

LOW COST DATA ACQUISITION FROM DIGITAL CALIPER TO PC

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Abstract

This paper aims to reduce the Inspection time during Online patrol Inspection. A physical check sheet is used to note down the measured values. A Wired DIGIMATIC to keyboard signal converter device is prepared. A Wireless digimatic to keyboard signal converter device is recommended to reduce the Inspection time and errors. The purpose of Wireless digimatic to keyboard signal converter device is to build a system which integrates with the server through SAP and process these data's to develop to its full potential. This Paper gives an account of reducing the inspection time during Online patrol Inspection in Pacific Fuel filter line. Trials are carried out after the development of solution and parameters are recorded, the achieved results were found to be highly beneficial and satisfactory. By this paper there is reduction in Inspection Time and errors. The thesis describes the above work in detail.

Keywords: Data Acquisition, Vernier Calipers, Inspection Automation, Arduino uno, Wireless, Digimatic to Serial.

1. INTRODUCTION

In today's world of manufacturing quality is given the highest priority and thus each component going out of the company to the customers must be inspected in all the possible ways of which it will not get rejected. In the present scenario of data measurement, the data are entered in a notebook which is referred by the supervisor at a frequency of 2 times per shift. As the data's are manually entered, there are cases where the data is entered wrongly due to manual error. Moreover the time taken to measure and enter the data in note-book and then again enter it in PC takes time leading to inspection of 2-3 components. This has led to many rejections and dimensional inaccuracy. This thesis deals with developing an automated inspection method where-in the data obtained from the Vernier is directly sent to PC which can be seen by the supervisors at any time, and the non-conformities can be identified.

2. EXPERIMENTAL EQUIPMENT AND INSTRUMENTATION

2.1 Arduino Uno

Arduino Uno is a microcontroller panel which consists of 14 digital input and output pins in total and out of which six are used as Pulse Width Modulation outputs, six are used as analog inputs, a USB connection, a power jack, and a reset button. Micro controller is connected to a PC by the usage of a

USB cable or can be powered by using an AC-to-DC adapter or a battery can be used to get started. "Uno" Means one in Italian.



2.1.1 Summary

Controller	ATmega328
Input voltage range	6-20V
Total number of pins	14
Number of analog i/p pins	6
Current/ Input, Output pin	40mA
Memory	32KB

2.1.2 Communication

The Arduino Uno has a wide range of number of facilities for the purpose of communication with a PC, other Arduino, or other microcontrollers. ATmega328 provides Universal Asynchronous Receiver Transmitter with a voltage of 5V for the purpose of serial communication, that is accessible on digital pins 0 (Receiver) and 1 (Transmitter). An ATmega16U2 on the panel channels this particular serial communication over a Universal Synchronous Bus and appears as a effective comport to the software which is existing on the PC. '16U2 is a firmware that uses the existing standard USB COM drivers, and an external driver is not required. But, on Windows, a .inf file is required. Simple textual data can be sent to and from the Arduino board using Arduino software. Available Receiver and Transmitter LEDs on the floorboard start blinking when the data is transmitted via Universal Synchronous Bus -to-serial chip on pins 0 and 1. Software Serial library allows the sequential communication on any one of the digital pins existing on Uno.' The ATmega328 supports I2C and Serial Peripheral Interface communication.

2.2 ARDUINO LEONARDO



Arduino Leonardo is a microcontroller panel which consists of a 20 digital inputs and output pins in total out of which seven are used as Pulse width modulation outputs and twelve are used as analog inputs, a micro USB connection, a power jack, and a reset button. This instrument contains all the features needed to support the microcontroller; this particular instrument is connected to a computer by the usage of a USB cable or can be powered with an AC-to-DC adapter or battery can be used to get started. The Leonardo differentiates from the other preceding boards in which ATmega328 has a built-in USB communication, which helps in eliminating the need of usage of a secondary processor. This leads the Leonardo appear to be connected to a PC as a keyboard, in addition to a virtual communication device class serial /communication port.

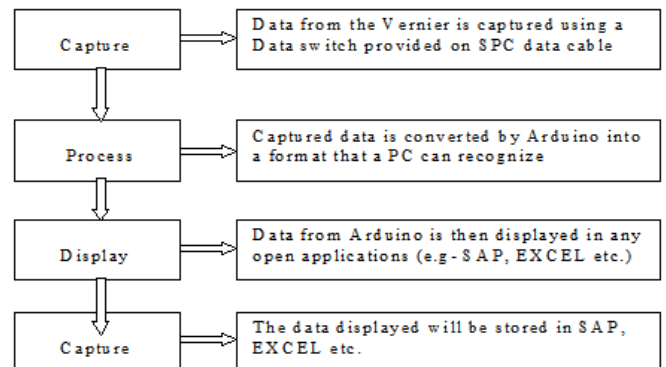
2.2.1 Summary

Controller	ATmega32u4
Input voltage range	6-20V
Recommended i/o Voltage	7-12V
Pulse Width Modulation channels	12
Total number of pins	20
Current/ Input, Output pin	40mA
Analog channels	7
Memory	32KB

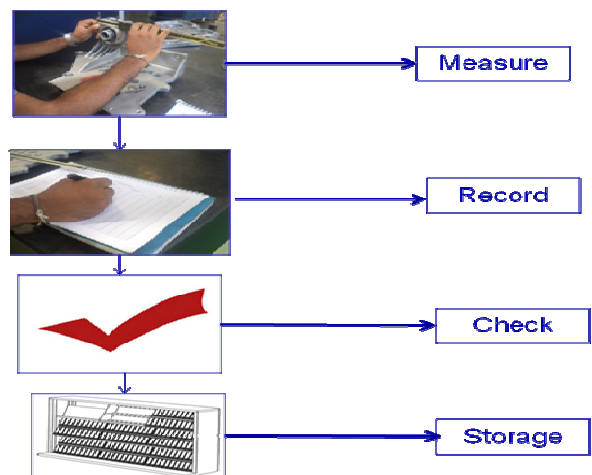
2.3 Arduino Software

Using this Arduino software, programs are developed on a PC using the Arduino integrated development environment (IDE). These programs are named as sketches. We can download this software in arduino.cc website. The IDE enables to write and edit code and convert this code into a set of instructions such that the Arduino hardware can easily understand and also transfers these instructions into the Arduino board. This process of transfer is called as uploading.

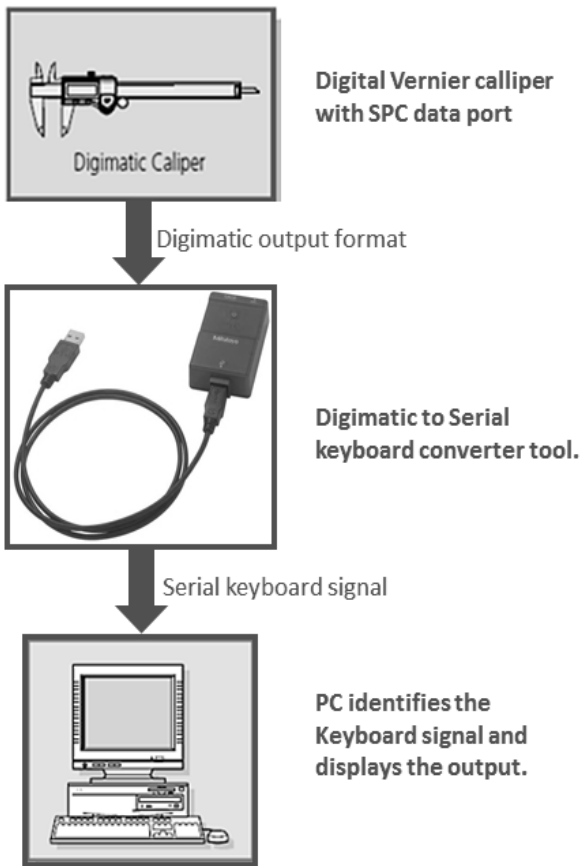
3. METHODOLOGY



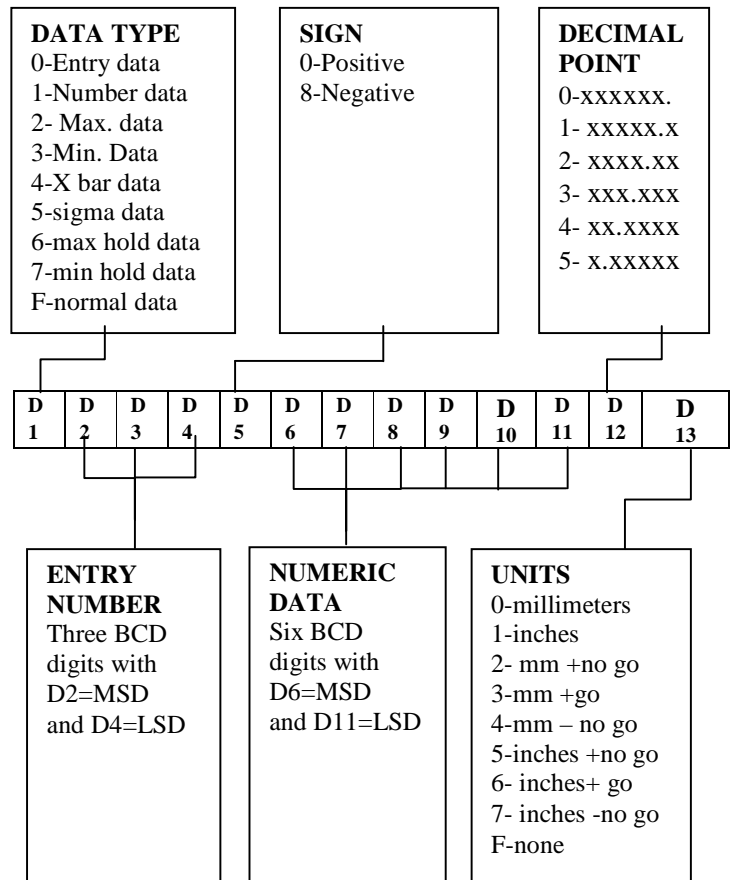
3.1 Current Setup



3.2 PROPOSED SETUP

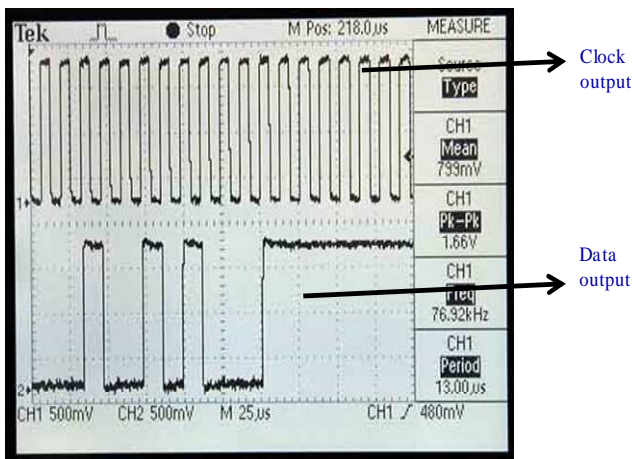


4.2 Digimatic Data Format



4. THE PHYSICAL FORMAT OF DATA OUTPUT

4.1 Oscilloscope Result



- Data is valid during the entire clock low time.
- Clock pulses stay 100 microseconds LOW and 100 microseconds HIGH.

First byte represents about the type of data that is going to be received. Choices available are data to the gauge, the data number, maximum, minimum, x-bar, sigma, max hold, min hold, or normal data. In general, this byte will be all ones or hex "F" for the normal data output. Bytes 2 through 4 are used as data entry numbers i.e. from 0-999. These are binary coded decimal BCD with the most significant bit MSB as byte two. Byte five represent their sign bit with its most significant Bit, MSB. Low represent positive and where as High represent negative. Bytes 6 through 11 are the binary coded decimal, BCD numeric data with byte six being the most significant digit MSD. Byte 12 sets the decimal point with zero an integer and five gives a total of five digits to the right of the decimal point. Consequently, the interface can deliver six decade accuracy over the plus or minus 9.99999 to 99999 range interval. Byte thirteen represents the units in use, with zero being millimetres and one being inches. Other options available are metric or inch go or no-go, high or low or "none of the above". Every second, the gauge sends out a low ready signal. If the computer host wishes to observe the data, it can respond at any time within 80 milliseconds by pulling the request line low.

4.3 Interfacing Arduino to Digital Calipers

The data output from the digital caliper is in the form of Digimatic output which cannot be directly sent to the PC. A converter is required which can translate the Digimatic signal into signal which can be understood by the PC such as, RS232 format or USB signal or keyboard signal. Using Arduino controller a converter has been designed and programmed.

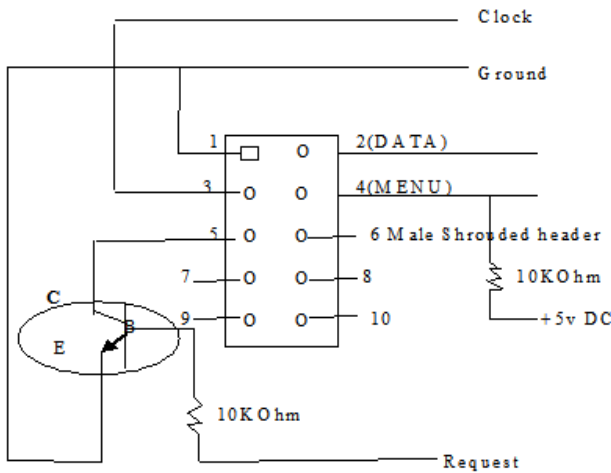
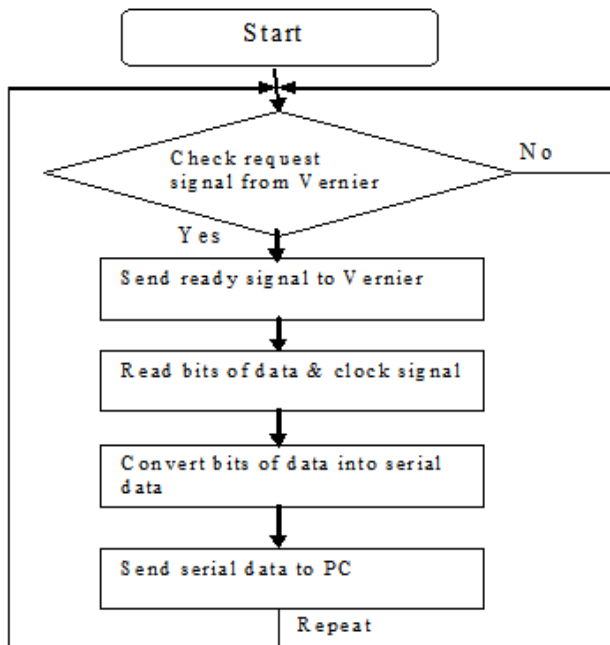


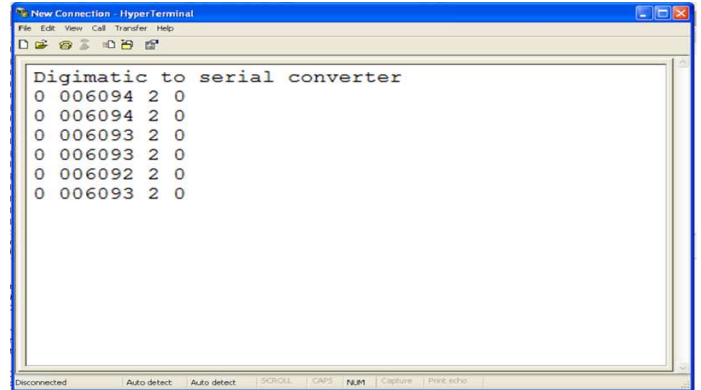
Fig: Safety circuit diagram

4.4 Programming Algorithm



4.5 Sample Program

The program for acquisition of data from vernier to PC has been written in Arduino IDE software. Based on the algorithm of the work operation a program is developed which was then uploaded to Arduino Uno controller



The output of the program was seen in the Hyper-terminal window.

Position	Value	Description
1	0	Indicates +ve (when 0) and -ve (when 8)
2 & 9	-	Always left blank
3 to 8	006093	Value
10	2	Decimal point position from right. (2 or 4)
11	0	Indicates mm (when 0) and inch (when 1)

The original value of vernier is +60.94mm but in that screen it shows 0 006094 2 0 from this output I conclude the result that result was given in the below table. The data obtained in the hyper terminal window was not able to satisfy the objective. To overcome this, a software PLX-DAQ was used which would transfer the data from the output of controller to the Excel sheet.

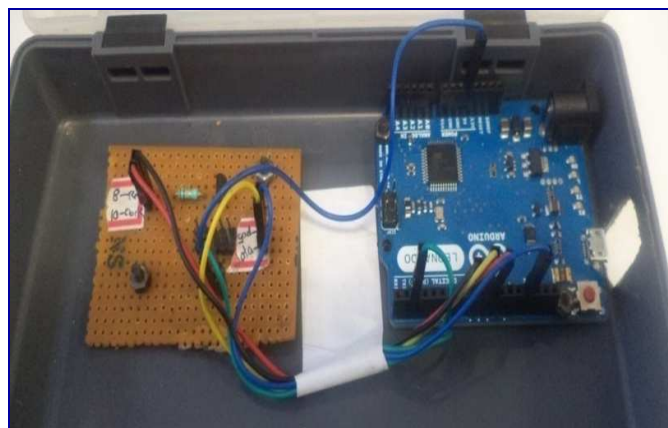
4.6 Move Serial Data to Excel Sheet

Time	Actual Value(mm)	Specification	Characteristics	Checking method	Frequency
	28.5	28.5 ± 0.50	5 x Chamfer Diameter	Vernier	2/ Shift
	0.5	0.75 ± 0.25	10 x Ø17.4 Chamfer Depth	Vernier / Contour Tracer	2/ Shift
	12	13.5 ± 0.50	Depth	Vernier / Flush pin gauge	2/ Shift
	10	9 ± 0.50	12x Chamfer diameter	Vernier	2/ Shift
	26.5	26 ± 0.25	1 hole drill depth	Vernier	2/ Shift
	19	19min	1 hole thread depth	Vernier	2/ Shift
	15.9	15.8 + 0.1	5 x Chamfer Diameter	Vernier / CMM	2/ Shift
		2.4 + 0.4	6 x Chamfer Depth	Vernier	2/ Shift
		13 Min.	5 x Thread Depth	Vernier+ SPG	2/ Shift
		13 Min.	Thread Depth	Vernier+ SPG	2/ Shift
		13 Min.	Thread Depth	Vernier+ SPG	2/ Shift

The PLX-DAQ application was launched and on the background the modified excel sheet was opened. The data output from the controller will be automatically updated in the modified excel sheet.

5. STANDARDISATION AND IMPLEMENTATION

The hardware components were fabricated inside a box which can be placed at the place of inspection. One PC also provided for this inspection process. Our setup will be always engaged with that PC. LAN connection and is provided for uploading measuring values in SAP frequently. The final set up of the project is like a picture shown in below.



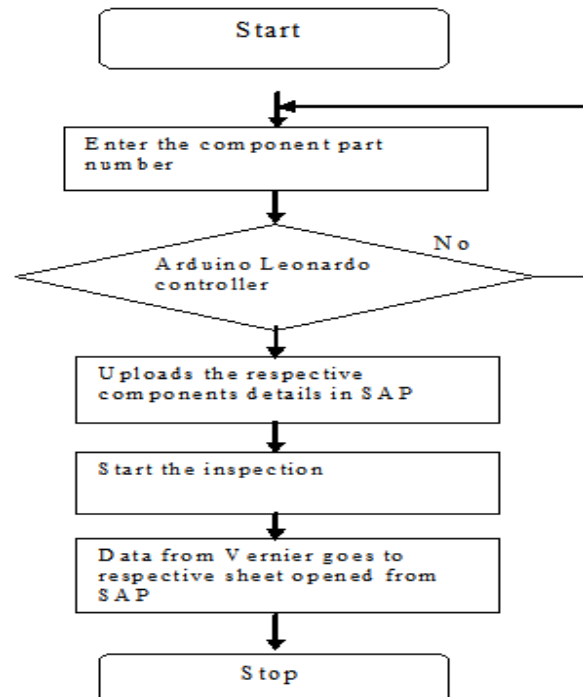
Using the set-up, the data updated in excel sheet can be seen only by the person who is measuring the component. The supervisor or the senior staff should come to the location and verify the readings. To overcome this, a concept of cloud computing was thought off. SAP (System Application Product) is the software available here using which the data can be viewed by anyone in the company within the company premises. The next step was to store the data obtained from the controller programmed to measure the dimension of the component in SAP. The program initially coded cannot be used to upload the data in SAP. To use the same Arduino UNO board for uploading the data into SAP, third party

applications and other hardware related components are required which adds to the cost of the set-up. To overcome this shortcoming Arduino Leonardo controller was used, which converts the output to keyboard signal which can be used to upload the data directly in SAP.



Final Setup

6. NEW WORKING METHODOLOGY



7. DISCUSSIONS AND CONCLUSIONS

The conventional method of well-logging is in analog form in which processing and manipulation of the data is fairly tedious if not impossible. Digital data has the big advantage of being processed using the computer. Manipulation, correction, etc. is easily done. This would otherwise be a cumbersome task using the analog data since such a huge amount of data would be manipulated manually. The system followed here had data's of measurement entered in a book and later was copied to PC manually leading to manual errors. With the current methodology it was not possible to determine the rejection data and the other factors which were needed from the data being measured.

8. CONCLUSIONS

The data acquisition system developed led to reduction in the inspection time and also helped in reducing the manual errors which existed prior to the implementation of the project. As the inspection time reduced to a great extent the number of parts which were supervised (initially 2 components per shift) has now rose to 5 components per shift leading to better dimensional accuracy and quality.

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