IoT Applications: A Literature Review

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Abstract— The likely benefits of Internet of Things (IoT) are unlimited and IoT applications are moving the way we work and live by saving time and properties and initial new prospects for evolution, modernisation and knowledge creation. The IoT allows private and public-sector organizations to manage assets, improve performance and develop innovative commercial models. The Internet of Things has excessive potential to improve the energy efficiency and to improve all categories of mobility and transport. The approaches like cloud technologies, big data, cyber-physical systems, and future networks like 5G are evidence of IoT. The success of IoT depends on environment development, where issues like identification, trust, privacy, security and semantic interoperability are crucial importance in relation to development.

Keywords: Sensors, Telematics

I. INTRODUCTION

The Internet of Things is the internetworking of physical devices, vehicles, buildings, and other items-embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. The Internet of Things (IoT) is a technological revolution that represents the future of computing and communications. Its development depends on the dynamic technical innovation in a number of important fields, from wireless sensors to nanotechnology.

The Internet of Things (IoT) has not been around for very long. However, there have been visions of machines communicating with one another since the early 1800s. The Internet of Things, as a concept, wasn't officially named until 1999. One of the first examples of an Internet of Things is from the early 1980s, and was a Coca Cola machine, located at the Carnegie Melon University. By the year 2013, the Internet of Things had evolved into to a system using multiple technologies, ranging from the Internet to wireless communication and from micro-electromechanical systems (MEMS) to embedded systems.

Simply stated, the Internet of Things consists of any device with an on/off switch connected to the Internet. This includes almost anything you can think of, ranging from cellphones to building maintenance to the jet engine of an airplane. Medical devices, such as a heart monitor implant or a biochip transponder in a farm animal, can transfer data over a network and are members the IoT. If it has an on/off switch, then it can, theoretically, be part of the system. The IoT consists of a gigantic network of internet connected "things" and devices. Ring, a doorbell that links to your smart phone, provides an excellent example of a recent addition to the Internet of Things. Ring signals you when the doorbell is pressed, and lets you see who it is and to speak with them.

The IoT offers both opportunities and potential security problems. At present, the Internet of Things is best viewed with an open mind, for purposes of creativity, and a defensive posture for purposes of privacy and security. IoT enables myriad applications ranging from the micro to the macro, and from the trivial to the critical. However, while the IoT seems to be just one technology, it actually incorporates other major technologies, such as cloud computing, data analytics, mobile, sensors, and machine-to-machine communications. The real value of the IoT doesn't come from all the connections it creates but from the data it generates. With real-time data analytics, the IoT becomes a live communications network for fostering insights and improvements. It will also become the foundation of Live Business, in which companies will be able to sense and respond to customers in the moment.

The Industrial IoT is defined as the automated interaction between smart devices and systems, exchanging data to an offsite or cloud-based solution for meaningful, time-sensitive analytics using components with very low energy consumption that are simple to install and based on industry standards. The Industrial IoT goes beyond the simple exchange of data by connecting devices, systems and people in intelligent, real-world applications to enable environments such automated factories, smart cities and connected healthcare. Traditional embedded systems are at the heart of this phenomenon, having evolved from standalone systems to become a network of connected devices and systems.

II. APPLICATIONS

Internet of Things plays a vital role in the area of present day wireless networking. It has a wide areas of applications in all the fields of society. In this paper we discuss different applications of IoT in relevant areas. Following are some of them. Figure 1 shows block diagram of wide areas of applications of IoT.

A. Smart Home

Home automation or Smart Homes can be described as introduction of technology within the home environment to provide convenience, comfort, security and energy efficiency to its occupants. Adding intelligence to home environment can provide increased quality of life for the elderly and disabled people who might otherwise require caregivers or institutional care. Smart home is a house that uses information technology to monitor the environment, control electric devices and for communication with outer world. Smart home is a complex technology and at the same time it is developing. The smart house can monitor and control temperature, humidity, lighting, fire and burglar alarm or other systems inside the house or outside around it. Surveillance system and motion sensors are used to guarantee family safe. The system also has internet connection to monitor and control house equipment from anywhere in the world. The interesting part of a smart house represents the facts that it can be controlled from a smart phone, tablet or laptop not being necessary a remote controller for each individual device, a single mobile application managing to incorporate all the equipment and the control and monitor can be realized from anywhere. The appliances are interconnected and allow the communication between them to achieve some activities. These type of house is not just able to be remotely controlled, but it will give warnings for appeared problems, will decide and action with predetermined actions for the real-world cases. If it is a break entering, the house will alert the owner, the police section and will close all other areas to defend it. If it is a problem to water supply, or with gas supply it will alert the owner. International Journal of Internet of Things and authorized personnel but in the same time it will interrupt supply for damaged system. Usually smart house means a varied system of automation subsystems.

The major areas of Smart Home are as follows.

– security system, fire alarm and access system
– water or gas leak detection system
– video surveillance system
– network communication system
– lighting system
– Building mechanization (open/close doors and windows, underfloor electric heating etc.)
– Audio Video technique (home cinema, multiroom audio system)
– telemetry - remote tracking system
– IP object monitor – remote control for network system
– GSM monitor – remote information on incidents inside or outside the house, remote control of electronic devices, actuators and other automation systems

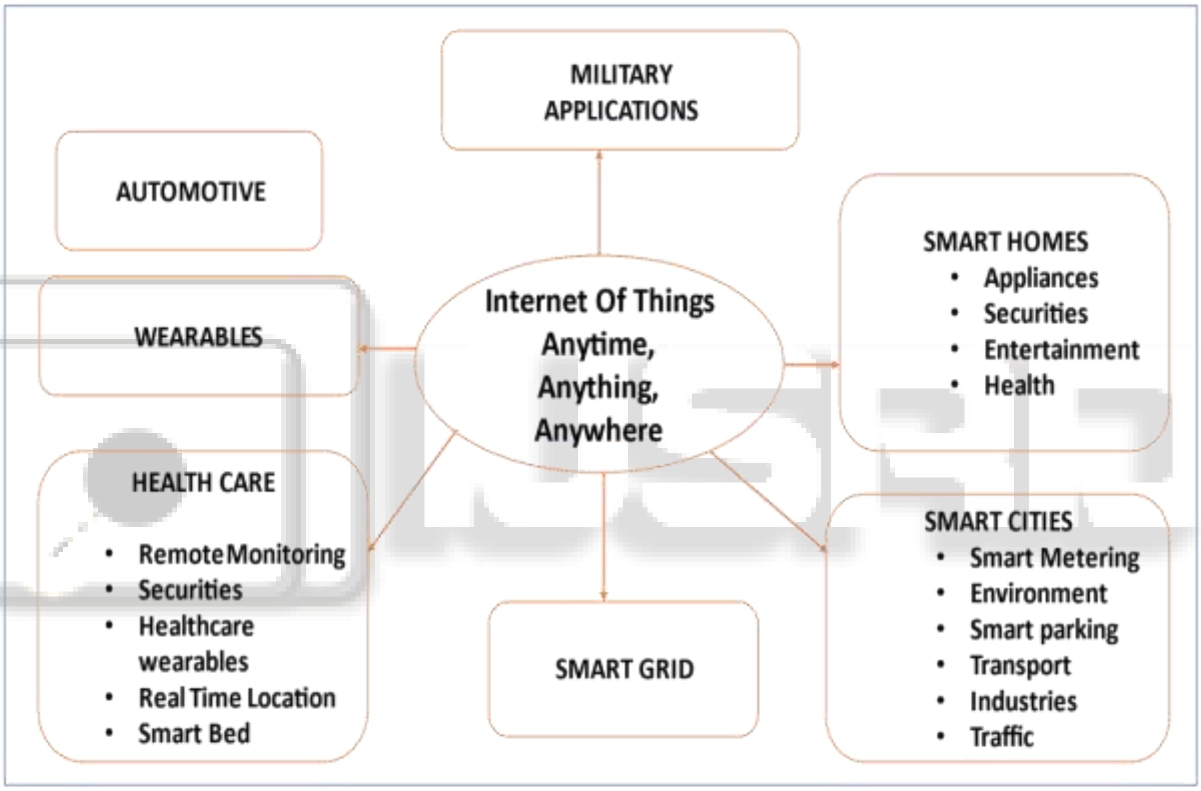

Fig. 1: Applications of IoT

B. *Smart Cities*

Structural Health of Buildings: The urban IoT may provide a distributed database of building structural integrity measurements, collected by suitable sensors located in the buildings, such as vibration and deformation sensors to monitor the building stress, atmospheric agent sensors in the surrounding areas to monitor pollution levels, and temperature and humidity sensors to have a complete characterization of the environmental conditions. This database should reduce the need for expensive periodic structural testing by human operators and will allow targeted and proactive maintenance and restoration actions. Finally, it will be possible to combine vibration and seismic readings in order to better study and understand the impact of light earthquakes on city buildings. This database can be made publicly accessible in order to make the citizens aware of the care taken in preserving the city historical heritage.

Waste Management: A deeper penetration of IoT solutions in this domain may result in significant savings and economical and ecological advantages. For instance, the use of intelligent waste containers, which detect the level of load and allow for an optimization of the collector trucks route, can reduce the cost of waste collection and improve the quality of recycling. To realize such a smart waste management service, the IoT shall connect the end devices, i.e., intelligent waste containers, to a control center where optimization software processes the data and determines the optimal management of the collector truck fleet.

Air Quality: an urban IoT can provide means to monitor the quality of the air in crowded areas, parks, or fitness trails. In addition, communication facilities can be provided to let health applications running on joggers' devices be connected to the infrastructure. In such a way, people can always find the healthiest path for outdoor activities and can be continuously connected to their preferred personal training application. The realization of such a service requires that air quality and pollution sensors be deployed across the city and that the sensor data be made publicly available to citizens.

Noise Monitoring: An urban IoT can offer a noise monitoring service to measure the amount of noise produced at any given hour in the places that adopt the service. Besides building a space-time map of the noise pollution in the area, such a service can also be used to enforce public security, by means of sound detection algorithms that can recognize, for instance, the noise of glass crashes or brawls. This service can hence improve both the quiet of the nights in the city and the confidence of public establishment owners, although the installation of sound detectors or environmental microphones is quite controversial, because of the obvious privacy concerns for this type of monitoring.

Traffic Congestion: On the same line of air quality and noise monitoring, a possible Smart City service that can be enabled by urban IoT consists in monitoring the traffic congestion in the city. Even though camera-based traffic monitoring systems are already available and deployed in many cities, low-power widespread communication can provide a denser source of information. Traffic monitoring may be realized by using the sensing capabilities and GPS installed on modern vehicles, and also adopting a combination of air quality and acoustic sensors along a given road.

Smart Parking: The smart parking service can be directly integrated in the urban IoT infrastructure, because many companies in Europe are providing market products for this application. Furthermore, by using short-range communication technologies, such as Radio Frequency Identifiers (RFID) or Near Field Communication (NFC), it is possible to realize an electronic verification system of parking permits in slots reserved for residents or disabled, thus offering a better service to citizens that can legitimately use those slots and an efficient tool to quickly spot violations.

Smart Lighting: This service can optimize the street lamp intensity according to the time of the day, the weather condition, and the presence of people. In order to properly work, such a service needs to include the street lights into the Smart City infrastructure. It is also possible to exploit the increased number of connected spots to provide WiFi connection to citizens. In addition, a fault detection system will be easily realized on top of the street light controllers.

C. Health Care

Internet-connected devices have been introduced to patients in various forms. Whether data comes from fetal monitors, electrocardiograms, temperature monitors or blood glucose levels, tracking health information is vital for some patients. Many of these measures require follow-up interaction with a healthcare professional. This creates an opening for smarter devices to deliver more valuable data, lessening the need for direct patient-physician interaction. Smart beds can detect when they are occupied and when a patient is attempting to get up. It can also adjust itself to ensure appropriate pressure and support is applied to the patient without the manual interaction of nurses. Another area where smart technology could be an asset is coupled with home medication dispensers to automatically upload data to the cloud when medication isn't taken or any other indicators for which the care team should be alerted. The advanced automation and analytics of IoT allows more powerful emergency support services, which typically suffer from their limited resources and disconnect with the base facility. It provides a way to analyze an emergency in a more complete way from miles away. It also gives more providers access to the patient prior to their arrival. IoT gives providers critical information for delivering essential care on arrival. It also raises the level of care available to a patient received by emergency professionals. This reduces the associated losses, and improves emergency healthcare.

– The smart health includes following applicable areas.
– Predictive Maintenance of Hospital
– Equipment Tracking Healthcare Devices
– Interoperability of Health Devices
– Remote Monitoring
– Security of Medical Records/Mobile
– Healthcare Wearables
– Elder care
– Patient data-gathering
– Real-time location
– Automotive

Service providers, insurance carriers and auto manufacturers are racing to connect vehicles using telematics devices to deliver safety related value-added services designed to offer drivers information, protection, and lower premiums. These value-added services include emergency services, remote vehicle diagnostics, vehicle tracking and recovery, safe driver and no-texting services and teen driver management. Additionally, insurance carriers are using the vehicle telematics data to analyze driving patterns, encourage safe driving practices and reward customers with lower premiums for good driving behavior. Asset tracking solutions require varying hardware and communication methods and features based on cost, physical size, environmental conditions, geographical location, and more.

Many modules are designed from the ground up to meet the automotive industry's toughest specifications and deliver high quality and long life spans under the hood. These modules are simple to integrate, easy to program, secure and scalable in network. And they are supported by easy-to-use development tools, software suites and expert automotive specialists to speed solutions to market and reduce total product costs. Cloud services provide the simplest and most scalable way to securely retrieve, store, analyze, and integrate data to build new value in IoT automotive applications. They accelerate time-to-market, reduce risk, and lower deployment and maintenance costs with over-the-air monitoring and upgrades of cellular IoT devices. The pre-certified wireless solutions, expert automotive professional services, and strong relationships with the world's leading wireless carriers accelerate network certification and integration. We help customers develop and scale new connected car solutions in months instead of years to enter new markets faster.

D. Wearables

Wearable devices are now at the heart of just about every discussion related to the Internet of Things (IoT), and the full range of new capabilities pervasive connectivity can bring. Some of the first functions that wearable devices are related to identification and security. Maybe you don't consider the badge you wear at work a wearable device, but it does provide identification and security features useful within the work environment. Some advanced badges even include some biometric capabilities (such as fingerprint activation, so only the badge's owner can use it to open a locked door) to improve security. Badges can also include capabilities for location sensing, useful in emergencies to make sure everyone has successfully evacuated the building. A wearable bracelet provides a more reliable indication of location since it is less likely to be left in a jacket on the back of a chair.

Health- and fitness-oriented wearable devices that offer biometric measurements such as heart rate, perspiration levels, and even complex measurements like oxygen levels in the bloodstream are also becoming available racking body temperature, for example, might provide an early indication of whether a cold or the flu is on the way. Some additional capabilities of wearable devices are more mundane, but might also provide information that could be useful in adjusting environmental controls. Wearable devices could tell if you have your jacket on in the car or if it's just in the back seat (perhaps by placing a few stress measurement device threads within the fabric of the jacket). This could be helpful in keeping the car temperature at a comfortable level. If your wristband can measure perspiration levels that could also be used as a data point for adjusting both temperature and humidity. Wearable devices could be allowed to automatically connect to devices around the home too.

E. Military Applications

The aim of IoT is to investigate feasibility of implementing data-centric security mechanisms for military IoT applications, while relying to greatest extent possible on commercially or openly available software and hardware components and services. Our proof-of-concept is a first step towards building a working prototype of secure IoT system based on commercial components, which could be used for larger scale experimentation and as a use case validation for the NATO data-centric security concept. The initial evaluation of available hardware and software libraries, as well as of the public cloud services shows that the existing commercial and open source components offer sufficient functionality for potentially implementing a large variety of military IoT applications at lower cost when compared to fully customized solutions. The lowered reliability and environmental resistance of components could be mitigated by redundant use of devices and services. Also, the architectures relying on commonly used IoT components and platforms can enable better civilian-military collaboration, as well as reuse of Civilian IoT resources available in the conflict area for military purposes.

F. Smart Grid

A smart grid is an energy delivery system that moves from a centrally controlled system, like we have today, to a more consumer driven, iterative system relying on bi-directional communication to constantly adapt and tune the delivery of energy. Through adaptation and tuning, especially at granular levels, greater amounts of energy can be delivered at the right time and at the best price. A smart grid includes many components, including a broad range of sophisticated sensors (over 20 specific types of sensors are used from the power generation unit to the meter into your residence). These components are constantly assessing the state of the grid, the availability of power flowing into the grid, and the demand on the grid. They are also capable of collecting a vast amount of this information over time, to determine what behaviors can be changed to optimize energy delivery.

III. Conclusion

Internet of Things applications are now fast developing. A real-time, low-power, low-cost, and consistent IoT outline will facilitate more sophisticated applications. In this paper, we are presenting Realtime IoT applications framework with configurable nodes and several sensors has been used. This framework can assemble statistics from the neighbouring atmosphere and existing it on the cloud for world-wide availability by the users. In this paper we are presenting applications that are used throughout real-time hardware execution for diverse applications such as military healthcare, wearables, structural health monitoring, object tracking, and linked vehicles etc.

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