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Industrial Automated Data Acquisition System

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***Abstract*: Data Acquisition Systems have its contribution in a wide range of activities of day-to-day life. Most commonly, it is used to measure the electrical signals from some sensor. These signals may represent the state of a physical process, such as the position and orientation of machine tools, the temperature of a furnace or the size and shape of a manufactured component. Data Acquisition Systems are widely used today in home automation systems, industrial monitoring and control as well as in a variety of other time-critical applications. Installation of Data Acquisition Solutions in Industries is a flexible and cost-effective measurement solutions. Today, Data Acquisition Systems along with "Internet of Things" have led to development of many applications.**

***Keywords*: Data acquisition, sensors, Internet of things, Industrial automation.**

1. Introduction

Large selection of rugged, reliable industrial data acquisition systems with modular, flexible I/O for applications including process control, equipment monitoring, test stands and quality control. The industrial data acquisition systems have the ability to scale from just a few channels to hundreds of input channels. Also, the different units can accommodate a wide range of sample rates; from once a second or slower on the low end to sample rates of 100's of kS/s or faster at the high end. Most models offer the flexibility to mix and match I/O to meet the specific needs of the application and have an easy connection to a PC via LAN, USB or Wi-Fi. Several have the ability to interface to common industrial communications buses: CAN, Profibus, Fieldbus, and Modbus. They are also available in compact models with DIN rail mounting for easy installation in a control cabinet, test stand, or control room. Our project focuses on industrial automation using data acquisition system

2. Objectives

The goal of this study was to clarify the management issues by using automated data collection system in real time application. To reduce the manual observation of machine process. The data acquisition is automatically monitored in excel system. The data is analyzed in ESP8266 and also stored in SD CARD. The acquired data is also analyzed in either online or offline mode.

3. Literature review

- IOT based Industrial Automation by N.C .Yadav - IOT or internet of things is a technology that makes use of control systems such as computer to control the physical devices over the internet. Proposed efficient industry automation system that allows user to efficiently control industry appliances/machines over the internet. It contains 3 loads as industrial appliances or machines and a motor to demonstrate as an industrial
- Wireless Industrial Automation System by M. Manu Prasad, M. Navin Kumar - The paper highlights the design and implementation of Raspberry Pi based wireless industrial automation system using PYTHON. The system consists of one module that is Sensor module- raspberry pi. It is used for monitoring and controlling the various parameters of an industrial plant. The coordinator module is implemented using the raspberry pi that is with sensor module. They are programmed using python. The proposed system in the paper demonstrated its usefulness in terms of the low power consumption. It is off low cost and targeted towards automation and remote control applications.
- Industrial Automation using Sensing based applications for Internet of Things by Geetesh Chaudhari, Sudarshan Jadhav, Sandeep Batule, Sandeep Helkar - The Internet of Things is a network of physical object that contain embedded technology to communicate with extrinsic environment. In the industry it's a part of internet of thing that focuses on devices and object used in business setting. It helps to connect everything around us to internet including wearable devices, metering devices and environmental sensor. These devices will connect to internet to share different types of data. In this paper the Industrial Automation has been proposed using cloud computing and sensing based applications for Internet of Things and sensing device to check different behaviour like fire, humidity, temperature of room can be used.
- Industrial Automation using Internet of Things (IOT) by Ashwini Deshpande, Prajakta Pitale, Sangita Sanap - In this paper, a system which will automatically monitor the industrial applications and generate Alerts/Alarms or take intelligent decisions using concept of IoT is developed. IoT has given us a promising way to build powerful industrial systems

and applications by using wireless devices, Android, and sensors.

4. Block diagram

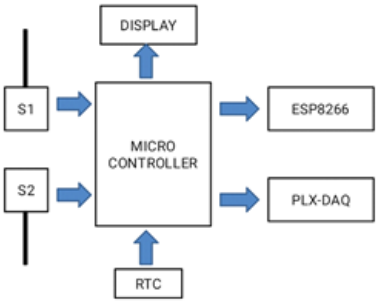

Fig.1. Block diagram

With reference to the Fig. 1, block diagram of the Proposed System, the proximity sensor S1 and IR sensor S2 are interfaced with the Arduino microcontroller. Hence the microcontroller will control the signals from both the sensors as programmed. The DHT-11 sensor will sense the temperature and humidity of the specimen. The data is sent to ARDUINO UNO to display the humidity and temperature on the LCD display to view at present values. The Wi-Fi module, ESP8266 is used here to display the graph of the output in Think Speak online free website to view later for clarifies the industrial management issues. PLX-DAQ is Microsoft excel plug-in software that helps us write values from Arduino to directly into an excel file on our PC.

5. Hardware used

A. Sensors

We are using three types of sensors namely Inductive Proximity Sensor, IR Sensor, Temperature sensor - DHT-11. An inductive proximity sensor can detect metal targets approaching the sensor, without physical contact with the target. An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. The DHT11 sensor is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). The IR sensor counts the number of products manufactured in the industries. The temperature sensor senses the real-time temperature with humidity of products manufactured to analyze the data of fault products. The inductive proximity detects the metal movement of the mould which is used for manufacturing of products. Through this the machine processing count can be identified. The output of this sensor is given to the Arduino.

B. Arduino Uno-Atmega 328p

A microcontroller board on which the Arduino Uno is based is ATmega328P. The microcontroller has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. ATmega328P contains everything needed to support the microcontroller. It is connected to computer using a USB cable or given a power supply with AC-to-DC adapter. In case of any severe damage, it can be replaced with a new chip. The meaning of word "Uno" is one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The reference versions of Arduino were the Uno board and version 1.0 of Arduino Software (IDE). The Uno board is the reference model and first in the series of USB Arduino boards, for an extensive list of current, past or outdated boards.

Technical specification

- Microcontroller: ATmega328P
- Digital I/O Pins :14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- Input Voltage (limit): 6-20V
- Flash Memory: 32KB (of which 0.5 KB used by boot loader
- SRAM: 2 KB (ATmega328P)

The sensed values from these sensors in the form of voltage, current and physical parameters are sent to Arduino and it converts these analog signals into digital and these values are analyzed in three different way of output measurements such as the required values are displayed in LCD, can be viewed through excel using PLX-DAQ software and also can be viewed as a graph through ThingSpeak website using ESP8266 Wi-Fi module

C. Wi-Fi module

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

Fig. 2. ESP8266 Wi-Fi Module

Through this ESP8266 Wi-Fi module, we can use the ThingSpeak online free website for viewing graph analysis.

D. LCD display

There are various display devices such as seven segment display, LCD display, etc. that can be interfaced with microcontroller to read the output directly. In our project we use a two-line LCD display with 16 characters each.

Fig. 3. LCD display

The data from DHT-11 sensor, IR sensor and proximity sensors are send to ARDUINO UNO and then the values such as number of products manufactured, machine processing count, humidity and temperature of the products are displayed on the LCD. These can be viewed only at present date and time.

Fig. 4. Difference between good and bad product

In the above Fig. 4, shows the LCD display of two different products. We are taking samples as a rubber product. The normal temperature range of the rubber is (28-32) degree Celsius and the humidity range is (50-58) degree. In the first image both humidity and temperature are within the range so it displays the product is good. In second image the temperature range is greater than the normal range so it displays the product is bad. From these data we can analyze the bad products manufactured in industries.

6. Soft wares used

A. PLX-DAQ

The software that has been used in this project is the PLX-DAQ software. The PLX-DAQ is a simple add-on for Microsoft Excel that makes it easy to simply create log excel sheets for laboratory purpose or other DAQ purposes. You simply install it and open the sample excel file then you access the VBA code (Visual Basic for Applications)-which is implementation of VB to be used inside Office Suite. PLX-DAQ is Microsoft excel plug-in software that helps us write values from Arduino to directly into an excel file on our PC by observing the machine process and to clarifies the industrial management issues. We can write and monitor the data at the same time and provides us way to plot them as graph and also stored in SD card. PLX-DAQ is a Parallax microcontroller data acquisition add-on tool for Microsoft Excel. Any of our microcontrollers connected to any sensor and the serial port of a PC can now send data directly into Excel. It has the following features

Features

- Plot or graph data as it arrives in real-time using Microsoft Excel
- Record up to 26 columns of data
- Read/Set any of 4 checkboxes on control the interface
- Read/Write any cell on a worksheet
- Example code for the BS2, SX (SX/B) and Propeller available
- Baud rates up to 128K
- Supports Com1-15

In the other side, the Arduino is connected to PC through USB serially. The PLX-DAQ software is used for the Data Acquisition System. The data are sent serially to the PLX-DAQ software. After the Baud rate, COM port is set up in the PC the date, time, humidity range, temperature values, number of products manufactured and number of machine processing count are automatically entered in excel using this PLX-DAQ. Through these the data can be monitored, the good and bad products are also analyzed. The serially collected data are also can be stored in SD card for future reference use. The below Fig 5 shows the data that are entered in the excel sheet. It shows all the data of the products. Through these we can clarifies the management issues.

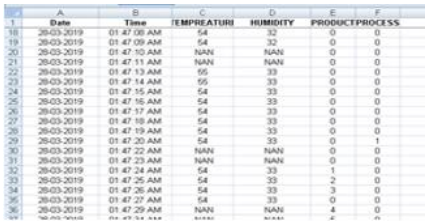

Fig. 5. The output from PLX-DAQ software

B. Thing speak

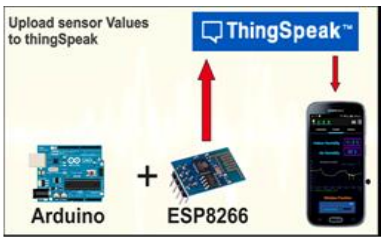

Fig. 6. Flow diagram of Thing Speak Platform

Thing Speak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to

execute MATLAB code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics. The flow diagram of ThingSpeak platform shown below in Fig. 6.

In the other hand, the values which are displayed in the LCD will be sent through ESP8266 Wi-Fi module to the Thing Speak online free website. Thing Speak is an open source website through which we can open our account through mail id. Once the account is setup the unique API key will be created for each single account. When the API key is given to the Arduino, the data will be transferred to the Thing Speak through ESP8266 Wi-Fi module. We will give a name to the created field in the Thing Speak website in which the data are stored and arranged with respect to date and time which we can view in the form of graph.

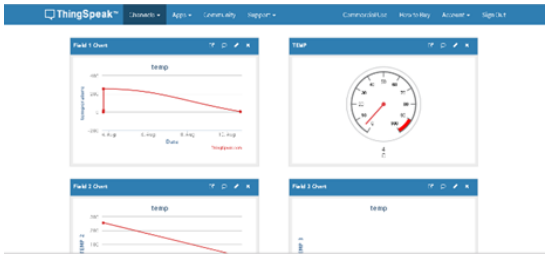

Fig. 7. Output of ThingSpeak website

The Fig. 7, Shows the Output from the Thing Speak online free website through ESP8266. From this graph we are able to view temperature and humidity range. We can analyze these data and we can able to analyze the good and bad products.

7. Conclusion

Nowadays we need everything computerized. Earlier we can only monitor the situations with the help of cameras. In industries to reduce manual overhead we have implemented Data Acquisition System in Industry to monitor as well as to inform the responsible person to take appropriate measures, but this will partially fulfill our requirement. So we are developing an industrial application using Data Acquisition System. We aim to provide an application for monitoring industrial appliance and also to serve as an efficient backbone for achieving a network of sensors and actuators which can help for improving the performances of the day to day gadgets/activities for industry use.

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