Iot based Industrial Sensor Monitoring and Alerting System using Raspberry Pi

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Abstract. The Industrial sensor monitoring is very important for employee security. Now a day’s technology enhances the security system to next level. Internet of things provides the security information known by anywhere in the world. In the proposed article we monitor the industrial security parameters and alerting system to prevent the over damage in case of emergency. Proposed system uses temperature, humidity, smoke, fire sensors for security monitoring and data will process by raspberry micro processor. All the sensor data will post into server for wireless security monitoring with the help of ESP8266 which inbuilt in raspberry pi processor. Buzzer module used to alert the employee at industry for security. This proposed article will enhance the employee security and necked eye monitoring about the emergency in industrial.

Keywords: DHT11, IOT, Raspberry Pi, Industrial sensor monitoring, LCD.

1. Introduction

Internet of Things (IoT) is a computer term that describes an all-encompassing Internet service that transforms ordinary objects into network devices. The basic premise behind all the IoT principle is to introduce billions or even trillions of intelligent devices able to perceive the surrounding area. By 2021, about 28 billion wireless modems are expected to be available. The relation of new artifacts to the Web enhances business and society's prosperity, health and the productive contact between the physical world and the interactive equivalent. IoT is generally portrayed as a disruptive innovation to address most contemporary social challenges such as digital communities, smart infrastructure, control of emissions and associated welfare. Using wireless connections usually addresses the flexibility and scalability desired by IoT communication systems. Wireless modems have in the past been based mainly on ad hoc approaches in industrial purposes, e.g. independently designed for the communication of shifting components or difficult to access tools. Just recently, industry-specific guidelines have been published nevertheless, when large areas are shielded, they encounter weaknesses in scalability and distribution. The fulfillment with the above specifications faces many great challenges in the growth of Industrial IoT (IIoT). Acknowledging these issues is key to ensuring that IIoT solutions are widely implemented. Throughout this article, we elucidate the theories of IoT, IIoT as well as the recent trend in manufacturing technology computerization and data transfer, called Industry 4.0. We emphasize the possibilities and challenges presented by IIoT for its implementation. We concentrate in detail on the problems of energy consumption, real-time results, coexistence, interoperability, data security. Smart Industry Surveillance is being used to supervise the climatic conditions of the machinery in the company, because if a sudden shift occurs in the machinry, if the chemical temperature of the device is above the desired temperature, if we cannot detect that the changes occur if the temperature in the industry is kept, then the chemical can overflow. The Internet of Things (IoT) has given enticing opportunities by exploiting the increasing all-embracing broadcast-frequency identification (RFID) and wireless, mobile and sensors systems to build strong industries and implementations. Throughout recent times, a wide array of industrial IoT technologies have also been built and tested. The paper discusses the existing research of IoT, core supporting technology and
significant IoT implementations for business, and describes market developments and barriers to recognize the advancement of IoT in industries. One significant contribution of this review paper is that it thoroughly discusses industry leading IoT developments. In existing system of Industrial sensor monitoring system all the temperature, humidity, pollution sensors monitor the data and display in LCD module. There is no automation. Only the manual mode of operation is going and it is very difficult to operate. No wireless technology used to transfer the data automatically alerts through buzzer. Due to no wireless data transmission it’s very dangerous in industrial application. So we proposed new system using IOT for easy access and alert the data.

2. Literature Survey

Zheng et al proposed “Smart manufacturing systems for Industry 4.0: Conceptual framework, scenarios, and future perspectives”. This report looks at Industry 4.0's sophisticated production processes. Next, a technical structure for intelligent production systems is introduced for Industry 4.0. Third, there are reflective examples related to intelligent design, intelligent machining, intelligent supervision, intelligent tracking, and intelligent scheduling. Glória et al proposed” Design and implementation of an IoT gateway to create smart environments”. The article includes a design for an IoT interface for real-time surveillance Built on the Raspberry Pi; the gateway enables bidirectional user-to-sensor system connectivity and information sharing using an Arduino. Schallock et al and Ramkumar et al proposed “Learning Factory for Industry 4.0 to provide future skills beyond technical training”. The report describes the architecture of the Industry 4.0 training business to fulfill the increasing needs for manufacturing personnel's potential skills. The software factory becomes a portion of a full intelligent engineering research group in China, with consulting and technical assistance. Some of the essential objectives of the training factory are to allow manufacturing staff to handle the transition, take decisions and innovate. Dinardo et al and Baskar et al proposed “A smart and intuitive machine condition monitoring in the Industry 4.0 scenario”. The suggested technique is based on constant monitoring of the energetic characteristics of the motion signals obtained from the devices under study. The variable considered is the RMS value of the movement velocity. [7]Pantelopoulos et al proposed “A survey on wearable sensor-based systems for health monitoring and prognosis”. This paper provides a thorough review of recent research and innovation on portable machine vision devices for remote monitoring. A number of device configurations were evaluated in an analysis aimed at finding the technical limitations of the current condition-of-the-art technologies for portable biosensors. [8] Schütze et al proposed “Sensors 4.0 - Smart sensors and measurement technology enable Industry 4.0”. This paper thoroughly describes the evolution of technology within the last two decades, illustrates some of the promise that can be accomplished with smart detectors and data processing, and addresses the performance criteria for new developments. [9] Liu et al proposed “Hardware Design of Smart Home System based on zigBee Wireless Sensor Network”. In this article, the architecture of the home automation system that relies on ZigBee technologies and the GSM / GPRS network, the home automation hardware framework, using the CC2430 ZigBee wireless detector networks, the actual time detection of temperature, precipitation, thermal, flame, gas, fire, burglary warning, household Appliances like environment at home, through wireless connection. [10] Appelboom et al “Smart wearable body sensors for patient self-assessment and monitoring”. The aim of this analysis is to overview the production and therapeutic use of smart wireless body detectors.
3. Proposed System

In this proposed system a low-cost, easily-installable and scalable Industrial sensor monitoring system is developed with IoT technology after researching lots of recently published papers and considering the reality of it. In this section, the experiment block diagrams with setup are illustrated.

The proposed system needs to collect temperature, humidity, gas, and fire intensity of particulate inputs from different sensors used to detect Industrial sensor monitoring. The monitoring data inputs are collected by the Raspberry Pi micro processor control unit, and then Raspberry Pi forwarded the monitoring signal conditionally to the RPI control unit, after that RPI WiFi module upload the transmitted data to Thing Speak cloud. Data transferring between Raspberry Pi and RPI, a filtering algorithm is used to remove the invalid and incomplete signals. After that the signals are sent to the cloud to reserve through the Internet. The Industrial sensor monitoring information could be visualized through a web page and mobile application provided by Thing Speak service.
This schematic diagram informs that which module of the pins connected to which pins of microprocessor Raspberry pi. All the hardware modules we used in the proposed system explained below.

**A. Regulated Power Supply**

In this section of RPS we need 5v dc to work RPI processor. This RPS module is getting the required voltages from higher voltages with the help of filters and voltage regulators. 12v alternating current received by 230 v alternating current step-down by transformer, Bridge rectifier used to converts AC voltage to DC voltage. 1000 micro farad Capacitor for filtering the noise and voltage regulator 7805 used to provide 5v DC for operating the RPI processor.

**B. Raspberry Pi**

Raspberry pi processor used to integrate the all input and output peripherals, process the input data and control the output modules. This processor having 4 USB ports for integrating output modules. 1GB RAM which is high speed process the data. 3.5mm audio socket for output voice, CSI camera port for interface camera, micro SD card for operating system storage, 1.2GHz speed 64 bit Broadcom processor. This processor having 40 GPIO pins. All input sensors and output modules are interfaced to processor. Python programming used to implement RPI based applications.

**C. DHT 11**

Temperature sensor used for measuring of the temperature. This sensor used for Coal mine temperature monitor. Normally used for heat measurement of the weather and auto represents into IOT and LCD. Humidity sensor is used to sense the surrounding humidity of the coal mine and data will be displays in LCD and IOT module. This humidity also is one the important parameter to detect the alerts the coal mine weather reporting depends on the weather we will take some decision.
D. LCD Monitor

A liquid Crystal Display commonly abbreviated as LCD is essentially a display unit built using liquid technology. LCD module is 32 character displays, which is 16x2 models. Having 16 characters in row. LCD module interfaced to microprocessor with 16 pin configuration. LCD has 16 pins in series. Each pin is programmed to do here: Pins 1 and 16: Power and ground are these. Pin 3: This is used to change the LCD's brightness. Pins 4–6: Used for LCD service. Pins 7–14: Used as line of info. Pins 15–16: Used to control backlight to the LCD.

E. GAS Sensor

A gas detector is a piece of hardware, which determines gas concentration in an environment, mostly as an aspect of a security system. The tool is used for measuring gas or other pollutants and can communicate with a control unit to disrupt the operation instantly. In the region during which a leak exists, a gas sensor may send an alert, and make them leave. This kind of gadget is significant in the view of the fact that there are innumerable gasses that could adversely affect natural life.

F. FIRE sensor

This fire sensor which converts the fire signal to voltage. In this we used condenser module used as converts sound to voltage. After that voltage converts to logic 0 and logic 1. This is operated trough 5v.
G. IOT- Module

ESP 8266 Module used for Internet of things operations. Internet of things is the latest technology for controlling and monitoring operations through the world fast and secure. Wireless fidelity based operating module which works with 5GHz frequency. It supports 802.11b, 802.11n wireless transmission of data protocols. Normally we use 4 pins in this 3.3v voltage, ground comes under power supply for operating device, TX,RX are transmit and receive the data from micro processor bidirectional.

H. Buzzer

Peizo electric buzzer is used for intimating the changes in this system. Buzzer is the output module used to generate alarm. This module which converts the voltage to sound signal. We directly connected to RPI processor for inform.

I. Water leak sensor

Water leak sensor used to measure the moisture content in the earth. This is indication for the water level or moisture content measurement. Depends on the moisture content its state gives to Raspberry pi micro processor automatically alerts the liquid leak and send to IOT modem for alerts.
J. Software

In embedded system software module plays important role for any electronic automation. This proposed article we use Python IDE for programming development, debugging and compilation process. Python is effective scripting language for real time applications. Rasberian Operating System is used in Raspberry pi modules.

K. Results And Discussion

We designed the hardware of internet of things based industrial sensor monitoring system. Temperature, Moisture level, Humidity, pollution sensors re integrated to the raspberry pi processor. The initial state of all the sensors which displays their measured values on the LCD screen as shown in figure 12. The same data generated by the sensors will post into the iot server for wireless data accessing system.
Figure 13 shows that continuous monitoring of temperature in the industrial. It is displayed in LCD and if the temperature exceeds the threshold limit then buzzer automatically alerts the instant. It affects the fields send the data to iot server. IoT server is the open source thing speak server. It can monitor the data continuously and displays like a graph.

Figure 14 shows that when the humidity is HIGH, it is displayed in LCD and buzzer automatically alerts the instant. It affects the fields send the data to iot server. IoT server is the open source thing speak server. It can monitor the data continuously and displays like a graph. Like the same way water leak sensor also monitor the status and alerts LCD, buzzer, iot.
Figure 15 shows that when the gas level is HIGH, it is displayed in LCD and buzzer automatically alerts the instant. It affects the fields send the data to iot server. IoT server is the open source thing speak server. It can monitor the data continuously and displays like a graph. Like the same way fire sensor also monitor the status and alerts LCD, buzzer, iot.

4. CONCLUSION

An effective IOT based Industrial sensor Monitoring structure to monitor sensor parameters using IoT is implemented. The developed device monitored the Industrial sensor monitoring and an alert on IOT server when the harmful gases like CO2, smoke, fire, water leak crosses the threshold level. We designed and implemented internet of things based industrial security system we obtained efficient results. Integrated all sensors to raspberry pi and monitor the display and post into Internet we can monitor anywhere in the world. This industrial security system enhance the previous system provides high effective secured.

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