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AUTOMATION OF CALIBRATION USING CMMS TECHNOLOGY

C. Stalin Jose[1], K.R. Ganapathi[2], K. Karthikeyan[2], C. Mahesh[2], and M.V. Muruga Vignesh[2]

[1]Assistant Professor-Department of EIE, Adhiyamaan College of Engineering, Hosur, India

[2]UG Student-Department of EIE, Adhiyamaan College of Engineering, Hosur, India

ABSTRACT: Instrument calibration is one of the primary processes used to maintain instrument accuracy. Calibration is the process of configuring an instrument to provide a result for a sample within an acceptable range. Eliminating or minimizing factors that would cause inaccurate measurements is a fundamental aspect of instrumentation design. Although the exact procedure may vary from product to product, the calibration process generally involves using the instrument to test samples of one or more known values called "calibrators." The results are used to establish a relationship between the measurement technique used by the instrument and the known values. Computerized Maintenance Management Systems are increasingly being used to manage and control plant and equipment maintenance in modern manufacturing and service industries. Computerised systems are now being installed in preference to the manual (paper based) preventive maintenance systems that have been around for many years. In recent years' private companies have come to recognize the value of these systems as a maintenance performance and improvement tool. The main objective of this project is to automate the calibration process with help of Calibration Software in TPS-1, EXPN, NLC India Ltd., Neyveli. In present situation, the calibration and data entry are done manually. This automated system of calibration will increase the accuracy of calibration, time management and less human employment. The miniature of automated calibration system and data entry is actually done with the help of Arduino Software.

KEYWORDS: automation, calibration, CMMS technology.

INTRODUCTION

Instrument calibration is one of the primary processes used to maintain instrument accuracy. Calibration is the process of configuring an instrument to provide a result for a sample within an acceptable range. Eliminating or minimizing factors that causes inaccurate measurements is a fundamental aspect of instrumentation design.

Although the exact procedure may vary from product to product, the calibration process generally involves using the instrument to test samples of one or more known values called "calibrators." The results are used to establish a relationship between the measurement technique used by the instrument and the known values. The process in essence "teaches" the instrument to produce results that are more accurate than those that would occur otherwise. The instrument can provide more accurate results when samples of unknown values are tested in the normal usage of the product.

Calibrations are performed using only a few calibrators to establish the correlation at specific points within the instrument's operating range. While it might be desirable to use a large number of calibrators to establish the calibration relationship, or "curve", the time and labour associated with preparing and testing a large number of calibrators might outweigh the resulting level of performance.

From a practical standpoint, a trade-off must be made between the desired level of product performance and the effort associated with accomplishing the calibration. The instrument will provide the best performance when the intermediate points provided in the manufacturer's performance specifications are used for calibration; the specified process essentially eliminates, or "zeroes out", the inherent instrument error at these points.

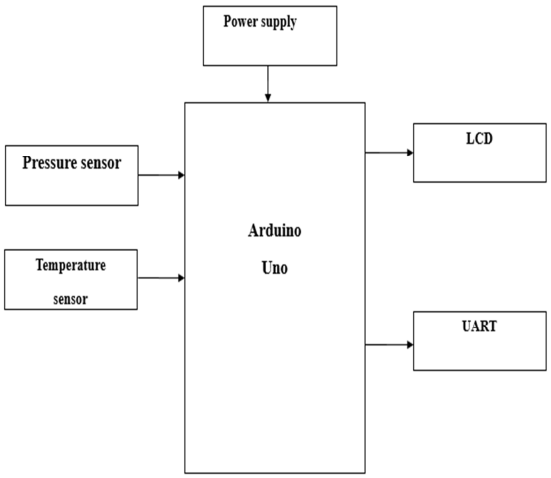
Corresponding Author: C. Stalin Jose

NEED FOR CALIBRATION

Calibration helps a power plant in maintaining or even improving safety, as well as in meeting national and international standards. However, calibration is also a matter of profitability. By using high-accuracy calibration equipment, the accuracy of vital measurements can be maintained on a required level and the plant can increase its annual power production capability.

PROPOSED METHOD

The objective of the project is to perform calibration in an automated manner (data entry) with the help of Arduino and its supporting software. These operations could be done in two manners remote and manual mode. If operated in manual mode it is necessary, that an operator is employed exclusively for this project at the lab with the help of HART communicating device which is actually used as the HMI for this process. Whereas here the operation is done with the help of Arduino board which is already preprogramed in it.



The calibration process is actually discussed for both manual and remote modes. The main objective of this project is to control and perform calibration and data entry without any human empowerment in the lab or in the site. Secondary thing is pen and paper based data entry will be eradicated and the calibration will be automated completely. The data that is received to the controller board (Laptops or PC's) is saved as Excel file sheet.

The Arduino is developed accordingly with the help of Arduino IDE software which will be acting as the front end of this project. The simulated result could be viewed with exact date, time and tag name which greatly reduces the chance of data loss and also data could be retrieved with an easy process. The main objective of this project is to achieve an automated calibration process and an automated data entry.

HARDWARE DESIGN

In order to achieve an automated calibration test bench some of the hardwares are required as explained below.

LM35 SENSOR

An LM 35 sensor is used a temperature calibrator or instrument.

PRESSURE SENSOR

A pressure sensor is actually used as the pressure instrument.

RS 232 PROTOCOL

The RS 232 is a serial communication used for the data receive or transmit data from the calibrator to the LCD (User front end).

INITIAL OPERATION

Initially the instrument that has to be calibrated (LM35 and Pressure sensor) is connected to the Arduino board and a power supply is given. Now the Arduino UNO senses the type of instrument and starts the procedure. The signal is from analog block is transmitted to LCD (laptops or PC's) and the Arduino sends the signal through RS 232 to the user end with the help of the software named as Arduino IDE this is already a preprogramed software which could also be altered according to the needs of the user.

If the sensors connected are detected the Arduino sends the information to the user in the form of a datasheet. The datasheet consists of date, time, tag name and the engineering value of the device that has been under calibration. The live feed of readings from the could also be viewed with the help of this datasheet.

RESULTS AND DISCUSSION

The advantages of implementing this project are:

- Selection of instruments could be done in an automated manner
- The range and error trimming of the device or the instrument could be done from the operator screen
- The data entry which is done through paper and pen work is now computerised
- This project minimises the risk of loss of any confidential data
- This project is user friendly
- Calibration procedure is made easier with this software
- The complexity of the work is reduced because of the replacement of manual calibration to automated calibration with the help of Arduino and Arduino IDE software
- The accuracy in calibration of the system is increased.

CONCLUSION AND FUTURE WORK

The existing system for calibration is in manual mode. With the proposed system, calibration and the data entry will be performed automatically using Arduino and Arduino IDE software. The advantages of the automated calibration system over manual methods are many. The speed of calibration is dramatically increased with automation of connect, read, adjust and record functions. Due to this kind of system installation calibration quality is improved, the calibrations are more consistent, and the testing of equipment is more comprehensive. Reports can be generated directly from measured data with the minimum of operator interface being necessary.

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