VISVESVARAYA TECHNOLOGICAL UNIVERSITY
Jnana Sangama, Belagavi - 590 018

Internship / Professional Practice Report On

Automatic Test Procedure using Labview

Submitted In Partial Fulfillment For The Award Of Degree Of

Bachelor of Engineering

in

Electronics and Communication Engineering

Submitted by

JAYPREET SINGH 1RN16EC045

Internship Carried Out At

VI Solutions

Internal Guide
Prakash Tunga P
Asst Professor

External Guide
Nagarajan G
Sr.Application Engineer

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
(Accredited by NBA for the Academic years 2018-19, 2019-20 and 2020-21)

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Channasandra, Dr.Vishnuvardhan Road, Bengaluru-560098

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CERTIFICATE

This is to certify that the Internship/Professional Practice work entitled **"Automatic Test Procedure using Labview"** has been successfully carried at **VI Solutions** by **Jaypreet Singh** bearing the USN **1RN16EC045**, bonafide student of **RNS Institute of Technology** in partial fullfilment for the award of Bachelor of Engineering in **Electronics and Communication Engineering** from **Visvesvaraya Technological University, Belagavi**, during the year 2020-2021.It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report.The Internship report has been approved as it satisfies the academic requirements in aspect of the internship work prescribed for the award of degree of **Bachelor of Engineering.**

Prakash Tunga P	Dr. Vipula Singh	Dr. M K Venkatesha
Assistant Professor	Head of the Department	Principal

External Viva

Name of the examiners	**Signature with date**
1	....
2	....

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DECLARATION

I, **Jaypreet Singh** bearing the **USN: 1RN16EC045**, pursuing Bachelor of Engineering in Electronics and Communication, RNS Institute of Technology, Bangalore. I hereby declare that the Internship titled, **”Automatic Test Procedure using Labview”** has been independently carried out under the supervision and guidance of **Mr.Nagarajan G, Sr.Application Engineer** and **Mr.Prakash Tunga P, Assistant Professor**. This report is submitted as a partial fulfilment for the award of Bachelor of Engineering degree in **Electronics and Communication Engineering** from **Visvesvaraya Technological University, Belagavi** during the academic year 2020-21. I also declare that the Internship has not been submitted previously for the award of any degree or diploma to any institution.

Name	USN	Signature
1. JAYPREET SINGH	1RN16EC045	Jaypreet Singh.

VI SOLUTIONS

CERTIFICATE OF COMPLETION

Of

INTERNSHIP

We present this certificate to

JAYPREET SINGH

In appreciation for your successful work as intern at ***VI Solutions, Bangalore,***

From ***08- July-2020*** *to* ***11-August-2020***

Mr. Sunil Kumar V
Managing Director
VI Solutions, Bangalore

Acknowledgement

The joy and satisfaction that accompany the successful completion of any task would be incomplete without thanking those who made it possible. We consider ourselves proud to be a part of RNS Institute of Technology, the institution which moulded us in all our endeavors.

I express my gratitude to the beloved Chairman **Late Dr. RN Shetty,** for providing state of art facilities.

I would like to express my deep gratitude to **Dr. HN Shivashankar,** former Director, who has always been a great source of inspiration.

I would like to express my sincere thanks to **Dr. MK Venkatesha,** Principal, for his valuable guidance and encouragement through out the program.

I extend my sincere thanks and heart felt gratitude to my internal guide **Mr. Prakash Tunga P**, Assistant Professor, for providing mean invaluable support through out the period of my Internship.

I wish to express my heart felt gratitude to my external guide **Mr. Nagarajan G,** Sr. Application Engineer,VI Solutions, for his valuable guidance, suggestions and cheerful encouragement during the entire period of my internship.

I would like to sincerely thank all those people who have been supporting in the part of my internship at VI Solutions.

Finally, I take this opportunity to extend my earnest gratitude and respect to my parents,teaching and non-teaching staff of the department, the library staff and all my friends who have directly or indirectly supported me during the period of my Internship.

JAYPREET SINGH

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Chapter 1

About the company

VI Solutions is an automation Company and a pioneer in providing Systems,Solutions and Products for a wide range of industries and applications.Headquartered in Bangalore,India,VI Solutions was founded by a pool of live wire professionals having several years of combined technical and corporate expertise in providing high quality,cost-effective and complete end-to-end solutions to its valued customers.All our team members are highly qualified in their respective fields and have years of industrial experience behind them.

VI Solutions is specialized in the design and realization of turnkey machines and tools.As an engineering company,they are known for our expertise in automated assembly lines,process automation,data acquisition and visual inspection.VI Solutions is one of the leading companies in building Advanced Communication Systems,Real Time Embedded Systems and other Industrial Automation services for applications in Department of Defense,Aerospace and Educational Institutions.

VI Solutions was started with the aim of always staying at the cutting-edge of automation technology and there by providing the most appropriate technology for every automation application.VI Solutions is focused on becoming a leader in the development of test and measurement and industrial automation software and systems. VI Solutions proud of the current products and services we offer and we look forward to contribute to future innovations in virtual instrumentation and automation technology.

Vision:

"Engineering Man power to provide global solutions"

Quality:

The one thing VI Solutions is fanatical about is Quality and they do not compromise on the quality of content delivered in any form either verbal or written.They take pride in the fact that they go to any length to ensure that their products and services exceed the customer's expectations.

Maintaining Relations:

VI Solutions is like a family,co-workers discuss,and debate!When you associate with them, you become part of the group.Their association does not end with delivery of a service or product in fact that just the start!

1.1 Product and Services

VI Solutions resources are focused on innovation, quality, and superior value for our customers. They work closely with their customers to understand their requirements, which enable them to provide innovative solutions to meet their specific needs. VI Solutions significant growth is an indication of their track record of success upon this commitment. It has separate business divisions with dedicated focus to offer the best possible solutions. They are

•Embedded Systems Division

•Automated Test Equipment (ATE) and Data Acquisition Division

•Electronic Manufacturing/Military Production Support Division

•Wire and Wireless Communication

VI Solutions is a total Virtual Instrumentation service provider offers cutting-edge solutions for the Small and Medium Business segment. It has been catering for various clients in this segment. The company has implemented several Turn-key Systems and System Integration projects for various organizations of Ministry of Defense. System integration practice provides end-to-end management from requirements development to solution integration and on-going support. The services range from Custom Application Services, Package Implementation Services to Infrastructure Services on a multi tier platform, which includes Analysis, Development and Deployment. Verticals comprise of almost the entire spectrum of Small and Medium Business Segment.

VI solutions adopt best industry practices and incorporate proven strategies to enhance the customer's business. The team of domain and technology experts and unmatched expertise make them the right choice for all technology needs. Industry partners are innovators in the fields related to technology programs. From multinationals to small SMEs, they encompass the complete value chain from raw materials to the final product. There is no limit to the number of partners in a program and continuously looking for new companies to join.

1.2 Bridging The Gap With Academia

VI Solutions, technology programs bring industry and academia together. Industry partners can drive the development of new technologies based on breakthroughs coming from the fundamental research being performed at institutions. In return, the universities get market insight and can draw on the industry experience of our partners to help focus their research activities.

VI Solutions is innovation in the field of education, a challenge to not just keep up but outsmart and set new industry standards. India's talent shortages are hitting the bottom line of business and are reflected in the increase in attrition rates of skilled manpower and wage inflation in various business verticals. This situation is compounded by the increase in demand for skilled and semi – skilled manpower in various sectors. The biggest uncertain in the economy growth of a country is the lack of quality trained professional. In India we definitely do not lack in the number but we lack a lot in level of professional education.

A 'research attitude' is missing amongst faculty and students. They should be "soaked in the research culture. "Industry is willing to give projects to faculty if the required domain knowledge/skills of staff are specified. At times undergraduates, graduates and even working professional may feel the need to upgrade them self and keep up with latest technologies

Faculties and students thoroughly believe that, by simply improving the quality of education they can uplift India's economic and technological status and thus VI Solutions bring together the BEST to create the BEST. VI Solutions encourage innovation in all forms, teaching methods, courses structure etc. They believe that education is beyond classroom lectures.

1.3 Academic Projects

VI Solutions, a premier technology firm invite all the budding professionals to quench their thirst for innovative academic projects. They are one of the leading firms in

India that provides Project Assistance to M Tech/MCA/B Tech/BCA/Bsc/Diploma graduates and technical training in various programming languages.

VI Solutions facilitate students to do their academic projects under the guidance of industry professionals. Selected candidates are offered assistance to do projects in latest technologies in Electronics, Electrical, Telecommunication, Medical Electronics, Instrumentation and Civil.

The projects are rated as Best Academic Projects in many reputed Engineering Colleges in South India by virtue of the quality delivery and innovative approach. Students get an opportunity to work on these projects rather than understanding already implemented projects. Thus students undergoing projects in the institute get opportunities to learn various aspects of project life cycle including requirement analysis, prototyping, architect, coding, testing, deployment etc. This approach helps to develop students as true professionals, fully equipped with all the needed skill sets required to get employed in top notch IT companies.

1.4 Work Culture

VI Solutions offers its employees challenging technical careers in one of the finest year round climates of the country. Teams at VI Solutions are young and full of energy. The members are competent professionals who have the drive and initiative to take challenges head on. The teams promote participation and sharing of knowledge in a highly collaborative spirit. They have the capability to help in building skills in Hardware/software based solutions Development in all application areas.

VI Solutions work culture is fluid and informal, and emphasizes experimentation, teamwork, and the importance of every individual's contribution. Employee's passion for excellence and innovation is the most prized resource. VI Solutions is committed to creating a diverse work environment and is proud to be an equal opportunity employer.

Expertise at VI Solutions has years of experience to select the needed hardware and software for applications. They can assist you in the crucial stages of Lab VIEW application / design, involving hardware such as

1.Compact-RIO

2.Compact-DAQ

3.PXI

4.Compact Field point

5.WSN (Wireless System Network)

VI Solutions is more than qualified to give a company an in-depth training. Often they get the question from customers where they can find a good training for large scale application development. Their questions concern

1. Graphical User Interface Development

2. Scale able ”plug-and-play” architectures

3. Software design rules, such as bottom-up approaches

4. How to create customized driver libraries

5. How to integrate Lab VIEW programs with their machinery and many more.

Many of the customers aren’t even aware of what they can do with Lab VIEW. Most of the times, people use Lab VIEW for test and measurement but not for GUI design, large application development or complete machine control (HMI included). VI Solutions, can give a very useful onsite training that will empower staff to rapidly develop high-level applications using Lab VIEW including but not limited to the following topics

1.Designing scalable user interfaces

2.Designing plug-and-play architectures, allowing to release ”field updates” for product(s) with very little overhead. Some updates can even be emailed to the clients

3.Learn how to integrate databases in your application, embedded databases such as MS Access, MS SQL and many more

4.Learn how to (correctly) use the power of the shared variable engine and OPC connectivity

5.Configuration file usage and windows registry

In a nutshell, trainees will learn how to unleash the power of LabVIEW during onsite training. There will be plenty of time spent on questions concerning about specific application development and there is also the possibility to customize the training schedule and training contents. The big training blocks are.

1. Windows based application development
2. Real-time based application development
3. FPGA based application development: Implement a custom I/O protocol using an FPGA (1) a real time processor,(2) another FPGA target or (3) get data from supported DAQ devices.

Chapter 2

Tasks Performed

Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW) is a platform and development environment for a visual programming languagefrom National Instruments. LabVIEW is a graphical programming language that uses icons instead of lines of text to create applications. The graphical language is named “G”. Originally released for the Apple Macintosh in 1986, LabVIEW commonly used for data acquisition, instrument control, and industrial automation on a variety of platform including Microsoft Windows, various flavors of UNIX, Linux, and Mac OS X. The code files have the extension “.vi”, which is an abbreviation for “Virtual Instrument”. figure 2.1 shows about different platform that supports LabVIEW and high-level design tools.

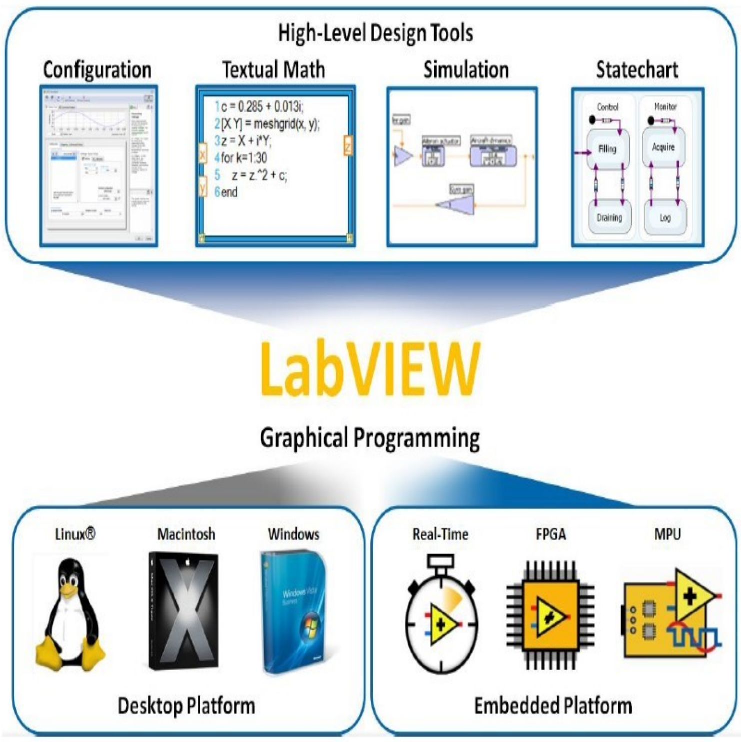

Figure 2.1: LabVIEW Platforms and High level design tools

2.1 Data flow Programming

The programming language used in Lab VIEW, also referred to as G, is a data flow programming language. Execution is determined by the structure of a graphical block diagram on which the programmer connects different function-nodes by drawing wires. These wires propagate variables and any node can execute as soon as all its input data become available. Since this might be the case for multiple nodes simultaneously, G is inherently capable of parallel execution. Multi-processing and multi-threading hardware is automatically exploited by the built-in scheduler, which multiplexes multiple OS threads over the nodes ready for execution.

2.2 Graphical Programming

Lab VIEW ties the creation of user interfaces into the development cycle. Each program has three components: a block diagram, a front panel, and a connector panel. Connector panel used to represent the VI in the block diagrams of other, calling Vis. Controls and indicators on the front panel allow an operator to input data into or extract data from a running virtual instrument. The front panel can also serve as a programmatic interface. Virtual instrument can either be run as a program, with the front panel serving as a user interface, or, when dropped as a node onto the block diagram, the front panel defines the inputs and outputs for the given node through the connector pane. This implies each program can be easily tested before being embedded as a subroutine into a larger program.

The graphical approach also allows non-programmers to build programs simply by dragging and dropping virtual representations of lab equipment with which they are already familiar. The most advanced LabVIEW development systems offer the possibility of building stand- alone applications. It is possible to create distributed applications, which communicate by a client/server scheme and are therefore easier to implement due to the inherently parallel nature of G–code.

2.3 Functions of Lab VIEW

LabVIEW predominantly performs three main functions Acquisition, Analysis and Presentation of the results.Figure2.2 shows the graphical representation of LabVIEW function.

Acquire: Measurements of the signal with a low-cost plug-in board, analyzing wave forms on a stand-alone oscilloscope or measuring strain with a sophisticated signal conditioning system, LabVIEW is the ideal development environment for application. From data acquisition to instrument control and image acquisition to motion control LabVIEW provides the tools to rapidly develop for acquisition system.

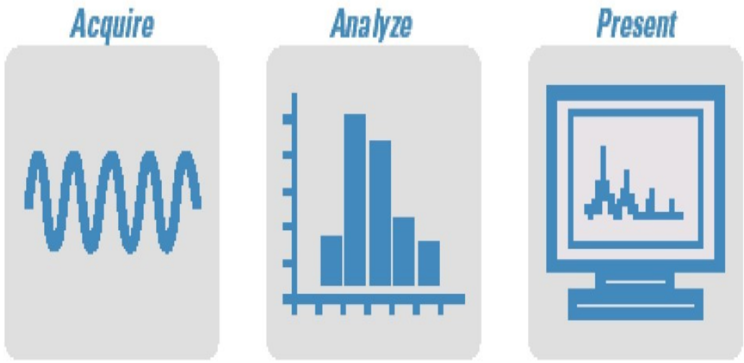

Figure 2.2 : Functions of LabVIEW

Analyze: Raw data is typically not the desired end result of a measurement and automation application. Powerful, easy-to-use analysis functionality is a must for software application. LabVIEW has more than 400 built-in functions designed specifically for extracting useful information from any set of acquired data and for analyzing measurements and processing signals. Functions such as FFT and frequency analysis, signal generation, mathematics, curve fitting and interpolation, and time and frequency-domain analysis gives the power to derive meaningful information from the acquired data.

Present: Presentation of analyzed data encompasses visualization, report generation, data management, and connectivity. LabVIEW supplies a wide array of tools to make the data presentation powerful and simple to create. LabVIEW is fully integrated for communication with hardware such as GPIB, VXI, PXI, RS–232, RS–485, and plug–in DAQ devices. LabVIEW also has built–in features for connecting any application to the World Wide Web using the LabVIEW Web Server and software standards such as TCP/IP networking and ActiveX.

Using LabVIEW, test and measurement, data acquisition, instrument control, data logging, measurement analysis and report generation applications can be created. Also stand-alone executables and shared libraries, like DLLs can be created because LabVIEW is a true 32-bit compiler. The virtual instrumentation and block diagram concepts embodied in LabVIEW design are at the leading edge of instrumentation and computer technology. The cost of developing test program software continues to rise with the increasing complexity of the devices being tested and the instruments needed to test them. Software modularity, maintainability and reusability are the key benefits of LabVIEW.

2.4 Benefits

One benefit of LabVIEW over other development environments is the extensive support for accessing instrumentation hardware. Drivers and abstraction layers for many different types of instruments and buses are included or are available for inclusion. These present themselves as graphical nodes. The abstraction layers offer standard software interfaces to communicate with hardware devices. The provided driver interfaces save program development time.

Interfacing to devices: LabVIEW includes extensive support for interfacing to devices, instruments, cameras, and other devices. Users interface to hardware by either writing direct bus commands (USB, GPIB, Serial) or using high-level, device specific, drivers is possible. LabVIEW includes built-in support for NI hardware platforms such as Compact DAQ and Compact RIO, with a large number of device specific blocks for such hardware, the Measurement and Automation explorer (MAX) and Virtual Instrument Software Architecture (VISA) tool sets.

Code Compilation: In terms of performance, LabVIEW includes a compiler that produces native code for the CPU platform. The graphical code is translated into executable machine code by interpreting the syntax and by compilation. The LabVIEW syntax is strictly enforced during the editing process and compiled into the executable machine code when requested to run or upon saving. In the latter case, the executable and the source code are merged into a single file. The executable runs with the help of the LabVIEW run-time engine, which contains some precompiled code to perform common tasks that are defined by the G language. The run-time engine reduces compilation time and also provides a consistent interface to various operating systems, graphic systems, hardware components, etc. The run-time environment makes the code portable across platforms

Large Libraries: Many libraries with a large number of functions for data acquisition, signal generation, mathematics, statistics, signal conditioning, analysis, etc., along with numerous graphical interface elements are provided in several LabVIEW package options. The number of advanced mathematic blocks for functions such as integration, filters, and other specialized capabilities usually associated with data capture from hardware sensors is enormous. In addition, LabVIEW includes a text-based programming component called MathScript with additional functionality for signal processing, analysis and mathematics. MathScript can be integrated with graphical programming using “script nodes” and uses a syntax that is generally compatible with MATLAB.

Parallel programming: LabVIEW is an inherently concurrent language, so it is very easy to program multiple tasks that are performed in parallel by means of multithreading. This is, for instance, easily done by drawing two or more parallel while loops. This is a great benefit for test system automation, where it is common practice to run processes like test sequencing, data recording, and hardware interfacing in parallel.

Ecosystem: Due to the longevity and popularity of the LabVIEW language, and the ability for users to extend the functionality, a large ecosystem of third party add-ons has developed through contributions from the community. This ecosystem is available on the LabVIEW Tools Network, which is a marketplace for both free and paid LabVIEW add-ons.

2.5 Applications of LabVIEW

Engineers and scientists implement LabVIEW applications in many industries worldwide, including automotive, telecommunications, aerospace, semiconductor, electronic design and production, process control, biomedical and others. The flexibility and scale ability of LabVIEW make it well-suited for initial research and design phases all the way up to large scale manufacturing test processes. By using the single, integrated LabVIEW environment throughout the phases of the design cycle to interface with real-world signals, analyze data for meaningful information and share results and applications can boost productivity throughout the organization.

Test and measurement: LabVIEW is an industry-standard development tool for test and measurement applications. With more than 1,400 instrument drivers, LabVIEW leads the industry in instrument control software solutions, gives a consistent development and execution environment for entire system. In addition to LabVIEW, National Instruments Test Stand test management software reduces test development time and simplifies maintenance. NI designed Test Stand to automate a wide variety of test systems. Test Stand is a ready-to-run test executive that organizes, controls and executes automated prototype, validation or production test systems. Test Stand is completely customizable, so it can be modify and enhance it to match specific functional test, electronic test and automated test needs.

Process Control and Factory Automation: In process control and factory automation applications, many engineers look to LabVIEW for high-speed, high-channel count measurement and control. For large sophisticated industrial automation and control applications, the LabVIEW family includes the LabVIEW DSC Module, designed specifically for monitoring large numbers of I/O points, communicating with industrial controllers and networks and providing PC-based control.

Machine Monitoring and Control: LabVIEW is ideal for machine monitoring and predictive analysis, vision and image processing and motion control. With the Lab VIEW platform of products, including the Lab VIEW Real-Time Module for real-time deterministic control and the LabVIEW DSC Module, can create powerful machine monitoring and control applications quickly and accurately.

Research and Analysis: The built-in LabVIEW measurement analysis library provides everything which need in an analysis package. Scientists and researchers use LabVIEW to analyze and compute real results for research applications in the such as joint time frequency analysis, wavelets and model-based spectral analysis, LabVIEW offers the specially designed Signal Processing Toolset.

Control Design: The product development cycle from design to production can be reduced using LabVIEW. By integrating LabVIEW closely with top design software and hardware, it is easier to take real-world measurements throughout all phases of the design process. In creating a new product, iteration on models, prototypes and tests is necessary before arriving at a finished design. Reducing time spent in this iterative process results in shorter time to market. With the integration of LabVIEW tests into the modeling and prototyping stages of development, real-world data can be compared to theoretical models earlier and more easily resulting in fewer design iterations to achieve the final product.

Academic: Just as LabVIEW revolutionizes industry, it also dramatically affects traditional academic research and teaching. A LabVIEW based laboratory makes researchers more productive and improves the way students learn. Rather than focusing on sometimes-tedious methods of gathering data, educators and students can focus on results and concepts. Students still learn methodology, but spend the majority of their time executing their experiments instead of building them. Research/Modeling Design/Simulation Verification/Validation Manufacturing.

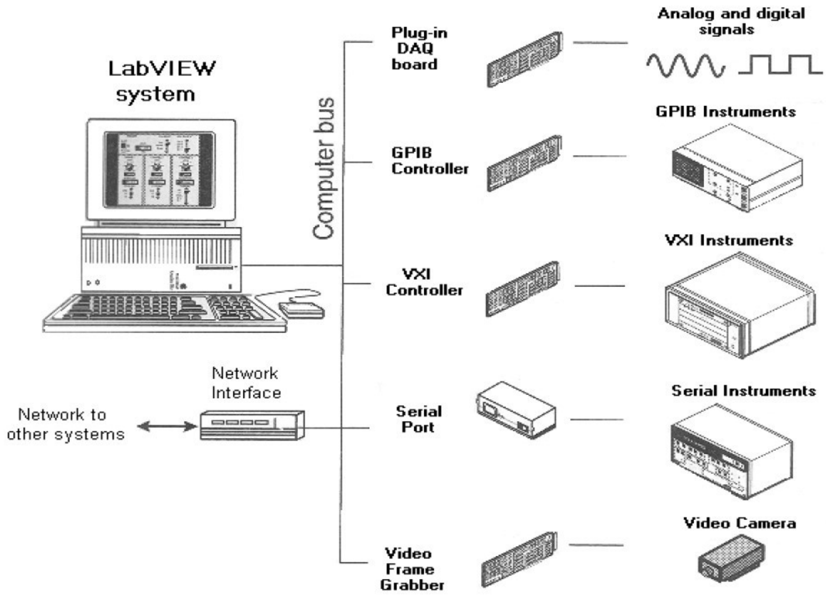

Figure 2.3 : Functions of LabVIEW

I/O Systems: Lab VIEW is amenable to most I/O interfaces known to the world of instrumentation, so they are generally free to shop around. Some of the most common interfaces are mentioned Plug-in data acquisition boards, Video frame grabbers, GPIB, VXI and Serial instruments. Using network connections, it is also possible to communicate with remote, intelligent devices or computers running Lab VIEW and other programs that add another dimension to data acquisition and control. The I/O System block diagram is as shown in the Figure 2.3.

Plug-In DAQ Boards: Plug-in data acquisition boards have made a major impact on the instrumentation world because they turn a general-purpose computer into an instrument that connects directly to signals in the outside world. They are versatile and cost-effective. With the use of proper signal conditioning and external multiplexers, hundreds of inputs and outputs can be handled using only one slot in the computer. Modern programmable instruments can be used to augment the performance of LabVIEW system. While plug-in boards do accommodate a wide variety of signals, they don't solve every problem.

GPIB: GPIB interfaces are particularly versatile and easy to use, design of the hardware standards and boards and to the built-in support in the Lab VIEW GPIB and VISA (Virtual Instrument Standard Architecture) library.

2.6 Advantages of LabVIEW

Serial Instruments: Serial port communications are supported by the serial port functions built into LabVIEW. However serial protocols are so poorly standardized that generally a lot of effort is spent in writing serial drivers than GPIB or VXI. Analyze with LabVIEW: LabVIEW is the built-in digital signal processing, analysis, and visualization capabilities need for measurement applications. High-level measurement analysis tools simplify development of applications that require common measurement analysis routines such as spectral analysis, filtering and statistics. At the same time, it has the flexibility to construct custom analysis algorithms using lower-level tools such as linear algebra, FFT and curve fitting.

Measurements and Mathematics: LabVIEW includes a variety of other measurement analysis tools. Examples include curve fitting, signal generation, peak detection and probability and statistics. Measurement analysis functions can determine signal characteristics such as DC/RMS levels, total harmonic distortion (THD/SINAD), impulse response, frequency response and cross-power spectrum. Using LabVIEW, can also employ numerical tools for solving differential equations, optimization, root finding and other mathematical problems.

Present with LabVIEW: Presentation of your data encompasses visualization, report generation, data management, and connectivity. LabVIEW supplies a wide array of tools to make your data presentation powerful and simple to create.

LabVIEW includes a wide array of visualization tools to present data on the user interface of the application. These include tools for charting and graphing, as well as built-in 2D and 3D visualization tools.Figure 2.4 represents the graph representation of the voice signal. Instantly reconfigure attributes of the data presentation, such as colors, font size, graph types and more, as well as dynamically rotate, zoom and pan these graphs with the mouse.

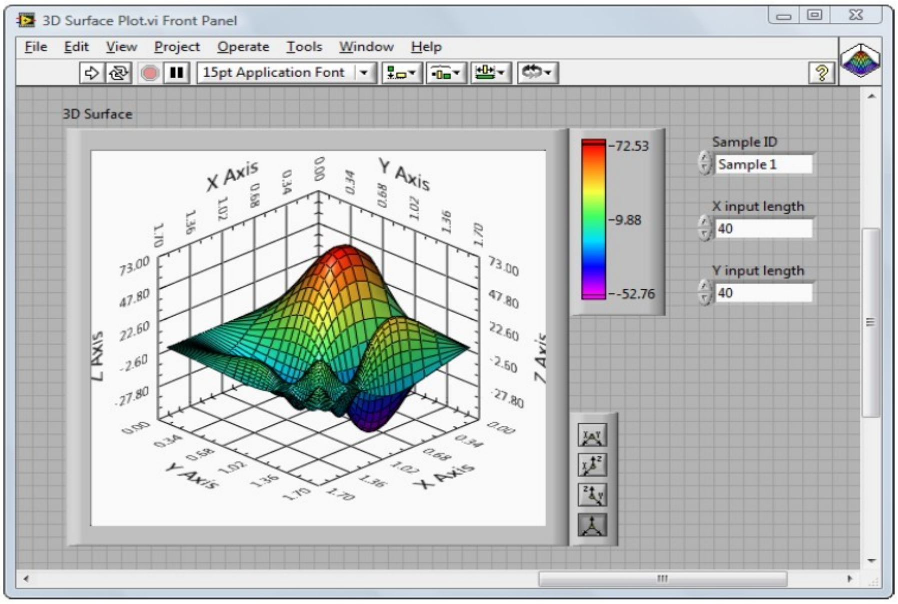

Figure 2.4 : Graphical representation of the voice signal

2.7 Programming using LabVIEW

LabVIEW programs are called Virtual Instruments or VIs because their appearance and operation imitate physical instruments, such as oscilloscopes and multimeters. LabVIEW contains a comprehensive set of tools for acquiring analyzing, displaying and storing data, as well as tools to help. A VI contains the following three components

1. Front panel-Serves as the user interface.
2. Block diagram-Contains the graphical source code that defines the functionality of the VI.
3. Icon and connector pane-Identifies the VI so that you can use the VI in another VI.

2.8 Front Panel

The front panel is the user interface of the VI. The front panel can be build with controls and indicators, which are the interactive input and output terminals of the VI respectively. Controls are knobs, push buttons, dials and other input devices. Indicators are graphs, LEDs and other displays.Figure 2.5 Controls simulate instrument input devices and supply data to the block diagram of the VI. Indicators simulate instrument output devices and display data the block diagram acquires or generates.

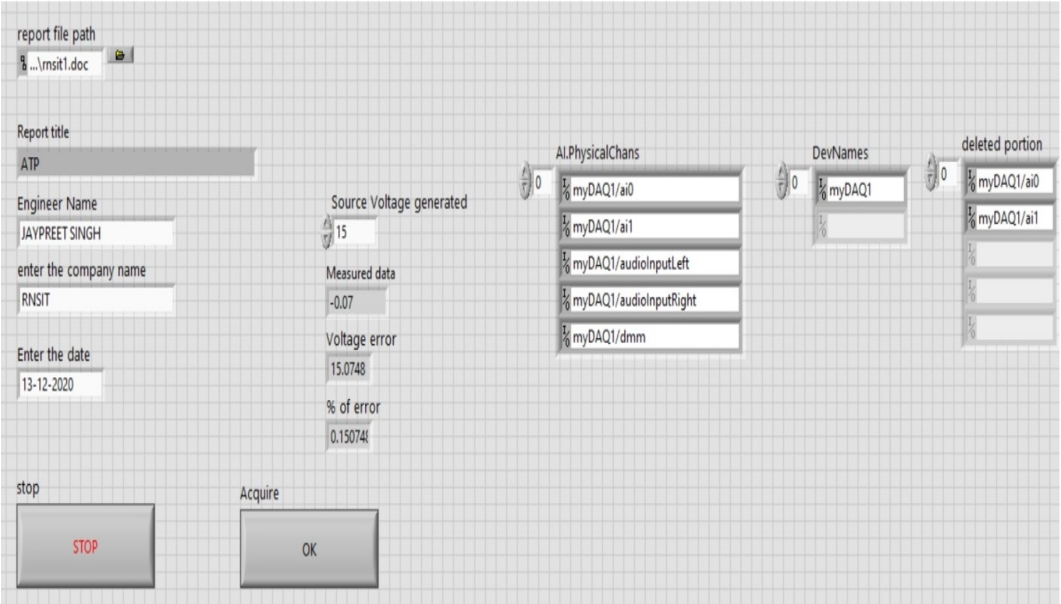

Figure 2.5 : Front Panel

2.9 Controls palette

The Controls palette is available only on the front panel. The Controls palette contains the controls and indicators you use to create the front panel. The controls and indicators are located on subpalettes based on the types of controls and indicators.

2.10 Block Diagram

After you build the front panel, you add code using graphical representations of functions to control the front panel objects. The block diagram contains this graphical source code, also known as G code or block diagram code. Front panel objects appear as terminals on the block diagram.

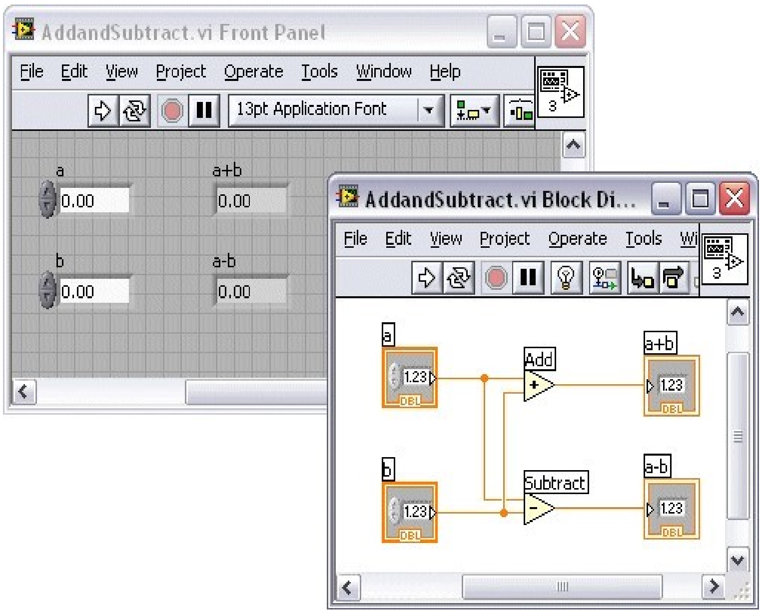

Figure 2.6 : Block Diagram

2.11 Functions palette:

The Functions palette is available only on the block diagram. The Functions palette contains the VIs and functions you use to build the block diagram. The VIs and functions are located on subpalettes based on the types of VIs and functions

2.12 Case Structure

A Case structure has two or more subdiagram, or cases.

Only one subdiagram is visible at a time, and the structure executes only one case at a time. An input value determines which subdiagram executes. The Case structure is similar to switch statements or if...then...else statements in text-based programming languages.

You must wire an integer, Boolean value, string, or enumerated type value to the selector terminal. You can position the selector terminal anywhere on the left border of the Case structure. If the data type of the selector terminal is Boolean, the structure has a True case and a False case. If the selector terminal is an integer, string, or enumerated type value, the structure can have any number of cases.Figure 2.7 is the case structure.

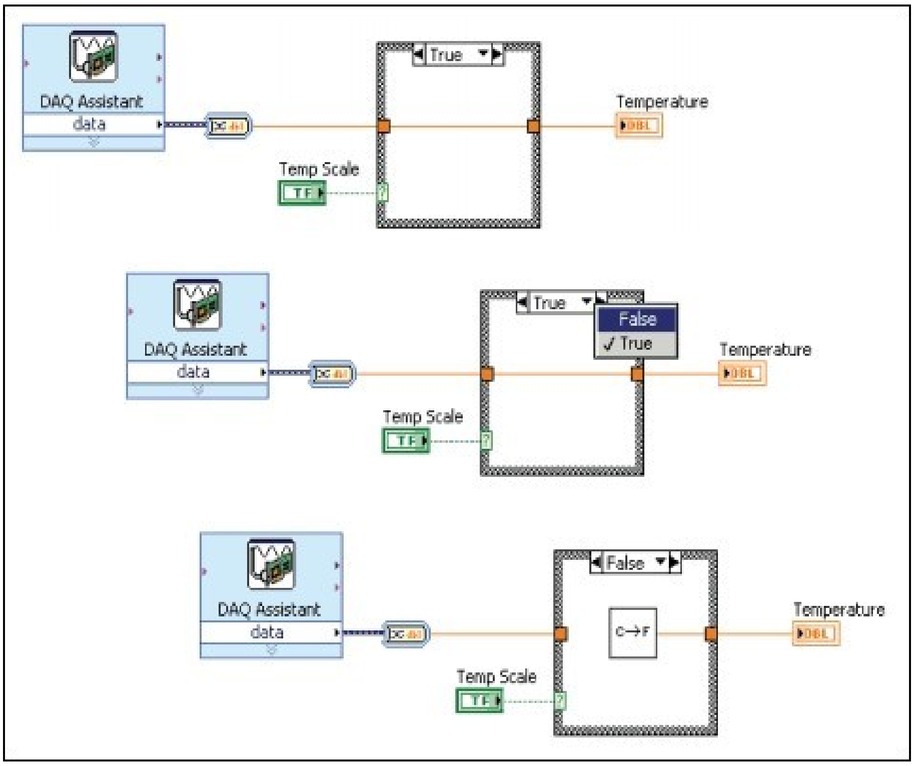

Figure 2.7 : Case Structure

2.13 While Loop

Similar to a Do Loop or a Repeat-Until Loop in text-based programming languages, a While Loop, executes the code it contains until a condition occurs.

The While Loop executes the code it contains until the conditional terminal, an input terminal, receives a specific Boolean value.

You also can perform basic error handling using the conditional terminal of a While Loop. When you wire an error cluster to the conditional terminal, only the True or False value of the status parameter of the error cluster passes to the terminal. Also, the Stop if True and Continue if True shortcut menu items change to Stop if Error and Continue while Error.

2.14 Event Structure

Waits until an event occurs, then executes the appropriate case to handle that event. The Event structure has one or more sub-diagram, or event cases, exactly one of which executes when the structure executes to handle an event. This structure can time out while waiting for notification of an event. Wire a value to the Timeout terminal at the top left of the Event structure to specify the number of milliseconds the Event structure waits for an event. The default is -1, which indicates never to time out.Figure 2.8 is the event structure.

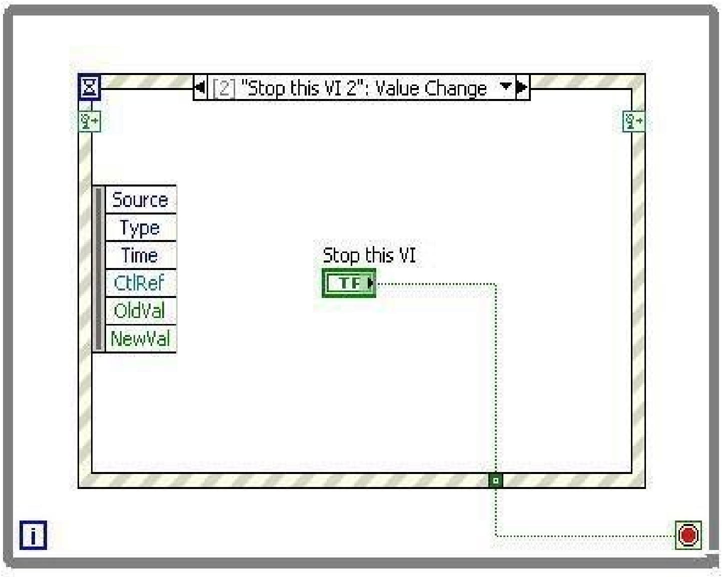

Figure 2.8 : Event Structure

2.15 Arrays

Sometimes it is beneficial to group related data. Use arrays and clusters to group related data in LabVIEW. Arrays combine data points of the same data type into one data structure, and clusters combine data points of multiple data types into one data structure.

An array consists of elements and dimensions. Elements are the data points that make up the array. A dimension is the length, height, or depth of an array. An array can have one or more dimensions and as many as (231)—1 element per dimension, memory permitting.

You can build arrays of numeric, Boolean, path, string, waveform, and cluster data types. Consider using arrays when you work with a collection of similar data points and when you perform repetitive computations. Arrays are ideal for storing data you collect from waveforms or data generated in loops, where each iteration of a loop produces one element of the array.

2.16 Clusters

Clusters group data elements of mixed types. An example of a cluster is the LabVIEW error cluster, which combines a Boolean value, a numeric value, and a string. A cluster is similar to a record or a struct in text-based programming languages.

Bundling several data elements into clusters eliminates wire clutter on the block diagram and reduces the number of connector pane terminals that subVIs need. The connector pane has, at most, 28 terminals. If your front panel contains more than 28 controls and indicators that you want to pass to another VI, group some of them into a cluster and assign the cluster to a terminal on the connector pane. File I/O

File I/O operations pass data to and from files. Use the File I/O VIs and functions on the File I/O palette to handle all aspects of file I/O, including the following:

• Opening and closing data files.

• Reading data from and writing data to files.

• Reading from and writing to spreadsheet-formatted files.

• Moving and renaming files and directories.

• Changing file characteristics.

• Creating, modifying, and reading a configuration file.

2.17 Property Node

Use the property node to get or set properties and methods on local or remote application instances, VIs, and objects. You can read or write multiple properties using a single node. However, some properties are not readable and some are not writable. Use the Positioning tool to resize the Property Node to add new terminals.Figure 2.9 is the property node.

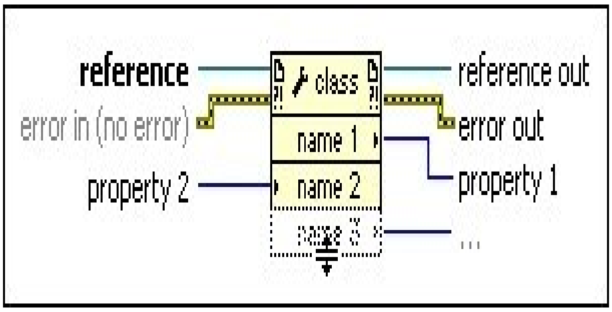

Figure 2.9 : Property Node

2.18 LabVIEW Hardware

LabVIEW can use all measurement and control hardware in a single development environment. LabVIEW offers seamless integration across multiple types of instruments, buses and sensors. Instrument control is a PC-based approach that combines programmable software and hardware connectivity for automating measurement acquisition from third-party instrumentation. An instrument control system consists of instrumentation, connectivity hardware and a computer with programmable software. Compared to traditional measurement systems, the combination of NI LabVIEW software, instrument drivers and connectivity hardware is the most productive, flexible approach to automating third-party instrumentation.

2.18.1 NI myDAQ

NI myDAQ is a low-cost portable data acquisition (DAQ) device that uses NI LabVIEW-based software instruments, allowing students to measure and analyze real-world signals. NI myDAQ is ideal for exploring electronics and taking sensor measurements. Combined with NI LabVIEW on the PC, students can analyze and process acquired signals and control simple processes anytime, anywhere.

Specifications of NI myDAQ

- Number of channels................................2 differential or 1 stereo audio input
- ADC resolution.......................................16 bits
- Maximum sampling rate.........................200 kS/s
- Timing accuracy ....100 ppm of sample rate
- Timing resolution ....10 ns Range
- Analog input....................................±10 V, ±2 V, DC-coupled
- Audio input......................................±2 V, AC-coupled
- Passband (–3 dB)
- Analog input....................................DC to 400 kHz
- Audio input......................................1.5 Hz to 400 kHz
- Connector type
- Analog input....................................Screw terminals
- Audio input......................................3.5 mm stereo jack
- Input type (audio input)..........................Line-in or microphone
- Microphone excitation (audio input) ......5.25 V through 10 k

NI myDAQ provides analog input (AI), analog output (AO), digital input and output (DIO), audio, power supplies, and digital multimeter (DMM) functions in a compact USB device.Figure 3.0 shows the NI MyDAQ.

Figure 3.0 : NI MyDAQ

Analog Input (AI):

There are two analog input channels on NI myDAQ. These channels can be configured either as general-purpose high-impedance differential voltage input or audio input. The analog inputs are multiplexed, meaning a single analog-todigital converter (ADC) is used to sample both channels. In general-purpose mode, you can measure up to 10 V signals. In audio mode, the two channels represent left and right stereo line level inputs. Analog inputs can be measured at up to 200 kS/s per channel, so they are useful for waveform acquisition. Analog inputs are used in the NI ELVISmx Oscilloscope, Dynamic Signal Analyzer, and Bode Analyzer instruments.

Analog Output (AO):

There are two analog output channels on NI myDAQ. These channels can be configured as either general-purpose voltage output or audio output. Both channels have a dedicated digital-to-analog converter (DAC), so they can update simultaneously. In general-purpose mode, you can generate up to 10 V signals. In audio mode, the two channels represent left and right stereo outputs.

Digital Input/Output (DIO):

There are eight digital I/O (DIO) lines on NI myDAQ. Each line is a Programmable Function Interface (PFI), meaning that it can be configured as a general-purpose software-timed digital input or output, or it can act as a special function input or output for a digital counter.

Power supply:

There are three power supplies available for use on NI myDAQ. +15 V and –15 V can be used to power analog components such as operational amplifiers and linear regulators. +5 V can be used to power digital components such as logic devices. The total power available for the power supplies, analog outputs, and digital outputs is limited to 500 mW (typical)/100 mW (minimum). To calculate the total power consumption of the power supplies, multiply the output voltage by the load current for each rail and sum them together. For digital output power consumption, multiply 3.3 V by the load current. For analog output power consumption, multiply 15 V by the load current. Using audio output subtracts 100 mW from the total power budget.

Digital Multimeter (DMM):

The NI myDAQ DMM provides the functions for measuring voltage (DC and AC), current (DC and AC), resistance, and diode voltage drop.DMM measurements are software-timed, so update rates are affected by the load on the computer and USB activity.

NI ELVISmx Driver Software:

NI ELVISmx is the driver software that supports NI myDAQ. NI ELVISmx uses LabVIEW-based software instruments to control the NI myDAQ device, providing the functionality of a suite of common laboratory instruments.

MyDAQ Connectors and Pins

MyDAQ Connectors and Pins: The available connection in MyDAQ is Audio, Analog input (AI), Analog output(AO), Digital input output (DIO), Ground (GND), and Power signals accessed through the 3.5 mm audio jacks and screw terminal connections.The figure 3.1, 3.2, 3.3 shows the myDAQ connector pins and terminals.

1. NI myDAQ
2. USB Cable
3. LED
4. 20-Position Screw Terminal Connector
5. Audio cable
6. DMM Banana cable

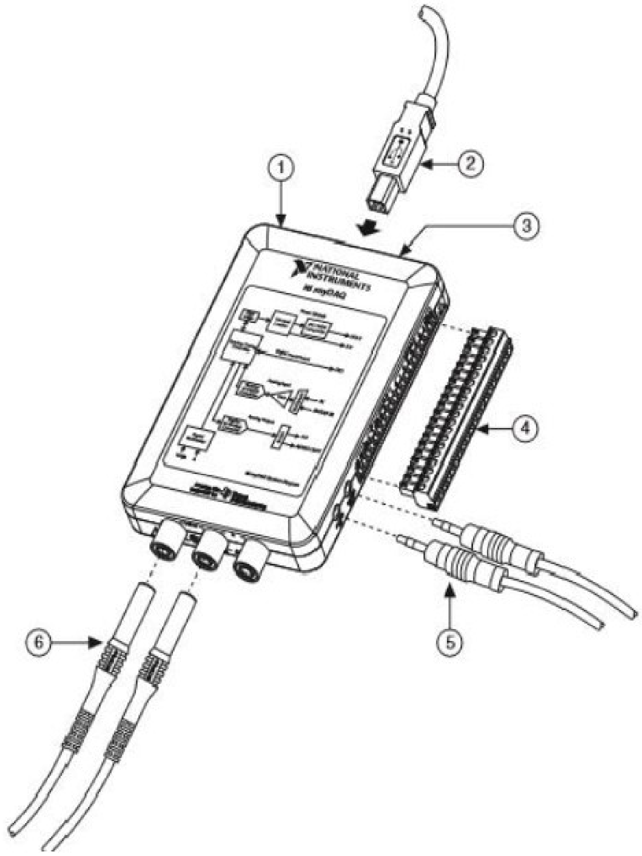

Figure 3.1 : MyDAQ Connector Pins Details

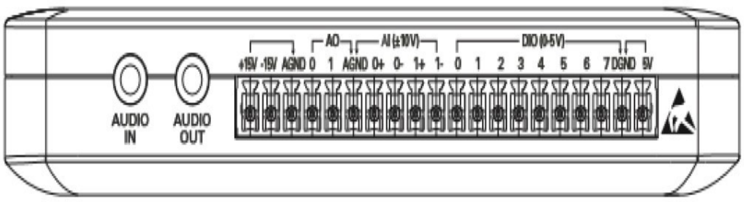

Figure 3.2 : 20-Position Screw Terminal I/O Connector

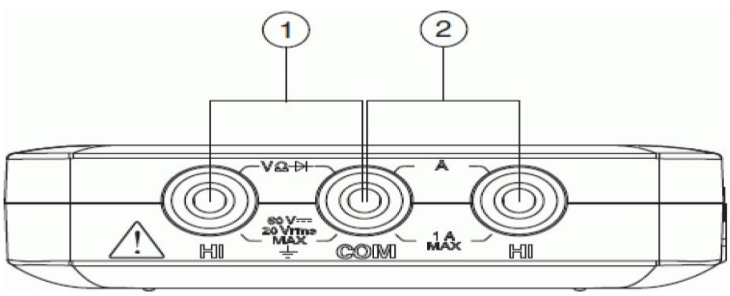

Figure 3.3 : Connector for DMM measurements

Signal Name	Reference	Direction	Description
AUDIO IN	—	Input	**Audio Input**—Left and right audio inputs on a stereo connector
AUDIO OUT	—	Output	**Audio Output**—Left and right audio outputs on a stereo connector
+15V/–15V	AGND	Output	+15 V/–15 V power supplies
AGND	—	—	**Analog Ground**—Reference terminal for AI, AO, +15 V, and –15 V
AO 0/AO 1	AGND	Output	Analog Output Channels 0 and 1
AI 0+/AI 0–; AI 1+/AI 1–	AGND	Input	Analog Input Channels 0 and 1
DIO <0..7>	DGND	Input or Output	**Digital I/O Signals**—General-purpose digital lines or counter signals
DGND	—	—	**Digital Ground**—Reference for the DIO lines and the +5 V supply
5V	DGND	Output	5 V power supply

Table 3.4 : Screw Terminal Signal Descriptions

Analog Input Signals:

When configuring the input channels and making signal connections, we must first determine whether the signal sources are floating or ground referenced. Ground-Referenced Signal Source: A ground-referenced signal source is connected to the building system ground, so it is already connected to a common ground point with respect to the NI myDAQ device, assuming that the computer is plugged into the same power system.

Floating Signal Sources:

A floating signal source is not connected to the same ground reference as NI myDAQ, but instead has an isolated reference point.Some examples of floating signal sources are battery-powered devices, outputs of transformers, thermocouples, optical isolator outputs, and isolation amplifiers. An instrument or device that has an isolated output is a floating signal source. It must be connect to the ground reference of a floating signal to an NI myDAQ AGND pin through a bias resistor or jumper wire to establish a local or on board reference for the signal. Otherwise, the measured input signal varies as the source floats out of the common-mode input range.

Digital I/O (DIO) and Counters/Timers:

There are eight, software-timed DIO lines on the NI myDAQ that can be individually configured for input or output. Additionally, lines DIO 0, DIO 1, and DIO 3 can be configured for counter/timer functionality. The input accessed through DIO 0, DIO 1, and DIO 3 signals configured as a counter is used for counter, timer, pulse width measuring, and quadrature encoding applications.

2.19 NI DAQmx Programming

2.19.1 DAQ Assistant

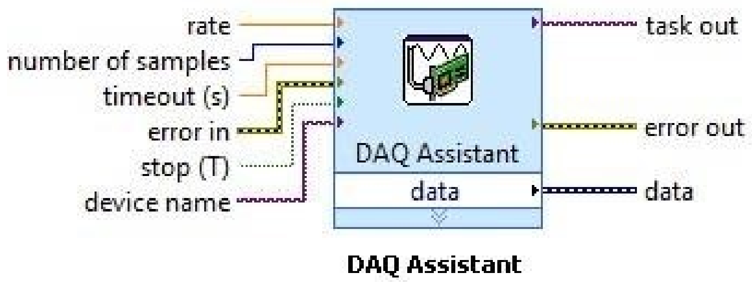

Figure 3.5 : DAQ Assistant

DAQ Assistant is a graphical interface for interactively creating, editing, and running NI-DAQmx virtual channels and tasks. An NI-DAQmx virtual channel consists of a physical channel on a DAQ device and the configuration information for this physical channel, such as input range and custom scaling. An NI-DAQmx task is a collection of virtual channels, timing and triggering information, and other properties regarding the acquisition or generation.The figure 3.5 above shows the DAQ assistant.

2.19.2 NI-DAQmx Create Virtual Channel

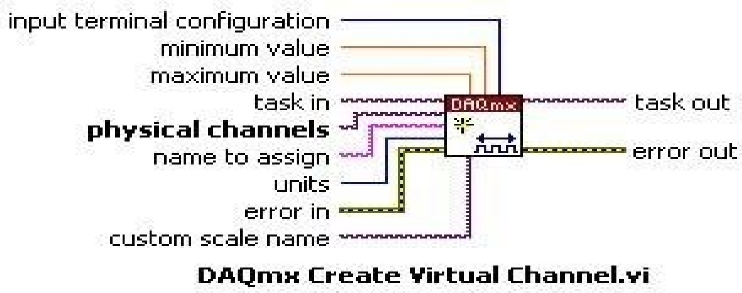

Figure 3.6: NI-DAQmx Create Virtual Channel

The NI-DAQmx Create Virtual Channel function creates a virtual channel and adds it to a task. It can also be used to create multiple virtual channels and add all of them to a task. When a task is not specified, the function creates a task. The NI-DAQmx Create Virtual Channel function has numerous instances. These instances correspond to the specific type of measurement or generation the virtual channel(s) perform.The figure 3.6 shows the NI-DAQmx Create Virtual Channel.

Creating a Channel in LabVIEW

The following figure shows four examples of different instances of the NIDAQmx Create Virtual Channel VI.

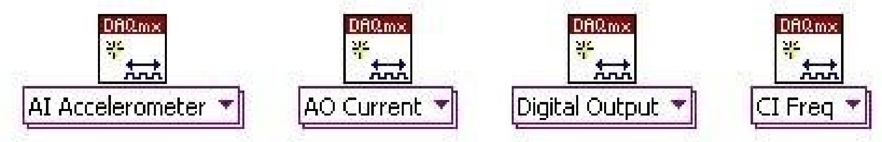

Figure 3.7 : Creating a Channel in LabVIEW

The inputs to the NI-DAQmx Create Virtual Channel function differ for each instance of the function. However, certain inputs are common to most, if not all, of the function's instances. For example, an input is required to specify the physical channels (analog input and analog output), lines (digital), or counter that the virtual channel(s) will use. Additionally, analog input, analog output, and counter operations use minimum value and maximum value inputs to configure and optimize the measurements and generations based on the minimum and maximum expected values of the signals.The figure 3.7 shows how to create a channel in LabVIEW.

2.19.3 NI-DAQmx Timing

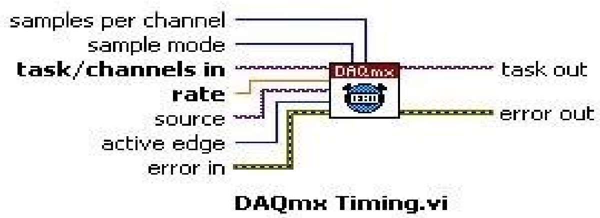

Figure 3.8 : NI-DAQmx Timing

The NI-DAQmx Timing function configures the timing for hardware-timed data acquisition operations. This includes specifying whether the operation will be continuous or finite, selecting the number of samples to acquire or generate for finite operations, and creating a buffer when needed.

For operations that require sample timing (analog input, analog output, and counter), the Sample Clock instance of the NI-DAQmx Timing function sets both the source of the sample clock, which could be an internal or external source, and its rate. The sample clock controls the rate at which samples are acquired or generated. Each clock pulse initiates the acquisition or generation of one sample for each virtual channel included in the task.The figure 3.8 shows the NI-DAQmx Timing.

2.19.4 NI-DAQmx Start task

Figure 3.9 : NI-DAQmx Start task

The NI-DAQmx Start Task function explicitly transitions a task to the running state. In the running state, the task performs the specified acquisition or generation. A task will be implicitly transitioned to the running state and automatically started if the NI-DAQmx Start Task function is not used when the NI-DAQmx Read function executes. This implicit transition also occurs if the NI-DAQmx Start Task function is not used and the NI-DAQmx Write function executes with its auto start input specified accordingly.The figure 3.9 shows NI-DAQmx Start task.

2.19.5 NI-DAQmx Read

Figure 4.0: NI-DAQmx Read

The NI-DAQmx Read function reads samples from the specified acquisition task. The different instances of the function allow for the type of acquisition (analog, digital, or counter), the number of virtual channels, the number of samples, and the data type to be selected.The figure 4.0 shows how NI-DAQmx Read.

2.19.6 NI-DAQmx Write

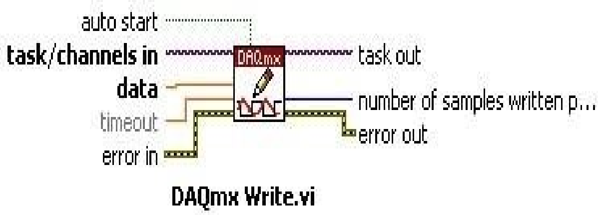

Figure 4.1: NI-DAQmx Write

The NI-DAQmx Write function writes samples to the specified generation task. The different instances of the function allow for the type of generation (analog or digital), the number of virtual channels, the number of samples, and the data type to be selected.The figure 4.1 shows how NI-DAQmx Write.

2.19.7 NI-DAQmx Stop

Figure 4.2: NI-DAQmx Stop

The NI-DAQmx stop function writes stops the running task and returns it to the state the task was in before.

2.19.8 NI-DAQmx Clear Task

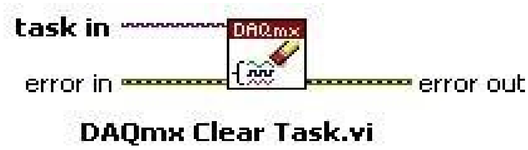

Figure 4.3: NI-DAQmx Clear Task

The NI-DAQmx Clear Task function clears the specified task. If the task is currently running, the function first stops the task and then releases all of its resources.

Once a task has been cleared, it cannot be used unless it is recreated. Thus, if a task will be used again, the NI-DAQmx Stop Task function should be used to stop the task but not to clear it.The figure 4.3 shows the NI-DAQmx Clear Task.

Conclusion

NI-DAQmx saves development time and improve the performance of data acquisition applications. One of the ways NI-DAQmx saves development time is by providing an API that requires only a small number of functions to expose the majority of its functionality.

Chapter 3

Project Design and Development

Automatic test procedure is a process to check the output of input source voltage, automatic test procedure system has been developed to automatically achieve some activities performed frequently in daily life, this has been designed using LabVIEW software.All the circuit diagram and report making process is done in LabView software which can generate a word file for the results in the last.

3.1 Procedure

1. Open NI-LABVIEW software.
2. Construct BLOCK DIAGRAM and design the FRONT PANEL.
3. In the FRONT PANEL first select the path to store file.
4. Give proper information and soruce input voltage.
5. Run the code and get the results for the input data.

3.2 Block Diagram

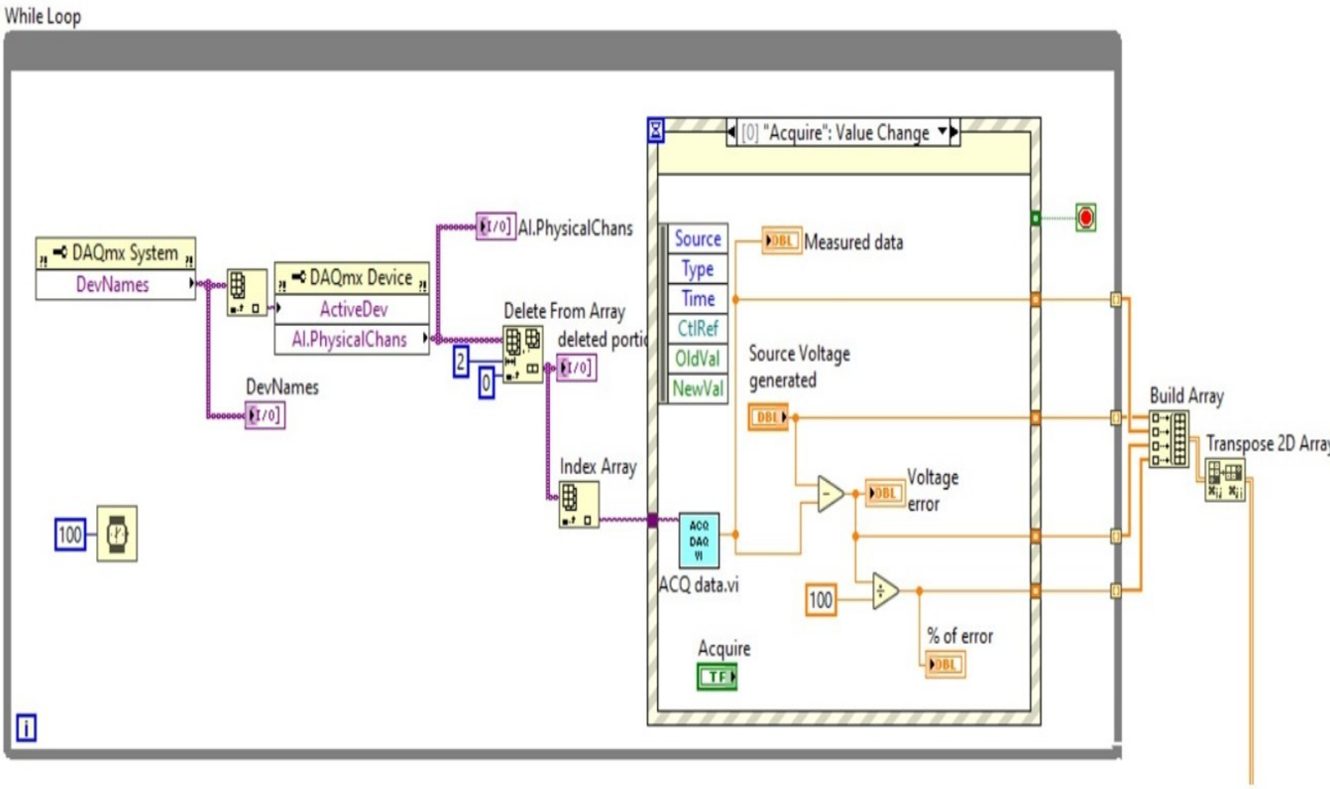

Figure 4.4: Block Diagram part 1

Block diagram 4.4 is designed using NI-DAQmx as shown in the above diagram.The connection is done using different types of hardware and while loop. DAQmx system is connected to the index array which is further connected to the property node.Property node is further divided into Small other parts which connects the delete array port and index array.Index array is connected to the main frame which is knows as event structure, which consists of different arithmetic units like addition,subtraction,multiplication,division and percentage calculation.All the functions further connected to input of the builtin array and transpose array.Finally the transpose array output is fed into the report creation circuit.

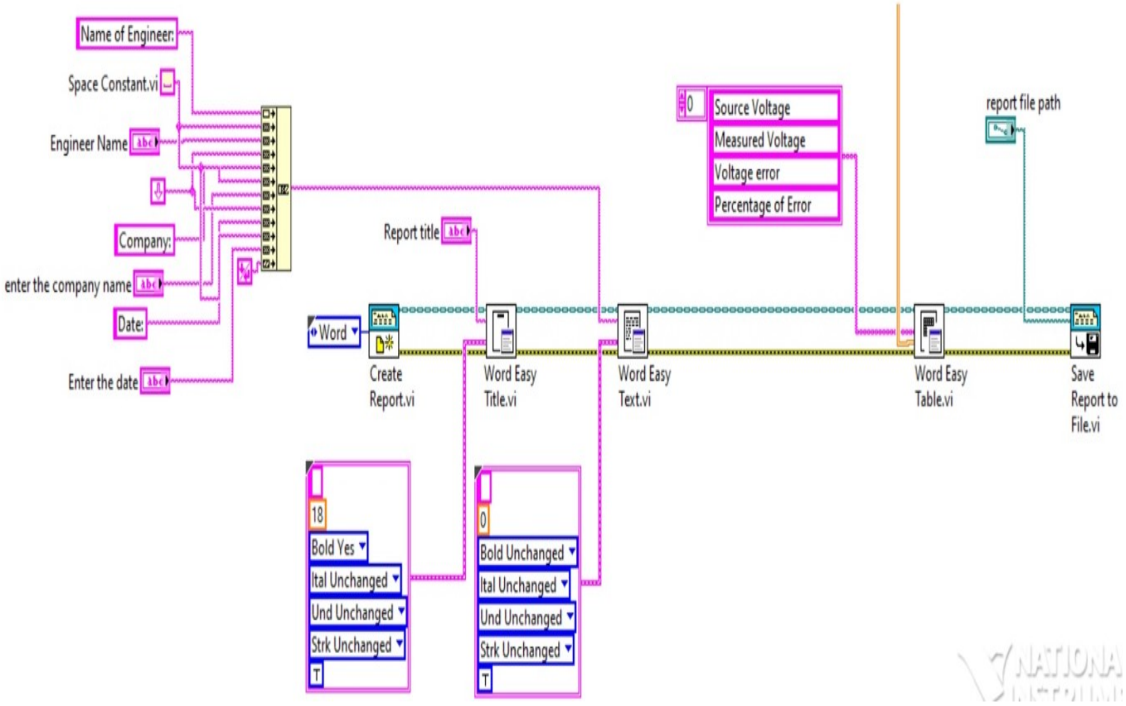

Figure 4.5: Block Diagram part2

This Block diagram 4.5 is designed using NI-DAQmx as shown in the above diagram. This part is for the report creation process.In the starting we have put multiple options for a person to input his/her details.Further the details are given to a word file creator.We can choose the various fonts types and size for the data to be printed in word file.In word easy table we can give the input of transpose 2D array and report creation input followed by input of source voltage.Finally the word easy table is connected to path storage link where a person can select the path to store the final report.

FRONT PANEL : where we have to give the necessary details for the results.The below figure 4.6 shows the front panel design.

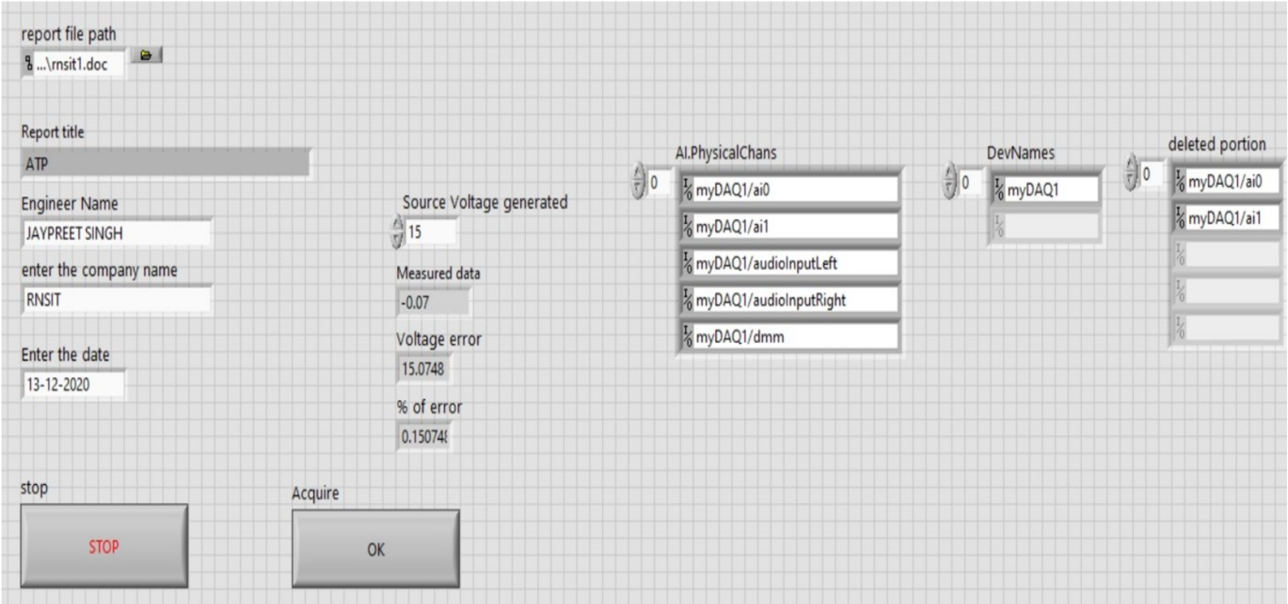

Figure 4.6: Front Panel

Chapter 4

Results

Automatic Test Procedure

Name of Engineer: JAYPREET SINGH
Company: RNSIT
Date: 25/05/21

Source Voltage	Measured Voltage	Voltage Error	Percentage of Error
7.566	-0.075	7.641	0.076
15.220	-0.075	15.295	0.153
4.550	-0.075	4.625	0.046
8.550	-0.075	8.625	0.086
6.220	-0.075	6.295	0.063
2.220	-0.075	2.295	0.023
0.000	0.000	0.000	0.000

The final results will be saved in the word file in the desired location, the following are the calculated results of a given input with the input of source voltage and the outcomes are measured voltage, voltage error, percentage of error.We can give multiple number of inputs and can get the results of the given input.

Chapter 5

Conclusion and Future scope

5.1 Conclusion

The project has proposed the idea of getting the correct accuracy of the input source voltage very easily just by giving the input voltage.

This project discussed the design of automatic test procedure which includes various hardware and design for building this.

5.2 Future Scope

Future scope for automatic test procedure can be used in the electronics industry for testing of hardware.This can be very accurate, fast and time saving.It is also very easy to use and can save multiple input records with all the necessary information and details like date, time, name and title.

Chapter 6

Specific Outcomes

6.1 Specific Outcomes

I have learnt new software tool that is LABVIEW. Laboratory Virtual Instrumentation Engineering Workbench (Lab VIEW) is a platform and development environment for a visual programming language from National Instruments, used for Testing and Measurement, Process Control and Factory Automation, Machine Monitoring and Control, Research and Analysis, Control Design. I have also learnt new NI hardware, which are MyDAQ, it is used for host programming to generate and acquire the data.

6.2 Internship Experience

The time I spent in VI Solutions as an intern from 1st week of July to 1st week of August 2020 was memorable one. I had so many experiences and opportunities which helped me to discover my potential. Internship at VI solutions helped me to increase my skills, knowledge, understanding of particular job in an industry, and also helped me gain an insight into the way an organization operates and the challenges they face. The internship also provided me with an opportunity to get to grips with working-meeting deadlines and working in team. I am thankful to Mr.Nagarajan G Sir for guiding me in this internship program. He spent his precious time to clear all the doubts I had and immensely helped me with my project. I am glad that I got an opportunity to work as an intern at VI Solutions. For interns, working hours were from 9am to 3pm. During my internship, I was initially trained to use LabVIEW with several tasks and application based programs.

6.3 Technical Outcomes

1. Planning and creating a rewarding events and utilizing imaginative ideas to create dynamic experiences.

2. Helping organization to build their brand and connect with their customers to strengthen relationships.

3. Ensuring that the clients expectations are exceeded in the flawless staging of the event, taking care of all the details so that the clients can have peace of mind.

4. Finally I gained real-world experience, often learning about the latest technology and equipment used in the workplace.

6.4 Non-Technical Outcomes

1. Along with the technical aspects I have grown my verbal and written communication skills. In any of of the field, it may be technical or non-technical like management, good verbal and communication skill is must.

2. In course of this internship the best part how I developed myself. This internship boosted me with lots of confidence. i learnt to behave with senior officials. Personality development is very important factor to survive in any of the organization.

3. Time management is a very important skill which takes anyone towards their success. I utilized my time to the fullest to submit projects and assignments within the deadline.

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[5] `http://wikipedia.com`