ENABLING SMART CLOUD SERVICES TO THE SMART CITIES VIA CARS ARCHITECTURE

N.RAJASEKHAR REDDY, ALTHAF ALI, Y.SURESH BABU

Abstract: The recent emerging technology in cloud based services is remote sensing. Cloud Assisted Remote Sensing (CARS) enables distributed sensory data collection, global resource and data sharing. CARS have great potential for enabling the so-called Internet of Everything. The CARS technology is applied in smart cities. In this paper first we discuss the CARS architecture, functionalities and responsibilities. Second, the Technical solutions and best practice guidelines adopted in the smart city project.

Key Words: Cloud computing, Internet of Everything (IOE), Remote sensing, Smart cities, Network architecture, Constrained Application Protocol (COAP).

Introduction: Our everyday life is totally based on the internet and its usage. Internet access will be of great ease, which helps in the household applications, controlling of cities, and its service approach. The method of gathering and accessing the sensory data will be provided by the CARS. The main objective of this paper is to discuss the general reference framework for the design of an urban internet of things by deploying the CARS architecture into it. Internet has been used primarily as a medium for the transfer of data and exchange of information and has been optimized for access and speed. Analyst now agrees that the next phase of the internet for the people brought by the rise of the internet of things.

Due to enormous amount of variety of connectable device and automatically collected data and entirely new services and features may arise which are to form the basis of among other concept, “smart cities”. The IOT [internet of things] and smart city scenario will bring enormous market opportunity as well as makes cities and life smarter. Smart city technology integrates and analyze massive amount of data to anticipate, mitigate and even prevent many problems. Our daily life will equipped with the necessary gadgets such as the microcontroller, transmitter, receiver etc., for the digital communication which is based on the IOT. We also use the set of suitable protocol stacks that helps in communication between the users which is a integral part of internet. This paper discusses trends, driving smart city growth, the vision for the smart city of the future and the maturity cycle that city can progress through to become smart cities.

Smart City Concept and Services By Using Cars: Urbanization accompanies the economic development. As countries move from being primarily agrarian economics to industrial and service sector, they also urbanize. Smart cities are referred to as “engines of the economic growth” and ensuring that they function as the efficient engine is critical to our economic development. There are some key ways in which internet of everything (IOE) will significantly impact our life. 1) IOE will automate connections. 2) IOE will enable fast Personal communication and decision making. 3) The IOE will uncover new information.

1) IOE will automate connections: there are three types of connections are associated with IOE i) machine-to-machine ii) machine-to-person iii) person-to-person. Today people must proactively connect to the network or internet via mobile devices like smart phones and tablets and to other people on the network via social media sites like face book and linked in.

2) IOE will enable fast personal communication and decision making**:** IOE will enable the communication between the service provider and the user. It also helps in the fast and reliable communication hence IOE has a better performance. It’s also used for the relevant information to apply analytics. It is also used for the personalized channel of communication. This type of data not only enable faster, better decision making but also helps in the complete change of type of services that are not offered by the provider.

3) IOE will uncover new information: with the deployment of so many sensors and other information gathering devices, city manager will be able to understand their city as never before. 22% prior to the sensors, the level of sensing will increase and hence helps in the uncovering of the any new information. The IOE has a new and upcoming updates of the information.

Smart city services using CARS architecture: Due to the lack of widely accepted communication and service architecture that can abstract from the specific features of the single technology and provide harmonized access to the service.

Structural health of building: proper maintenance of the historical buildings of a city requires the continuous monitoring of the actual condition of each building and recognition of areas. The urban IOT may provide a distributed data base of building structural integrity measurements, collected suitable sensors located in the buildings. The database maintained must be publically accessible in order to make the citizen aware of the care taken in preserving the historical heritage. The practical realization of this service requires the installation of sensors in the buildings and surrounding areas and their interconnection to a control system.

Waste management: it is the primary issue in many modern cities, due to the cost of the service and the problem of the storage of garbage in landfills. A depth penetration of the internet domain solutions may result in the significant savings and economical and ecological advantages. 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.

Smart parking: it is also a very beneficial issue in the internet of everything. The benefit deriving from this service is manifold faster time to locate a parking slot means fewer CO emission from the car, less traffic congestion, and happier citizens. The smart parking service can be directly integrated in the urban IOT infrastructure, because many companies are providing market products for this application. By the usage of the short range communication technologies such as radio frequency identifier [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. This is a very efficient tool to quickly spot violations technology.

Air quality: this is a very big issue in the smart city now a day. The target calls for the 20% reduction in the green house gas emissions by 2020 compared with 1990 levels, a 20% cut in energy consumption through improved energy efficiency by 2020 and 20% increase in the use of renewable energy by 2020. The urban IOT can provide means to monitor the quality of the air in crowded areas, parks, or fitness trails. The communication facilities can be provided to let health applications running on joggers devices be connected into the infrastructure. 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: noise can be seen as a form of acoustic pollution as much as carbon oxide is for air. An urban IOT can offer a noise monitoring service to measure the amount of the noise produced at any given hour in the place that adopt the services. Besides building a space time map of the noise pollution in the area, such as service can also be used to enforce public security by means of the sound detection algorithm. This service can improve the quiet of the nights in the cities and also the confidence of public establishment owners. The installations of the detectors or the environmental microphones is quiet 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. The camera based traffic monitoring systems are already available and deployed in many cities, lower power widespread communication can provide denser source of information. Traffic monitoring may be realized by using the sensing capabilities and GPS installed on modern vehicle. This information is of great importance for city authorities and citizens for the former to discipline traffic and to send officers where needed and for the latter to plan. It also helps in the proper and better scheduling of a journey in the city center.

City energy consumption: along with the air quality monitoring service, an urban IOT may provide a service to monitor the energy consumption of the whole city and this enables authorities and citizens to get a clear and detailed view of the amount of energy required by the different services. The services are such as the lighting, transportation, traffic light, control cameras, heating/cooling of public buildings and so on. This leads to the possibility to identify the main energy consumption sources and to set priorities in order to optimize their behavior. In order to obtain such a service, power draw monitoring devices must be integrated with the power grid in the city to enhance the service with the active functionality to control local power production structures.

Smart lighting: optimization of the street lighting efficiency is an important feature**.** This service can optimize the street lamp intensity according to the time of the day, the weather condition and also based on the presence of the people. In order for the working of smart lighting, the 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 Wi-Fi connections to citizens. In addition to this, a fault detection system will be easily realized on top of the street light controllers.

Automation and celebrity of public buildings: another important application of IOT technologies is the monitoring of the energy consumption and the celebrity of the environment in the public building. The public buildings can be schools, administration offices and museums. Monitoring requires the different types of sensors and actuators that control lights, temperature and humidity. By controlling these parameters, indeed, it is possible to enhance the level of comfort of the persons that live in this environment. The positive return will be in terms of productivity, while reducing the costs by heating/cooling.

.

physical world represented via. fog layer to alto-cumulus layer, this layer does not interact directly with CARS customers but serves them through requests received from higher layer.

Alto-cumulus layer: Alto-cumulus layer is the middle layer that serves as a point of liaison between the stratus and cirrus layer. It facilitates negotiations related to pricing policy, regulations and SLAs between stratus and cirrus layer and ensure that the agreed upon terms are not violated. Major functions of alto-cumulus layer are as follows:

1) Serving as a point of liaison between cirrus and stratus layers by translating policy and regulations requirements expressed by cirrus layer into domain-specific requirements understood by stratus layer.

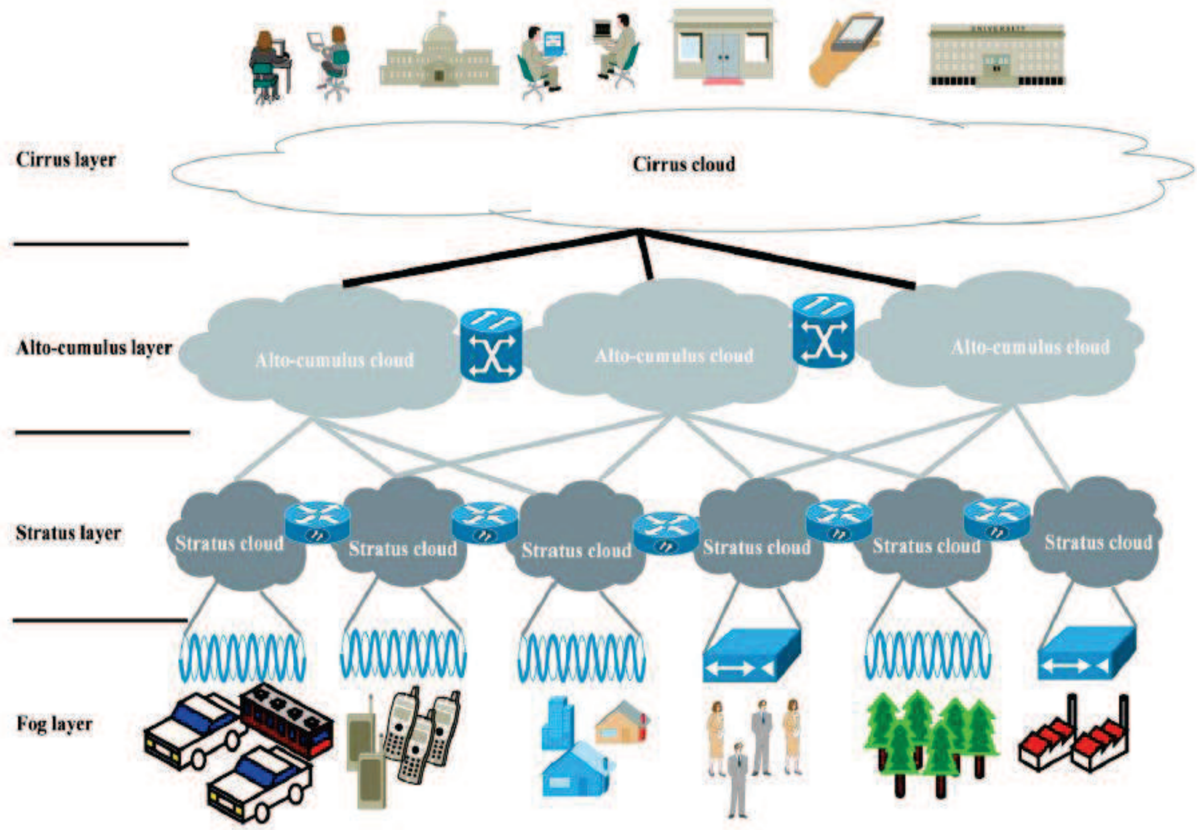
2) Enabling business and payment transactions between cirrus and stratus layers by providing two way brokerage services.

3) Enabling and facilitating SLA negotiations between the cirrus and stratus by playing the role of enforcement agent.

4) Co-coordinating and facilitating inter cloud interactions, data exchange, task migration and resource sharing access different stratus clouds.

Cirrus layer: Cirrus layer is the highest layer in CARS architecture and main role is to interact with the CARS service

Fig1: Proposed CARS architecture



1)Acting as the customers entry point to CARS systems by allowing them to specify their required services via. SLAs and to select their desired service models.

2) Allowing CARS customers to set up their sensing task requirements and do whatever their chosen service model allows them to do.

3) Negotiating SLAs with customers and communicating them to alto-cumulus layer.

4) Providing online applications for remote data analysis to be used by customers to visualize their data in real time.

Smart City Project and Its Architecture: The framework discussed in this paper has already been successfully applied to a number of different use cases in the Context of IOT systems. For instance, the experimental wireless Sensor network test bed, with more than 300 nodes, deployed at the Smart City has been

designed according to these guidelines, and successfully used to realize proof-of concept demonstrations of smart grid and health care services. In this section, we describe a practical implementation of an Urban IOT, named " Smart

City," that has been realized in the city. The primary goal of Smart City is to promote the early adoption of open data and ICT solutions in the public administration. The target application consists of a system for collecting environmental data and monitoring the public street lighting by means of wireless nodes, equipped with different kinds of sensors, placed on street light poles and connected to the Internet through a gateway unit. This system shall make it possible to collect interesting environmental parameters, such as CO level, air temperature and humidity, vibrations, noise, and so on, while providing a simple but accurate mechanism to check the correct operation of the public lighting system by measuring the light.

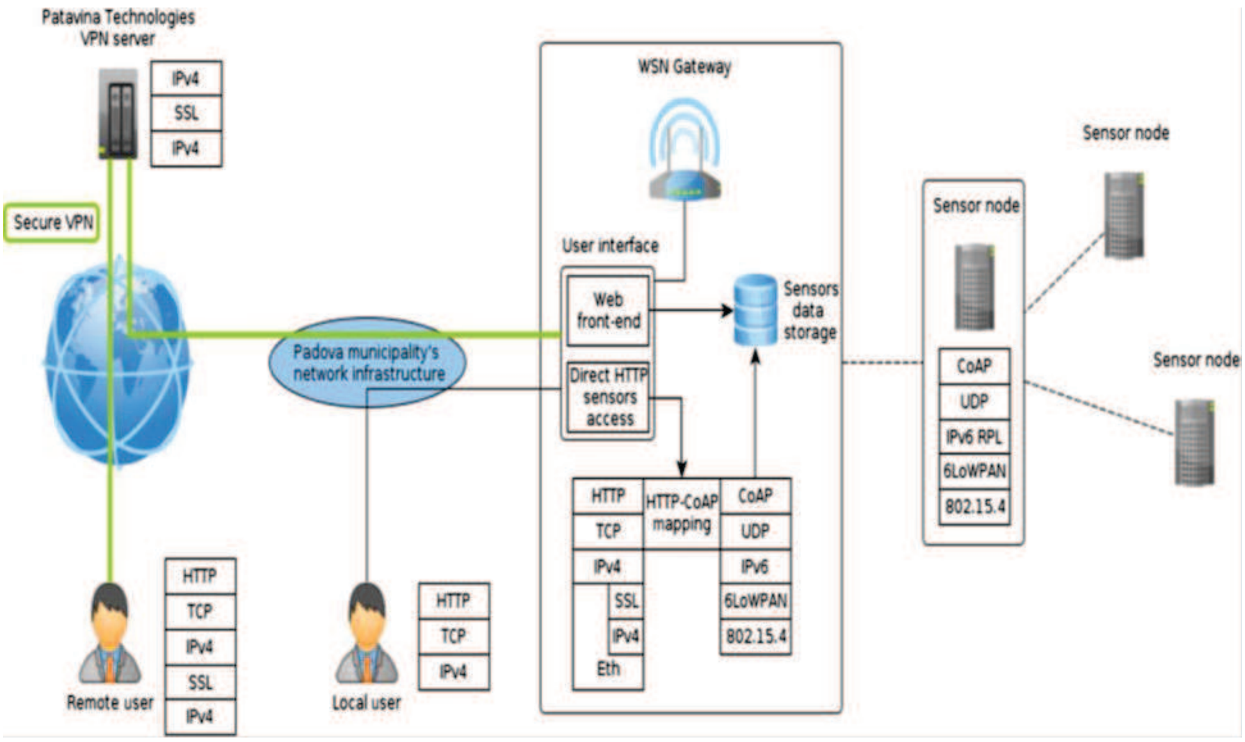


Fig 2: System architecture of smart city

Smartcitycomponents:

A conceptual sketch of the Smart City system architecture is given in Fig. 2. In the following, we describe in more details the different hardware and software components of the system.

Street light: It is the leaf part of the system where IOT nodes are placed. Each streetlight is geographically localized on the city map and uniquely associated to the IOT node attached to it, so that IOT data can be enhanced with context information.

Constrained link layer technologies: The IOT nodes mounted on the streetlight poles form a 6LoWPAN multi hop cloud, using IEEE 802.15.4 constrained link layer technology. Routing functionalities are provided by the IPv6 Routing Protocol for Low power and Lossy Networks (RPL).

WSN gateway: The gateway has the role of interfacing the constrained link layer technology used in the sensors cloud with traditional WAN technologies used to provide connectivity to the central backend servers.

HTTP-CoAP proxy: The HTTP-CoAP proxy enables transparent communication with CoAP devices. The proxy logic can be extended to better support monitoring applications and limit the amount of traffic injected into the IOT peripheral network. For instance, it is possible to specify a list of resources that need to be monitored, so that the server can autonomously update the entries in a cache related to those devices. This mechanism can be supported by two different approaches: 1) by polling the selected resource proactively, thus enabling the implementation of traffic shaping techniques at the proxy or at the gateway and 2) by subscribing to the selected resource using the "observe" functionality of CoAP, thus enabling the server on the node to send the updates only when the value measured by the sensor falls outside a certain range. This service is collocated on the switchboard gateway in the Smart City system, though it could also be placed in the backend servers, thus making it possible to control multiple gateways by using a single proxy instance.

Database server: The database server collects the state of the resources that need to be monitored in time by communication

with the HTTP-CoAP proxy server, which in turn takes care of retrieving the required data from the proper source. The data stored in the database are accessible through traditional web programming technologies.

Operator mobile device: Public lighting operators will be equipped with mobile devices that can locate the streetlight that requires intervention, issue actuation commands directly to the IOT node connected to the lamp, and signals the result of the intervention to the central system that can track every single lamppost and, hence, optimize the maintenance plan.

IOT node connected to the lamp, and signals the result of the intervention to the central system that can track every single lamppost and, hence, optimize the maintenance plan. Such a system can be successively extended to include other types of IoT nodes or clouds of IoT nodes, provided that each IoT peripheral system supports an HTTP-based interface, which makes it possible to interact with it in an open-, standard-, and technology-independent manner.

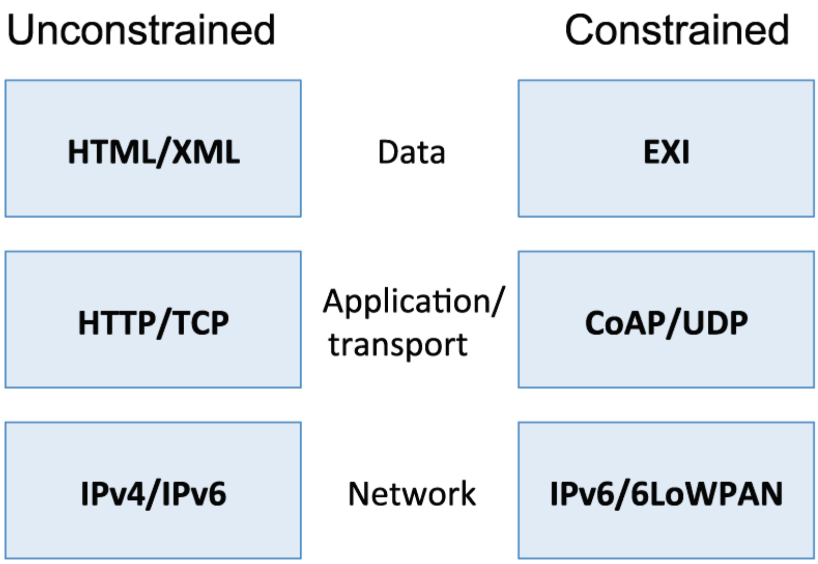


Fig 3: Protocol Stacks for constrained and unconstrained IOT nodes.

Fig. 3 shows a reference protocol architecture for the IoT system that entails both an unconstrained and a constrained protocol stack. The first consists of the protocols that are currently the de-facto standards for Internet communications, and are commonly used by regular Internet hosts, such as XML, In the protocol architecture shown in Fig. 3, we can distinguish three distinct functional layers, namely (i) Data, (ii) Application/ Transport, and (iii) Network, that may require supported by Internet hosts. However, IANA, the international organization that assigns IP addresses at a global level, has recently announced the exhaustion of IPv4 address blocks. IoT networks, in turn, are expected to include billions of nodes, each of which shall be (in principle) uniquely addressable. A solution to this problem is offered by the IPv6 standard , which provides a 128-bit address field, thus making it possible to assign a unique IPv6 address to any possible node in the IoT network. While, on the one hand, the huge address space of IPv6 makes it possible to solve the addressing issues in IoT; on the other hand, it introduces overheads that are not compatible with the scarce capabilities of constrained nodes. This problem can be overcome by adopting 6LoWPA, which is an established compression format for IPv6 and UDP headers over low-power constrained networks.

border router, which is a device directly attached to the 6LoWPANnetwork, transparently performs the conversion between IPv6 and 6LoWPAN, translating any IPv6 packet intended for a node in the 6LoWPAN network into a packet with 6LoWPAN header compression format, and operating the inverse translation in the opposite direction

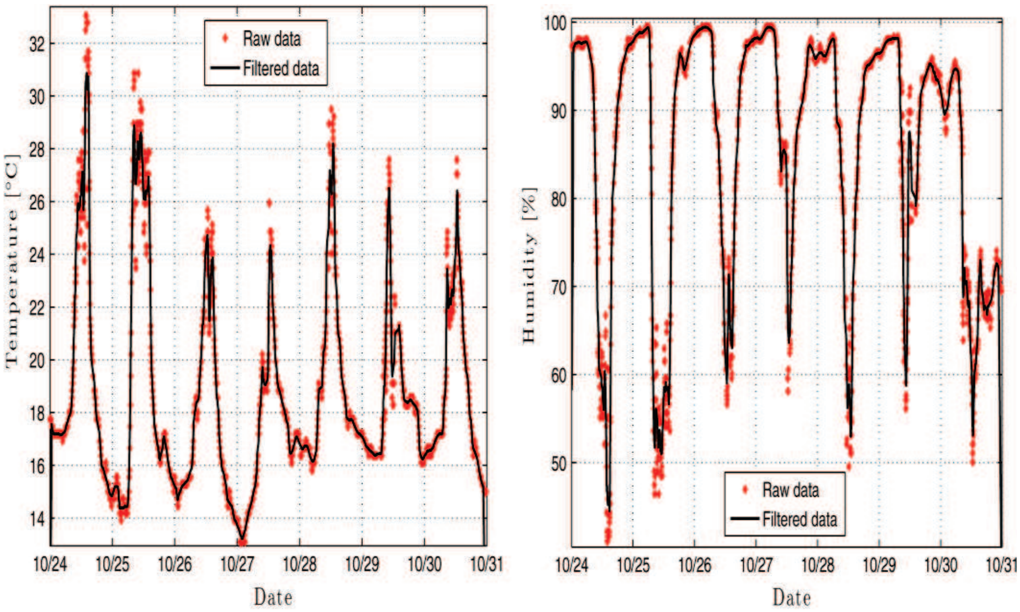
Service	Network type(s)	Traffic rate	Tolerable delay	Energy source	Feasibility
Structural health	802.15.4; WiFi and Ethernet	1 pkt every 10 min per device	30 min for data; 10 s for alarms	Mostly battery powered	1: easy to realize, but seismograph may be difficult to integrate
Waste management	WiFi; 3G and 4G	1 pkt every hour per device	30 min for data	Battery powered or energy harvesters	2: possible to realize, but requires smart garbage containers
Air quality monitoring	802.15.4; Bluetooth and WiFi	1 pkt every 30 min per device	5 min for data	Photovoltaic panels for each device	1: easy to realize, but greenhouse gas sensors may not be cost effective
Noise monitoring	802.15.4 and Ethernet	1 pkt every 10 min per device	5 min for data; 10 s for alarms	Battery powered or energy harvesters	2: the sound pattern detection scheme may be difficult to implement on constrained devices
Traffic congestion	802.15.4; Bluetooth and WiFi; Ethernet	1 pkt every 10 min per device	5 min for data	Battery powered or energy harvesters	3: requires the realization of both air quality and noise monitoring
City energy consumption	PLC and Ethernet	1 pkt every 10 min per device	5 min for data; tighter requirements for control	Mains powered	2: simple to realize, but requires authorization from energy operators
Smart parking	802.15.4 and Ethernet	On demand	1 min	Energy harvester	1: Smart parking systems are already available on the market and their integration should be simple
Smart lighting	802.15.4; WiFi and Ethernet	On demand	1 min	Mains powered	2: does not present major difficulties, but requires intervention on existing infrastructures
Automation and salubrity of public buildings	802.15.4; WiFi and Ethernet	1 pkt every 10 min for remote monitoring; 1 pck every 30" for in-loco control	5 min for remote monitoring, few seconds for in-loco control	Mains powered and battery powered	2: does not present major difficulties, but requires intervention on existing infrastructures

Table 1: Service Specifications of the smart city

The constrained physical and link layer technologies are, instead, generally characterized by low energy consumption and relatively low transfer rates, typically smaller than 1 Mbit/s. The more prominent solutions in this category are IEEE 802.15.4 Bluetooth and Bluetooth Low Energy,8 IEEE 802.11
Low Power, PLC. These links usually exhibit long latencies, mainly due to two factors: 1) the intrinsically low transmission rate at the physical layer and 2) the power saving policies implemented by the nodes to save energy.
Figs. 4 and 5 report an example of the type of data that can be collected with the Smart City system. The four plots show the temperature, humidity, light, and benzene readings over a period of 7 days. Thin lines show the actual readings, while thick lines are obtained by applying a moving average filter over a time window of 1 h (approximately, 10 readings of temperature, humidity, and light, and 120 readings of the benzene sensor, whose sampling rate is larger since the node is powered by the grid). It is possible to observe the regular pattern of the light measurements, corresponding to day and night periods. In particular, at daytime, the measure reaches the saturation value, while during night time , the values are more irregular, due to the reflections produced by vehicle lights.
The discussed technologies are close to being standardized, and industry players are already active in the production of devices that take advantage of these technologies to enable the applications of interest, such as those described. IoT solutions and services, starting from field trials that will hopefully help clear the uncertainty that still prevents a massive adoption of the IoT paradigm. A concrete proof-of-concept implementation, deployed in collaboration with the city, has also been described as a relevant example of application of the IoT paradigm to smart
Ioe Reality: Real World Cases: IOE has the potential to improve our lives by enabling healthcare to become more of an ongoing process in our daily life rather than a series of static events when we need care. Virtual reality, smart surfaces, cloud computing, gesture recognition and new sensing advances like eulerian video magnification and the radiate shirt (change the color according to the body temperature) can literally measure vital signs such as your body temperature and heart beat .By now everyone is

probably familiar with Google glass, Google wearable computer that includes a head-mounted display, attached to fashionable eye glasses. By connecting to

In reality the use cases for IOE are nearly limitless. By taking time to understand how IOE can impact our



(a) (b)

industry and business, we can begin preparing for the IOE

Conclusion: This paper surveys the deployment of smart cities through the implementation of CARS architecture, services and applications. Starts by analyzing the smart city concepts and services

the internet via. Wireless radio in the Google glass augments what users see through their eyes.

deployed through CARS. and analyzing the four layered architecture of CARS and then smart city concept and its services are described along with the IOT architecture with Protocol Stack. and we also described some real world cases of IOT and thereby giving the future enhancement and challenges for the smart city concept for the enhancement of its services.

References:

1. J. Bradley, J. Barbier, and D. Handler, "Embracing the Internet of Everything to capture your share of $14. 4 trillion," 2013.
2. J. A. Stankovic, "Research directions for the Internet of Things," IEEE Internet Things J., vol. 1, no. 1, pp. 3–9, Mar. 2014.
3. C. Pereira, A. Zaslavsky, P. Christen, and D. Georgeakopoulos, "Sensing as a service model for smart cities supported by Internet of Things," Trans. Emerging Telecomm. Technol., vol. 25, no. 1, pp. 81–93, 2013.
4. J Huang, C. M. Kirsch, and R. Sengupta, "Virtual vehicle and cyberphysical cloud computing," 2013.
5. Z. Chong et al., "Autonomy for mobility on demand," in Intelligent Autonomous Systems 12.NewYork,NY,USA: Springer, 2013, pp. 671–682.
6. A. Zanella, N. Bui, A. P. Castellani, L. Vangelista, and M. Zorzi, "Internet of Things for smart cities," IEEE Internet Things J., vol. 1, no. 1, pp. 22–32, Feb. 2014.
7. X. Sheng, J. Tang, X. Xiao, and G. Xue, "Sensing as a service: Challenges, solutions and future directions," USA, Tech. Rep., CPCC-WP-2013-01-01, 2013, unpublished.
8. S. Ehsan et al., "Design and analysis of delay-tolerant sensor networks for monitoring and tracking free-roaming animals," IEEE Trans. Wireless Commun., vol. 11, no. 3, pp. 1220–1227, Mar. 2012.
9. S. Bhattacharya, S. Sridevi, and R. Pitchiah, "Indoor air quality monitoring using wireless sensor network," in Proc. 6th Int. Conf. Sens. Technol. (ICST), 2012, pp. 422–427.
10. S. Bhattacharya, S. Sridevi, and R. Pitchiah, "Indoor air quality monitoring using wireless sensor network," in Proc. 6th Int. Conf. Sens. Technol.(ICST), 2012, pp. 422–427.
11. A. K. Jain, A. Khare, and K. K. Pandey, "Developing an efficient framework for real-time monitoring of forest fire using wireless sensor network," in Proc. 2nd IEEE Int. Conf. Parallel Distrib. Grid Comput. (PDGC), 2012,pp. 811–815.
12. T. Vaidya, P. Swami, S. Rindhe, S. Kulkarni, and S. Patil, "Avalanche monitoring& early alert system

using wireless sensor network," Int. J. Adv.Res. Comput. Sci. Electron. Eng., vol. 2, no. 1, p. 38, 2013.

13. S. Yadav, K. Swarnkar, T. Chauhan, and R. Jain, "How to improve food security and farming systems by using wireless sensor networks (WSN)," J.Inf. Eng. Appl., vol. 2, no. 6, pp. 11–20, 2012.

N.Rajasekhar Reddy
Associate Professor, R.H.Sapat College of Engineering
Althaf Ali
Assistant Professor
M.I.T.S, MadanapalliY.Suresh Babu
Assistant professor
T.K.R. College of Engineering