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Role of Internet of Things (IoT) to Overcome Social Challenges

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Abstract - *From an operational prospect and vision, it is functional and exploitable to address the smart devices as IOT (Internet of Things) that connect and communicate. At the same time, the end user gets the benefit from effective communication between Internet of Things and it also upgrades technical novelty in terms of idea, devices or remodeling. Internet of things opens an opportunity for a commercial increase in the inflation of the services provided to the user. New products and utilities are being designed to take fringe benefits of IoT data streams that exist which were not previously present. Lately one can remark the social advantages this Internet of Things can advance to make our surroundings smarter. New scenarios are opened that support evolution of the Internet of People. Social Internet of Things opens one of the ways to these new scenarios. To this motivation, we examine the statistics and development of the objects in the society we live. The main objective is to ascertain what are the key application areas and social objects which are evolving currently and needs to be evolved to make a better society.*

Key Words: **Internet of Things, Social Internet of Things, Social objects, Sensors, RFID**

1. INTRODUCTION

The Internet of Things (IoT) is a term describing a system of connected people, devices, and services [1]. The Web embodies a great number of objects or devices that, provides valuable information and advance services to the users through some standard communication protocols and each device has its own unique addressing scheme. In the future network, it is expected that there will be billions of objects that will play a major active role in connecting the physical world data with the world of digital content and efficient services. The resulting networking paradigm, referred to as the Internet of Things (IoT), will provide a paramount set of opportunities to users, manufacturers, and service providers with a wide applicability in many productive sectors. These include environmental monitoring, health care, inventory and product management, smart home and workplace, security and surveillance, and many others. As a main result, we have today a new approach to build applications that are enhanced and services involving the communications among objects on the Internet of services of the human beings [2]. The inspiration to develop more IoT objects has, therefore, evolved in past couple of years and outstands as succeeding research area that will unsurprisingly continue over the coming years with the beginning of innovative enabling technologies. For example, the arrival of the latest concepts, like big data, informatics centric networking, cloud computing and social networking [3][4]. These technologies have by now to some extent impacted and are playing important role in evolving the IoT idea and many new ultramodern paradigms are already in the sphere of progress. This paper is a review to motivate by the above considerations and aims at providing a vigilant analysis of the technologies that have contributed to the birth of the IoT and to its growth over the time. And also how necessary is the need of smart objects for the social use.

Smart objects are only the first step of an evolutionary process that is affecting modern communication devices and has been triggered by the advent of IoT in the telecommunication scenario. We are currently observing a generational leap from objects with a certain degree of smartness to objects with an actual social consciousness. One primary goal behind such smart integration of devices is to simplify people's lives by having technology work for them seamlessly [5]. Our societies are facing numerous challenges, and therefore the rise of IoT systems taking a significant accountability in this process. The aging procedure of the operational population puts the health and wellbeing issues among the top priorities in our society. Advancements in this vicinity necessitate the introduction of systems and technologies that enables to constantly examine the condition of the environment where people live, work, travel, and to acquire data about the environment of the community themselves. The ensuing information should be accessible everywhere by the smart objects so that appropriate proceedings can be taken when needed. For instance, when the information is acquired through automatic context-aware processes in a smart object to guide the patient in taking the right medicines, the IoT can play a key part in this context. On the other hand, this implies that its mechanism should be far and wide embeddable in the device setup and wearable so to persistently human conditions can be monitored and the issues are transparent as much as possible. Also, the devices should be trustful in handling personal data in a secure way.

As IoT applications proliferate they will become more sophisticated. In many new applications there will be involvement of humans, i.e., humans and things will operate synergistically. Human in-the-loop systems offer exciting opportunities to a broad range of applications including energy management [6], health care, and automobile systems. The following remarkable examples attempt to go well beyond the current vision of an IoT as a mere opportunity of having objects connected and easily increasing interoperability and visibility of smart things in the IoT. There are many biological resources that are used to aim the best use of food safekeeping and sustainable agriculture. Therefore, the concept of smart farms is introduced currently by exploiting the IoT standard

corresponding to major means to reach these goals. In a smart farm the grade of the crop and terrain is always under control, many of the production procedures can be activated remotely by the farmer, sales can be synchronized with the production (as the time schedule of the crop can be shared with external systems), and the usage of resources matches the actual needs (thus, wastage is avoided). However, it is extremely important that the relevant systems are easy to deploy and use. Otherwise, the configuration and the maintenance costs may overcome the benefits. Most countries have agreed on ambitious plans to reduce greenhouse gas emissions, increase the share of renewable energies, and improve energy efficiency. Achieving these objectives would advance our society along the path to sustainability. IoT technologies will take a major role in this context with the intent of delivering systems for automatic management of production and distribution of energy by means of sensors and actuators distributed across the whole chain, with the smart grid as one of the major application scenarios.

IoT numbers are increasing at a dizzying pace. Experts forecast 25 billion connected devices in 2020 [7]. The challenge of a smart, green and integrated mobility is enabling a transportation system that is resource-efficient, environment-friendly, safe and seamless for the benefit of all citizens and of the economy. This is the area where IoT has taken its first steps since RFID tags have been massively used to track goods and improve the efficiency of transport and logistics procedures. Indeed, real-time information processing technology based on RFID and NFC can implement real-time monitoring of almost every segment of the supply chain. By obtaining information related to products promptly, timely, and accurately, either a single enterprise or even the whole supply chain can respond to intricate and changeable markets in the shortest time. It is a matter of fact that the era of seemingly plentiful and low-cost natural resources is coming to an end: sources of raw materials, water, and air, as well as terrestrial, aquatic and marine ecosystems are all under pressure. As a consequence, there is a need for decoupling economic growth from resource usage. An IoT challenge in this direction is to support green economy activities. An exemplary application is the automatic management of the energy consumption in smart cities so that the waste of energy resources is limited if not completely avoided. An IoT does not focus on thing-to-thing or human-to-thing interactions, but proposes a novel role for augmented everyday objects, which are called to:

- Mediate human-to-human communication
- Support additional ways for making noticeable and noticing activities in everyday life

The main objective is to bring awareness and enhance intelligence to the IoT systems by analyzing the interactions between humans and smart objects. In this view the objects within the IoT actively contribute to provide the IoT with the user-friendly experience, ambient, and social awareness by sensing and monitoring human behavior.

2. WEB OF THINGS ARCHITECTURE

The Internet of Things as it appears today and is a theoretical framework that leverages on the accessibility of heterogeneous devices and interconnection solutions, as well as improved physical objects providing a shared information base on global scale, to sustain the design of applications involving at the identical virtual level both people and representations of objects. In accordance with the above definition, we envision that in the next future IoT platforms will evolve towards the architecture shown in Fig 1, as explained in the following. Appropriate software drivers will create abstractions of the IoT physical resources in Sensing Layer. Note that drivers can run either in the IoT devices or in some server. Such abstractions will hide the specific hardware/software features of the IoT resources.

The architectures of these IoT systems are fragmented and cannot correlate and integrate the data from different silos; these isolated IoT solutions use private protocols and cause many problems in information sharing, technology multiplexing, network management, and upgrading.

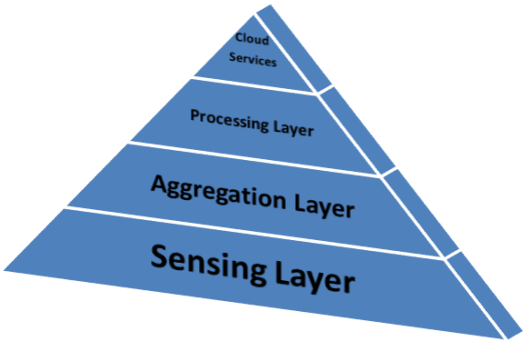

Fig -1: Layers of IoT

All these problems are hindering the development of IoT. In order to reduce the total IoT cost and share information, we need to integrate multiple functions and resources into a larger system. IoT thus needs to be designed with an open and generic IoT architecture with open interfaces and resources, considering different business scenarios, application-based requirements, and current technologies as shown in Fig 2. We have thus seen the motivation to formulate a standard for IoT integration in order to reduce the total cost of money and time from devices, developments, and deployments. An open and generic IoT architecture is an integrated solution with interoperability. It will have the following characteristics.

1) Standard Interface and Protocol: By comparing various private IoT systems, a generic IoT infrastructure has the same hardware and software interfaces, and protocols.

2) Public and Operating: A general IoT architecture is deployed to take over public IoT applications with open operating capability. A public IoT system can thus integrate multiple IoT applications into one architecture.

3) Open, Scalable, and Flexible: An open IoT architecture with open resources, open standards, and open interfaces can easily extend its functionality and the scale of performance. It can thus adapt to different requirements including technical developments flexibly.

The five new elements extending the architecture are:

_ The Quality of Data (QoD) accompanies application data requests, specifying accuracy and timeliness targets. The QoD has an associated element in replies, providing confidence intervals.

_ The Service Layer moderates incoming data requests and actuation attempts, allowing only approved connections through to the private cloud.

_ The Sensing Layer observes and anticipates system behavior, applying context information to determine when system behavior is anomalous or when a command may lead to a fault.

_ The Data Proxy in Network Layer applies process and measurement knowledge to estimate the system state from limited input data.

_ The Application Agent uses prior simulation and learned models to optimize input sampling rates based on acquisition costs and aggregate Quality of Data needs.

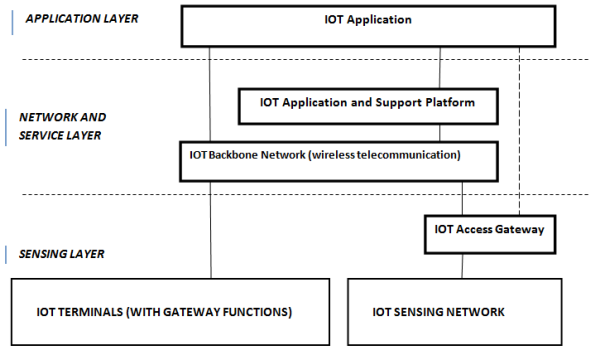

Fig -2: Traditional Architecture of IoT

This "New IoT" optimizes sampling to meet QoD objectives while minimizing resource use and related cost subject to constraints. These constraints include physical constraints, like minimum and maximum sensor sampling rates, as well as application constraints, like minimum and maximum freshness and/or error [8].

3. ADDING THE SOCIAL ASPECT TO IOT

An effective classification of the societal challenges is provided by the Horizon 2020 framework, which is the main program funding research and innovation activities in Europe [9]: health, demographic change and wellbeing; food security and sustainable agriculture; secure, clean and efficient energy; smart, green and integrated transport; climate action, environment, resource efficiency and raw materials; inclusive, innovative and reflective societies; secure societies.

We observe that smart objects will need to operate in an extremely complex context full of opportunities as well as difficulties and threats. It is unlikely that single (even very smart) objects will ever have the capabilities to face such complexity by themselves. The Internet of Things can also be considered as a global network which allows the communication between human-to-human, human-to-things and things-to-things, which is anything in the world by providing unique identity to each and every object [10]. In the natural world, several species of animals (humans are the most brilliant example) have been able to master complexity and the difficulties that characterize the environment in which they live by creating a dense network of social relationships. Accordingly, one can envisage a new generation of social objects that: i) are able to interact with other objects in an autonomous way with respect to the owners; ii) can easily crawl the IoT made of billions of objects to discover services and information in a trust-oriented way; and iii) are able to advertise their presence to provide services to the rest of the network. This is resulting in a new vision of an augmented IoT where the concepts and technologies typical of social networks are applied to the world of things to foster resource visibility, service discovery, object reputation assessment, source crowding, and service composition, similar to what has been partially done to address the routing issue in delay-tolerant networks.

Nonetheless, smart objects are only the first step of an evolutionary process that is affecting modern communication devices and has been triggered by the advent of IoT in the telecommunication scenario. We are currently observing a generational leap from objects with a certain degree of smartness to objects with an actual social consciousness. In analogy with the human evolution from homo sapiens to homo agens used in economic and sociological studies, we may talk of a similar evolutionary path from a res sapiens (smart object) to what we call a res agens (an acting object), which is able to translate the awareness of causal relationships — the basis of knowledge of change and evolution of its environment — into actions.

The major contribution of this article is to provide the reader with a comprehensive analysis of the key aspects of this new phenomenon, with particular attention to the different visions, technical solutions, ongoing projects, and open research challenges that the research community is called to address. The first innovation has been the introduction of what is today commonly referred to as the Web of Things (WoT), which relies on the implementation of web protocols into the objects themselves, or specific objects' proxies/ gateways. Still, the WoT paradigm by itself has some limits, caused by the difficulties in advertising, discovering, accessing, and exploiting the objects and their services. An additional desirable feature is the capability that allows Internet users and services to sense the physical world and

act on it. One approach in this direction is to create a platform where the objects can easily be found, searched for, exploited, and composed. The natural evolution of this idea is improving the attitude of users about sharing their smart objects with people they know and trust (e.g., relatives, friends, colleagues, and fellow researchers), without the need to recreate from scratch any additional social network or user database on a new online service.

This has nothing to do with the IoT object's evolution toward the social consciousness we are addressing in this article, but it is worth mentioning as evidence that the IoT and social networks are two worlds not that far apart from each other. The main idea proposed in that article is that a user who wishes to share data sensed by her own objects can do this by posting such data on Facebook and allowing selected people to view them. A similar approach is proposed in the CenceMe application (http://metrosense.cs. dartmouth.edu/projects.html), which focuses on combining information on the presence of individuals obtained through off-the-shelf sensor, enabled mobile phones, with the user profile in social networking platforms such as Facebook and MySpace.

Another interesting example is given by the MemPhone memory augmentation system, which enables users to associate their memory/experience data with various physical objects through mobile tagging. The interesting results of this study is that by embedding physical contexts into human social networks, object-based social networks can be formed that are augmented by new connections among people with shared memories. Not only are experimental platforms available, but commercial products can also be found on the market. A popular product is the Nike+, which combines individual statistics and visualizations of sensed data and promotes competition between users. The collected data can be shared in social networks with the intent of forming communities around a sensing application. Other applications have emerged that are considerably more sophisticated in the type of inference made, but have had limited uptake, and it is still too early to predict which of them will become the most compelling for the IoT user communities.

A further step ahead in this direction is the definition of an interaction model that does not rely on tight coupling with a single external service whose contract (API and allowed accesses) is subject to change over time. In this sense, the best solution would be to define an interaction paradigm that allows supporting different social networks and enabling users to control which ones to use for each device. A system is described to share IoT smart objects and facilitate access to real-world services offering a RESTful web API. A web platform called Social Access Controller is proposed, which acts as an authentication and sharing proxy for smart things. This helps users to fine-tune the nature of interactions they want to allow for their smart things (e.g., read-only, read-write) and manages the access control based on the existing social structure of several social networks.

Apart from making life more comfortable for users without particular needs, the software system can offer significant advantages to the elderly and/or disabled people as well. For these segments of the population, even the simplest of everyday actions may represent an insurmountable obstacle, hence a system that learns their habits and performs actions in their stead can offer much needed support and safeguards [11].

4. CURRENT SCENARIO

In a more desirable IoT scenario, technology would take people's context into account, learn from it, and take proactive steps according to their situation and expectations, avoiding user intervention as much as possible. Thus, if someone plans to arrive home late, they would like the air conditioning kept off until they're actually on their way back home. Enabling such scenarios requires moving from the Internet of Things to the Internet of People (IoP) [12]. Here, we propose an infrastructure supporting this evolution, and making it possible to construct software for it.

Sample services, applicable to Smart Cities or Smart Homes, are given below:

- The car driver knows about the status of her car and of the roads on the path towards her destination. Such awareness is achieved by accessing, through her mobile phone (or through any communication technology in her car), web services that are fed by data collected from sensors scattered both in her car and in the areas of interest.

- The domestic appliances may be accessed by the owner through web services from remote sites and some actions can be performed on them to prepare comfortable conditions for a better welcome home.

- Eco-compatible houses may be equipped with controllers and sensors able to measure the local energy production and consumption and manageable through web services towards a reduction of the environmental impact.

Besides the obvious advantages of the depicted sample scenarios, one cannot hide the doubts on the ability of the proposed solutions to effectively harness the full potential of the new paradigm without colliding with the limitations of the current Web service platforms in the presence of trillions of additional actors (objects, precisely).

The projects listed here bring together the technological aspects, related to the functionality offered by the so-called smart objects, with the social aspects. Projects in this list mainly fall into one of the three scenarios emerged from the previous sections: participatory sensing, device-in-the-circle, and devices-that-socialize. Table I summarizes the described challenges and the corresponding required IoT features and possible contributions to their overcoming [13].

Table -1: Major Contribution of IOT systems in overcoming social challenges

Societal Challenges	IOT Major Contribution	IOT System Desired Features
Health and Well Being	Monitoring of societies health and quality of life	Transparency Wear-ability (Smart Watches) Security
Food Security and Sustainable agriculture	Smart Farms	Usability Sustainability
Secure, clean and efficient energy	Smart Grids	Stringent QoS Adaptively
Climate action, environment, resource efficiency and raw materials	Smart Cities	Distributed local awareness
Secure Societies	Automatic detection of malicious behavior	Security Trustworthiness

The tools to compose and build personalized and social application that merges together data from different sources belong to a field in continuous evolution and such tools are often the basis for other projects: they are mainly cloud-based because the cloud is always there, up and running, it is reachable from everywhere, and a large amount of application complexity can be moved from the target devices to the cloud components. Among them, RFID is the foundation and networking core of the construction of Internet of Things [14]. In the research paper "Research and application on the smart home based on component technologies and Internet of Things", the included key technologies of IoT are RFID, the sensor technology, nano technology and intelligence embedded technology. IoT, which is integrated with Sensor Technology and Radio Frequency Technology, is the ubiquitous network based on the omnipresent hardware resources of Internet, is the Internet contents objects together. It is also a new wave of IT industry since the application of computing fields, communication network and global roaming technology had been applied. It involves in addition to sophisticated technologies of computer and communication network outside, still including many new supporting technologies of Internet of Things, such as collecting Information Technology, Remote Communication Technology, Remote Information Transmission Technology, Sea Measures Information Intelligence Analyzes and Controlling Technology etc. [15]. IoT has been gradually bringing a sea of technological changes in our daily lives, which in turn helps to making our life simpler and more comfortable, though various technologies and applications.

Smart Transportation

David lives in a residential suburb of Paris. Today, like every day, he's driving his daughter to school before he goes to work. His smart phone has learned where he lives, where he works, and the route he usually takes and at what time. The phone routinely reports this information to the city's transportation control systems. David is happy to anonymously contribute such information, because it's used for simulations and previsions of potential traffic problems, and to plan improvements in the city. David has no need to interact with his smart phone because, when he left home this morning, it already knew where he was going. This was confirmed when it detected that the route and speed were as usual. Unfortunately, a traffic accident just occurred, and David is stuck in a jam. His smart phone detected an abnormally low speed at a certain point in his route. It asks the smart phones of people nearby whether they're stuck, too. On confirmation, it alerts the transportation control systems of a possible incident. Because every smart phone is reporting the same issue, the control system raises a traffic alert and notifies the smart phones of people who usually take the same route, suggesting an alternative. David's smart phone is now receiving information about the new route to follow and the estimated time of arrival. It then passes the new route to the car navigator, which immediately informs David about the best way out of the jam. The smart phone knows that David is now late, and reports to his office, indicating his expected arrival time. Most of the people behind David manage to avoid the jam, and David arrives only 10 minutes late. His unhappiness about the congestion is mild, because he recalls the days when smart phones were only used to talk, read emails, and surf the Web during traffic jams. He's also pleased that he contributed to reducing the traffic jam's impact on his neighbors.

Smart Agriculture

- Agricultural practices will need to continue to develop and become more efficient, if the findings of recent research pieces are anything to go by.
- PwC has reported- Agricultural consumption will need to increase by close to 70 per cent by 2050 to account for the world's growing population — projected to hit 9 billion people in the same year.

World Bank has predicted that those across the globe will need to produce 50 per cent more food by 2050 should global population continue to rise at its current pace.

Farming drones

They offer numerous benefits for those in agriculture. Here are a few reasons why:

They can be used for planting: Drones shooting pods with seeds as well as plant nutrients into the soil, enabling plants to receive the nutrients they need to sustain life.

They can make the most of irrigation: To avoid wasting water around a farm, drones can be fitted with remote sensing equipment.

They can be used to spray and monitor crops: Drones can effectively scan the ground of a farm and then spray the correct amount of liquid once the distance from the ground has been modulated.

Autonomous farm vehicles

- Just like drones, the market for autonomous vehicles is looking very bright.

- There will be close to 10 million cars available which will have either semi-autonomous or fully autonomous capabilities.
- The tractor driver won't be physically in the tractor driving up and down a field. Instead, they will be a fleet manager and agricultural analysts, looking after a number of farming robots and meticulously monitoring the development of their crops.

Smart Cities

- Smart city device shipments will increase from 202 million units in 2017 to 1.4 billion units in 2026
- Smart city market is fragmented at present in the type of smart city projects developed, in the technology, in the ecosystem and in the solutions.
- The smart city market to the next level, successful business models should leverage an extremely wide ecosystem of possibilities and collaborations to make it happen.
- Players in this market range from small startups to international giants and span a variety of backgrounds, from telecom operators and network vendors to software companies, device manufacturers and connectivity players.
- Smart cities aren't possible without city-wide Wi-Fi – everything needs to be connected wirelessly for the smart city to operate.
- Transportation officials can use traffic data to optimize stoplight timing (something currently being done in Palo Alto).
- MC can gather information to improve rubbish collection schedules and be notified instantly if, for example, a water line ruptures.
- Technologies like ShotSpotter are already helping to reduce instances of gunfire by using sensors to determine where the gunshot occurred. This information is relayed to law enforcement, but imagine if that same information could be disseminated through the city's Wi-Fi network to alert residents about a high-risk area to avoid.

Smart Devices for smart cities

- Bigbelly

  Bigbelly is a smart waste and recycling system that has been deployed in all 50 US states and in 50 countries. It provides a solar-powered compacting waste bin that allows for up to five times the amount of waste as in a traditional bin, and it also alerts the appropriate city department when it needs to be emptied, according to Leila Dillon, vice president of marketing for Big Belly.

- Parking sensors

  Imagine driving through a city, and accessing a mobile app that tells you when a parking spot is available. Parking sensors make this happen by sending a signal that indicates whether a parking spot is taken.

- TZOA (Wearables / Citizen Data Sharing)

  "TZOA uses internal sensors to measure your air quality, temperature, humidity, atmospheric pressure, ambient light and UV (sun) exposure all in one wearable device."

- EverImpact (Climate)

  "We help Cities track their greenhouse gas emissions in real-time and monetize their reductions with Carbon Pricing Instruments."

- BestMile

  "BestMile offers an ecosystem to manage autonomous vehicle fleets: fleet management software, a smartphone application, a system for traveler information and solutions for the control of smart infrastructure."

- Kiunsys

  "INES App, a product of Kiunsys, is full stack solution to deal with all aspects of parking including high level tools for management and analytics software down to street level occupation sensors and enforcing tools."

- Anagog

  "We collect and analyze in real-time raw signals from multiple smartphone sensors in order to determine and predict the user mobility status."

- CityZenith

  "The company's software platform maps and visualizes the torrent of data produced by modern cities to an intuitive real-time 3D simulation that anyone from the mayor to the engineer in the field can easily use."

- Solomon

  "Solomon is a growing ecosystem of hyper local technologies, easily combined to create powerful tools and projects for use on the web."

In the field of Smart Cities, the project City Scriptsis an experiment built on top of the Smart Santander platform (with a base of 12000 urban sensors deployed in the city of Santander). The City Scripts project is aimed at integrating and experimenting a Web of Things scenario in which sensors and actuators in the city have a digital counterpart and can be used by citizens to compose personal applications integrating sensor data with social networks and other online data sources.

5. CONCLUSION

The success and growth of the IoT is unquestionable. In this review paper, we have analyzed and discussed the previous and current approaches. We presented different reference scenarios to relate out how people are connected with IoT systems. By people's interactions with the smart objects through their smart phones, our proposal is to reduce the complexity inherent in the IoT, contributing to evolution towards a true IoP. The term "Internet of People" has been used before, but usually to refer to traditional Web systems designed only for humans to use. Here, we use it in the sense of bringing the IoT closer to people, for them to easily integrate into it and fully exploit its benefits

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