Real Time SPC Embedded Gauging System For Industrial Application (LVDT Based Measurment System)

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Abstract- *Data logging with displacement sensor has diverse functionality in scientific fields like robotics, mechanical engineering, civil engineering. Linear (LVDT) sensors are widely used in systems for measuring physical quantities like displacement, force or pressure. Signal conditioning electronics handles the output from the LVDT sensor to produce data of voltage, current proportional to the measurement position of the displacement transducer. Therefore, we can analyse the data to meet our purpose. Using the computational power of PC for analysing large amount of discrete data is not only more error free but also time saving method. In this project we are going to describe a developed system consists of microcontroller, signal conditioning electronics. The developed system facilitates a user by providing an interface between LVDT sensor and PC through COMP port. COMP port has now become the dominant among other PC interface protocols like serial RS232, parallel, PCI.*

Keywords- LVDT,Serial RS232

I. INTRODUCTION

Now days the demand of digital measuring machine increasing day by day in most of business enterprises because Measuring the inner diameter and outer diameter with digital measuring machine is user friendly with variety of various applications. This research paper shows the design and implementation of high resolution advanced digital measuring scale design based on 12-bit ADC along with fully featured embedded system.

As the measuring of articles is an essential part of modern life, there is a constant need for knowing the exact inner diameter and outer diameter of bearing and many items, e.g., for production, testing, etc. Consequently, the legal requirements of government bodies internationally are trying to maintain the same constant pace. In production, this means high accuracy and efficiency of measuring are also constantly high on the agenda. Continuation of this trend brings benefits for both the customer and the producer. That is, manufacturing efficiency is increased and hence profitability while package quality and quantity are assured to the customer's satisfaction. In the area of mass production, products are weighed using electronic measuring scale, that a package fast and accurately. In the mail sorting and grading machinery. In the practice, the micro-controllers using general algorithms cannot meet higher accuracy.

This dedicated Instrument provides facilities like static and dynamic mode measurements, Inch and Metric scale measurements, high and low Gain settings, storage of UPPER and LOWER set limits with a Tolerance Status Multicolor Indicator, Hold function to hold the current reading, Least Count setting for better resolution and accuracy, Inner and Outer diameter measurements and above all, MEG is equipped with a serial communication utility based on RS 232 standard connected with PC.

II. EASE OF USE

A. Objective

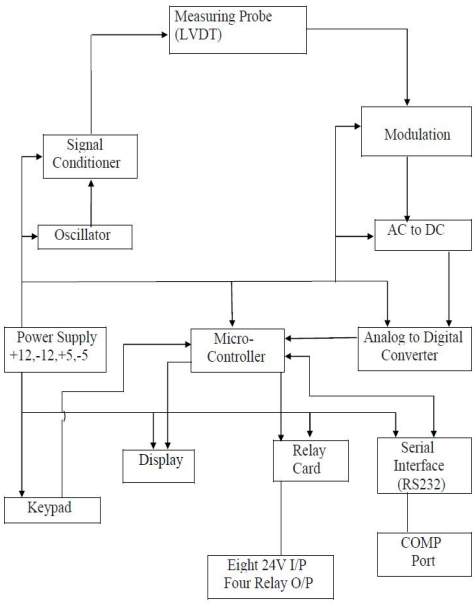
This dedicated Instrument provides facilities like static and dynamic mode measurements, Inch and Metric scale measurements, high and low Gain settings, storage of UPPER and LOWER set limits with a Tolerance Status Multicolor Indicator, Hold function to hold the current reading, Least Count setting for better resolution and accuracy, Inner and Outer diameter measurements and above all, MEG is equipped with a serial communication utility based on RS 232 standard connected with PC.

B. Interaction between simulink and hardware

The Hardware blocks for the Communications Block set allow you to interact with the Software Defined Radio peripheral from within a Simulink model. This capability enables you to model and deploy your communications algorithms within the context of Simulink, with the benefit of

real-time signal I/O for Software Defined Radio (SDR). The Hardware blocks Transmitter and Receiver blocks support communication between Simulink and a Hardware board, allowing simulation and development of various software-defined radio applications. These two blocks enable communication with a Hardware board on the same Ethernet sub network. The following block diagram illustrates how Simulink, blocks, and hardware interface.

C. Block Diagram



D. *Block diagram description*

The measuring probe is connected to the probe connector (5 pin Ahuja). The analog input signal from probe is amplified, demodulated, filtered and converted in to a DC signal, proportional to a measured dimension.

This analog signal is converted in to a digital signal using a analog to digital converter IC. This signal is processed and displayed on a display unit using a processor. A TTL to RS232 Trans-receiver is used for communication with an external device.

Oscillator and Audio Amplifier

The Oscillator section generates the excitation required to drive the transducer. A transistorized RC phase shift oscillator is used generate oscillations. Its O/P is buffered by an audio amplifier IC and fed to the primary of driver transformer. Secondary O/P of transformer is adjusted to 4V p-p, 10kHz AC and given to Transducer (probe). Linear electronic oscillator circuits, which generate a sinusoidal output signal, are composed of an amplifier and a frequency selective element, a filter. An oscillator circuit which uses an RC network, a combination of resistors and capacitors, for its frequency selective part.

Signal Conditioner:

Signal conditioning means manipulating an analog signal in such a way that it meets the requirements of the next stage for further processing. Many applications require environment or structural measurements, such as temperature and vibration, from sensors. These sensors, in turn, require signal conditioning before a data acquisition device can effectively and accurately measure the signal. Key signal conditioning technologies provide distinct enhancements to both the performance and accuracy of data acquisition systems.

LVDT Sensor:

The linear variable differential transformer (LVDT) (also called just a differential transformer, linear variable displacement transformer, or linear variable displacement transducer) is a type of electrical transformer used for measuring linear displacement (position). LVDTs are robust, absolute linear position/displacement transducers; inherently frictionless, they have a virtually infinite cycle life when properly used. As AC operated LVDTs do not contain any electronics. The LVDT converts a position or linear displacement from a mechanical reference (zero, or null position) into a proportional electrical signal containing phase (for direction) and amplitude (for distance) information. The LVDT operation does not require an electrical contact between the moving part (probe or core assembly) and the coil assembly, but instead relies on electromagnetic coupling.

III. DECLARATION

We developed the system made of three different parts. We designed the circuit for the hardware which will be used to collect data from the inductive linear displacement sensor and generate a output of digital data. Signal conditioning circuit was used to filter the sensor signal to the ADC of core microcontroller. We also developed the firmware using the COMP port which is a framework for the Microcontroller as the core processing unit of our system. A user interface software in the PC side also been developed written it Embedded C programming language.

IV. CONCLUSION

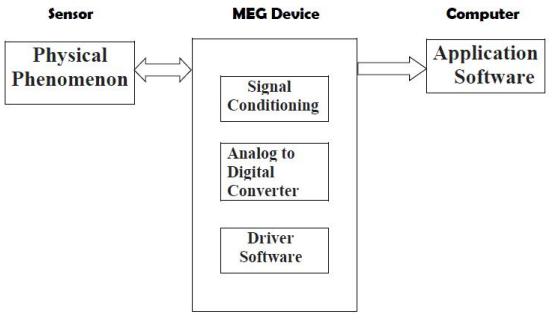
In the static Measuring Electronic Gauging System conventional filtering method employed have limitation in improving the accuracy and in throughput rate. In this case, an alternative technique has been explored to find a solution. It will enable high measurement accuracy and good throughput rate of article measuring. By doing this work we also experienced that it is tough task to get good result with 12-bit ADC under much more noisy circumstances. Thus with the help of this it is possible to design very high precision enhanced measuring scale at low cost. The displacement sensor is useful in various fields of engineering and testing. The described device is a substantially cheap structure for the displacement sensor. Therefore by proper finance and marketing, the device may be a potential replacement for present displacement sensors along with being much more cost-effective.

V. FUTURE SCOPE

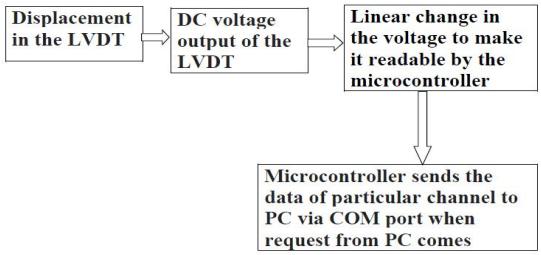
The FPGA realization has been implemented is based on total digital techniques and the realization needs only digital circuits. The carrier used is also digital high frequency square wave signal. As a result the total realization is much faster than other technique which uses Analog signals and Analog circuits.

In future it is possible to develop a complete FPGA based modulation and demodulation technique in MATLAB Simulink and partially in FPGA.

A. *Figures and Tables*



Hardware connection



Working flow

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