Chapter 6
A Comparative Study of Different IOT Sensors

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Abstract The Internet of Things (IoT) is accepted concepts that have been functioned to many conventional areas for example business processes, medicine and smart cities etc. One of the major problems of an IoT method is the quantity of information; it has to monitor and to manage. This information turns up as procedures that require selecting and processed in instantaneous consecutively to build an accurate decision. The sensors used in IoT produce an enormous quantity of diverse information that requirements to be switch by the suitable techniques. IoT is a revolutionary technology in smart living standard. It's revolutionization, the world through billions of inclination on sensors by using it to create a resourceful environment in the region of us. Sensors are recognized as be a forthcoming field, which has been demonstrated in scientific research in any IoT application, IoT sensors are used effectively to build a smart world. In this manuscript discussed different type of IoT sensors on their applications based. In addition, it is given the data in which different type of sensors are used in many purposes. The IoT is previously approaching to existence particularly in smart environment applications and healthcare by addition of a huge quantity of sensors. The actuators used in IoT are to develope the way of life and initiate innovative services to the area.

6.1 Introduction

The IoT connects all living things that bring about change. Things are linked through a variety of medium to communicate and make it easier. IoT encompasses a broad range of fields includes in cloud, mobile sensors, virtualizes environment, artificial intelligence and radio frequency identification system (RFID). Such IoT are used in a separate application. The technology based on IoT has lead individuals to ubiquitous

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communications and elegant services. Computers can exchange information and provide efficient services through IoT. Alexia and many other IoT enabled products, such as lamps, stream heaters, washing machines, air conditioners etc. [1].

These are apps-based systems available, no screen market without a mobile. Only audio services are provided and a monitor and also provided with screen devices. Sensors are very important in smart applications. IoT permitted this connectivity. It enchants the collection and storing of information in real-time with the cloud-based platform. In the field of IoT, different resource limitation devices, used to communicate over the network using RFID. A fast-growing technology that enables automatic identification of RFID tag objects [2–7]. The different types of sensors are discussed here.

Proximity sensor: The proximity sensor makes it possible to detect the position of any nearby object without any physical touch. By emitting electromagnetic radiation, the presence of an object is detected simply by looking for any difference in the return signal. Various types of proximity sensors are available, such as inductive, capacitive, ultrasonic, magnetic, etc. This particular type of sensor is used primarily in these particular applications [1].

Chemical sensor: Sensors are called chemical sensors by detecting any chemical reaction, material or group of chemicals [1, 5, 8, 9].

Temperature sensor: Temperature sensors are useful in calculating heat energy to detect a physical change in one's body. Temperature sensors are used for monitoring of ambient environmental conditions. They gather data and then use Wi-Fi to send it to the cloud for review [2, 5, 8, 9].

Gyroscope sensor: Gyroscope sensor measuring angular velocity detects any tilt angle movement in the body. This sensor commonly used in 3D mouse games for sports player instruction, industrial automation and much more [6].

Velocity sensor: A sensor to facilitate the measures of the speed of transform in steady point standards at recognized interval. The speed sensor distinguished the motion of an object along a straight line, where angular velocity sensors monitor how quickly the system rotates. It is used for intelligent vehicle tracking in smart cities.

6.2 Related Work

IoT is recently introduced technology. In this world, there are trillions of actuators and sensors using by them for constructing a modern environment. In this paper it is explaining about the various sensors that are used in IoT applications [1]. The IoT is a technology that actives the computing which can be physical and virtual devices. These are connected to the Internet. In our automated home, it can be controlled everything in our home with the help of a mobile. For this, it is using a generic framework that can automatically control all the devices in the automated home [2]. IoT actives an innovative generation of inventive services. Smart devices can be controlled automatically because they are connected to the Internet. IoT devices are

Table 6.1 Billions of units installed based on IoT (2018–2020)

Segments	2020	2019	2018
Transportation	0.08	0.07	0.06
Information	0.37	0.37	0.37
Retail and wholesale Trade	0.44	0.36	0.29
Healthcare providers	0.36	0.28	0.21
Automotive	0.47	0.36	0.21
Manufacturing and natural resources	0.49	0.40	0.33
Physical security	1.09	0.95	0.83
Building automation	0.44	0.31	0.23
Government	0.70	0.53	0.40
Utilities	1.37	1.17	0.98

Source Gartner (August 2020)

transmitted through the untrusting network. So that, it needs security and privacy for that reason which are using attribute-based encryption (ABE) and it is very helpful. By using ABE, there are many advantages like, it is in bearable cost. It is used in many other IoT applications [3].

Nowadays, a smart home, smart meter based on IoT, are using widely which replaces the Analog based meters. The data is communicated in wireless modes, so that the manual work is reduced. The communication of the smart home network is reduced by the energy theft. This attack cannot be completely identified by using present techniques. So in this manuscript expanded an energy recognition method called Smart Energy Theft Systems (SETS). The SETS is planned for energy theft identification. Its results have three stages. Stage first has an energy theft accurateness result of 57.40%, after adding Stage two it increased to 77.80%, after the presence of stage three finally get 98.52% [4]. As the population increases worldwide, there is a need that arises to make available appropriate healthcare services by using modern technology like the IoT based healthcare observing system. By using IoT sensors, these devices store information and it has fixed bandwidth on the device that can communicate in the particular channel. For the health monitoring system, it has to work properly by maintaining the sample rate and stoppage constraint of each sensor used for monitoring system is important [5]. Billions of units installed based on IoT, endpoint market segment worldwide (2018–2020) shown in Table 6.1.

6.3 Methodology and IoT Based Sensors Equipment's

The IoT is one of the latest and fastest developing technology in India and worldwide also. In India, many people depend on agriculture. So, this has been replaced by the agriculture traditional technique with modern IoT based methods in farming. Here

we are using Wi-Fi, it is used in particular areas. These devices perform when they are connected to the Internet which can be controlled by the remote in anyplace, these devices cost is very low. By using of sensor it collects data and takes individual decisions and autonomous decisions [8, 9]. Here it wants safe vehicular traffic across the busy traffic way. We require real-time monitoring systems. In intelligent traffic monitoring systems, we are using RFID sensors for real-time tracking of vehicles. The RFID sensor can detect the velocity of the vehicle. It is very useful for the traffic department. It alerts the drivers when they exceed the speed limit. It is designed at a low cost [6]. To give the safe supply of drinking water there is a need for quality of monitoring, it can be done easily by using IoT sensors, it can measure physical and chemical parameters of water. The collected information can be seen on the Internet. The parameters such as temperature, pH and dissolved oxygen of the water can be measured [7]. The sensor element used in IoT is shown in Fig. 6.1.

Sensor component: The elementary method of transduction (e.g., an object), which transforms individual structure of power into another. A number of sensors can include additional than one sensor component (for example a complex sensor). Sensor features are counting its internal wrapping and peripheral (e.g., optical or electrical) connections.

Interface Electronics: Interfacing is the procedure of linking one device, in exacting a processor or micro controller with another. Its permit to propose or transform the two electronic devices amount produced and contribution configurations. So it can function simultaneously.

Sensing Processing: Sensor is a piece of equipment, element, appliance, or subsystem, whose principle is to distinguish proceedings or change in its atmosphere and transmit the data to previous electronics, regularly with a processor.

Sensors participate a significant role in automating any request by measuring and analyzing the information obtained to detect the changes in the physical material. Whenever any physical environment in which a sensor is rendered changes, it produces an assessable response. Figure 6.2 shows the related electrical signals and sensing modules. A variety of sensors can vary from simple to multifaceted. The detection of the sensors may be dependent on their description, their mechanism of procedure. The type of objects used the substantial occurrence of the senses, the properties of its method and their area of function.

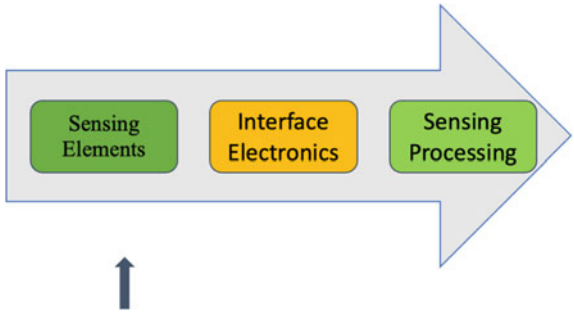

Fig. 6.1 Consequent electrical signal for sensing elements

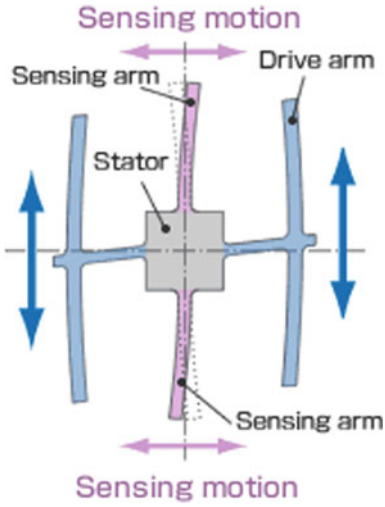

Fig. 6.2 Gyroscope sensor

6.3.1 Gyroscope Sensor Equipment

Vibration gyroscope sensors identify angular speed from the energy functional to a shacked body by the Coriolis. Here it is illustrated that how this works, with a double T-crystal dimension of structure of Epson as an example. The Coriolis power act ahead to the constrained artillery at what time the gyroscope is rotating, causing the perpendicular vibration.

6.3.2 Speed Sensor

A speed sensor is a sensor that response to speed rather than absolute location. Movement causes the coil to move concerning the magnet, which in turn creates a voltage proportional to the speed of that movement (Fig. 6.3).

The speed sensors proposed to observe the velocity by induction motor of the three phases. It is used by the joint of MCU regulator. It is also reduced by the switching and harmonic losses of the circuit. The Node MCU transmitted the speed signal throughout Wi-Fi and observes the velocity of the motor [10–21].

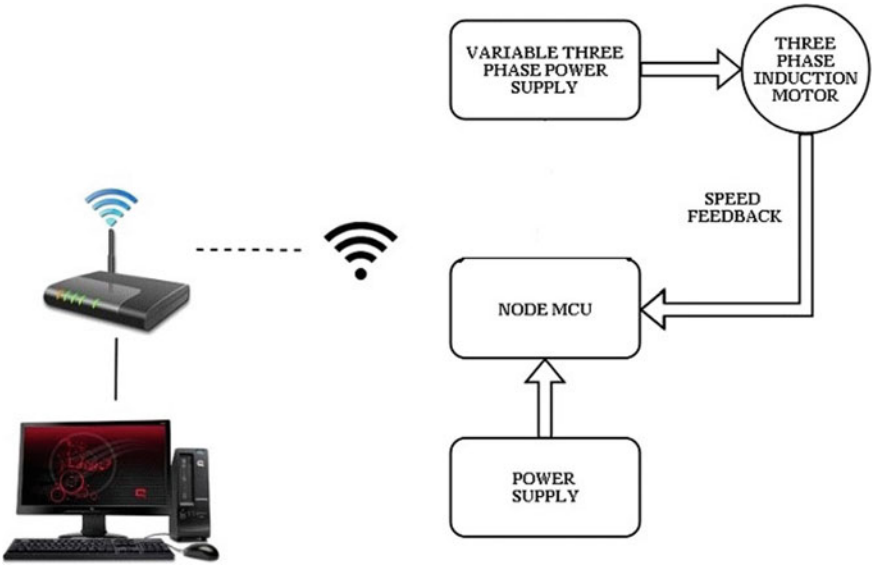

Fig. 6.3 IoT based speed monitoring sensors

6.4 Result Analysis Based on IoT Applications

6.4.1 Application in Smart Water Measurement

Water feature monitoring, ground stage monitoring, pollution level and some types of storage place seepage can put away water. Any such intellectual sensors know how to be used for correct stream superiority application. Water leakage: This water pressure on the outer tanks and pipes can be assessed in order to prevent timely leakage. Regulation of the level of contamination of the sea: the introduction of dangerous leaks or waste to the sea may be controlled by sensors to avoid seawater. Smart swimming pool: the swimming pool conditions can be guarded by the use of sensors and timely preservation can be approved out in this way. The monitoring of water levels and their fluctuations in rivers, dams and reservoirs from time to time is an important task.

6.4.2 Smart Security

Sensors preserve to be installed in different areas to certify the environmental security. Some of those applications everywhere sensors participate a key position to ensure safety is discussed in Smart perimeter access control: Sensors can be used to make an elegant outskirts approximately specific areas, and alarms can be introduced to warn

unauthorized persons to enter restricted areas. Devices can be used intelligently to detect unsafe levels of gas, radiation levels and leakage. Sensors can be connected to walls in factories, mines and industries where readily available is a possibility of escape. The use of sensors can be done smartly to identify dangerous gas level, emission level and leakage. Smart Homes: When building or a smart house, sensors linked to different items at house like smart switching on/off machines, distinguishing intruders, and detecting the amount of ingredients used in cooking. This is completed by transferring out warnings, which lead to a healthier lifestyle. Some of the smart home implementations are as follows:

1. Remote piece of equipment: Sharply switch on/off devices makes existence simple and secure by preventing accident and as well save the energy.
2. Intrusion detection system: sensors can detect intruders at the entrance, and well-timed warning is capable of being sent to the authorities worried. It makes existence safer and easier as a person can watch his or her house from anywhere. This can be enforced if entry is only permitted for designated persons after proper approval and the door is opened. In [6], the authors introduced an intrusion detection method that senses indoor motion and intimates owners through a message. It is a sensor that measures the rate of change in constant position values at given intervals [6] in Table 6.2, it is mentioned the types of IoT sensors and their application.

Table 6.2 IoT sensors and their application

IoT applications	Types of sensors
Smart agriculture	Chemical, proximity, water quality, temperature, humidity
Smart security	Temperature, gyroscope, infrared, chemical, light
Smart transport	Infrared, pressure, gyroscope, temperature, pressure, chemical
Smart home	Position, light, accelerometer, proximity, chemical
Smart health	Pressure, accelerometer, light, magneto, bio-sensors
Smart building	Magneto, chemical, light, gyroscope, chemical
Smart water	Water quality, occupancy, humidity, temperature
Smart environment	Optical, chemical, bio-sensors, temperature, light,
Smart city	Infrared, pressure, humidity, proximity, velocity, light

With the aid of sensors, advice can be given on controlling water and electricity consumption. Sensors are using in all IoT applications. In any small application, we use more than one sensor. After studying different sensor types and smart applications in IoT. In this, we suggest that different sensor required in IoT applications to create a smart world.

6.5 Conclusion

The IoT based different applications are changing our humankind by constructing contemporary, well turned-out surroundings around us. In many IoT based elegant application, the sensor plays an explanation responsibility in the computerization of relevance procedure by assembling the devices smarter and more receptive exclusive of individual involvement. Reduces manual labour and saves time. In this manuscript, many types of sensors are presented in IoT enabled smart environments, IoT sensors are used effectively for agriculture, home appliances, water, health, etc. The sensors can communicate wisely and remotely with each other. Better crop improvement is a major challenge for well developed countries, such as India, to take on new smart technologies as part of the agricultural stream that leads to a green population region.

References

1. Sehrawat, D., Gill, N.S.: Smart sensors: analysis of different types of IOT sensors. In: 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI), pp. 523–528. IEEE (2019)
2. Gunge, V.S., Yanagi, P.S.: Smart home automation: a literature review. Int. J. Comput. Appl. **975**, 8887 (2016)
3. Girgenti, B., Perazzo, P., Vallati, C., Righetti, F., Dini, G., Anastasi, G.: On the feasibility of attribute-based encryption on constrained IOT devices for smart systems. In: 2019 IEEE International Conference on Smart Computing (SMARTCOMP), pp. 225–232. IEEE (2019)
4. Li, W., Logenthiran, T., Phan, V.-T., Woo, W.L.: A novel smart energy theft system (SETS) for IOT-based smart home. IEEE Internet Things J. **6**(3), 5531–5539 (2019)
5. Dhar, S.K., Bhunia, S.S., Mukherjee, N.: Interference aware scheduling of sensors in IOT enabled health-care monitoring system. In: 2014 Fourth International Conference of Emerging Applications of Information Technology, pp. 152–157. IEEE (2014)
6. Prasanna, G.S., Pavani, K., Singh, M.K.: Spliced images detection by using Viola-Jones algorithms method. Mater. Today Proc. (2021)
7. Kanchana, V., Nath, S., Singh, M.K.: A study of internet of things oriented smart medical systems. Mater. Today Proc. (2021)
8. Padma, U., Jagadish, S., Singh, M.K.: Recognition of plant's leaf infection by image processing approach. Mater. Today Proc. (2021)
9. Lu, D., Liu, T.: The application of IOT in medical system. In: 2011 IEEE International Symposium on IT in Medicine and Education, vol. 1 (pp. 272–275). IEEE (2011)
10. Singh, M., Nandan, D., Kumar, S.: Statistical analysis of lower and raised pitch voice signal and its efficiency calculation. Traitement du Sig. **36**(5), 455–461 (2019)

11. Duan, R., Chen, X., Xing, T.: A QoS architecture for IOT. In: 2011 International Conference on Internet of Things and 4th International Conference on Cyber, Physical and Social Computing (pp. 717–720). IEEE (2011)
12. Singh, M.K., Singh, A.K., Singh, N.: Multimedia analysis for disguised voice and classification efficiency. Multimedia Tools Appl. **78**(20), 29395–29411 (2019)
13. Zhang, Z.K., Cho, M.C.Y., Wang, C.W., Hsu, C.W., Chen, C.K., Shieh, S.: IoT security: ongoing challenges and research opportunities. In: 2014 IEEE 7th International Conference on Service-Oriented Computing and Applications (pp. 230–234). IEEE (2014)
14. Singh, M.K., Singh, A.K., Singh, N.: Acoustic comparison of electronics disguised voice using different semitones. Int. J. Eng. Technol. (UAE) **7**(2), 98 (2018)
15. Veerendra, G., Swaroop, R., Dattu, D.S., Jyothi, C.A., Singh, M.K.: Detecting plant Diseases, quantifying and classifying digital image processing techniques. Mater. Today Proc. (2021)
16. Hassan, W.H.: Current research on Internet of Things (IoT) security: a survey. Comput. Netw. **148**, 283–294 (2019)
17. Singh, M.K., Singh, A.K., Singh, N.: Disguised voice with fast and slow speech and its acoustic analysis. Int. J. Pure Appl. Math. **118**(14), 241–246 (2018)
18. Balaji, V.N., Srinivas, P.B., Singh, M.K.: Neuromorphic advancements architecture design and its implementations technique. Mater. Today Proc. (2021)
19. Punyavathi, G., Neeladri, M., Singh, M.K.: Vehicle tracking and detection techniques using IoT. Mater. Today Proc. (2021)
20. Singh, M.K., Singh, A.K., Singh, N.: Multimedia utilization of non-computerized disguised voice and acoustic similarity measurement. Multimedia Tools Appl., 1–16 (2019)
21. Hassija, V., Chamola, V., Saxena, V., Jain, D., Goyal, P., Sikdar, B.: A survey on IoT security: application areas, security threats, and solution architectures. IEEE Access **7**, 82721–82743 (2019)
22. Singh, M.K., Singh, N., Singh, A.K.: Speaker's voice characteristics and similarity measurement using euclidean distances. In: 2019 International Conference on Signal Processing and Communication (ICSC) (pp. 317–322). IEEE (2019)