IOT Sensors And Applications: A Survey

Dr. J. Jegathesh Amalraj, S. Banumathi, J. Jereena John

Abstract— The Internet of Things (IoT) is unique of the current most promising and important technological issues. Sensors have recently been considering a highly prospective feature of scientific research. IoT based sensors now play major role since the usage and features are numerous. Sensors helps to monitor our state of health, air quality, home security, and our widely used to monitor production process in industrial internet. For these reasons, knowing how they work and how they can use them to gain information is important. Earlier the Industries and organizations have been using various kinds of sensors but the invention of the Internet of Things has promotes the growth of sensors to a completely different level. For water, transport, garbage, environment, etc., the IoT sensors can be used effectively. This paper presents different types of IoT sensors and its various applications.

Index Terms— IoT, Sensors, Smart phones, Bio-sensors, IoT Usages, IoT applications, Internet of Things, Smart Sensors, Sensor Types, Smart environment, IoT Issues.

1 INTRODUCTION

The Internet of Things (IoT), sometimes called the Internet of Objects, will change everything that includes us. The Internet affects education, communication, business, science, government, and mankind. The main idea of IoT is to promote communication between anything from anywhere at any time through context-aware applications can be expressed considerably. IoT works in all the fields such as making smart city, smart transportation system, development smart industry creation and many other things. IoT can be accessed at any time, any place connectivity for anyone, we will have connectivity for anything [11] [12]. Internet of Things can connect devices embedded in various systems to the internet. When devices/objects can represent themselves digitally. They can be controlled from anywhere. The connectivity then helps to capture more data from more places, ensuring more ways of increasing efficiency and improving safety. This new and current technology provides many applications to interconnect the things with the help of internet. Internet of things is a new technology which provides many applications to connect the things to things and human to things through the internet. Each and every object in the human useable systems can be identified, connected to each other through the internet to take decisions independently.

2 LITERATURE SURVEY

U.S. Thakarel et al, IoT is the future of technology which will decide how we control and interact with our day to day devices and make them more efficiently. The scheme main problem with IoT is improper use of power, non standard addressing scheme and lake of device security [1].

Perara et al, when a sensor service becomes unavailable at runtime, there is a need for an efficient compensation mechanism to minimize service disruption. The author mention our future work involves improving current methods of service discovery, in particular the ranking of sensor service based on semantic reasoning and related data on the semantic web. Another research issue is the development of smart compensation services based on an approximate analysis of sensor data, networks and services in situations where exists compensation methods do not provide solutions [2].

Hemlata Channe et al, Wireless sensor networks is said to be mature technology and much work has been done on the domain of agriculture. Sensors are available to detect and analyze the different parameters required in the field of agriculture. There are many applications in use that use agricultural sensors. WSN architectures for monitoring soil properties have been proposed, implemented and tested. The author mention our future work will focus on interfacing different soil nutrient sensors with beagle black bone and analyzing results to achieve correct and better results, implementing this model and collecting data from different farmlands. [3]

Priti Bedmuttha et al, the rapid increase in the aging population has been a challenge for global healthcare systems in recent decades. Many countries have been active in restructuring hospital by optimizing medical resources and increasing the use of IoT home healthcare. An IoT-based smart home-centric healthcare platform that connects smart sensors attached to the human body seamlessly for physiological monitoring and smart pharmaceutical packaging for daily drug management [4].

Ms. Pradnya.A. Hukeri et al, recent development in RFID, smart sensors, communications technologies, and Internet protocols enable IoT. The basic premise is to have a smart sensors working directly to deliver a new class of applications without human involvement. The current Internet, mobile and machine-to-machine technology revolution can be viewed as the IoT's first phase. This kind of system is useful because human beings can make mistakes and have forgotten to switch off the machine under certain conditions [5].

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Ambarish Paul et al, The conductive pathways based on cellulose micro-fibers' three-dimensional network show reduced electrical resistance under applied pressure. The device is easy to manufacture and was made from biocompatible materials. The paper-based sensors are used in many applications including pressure assessment of robotic hand static grip, bandage pressure determination and other wearable applications such as blood pressure monitoring [6].

Dr. Vineet Kumar Rai et al, Novel sensitive devices are the optical sensors. Generally speaking, optical sensors are based on monitoring the change in intensity of one or more light beams or changes in their phases when interacting with physical systems. The intensity or interferon-metric sensors are categorized as sensors of this type. Optical fiber sensors were developed to measure a wide range of parameters such as chemical changes, stresses, electrical and magnetic fields, temperatures, pressure, optical rotation, displacement, etc. [7].

Chia-Yen Lee et al projected environmental monitoring, electronics and agricultural and bio-medical applications sensor named as Humidity sensors. For many applications, an important factor is not only humidity, but also temperature. There is a tough stipulation for integrated humidity and temperature sensors that are simply manufactured and applied in many fields. The humidity sensors has developed and addressed by Miniaturization technology which normally adopts vapor-absorbent films as its sensing materials. There is an increasing need for minimum cost and high demand and reliable functional humidity sensors in today's market [8].

Hadeel Elayan et al proposed one of the essential design fundamentals of a wireless body area network. This design provides security for the entire system. Data integrity must be ensured where the sensors must fulfill the privacy requirements provided by the law. Noticeably the basic software components needs to identified and created to satisfy very secure and efficient wireless networks. In which the data should be available and used only with secured authenticated processing filtering by identifying authorized person in remote destinations. The coordination between the hardware components and the software program is fundamental to providing secure and reliable communication [9].

Hui Suo et al, mentioned the Internet Of Things is emerging domain in the current decade. The authors specified that significance and usage importance will be increasing in fore coming periods. Several challenges are exist and needs to be considered in IOT even it has several technological features. Because considering security oriented mechanism of each layer implements is very difficult and tedious task. Each layer cannot be easily implemented for example in the defense-in-depth of system. So it is a challenge and important research area to construct security structure with the combination of control and information [10].

3 CHARACTERISTICS OF IOT

3.1 Interconnectivity

With regard to the IoT, the global information and communication infrastructure can interconnect anything.

3.2 Things-related services:

Within the constraints of things such as privacy protection and semantic consistency between physical things and their associated virtual things, the IoT is capable of providing things - related services. To deliver object - related services within the constraints of things, both the physical world technologies and the information world will be changing.

3.3 Heterogeneity:

The IoT devices are not homogeneous. They are heterogeneous which are based on different platforms and networks of hardware. They can interact through different networks with other devices or service platforms.

3.4 Dynamic Changes:

Device status changes dynamically, e.g. sleeping and waking up, connecting and/or disconnecting, as well as device context including location and speed. In addition, the number of devices can dynamically change.

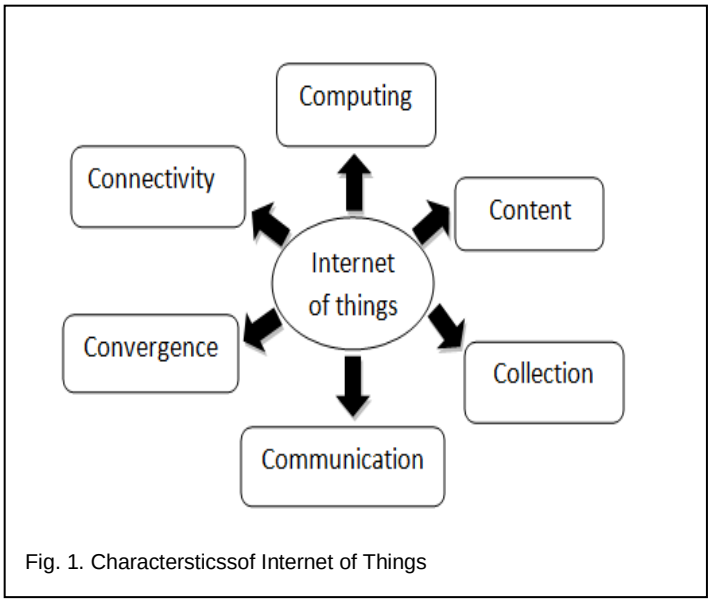

Fig. 1. Charactersticssof Internet of Things

3.5 Enormous scale:

The order of scalability is very large in the connectivity with internet. These devices absolutely require to be managed and that communicate with each other. So, the management of the generated or processed data and their interpretation for application purposes will be even more critical. It is relates to data semiconducting and efficient handling of sensor data.

3.6 Safety:

Since we gain advantages from the IoT, we should not forget safety. Securing endpoints, networks, and moving data across it all means creating a scale - up security paradigm.

3.7 Connectivity:

Connectivity allows accessibility and compatibility of the network. Accessibility becomes available on a network and the compatibility provides the ordinary capability to consume and generate data.

3.8 Sensor:

A sensor is generally a device capable of detecting changes in an environment. A sensor is able to measure a physical phenomenon and transform it into an electric signal.

For papers accepted for publication, it is essential that the electronic version of the manuscript and artwork match the hardcopy exactly! The quality and accuracy of the content of the electronic material submitted is crucial since the content is not recreated, but rather converted into the final published version.

4 TYPES OF SENSORS

4.1 Physical Sensor:

Physical sensors generally measure physical quantities such as length, temperature pressure, electricity, weight, sound, etc. It can be defined as a device that corresponds to physical property, called stimulus, and produces a corresponding electrical signal that can be measured.

4.2 Chemical Sensor:

Chemical sensors are widely used in industrial purposes. The chemical liquid changes company mainly applied and used this type of sensors. These sensors play a very significant part in developing industry based smart cities. It should also need to consider the protection and environmental friendly smart city. The important and featured use cases of chemical sensors only can be found in industrial environmental checking and monitoring process control.

4.3 Bio-Sensor:

Bio-sensor is a chemical sensor subset, but is often treated as a separate area. It is an interdisciplinary area that cannot be easily defined with exact boundaries. Basically, a biosensor is a self-contained analytical device that selectively and reversibly responds to the concentration or activity of biological sample chemical species, meaning that any sensor that is physically or chemically operated in biological samples can be considered as a biosensor using living components or a product of living things for measurement.

4.4 Temperature Sensor:

These are one of the sensors commonly used to measure a given medium's temperature or heat. These sensors use a number of methods to determine and quantify and object's temperature. Some of the temperature sensors required physical contact with the object while other types do not require contact as they can detect liquid or gasses that emit radiant energy such as heat spike or temperature spike.

4.5 Proximity Sensor:

Sensors of proximity are the best way to detect any movement. In applications such as safety or efficiency, they are widely used. These sensors are used as the best possible sensor for map building to avoid obstacles in navigating to a crowded place or any complex route.

4.6 Pressure Sensor:

A pressure sensor is a sensor which helps to senses the pressure and converts that into an electrical signal. The value of pressure sensor is correlates to the pressure applied. These sensors produce IoT systems that monitor new systems and devices which are pressure propel.

4.7 Optical Sensor:

Optic sensing technology is used to detect electromagnetic energies such as light. It uses the photoelectric effect concept, says electrons will be ejected when a negatively charged plate of some suitable light-sensitive material is hit by a photon beam. Then the electrons can flow as a signal from the plate feed as a current.

4.8 Humidity Sensor:

Humidity is water in the air. As well as many manufacturing processes, the amount of water vapor in the air can affect human life. The presence of water vapor also influences various physical, chemical, and biological activities and its measurement in industries is critical because it can affect the product's quality and cost, staff's health and safety. Humidity sensing is therefore important for industrial processes and human life control system. Many industrial, agricultural and domestic applications are important for controlling or monitoring humidity.

4.9 Micro Sensor:

Micro sensor is an extremely small device that can collect and relay information about the environment. Such devices can measure and send biological, thermal, chemical, and the other data forms to a processor, which then converts the information into a meaningful form for a variety of users to allow access to it.

4.10 Odour Detection Sensor:

The odour detection systems can be commonly arranged into four categories such as gas sensors, bio-sensors, gas chromatography systems and hybrid systems. Other common odour detection instruments like electronic noses (E-noses), mass spectrometers (MS), differential optical absorption spectrometers (DOAS) are frequently used sensors. The choice of any odour detection technique is influenced by several factors like on-field deploy ability, odour detection and classification capabilities, sensitivity of the instruments and sensitivity of the instruments to the air matrices. Among all the achievable detection methods, Electronic nose is having highly developed capabilities as compare to other instruments. The presence of interference noise acts as a main interference for the efficiency of the

odour detection devices. Incorporation of gas chromatography beside with hindrance filters can provide an improved accuracy in the odour detection.

5 SENSORS USAGE IN IOT

All sensors has possessed in service electrical energy range. Each sensor has their separate voltage threshold value. This electrical energy range is very imperative because the voltage abounding by the board must not be greater than the maximum threshold voltage allowed by the sensor. Obviously it is very noticeable and important to get the sensor data sheet cautiously before it is connection. Usually the connection is made into the board to which considers the threshold voltage checking in order to avoid damage. The same checking principle is applicable for the output signal also, which must be lesser than the maximum electrical energy voltage that the board can accept.

5.1 Applications of IoT Sensors

The IoT sensor applications includes air pollution, water pollution, water monitoring, forest fire detection, smart home development, smart cities and smart industry development where everything can connect from anywhere to anything to make our life easier.

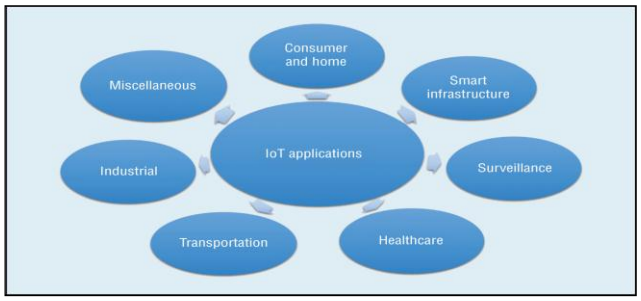

Fig. 1. Applications of Internet of Things.

A. Smart Cities:

The Smart city projects held in various countries such as Seoul, Dubai, New York, and Singapore have supported many major smart cities development. The smart city development can be seen as the future of leading smart life, and entering the development of IoT technology will become very reasonable where as the innovation rate of creating today's smart cities is remarkable. The smart city development using sensors requires very cautious and systematic planning at all in single stages, with government policy approval and citizens agreements to appreciate the internet of things technology.

B. Smart Home:

The electronic devices used in home such as Television, Air conditions, Refrigerators, mobile devices needs automation through internet. The home usage electronic devices automation is the primary need to make smart home development. The Wireless fidelity has become a part of Internet protocol network where as mobile devices and computing being used and adopted.

C. Smart Health:

Health is considered very vital one around the people and people needs automation to monitor the health. Efficient and effective health monitoring system needed because a person is affliction from bad health and does not have automated usage. The current situation is very critical and identified being patients is very decisive in disease identification. To resolve this issue an automated IoT connected wireless automated system makes possible for monitoring health oriented issues. This solution is best and captures patient health in a protected manner.

D. Smart Transportation and Mobility:

The development in transportation system is the main factors indicate the nation's infrastructural growth. The main application is IoT sensor based automated transportation system. This system helps to monitor road condition and alert applications. The principles of crowd sourcing and sensing provides the significant idea to make the smart transport and mobility. The IoT based smart Transportation development is considers the cost of fuel and also eco-friendly global warming feature. Many countries funded smart transportation research projects to make the environment safer and smarter. Particularly Lithium-ion battery performance for electric vehicles as explored and these projects have been funded in numerous.

E. Smart Cities:

From an investor perspective, a most attractive city has the best transportation, water, energy, communication and building availability, manageability and performance for residential work, entertainment and play. People's Internet with PCs and mobile devices extends to the Internet of Things (IoT). The Internet vision of things is to manage objects around us with a unique IP address of their own. IoT will consist of billions of devices capable of sensing, communicating, calculating and potentially acting.

F. Smart Water:

Water is one of the life's essential elements. Water pollution is one of the world's major problems. The water should be monitored to ensure the safe supply of drinking and useful water for various purposes such as agriculture. Recently, water levels are very low and there is a drop in the lakes. It is therefore too important to find the water monitoring and control system solution. IoT is a solution for it.

G. Smart Agriculture:

IoT based agricultural convergence technology creates high quality and increased production value, as well as significantly reducing the burden on farmers. The data generated from GPS and smart sensors on the agricultural field specifically used with the integration of smart farming equipment in conjunction with Big Data analytics. The farmers would be able to improve crop yields and make efficient use of water, thus reducing waste of any kind of to a remarkable level.

H. Security and Emergencies:

The system proposed can detect smoke, various flammable gasses and fire. This system is capable of providing the nearby fire department with hazard location coordinates. This fire hazard sensing system with a systematic IoT framework highlights an innovation in application to the public safety and service life support sector.

6 ISSUES AND CHALLENGES

The internet of Things is taking shape as an ever-present global computing network with continuous advances in sensor and networking technology. The number of internet-connected devices and industries is growing exponentially and having them all interconnected through wire or wireless will put a powerful source of information at your fingertips. IoT sensors monitor underground miners' location and analyze sensor safety data to improve safety measures [13].

6.1 Powerful Sensing Solution:

IoT sensors use some of the latest technology in the design and manufacture of sensors. IoT based sensors to providing a powerful sensing solution for quick marketing. The leader in low-cost remote monitoring solutions and wireless sensing enables you to monitor/control from anywhere your business or home. It provides the simplest, quickest and most robust way to develop Internet of Things applications. The leader in products for analog and embedded processing helps make the world smarter, safer, greener, healthier and more fun.

6.2 Smarter:

The variety of sensors delivers various different kinds of intelligence and data. These data are based on IoT platforms function. The collected data are shared using network using autonomous function which requires providing the ecosystem very smarter. By combine a set of sensors and a communication network, devices share information with one another and are improving their efficiency and functionality.

6.3 Essential:

Sensors are the essential IoT enablers. The Radio Frequency Identification (RFID) tags on the Internet of Things serve three purposes are identify items, locate them and determine their environment [14]. Smart Internet of Things Sensors has an impact on the food supply chain that can improve the product manufacturing process. To monitor, control and improve operations, they take control of the entire manufacturing process.

6.4 Connectivity:

The big wave of connectivity goes beyond laptops and smart phones and goes to connect cars, smart homes and smart cities [15]. Continue to read about how IoT applications are transforming our lives and the areas where IoT is going to have a huge impact on business and society.

6.5 Efficiency:

For a long time, different types of sensors have been used by industries and organizations, but the discovery of the Internet of Things has considers sensors evolutions to a entirely special level. By combining a set of sensors and a communication network, devices share information and improve their efficiency and functionality.

7 CONCLUSION

IoT's growing popularity is increasing attention in IoT devices and applications toward security issues. In this paper, we surveyed on different types of IoT sensors and its applications. In IoT devices and existing sensor management systems adapt in commodity IoT, we presented a comprehensive overview of sensors. There is countless use of IoT sensors application in all fields including medical, manufacturing, industrial, transport, education, governance, mining, etc. The use of sensors in IoT devices inevitably increases the devices' functionality. For example, several recent attempts have been made to exploit the security of IoT device through their sensors. So, security is important in IoT based sensors. The combination and fusing of all the sensors make the complete platform in various applications very smarter one. The concept of collecting smart sensors data collection and analysis makes the IoT very smarter and IoT becomes smarter in the future technologies.

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