ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol4, Issue 6, June 2017

Literature Surveyon Sensors

[1] Aruna T M, [2] Rajeswari R, [3] Lavanya H V ,[4] Meghana B S

[1] Assistant professor, Department of ISE, Sri Venkateshwara College of Engineering, Bangalore

[2][3][4] UG Scholar, Sri Venkateshwara College of Engineering,Bangalore

***Abstract*— As we all know that the sensors are the most important part of the embedded system and the robotics world. By using different types of sensors, we can minimize the logic circuits and also make the system more efficient to get output by taking less input. Therefore, here is detailed view of different types of sensors and their applications in the different fields[1].**

I. INTRODUCTION

Sensorsare sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically [1].

There are 7 types of sensors:

1. Temperature Sensor
2. IR Sensor
3. Ultrasonic Sensors
4. Touch Sensor
5. Proximity Sensors
6. Level Sensors
7. Smoke and Gas Sensors

II. TEMPERATURE SENSORS

This device collects information about temperature from a source and converts into a form that is understandable by another device or person. The best illustration of a temperature sensor is mercury in glass thermometer. The mercury in the glass expands and contracts depending on the alterations in temperature. The outside temperature is the source element for the temperature measurement. The position of the mercury is observed by the viewer to measure the temperature.

Figure:1.1 Temperature Sensor

Basic physical types of Temperature Sensors. In general, there are two sensing methods:

Contact Sensors – This type of sensor requires direct Physical contact with the object or media that is beingsensed. They supervise the temperature of solids,liquids and gases over a wide range of temperatures.

Non-contact Sensors – This type of sensor does not require any physical contact with the object or media that is being sensed. They supervise non-reflective solids and liquids but are not useful for gases due to natural transparency. These sensors use Plank's Law to measure temperature. This law deals with the heat radiated from the source of heat to measure the temperature [2].

Working of different types of Temperature Sensors along with examples

a) Thermocouple – A Thermocouple is a sensor used to measure temperature. Thermocouples consist of two wire legs made from different metals. The wires legs are welded together at one end, creating a junction. This junction is where the temperature is measured. When the junction experiences a change in temperature, a voltage is created [3].

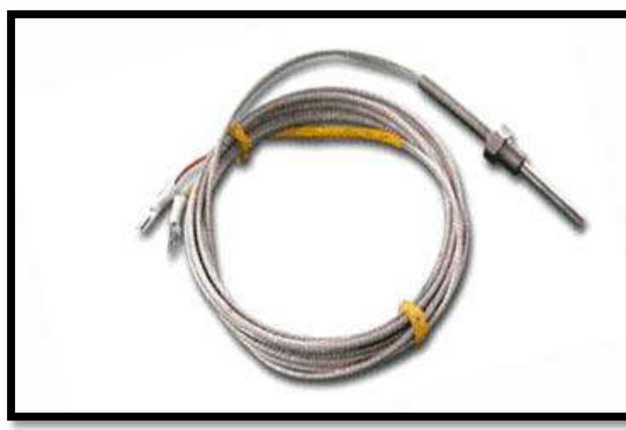

Figure:1.2 Thermocouple Sensor

Thermocouple Applications

- Plastic injection molding machinery
- Food processing equipment
- Deicing
- Semiconductor processing
- Heat treating
- Medical equipment
- Industrial heat treating
- Packaging equipment

Advantages Of Thermocouple

- High temperature ranges
- Rugged and withstand shock and vibration
- Provides immediate response to temperature changes

b) Resistance Temperature Detectors (RTD)

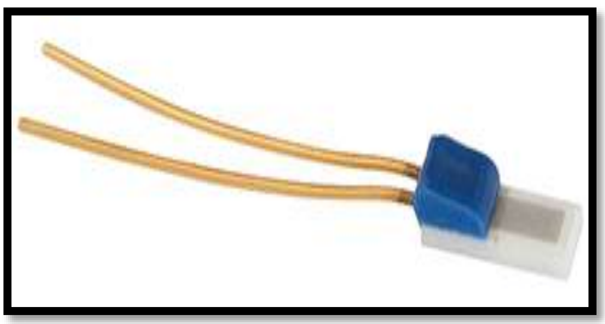

Figure:1.3 RTD Sensor

These are types of thermal resistors that are fabricated to alter the electrical resistance with the alteration in temperature. They are very expensive than any other temperature detection devices.

RTD Applications

- Air conditioning and refrigeration servicing
- Furnace servicing
- Foodservice processing
- Medical research
- Textile production

Advantages of RTDs

- Wide temperature range from -200 to 650°C
- Provides a high output for a current drop
- More linear compared to thermocouples and thermistors

c) Thermistors – They are another kind of thermal resistor where a large change in resistance is proportional to small change in temperature.

Figure: 1.4 NTC Type Thermistor (Epcos) Sensor

Thermistor applications

- Most are seen in medical equipment markets.
- Thermistors are also used are for engine coolant, oil, and air temperature measurement in the transportation industry.

Advantages of thermistors

- Better speed of response to changes in temperature, accuracy and repeatability.
- Inexpensive compared to rtds
- Higher resistance in the range of 2,000 to 10,000 ohms
- Much higher sensitivity (~200 ω/°c) within a limited temperature range of up to 300 °c

III. IR SENSOR

This device emits and/or detects infrared radiation to sense a particular phase in the environment. Generally, thermal radiation is emitted by all the objects in the infrared spectrum. The infrared sensor detects this type of radiation which is not visible to human eye[4].

Figure: 2.1 IR Sensor

Advantages of IR Sensors

- Easy for interfacing
- Readily available in market

Disadvantages of IR Sensors

- Disturbed by noises in the surrounding such as radiations, ambient light etc.

The Types of Infrared Sensors

Infrared sensors are broadly classified into two main types:

a) **Thermal infrared sensors** – use infrared energy as heat. Their photo sensitivity is independent of the wavelength being detected. Thermal detectors do not require cooling but do have slow response times and low detection capabilities.

b) **Quantum infrared sensors** – provide higher detection performance and faster response speed. Their photo sensitivity is dependent on wavelength. Quantum detectors have to be cooled in order to obtain accurate measurements.

IR applications

- Night Vision Devices
- Infrared Astronomy
- Infrared Tracking
- Art History and Restoration
- Hyper spectral Imaging
- Climatology
- Meteorology
- Night vision
- Photo biomodulation
- Gas detectors
- Water analysis
- Anesthesiology testing
- Petroleum exploration
- Rail safety

IV. ULTRASONIC SENSORS

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object[5].

Figure: 3.1 Ultrasonic Sensor

Advantages of Ultrasonic sensor

Ultrasonic sensors produce ultrasonic frequencies that humans cannot hear, making them ideal for quiet environments. They do not use much electricity, are simple

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol4, Issue 6, June 2017

in design, and are relatively inexpensive. Some piezoelectric crystals transmit and receive ultrasonic sound waves. Likewise, ultrasonic sensors can be used with both radio and sound waves.

Disadvantages of Ultrasonic sensor

Ultrasonic sensors do not have many disadvantages, but are limited in their capabilities. For example, density, consistency, and material can distort an ultrasonic sensor's readings.

Applications of Ultrasonic sensor

Ultrasonic sensors have many uses, but typically involve measuring speed, distance, or volume. They are used in navigation to determine the device and user's location. Ultrasonic sensors detect wind speed and direction, and determine how much liquid is in a container by measuring the distance from the top of the container to the surface of the liquid. They are also used in humidifiers, burglar alarms, medical ultrasonography, and some forms of testing.

V. TOUCH SENSOR

A touch sensor is a type of equipment that captures and records physical touch or embrace on a device and/or object. It enables a device or object to detach touch, typically by a human user or operator.A touch sensor may also be called a touch detector[6].

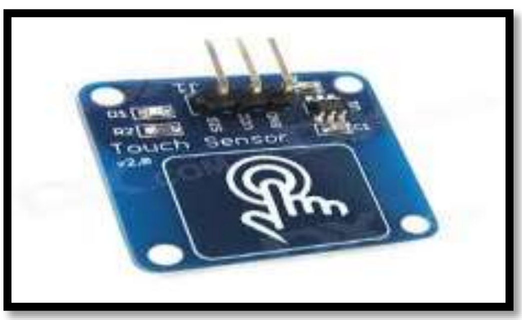

Figure: 4.1 Touch Sensor

Applications of Touch sensor

- Gaming controllers
- Home entertainment
- Home appliances
- Cellular handsets
- Portable media devices

VI. PROXIMITY SENSORS

A proximity sensor detects the presence of objects that are nearly placed without any point of contact. Since there is no contact between the sensors and sensed object and lack of mechanical parts, these sensors have long functional life and high reliability. The different types of proximity sensors are Inductive Proximity sensors, Capacitive Proximity sensors, Ultrasonic proximity sensors, photoelectric sensors, Hall-effect sensors, etc.[1].

Types of Proximity Sensors

There are several types of proximity sensor which are used according to the need, material detection and many other things. To classify them here are its types:

a) **Inductive Proximity Sensors**

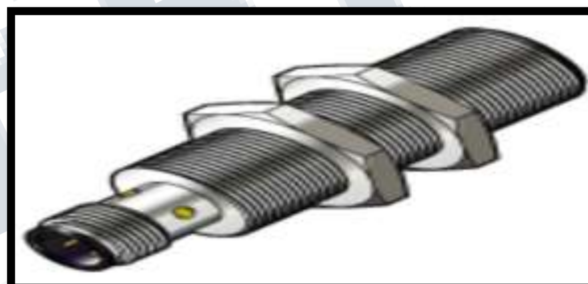

Figure: 5.1 Inductive Proximity Sensor

Device which generates output from any direction. The metal objects above signal or electrical signal when metal objects are either inside or entering into its sensing area includes iron, aluminum, brass, copper, etc. with varied sensing distances[8].

b) **Capacitive Proximity Sensors**

Figure: 5.2 Capacitive Proximity Sensor

It can also detect metals but along with it can also detect resins, liquids, powders, etc. This sensor working can vary accordingly covering material, cable longness, noise sensitivity. It's a sensing distance also vary according to factors such as the temperature, the sensing object, surrounding objects, and the mounting distance between Sensors. Its maximum range of sensing is 25 mm [8].

c) Magnetic Proximity Sensors

Name is saying its sensing object – magnets. Magnetic Proximity Sensors have no electrical noise effect and it can work on DC, AC, AC/DC, DC. Again, sensing distance can vary due to factors such as the temperature, the sensing object, surrounding objects, and the mounting distance between Sensors. This type of sensors has highest sensing range up to 120 mm [7].

Figure: 5.3 Magnetic Proximity Sensor

VII. LEVEL SENSOR

A level sensor detects the level of liquids and other fluids and fluidized solids, including slurries, granular materials, and powders that exhibit an upper free surface[8].

a) **Laser:** This technology offers the broadest availability of offerings, flexibility, ease of set-up andalignment, and cost. While lasers work well for bulk and liquid, continuous, and switching applications, it's not as well-suited for clear materials, foam (light loss due to dispersion), or sticky fluids (lens contamination).

b) **Microwave:**Because of its ability to penetrate temperature and vapor layers that may cause problems for other techniques, guided microwave technology (also known as guided radar) compares well with lasers as they don't need calibration and have multiple output options. Guided microwave is also among the handful of technologies that works well with foam and sticky materials. However, guided microwave sensors do have a limited detection range in someapplications.

c) **Tuning Fork:** This vibrating-style sensor technology is ideal for solid and liquid detection,including sticky substances and foam, as well as bulk powders. However, tuning forks arelimited to detection applications (i.e., overfill and dry run), and do not provide continuousprocess measurement. The mounting position of the devices is also critical.

d) **Ultrasonic:** These devices, which gauge levels by measuring the duration and intensity ofechoes from short bursts of energy, share the same capabilities as lasers and offer flexibility inmounting and outputs. The technology is ideal for many types of liquids, but performance dropsoff in applications involving foam. Range is more limited than laser offerings and alignment ofthe emitting/detection and reflection components is also critical.

e) **Optical Prism:**Inexpensive and simple to set-up and operate, optical sensors detect variationsin emitted light. However, optical prisms work only in clean translucent to transparent liquids,while their limited "on/off" functionality also restricts their use to protecting from overflows anddry runs.

f) **Pressure:**Used for a variety of liquids, pressure sensors measure the hydrostatic pressure ofthe liquid at the bottom of the tank with respect to atmospheric pressure to determine the levelof the liquid. Though highly accurate, pressure sensors' setup and calibration requirementsmake them more of a specialty solution in situations where all other options are not viable dueto the type of liquid, or configuration of the tank itself. For example, the tank bottom may have afunnel or cone shape, or there may be a motor or agitator positioned in the middle that preventsa straight-down view.

g) **Capacitance:** Capacitance level sensors operate with a variety of solids, liquids, and mixedmaterials. There are also a wide range of device types, some of which can be attached outsidethe vessel. Users need to be cautious when selecting a device, as not every capacitance sensorworks with every type of material or vessel. In addition, some capacitive probes can givecontinuous output much the way guided microwaves or conductive probes do, but need to becalibrated to the material being measured. And because capacitance probes are a contactbasedmeasurement system, the technology is not always suitable for use with sticky fluids.

h) **Floats:**The oldest and simplest measuring technology can still be found in automatedmanufacturing processes. Being a mechanical device, however, floats offer little otheradvantage to users for all but the most basic applications[9].

VIII. SMOKE AND GAS SENSORS

a) Smoke Detection Sensor

A smoke sensor is a device that senses smoke, typically as an indicator of fire. Commercial and residential security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible or visual alarm from the detector itself[10].

Applications of Smoke Detection Sensor

- Industry (production environments and offices)
- Commercial activities
- Public and private buildings
- Home environments

Advantages of Smoke Detection Sensor

- Prevent the spread of fires, increasing security.
- Avoid damaging or stopping of the industrial production process.
- Increase efficiency and competitiveness.
- Efficient and precise monitoring, in real time, for the users.
- Easy accessing data through PC/tablet/ Smartphone.
- Timely detection in critical environments.
- Major fire safety through integration with other security systems (video surveillance systems, access control system, gas detection sensors, alarm systems such as sirens or flashing). The result: a solution IoT (Internet ofThings*)* high efficiency and functionality.
- The Wireless – a particular character of IoT (Internet of Things) – allows the installation even in complex environments where laying cables is difficult.

b) Gas detection Sensor

A gas detector is a device that detects the presence of **gases** in an area, often as part of **a safety system**. This type of equipment is used to detect a **gas leak** or other emissions and can interface with a **control system** so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals[11].

Applications of Gas Sensor

- Process control industries
- Environmental monitoring
- Boiler control
- Fire detection
- Alcohol breath tests
- Detection of harmful gases in mines
- Home safety
- Grading of agro-products like coffee and spices

IX. CONCLUSION

In this survey, we recognize many sensors. All sensors are used for different applications. The flexibility, fault tolerance, high sensing fidelity, low-cost and rapid deployment characteristics of sensor networks create many new and exciting application areas for remote sensing.In the future, this wide range of application areas will make sensor networks an integral part of our lives.

REFERENCES

[1] Types of Sensors and Their Applications 1Snuti Kumari, 2Garima Rathi, 3Priyanka Attri, 4Manee Kumar

[2] http://www.engineersgarage.com/articles/sensors?page=2

[3] http://www.thermocoupleinfo.com/

[4]http://www.engineersgarage.com/articles/sensors?page=3

[5]http://education.rec.ri.cmu.edu/content/electronics/boe/ultrasonic_sensor/1.html
[6]https://www.techopedia.com/definition/30234/touch-sensor
[7]http://thegadgetsquare.com/1334/what-are-proximity-sensors-types-and-how-it-works/
[8]https://en.wikipedia.org/wiki/Level_sensor
[9]https://www.sick.com/medias/8-Level-Sensing-Solutions-to-Reduce-Costs.pdf?
[10]http://www.energiazero.org/arduino_sensori/smoke_sensor_module.pdf
[11]https://en.wikipedia.org/wiki/Gas_detector