**IoT in Smart cities :**

**Abstract:** The large deployment of Internet of Things (IoT) is actually enabling Smart City projects and initiatives all over the world. Objects used in daily life are being equipped with electronic devices and protocol suites in order to make them interconnected and connected to the Internet. According to a recent research study, 50 billion connected objects will be deployed in smart cities by 2020. These connected objects will make our cities smart. However, they will also open up risks and privacy issues. As various smart city initiatives and projects have been launched in recent years, we have witnessed not only the expected benefits but the risks introduced. We describe the current and future trends of smart city and IoT. We also discuss the interaction between smart cities and IoT and explain some of the drivers behind the evolution and development of IoT and smart city. Finally, we discuss some of the IoT weaknesses and how they can be addressed when used for smart cities.

**Introduction :** As cities grow and expand, smart and innovative solutions are crucial for improving productivity, increasing operational efficiencies, and reducing management costs. Citizens are gradually equipping their homes with IoT devices such as TV and Internet box. In the real estate sector, connected objects include thermostats, smart alarms, smart door locks, and other systems and appliances. At the United Nations conference on climate change (Cop21) held in Paris in 2016, connected objects were extensively addressed and gave to many local communities the opportunity to rethink their environmental objectives in order to reduce their CO2 emissions through the use of IoT. The latter can play a vital role in the context of

smart cities. For example, intelligent waste containers can bring real benefits to citizens; they will be able to indicate that they are soon going to be full and must be emptied. Citizens can check through a smart phone application if the waste containers in the street are full or not. Also, after waste containers reports their status, companies can offer route optimization solution to the teams responsible for

garbage collection. Places can be equipped with sensors and monitor environmental conditions, cyclists or athletes can find the most "healthy" trips and the city can respond by adjusting the traffic or by planting more trees in some areas. The data will be accessible to all citizens to promote the creation of applications using real-time information for residents. Cities have become hubs for knowledgesharing. The technologies and solutions needed for creating smart cities are just beginning to emerge and this describes an example of a smart city.

In between the urban context and Information Communication Technologies (ICT), the term smart city is a relatively recent concept, whose diffusion has been rapidly increasing in the last years. Academic and industrial worlds, together with governments, institutions, and citizens, have coined several definitions for this emerging paradigm, which is now extremely popular and attractive. As an example, according to the authors of [1], a smart city could be defined as “a well-defined

geographical area, in which high technologies, such as Information Communication Technologies (ICT), logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well-being, inclusion and participation, environmental quality, intelligent development; it is governed by a well-defined pool of subjects, able to state the rules and policy for the city government and development.” More recently, together with first attempts of practical implementations, the smart city concept has been accused of being often too technology-concentric, mainly driven by technological companies’ own goals, while lacking real attention to the municipality and people’s needs. Therefore, this has led

to a generalized need for a more sustainable approach. Unlike the concept of smart city, sustainability has a long history (being first introduced in 1987) and has been widely accepted. It is based on three main pillars or aspects: social sustainability, environmental sustainability, and economic sustainability. A more recent definition describes a “sustainable city” as an entity for which the inflow of material and energy resources and the disposal of wastes do not exceed the capacity of the city’s surrounding environment. More practically, in order to achieve this goal, the consumption of urban resources in a city should match—or not exceed—the quantity provided by the natural environment (e.g., soil, water, or energy resources). Moreover, pollution levels resulting from the city’s activities should not overwhelm the environment’s ability to provide resources to citizens and other members of the ecosystem. Even if extremely simple and logical, the sustainability concept has been criticized for being, in some cases, outdated and not suitable for the needs of the highly digitized current society, characterized by extremely rapid change and growth. As a consequence of these concepts’ evolution, a new wave of academic discussions proposes a new paradigm, denoted as smart sustainable city, as a response to the current criticisms, proposing a more balanced approach. More in detail, this paradigm aims at combining urban sustainability and smartness of a municipality, focusing on the fact that both aspects should simultaneously be considered to provide the best “urban performance”. A comprehensive definition describes smart sustainable cities as “innovative cities that use ICT and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that they meet the needs of present and future generations with respect to economic, social, environmental, as well as cultural aspects.”

On the basis of these conceptual definitions, it is important to consider how a practical implementation of these concepts will affect the everyday lives of citizens. This is based on the new possibilities opened by the current wave of technological innovation and, more precisely, on the increasing adoption of devices and entities based on Internet of Things (IoT) technologies. The IoT paradigm is one of the key aspects guiding the technological evolution and involvements in several scenarios and contexts, through a multitude of connected devices operating and cooperating

in order to sense the physical world and adapt their behavior taking into account the changing context of the environment where they “live”. Consequently, through the introduction of IoT innovation, smart sustainable cities can improve different aspects of their urban management, for instance, urban mobility, public transportation, e-governance, safety, security, public lighting, and environmental monitoring. The adoption of IoT technologies is expected to allow to monitor, control, and manage all the available resources, such as electric power, soil, water, people, and so on.

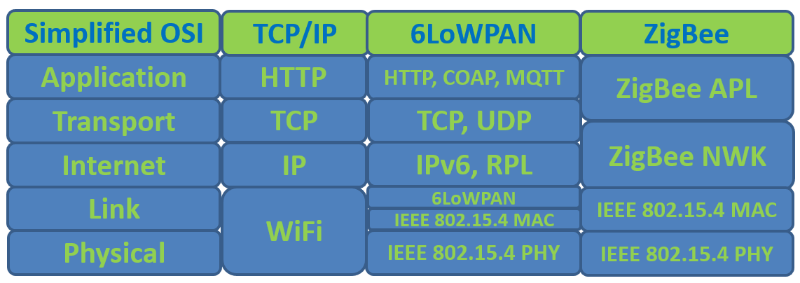
After the deployment of a reliable connectivity infrastructure, which represents the backbone of an IoT-based smart city, it is possible to define the application level in different aspects of urban management, leading to the implementation of services of interest for citizens and institutions. The aim of this paper is to fold: (i) we provide a review of the literature on smart cities, based on different indicators, and (ii) we address the main challenges and propose solutions related to the improvement of these indicators. Through the analysis of the existing literature, we identify the key

challenges and propose IoT-based solutions on how a medium-sized city, such as the city of Parma, Emilia Romagna region, Italy, could improve the services offered to its citizens. In this way, we want to give a reference to researchers, companies, and institutions from different areas to suggest the main challenges that future smart cities have to face in different technological contexts, together with insights and references for smart cities’ administrators, giving them the opportunity to better approach the technological revolution that will pave the way to the smart cities of the future. The rest of the paper is organized as follows. In one, we provide an overview on primary topics to be taken into account in a smart city, namely, the connectivity infrastructure and the set of indicators to be satisfied. In other section presents an overview of possible solutions which a municipality can introduce considering different application areas, with particular attention to the choices of the city of Parma. In next section, we deepen our analysis on the smart sustainable urban mobility topic, which represents one of the key evolution directions for the future of a smart city. In the section after that, an overview on global future research directions is discussed. Finally, in the last sections we draw our conclusions.

**The concept of Smart Cities and IoT Services :**

According to Pike Research on Smart Cities, the Smart City market is estimated at hundreds of billion dollars by 2020, with an annual spending reaching nearly 16 billions. This market springs from the synergy interconnection of key industry and service sectors, such as Smart Governance, Smart Mobility, Smart Utilities, Smart Buildings, and Smart Environment. These sectors have also been considered in the European Smart Cities project to define a ranking criterion that can be used to assess the level of “smartness” of European cities. Nonetheless, the Smart City market has not really taken off yet, for a number of political, technical, and financial barriers. Under the political dimension, the primary obstacle is the attribution of decision-making power to the different stakeholders. A possible way to remove this roadblock is to institutionalize the entire decision and execution process, concentrating the strategic planning and management of the smart city aspects into a single, dedicated department in the city. On the technical side, the most relevant issue consists in the non-interoperability of the heterogeneous technologies currently used in city and urban developments. In this respect, the IoT vision can become the building block to realize a unified urban-scale ICT platform, thus unleashing the potential of the Smart City vision.

Finally, concerning the financial dimension, a clear business model is still lacking, although some initiative to fill this gap has been recently undertaken. The situation is worsened by the adverse global economic situation, which has determined a general shrinking of investments on public services. This situation prevents the potentially huge Smart City market from becoming reality. A possible way out of this impasse is to first develop those services that conjugate social utility with very clear return on investment, such as smart parking and smart buildings, and will hence act as catalysts for the other added-value services. In the rest of this section, we overview some of the services that might be enabled by an urban IoT paradigm and that are of potential interest in the Smart City context because they can realize the win–win situation of increasing the quality and enhancing the services offered to the citizens while bringing an economical advantage for the city administration in terms of reduction of the operational costs [6]. To better appreciate the level of maturity of the enabling technologies for these services, we report in Table I a synoptic view of the services in terms of suggested type(s) of network to be deployed, expected traffic generated by the service, maximum tolerable delay, device powering, and an estimate of the feasibility of each service with currently available technologies. From the table, it clearly emerges that, in general, the practical realization of most of such services is not hindered by technical issues, but rather by the lack of a widely accepted communication and service architecture that can abstract from the specific features of the single technologies and provide harmonized access to the services.



**Role of IoT in Smart Cities :**

Companies use IoT for innovative management and for monitoring widely dispersed processes. As a result, they even can control the latter even from distant places as information is continuously fed into applications and data storage. IoT provides an advantage of knowing things in advance. Due to the low cost of IoT, it is now possible to monitor and manage activities that were previously unreachable. The financial aspect is the best advantage, because this new technology could replace humans who are in charge of monitoring and maintaining supplies. Consequently, costs can be significantly reduced and optimized. IoT also makes it possible to gain completely new insights e.g. associating weather influences to industrial productions.

**Understanding the role of smart city and its components in the IoT era :**

Tokyo, the city with the world’s largest population density keeps growing and boasting the largest number of people of all the cities in the world. Japan’s capital is the largest urban area worldwide with a population of more than 38 million people (38,050,000 people). In addition, more than 31 million people (32,275,000 people) live in Jakarta, Indonesia and around 26 million in Delhi, India. According to forecasts, 60% of the world’s population will live in major cities by 2030.

The consequences: freshwater scarcity, pile of garbage, collapse of traffic and air pollution. How can we cope with these challenges? One key is Smart City - the networked and intelligent city. It stands for better quality of life and lower consumption of resources. Here are five components of the smart city and their impact in the IoT era:

1. Smart Infrastructure

Cities must create the conditions for continuous development: digital technologies are becoming increasingly important, urban infrastructures and buildings must be planned more efficiently and sustainably CO2 emissions should be kept as low as possible for example investing in electric cars and self-propelled vehicles.

Smart cities use intelligent technologies to achieve an energy-efficient and environmentally friendly infrastructure. Smart lighting should only give light when someone actually walks past them like setting brightness levels and tracking daily use to reduce the need of electrical power

2. The City Air Management Tool (CyAM)

Siemens has developed a complete, cloud-based software-suite “The City Air Management Tool”: Captures pollution data in real time and forecasts emissions. Forecasts up to 90% accuracy is possible to gain the emissions for the next three to five days. It is the prediction of air pollution with the measurement of the effectiveness and the technologies that are used which make the City Air Management tool unique. The prediction is based on an algorithm that works with an artificial neural network. CyAM is a cloud-based software suite with a dashboard that displays real-time information on the air quality detected by sensors across a city and predicts values for the upcoming three to five days. Cities can choose from 17 measures to simulate the next three to five days (effects of the air quality for the upcoming three to five days).

Consequences: Introduction of new environmental zones (low-emission zones), speed limits or free public transport. CyAM is based on MindSphere, Siemens' cloud-based, open operating system for Internet of Things (IoT).

3. Traffic Management

Challenge for large smart cities is to optimize traffic. Los Angeles: As one of the busiest cities in the world, the city has implemented an intelligent transport solution to control the traffic flow, pavement integrated sensors send real-time updates of traffic flow to a central traffic management platform which analyses the data and automatically adjusts traffic lights to the traffic situation within seconds. It uses historical data to predict where traffic can go – everything without human involvement.

4. Smart Parking

Intelligent parking solutions identify when a vehicle has left the parking area

The sensors in the ground report via smartphone the driver, where they can find a free parking space Others use vehicle feedback to tell precisely where the openings are and nudge waiting cars towards the path of least resistance. Smart Parking is reality today and does not require complicated infrastructure and high investment making them ideal for a mid-size Smart City.

5. Smart Waste Management

Waste management solutions help to optimize the efficiency of waste collection and to reduce operational costs and better address the environmental issues associated with an inefficient waste collection. Waste container receives a level sensor; when a certain threshold is reached, the management platform of a truck driver receives a notification on the smartphone. The message appears to empty a full container, which avoids half empty drains.

**IoT as an enabling technology for Smart City :**

The IoT concept leverages several ubiquitous services to enable Smart City deployments all over the world. IoT introduces new opportunities such as the capability to monitor and manage devices remotely, analyze and take actions based on the information received from various real-time traffic data streams. As a result, IoT products are changing cities by enhancing infrastructures, creating more effective and cost-efficient municipal services, improving transportation services by decreasing road traffic congestion, and improving citizens’ safety. To achieve the full potential of IoT, smart city architects and providers recognize that cities must not offer a separate smart city feature, but rather deliver scale-able and secure IoT solutions that include efficient IoT systems.

**IoT Applications and Technologies used in Smart Cities :**

It is interesting to consider the application of the IoT paradigm to an urban context. Indeed, many national governments extensively are currently studying and planning how to adopt Information Communication Technology (ICT) solutions in the management of public services in order to realize Smart City concept.

Health of Buildings: To properly maintain the historical buildings of a city we need to: (1) continuously monitor the actual conditions of each building and (2) to identify the most affected areas due to various external agents [26]. The city contains multiple structures, which have different sizes and different ages. It is different

from one city to another, but, generally, most of the structures are very old (such as buildings, dams, or bridges). To assess the conditions of a building, passive WSNs can be embedded within a concrete structure, and periodically send a radio signal of suitable amplitude and phase characteristic to inform about the structure’s

state.

Environmental Monitoring: WSNs process, analyze, and disseminate information collected from multiple environments. The various parameters measured by sensors are:

• Water level for lakes, streams, sewages.

• Gas concentration in the air for cities, laboratories, and deposits.

• Soil humidity and other characteristics.

• Inclination for static structures (e.g., bridges, dams).

• Position changes (e.g., for landslides).

• Lighting conditions either as part of combined sensing or standalone (e.g., to detect intrusions in dark places).

• Infrared radiation for heat (fire) or animal detection.

Waste Management: Waste management becomes an increasing problem in urban living. It is related to many aspects including socioeconomic and environmental ones. One important feature in waste management is environmental sustainability.

A major benefit of global IoT infrastructures is that they provide us with the ability to collect data and, further help in improving effective management for various issues. Nowadays, the garbage-truck needs to pick-up all garbage cans even when they are empty. By using IoT devices inside the garbage can, these devices will be connected to the computing server using one of LPWAN technologies. The computing server can collect the information and optimize the way to garbage-collection is performed by the garbage trucks.

Smart Parking: In this use case, there is a wireless sensor (or connected object) at each parking spot. If a vehicle parks, or if a parked vehicle leaves a parking spot, the sensor at the parking spot sends a notification to a management server. By collecting information regarding the parking bay occupancy, the server can provide parking vacancy information to drivers through a visualization platforms such as smart-phones, vehicles’ Human Machine Interfaces (HMIs) or advertisement boards. These information will also enable the city council to apply fines in case of parking infringements .

Radio Frequency Identification (RFID) technology is automated and can be very useful to vehicle identification systems. Vehicles are identified and parking-lot fees are collected automatically via this system. As for the hardware requirements, by utilizing RFID readers, barriers, parking-lot check-in and check-out controls can be

achieved. In this way, in contrast to personnel-controlled traditional parking-lot operations, an unmanned, automated vehicle control and identification system can be developed as described in. The development of Vehicle Ad Hoc Networks (VANETs) along with the advances and wide deployments of wireless communication

technologies, many major car manufactures and telecommunicationindustries are increasingly fitting their cars with On Board Unit (OBU) communication device. This allows different cars to communicate with each other as well as with the roadside infrastructure. Thus, applications that provide information on parking space occupancy or guide drivers to empty parking spaces, are made possible

through vehicular communications .

Smart Health: A Wireless Body Area Network (WBAN) which is based on a low-cost wireless sensor network technology could greatly benefit patient monitoring systems in hospitals, residential and work environments . The miniature sensors can be

embedded inside the body or mounted on the surface of the body. The sensors communicate with a medical devices using different technologies of WPAN (ZigBee, 6LowPAN, CoAP, etc.). The sensors are also capable of measuring various physiological parameters information (e.g., blood flow, respiratory rate, blood pressure, blood PH, body temperature, and so on), which are collected and analyzed

by remote servers (see Figure 5). The wear ability requirement poses physical limitations on the design of these sensors. The sensors must be light, small, and should not hinder a patient’s movements and mobility. Moreover, because the sensors need to operate on small batteries included in the wearable package, they need to be highly energy-efficient .

Navigation System for Urban Bus Riders: UBN is based on an IoT architecture which uses a set of distributed software and hardware components that are tightly integrated with the bus system. The UBN system deployed in Madrid, Spain is composed of three key components: 1) the network-enabled urban bus system with WiFi equipped buses, 2) the UBN navigation application for bus riders, and 3) the bus crowd information server which collects real-time occupancy information from buses operating on different routes in Madrid.

Smart Grid: The smart grid uses new technologies such as intelligent and autonomous controllers, advanced software for data management, and two-way communications between power utilities and consumers, to create an automated and distributed advanced energy delivery network. Deployed as an infrastructure for sensing and transmitting information for the smart grid, the IoT technology, when applied to the power network, will play a significant role in cost-effective power generation, distribution, transmission and consumption.

Autonomous driving: In a smart city, autonomous driving technologies will be synonymous with saving time for the user. This technology would help speed up the flow of traffic in a city and save almost 60% of parking space by parking the cars closer to each other. According to Nissan-Renault, autonomous vehicles will likely to be marketed in 2020. These "automatic cars" will circulate autonomously at around 30 to 50 km/h as the Renault Next Two-autonomous model of the French manufacturer . In 2017, Volvo will experiment with a hundred autonomous cars driving in real traffic conditions on roads in Gothenburg, London and several

Chinese cities. Through a combination of radar, cameras and ultrasonic sensors located around the car, an autonomous car can detect anomalies all around and trigger an alert that automatically activates the emergency brakes to prevent accidents or collisions. The Intelligent Transport System could enable us to calculate the best route in real-time by connecting different transport modes to save time and

reduce carbon emissions.

**Issues and Challenges faced by Smart cities :**

Networking and transport issues

IoT includes a huge number of objects that should be reachable. Besides, each object will produce content that can be retrieved by any authorized user regardless of his/her location. To achieve this goal, effective addressing policies should be implemented. Currently, IPv4 is the most predominant protocol. However, it is

well-known that the number of available IPv4 addresses is decreasing rapidly and IPv4 will soon become inadequate in providing new addresses. Therefore, we need to use other addressing policies. IPv6 addressing represents the best alternative to IPv4. Many works that aim to integrate IPv6 with IoT have been undertaken

recently. For example, 6LowPAN describes how to implement IPv6 protocol in a WSN context. However, since RFID tags use identifiers rather than MAC addresses (as standardized by EPC global), it is necessary to propose new solutions in order to enable the addressing of RFID tags in IPv6-based networks. Recently, multiple studies that intend to integrate RFID tags into IPv6 networks have been investigated and multiple approaches aimed at integrating RFID identifiers and IPv6 addresses have been proposed. However, results in this area are not completely mature and in particular there are no standards that currently describe how this integration should be done. It is also important to note that RFID mobility is not supported and still represents an open research issue.

In traditional networks, IP addresses are resolved through the Domain Name System (DNS). In IoT, communications occur between objects. Thus, the concept of Object Name Service (ONS) must be introduced and supported. The difficulty of ONS arises especially in the case where the object is an RFID tag. In this case, the tag identifier (or IP address) is mapped onto an Internet Uniform Reference Locator (URL), which points to the relevant information of the object. In other cases, the ONS must have the capacity to associate the object’s description with a given RFID tag identifier (or IP address). However, the design and standardization of such a system is still being investigated by researchers and designers of such systems.

The main goals of the transport layer resides in guaranteeing end-to-end reliability and to perform congestion control. In traditional networks, the Transmission Control Protocol (TCP) supports these goals. However, it is known that TCP is not adapted to IoT environments because of many reasons:

1. Connection setup: in TCP, each session begins with a connection phase procedure called the three-way handshake. Within the IoT ecosystem, a small amount of data will be exchanged. Therefore, the setup phase would last for a large part of the session time. This may lead to additional consumption of resources and energy.
2. Congestion control: TCP ensures end-to-end congestion control. In the IoT context, it can generate performance problems as most of the communications are wireless. Indeed, such an environment is not well optimized for TCP. Besides, the exchanged data amount within a single session, is in general, very small. Finally, TCP congestion control is not very adapted to the IoT environment because the whole TCP session includes just the transmission of the first segment and the reception of subsequent acknowledgments.

1. Data buffering: TCP stores data in a memory buffer at both source and destination. (1) at the source for re transmission needs and (2) at the destination for ordered delivery purposes. The management and allocation of such buffers may be too costly for objects. As a result, TCP cannot be used efficiently for the end-to-end transmission control in IoT and new transport layer protocol solutions are required. The transport layer plays an essential role in IoT. Indeed, attacks towards this layer and its underlying routing protocol will seriously affect the network’s operation. Therefore, the design of secure and effective routing protocols is an important research area in the IoT context. Due to typical characteristics of IoT objects, existing solutions that have been previously applied to adhoc and sensor networks do not completely address the needs of IoT. For example, Denial of Service (DoS) attacks could be more easily achieved on multiple IoT systems. The consequences of such attacks would be disastrous to the systems and their end-users. The best way to detect and stop DoS and DDoS attacks is by using Intrusion Detection Systems (IDSs). However, the implementation of such systems in an IoT infrastructure appears to be a very challenging task because of the specific characteristics of the objects and their capabilities. Another important issue is traffic characterization. Indeed, in IoT, highly heterogeneous objects lead to different scenarios. The charcharacteristics of the related traffic flows generated by these scenarios have not really been studied extensively. The traffic’s characterization represents a is very important step, because it helps network providers to plan the expansion of their infrastructures when it is needed, and to develop appropriate solutions for Quality of Service (QoS) support when needed.

Security issues

The security of IoT is a major challenge for the sustainability and competitiveness of companies and administrations. The US Federal Trade Commission (FTC) pointed out in a report that the planned deployment of IoT technology will open up various security and privacy issues for IoT users and they need to be well addressed or resolved. For many of these critical IoT applications, the use of incorrect or maliciously corrupted data can have serious consequences. Conventional security solutions such as authentication, confidentiality, and data integrity are critical to IoT objects, networks, and applications. If IoT objects have enough memory and

processing power, existing security protocols and algorithms may be applicable, but because of the resource constraints of IoT objects, these existing security solutions are too costly for the objects in IoT. Security issues remain major obstacles to the worldwide adoption and deployment of IoT. In other words, users will not fully adopt

IoT if there is no guarantee that it will protect their privacy. Indeed, IoT is highly vulnerable to attacks for numerous reasons: (1) usually, objects spend most of their time unattended, which makes physical attacks on them relatively easy, (2) most of the communications are wireless, which makes Man-in-the-Middle attack, one of the most common attacks on such a system. Consequently, exchanged messages may be subject to eavesdropping, malicious routing, message tampering and other security issues which can affect the security of the entire IoT, and (3) multiple types of objects such as RFID tags have limited resources in terms of energy and computation power, which prevent them from implementing advanced security solutions.

Connected objects have their own vulnerabilities related to their specific features, in addition to existing vulnerabilities. These new vulnerabilities are caused by:

• Many different types of operating systems are used by the connected objects and are not always well known. The code of an operating system is usually in the order of tens of thousands or millions of lines code. Hence, the likelihood of having vulnerabilities is high.

• There are no known security standards.

• There are many proprietary protocols.

• The architectures are very heterogeneous, and the physical security is often compromised.

• The software integrity update of connected objects is not guaranteed.

• The security of the stored data is not guaranteed.

• The limited resources of a connected object prevent the use of classic cartographic functions and security protocols.

Data security issues can be summarized into data confidentiality, data authenticity, data integrity, and data freshness. Cryptography techniques are the best solutions to support these security needs.

**Future IoT Applications :** Here is a glimpse of futuristic IoT devices.

1. Vision Van of Mercedes-Benz

Vision Van of Mercedes-Benz is a van concept for urban areas and is characterized by several innovative technologies on board such as an autonomous drone delivery. The drone can deliver autonomously within a radius of ten kilometres. Another advantage would be that the parcel carrier saves a lot of time – while loading and delivering. As a contrast, manual-loading takes up to an hour and a half and at one-shot loading it only takes about five minutes. The delivery on the last mile is shortened by the automation technology in the hold and the drones delivering parallel to the deliverer by up to 50%.

2. Smart Eye

The smart eye technology is very similar to Google’s most ambitious project – the Glass. The smart eye is equipped with sensors, Wi-Fi and Bluetooth to provide options and accessibility features right in front of your eye but without causing a distraction. This technology makes it possible to read messages, surf the internet and more.

**Conclusion**

With the expansion and the growth of cities, making them smart becomes vital. Indeed, numerous governments such as US, Chinese or UAE launched smart city’s projects e.g. Malmo, Fujisawa, Songdo and Masdar. IoT represents the best way to make a city smart. Indeed, IoT can applied in multiple scenarios such as monitoring of building’s status with passive WSNs, environmental monitoring e.g. Gas concentration, Water level for lakes or soil humidity, waste management, smart parking, reducing CO2 footprint, or autonomous driving. Achieving such goals needs a tremendous number of connected objects. Indeed, the number of connected objects is growing exponentially and it is estimated that 50 billion connected objects will be deployed in smart cities by 2020. However, this high number will open up numerous risks and privacy issues. In this work, we presented an overview of IoT in the context of smart cities, and discussed how it can enhance a city’s smartness. We also identified the weaknesses and risks associated to IoT deployment and adoption in the smart city environment. As part of our future work, we plan to survey the different solutions and recommendations to address several of the challenges of IoT and smart cities we have discussed in this paper and in particular the security challenges and issues.

The future of IoT is unlimited. It provides solutions in all sectors including manufacturing, fashion, restaurant, healthcare, education etc. Smart cities can share a common smart city platform, which makes sense especially for small cities. The cloud-based nature of IoT solutions for Smart Cities is appropriate by sharing a platform based on open data. Small cities can form a common urban ecosystem. In this way, solutions of small and large smart cities are networked and controlled via the central cloud platform. Finally yet importantly, the size of a city is not an obstacle on the way to becoming "smart". Cities in each group can benefit from intelligent technologies.