

# A Survey on Deployment Applications and Challenges of Internet of Things (IoT)

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**Abstract**— This paper presents an overview of recent Internet of Things (IoT) based applications and challenges in-fort of IoT. The IoT based systems are easy to install and use. As the system interfaces with the cloud, then it is essential to protect it from harmful attacking situations.

**Index Terms**— Internet of Things (IoT), Smart Integration, Cloud Computing, Cyber securities.

## I. INTRODUCTION

The term “Internet of Things” (IoT) was first used in 1999 by British technology pioneer Kevin Ashton to describe a system in which objects in the physical world could be connected to the Internet by sensors [1]. Ashton coined the term to illustrate the power of connecting Radio-Frequency Identification (RFID) tags used in corporate supply chains to the Internet in order to count and track goods without the need for human intervention [2].

The main strength of the IoT concept is the high impact on several aspects of everyday domestic purposes and industrial applications. Few examples of domestic application are assisted living, enhanced learning and e-health and in the context of industrial purposes are industrial manufacturing, automation, logistics, business/process management, intelligent transportation and security management etc.... From the last few years there is shift of industry towards the IoT technology, but even amid this environment connected devices are typically thought of as the preserve of additional developed markets[3]-[5].

The large-scale rating of IoT devices promises to make over many aspects of the way we live. New IoT products like, home automation workings, Internet-enabled devices and energy control & management devices are helping us move towards a vision of the “smart home”, offering more energy efficiency along with security. On the other hand small and efficient personal IoT devices like health monitoring devices, wearable fitness and network enabled medical devices are transforming the way healthcare services are delivered [6]. To minimize the congestion and energy consumption of ‘smart cities’ IoT systems like intelligent traffic systems, networked vehicles, sensors embedded roads and bridges can be used. By using sensors enabled network IoT technology can transform industry, agriculture, and energy sector to increase the availability of information along the value chain of production. However, IoT raises many issues and challenges that need to be considered and should be minimized [7]-[14].

## II. APPLICATIONS OF IOT

With the robust features of the technology, the Internet of Things exhibits a broad field of applicability and is shown by Table.1.[12]-[20].

Table.1. Applications of IoT

| Column I: Major Application Area of IoT | Column. II: Sub-application of column.1 | Column.III: Purpose & Functioning of Colum. II  |
|---|---|---|
| I. Smart Cities                         | 1. Smart Parking                        | Monitoring of parking spaces availability in the city.  |
|   | 2. Structural health                    | Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.  |
|   | 3. Noise Urban Maps                     | Sound monitoring in bar areas and centric zones in real time.   |
|   | 4 Smartphone Detection                  | Detect iPhone and Android devices and in general any device which works with WiFi or Bluetooth interfaces.  |
|   | 5. Electromagnetic Field Levels         | Measurement of the energy radiated by cell stations and WiFi routers.   |
|   | 6. Traffic Congestion                   | Monitoring of vehicles and pedestrian levels to optimize driving and walking routes.  |
|   | 7. Smart Lighting                       | Intelligent and weather adaptive lighting in street lights.   |
|   | 8. Waste Management                     | Detection of rubbish levels in containers to optimize the trash collection routes.  |
|   | 9.Smart Roads                           | Smart Roads Intelligent Highways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams. |
|   | 10. Forest Fire Detection               | Monitoring of combustion gases and preemptive fire conditions to define alert zones.  |

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|---------------------------------------|--|---|
| <b>II. Smart Environment</b>          | 11. Air Pollution                        | Control of CO2 emissions of factories, pollution emitted by cars and toxic gases generated in farms.  |
|                                       | 12. Snow Level Monitoring                | Snow level measurement to know in real time the quality of ski tracks and allow security corps avalanche prevention.                        |
|                                       | 13. Landslide and Avalanche Prevention   | Monitoring of soil moisture, vibrations and earth density to detect dangerous patterns in land conditions.                                  |
|                                       | 14. Earthquake Early Detection           | Distributed control in specific places of tremors.  |
| <b>III. Smart Water</b>               | 15. Potable water monitoring             | Monitor the quality of tap water in cities.   |
|                                       | 16. Chemical leakage detection in rivers | Detect leakages and wastes of factories in rivers.  |
|                                       | 17. Swimming pool remote measurement     | Control remotely the swimming pool conditions.  |
|                                       | 18. Pollution levels in the sea          | Control real-time leakages and wastes in the sea.   |
|                                       | 19. Water Leakages                       | Detection of liquid presence outside tanks and pressure variations along pipes.   |
|                                       | 20. River Floods                         | Monitoring of water level variations in rivers, dams and reservoirs.  |
| <b>IV. Industrial Control</b>         | 21. M-M Applications                     | Machine auto-diagnosis and assets control.  |
|                                       | 22. Indoor Air Quality                   | Monitoring of toxic gas and oxygen levels inside chemical plants to ensure workers and goods safety.  |
|                                       | 23. Temperature Monitoring               | Control of temperature inside industrial and medical fridges with sensitive merchandise.  |
|                                       | 24. Ozone Presence                       | Monitoring of ozone levels during the drying meat process in food factories.  |
|                                       | 25. Indoor Location                      | Asset indoor location by using active (ZigBee) and passive tags (RFID/NFC).   |
|                                       | 26. Vehicle Auto-diagnosis               | Information collection from CanBus to send real time alarms to emergencies or provide advice to drivers.                                    |
| <b>V. Smart Metering</b>              | 27. Smart Grid                           | Energy consumption monitoring and management.   |
|                                       | 28. Tank level                           | Monitoring of water, oil and gas levels in storage tanks and cisterns.  |
|                                       | 29. Photovoltaic Installations           | Monitoring and optimization of performance in solar energy plants.  |
|                                       | 30. Water Flow                           | Measurement of water pressure in water transportation systems.  |
|                                       | 31. Silos Stock Calculation              | Measurement of emptiness level and weight of the goods.   |
| <b>VI. Security &amp; Emergencies</b> | 32. Perimeter Access Control             | Access control to restricted areas and detection of people in non-authorized areas.   |
|                                       | 33. Liquid Presence                      | Liquid detection in data centers, warehouses and sensitive building grounds to prevent break downs and corrosion.                           |
|                                       | 34. Radiation Levels                     | Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.                              |
|                                       | 35. Explosive and Hazardous              | Gases<br>Detection of gas levels and leakages in industrial environments, surroundings of chemical factories and inside mines.              |
| <b>VII. Retail</b>                    | 36. Supply Chain Control                 | Monitoring of storage conditions along the supply chain and product tracking for traceability purposes.                                     |
|                                       | 37. NFC Payment                          | Payment processing based in location or activity duration for public transport, gyms, theme parks, etc.                                     |
|                                       | 38. Intelligent Shopping Applications    | Getting advices in the point of sale according to customer habits, preferences, presence of allergic components for them or expiring dates. |

|   |                                       |   |
|---|---------------------------------------|---|
|   | 39. Smart Product Management          | Control of rotation of products in shelves and warehouses to automate restocking processes.                                 |
| <b>VIII. Logistics</b>                    | 40. Quality of Shipment Conditions    | Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.                     |
|   | 41. Item Location                     | Search of individual items in big surfaces like warehouses or harbors.  |
|   | 42. Storage Incompatibility Detection | Warning emission on containers storing inflammable goods closed to others containing explosive material.                    |
|   | 43. Fleet Tracking                    | Control of routes followed for delicate goods like medical drugs, jewels or dangerous merchandises.                         |
| <b>IX. Smart Agriculture</b>              | 44. Wine Quality Enhancing            | Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.     |
|   | 45. Green Houses                      | Control micro-climate conditions to maximize the production of fruits and vegetables and its quality.                       |
|   | 46. Golf Courses                      | Selective irrigation in dry zones to reduce the water resources required in the green.                                      |
|   | 47. Meteorological Station Network    | Study of weather conditions in fields to forecast ice formation, rain, drought, snow or wind changes.                       |
|   | 48. Compost                           | Control of humidity and temperature levels in alfalfa, hay, straw, etc. to prevent fungus and other microbial contaminants. |
| <b>X. Smart Animal Farming</b>            | 49. Hydroponics                       | Control the exact conditions of plants grown in water to get the highest efficiency crops.                                  |
|   | 50. Offspring Care                    | Control of growing conditions of the offspring in animal farms to ensure its survival and health.                           |
|   | 51. Animal Tracking                   | Location and identification of animals grazing in open pastures or location in big stables.                                 |
|   | 52. Toxic Gas Levels                  | Study of ventilation and air quality in farms and detection of harmful gases from excrements.                               |
| <b>XI. Domestic &amp; Home Automation</b> | 53. Energy and Water Use              | Energy and water supply consumption monitoring to obtain advice on how to save cost and resources.                          |
|   | 54. Remote Control Appliances         | Switching on and off remotely appliances to avoid accidents and save energy.  |
|   | 55. Intrusion Detection Systems       | Detection of windows and doors openings and violations to prevent intruders.  |
|   | 56. Art & Goods Preservation          | Monitoring of conditions inside museums and art warehouses.   |
| <b>XII. e-Health</b>                      | 57. Fall Detection                    | Assistance for elderly or disabled people living independent.   |
|   | 58. Medical Fridges                   | Control of conditions inside freezers storing vaccines, medicines and organic elements.                                     |
|   | 59. Sportsmen Care                    | Vital signs monitoring in high performance centers and fields.  |
|   | 60. Patients Surveillance             | Monitoring of conditions of patients inside hospitals and in old people's home.   |
|   | 61. Ultraviolet Radiation             | Measurement of UV sun rays to warn people not to be exposed in certain hours.   |

### III. CHALLENGES IN-FRONT OF IOT

The IoT applications are becoming popular in a wide range of domains, like homes, cities, energy, automobiles, environment, retails, logistic, industry and health. But with increase in number of devices there is lots of challenges in-front of IoT that require awareness to overcome the associated problems and few of them listed below [18],[19],[20].

- i. Security: In wireless networks security becomes the major concern because a lot of data is generated and transferred through IoT devices.
- ii. Data management: In case of IoT where devices are heterogeneous and they have different way of data representation and semantics hence the managing of data is extremely difficult task.
- iii. Network architecture: Finding a flexible, scalable and cross platform architecture is another major goal of IoT.

### IV. FEATURE SCOPE OF OF IOT IN INDIA

In India there is a lot of future for IoT and Government also has rightly recognized it and working towards it. Government's intention is to create an IoT based industry in India of USD 15 billion by the end of 2020. Another key initiative taken by Government is the formation of Centre of Excellence on IoT as a joint initiative with The National Association of Software and Services Companies (NASSCOM). As part of this joint initiative, Government plans to nurture and grow up the IoT ecosystems [21],[22].

## V. CONCLUSION

Therefore, in this paper, The Internet of Things (IoT) basics, trends, challenges and wide range of applications in the areas of electrical, communication software engineering have been discussed along with new policies and schemes of IoT in India.

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