Chapter 11
Study of Different Types of Smart Sensors for IoT Application Sensors

Ch. V. N. S. Mani Kiran, B. Jagadeesh Babu, and Mahesh K. Singh

Abstract IoT appliances form part of the wider home automation definition that is included security systems, television, air conditioning, heating, and lighting. Long-term reimbursement could consist of power savings and making sure the lighting and appliances are shut off automatically. Wireless sensors are important component for building the sensing system for the Internet of Things (IoT). The IoT is a technology in which one or more technologies are replaced by another technology. IoT building a small eco-system around us, with the number of sensors and actuators. These manuscripts show the numerous IoT sensors and in addition explain a variety of sensor dependent IoT application. In addition, subsequent to analyzing is diverging sensor application. These manuscripts enlighten that IoT function requires which category of sensor. In the opportunity, this effort will provide as the source for additional explore the work in the connected area. In this paper mainly we are discussing the scrutiny of dissimilar types of sensors like humidity sensor, temperature sensor, pressure sensor, optical sensor, proximity sensor, position sensor, and velocity sensor. We also discuss sensor applications.

11.1 Introduction

The IoT connect everything, animates and inanimate things which lead to drastic change. Their main objective is to make things more energetic and comfortable. This allows for many devices to behave as intelligent equipment. IoT technologies have inspired smart services for people. IoT permitted smart devices to provide the possessor with many services, such as washing machines, water heaters, lights such as outdoor electronic devices and indoor etc. It is additional obliging for blind and deaf persons with a disability. Such procedures are obtainable on the mobile markets, and with no display, they only provide audio services with a display [1].

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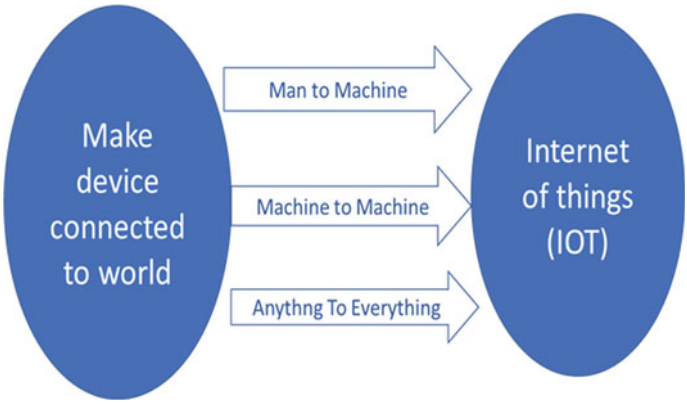

Fig. 11.1 IoT interfacing technique

Sensors are all over the place. They are in our homes and places of work, in our shopping centers and in our hospitals. We are found in smart phones and are an integral part of the IoT [2]. For a long time, sensors have been around. In the late 1880s, the first thermostat was introduced, and since the 1940s infrared sensors have been around. The IoT and its equivalent, the commercial IoT, are bringing a new level of sensor use. Sensors are very critical in the smart application that shown in Fig. 11.1 [1].

Temperature Sensor: Temperature sensors are effective in calculating heat energy to identify the substantial change in one's body. People were using temperature sensors to track ambient environmental conditions. The collected data is subsequently forwarded to the obscure by Wi-Fi for review. All this is completed with the mobile app. A comparable kind of sensor is too used in smart farming and enables farmer to enlarge their generally capitulate and item for consumption superiority by collecting survive information from their land in real-time [2, 3] (Fig. 11.2).

Humidity Sensor: A humidity sensor monitors both air temperature and humidity, which shows moisture in the atmosphere. People use moisture sensor for elegant farming and allow farmers to boost their yield and manufactured goods feature by obtaining survive information of their property in real-time [3, 4].

Pressure Sensor: Pressure sensors can sagacity the power and turn it into signal. This category of sensor can be used for tracking your physical condition [5].

Proximity Sensors: With the proximity sensor, the location of any close entity can be simply detected any substantial make contact with each other. By emitting electromagnetic emission like an inflator, it detects an object's presence through basically look for any difference in the arrival signal**.** There are various types of propinquity sensors that target different applications, such as magnetic, photoelectric, ultrasonic, capacitive, inductive etc. This exact type of sensor is mainly used in application where safety and effectiveness are required [6, 7].

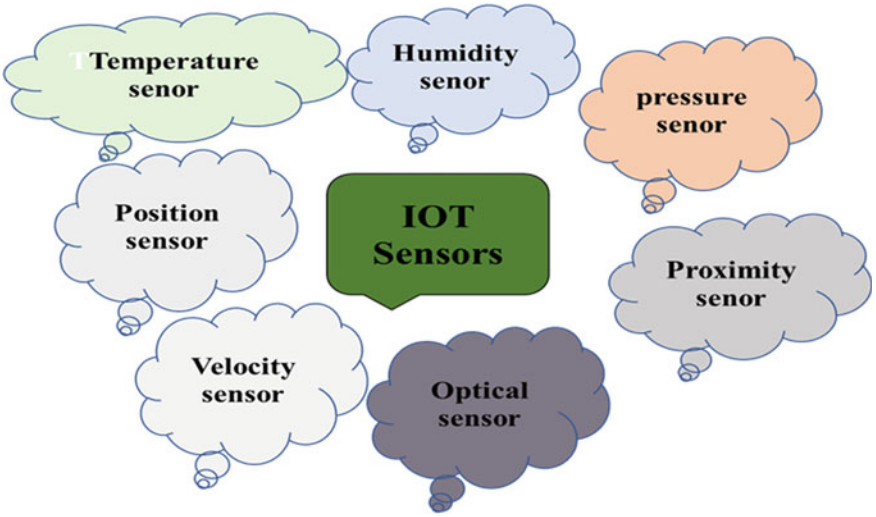

Fig. 11.2 Different type of IoT sensor

Optical Sensors: For the detection of electromagnetic energies like light, optical sensors are useful. They are commonly used in IoT application as well as in digital cameras, being sensitive to all types of electrical interfaces. Optical sensors are good for aerospace, chemical, oil refineries, environment, health, energy and other IoT applications [8].

Velocity Sensors: This type of sensor that measures the rate of transform at defined intervals in the quantity of the constant position and location values. Sensor velocity can be linear or angular. This can be used in advanced vehicle tracking applications in Smart Cities [9, 10].

Position Sensors: By detecting their motion the position sensor distinguishes the occurrence of humans or things in a scrupulous area. It could be used in home safety to allow the landlord to monitor room and appliance doors and window from anywhere [11, 12].

11.2 Related Work

In 1993: The convey of an objective amount beginning one power area to an additional is based on sensors and actuators. The renowned healthy, chemical domains, thermal, magnetic, electrical, mechanical are these. Actuators and sensors can be sub-divided into three stages depending on the dynamic cross effects, static cross effects, and physical principles involved [1]. **In 1995**: Many possibilities are proposed for modern fiber-optic sensors based on two-photon spectroscopic technique. Types

include chemical sensor, counting multiple sensors, and dielectric sensors [2]. It is also proposed to develop a lightweight, low-cost fiber optics system for precise time–frequency calculation. **In 2000**: This work provides an overview of fiber optic sensor technology advances and innovations, outlining the main issue foundation current investigate and demonstrating several significant application and input area of successful fiber optics sensor in advancement [3, 13]**.**

In 2012: With the advancement of IoT technology, the use of more and more media sensors for tracking the health of the persons. Each time, tons of IoT sensors recognize the huge sensor information. All this large sensor information is stored in the HDFL and a number of data is stored in the heading a database based on columns [14]. **In 2014**: As the populace is raising universal, an enormous requirement arises to provide proper health care service. The need-gap may be increased with the advent of modern technology. The sensor is one such technology that can be worn to allow health care monitor systems based on the IoT [15]. **In 2016**: The IoT technique has carried rebellion to each common man in area of existence by production of the intelligent. IoT referred to a network of things that create a system optimized by itself. Invention of IoT-based intellectual elegant cultivation systems transforms the features of agricultural production day by day by not simply improving it but also making cost-effective and reducing the desecrate [16].

In 2016: The real-time monitor has turn out to be a critical requirement for today's intellectual interchange monitor system to ensure safe traffic across the expressway. In this paper, presented a low-cost and secure IoT system consisting of a variety of RFID sensor for the real-time tracking. The motor vehicle is during its transportation beginning one end to a different of the high speed expressway [16]. **In 2018**: The IoT is accepted to participate a key part in our daily life during a large extent of sensor systems that surround our world. Such systems are made to track critical objective properties of matter and energy. In IoT, the information can be used to active term acts such as remote control of heat equipment or cool equipment. **In 2018**: Climate change has lead to the increased the significance of monitor the atmosphere [3]. Continuous tracking of the environmental parameter is needed to determine the ambient quality. Given that IoT is the mainly up-and-coming technology. It plays a significant position in the collection of sensing unit information. The IoT helps bring everything together and allows us to connect with our very own things [2].

In 2018: The increasing number of expensive information sources, developments in the big data technologies and IoT as well as the development of a broad choice of appliance knowledge algorithms give the new probable for providing predictive services to people and decision-makers in urban areas [4]. **In 2019**: The IoT is a technology in which one or more technologies are replaced by another technology. IoT building a small eco-system around us, with the number of sensors and actuators. Ubiquitous sensing technologies deliver shared information to create a growing image of operations. The IoT sensors are used to build a smart environment by using the IoT application. This paper shows IoT sensors and different IoT applications based on sensors [5].

11.3 Method and Methodology

The temperature sensor LM35 provides ADC0804 with the analog Temperature Data, which it transforms to Digital Values, and sends to 8051. The 8051 Microcontroller performs a brief measurement after obtaining the digital values, and then shows the temperature on the LCD.

It is as quick to use the automatic fan control to choose the desired temperature range and allow it to do its job. When the temperature rises above the target temperature range, the fans will work in the forward direction automatically and will create a cooling effect shown in Fig. 11.3.

Humidity is defined in terms of the quantity of stream in the nearby air. The stream contented in the soil is a crucial feature in human health. For though the heat is 0 °C with fewer moisture i.e. the atmosphere is fresh, we'll feel comfortable. Moisture sensors are used in products such as incubators, sterilizers, and medication manufacturing devices. Humidity control sensor through IoT is shown in Fig. 11.4.

There are various types of humidity sensors available, which work on different concepts, such as capacitive, semiconductors, and resistive. Humidity Sensor Fan Control senses excess humidity in a room and triggers the ventilation fan automatically to minimize excess condensation. The use of this sensor as an added benefit helps to reduce energy use by automatically running the fan only when required, reducing constant or repetitive usage. An optical sensor is generally part of a larger system**.** A sensor is defined as an instrument that transforms the physical stimuli into a readable output. A sensor's position in a control and automation system is to detect and quantify any physical effect while supplying the control system with

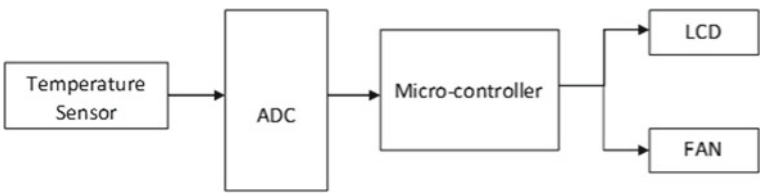

Fig. 11.3 IoT based temperature sensor

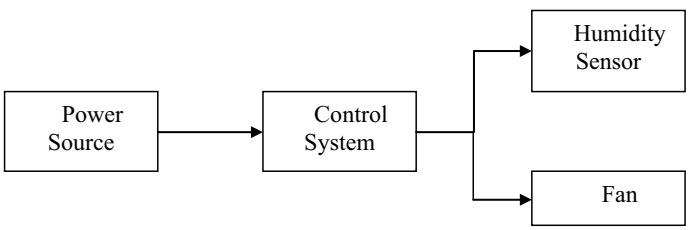

Fig. 11.4 Humidity control sensor through IoT

Table 11.1 IoT application and type of sensors

IoT applications	Types of sensors
Smart cities	Pressure, Humidity, Proximity, Temperature, Position, Light accelerometer, Velocity
Smart environment	Optical, Light temperature, Accelerometer, Biosensors, Gyroscope, Chemical, Humidity, Chemicals
Smart transport	Motion, Gyroscope, Temperature, Chemicals, Magneto, Pressure, Accelerometer
Smart agriculture	Position, Proximity, Chemical, Water quality, Humidity, Temperature

this information. By controlling the sum of movements and strokes, the shipping conditions can be increased efficiently.

Air quality monitoring, field-level monitoring, emission level, and some sort of bottle leakage will save water. Many other intelligent devices can be used for applications for proper air control.

11.4 Results and Discussion

Based on different types and based on IoT sensors application like temperature, humidity, pressure, proximity, optical, velocity, positional sensors the outcome of the IoT is enhancing performance. Data is the key to making IoT systems effective in increasing profitability and operational efficiency. A majority of the executives surveyed say IoT is a significant contributor to their company to expand your outlook on IoT. Generally, all type of sensors may be categorized into digital sensors and analogue sensors. Nonetheless, in most electronic systems, there are a small number of sensors for example temperature sensors (Table 11.1).

Analysis IOT Sensors: For all IoT, system sensors are used. This section, after examining diverse types of sensors and elegant IoT implementations, indicates the kind of sensors needed in building a smart environment in an IoT framework.

11.5 Conclusion

IoT by building a safe ecosystem around us is revolutionizing our society. Sensors participate an input position in automating the submission in any IoT-based smart device. By creation it is smarter to react with no individual interference. This manuscript introduces different kinds of sensor in the elegant world activated by IoT. IoT sensor can be efficiently warned for physical condition, transport, water, environment, agriculture. This paper analyzes various IoT sensors and IoT applications based on sensors and illuminates what sensor is used in many IoT applications.

The Real-time vehicle speed regulation is crucial for preventing fatal accidents on the expressways. During times that vehicles surpass the thresholds, warnings can be issued for passengers.

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