Research and Implementation on Model-Driven Data Acquisition System

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Abstract- A Data Acquisition System is a collection of hardware and software components that enable a computer to receive physical signals, it may be serial data also sometimes it may go to PLC's or it may go through some actuators, for example like a valve, something like a motorized valve. All these equipment there are through data acquisition processes that it actually gets into a computer so once it gets into the computer through electronic boards and there is some software residing in the computer. Software does two things it firstly helps input cards to transfer the data into the computer or other interfaces and secondly it may help the actual usage of the in terms of display in terms of decision making, trending, alarm generation. It may be utilized at that computer itself. The sensing part is comes from the sensor, then there could be multiplexing sample-and-hold multiplexing, means that time division multiplexing if have a number of analog sensors very quickly you scan the channels so that's called multiplexing and then sample-and-hold so sampling and holding the signal for that small interval of time when it is being converted then AD conversion, the process of converting it to digital and interfacing with computer.

Keywords- *Data acquisition System; Transducer; Multiplexer; A to D converts.*

I. INTRODUCTION

The word acquisition means that we are acquiring or collecting something from the nature, acquisition is collecting something so data acquisition means collecting the data from the real world or the physical world and then converting that data into the signals which can be processed by the computer so data acquisition system they are those systems which collects the data and convert those data into some signals, do some processing over those signals and those signals are then processed by the computer for the use of the engines. These systems are used in the industrial and the electronic engineering field so in that the it is used to capture the electrical signals and those electrical signals are converted into other form of signals and then they are processed by the computer so that in future if we want to use those signals that can be done with the help of computers so these data acquisition systems they find their application in the industrial and the commercial electronics where they are used to capture the electrical signals from the physical world. They can be used to capture in electrical signals or the environmental conditions so from the physical world we are getting the signals and these signals are then stored in a computer device so that processing can be done into it and they can be used for the future use. So because it is doing the work of capturing converting and storing so know various components of the data acquisition system their objective is to accumulate the data and do processing, here is shown in fig 1 General Data Acquisition system.

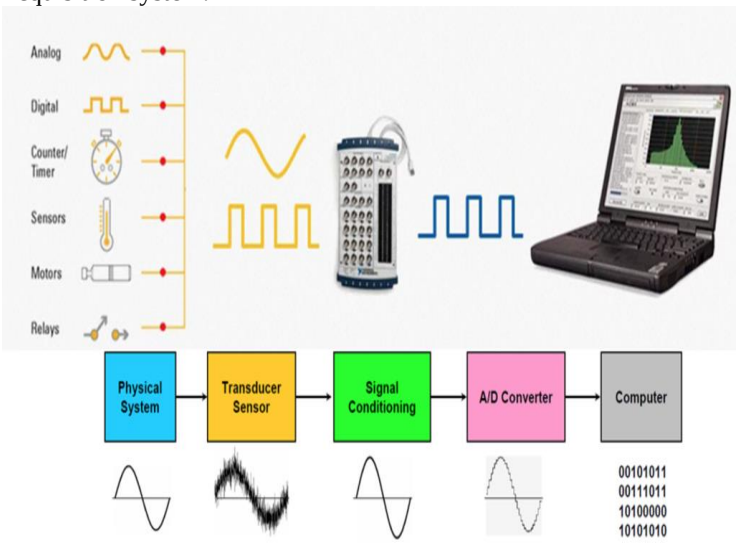

Fig.1: General Data Acquisition system

So these systems because they are collecting storing and processing the data so they include different tools and technologies which are designed to accumulate the data, these are the various components of a data acquisition system you to a typical data acquisition system it consists of all sensor then it consists of our signal conditioning equipments, a data conversion unit, data processing, multiplexing, data handling because the work of data acquisition system involves first acquiring the data then you do the processing over it, storing that data and then transmitting that data, here is shown the block diagram of a DAS in fig.2.

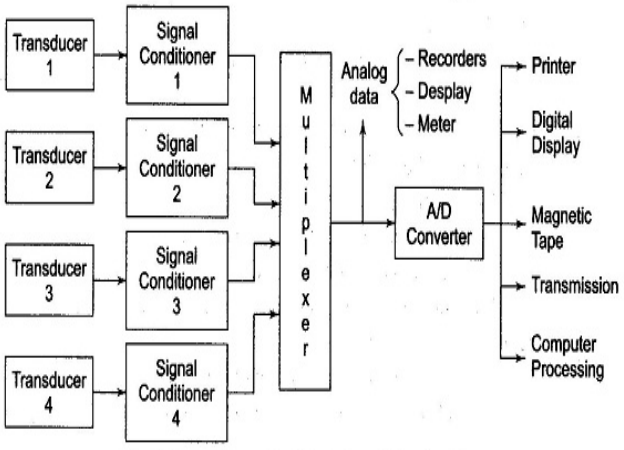

Fig.2: Block diagram of Data Acquisition system (DAS)

The capturing of the data it is having the sensor for processing, over that data it is having signal conditioning, data conversion, data processing, multiplexing, data handling units. These are all handling the data doing the processing over it. After that for the storage for the display for the transmission of the data we are having different devices for associated transmission, storage and the display devices, so we can broadly say that the data acquisition unit it consists of these separate or the individual units and the function of these units is to first acquiring the data then doing the processing over it and then the its transmission or its storage or display.

This is the block diagram of the data acquisition system. This data acquisition system it is first acquiring the signals from the physical world so there are various transducers here these transducers are collecting the data because that data is in the non electrical form so that is converted into an electrical form by the transducer so that electrical signals can be used by the other stages of the system now after that data which is converted into an electrical signal like voltage current resistance in that form in the electrical form that data is going to be processed those electrical signals will be processed like if there is any noise or any unwanted signals are there so those signals will be filtered out. So signal conditioning is done there after doing signal conditioning we are having the multiplexer that which electrical signal we want to choose so according to that because different electrical signals are given to the system so multiplexing is done that which electrical signal we want to use for the further stages then either that data is converted into the digital form or if you want the analog form of the data then analog data is also used so then conversion is done either analog to data conversion or directly the analog data is used now after doing the conversion the data is transmitted it is displayed or it is either store. So display devices are also there and storage devices are also there so storage devices are used so that the signal can be used for the future use and display devices if we want the direct display of that data then display devices can also be used so analog data also the display and transmission and storage is there for the digital data also the display storage and transmission is there like it can be transmitted to some other system also so these are the main components of a data acquisition system.

II. TRANSDUCER

The first component of the data acquisition system was a transducer, so it converts the physical quantity into an electrical quantity, it can be used to convert the physical quantity into the electrical signal or it can be used to directly measure the electrical signals; electrical signals like voltage, current, frequency & resistance all these are the electrical quantities. We can have a transducer or we can also say that it is the sensor. Sensor is going to measure directly the electrical quantity and transducer is converting the physical quantity into the electrical quantity so that is the first component of the data acquisition system which is acquiring the data from the physical world or the environment, as shown in fig. 3.

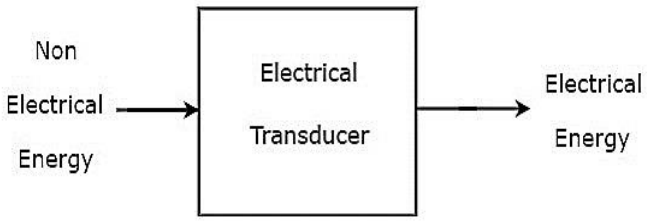

Fig.3: Block diagram of Transducer

III. SIGNAL CONDITIONING UNIT

next component is the signal conditioner or we can say the signal conditioning unit, now the signals which are coming out of the transducer they are the electrical signals but they are very weak signals means they are having very low amplitude so to increase their amplitude amplification has to be done also if the signal is containing any unwanted signal or noise is there so to remove those noise and to do them to remove the unwanted signal either rectification or filtration of those

signals is being done, so all that is done in the signal conditioning unit. So as the output signals of the transducer is very weak signal very low signal is there so this weak signal cannot be used for the processing or for the further stages in the data acquisition system so first the conditioning is to be done, so to make these signals is strong various signal conditioners are used and these signal conditioners can be like if we want to amplify the signal then we are having amplifiers if you want to filter the signal means if we want to remove the noise then filters are used, if you want to modify the signal then modifiers are used, so depending upon that what type of signal we want for the other stages depending upon them the processing over the signal is being done and the element is used.

IV. MULTIPLEXER

After signal conditioning we are having the multiplexer and the A to D converter, first we are having the multiplexer. The function of multiplexer accepts many signals and it gives only a single output so multiplexer is going to mix all the signals and that according to the need of the system it is going to generate the output signal. So multiplexer it accepts multiple analog inputs and provide output signal according to the requirements of the system as shown in fig.4.

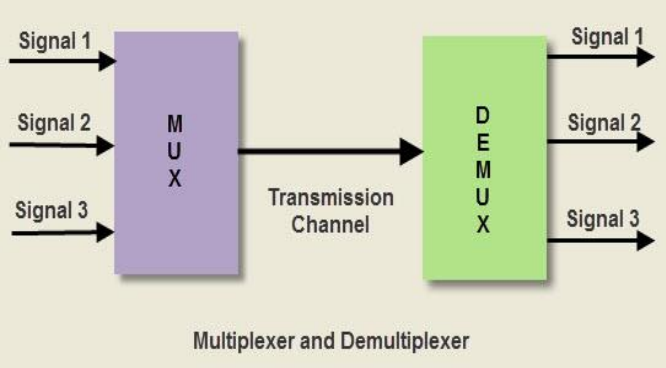

Fig.4: Multiplexer and De-Multiplexer

V. A/D CONVERTS & DISPLAY UNITS

In the diagram also there also we were having from the signal conditioner various analog input signal analog signals are coming multiplexer is accepting those signals and it is providing only a single output signal after multiplexer we are having the A to D converter the A to D converter it converts the analog data into the digital data because in many electronic systems only the digital data is being used, because the transmission of digital data is very fast also its processing is very fast so in most of the areas only digital form of signal is used so conversion is the conversion becomes very important. A to D converts, the analog data into the digital data, conversion of data is important because digital data it is very easy to process, it is very easy to transmit under the processing over digital data is very easy. It is very easy processing easy transmission and also digital display and storage is also easy because when digital data is stored, it is going to acquire less space also.

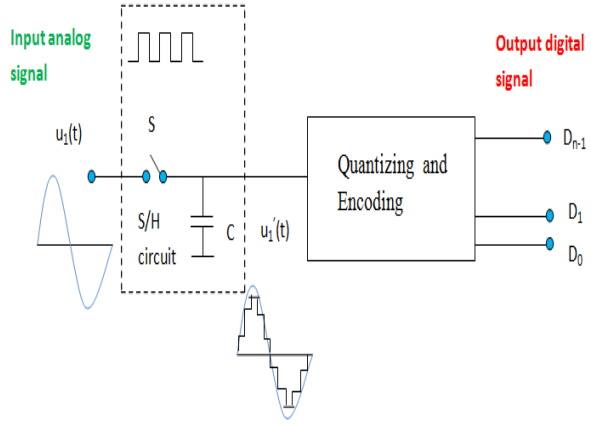

Fig.5: Analog to Digital Converters

If we are getting the digital readings then also the errors are reduced so in all these cases the digital data is having more advantages than the analog data so there is a need for conversion converting the analog data into the digital form which is done by A to D converter after the conversion does the transmission or the display or storage of data is needed so for that purpose we are having the recorders and the display devices.

Data is displayed in the display devices so that the input signals can be easily monitored now examples of display devices are Oscilloscopes, numerical displays, panel meters are there so there are different types of display devices. Oscilloscopes, numerical displays, panel meters are there which gives us the digital reading or digital output now recording can also be done like if we want that at present we don't want to use the data or get its reading we want to store it and keep it for the future use so recording can also be done. In fig no. 6 showed Simulation results for ADC communication.

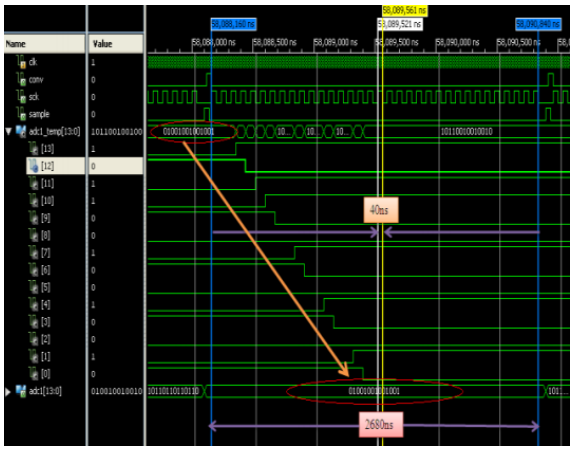

Fig.6: Simulation results for ADC communication

They took an either be permanently or temporarily stored so if you want to store the data then storage devices can be used if you want to record them like recorders can be used for that purpose so various elements are used examples of such are like optical recorders, ultraviolet recorders are there also. So if we want to analyze the input signal is varying what are the changes occurring in the input signal that can be recorded so signal will be recorded for a period of time now if we want that data is to be stored either in her place so we can use the storage devices like disk can be used. Printed magnetic tapes can be used for that purpose floppy disks can be used. So in the disk and tapes the data can be stored for the future purpose so magnetic tapes and punch recorders and punch tapes they can be used so in the block diagram of the data acquisition system we studied that the transducers. They are going to acquire the data collect the data or capture it then convert it into electrical signals those electrical signals will be processed or conditioned by the signal conditioning unit, then multiplexer is going to accept all these analog signals and provide us a single output according to the require means that according to the requirement of the system that which type of electrical signal we want now according to our need that whether we want an analogue output or digital output then conversion is done for storage transmission and for the recording purpose we can use different devices. These data acquisition system based on the type of output produced by them they are divided into two types one is the analog data acquisition system, another is the digital data acquisition system data acquisition system will give us the analog output and digital data acquisition system will give the digital output.

VI. OBJECTIVES

These are the different objectives of the data acquisition system.

A. First objective of the data acquisition system or first requirement which we expect from the data acquisition system is that it is it must acquire the necessary data and collected. This type of electrical signal should be collected from the physical environment of physical world then the data acquisition system it must acquire that necessary signal so the system its must acquire the necessary data at the correct speed.

B. Data should be efficiently handled so as to inform the operator about the state of the input because this data after acquiring it has to be properly transmitted so that operator can get the correct data.

C. It should be able to monitor the complete plant operation because it is involving different subunits. It must monitor all the complete plant operation so that safe operations and optimum operations can be performed.

D. The data acquisition system must be able to summarize and store the data for diagnoses of operation and for the record purpose.

E. When the last stage is done that at the last stage recording and storage of the data is done so at that time the ear das must be able to summarize the data and store it properly so that when the time of diagnosis of the data it can be easily done and for the record purpose also, like when they are storing the data all the data has to be accumulated correctly and stored properly so that meant diagnosis is done data is not damaged I'm not entering details available at that time.

F. The data acquisition system it must be able to expand so that for the future requirement if in future we born that this estate should also be added in the system so that can be easily done, so it must be flexible and capable of being expanded for the future requirement.

G. Also the data acquisition system must be reliable and not have a downtime greater than 0.1 percent, reliable is that if we are using the system for a longer period of time its performance is not degraded its efficiency does not decreases so it's a reliable that it every stage it is going to give us the accurate and correct measurements and correct data is available to us so it must be reliable and it should not have a downtime greater than 0.1%.

H. So the next objective is it must provide an effective human communication system because the operator of the system is a human so that human can easily understand the output and it is in the readable form okay if it is in the machine form then the human operator they will not be able to understand it so the system should be an effective human communication

system so that the operator can easily handle that system.

I. Also the other requirements of the data acquisition system involves that it should be very simple it should be cost-effective, so that it is having a minimum cost to the operator.

So these are the different objectives of the data acquisition system which it should fulfill for its better use and for its better performance.

VII. CONCLUSION

They are of two types data acquisition system analog and digital depending upon the type of output provided by them. Their applications are also different analog data acquisition system also have different application digital also have different applications. The analog data acquisition system, they are used within the applications where the physical quantity which we are monitoring through the system that is having a white frequency good, so when white frequency width is required and then lower accuracies can be tolerated means if we are having the system which is providing very low accuracy and the physical quantity is having a very wide frequency build then we can use the analog data acquisition system. Whereas the digital data acquisition system they are used when the physical quantity it is having a very narrow bandwidth also high accuracies are needed in the system and low per channel cost is required so according to our requirement the digital acquisition systems are used in digital or analog. As these digital data acquisition system they are more complex than the analog systems. The digital data acquisition system they are more complex than the analog systems because both in terms of the instrumentation the components the various components which are used in these system. The volume and the complexity of the data which they are handling that is also making the digital systems more complex, volume is of data is also more complexity. Digital systems are more complex than the analog systems now this was the difference between analog and digital and on the basis of that difference their applications is also different if we talk about together the application of the data acquisition system then they are having industrial applications also in industrial areas also and in scientific areas also like in the aerospace, they are used in biomedical field, they are use in telemetry also, they are used now in industrial areas in the plants are used for capturing the data. So this was all about the applications of the data acquisition system.

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