

# IoT: To transform the Planet into Smart and Pollution Free Environment

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## ABSTRACT

IoT is an acronym for the Internet of Things. In the entire universe, today with the changing excellence in Computer Science and Information Technology, the wave of IoT has become too huge and important by which every one today sets high aim to live automated modern life. It makes positive impact on entire society of the universe. It plays a great role in various sectors and fields. It uses the concept of any network, anyone, anyplace, anyhow, anything and at anytime. That's why, today the Internet and IoT are popular technology for smart activities. The motivations behind this work and overall concept of IoT are related with the property of automation and smartness in things. We are here demonstrate, how IoT transform the planet into smart and pollution free environment? Furthermore, we explore various aspects of current trend and technologies, integrates with IoT. Besides we focus on the evidences and illustrate key challenges in the deployment of IoT. Apart from that, we are giving directions to fill the gap in the field of research. Paper reflects the parametric approach of technical and potential strategic solutions of problematic risk.

**Keywords:** toxic, gas sensor, MQ series sensor, pollution free environment, edge, fog computing.

## INTRODUCTION

The aim of IoT is to transform the Planet into smart where we live. First of all the buzzword IoT was proposed by Kevin Ashton, a British technologist, in 1999 [1]. IoT is the short form for Internet of Things. In this rapidly evolving world and with the changing advancement in science and information technology, the place of IoT has become too important that everyone today sets high goals to live automated modern life. An IoT is one of the innovative researches of the emerging trends in Science and Technology of advanced Computer Science and ICT. IoT makes positive impact on entire society of the World. Also this mechanism is affordable economically for financially stable society. IoT technology is not only economically affordable but also more reliable, comfortable and suitable for real time application.

In the recent modern era of Science and Technology nearly most of the things are automated and working in the Smart and auto switched way in one click or in one touch through different sensors, emerging technologies, innovative research and huge computing with new paradigms. IoT is one of the innovative research-es and newly launch paradigms. To live a sophisticated life style, IoT is used by us in our daily routine. Also it is applied to make more efficient, convenient and intelligent. IoT plays an important role in nearly all the application domains, most of the sectors and fields using any network, any one, from any place, for anything and at any time of any type of service or connectivity. This is the reason that today the Internet has become more popular and ubiquitous. Ultimate-ly, IoT is also ubiquitous. It has touched almost every corner of the globe.

Now a days there is the burning problem of fire, smoke and air pollution. Also the recent IoT technology is the today's burning topic. IoT is integrated with different objects and sensors for real time smart monitoring and detection of fire and air pollution. Due to which environment make neat and clean, and also fruitful for human and animal health. MQ series sensors are used to detect the carbon monoxide, smoke and fire. This sensor or equivalent similar functioned group of sensors is/are connected with Microprocessor Raspberry Pi or Microcontroller

Arduino UNO or Microcontroller ESP8266. Display the physical properties and level of pollution which compares with standard datasets or values by which the IoT technology helps us to smart real time monitor and also detect the particle of PPM (Part Per Million).

IoT includes in various latest technological aspects of Computer Science and Information and Communication Technology for example the concept of fog computing and edge computing to augment performance, improve speedup, reduce latency time, excellence in manufacturing and to take care about risk factor. IoT has been used in smart agriculture, smart buildings and architecture, smart city, smart grids, power management, water management, waste management, air pollution, sound pollution, smart farming and food security, smart living environment for ageing well, home appliances like TV, AC, Fridge, Cooler and Washing machine, markets in the field of health care and retail markets, smart energy and manufacturing companies, smart mobility and transportation, logistics companies, and by media. It is believed that IoT will improve energy efficiency, remote monitoring, and control of physical assets and productivity through applications [2].

WWW (World Wide Web) was introduced to the general public in the mid of 1991 by English scientist Tim Berners-Lee. Net connectivity became big extensive and more popular during the year of 2000. Wireless Sensor Network Technology is integrated with IoT by which in the present scenario and in coming future it approaches with bright and great revolution making more modern, effective and well developed, and great positive impact in almost every corner of our society, ranging from health care to homeland security or environmental protection [3]. This field drawn more attention from researchers and it is the development production of Computer Science, Electronics and Communication Technology.

To investigate the present scenario about how IoT technology takes steps to transform the Planet into Smart and pollution free. In which way and how the recent trends and technologies integrates with IoT to solve different problem and threats along with its potential strategic solution.



**Figure 1: Conceptual images illustrate the concepts of IoT (Source: taken from internet)**

## LITERATURE REVIEW AND MOTIVATION

Performed a study for state of the art in electromagnetic communication in different nanoscale devices. [3] Internet defines a new networking paradigm that is further referred to as the Internet of Nano-Things. This gives new solutions for applications in the bio medical, industrial and military fields. Also in consumer and industrial goods. It will have a positive impact in almost every field of our society from healthcare to homeland security or environmental protection. They highlight the research challenges in channel modeling, information encoding and protocols for nano networks and the Internet of Nano-Things. This discussion is conducted in a focused and systematic manner, as it was the related with fine skills of IoT, as these aspects involves motivation towards main aim of this paper. This paper is useful for us. The motivation comes from by knowing the state of the art in electromagnetic communication in different nanoscale devices and the new networking paradigm, said to be as the Internet of Nano-Things.

Widened the role of IoT to detect fire in forest with practical demonstration. [4] Also monitor fire and smoke range. If it goes on threshold value the fire alarm and message has been gone to fire brigade. As soon as the indication receives through microcontroller module the action will be taken by concern authority. Sensors play an important role in throughout the experiment. Most of the part is hidden in this paper. The hidden part is clear from other secondary data collection. Experimental figure clears

the concept easily. We motivate towards the overall part of practical approach.

Explored the value of distributing and networking smart devices. [5] As the author is the Chief Technology Officer of Echelon Corporation, his experience and case studies has an important and useful for us. Improving energy efficiency gives the motivation. This paper illustrates the real applications and challenges in deploying the IoT. Three case studies are discussed. First, related to building automation, second, about electrical distribution and third demonstrates economic importance of light bulbs. As the Echelon involve in the role of supplier and selling the technology and infrastructure products, the author is more familiar with the details and economic rationale than is normally the case. Echelon's headquarters in San Jose, some 50 miles north from San Francisco, is completely automated. About 80% of the energy consumed is for Heating, Ventilation, Air Conditioning (HVAC). They participate in an energy conservation study with LLL (Lawrence Livermore National Laboratory). There are lot of non intelligent things in the world and replacing those takes five to fifteen years as per author. About these issues few examples are mentioned. Furthermore, problems in the Internet communications, security and interoperability are discussed openly. One and all terms are motivated us, as these terms are practical and related to this paper.

## PURPOSE, AIM AND OBJECTIVE

a) To introduces the IoT features of smart, intelligent, efficient and its potential of doing work for

pollution free continuously with effectiveness and sustainable monitoring.

- b) To introduce different components and tools of IoT such as Microprocessor Raspberry Pi, Microcontroller Arduino UNO, Microcontroller ESP8266, Node-RED, IBM Watson IoT Platform, Thing Speak Platform, IoT geco and so on.
- c) To show evidences for any network, anyhow, at any time, anything and anywhere in the entire world its implement is now becomes possible.
- d) To investigate the recent scenario about how IoT technology takes steps to transform the Planet into Smart and pollution free environment.
- e) To study and find in which way and how the recent trends and technologies integrates with IoT to solve entire problem and threats along with its potential strategic solution.

### EXISTING SYSTEM

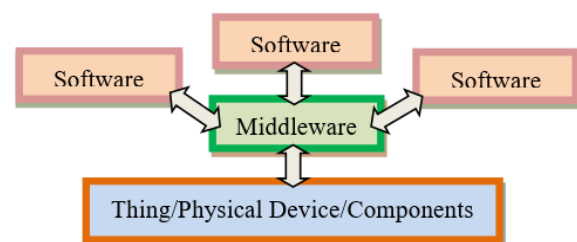
Internet and satellite communication is the existing technology. In existing technology entire things are not covered. Also not possible to sense like humans and if possible by machine then to make connection establishment of all the physical objects is quite difficult by plain Internet. For example as far as monitoring and detection of fire in forest or any such uncertain thing or disaster is concern, in existing satellite communication technologies it requires more latency time due to which action taken for higher authority or for any common person require more time, by which there might be indirectly increase in loss rate of physical and logical things like death rate, property damage, health problems by toxic gases, smoke and particles due to release of Carbon monoxide, Carbon Dioxide and other related particles. This is one of the example, but in general case such problems arise in existing technologies which is one of the threat.

It is quite difficult to make the thing or any object perform in smart and intelligent way with automation, without network or connecting of object/thing. No doubt data analysis, comparison, detection and monitoring for each time slot in real time can be done in existing Internet technologies, but not pervasive or ubiquitous with respect to embedded particular thing/machine/any sensor with entire world. Such various aspects of cumbersome is

avoided by best and recent new smart IoT technology. Due to this new and smart technology not only particular man or society, not only retail market or industry, not only pharmacy or medical even not only one state or country but also the entire world is going to be smart in future. As an internet is the part of IoT, an internet is also becomes ubiquitous.

### BLOCK DIAGRAM AND WORKING

As per the Gartner, Inc., USA, "The IoT is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment."



**Figure 2: IoT Architecture : Controlling/Monitoring Software**

In above figure anything to manage is with the help of sensors which is connected to the Middleware and different software through internet and web application or cloud platforms with interactive development environment easily control, monitor for each time slot continuously and sustainable activity with effectiveness and user friendly, and the data detects by sensor is recorded and compare with standard datasets. As per the requirement or goal, microprocessor/microcontroller performs the function and/or the data is displayed at the end user on screen of smart device as per the purpose of system design.

World where billions of objects can sense, communicate and share information, all are interconnected over public or private Internet Protocol (IP) networks. IoT as on date is the technology one who regulates the world. Software need to control and monitor the domain. Software should provide a user interface and has the ability to regulate the sensors and middleware platform through hardware instructions and doing function by the keys in one touch. As soon as in one touch everything becomes smooth, smart and user friendly.

## COMPONENTS AND TOOLS

As far as concern with the title of this paper, the following tools are used. Integrated technology with IoT helps us to find the potential solution.

### i) *Microprocessor Raspberry Pi:*

The Raspberry Pi launched in 2012. It is the single-board Computer. It is made by the Raspberry Pi Foundation, a UK charity. This foundation works to put power of computation and making portable into the hands of people all over the world. It provides low cost and high performance computers.

Raspberry Pi runs on LINUX. It operates in the open source ecosystem. Its main supported operating system is Raspbian. Red Hat, Inc. [6] The original pi is single core 700MHZ CPU and 256MB RAM. Now the latest model 1.4GHz CPU with 1GB RAM. It is not expensive. Its cost is near about \$20 to \$35 and the Pi Zero cost is only \$5.



**Figure 3: Microprocessor Raspberry Pi**

It uses to solve problems and fun. Also use to learn programming skills, hardware projects, home automations and industrial applications. It also provides a set of GPIO (General Purpose Input/Output) pins. These pins allow controlling electronic components for physical computing and also displaying the same on the output with the help of LCD. It explore the Internet of things (IoT).

For example, if we connect the gas sensor. It detects the smoke and fire, compute the physical properties and compare with standard datasets or values. After computation part finally output should be displayed on LCD or on screen of smart device.

### ii) *Microcontroller Arduino UNO:*

The Arduino UNO is an open source microcontroller board. It is based on small microchip ATmega328P microcontroller. It is manufactured by Arduino.cc. The board has 14 digital I/O pins. It can be powered by the USB cable or 9 volt external battery.



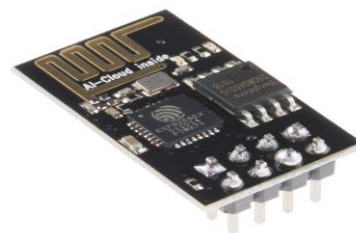
**Figure 4: Microcontroller Arduino UNO**

It accepts voltages between 7 and 20 volts. Arduino Nano and Leonardo are the similar to Arduino UNO. Wikimedia Foundation, Inc. [7] UNO in Italian means one. UNO word chosen to mark the initial release of Arduino Software. In the series of USB-based Arduino boards the UNO board is the first one. The ATmega328 on the board comes preprogrammed with a bootloader. It allows uploading new code to it without the use of an external hardware programmer. Original STK500 protocol is use to UNO communications.

Raspberry Pi is differ from Arduino, Raspberry Pi is the microprocessor where as Arduino is the mimcrocontroller. Raspberry Pi speed is forty times faster than Arduino. Raspberry Pi is 32bit architecture whereas Arduino is of 8bit architecture. Both are used for building various projects and both consist of GPIO. Arduino does not require an interpreter, operating system or any firmware. On the other hand Raspberry Pi is Single Board Computer or SBC, on the board, 32 bit microprocessor, video, audio, USB host, Ethernet, SD card and even HDMI port and also GPIO. Here operating system is typically LINUX.

### iii) *Microcontroller ESP8266:*

Microcontroller ESP8266 is manufactured by Espressif Systems in Shanghai at China. It is a low cost Wi-Fi microchip. It contains full TCP/IP stack and having microcontroller capability. The evolution begins from Western makers in the month of August of year 2014 with the ESP-01 module. Wikimedia Foundation, Inc. [8]

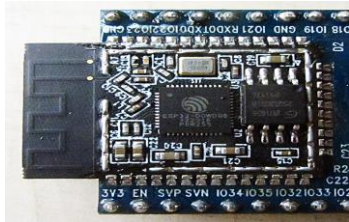


**Figure 5: Microcontroller ESP8266**

It is made by third-party manufacturer Ai-Thinker. This small module make simple TCP/IP connections

and microcontrollers to connect to a wi-fi network. There is no any English documentation on the chip. But commands or instructions are accepted using Hayes-style commands.

The ESP8285 is an ESP8266 with 1 MiB of built in flash and for single chip devices capable of connecting to wifi. [9] As the evolution part, the successor to these microcontroller chips is the ESP32. It is released in 2016. *Wikimedia Foundation, Inc.* [10].



**Figure 6: Microcontroller ESP32**

ESP32 comes with integrated wi-fi and dual mode Bluetooth. It is a low cost and low power system on a chip microcontrollers. Also it includes built-in antenna switches, low-noise receive amplifier, filters, power-management modules and RF balun.

#### *iv) Sensors and Actuators:*

A sensor is an electronic device that is able to measure the physical quantity and generate a considerable output. These output of the sensors are usually in the form of electrical signals. Sensors and Actuators both are very important and basic essential terms of the embedded systems. These are used in IoT technology. The sensor is used to changes in the environment while the actuator is used when along with monitoring the control is also applied to control the physical change. These are used for real life applications such as human health control, flight control system in aircraft, process control systems in nuclear reactors, power plants which are operated in an automated manner.

Sensors are used to measure the continuous and discrete process variables. Actuators agitate continuous and discreet processes parameters. Sensors placed at input port whereas actuators are placed at output port. The outcome on sensor is electrical signal and the outcome of actuators is heat or motion. For example magnetometer, microphones, cameras,

accelerometer and so on are the sensors and LED, Loudspeaker, Laser, motor controllers are the actuators. There are various types of sensors such as position, temperature, pressure, speed sensors, but fundamentally there are two types - analog and digital. The different types come under these two basic types. A digital sensor is incorporated with an Analog-to-digital converter while analog sensor does not have any ADC.

An actuator is a device that alters the physical quantity as it can cause a mechanical component to move after getting some input from the sensor. In other words, it receives control input (generally in the form of the electrical signal) and generates a change in the physical system through producing force, heat, motion, etc. An actuator can be interpreted with the example of the stepper motor, where an electrical pulse drives the motor. Each time a pulse given in the input accordingly motor rotates in a predefined amount. A stepper motor is suitable for the applications where the position of the object has to be controlled precisely, for example, robotic arm.

#### *v) Node-RED:*

Node-RED is the low-code programming for event-driven applications. It is a visual tool for writing the IoT. It is a programming tool for writing together hardware devices, application program interfaces in new and interesting ways. [11] It provides a browser based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single click.

Node-RED is built on Node.js, non-blocking model. This makes it ideal to run at the edge of the network on low-cost hardware such as the Raspberry Pi as well as in the cloud.

#### *vi) IBM Watson IoT Platform:*

IBM Watson IoT Platform is comes under Platform as a service software category. It can help to get a quick start on any IoT project. It is a fully managed, cloud-hosted service designed to make it simple to derive value from your IoT devices.[12] It provides capabilities such as device registration, connectivity, control, rapid visualization and data storage. Easily register and connect sensors and mobile devices.

Remotely monitor the connectivity devices. With IBM Bluemix, visually assemble events from the IoT into logic flows. Use Node-Red in IBM Bluemix for easy drag and drop flow assembly. Collect and manage a time-series view of data and see what is happening on your devices with real time IoT data visualization. Pay for what you use with purchase options available through IBM Bluemix. This highly scalable service allows payment through the IBM Marketplace.

**vii) IOT2cell:**

IOT2cell is a leader in smart city applications. It is a Mobile Collaboration (MCP), which provides the features needed for most of the IoT applications. With small effort collaboration, communication, task management and augmented reality features added to IoT solution. [13] It provides the situational awareness information, video from drones and GPS locations of resources and people. GPS tracking is the best feature. All of this information is available in the palm of your hand through a time tested, user-friendly and well-crafted map based interface.

**viii) IoT gecko:**

IoT allows us to control and puts new dimension on the Internet. It uses to develop our own IoT based system. It uses to read sensor values, operate monitoring machines and do a lot more by using IoT. IoT Gecko Cloud Platform consists capability of API (Application Programming Interface) support over Arduino, Raspberry Pi, Microcontrollers and other controller boards. [14] Bring your internet of things programming skills to life with IOTGecko GUI (Graphical User Interface) builder and customized application creator system. Make desired IOT systems using this open source internet of things development platform. Even with the help of this IoT development platform we setup our devices and also run them on our IOT Cloud today. For that there is no any expense.

We make our own layout as per our choice and desired theme online. With desired GUI using IoT Gecko sustainable monitor and operate the IoT system. Select from various options of IoT themes ranging from industrial automation, healthcare automation, home automation to liquid sensing

and fire and air pollution monitoring. IOTGecko offers the largest platform to operate and develop internet of things based systems with ease. Monitor and control the physical world using our web interface on IOTGecko.

**THREATS AND RISK**

For new researchers in the area of IoT it is very important besides there problem statement, also to think, learn and study about threats of IoT. In the new advanced high profile admired and wonderful digital World there are chunk of threats which might be dangerous and harmful for users of IoT.

That is, the latency time require for automation of an object of IoT, and second one is security problem because each action part is related with Internet.

**a) Latency time:**

Time require to take action after processing for automation of IoT based system. If latency time require more then there might be problem where there is real time application. For example in case of IoT based healthcare automation. If latency time is not reduced then there might be possibility of the patient is no more. So due to more latency time this kind of harm effect might be seen. Similarly in IoT based fire system huge property losses, animal and human life losses may happen due to more latency time. For this the concept of fog and edge computing concept is applied. This is the solution for more latency time.

**b) Security:**

It is very important issue with IoT. Security system must be in isolation as they are unable to secure interconnected devices. Hence it is hard to measure the risk factor such as financial data breaches. Similarly commercial enterprises face the challenge of changing technology trends and lack of clarity of information security standards, governance and so on. By which it is quite difficult to proceed the process further.

Public trust is the major challenge due to emerging technologies integrating, aggregating, and exchanging data which raises privacy concerns. Enterprises owning or depending on cyber-physical systems should maintain safety, stability, as well as availability of collected data.

Concern with smart city safety, security and infrastructure part is highly customer confidence and each city shall take active precautions in the type and nature of security they build with respect to citizen specific data. [15] These steps can prevent Safety & Security breach: 1. Compliance audit 2. Statutory policies 3. User training and awareness programs and 4. Share the statistics with public.

## CONCLUSION

A smart world shouldn't just save money, but should also be attractive and fun to live in such smart Planet. Everyone wants in to the ground floor of the IoT. Throughout the current trend and technologies, the IoT technology is comes under in Computer Science, Electronics and Information & Communication Technology. It uses for any network, any place, anything, any time and any how makes thing to be automated and smart. For new researchers in the area of IoT it is very important besides there problem statement, also to think, learn and study about threats of IoT. In the new advanced high profile admired and wonderful digital World there are chunk of threats which might be dangerous and harmful for users of IoT. That is, the latency time require for automation of an object of IoT, and second one is security problem because each action part is related with Internet. This paper covers overall and near about part of the concept and background of IoT.

IoT themes ranging from industrial automation, healthcare automation, home automation to liquid sensing and fire and air pollution monitoring. MQ series sensor is used to capture the level of temperature and humidity and via microcontroller and cloud platform as per the standard dataset values compare and detect actual values of carbon monoxide, particle per million (PPM) and so on, also sustainable monitoring pollution level in the environment and with the help of cloud platform the IoT based system parameters are developed and explore in entire world. The largest platform to operate and develop internet of things based systems with ease. Monitor and control the physical world using our web interface on IOTGecko.

Finally, we can say in short but sweet that the IoT is the technology by which it is possible to transform the planet into smart and pollution free environment.

**Conflicts of interest:** The authors stated that no conflicts of interest.

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