

THE INTERNET OF THINGS – A SURVEY OF CURRENT TRENDS AND APPLICATIONS

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Abstract—The Internet of Things is a model where everyday objects can be equipped with recognizing, detecting, interacting and competences capabilities that will allow them to connect with one another devices and services over the Internet to achieve some objective. Ultimately, IoT devices are universal, context-aware and will enable ambient intelligence. The Internet of Things allows devices to be sensed and controlled remotely across existing network setup, making opportunities to integrate the physical devices and computer based systems, for enhanced efficiency, correctness and financial advantage. This survey reports on the current state of research on the Internet of Things by examining the literature, identifying current trends and its application.

Keywords— Internet of Things, IoT, Ubiquitous, Ambient, Machine-to-Machine

I. INTRODUCTION

Internet is getting evolved continuously from the last many decades. Previously Internet was mainly the World Wide Web (a network of linked HTML), which was slowly enhanced to Web 2.0. Due to this now social networking, blogging and online enterprise applications (consumer to business and business to business) are enabled. And it is constantly getting dominated by new web architectures like Web 3.0 (as the Semantic Web).

On another side- Sensor networks, RFID's Near Field Communication is also getting evolved.

Combination of both technologies (Internet and Sensing Devices) enables new opportunities of machine-to-machine communication over the internet, which is known as the Internet of Things (IoT).

This paper shows survey of major applicable areas which are IoT enabled and/or future work can be done.

II. SURVEYED AREAS

Major surveyed areas have been summarized as shown in Fig. 1. It is desirable to consider all possible areas to check the current trends and future possibilities. This paper collects information from major possible areas to make the overall survey.

III. TRENDS AND APPLICATIONS

This section shows major trends and applications from the review of studied literatures.

A. Smart Homes

Sensors and actuators distributed in houses and offices can make our life more comfortable in several aspects: rooms heating can be adapted to our preferences and to the weather; the room lighting can change according to the time of the day; domestic incidents can be avoided with appropriate monitoring and alarm systems; and energy can be saved by automatically switching off the electrical equipment when not needed. For instance, we may think of energy providers that use dynamically changing energy prices to influence the overall energy consumption in a way that smoothes load peaks [7].

1) *Health*: Triage, patient monitoring, personnel monitoring, disease spread modelling and containment—real-time health status and predictive information to assist practitioners in the field, or policy decisions in pandemic scenarios [1].

2) *Smart museum and gym*: As to smart leisure environments, the museum and the gym are two representative examples where the IoT technologies can help in exploiting their facilities at the best. In the museum, for instance, expositions in the building may evoke various historical periods (Egyptian period or ice age) with widely diverging climate conditions [4].

B. Smart Environment/City

The IoT concept, hence, aims at making the Internet even more immersive and pervasive. Furthermore, by enabling easy access and interaction with a wide variety of devices such as, for instance, home appliances, surveillance cameras, monitoring, sensors, actuators, displays, vehicles, and so on, the IoT will foster the development of a number of applications that make use of the potentially enormous amount and variety of data generated by such objects to provide new services to citizens, companies and public administrations [6][10].

C. Smart Grid

Smart grids use IoT technology to collect data about energy consumption and make the data available online. The data are typically incorporated into reports showing patterns of use and include recommendations for how to reduce energy consumption and cost (Liu et al. 2011)[5].

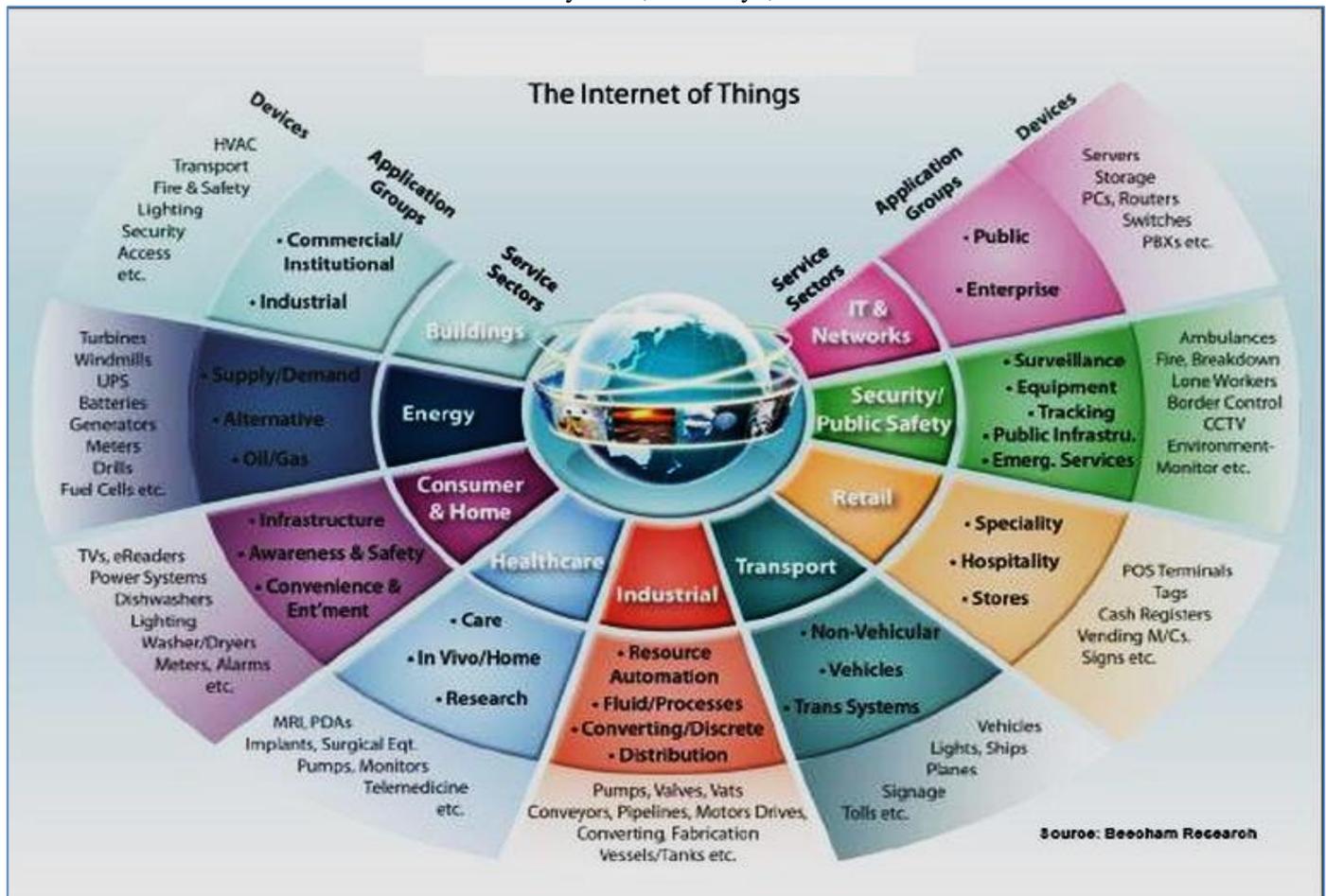


Fig. 1 World of The Internet of Things [14]

D. Industrial Internet

The Industrial Internet of Things (IIoT) is the use of Internet of Things (IoT) technologies in manufacturing.

Also known as the Industrial Internet, IIoT incorporates machine learning and big data technology, harnessing the sensor data, machine-to-machine (M2M) communication and automation technologies that have existed in industrial settings for years [11].

E. Connected Cars

Cars, trains, and buses along with the roads and the rails equipped with sensors, actuators and processing power may provide important information to the driver and/or passengers of a car to allow better navigation and safety [4].

F. Medical and Healthcare Systems

1) *Connected Health:* Many are the benefits provided by the IoT technologies to the healthcare domain and the resulting applications can be grouped mostly into: tracking of objects and people (staff and patients); identification and authentication of people; automatic data collection and sensing [4].

G. Manufacturing

1) *Smart Supply Chain:* Sophisticated control systems

are needed that provide Supply Chain (SC) capabilities for: (i) monitoring, (ii) event management, (iii) optimization and (iv) autonomy [2][3].

2) *Factory:* We refer to the 'Network of Things' within a work environment as an enterprise based application. Information collected from such networks is used only by the owners and the data may be released selectively. Environmental monitoring is the first common application which is implemented to keep track of the number of occupants and manage the utilities within the building [1].

3) *Retail:* Retail is increasingly less about transactions and more and more focused on the relationship between buyers and sellers. The Internet of Things emphasizes this shift with a focus on personalization. A mix of new connected touch points and real-time access to customer data allow retailers to offer better and personalized promotions and customer experiences [12].

4) *Surveillance:* Surveillance, the most widely used camera network applications, helps track targets, identify suspicious activities, detect left luggage and monitor unauthorized access [1].

5) *Business Intelligence:* Things are active participants in business, information and social processes where they are enabled to interact and communicate among

including farm land parcels, stables and machinery, and agricultural products including cattle and produce. These farm outputs are processed into food products in batches.

After processing, products become discrete objects when they are packaged (fresh products are directly packed without processing [2]).

K. Environmental Monitoring

Air pollution, noise monitoring, waterways, industry monitoring [1].

L. Infrastructure Management

Integrating smart objects into physical infrastructure can improve flexibility, reliability and efficiency in infrastructure operation. These benefits can reduce cost and manpower requirements as well as enhance safety[5].

M. Defence

Remote personnel monitoring (health, location); resource management and distribution, response planning; sensors built into building infrastructure to guide first responders in emergencies or disaster scenarios [1].

N. Smart Water

Water quality, leakage, usage, distribution, waste management [1].

O. Robot Taxi

In future cities, robot taxis swarm together, moving in flocks, providing service where it is needed in a timely and efficient manner. The robot taxis respond to real-time traffic movements of the city, and are calibrated to reduce congestion at bottlenecks in the city and to service pick-up areas that are most frequently used [4].

P. City Information Model

The idea of a City Information Model (CIM) is based on the concept that the status and performance of each buildings and urban fabrics such as pedestrian walkways, cycle paths and heavier infrastructure like sewers, rail lines, and bus corridors are continuously monitored by the city government operates and made available to third parties via a series of APIs, even though some information is confidential [4].

Q. Enhanced Game Room

The enhanced game rooms as well as the players are equipped with a variety of devices to sense location, movement, acceleration, humidity, temperature, noise, voice, visual information, heart rate and blood pressure. The room uses this information to measure excitement and energy levels so that to control the game activity according to status of the player [4].

R. Crowd monitoring

Crowd flow monitoring for emergency management, efficient use of public and retail spaces[1].

IV. CURRENT AREAS AND APPLICATIONS

Table-1

Application Areas	Domain	Current Applications
Smart Homes	Health	Smart Therostat
	Entertainment	Connected Lights
	Security	Smart Fridge
	Utilities and Appliances	Smart Door Lock
	Smart museum and gym	Aware Home
Smart Environment/City		Smart Parking
		Smart Waste Management
		Smart Santander
		City Sense
Smart Grid		Smart Metering
Industrial Internet		Remote Asset Control
Connected Cars		Remote Car Control
Manufacturing	Smart Retail	
	Smart Supply Chain	
	Factory	
	Retail	SAP Future Retail Centre
	Surveillance	
	Business Intelligence	
	Smart Metering	
Smart Farming		SiSViA
Smart Water		GBROOS
		SEMAT

V. FUTURE AREAS

Application Areas	Domain
Medical and Healthcare Systems	Connected Health
Transportation	Logistics
	Traffic
	Parking
	Emergency Services
	Highways
	Mobile Ticketing
	Augmented Maps
Personal and Social	Social Networking
	Historical Queries
Environmental Monitoring	
Defence	
Robot Taxi	
City Information Model	
Enhanced Game Room	
Crowd Monitoring	

Table-2

VI. CONCLUSIONS

This paper reported on the current trends and application on of IoT research by examining the literature and identifying current trends. IoT improves the lives using automations, which is applicable to save the time and money with more feasibilities and accuracy.

Major Industrial and Environmental areas are in trend now, as shown in Table-1. Survey Table-2 shows the available applications and also the scope to research and create the futuristic applications.

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