



Sensors and actuators

PROJECT PROPOSAL

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INDUSTRIAL AUTOMATION USED SENSORS AND
HEALTH CARE USED SENSORS

Introduction:

A Sensor is a device that identifies the progressions in electrical or physical or other quantities and in a way to deliver a yield as an affirmation of progress in the quantity. In simple terms, Industrial Automation Sensors are input devices which provide an output (signal) with respect to a specific physical quantity (input).

Sensors used in Automation:

In the industrial automation, sensors play a vital part to make the products intellectual and exceptionally automatic. These permit one to detect, analyze, measure and process a variety of transformations like alteration in position, length, height, exterior and dislocation that occurs in the Industrial manufacture sites.

Also Read: Enhancing Efficiency and Precision through Sensor-Based Automation

These sensors also play a pivotal role in predicting and preventing numerous potential proceedings, thus, catering to the requirements of many sensing applications.

The following are the various types of sensors used in automation:

Temperature Sensors

Pressure sensors

MEMS Sensors

Torque Sensors

Let's discuss about these different Types of industrial automation sensors in detail to understand their scope of use:

Also read: Understanding the Mechanics of Submersible Water Level Sensors

Temperature Sensors :

A temperature sensor is a device that collects information concerning the temperature from a resource and changes it to a form that can be understood by another device. These are commonly used category of sensors which detect Temperature or Heat and it also measures the temperature of a medium.

Digital Temperature Sensors and Humidity & Temperature Sensors are few of the main temperature sensors used in automation.

Digital Temperature Sensors:



Digital Temperature Sensors These Digital Temperature Sensors are silicon-based temperature-sensing ICs that provide accurate output through digital representations of the temperatures they are measuring. This simplifies the control system's design, compared to approaches that involve external signal conditioning and an analog-to digital converter (ADC).

Also Read: [How to Choose the Right Sensor for Your Industrial Automation System](#)

Humidity & Temperature Sensors

Temperature Humidity Sensors



The Temperature & Humidity sensors attribute a temperature & humidity sensor complex with a measured digital signal output. By utilizing the technique and temperature & limited digital-signal-acquisition humidity sensing technology, it ensures high consistency and exceptional long-standing stability.

Applications of Temperature Sensors:

They are weatherproof & designed for continuous temperature measurement in air, soil, or water

Exceptional accuracy and stability

For measurements in complex industrial applications

For measurements under rough operating conditions

Pressure Sensors:

The Pressure Sensor is an Instrument that apprehends pressure and changes it into an electric signal where the quantity depends upon the pressure applied.

Turned parts for Pressure Sensors and Vacuum Sensors are few of the major pressure sensors used in Industrial automation.

Turned parts for Pressure Sensors

Turned Parts for Pressure Sensors



These Pressure sensors are widely used in Industrial and hydraulic systems, these are high pressure industrial automation sensors also used in climate control systems.

Vaccum Sensors



Vaccum Sensors are used when the Vaccum pressure is below atmospheric pressure levels and it can be difficult to sense through mechanical methods. These sensors generally depend on a heated wire with electrical resistance correlating to temperature. When vaccum pressure increases, convection falls down and wire temperature up rises. Electrical resistance increases proportionally and is calibrated adjacent to pressure in order to give an effective measurement of the vaccum.

Applications of Pressure Sensors:

Used to measure pressure below than the atmospheric pressure at a given location

Used in weather instrumentation, aircrafts, vehicles, and any other machinery that has pressure functionality implemented

Pressure sensors can be used in systems to measure other variables such as fluid/gas flow, speed, water level, and altitude

MEMS Sensors (Micro-electro-mechanical Systems)

These MEMS industrial automation sensors convert measured mechanical signals into electrical signals.

Acceleration and Motion MEMS are few important sensors used in industrial automation.

Acceleration sensors



Micro-electro-mechanical Systems (MEMS) Acceleration Sensors are one of the main inertial sensors; and are dynamic sensor competent of have a greater range of sensing capabilities.

Motion sensors



Micro-electro-mechanical system (MEMS) motion sensors use data processing algorithms designed on a motion interaction platform which integrates numerous low-cost MEMS motion sensors with ZigBee wireless technology to carry personified interactions while working together with machines. Sensor signal processing systems mainly solve noise cancellation; signal smoothing, gravity influence partition, coordinate system alteration, and position information recovery .Widely used in the automotive Industry in ABS technology.

Applications of MEMS Sensors:

These have numerous applications ranging from industry, entertainment, sports to education. For example, triggering airbag deployments or monitoring of nuclear reactors

Used to measure static acceleration (gravity), tilt of an object, dynamic acceleration in an aircraft, shock to an object in a car, vibration of an object. Cell phones, washing machines or computers

Used to detect motion

Torque sensors



The torque sensors complete with essential mechanical stops, raise overload capacity and offer additional guard during mounting and operation.

Rotating Torque & Torque Transducers are few important sensors used in industrial automation.

Rotating Torque Sensors

Rotating Torque Sensors

This Rotating Torque industrial automation sensors used for measuring reaction of rotating torque. These torque meters complete with essential mechanical stops increase surplus capacity and offer extra safety during mounting and operation.

Torque Transducers



These torque transducers utilize superior strain gage technology to indulge the most challenging necessities for static and dynamic applications of sensors.

Applications of Torque Sensors:

Used to Measure the speed of rotation and maintenance necessities

Used to measure Mass and mass moment of inertia

The amount of the torque to be calculated, from the point of vision of quasi-static process

Used to measure the highest speed of rotation, oscillating torque

Also Read: [Sensors in the Internet of Things \(IoT\): Enhancing Connectivity and Data Collection](#)

Conclusion:

All these above mentioned sensors are increasingly utilised in the automation industry. The recent surge in commercial demonstration of these sensor systems highlights their unique capabilities.

Introduction:

A healthcare sensor is a device or component that is used to detect, measure or monitor various physiological or environmental parameters related to an individual's health. These sensors are specifically designed for use in healthcare settings and are used to gather important data that can be utilized for medical diagnosis, treatment, monitoring, and research purposes. Healthcare sensors are required for several reasons as outlined below.

Monitoring Vital Signs: Healthcare sensors enable the monitoring of vital signs such as heart rate, blood pressure, body temperature, respiratory rate and oxygen saturation level. These measurements are crucial in assessing a patient's overall health status.

Disease Diagnosis and Management: Sensors play a vital role in diagnosing and managing various medical conditions. For example, glucose sensors are used by diabetics to monitor blood sugar levels, while electrocardiogram (ECG) sensors are used to diagnose and monitor heart conditions.

Remote Patient Monitoring: Healthcare sensors enable remote monitoring of patients in their homes or other non-clinical environments. This is particularly useful for individuals with chronic conditions or those recovering from surgeries, as it allows healthcare providers to monitor their health status, track progress, and intervene if necessary.

Personalized Healthcare: Sensors facilitate personalized healthcare by capturing individual-specific data. This data can be used to tailor treatment plans, medications, and interventions to the unique needs of each patient.

Prevention and Early Detection: Sensors can aid in the early detection and prevention of certain health conditions. For example, wearable sensors can track physical activity, sleep patterns, and other lifestyle factors, providing insights into overall well-being and alerting individuals to potential health risks.

Research and Development: Healthcare sensors are essential for medical research and development by researchers. They enable the collection of large-scale data sets that can be used to analyze health trends, identify patterns and develop new treatments or interventions.

Healthcare sensors:

There are many types of sensors used in healthcare for various purposes. Some of the commonly used sensors in healthcare industry are as follows.

Diagnostic ECGs and ECG sensors: These sensors measure the electrical activity of the heart to diagnose heart conditions. Examples : Diagnostic ECG manufactures include Philips Healthcare, GE Healthcare, Siemens Healthineers and Medtronic. The low cost manufacturers of ECG sensors and kits include ADInstruments, Olimex, Protocentral, DFRobot (designed for Arduino) etc.

Blood Glucose Sensors: These sensors are used by diabetics to monitor their blood sugar levels. Example: Dexcom G6 sensor

Pulse Oximeters sensor: These sensors measure the oxygen saturation in the blood and are often used in critical care settings. Examples : Low Noise Cabled Sensors from Masimo, BluPRO SpO2 reusable sensors from Nihon Kohden etc.

Blood Pressure Sensors: These sensors measure the pressure of blood in the arteries and are used to diagnose hypertension and other cardiovascular conditions. Examples: Invasive and non-invasive manufacturers of blood pressure sensor chips are available. Non-invasive blood pressure sensor chips are manufactured by Maxim Integrated, NXP semiconductors etc.

Body Temperature Sensors: These sensors measure body temperature and are used to diagnose fever and monitor the temperature of patients undergoing treatment. Examples: Analog Devices/Maxim Integrated MAX30205 Human Body Temperature Sensor

Electroencephalogram (EEG) Sensors: These sensors measure the electrical activity of the brain and are used to diagnose neurological conditions. Examples : Advance Technologies EMG Muscle Sensors, Muse and MindWave offer EEG headband and EEG headset respectively.

Accelerometers: These sensors measure movement and are used to track physical activity, monitor sleep patterns, and detect falls. Examples : Renesas (company develops contactless position sensors also)

Imaging Sensors: These sensors include X-ray, MRI, CT, and ultrasound sensors, which are used to create images of the body for diagnostic purposes. Examples: Canon Medical Systems

Cloud based IoT System:

A cloud based IoT system for healthcare sensors should meet several requirements to ensure the effective and secure management of healthcare sensor data. Some of the key requirements for a cloud based IoT system in healthcare are listed below.

Scalability: The system should be able to handle a large number of healthcare sensors and accommodate future growth as the number of connected devices increases. It should scale seamlessly to support the growing demands of sensor data processing and storage.

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Security: Healthcare data is highly sensitive and needs to be protected from unauthorized access. Hence IoT system should incorporate robust security measures. For this requirement, data should be encrypted during transmission and reception as well as during storage.

Data Storage and Management: The system should provide efficient storage and management of sensor data.

Real-time Data Processing: Healthcare sensors generate continuous streams of data. The IoT system should support real-time data retrieve, processing and analytics.

Interoperability: Healthcare systems often involve multiple devices, sensors and platforms. Hence IoT system should support interoperability standards and protocols. This offers seamless integration and communication between healthcare sensors, gateways or routers and other systems.

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Analytics and Insights: The system should provide meaningful data for doctors, researchers and healthcare service providers. This will help them to take meaningful decisions for the patients under treatment.

Remote Monitoring and Alerting: The IoT system should enable remote monitoring of healthcare sensors and ability to trigger alerts under certain conditions. This facilitates timely intervention and patient care.

Compliance and Regulations: The system should comply with relevant regulations and standards such as HIPAA (Health Insurance Portability and Accountability Act), GDPR (General Data Protection Regulation) and other medical regulations.

Reliability and Redundancy: Healthcare systems demand high reliability and availability. The cloud based IoT system should incorporate redundancy measures to minimize downtime and ensure continuous operation.

Integration with Existing Systems: The IoT system should support integration with existing healthcare infrastructure and other healthcare applications (Mobile App or Web App).

These requirements ensure that a cloud based IoT system for healthcare sensors is capable of securely managing sensor data, providing real time analysis and supports efficient healthcare operations.

Applications of Healthcare sensors:

They are widely used in various settings and applications within healthcare industry. They are used in wearable healthcare devices which include fitness trackers, smartwatches and biosensor patches. These devices are used by individuals for personal health monitoring.

Healthcare sensors find applications in hospitals and clinics for patient monitoring, home healthcare to avail timely interventions and care from remote, rehabilitation and physical therapy, medical research and clinical trials, ambulances and emergency medical services, medical devices and implants etc.

In summary, healthcare sensors are critical components in modern healthcare systems. They provide essential data for monitoring, diagnosis, treatment, and research purposes, enabling healthcare professionals to deliver evidence-based care.