EMBEDDED SENSOR IMPLEMENTATION IN INDUSTRIAL PRODUCT AND INDUSTRIAL FACILITIES

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ABSTRACT:

A device which gives an output by detecting the changes in quantities or measures can be definite as a sensor. In the main, sensors produce an electrical signal or optical output signal consequent to the changes in the inputs. Sensors can be essentially confidential interested in analog sensors and digital sensors. But, there are a only some types of sensors such as temperature sensors, IR sensors, pressure sensors, proximity sensors, and touch sensors are habitually worn in nearly everyone of the electronics applications.The resistance can be slow by a multimeter then applying strength to the sensing district. Light, radiation, pressure, flow level, and acceleration. In this respect, sensors frequently form the hub constituent in their products and solutions and have a key control on the worth, economic good organization and shelter of the application by jealous key practice parameters.

KEYWORDS: **Touch sensor, Temperature sensor, PIR sensor, Pressure sensor.**

I. INTRODUCTION

Sensor are becoming the biggest and fastest growing markets, comparable with computers and communication devices market. You find sensors in smart phones, automobiles, security systems and even everyday objects like coffee makers! Apart from consumer electronics, these are also an integral part of the internet of things, medical, nuclear, defence, aviation, robotics and artificial intelligence, agriculture, environment monitoring and deep-sea applications.

Sensor is a device that detects and responds to a number of type of input from the physical environment. The unambiguous input possibly will be light, heat, motion, moisture, pressure, or any one of a enormous integer of other environmental phenomena. The output is commonly a signal that is renewed to human-readable display at the sensor scene or transmitted electronically over a network for reading or auxiliary dispensation. Motion sensors in a range of systems counting home security lights, automatic doors and bathroom fixtures typically transmit out several type of vigour, such as microwaves, ultrasonic waves or light beams and perceive when the flow of energy is sporadic by something inflowing its path.

Fig. 1 Sensor Technology In 2020

- **The 'unobservable' sensing** breaks new floor in sensing biohazards, smells, material stresses, pathogens, level of rust and chemicals in objects.
- **Micro-sensor implants** in patients track the healing process for internal injuries, enable health care professionals to take remedial action based on continual data from the system.
- **Biodegradable sensors** monitor soil moisture and nutrient content for optimum crop production.
- **Self-powered sensors** that are powered using the heat difference between the patient's body and surrounding air find applications in medical care.
- **Self-healing sensors** repair themselves in the event of disaster or other structural disruptions.
- **Live cell-based sensing**, an amalgamation of sensor technology and living cells, allow scientist to understand the biological effect of medicines, environment and biohazards.
- **Sensor swarms** coordinate their conduct, decide what to measure and where through a self-learning system directing their actions and data gathering.
- **Smart dust**, microscopic sensors powered by vibrations, monitor situations ranging from battlefield activities, structural strength of buildings and clogged arteries.

Sensors record vibration, temperature, pressure and voltage, among other conditions, and make available data for real-time analysis. They also can help lead to discovery of faulty parts in products weeks before they in reality fall short. When sensors were initially being developed they were designed for large and steep industrial platforms, such as electrical group systems and jet engines. In no time, sensors connected to analytical platforms will be create in nearly every produce. This is because it is becoming a belief that technology will make machinery and systems more reliable. Sensors and analytics will alert users and trader to problems sooner than they become visible, which will abolish many continuation checks so companies can save moment and wealth.

Sensors will also allow businesses to learn how clients are using their products, which will help shape how products are made. Sensor data analytics allows companies to look at patterns of raw sensor data and their connection to everyday deeds and events. The starting point for this is often raw tremor data from an accelerometer, which have advanced power-saving sort that make them the ideal selection for ultra-low power applications.

Many sensor manufacturers are making a big push on innovation of new sensor technology. Freescale has presently now stubborn on sensor fusion, which is a string by which data from many different sensors are "multipart" to compute a little more than could be determined by any one sensor alone. This allows for an improvement in application or system performance. "It 's all about bringing the relevant data together from multiple sensors to provide a bigger picture of what's going on in a system," Steve Whalley, Chief Strategy Officer at MIG told EE Times. Advanced MP Technology is a worldwide trusted distributor for electronic components. We supply and support a wide range of sensor manufacturers including, Honeywell, Omron, Freescale, NXP, and STM.

II. TYPE OF SENSORS

TOUCH SENSOR FLEXIFORCE™ A502 SENSOR

They have a energy range of 0-222 N (0-50 lb), individual with Tekscan electronics. The model is linear through a much lower collection of 0-22N (0-5 lb) and is capable of measure loads up to 44,482 N (10,000 lb).The bouncy range of this tiny force sensor can be bespoke by shifting the force voltage and correct the resistance of the feedback resistor .

Fig. 2 Flexi Force A502 Sensor Image

TYPICAL PERFORMANCE:

Linearity (Error): < ±3% of Full range (column pinched from 0 to 50% load) **Repeatability:**

< ±2.5% (broken in Sensor, 80% of Full Force functional) **Hysteresis:** < 4.5 % of Full Scale
(inured Sensor, 80% of Full Force theoretical) **Drift:** <5% / logarithmic time (invariable Load
of 25 lb (111 N))
Response Time: < 5 µsec (Time compulsory for the sensor to respond to an input force; contact load - recorded on Oscilloscope)
Operating Temperature: -40°C - 60°C (-40°F - 140°F)
Force sense vary per degree of temperature change = 0.36%/ºC (±0.2%/ºF)

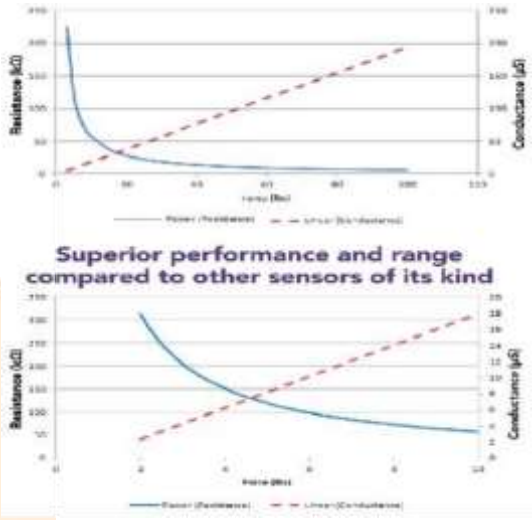


Fig. 3 Typical Performance

HOW TO ADJUST THE FORCE RANGE:

In order to measure higher forces, apply a lower drive voltage (-0.5 V, -0.25 V, etc.) and reduce the resistance of the feedback resistor (1kΩ min.) To measure lower forces, apply a higher drive voltage and increase the resistance of the feedback resistor.

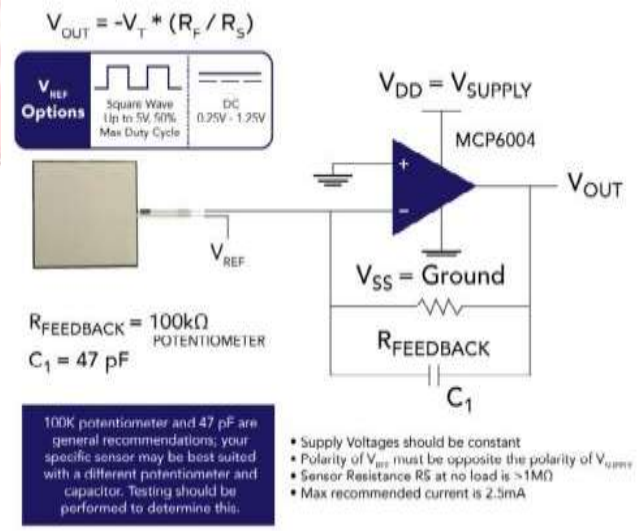


Fig. 4 Force Range

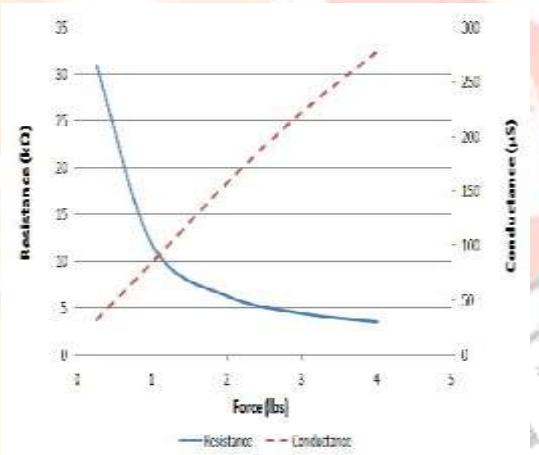
A101 TOUCH SENSOR

The smallest sensor optimized for high volume industrial and ideal for embedding into merchandise. The 2-pin sensors are at this time our fewest gauge sensor.The strong range of this mini sensor can be personalized by shifting the drive voltage and adjust the resistance of the feedback resistor

Fig. 5 A101 Touch Sensor

TYPICAL PERFORMANCE:

Linearity (Error): < ±3% of Full Scale (Line drawn from 0 to 50% load) **Repeatability:** < ±2.5% (Conditioned Sensor, 80% of Full Force Applied) **Hysteresis:** < 4.5 % of Full Scale (Conditioned Sensor, 80% of Full Force Applied) **Drift:** <5% / logarithmic time (Constant Load of 111 N (25 lb))
Response Time: < 5 µsec (Time required for the sensor to respond to an input force; Impact load - recorded on Oscilloscope)
Operating Temperature: -40°C - 60°C (-40°F - 140°F)*
Force reading change per degree of temperature change = 0.36%/ºC (±0.2%/ºF)Flexi Force™ A101 Sensor



Voltage (V)	Force (lbs)	Resistance (KΩ)	Conductance (µS)
0.5	0.25	20.05	32.41
0.5	1	11.79	85.20
0.5	2	6.33	158.40
0.5	3	4.49	222.99
0.5	4	3.68	277.53

Fig. 6 Typical Performance

TEMPERATURE SENSOR

Heat sensing element that develops a large resistive change with temperature. This thermo resistive device is etched from a concrete part of a set of doped material and has a bare minimum of molecular slippages and/or dislocation resulting in a highly reliable device. When used as recommended, a signal resolvable to 0.001° F is possible. The individual passive elements R1 and R2 have no effect on linearization and can be used to make available an offset or bridge balance at any temperature within the operating range. The temperature sensing element can be bonded with epoxy to materials which can shape the data somewhat due to the differences in thermal expansion between the silicon and the material to which it is being bonded. The group of the temperature sensing element is small and will take action to a 180 deg F change of temperature in water in less than two milliseconds.

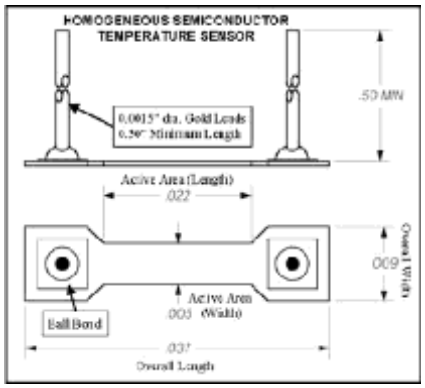


Fig. 7 Temperature Sensor

FEATURES

- High reliability
- Low cost
- Fast response
- High resolution

APPLICATIONS

- Useful in Lines
- Storage Tanks
- Air Conditioners
- Fuses and Anemometers

PRESSURE SENSOR DESCRIPTION

Dynisco's PT303 pressure transmitter is designed for gas turbine pressure applications in hazardous locations. They heavy duty construction and wide pressure ranges offer trouble-free operation and flexibility to meet your requirement

Fig. 8 PT303 Pressure Sensor

Honeywell's Model IP is a new platform of intrinsically safe pressure sensors are designed to offer repeatable, reliable and accurate pressure measurements over time. These rugged, stainless steel, all-welded pressure sensors are pre-configured with the most commonly requested options. They may be used in many demanding, harsh environments and with a variety of media. Configurations for current measurements are fully temperature compensated and calibrated.

BENEFIT

- Accuracy ± 0.25%
- Stainless steel construction
- Heavy duty construction
- Ranges 0-110 PSI through 0-750 PSI
- Advanced electronic design

FEATURES

- All-welded, 300 series stainless steel and Hastelloy
- 7 bar to 350 bar [100 psi to 5000 psi] pressure range

- Accuracy options:- Standard accuracy: IPG2 provides ±0.25 % BFSL2- Optional enhanced accuracy: IPG1provides ±0.15 % BFSL2
- 4 mA to 20 mA current output
- ±2 %FS (Total Error Band3) IP65 rated protection
- <2 ms response time provides accurate, high-speed measurement
- CE and RoHS compliant
- Intrinsically Safe: cFMus/ATEX, IEC Ex certification

May be used in pumps, compressors, generators, fracturing trucks, wellheads, pipelines, manifolds, andoil/water/gas separators.Honeywell IP IS Series pressure sensors help keep equipment safe and minimize maintenance through reliable measurement of media (gas, fluid) under extreme environmental conditions. Pressure feedback on inlet and/or discharge may be used for both control and monitoring conditions such as fault monitoring to shut down or control equipment to avoid damage or failure of other equipment in field or cause safety issues

May be used in production/process equipments, end-of-line testers and product/material test machines. Honeywell IP IS Series pressure sensors help keep people, equipment, and industrial manufacturing plants safe through reliable measurement of media (gas, fluid). Pressure feedback for both control and monitoring conditions can be used for fault monitoring, hydraulic/pneumatic fluid pressure monitoring/control, tank pressure monitoring, leak detection, pump control, process control/monitoring to shut down or control equipment to mitigate equipment damage/failure, product deficiency or safety concern.

PASSIVE INFRARED SENSOR (PIR)

A passive infrared sensor (PIR sensor) is an electronic sensor that agency infrared (IR) light radiating from things in its ground of analysis. They are most often used in PIR-based motion detectors. An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a human, passes in front of the background such as a wall the temperature at that point in the sensor's field of view will rise from room temperature to body temperature and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage and this triggers the detection. Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well. Ocular radiations use infrared and perceptible section of the spectrum; audio waves use an ultrasonic fraction of the frequency scale; and, micro and millimeter waves are referred to as radio waves.IR radiation is the section of the electromagnetic spectrum that has wavelengths smaller than microwaves and longer than the visible light wavelengths.

The infrared region is from 0.75um to 1000umand, the IR waves are too small to be seen with the human eyes. If the wavelength region is from 0.75um to 3um – it is called as near infrared; the region from 3um to 6um is called as mid infrared; and if the region is higher than 6um, then it is called as far infrared. These radiations have been broadly used in various sensors and electronic gadgets. Right from the TV remotes to the complicated devices like night-vision equipments use IR waves. The following section discusses about the PIR sensor basics and its applications. The term PIR is the short form after Passive Infrared. The term "passive" indicates that the sensor does not actively take part in the process which means, it does not emit the referred IR signals itself, rather passively detects the infrared radiations coming from the human body in the surrounding area. The detected radiations are converted into an electrical charge, which is proportional to the detected level of the radiation. Then this charge is further improved by a built in FET and fed to the output pin of the device which becomes applicable to an external circuit for further triggering and amplification of the alarm stages.

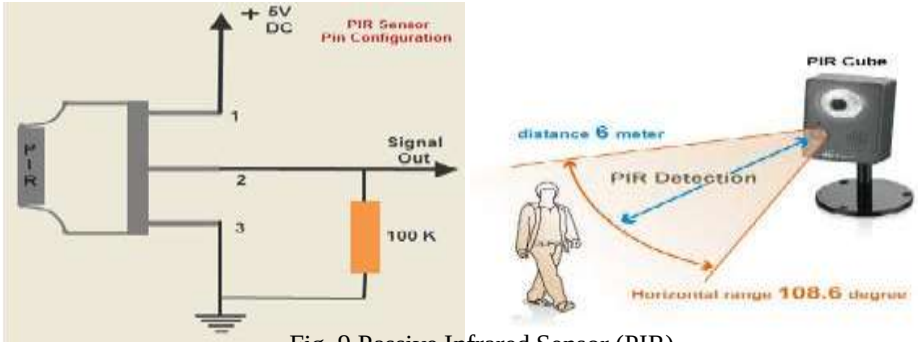


Fig. 9 Passive Infrared Sensor (PIR)

The PIR sensor range is up to 10 meters at an angle of +15o or -15o.The below image shows a typical pin configuration of the PIR sensor, which is quite simple to understand the pinouts; and, one may easily arrange them into a working circuit with the help of the following points:Pin1 corresponds to the drain terminal of the device, which should be connected to the positive supply 5V DC.Pin2 corresponds to the source terminal of the device, which should be connected to the ground terminal via a 100K or 47K resistor. In the above section, we have scholarly the pin outs of a PIR sensor, now let's move on to study a simple application of the PIR sensor.In the being there of a being IR energy or radiation, the infrared sensor detects the energy and immediately convert it into minuscule electrical pulses, enough to set off the transistor BC547 into transfer and to make its collector go low.

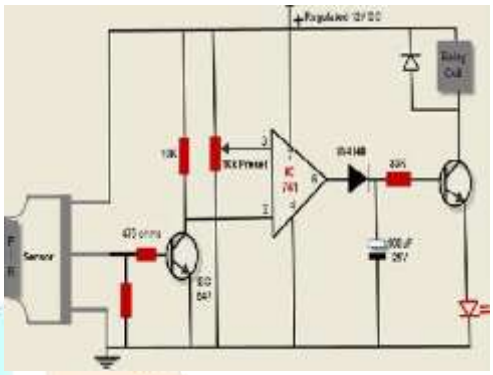


Fig. 10 PlR Sensor

As a comparator, the IC741 is set up –which consists of 8 pins. in which the pin3 is allocated as the situation input, while the Pin2 as the sensing input. When the collector terminal of the transistor goes low, then the potential pin2 of the IC becomes lower than the potential pin3. Immediately it makes the output of the IC high, triggering the relay driver consisting of another transistor and relay. The relay triggers and switches on the alarm device, which is connected to the circuit. The capacitor 100uF/25V makes sure that the relay remains on even after the passive infrared sensor is turned off possibly due the exit of the radiation source.

III. CONCLUSION

Sensor can be made to fit almost anywhere in consumer devices, robots, automobiles and even humen bodies. Use of intelligent sensor is also increasing in counter-terrorism, cargo tracking, biometrics among other applications. Latest sensors are used in automobiles to prevent impending crash and determine the typr of airbags to be fired, force, speed of their deployment.

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