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Research paper

Sensors in IoE: A Review

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Abstract

Internet of everything (IoE) is the popular technology in the industry. IoE platforms deliver various kinds of intelligence using sensors. Sensors are autonomous and work as smarter. In this paper we have portrayed the different types of sensors, with their applications in various domains. This paper also discusses the factors that determine the suitability of sensors, various challenges, and solutions for sensors in IoE.

Keywords: *Internet of things, Internet of everything, Smart sensors*

1. Introduction

Internet of everything (IoE) is the intelligent integration of people, process, things and data. It is a platform which makes the connections for individuals, countries, and business by converting information into actions.
IoE is based an IoT, with intelligence in the network. IoE has significance over IOT in terms of privacy, security, congestion and energy. Major components of IOE are shown on **Figure 1**

Fig 1: Four major components of IoE [1]

IOE consist of internet of things (IOT), Internet of humans (IOH) and internet of devices (IOD), which is shown in **FIGURE 2**

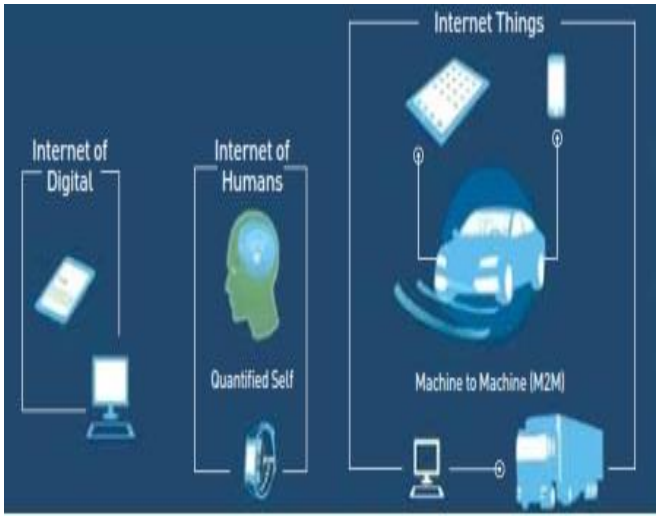

Fig 1: Four major components of IoE [1]

New objects and sensors play an important part in IOE. Sensor is an electronic device, which converts non electrical signal which is derived from a physical condition (or) event and produces optical, electrical (or) digital media. Sensor belongs to a category of transducer. Different sensors capture different information.
Sensors are classified into two types.
1. Active
2 passive
Active sensors emit energy and sense the response of the environment in that energy.
Example: RADAR.
Passive sensors receive energy. This type of sensors requires less energy.

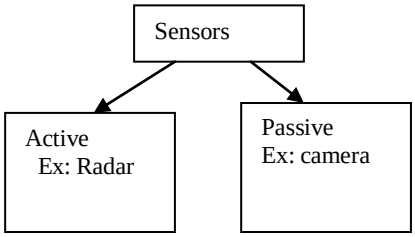

Fig 3: Sensor types

Primary factors driving adoption of sensors
Factors which drive adoption of sensors are classified into three types based on price, capability, and size.

1. **Cheaper sensors:** price of sensors have fallen over last 25 years, as shown in figure 4

Fig4: sensor prices for the last decade [2]

2. Smarter sensors: Over the last decades computational power of processor has improved.
It doubled every three years, which is shown in Figure 5

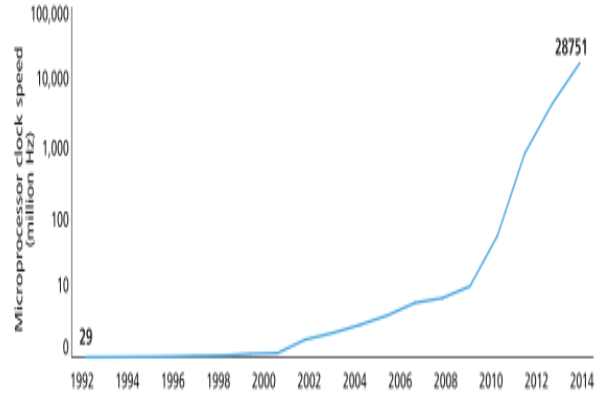

Fig 5: Increasing Speed of Computing Power[6][7]

3. **Smaller sensors**: smaller sensors have the potential to drive IOE.

2. Type of Sensors

Industries have been using different types of sensors. Sensors have changed the IOE and world forever. Table 1 shows different types of sensors and their domain [4][5].

Sno	Type Of Sensor	Subcategories Of Sensors	Sensor Description
1	Temperature	Infrared Thermometer Temperature Gauge	These Are Used To Measure The Amount Of Cold (Or) Heat, Which Is Present In System Used In Healthcare, Agriculture.
2	Pressure	Barometer Piezometer Pressure Gauge	Industries Use Pressure Sensors For The Measurements Of Weights And Also To Control Gases. Ex: Heating System, Weather Forecasting, Water System.
3	Biosensors	Blood Glucose Biosensors	Detects Various Biological Elements Such As Enzymes, Organism Etc.
4	Light Sensors	Ir Sensor, Flame Detector	These Sensors Are Used To Detect The Presence Of Light.
5	Position Sensors	Inductive Sensor Ultrasonic Photo Electric	Position Sensors Are Used To Measure The Objects Position.
6	Velocity Sensors	Gyroscope, Accelerometer	These Sensors Are Used To Measure Speed Of Motion.
7	Level Sensors	Continues Point Level	Medical Equipment Recycling Industry Fuel Industry Alcohol Industry
8	Smoke	Smoke Detector Ionization Smoke Sensor	These Are Used In Manufacturing Industries.
9	Chemical	Chemo Resistor Chemical Field –Effect Transistor	These Sensors Are Used To Identify Changes In Liquid.
10	Gas Sensor	Hydro Sensor Ozone Meter	Specially Used To Monitor Changes In Air Quality.

3. Factors that determine the suitability of sensors for a specified applications.

(i) **Accuracy**: Measures how precisely a sensor reports a signal.
(ii) **Repeatability:** Sensors should report the same response when same input is given under constant condition.
(iii) **Range:** Band of input signal, where sensor perform accurately.
(iv) **Selectivity:** The ability of a sensor to sense a signal.

(v) **Noise:** Fluctuation in the output, when sensors sensify a signal.
(vi) **Resolution:** Smallest change in the input signal [8].

4. Challenges and Solutions for Sensors in IOE

Following are the major challenges faced by sensors even they are small in size, smart.

1. Power consumption:
Power to sensor is through 1) Inline connections
2. Using Battery:
Inline connections are expensive, whereas batteries life and replacement is an issue.

2. False Messages:
If sensor is hacked, it will produce false messages.

3. Data Transmission issue:
Transmission of original data which sensors collect is real issue in IOE.

4. Break in Communication:
Interrupts which are used as a part of sensors may cause break in communication.

5. Security of Sensors:
Security is key concern in IOE. Sensors import secret messages to the gadgets. Hacker may hack this information, if proper security arrangements have not been made.

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