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Weighing Transmitter By Using Ethernet Modbus/TCP protocol

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Abstract: *As we know that weighing processes is very important part of any process industry. For transmitting the weighing information from the factory to plant control system (PLC/SCADA/DCS) nowday'swe are using either Analog signals (0-10Vdc/4-20mA) or Digital communication protocols like Ether CAT /PROFINET/Modbus RTU etc. by interface through the RS485/RS232/CAN/etc. So in thisprojectwetry to do something new.*

Approximately we all are aware the Ethernet which is dominantly accepted by the people for high speed communication. Ethernet globally free that's why it is fast gaining popularity in the shop floor with different device being introduce by vendors. Basically our project based on Ethernet but we are providing Modbus facility also because we won't know which industry use ourproduct, itmaybe large industry which uses Ethernet completely or moderate industry whichis use Ethernet as well as Modbus protocol also or it could be a small industry which is not use Ethernet it is totally dependent on Modbus RTU. So finally the aim of this project is to combine both technology Ethernet and Modbus TCP based weighing transmitter for getting good speed and ease of Ethernet by interfacing to the factory and automation industry.

I. Introduction

In any process industry weighing is very important part .For weighing in industry using number of weighing tools which is dependent on different type of protocols(Modbus ,profibus ,CAN , etc.). Therefor it is necessary this work is done in the proficient way , so there is no chance for error.

For example we are working in coca-cola factory. The ingredient of coca cola are been measured very specifically in weight. The small change in the weight of the ingredient can change the taste of the drink. This is not good for company's reputation, that's why weighing is very important.

Now day's weighing transmitter are of two types Analog signals (0-10Vdc/4-20mA) and Digital signals based on some special type of protocol like Modbus RTU/PROFIBUS/etc. which is interface by RS485,RS232/CAN etc.

But in both type have certain issues which is overcome in our project**.**

II. Problems

Analog Transmission: analog transmission is one of the most complicated connections. In this each section required separate interfacing. which is make very complicated connection. By using analog signal noise cannot be removed completely, with good engineering and proper installation. External interference can affect signal quality. In analog transmission the signal shows in the form of 0-10Vdc .therefor we can't use for long distance communication because voltage is drop in between.

Digital transmission: Digital transmission is very costly system. As we know that control system is very much costlierthat's the company spend more many for that control system .

No plug and play facility: is also a big problem in the system i.e. mean it is one type of technology which is not allows the system to connect directly .they need some specific configuration. It does not have the ability to detect the external component directly.

Low volume data transmission and low speed is also a issue .it's not compulsory the speed all ways important but some time it's matter more.

III. Objective

Our project based on the modern concept of the weighing transmitter by using Ethernet Modbus TCP protocol for process industry. This device suitable for all type of process industry .small ,moderate or large industry also. we are trying to make this device comfortable for all.

It is not more expensive .By using this device we can reduce the junk wire .Just because our device is also act as a controller that's why do not need to connect the wire directly through control system. In this device plug and play facility is also given. If you connect any external device to the our device the you no need of configuration

Ethernet is globally free that why most of the industry prefers.it is secure as well as high speed communication also provide .

For weighing in our device we are using load cell. In market many type of load cell are available but in our project we are using strain gauge load cell. It can be 4-wire or 6-wire and both can configure with our device simultaneously.

IV. Outline

Earlier we mention that in this paper weighing is main part of our project which has been done by load cell and for transmission of weighing data we are using Ethernet .

Load cell is one type of transducer which is convert the different physical quantity to the electronic signal. In are case load cell convert mechanical stress into analog signal .The output of load cell is input of ADC.

In our project we are using delta sigma ADC. The ADC is very high resolution that is 24-bit .just because resolution is very high the clarity of data is totally provide.

As we know that ADC is convert analog signal to digital signal, so whatever analog signal received by ADC that data convert into digital form.

The digital data transfer to the micro-controller. according instruction micro-controller work on it. After all this process through the Ethernet controller data transmit the anther section by using Ethernet Modbus/TCP.

V. Proposed Methodology

The mean purpose of are project is pass the data through the Ethernet TCP/IP protocol. As we know that Ethernet work on 2 layer (data link layer) and TCP (transmission control protocol) which is work on 4 layer (transport layer). Ethernet is half duplex i.e. mean you can't transmit and receive the data at a time. but it doesn't mean TCP is not use. TCP still work on top of Ethernet and itcan also support IP which is help to create bidirectional connection. I this project for transmission purpose we are use SNMP protocol. SNMP is basically use for network management. By using SNMP protocol we are monitor the data and display on the LCD.

VI. Hardware

ARM cortex M3 micro-controller :

The LPC1769 are ARM cortex M3 based microcontroller which is 100 pin IC. Out off 100 pin ,70 pin is dedicated for general purpose I/O. we can provide 2.4V to 3.6V power supply but in our case we are provide exact 3.3V. operating range of crystal oscillator is 1MHz to 25MHz. SPI controller with synchronous, full duplex communication and programmable data length. The CPU frequencies of LPC1769 can work up to 100MHz.This is based on Harvard architecture with separate local instruction and data buses as well as third bus for peripherals.

Fig 6.1 LPC1769 ARM cortex M3 micro- controller

Sigma-Delta ADC:

This is high resolution sigma-delta analog to digital convertor. In our case the input of ADC is output of load cell. The accuracy of $\Delta\sum$ ADC is very high which is achieve 24-bit performance. We can provide power supply +5,+2.5 or +3. By using simple three wire serial interface which is SPI we can easily create communicationbetween ADC and microcontroller. In our project we are using 24-bit high resolution which is

capture a small fluctuation.i.e.8.821e^-9 for 1- bit. The CS5532's have 4 control lines for serial interface: CS, SDI, SDO, SCLK .

CS, chip select grant the access to the serial port by using control line. If the CS pin is low, then port can function as a three wire interface.

SDI, serial data In, is use to transfer the data signal to the converters.

SDO, serial data out, using SDO the output data is transfer through the converter. When CS is at logic 1 then SDO output will be held at high impedance at any time.

SCLK, serial clock, is the serial bit clock which control the shifting of data to or from the ACDC's serial port.

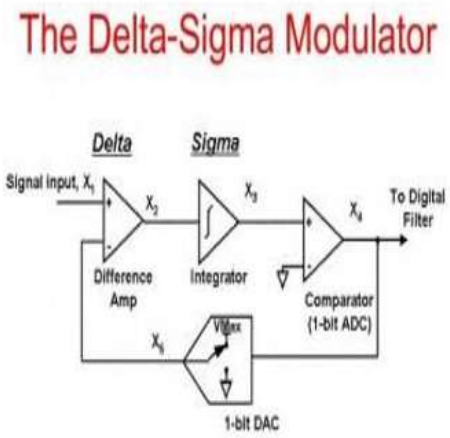

Fig 6.2 Delta-sigma ADC

Load cell:

Load cell is a one type of transducer which is convert mechanical form i.e. stress into electrical signal i.e. analog signal. In our project we are using stain gauge load cell in this load cell we getting output in the form of stress. Basically load cell have two type 4-wire and 6-wire. In our device we can use any one simultaneously.

A load cell usually made up of four Wheatstone bridge configuration. The load cell give the output in the few millivolt. Whatever load you put in the transducer according to load the transducer give the output in the form of millivolt. We can directly interface 24-bit ADC because it is industrial standard.

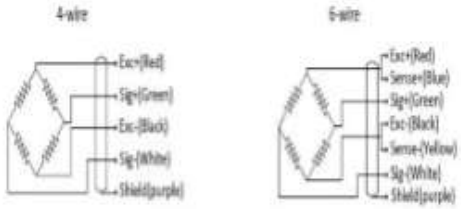

Fig 6.3.1 4-wire and 6- wire

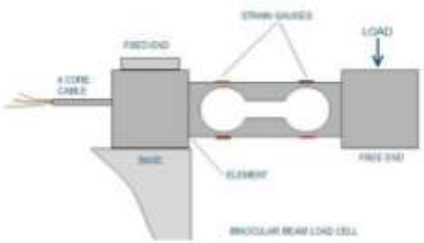

Fig 6.3.2 Load Cell

Ethernet Modbus/TCP:

The DP83848C is a robust. It is have features 10/100/single port in a physical layer device. It is consume very low power i.e. 3.3V .The DP83844C is 48 pin IC. It is small in size that's why it is take small space in the board. The DP83848C includes a 25MHz clock out. At the speed of 10Mb/s and 100Mb/s, the DP83848C supports both half and full duplex operation. Half duplex relies on the CSMA/CD protocol to handle collision and network access. In half duplex mode CRS is control both the activity i.e. transmit as well as receive so that maintain all the compliance in the order with IEEE802.3 specification. The DP83848C is support only two mode of operation either full duplex or half duplex.

Fig 6.4 DP83848C Ethernet Device

VII. Software

Keil Software:

Keil software is basically development tools which is use for solving the complex problems facing embedded software developers. In our project keil software is use for coding purpose i.e. arrange the set instruction and get proper output. When starting a new project whatever device you use you select and select microcontroller simply. In our case we select the ARM device and choose the micro controller LPC1769. After that go the pack installer and select the board MCB1700 and install code SNMP agent .

Fig 7.1 Keil Software

wire shark software:

Wire shark is free and open source protocol analyzer. This software use for checking the sending data and Troubleshooting problem. The real name of this software is Ethernet but in May2006 name was rename wire shark because data is captured from the wire from a live network.

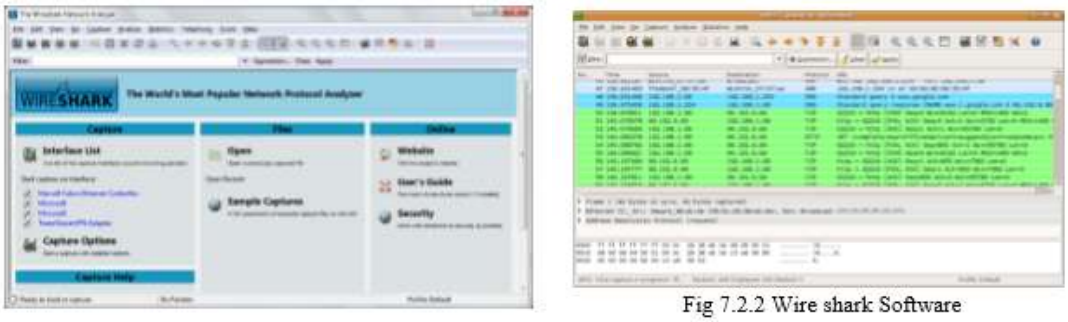

Fig 7.2.2 Wire shark Software

VIII. Conclusion

In this paper we are studied basically weigh a some load through load cell and convert the analog output of load cell into the digital signal by using the ADC and microcontroller pass the specific instruction and through Ethernet controller we transmit data into the other section by using SNMP protocol. the hardware implementation is complete . By using this device we can transmit high Speed Data and less complicated manufacturing. Commercially it is highly suitable for process industry .this device act as controller also so many devices connected through this device if this device get damage then it will create a big problem

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