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Design of Smart Sensor

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***Abstract*: Smart sensors are an extension of traditional sensors with advanced learning capabilities. They are low cost sensors which are silicon based that support some intelligence in a single package. They are also called as intelligent sensor with ability to make some decision. This discusses general architecture of smart sensor and the usefulness of silicon technology in smart sensor. This also pays attention to the importance and adoption of smart sensors. In addition to this an effort is made to present the design consideration of smart sensor as per the functions performed.**

***Keywords*: Advanced learning, Intelligence.**

1. Introduction

The advent of integrated circuits which became possible because of the tremendous progress in semiconductor technology resulted in the low cost microprocessor. Thus if it is possible to design a low cost sensor which is silicon based then the overall cost of the control system can be reduced. We can have integrated sensors which has electronics and the transduction element together on silicon chip. This complete system can be called as system on chip. The main aim of integrating the electronics and the sensor is to make an intelligent sensor which can be called as smart sensor. Smart sensor then has the ability to make some decision. Physically a smart sensor consists of transduction element, signal conditioning electronic and controller that support some intelligence in a small package. In this report the usefulness of silicon technology as a smart sensor, physical phenomena of conversion to electrical output using silicon sensors.

2. Overview of Smart Sensor

Smart sensors are sensors with integrated electronics that can perform one or more of the following function logic functions, two -way communications make decisions. There is very convincing advantage of using silicon technology in the construction of smart sensor. All integrated circuits employ silicon technology. A smart sensor is made with the same technology as integrated circuits. A smart sensor utilizes the transduction properties of one class of materials and electronic properties of silicon. A transduction element either includes thin film metal, zinc oxidant polymeric films. Integrating electronics circuits on the sensor chip make it possible to have single chip solution. Integrated sensors provide significant advantages in terms of overall size and the ability to use small signals from the transduction element. The IC industry will get involved in smart sensor if a very large market can be captured and the production of smart sensor does not require non-standard processing steps.

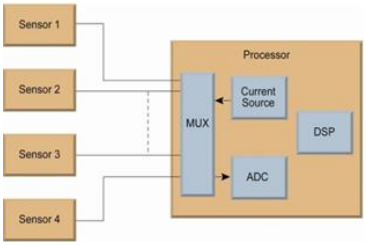

Fig. 1. Block diagram Smart Sensor

3. Importance and adoption

The presence of controller in smart sensor has led to corrections for different undesirable sensor characteristics which include input offset and span variation non linearity and cross sensitivity. As these are carried in software no additional hardware is required and thus calibration becomes an electronic process. Thus it is possible to calibrate the batches of sensor during production without the need to remove the sensor from its current environment. In case of smart sensor inside hardware is more complex in the sensor on the other hand it is simpler outside the sensor. Thus the cost of the sensor is in its setup, which can be reduced by reducing the effort of set up and by removing repetitive testing.

Due to the existence of processor with in the package, it is possible to have digital communication via a standard bus and a built in self-test. This is very helpful in production set of integrated circuits. This diagnostic can be a set of rules based program running in the sensor.

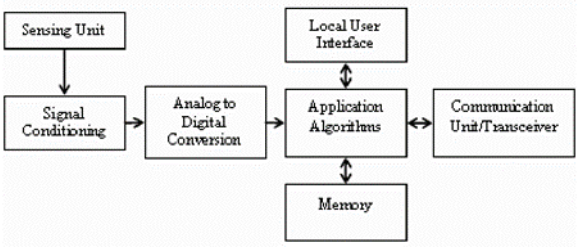

Fig. 2. Smart sensor

4. Different Smart Sensors

Optical sensor is one of the examples of smart sensor, which are used for measuring exposure in cameras, optical angle

encoders and optical arrays. Similar examples are load cells silicon based pressure sensors.

Fig. 3. Optical Sensor

Accelerometer fabricated at the IBM Research laboratory at San Jose California, which consists of the sensing element and electronics on silicon. The accelerometer itself is a metal-coated SiO2 cantilever beam that is fabricated on silicon chip where the capacitance between the beam and the substrate provides the output signal

Fig. 4. Accelerometer

5. Significance

1. Network setups can be carried out without fixed infrastructure.
2. Suitable for the non-reachable places such as over the sea, mountains, rural areas or deep forests.
3. Flexible if there is random situation when additional workstation is needed.
4. Implementation pricing is cheap.
5. It avoids plenty of wiring.
6. It might accommodate new devices at any time.
7. It's flexible to undergo physical partitions.
8. It can be accessed by using a centralized monitor.

6. Conclusion and future Scope

In conclusion, silicon is very suitable material for fabrication of smart sensors. But still a lot of research is required to get benefits of the smart sensor, but from the experience of already existing devices, we can expect that in the coming decade a large number of successful smart sensors will emerge. The size of the smart sensor is decreasing day by day, but the technology that it holds within it has become remarkable. There are current processes involved which tend to take smart sensing to a whole new level where one sensor would be able to sense an entire house or building.

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