasions.

Mahmoud is an expert in Information's systems, project management, and strategic management consultant with over 16 years of experience in following field's software field, IT frameworks, management frameworks design and implementation, and strategic management. Leading success stories with big companies in the middle east with cooperation from national and international companies. I have unique soft skills to work and lead teams. I had lead projects to success on many occasions. I am seeking to utilize my personal and professional skills to work as a Management Consultant.

My 16 years in private and public organization helped me to gain more experience in many business sectors such as strategic management, IT consultations, software development, systems integrations, multimedia systems, and popular frameworks implementation such as ITIL, and CRM. ITIL and CRM frameworks are from my favorite experience since I was responsible for the whole orchestration, integrations with a governmental organization on many occasions. I made many successful stories in private and public organization to transform ordinary systems into an excellent system. The ITIL program achieved success story with Microsoft. Also, I gained experience in software engineering for documenting current document process and set the target processes with provided templates and documentation.

Strategic management is one of my expertise, which I used in electronic transformation strategic plans with strategic assessment, Senior IT Consultant and Senior IT Project Manager Kingdom of Saudi Arabia. Planning, and performance management. Project management helped me to deliver many projects in my professional life, I applied PwC and national organization processes and templates successfully, and I made successfully my models, which used with many projects. I am capable of implementing any given framework to any public or private organization worldwide, and I have enough experience to search and use for academic or non-academic frameworks or methodologies to apply for any governmental organization.

The ability to have academic experience helped me by adding more skills to professional writing. I can write scholarly articles, document processes, support others, use my scholarly writing experience and professional experience in writing technical documentation such as technical proposals and request for proposals. I joined the governance team to evaluate the technical plans to

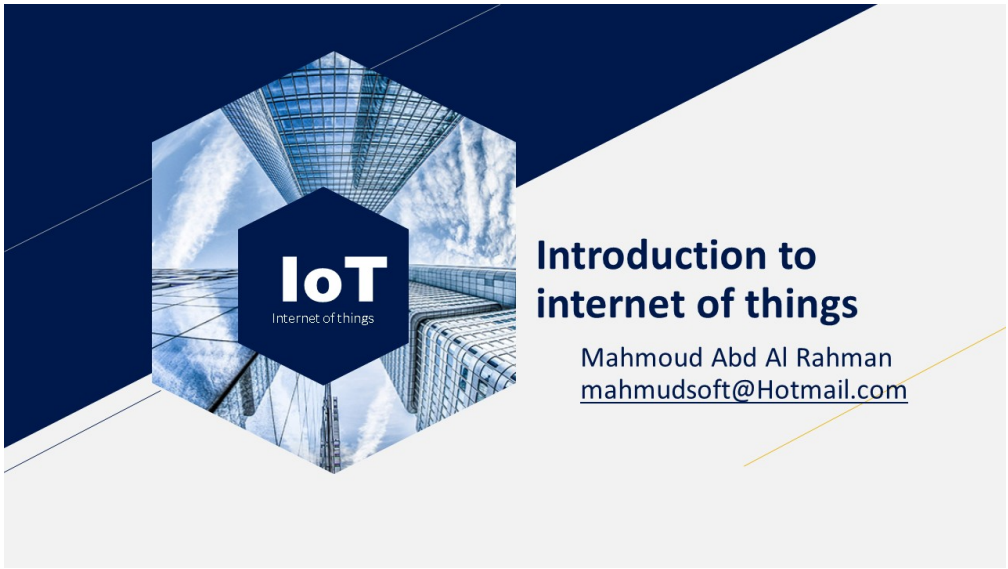
make sure the requirements are matching the best practices and the required scope. The writing proposals are part from the work which is designed to enhance the current projects to transfer the organization from the current state to another level with balancing the competing demands to make sure the execution of the requirements done smoothly.

Please visit the academic website https://roehampton-online.academia.edu/mahmoudabdalrahman

Please feel free to send an email to my inbox at: mahmoudsoft@hotmail.com

7.2 Internet of things resources

Please download the PowerPoint presentation as a PDF file from academia website and you also can watch YouTube video for the presentation.



Description	Link
PDF file	https://www.academia.edu/s/55e2ac0f23?source=work
Internet of Things - Part 1	https://www.youtube.com/watch?v=64gV51wQzUw
Internet of things - Part 2	https://www.youtube.com/watch?v=f-hyxjrBgRE&t=527s