International Journal of Pure and Applied Mathematics
Volume 120 No. 6 2018, 3101-3117
ISSN: 1314-3395 (on-line version)
url: http://www.acadpubl.eu/hub/
Special Issue

http://www.acadpubl.eu/hub/

BUILDING AN IOT WEB SERVICES FOR INTELLIGENT SYSTEMS

P S V Sucheta[1], D. Vijaya Lakshmi[2],
M.Swami Das[3],
[1]BTech Student, Department of CSE,
[2]Professor & Head, Department of IT,
MGIT, Hyderabad, Telangana, India
[3]Associate Professor, Department of CSE,
MREC(A), Hyderabad, Telangana, India
suchetapallempati6@gmail.com,
vijayadoddapaneni@yahoo.com,
msdas.520@gmail.com

June 10, 2018

Abstract

The Internet is a smart connected, sensor as a medium to communicate people around the world for web applications including online applications, business, trading, games, email and others. The development of IoT devices are discussed, characteristics of IoT, Layered architecture for building the intelligent IoT applications. The various technologies are used to building the IoT systems that use sensors, communication network, service and application layers. IoT is aimed at daily activities in a more convenient way, flexible and highly connected to any objects around the world. In this paper we have discussed fundamental concepts, Types of IoT, characteristics, architecture, communication with Wireless Sensor Networks, features, IoT security, principles, Intelligent IoT connected with sensors to capture data, information

analysis, and various functions, The various IoT, Applications in various sectors are discussed, the study based on web analysis the IoT health wearable devices are shown highest rank, and safety, transportation, environment application are lower rank of IoT systems. In the objects in the real-time in future building Intelligent IoT applications robots soldiers and pilotless planes will be used in military services.

***Keywords*:** IoT, Intelligent Systems, RFID, Wireless Sensor Networks, Web Service.

1 INTRODUCTION

Internet of Things (IoT) is the internet functioning of physical devices with sensors that operated by softwares and network connectivity to process the data. The software agents that are used to process, analyze and visualization of systems. In the year 2000 demand for expedited logistic that use RFID tags for routing inventory, this can be used to identify the object, the tags consist of electronically stored information. Later developments of things, In 2010 IoT is used for cost reduction applications in surveillance, food safety, healthcare, security, transport and document management applications. In future by 2020, the ability of devices to locate in indoor to receive the geological signals, locating the people using sensors that detect every object, efficient teleoperation and monitor control. The software agents and sensors are used to control various devices using web applications; the IoT objects are shown in Figure.1 that consists of sensor-controlled network infrastructure, technologies that are used for smart home, smart grids, intelligent transportation, smart cities and other applications. (Mirjami Jutila(2016)) For IoT to a large number of different heterogeneous systems Andrea Zanella, Nicola Bui etl(2014) proposed a conceptual web-based approach for building Urban IoT to support smart cities. They are compared with various services, network types, traffic rates, tolerable delays energy sources, these, for example, Padova Smart City Project. The Internet is more popular, and a billion numbers of electronic devices and most of the applications are smart buildings and intelligent transportation systems. A Meena

Kowshalya etl., (2017) proposed a trust management model for automatic decision making of objects. The decisions are compared with trust management schemes, models, metrics with various approaches like centralized, distributed systems; these trust predictions will prevent the malicious objects in selective forwarding trust management models are suggested. In ubiquitous computing plays an important role in data production, sensors, and network connectivity for building IoT applications. Shaik Shabana Anjum etl.,(2017) given an over of RFID Sensor Networks(RSN) and energy harvesting, for dynamic energy, to ensure reliable communication. They have discussed RFID characteristics and frequency, taxonomy management of RSN, and IoT energy management strategies.

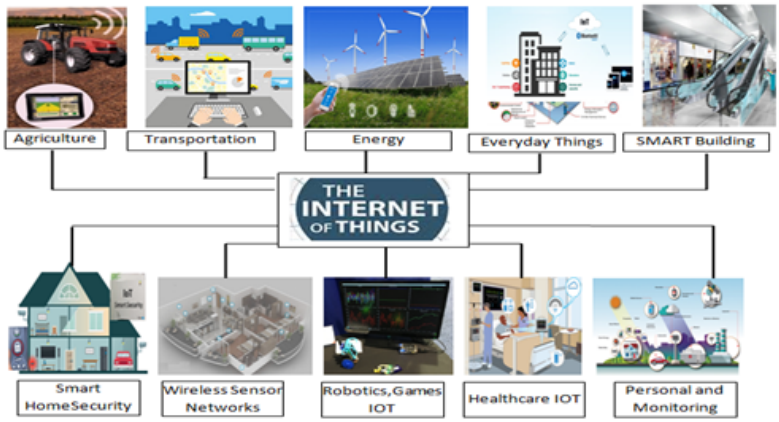

Figure 1: Internet of Things connected devices

The reminder of the paper is organized as describes Internet of Things, Features of IoT, Intelligent system, Web Services, Applications, and Conclusion and future scope.

2 INTERNET OF THINGS

The history of IoT applications is broadly represented as in Evolution of technological developments as shown in the following: **The innovation of radio communications and Computing**:

In the year 1832 the electromagnetic telegraph is invented by Baron Schilling in Russia, Electromagnetic signals are used in radio communications. In 1950 Alan Turing designed computing machinery which is mostly used in compilers and linkers.

Network Protocols and ARPANET: In 1969 Research Advanced Research Project Agency Network (ARPANET is a defense project for communications used packing switching technology), later developments of technology, in 1974 TCP/IP model used for network communications. The model is most widely used in network communication to share the information on the internet.

Evolution of Web: In 1984 Domain name systems are introduced, in 1989 Tim Berners-Lee(British Computer scientist and Software Engineer) proposed the World Wide Web is an internet which is most widely used now in many web applications, and he created the first web page in 1991 later he joined the web Community European Organization for Nuclear Research (CERN). The Internet invention is the inception of web applications.

Social and web Applications: Most of the companies deploy popular devices to connect networked environment, and share information like (text, photos, video, and others) to web users. For example, social familiar web applications are Facebook, WhatsApp, and Twitter.

The intent of Things and Applications: In 1999 is the remarkable year for the Internet of Things that use RFID (Radio Frequency IDentification) for tracking the objects, these stored data process information used in various applications for analytics, the developments of sensor-controlled devices, that can use Wi-Fi communication. The year wise population and devices connected are shown in table.1. Which gives the demand of connected people use IoT (B.K.Tripathy, J. Anuradha(2017).

The Challenges/Issues of IoT: Consumers and end users who want to IoT applications, using smart, and handheld devices, mobile phones, these devices can be connected using network protocols, standards, business process with the highly secured environment, dynamic data update, storing, retrieving, analysis and reporting capabilities.

The issues of IoT some are discussed here:

Table 1: The world population, with devices connected with people

Year	World Population	Connected devices	Connected people percentage
2003	6.3 billion	500 million	0.08
2010	6.8 billion	12.5 billion	1.84
2015	7.2 billon	25 billion	3.47
2020	7.6 billion	50 billion	6.58 9(expected to be)

Scalability: Inter of things can be inside or outside the world, these objects connected using the internet, machine to machine interaction will grow tremendously by users and devices, then the scalability of the system to be increased in all infrastructural and application services.
Continuous object operation (Functionality): The functionality is to add new features to the existing modules with enhanced dynamic object interactions over Application services.
Use Internet IP: The Communication is one of the most essential components, which is wide, using various applications which use connection-oriented, connectionless, WiFi, RFID and other protocols.
The architecture of the IoT system: One the most important backbone of IoT applications is the architecture, the devices /sensors/smart object layers, network layer, service, and application layer support.
Data volumes: The data may be collected, stored, accessed systematically to organize these data for analysis and future predictions.(Mirjami Jutila(2016),Yunior Luis(2016))

Types of IoT
IoT interconnected collection of systems, using communication protocols (wired, wireless), sensors, actuators, RFID, cogitative Radio Networks (CRN) into IoT, these are used to connected things, objects addressable based on standard communication, protocols, allows the people, anywhere, anytime, any path and any service. These can be into three types
Information technology: The connected devices with PC, servers, routers, switches.
Personal Technology: The connected devices use tablets, smartphone, smart watches, and Home appliances and other applications.

Operational Technology: This uses Industrial control systems, control the devices, in various sectors manufacturing, Medical, Environment and other applications.

Future IoT classifications: IoT is a concept that uses pervasive environment of things and objects, information using broadband connections. The people will use connections to open the global network. Future challenges 5G scenarios is shown in figure.2 connecting offices for example Shopping mall, Mobile cloud computing, Energy communications, Smart Grid applications, with reliable connections. Internet of things can be grouped into Technologies for contextual information, security, and privacy.

Characteristics of IoT

Developing IoT products nature of the business process, with infrastructure, communication technologies, into several domains insight development of applications by creating, communication, aggregate, analyze, optimize. Finally, actions performed based on the information. The characteristics of IoT are shown in table.2.

IoT Layered Architecture

Intelligent Services of IoT is network virtualization (i.e., Network topology to meet personalized service requirements), network management, utilization of resources, services oriented virtualization for IoT, Internet of things, Model of network resources, network management, smart computing systems, Smart service architecture is a Service model (Service registration, service discovery, service description, service execution) (Yongan Guo etc.(2016))

Table 2: Characteristics of IoT

Characteristics	Description
Data consumption	The data originated by the devices (physical, sensor objects) to consume the IT infrastructural
Communication connectivity	The connectivity between IoT devices with adaptable and smart network accessibility by secured communication.
Data transformation	The collected information should be transformed into significant knowledge.
Centralized control	IoT connected devices data collected from distributed environment systems, but these data should be centralized in one place for data analysis and reporting.
Perception	It is a part of algorithm used in software/hardware to represent knowledge and perception are applied to the collected data.
Configuration	This is applied to the safety of data when information transmission and use of internet world, cyber applications to physical world or vice verse, and these applications must be provided highly security configurations.
Coordination	The communication and coordination between the connected devices will use an Intelligent method for business logistics, scheduling, and operations.

The architecture for IoT services should be designed, developed, and integrated and utilized in ubiquitous computing

Figure 2: Future communication challenges 5 G scenario Internet of Things

with networking technologies to provide intelligent services. The architecture and design of IoT is a layered approach; it consists of following layers.IoT layered Architecture Figure.3. Shows Lower layer has

Devices /sensors/smart object layers: Various devices connected with communications. Device management layer, machine to machine communication using protocols

Network layer: Receives the data from lower device layer and the network layer has to route, transporting the packets. Device communication and controller in real time computing layer.

Service and application layer support: The Services which are providing services i)Generic support consists of consists of Design, Implementation, and evaluation of applications, APIs, small objects, etc. ii) Specific support for example e-health, telematics support services.

Application Layer: This layer provides the IoT applications, which consists of Process management, rule management, big data processing, and visualizations. GUI based web application: Graphical User Interface based web applications that invoke functions of IoT applications and use of cloud applications.

IoT Communications

IoT smart objects communicate together to make easy life, with

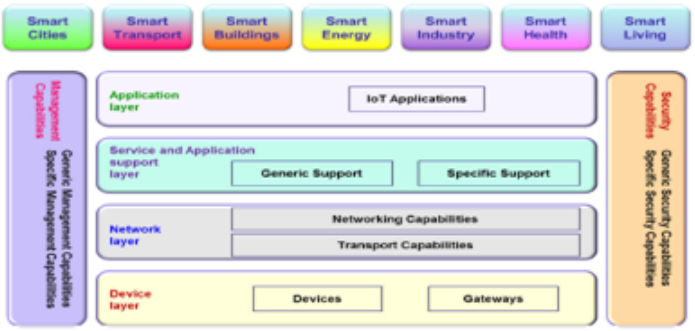

Figure 3: Internet of Things layered Architecture from ITU-T(Marina Ruggieri 2016)

use of smart devices, framework, physical objects, networks, sensors, traditional systems and cloud resources keeping human users. IoT applications resources (local, remote, cloud) and unique distributed services and IoT applications use local resources IoT software architecture to prove human interactions. Demonstration of IoT applications. Using wireless and wired connections with a unique address to operate the things and applications to invoke services. (Marco E. Perez Hernandez(2017))

RFID application system can be used Intelligent Transport system, and other services are an advanced application which without manual operations, the basic model shown in Figure.5 contains RFID, Reader, communication network and receiver.

RFID tag: The device is easy to implant inside of the body of animals and helping them keep track on them. It can store up to 2KB, and it can be attached to the objects, IT contains electronically stored information. It identifies electronic code. Two types of tags shown in Figure.4, Active tag consists of Low power source battery may operate from RFID reader. A passive tag has a Local power source such as Passive Reader is a positive reader which only receives a radio signal from active tags. It is allowing flexibility of application protection and supervision.

Communication Network: is a collection of nodes to communicate and information transmission, data and Network

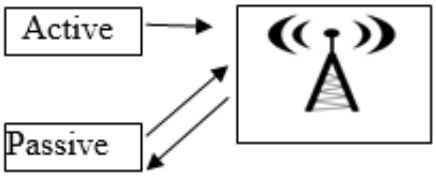

Figure 4: RFID active and passive Elements

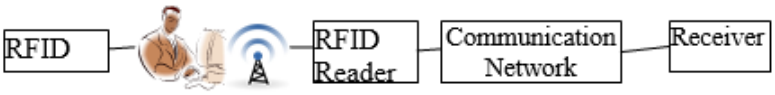

Figure 5: Radio Frequency IDentifier (RFID) basic model

management which is control, administration of traffic, Wireless Sensor Network Wireless sensor networks are designed to process monitor and control Network, Sensor a radio transceiver device (wireless communication), power, external sources (ex. solar, thermal),WSN node contains the wireless communication interface, Processor with memory, Sensor and Power storage

Wireless Communication Interface: The sensor node will receive the signals from communication devices. Wireless communication systems with Computational technologies, and Cellular data, sensing technologies, RFID detections, and other things used in emergency situations. This will give notifications to the users/clients. Wireless Sensor Networks are widely used civilian applications like home, building automation, heath, traffic control and other applications. (A. Flamminiand E. Sisinni(2014)

Receiver: Receivers RF signal and demodulates (extracting original information). There are two types of RF receivers, active and passive which are already discussed above. RFID receiver: Sensors, Local processing Systems, Local storage, Network, Internet, Web services, Cloud services, cloud storage.

Printed Circuit Board: A small PCB (Printed boards mechanically support and electrically connects) modulating (Modulation: is a process of varying one or more properties of a periodic waveform, called carrier signal.) Electronic computing

using conductive tracks, pads, and other features. Capable of transmitting of a radio wave to carry data.

Principles of IoT
Interoperability for enabled communication devices with agreed standards. To provide privacy and security and Government and corporate identity to use smart enable IoT applications.
IoT Security
Security is the most important aspect of the IoT devices, the heart of the system and IoT security into three ways Confidentiality: Refers to the information is disclosed to unauthorized users. Privacy is the guarantee of the information to control for the authorized users. Integrity is the guarantee of the data is not modified or altered by anyone during information access. This can be of two types Data integrity is the guarantee of the information and program only specified by authentication users. System integrity is the assurance of the system performs its intended function is unimpaired manner. Availability is the assurance of system resources and services is available to authorized users and denied to unauthorized users .

3 FEATURES OF IOT

Features of IoT are intelligence, connectivity, sensing, expressing, energy, and safety of applications shown in Figure 6.

4 INTELLIGENT SYSTEMS

Internet-connected devices using sensors of Various IoT applications, information, and data analysis, based on input the IoT system suggest decisions to the users, for example, driverless car. In future robots will be used as soldiers in military operations by 2025 in the USA. The pilotless planes are on its way of development.

Intelligent IoT developing to add information in virtual form presents dynamically represented to audio visual object that human creates influence the human attitude and behavior.

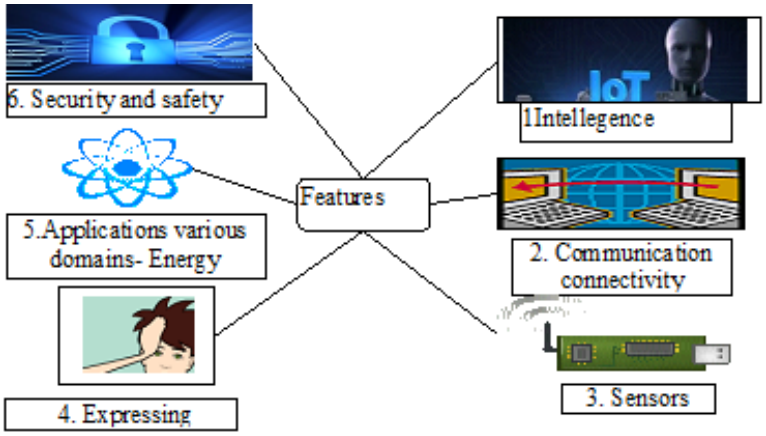

Figure 6: Features of IoT

5 WEB SERVICES

Web service interface is a collection of operations or application programs that are used by clients over the Internet. This web service components are cost-effective solutions, distributed, platform, interpretable, portable, independent environment applications. The components are consists of Simple Object Access Protocol (SOAP), is used for message communication, Web service Description Language (WSDL) service location and functionality of service provider, and Universal Description, Discovery, and Integration (UDDI), this is used to search and locate the services. The development of web applications also includes TCP, HTTP, XML, and others concepts.

Integration of IoT, web service and intelligent applications

Cloud computing: Enable services and provide them on demand with pay as you manner the Cloud services namely application as a service, Platform as a service, and Infrastructure as a service.

IoT applications use sensor based on demand cloud computing applications. Virtualized sensor data and scalable fashion on demand service (such as Sensing as services). Cloud computing

with centralized cloud servers, distributed computing, direct connection to the internet, and Hybrid computing using IoT.

6 APPLICATIONS OF IOT

Applications of IoT into various sectors and domains shown in Table.3 and Figure.7.shows analysis and ranking of IoT applications in various sectors, in these wearable devices has the highest rank, and supply chain has the lowest rank.

Type of Applications
The various applications are shown in table.3, and ranking on web analysis from IoT Analytics-Market Insights for the Internet of Things -2016.

Internet of things made up of a collection of disparate, build networks, and multiple networks control engines with functionality, safety features, and communication systems and so on.

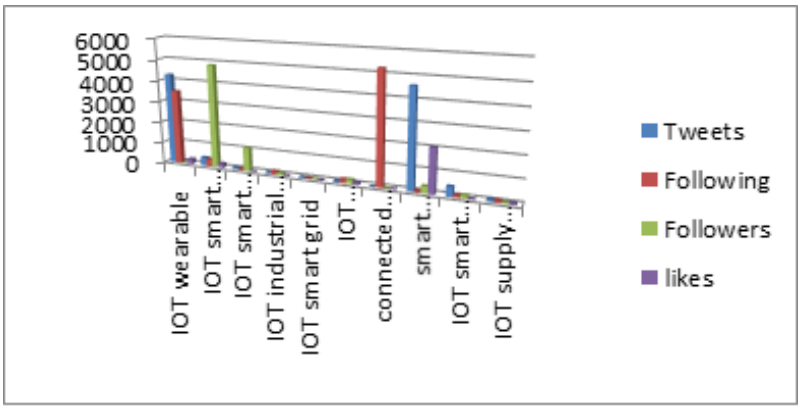

Figure 7: Ranking of IoT number of tweets, following, and followers and like from Twitter. The Analysis, year 2017.(X-axis IoT type, Y-Axis Number users Tweets on internet)

Industry sectors	Type of applications	Type of devices	Ranking web analysis
Wearable devices	IoT functions and applications use Integrated Micro chips in wearable devices that instantly operate data collection, notification, data analysis, security, and visualizations.	Phones, cameras, fitness trackers, heart rate monitors. Multi-device exchange with sensors, data integration, apps, cloud storage, firmware, data analytics	1
smart cities and Construction	Using IoT Technologies for Building management of commercial applications like smart cities	Fire safety, lights, powers, water control, access control	2
Home appliances	In-home sensor controlled devices Education, entertainment, convenience	Digital cameras, Gaming audio, Video system, vehicles, smart home, alarms, Refrigerators, sprinklers.	3
IT, Industrial internet	Customer relationship management(CRM), Enterprise resource planning (ERP), Supply chain management (SCM), Human resources (HR), Finance and Business applications	Smart phones, desktop systems, PC, storage, servers, and embedded systems	4
Smart grid and Energy	Supply and demand management, purification, storage, transport, smart grid	Turbines, UPS, batteries, Generators, compressors, meters	5
Transportation and Logistics	Planning, scheduling, delivery tracking, bill lading, loading applications	Vehicles, RFIDs, tracking objects using sensors, storage, pathway	6
Healthcare & Hospitality	Patient care, Health monitoring	Wearable, MRIs, PDAs, RFID data, surgical equipment monitors, Implants, Bio-sensors	7
Retail	Inventory management, order management, Incident management, service management applications	Receiving RFID data, the point of sales, cash register, vending machines.	8
Manufacturing	Production Planning, scheduling, distribution, process engineering, Industrial design applications	Compressors, conveyors, pumps, motors, turbines, fabrication, assembly, Packing products	9
Public sector	Safety, security, response, emergency, surveillance, weather, environmental applications	Trucks, cars, satellites, space ships, weather sensors, Flight planes	10

Table 3: IoT Applications and ranking based on web analysis

Future is the Internet of things in India: Internet of Things is growing in various areas such as Government is initiative policies to connect the devices and provide various services using devices with web applications via communication. For example intelligent transport system, smart parking, women safety, smart grids, smart urban lighting.

Industries: IoT will transform the companies to do business and innovations. For example. Usage-based Insurance, Intelligent

Emergency Call, and Stolen Vehicle Tracking, etc
Startups: To establish startups in major cities in India by conducting workshops, spread knowledge, awareness about IoT (William Stallings (2005))
100 smart city project in India by Government of India. IoT requires infrastructure facilities systems, devices, communications, in various sectors like healthcare, Information sharing, and other areas. The information for these connected devices has two challenges to provide safety security for Connected devices and Hardware, software applications of IoT devices.
Example application Virtual reality
Virtual Reality: For the smart city is digitally developed intelligent Internet of Things, which offering various service to human beings, for example, virtual real world, augmented reality. The virtual form has two problems Design virtual form for attitude, behavior and Investigate towards some direction.

7 CONCLUSION AND FUTURE SCOPE

IoT First Evolution of the Internet: development and improvement of ARPANET, to protocols, and IoT connected devices data information, knowledge. IoT critical for human progression, IoT device to sense, college, transmits, analyze and distribute data. IoT applications for connecting more objects than people to the internet, a machine to machine communication by installing sensors RFID, IR, GPS. Performance of the IoT devices can be improved, by Operating system, modularity, heterogeneity, network connectivity, Energy run on batteries, MCU, Radio receivers by Oliver Hahm et al. (2016). IoT applications are shown in the table. 3. And Figure.7, Internet of Things (IoT) for building Intelligent IoT web service applications with use of a network of physical objects, devices, buildings and others items embedded with electronics, sensors, software and network connectivity that enables these objects to collect and exchange data. IoT network will use networked radio frequency identification (RFID) and sensing technologies, the IoT as Network of networks, today cars, for example, multiple network

control operations used in the engine, safety measures, communications and so on. IoT network security is added to help reliable and safe services. IoT as into Individual Networks, Connected together and with security and analytics and management. IoT is most important to understand the differences between the internet and World Wide Web (WWW), the Internet is a physical layer or network is made up with switches and routers and other devices, the function of the internet is a point to point data transfer with reliability, and security. The internet usage application is doubled every year. The highest rank of use of IoT devices are wearable health care systems, and lowest rank is safety, environment and transport applications. In future intelligent IoT controlled robotic soldiers; pilotless planes will be used in military services.

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