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Sensor Systems

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The era of automation has begun already. Most of the things that we use now can be automated. To design automated devices first we need to know about the sensors, these are the modules/devices which are helpful in making things done without human intervention [9]. The sensor can be defined as a device which can be used to sense/detect the physical quantity like force, pressure, strain, light etc. and then convert it into desired output. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for reading or further processing [1]. We use sensors in our everyday life. For examples: sensors in our smartphone (it contains accelerometer, Gyroscope, GPS, Proximity Sensor and so on), at home and in all large enterprises we use a security system that is based on motion sensors, in medicine often used thermal imagers which use temperature sensors. We use sensors everywhere on work, at home and when we travel abroad. By combining a set of sensors and a communication network, devices share information with one another and are improving their effectiveness and functionality. This helps sensors becoming "smarter" every day and takes the sensor evolution to a completely different level. Irrespective of types of IoT sensors, any end point is where the IoT begins. Sensors generate primary signals that reflect one or another property of objects where sensors are installed. No sensors – no data. The wider variety of sensors appears, the more flexible IoT development

is provided. We greatly appreciate our natural sensors – eyes, ears, fingers etc. being afraid of losing any of our sensory capabilities. The industrial IoT sensors described above constitute just a tiny part of all available data-generating devices. Nevertheless, a deep expertise even in a given brief list of sensors enables any IoT solution provider to create powerful systems for a broad range of applications [8]. There are some examples of sensors:

1. Temperature sensor

Followed are some sub-categories of temp sensors:

- Thermocouple
- Resistor temperature detector (RTD)
- Thermistor
- IC (Semiconductor)
- Infrared sensor

2. Proximity sensor

Following are some sub-categories of proximity sensors:

- Inductive sensor
- Capacitive sensor
- Photoelectric sensor
- Ultrasonic sensor

3. Water quality sensor

Following is a list of the most common kinds of water sensors:

- Chlorine residual sensor
- Total organic carbon sensor
- Turbidity sensor
- Conductivity sensor
- pH sensor
- Oxygen-Reduction potential sensor [5].

On the example of a motion sensor (one of the most popular sensor used in our life), we consider how a sensor works and advantages and disadvantages of this sensor. This type is usually used in security systems. The device has the ability to quantify motion and alert the individual about any

movement, within a stipulated range, in the surroundings. Basically there are two types of sensors: active and passive.

Active sensors a.k.a. radar-based motion detectors: these sensors use ultrasonic sound waves to track any movement in the specified range. Once activated, an active sensor sends out pulses of energy and times the echoes those pulses create when the energy reflects off of nearby objects. If someone walks into the scanned area, the echo time will change, indicating that someone is moving through the area.

Passive sensors a.k.a. pyroelectric detectors: these sensors read changes in infrared energy levels in the surroundings in order to detect the presence of any individual. Passive infra-red sensors are the most widely used motion in home security systems. All living things give off heat, and these sensors can detect that heat. Passive sensors are programmed to detect sudden changes in the temperature of surroundings. Changes in energy levels are detected by a photo detector, which converts the wavelengths to electric current and transfers it to a small computer unit present in the device. When a human or animal enters an area covered by passive infrared sensors, the increase in infrared energy tells the sensor that someone or something is moving through the area. Normally the detector is programmed to detect emissions in the range of 8 to 12 micrometers. The detector triggers the alarm as soon as the photo detector 'senses' large variations in infrared energy levels in the surroundings. [2, 7].

Advantages: it can be used in very harsh environment having irregular heat cycles, has more lifespan which is about 100000 hours, detects motion both day and night, helps in providing security, easy to install. Disadvantages: radio frequency at high power is harmful for humans and in microwave range do not penetrate metal objects (active type), passive motion sensors do not operate above temperature of 350° C, passive infrared (PIR) sensor can detect human being

within 10 meters range, any kind of moving object can trigger the sensor [6]. Various forces underpinning the changing role of sensors in electronics systems include the following:

• The extreme miniaturization of components of many sensor systems. In optical applications, for example, aims pioneered the fabrication of on-wafer interferometric light filters for multi-channel spectral sensors, and micro-optic lens arrays for miniature light sources and light detectors.

• The availability of advanced computing resources in non-computer devices – a capability that enables products such as smartphones to process and intelligently use vast amounts of sensor data.

• The expansion of the Internet of Things (IoT), which gives rise to a new class of connected, autonomous devices that need the ability to see, hear, feel and smell, and to report their "perceptions" to cloud-based monitoring and control systems.

• Climate change, which gives urgent impetus to OEMs' energy-saving innovations, many of which depend on capturing more precise and relevant information about the real-world phenomena experienced or produced by electronics devices, such as heat, noise and vibration [3].

In the conclusion I want to say that creating of sensor made great influence on our life, because it made possible the creation of multi-functional devices. Sensors make our life easier. The future of sensors is complex, sophisticated, application-focused and often supplied as a modular solution. Enough real-world examples already exist for the electronics industry to clearly see where the future is headed.

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