Feeder Automation

[1]Maulik Kachhiya1[st], [2]Manan Patel2[nd], [3]Krunal Rathva3[rd], [4]Sneh Shah4[th], [3]Honey Sharma5[th]
[1]Electrical Department of Engineering 1[st],
[1]Indus University 1[st], Ahmedabad, India

Abstract: Feeder automation (FA) is a Smart Grid technology that can be implemented on the electric grid's distribution system of local power lines and neighborhood substations. It improves reliability with the real-time monitoring and intelligent control. Feeder automation (FA) represents the evolution of control technologies that has taken place as computing power becomes embedded in the individual products that make up the distribution system. Feeder Automation allows individual devices to sense the operating conditions of the grid around them and make adjustments to improve the overall power flow and optimize performance. Without Feeder Automation, there are grid operators in centralized control centers and they have the responsibility to identify and analyze their power system and intervene by either remotely activating devices or dispatching a service technician.

Index Terms **- Component,formatting,style,styling,insert.**

I. INTRODUCTION OF FEEDER AUTOMATION

"FA is a set of technologies that enable an electric utility to remotely monitor, coordinate and operate distribution components in a real-time mode from remote location"

Single engineer can be achieved by feeder monitoring and local protection alone. When they cooperate, they can locate the fault line section rapidly and accurately, isolate the fault line section and restore power to unfaunted line section intelligently.

Strategy about fault processing of feeder automation sys- tem based is analyzed through experiments done in laboratory. It is proved that feeder automation is more effective.

Remotely monitors the distribution system, facilitates supervisory control of devices and provides decision support tools to improve the system performance.

1.1 Features and Applications of FA:

The distribution feeder automation consist the following features:

- Peer-to-peer logic and control (no centralized controller).
- Differential measurement technique over common link.
- Automatic Transfer Scheme (ATS) for critical loads.
- Fault Location, Isolation and Service Restoration (FLISR).
- Load Management and Load Balancing.
- Volt / VAR Control and Voltage Reduction

1.2 Feeder

A feeder is conductor which connects substation to the area where the power is to be distributed. There are no tapings taken from feeders so the current in it remains the same throughout. Main consideration in the design of feeder is current carrying capacity.

II. LOW TENSION DISTRIBUTION SYSTEM IN FEEDER AUTOMATION

2.1 Overview

It is to inform you that we have studied about hall distribution process of secondary distribution transformer to consumer under the guidance of Torrent power Pvt Ltd. And Rajesh power Pvt Ltd. At the Chanakyapuri Ahmedabad.

2.2 Secondary Distribution System

In this system an AC power distribution system within which customers are served from 3 - phase, four-wire low-voltage circuits equipped by 2 or more network transformers whose low-voltage terminals are connected to the low-voltage circuits through network protectors.

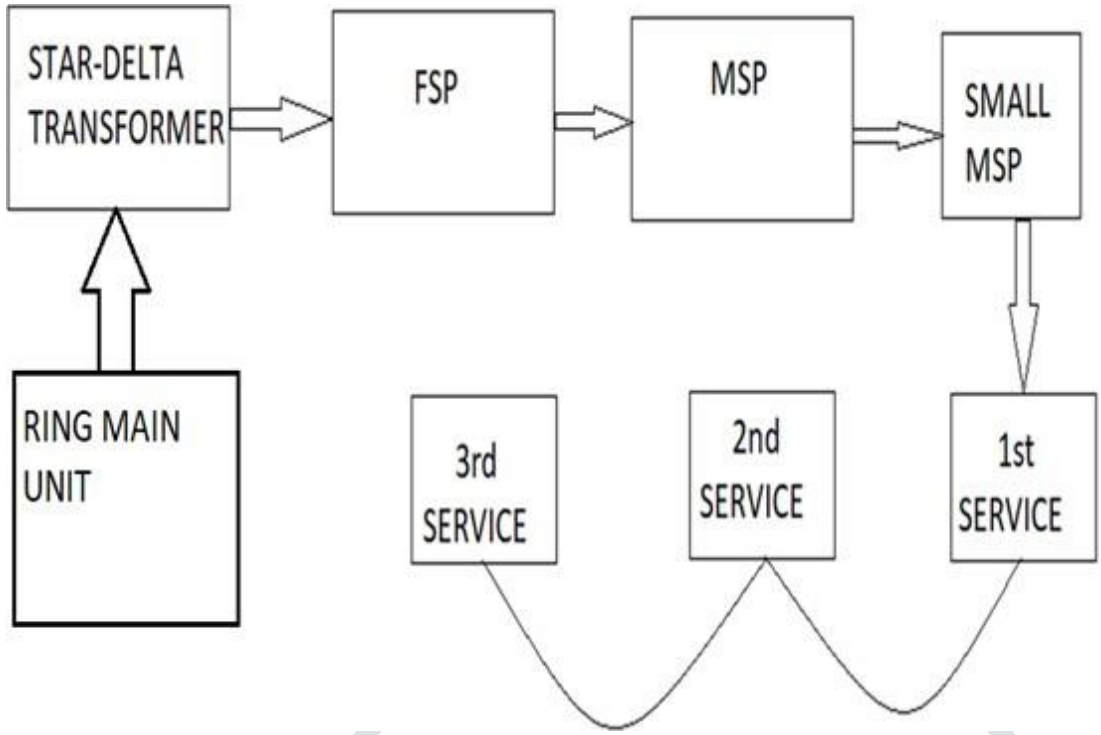

Figure 1: Block Diagram of Secondary Distribution System

2.3 Study of Ring Main Unit

Ring Main Unit (RMU) is a totally sealed, gas-insulated compact switchgear unit used in are applicable in medium voltage secondary distribution system for outdoor and indoor applications. The primary switching devices consists of switch dis connectors / isolators or \ circuit breakers

Depending upon the application the circuit breaker is equipped with a protective relay.

Depending upon the application ring main unit can be installed in extensible and non-extensible modules. The switching modules (switch dis connector / isolators or circuit breakers) can be added in the extensible ring main unit depending upon the application of the Ring Main Unit.

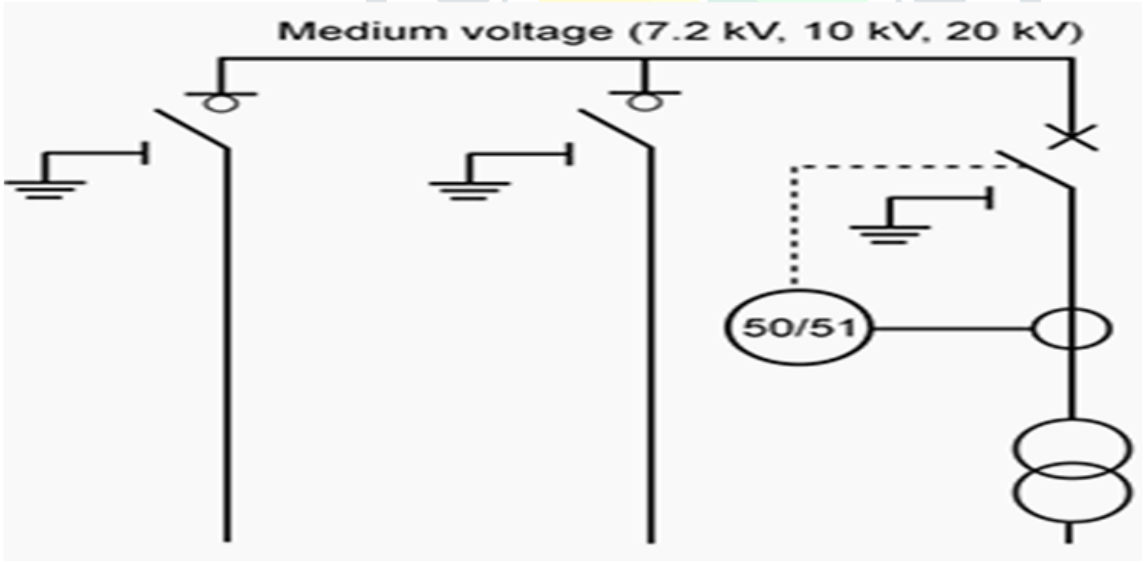

Figure 2: Connections of RMU

2.4. Star-Delta Step down Transformer

These transformers are used for electric power distribution purpose are referred as distribution transformer and there are several types of transformer used in the distribution system like pole mounted transformer, and underground transformer

2.5. Fuse section pillar

The function of this pillar is to take in a supply of electrical energy from a transformer and allocate it, via fuse ways, to a number of outgoing circuits, providing each with a means of protection and control. In effect, they are a very basic form of LV switchboard.

Fuse section pillar have the High rupturing fuse for the protection of line over the short circuit current

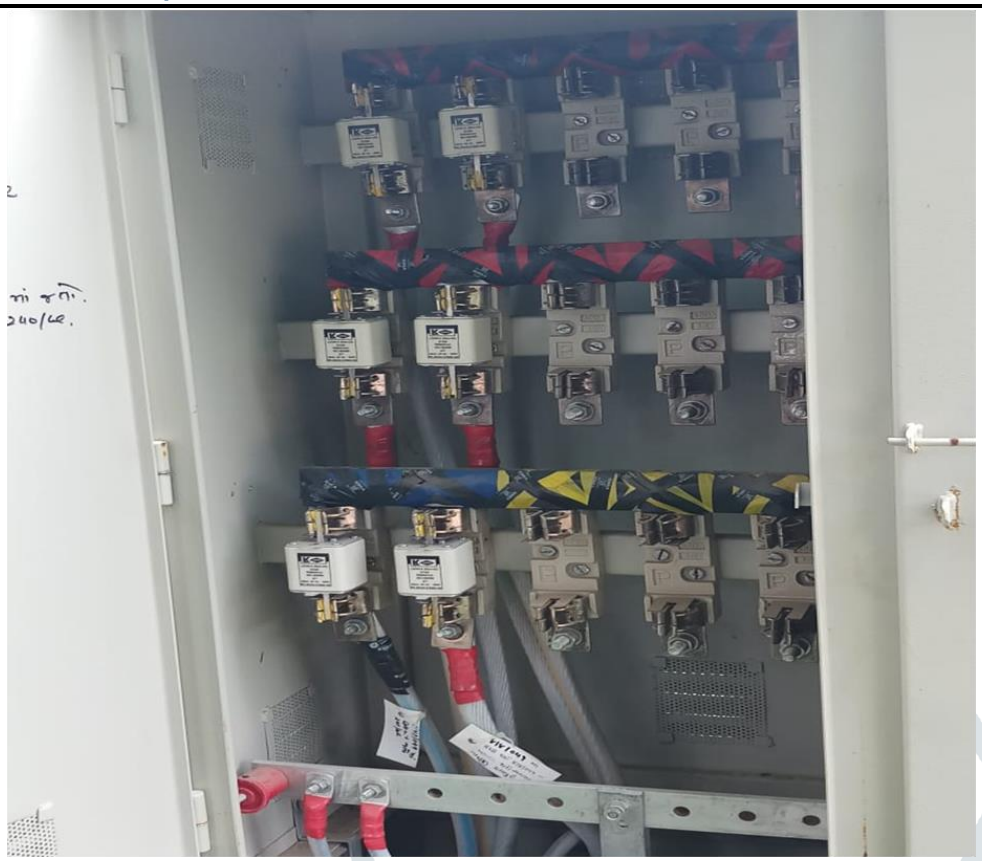

Figure 3: Fuse section pillar

2.6. Mini section pillar

MSP (Mini Section Pillar) also known as OSP (Open Space Panels) are manufactured using high grade M.S raw material and designed using advanced technology & Sturdy in construction, MSP are resistant to corrosion and feature proof age from water & weather.

MSP (Mini Section Pillar) are mainly used for providing connection to big switchgear or for distributing main power supply in a Residence Apartment & Commercial building. MSP also used in where very heavy current passes through electrical equipment's or in situations, which needs distribution of heavy current in a building.

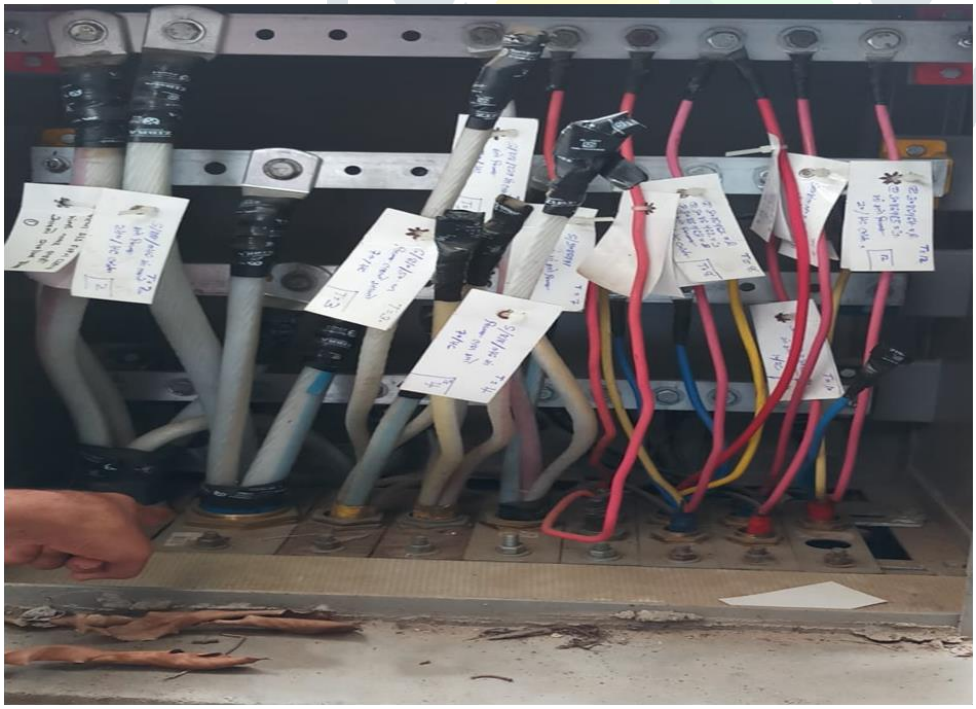

Figure 4: Mini Section Pillar

III. SCADA IN AUTOMATION

3.1 Overview

We have ascertained the SCADA system at UGVCL SCADA room Gandhinagar, wherever SCADA isn't solely restricted for electric field but everywhere where oversight is required. SCADA system was of 11kv of DISCOM Company. In SCADA the connection is divided into sub-stations and sub-divisions. SCADA is connected with SIC (SCADA Interface Cabinet) at sub-stations by which they can control from the site.

RTU (Remote Terminal Unit) is installed at sub- divisions, by which we can remotely control the electric supply from site. The FPI (Fault Passage Indicator) which is connected in within the feeder from sub-divisions to RMU, it detects the fault in the feeder and indicates it directly in the SCADA system. DCU (Data Concentrated Unit) is connected at FPI.

FRTU (Field Remote Terminal Unit) it is installed in RMU at the consumer site.

In FRTU a modem is installed in it and is connected with SCADA through GSM connection, by using SIM card. A unique IP address is given to modem with which the SCADA system is connected.

So by this process the SCADA system is connected through sub-stations to client and can control the whole termination from the SCADA control room.

3.2 Introduction

1 SCADA (Supervisory Control and Data Acquisition) is a system that operating with coded signals over communication channels thus on provide control of remote equipment.

2 The control system is combined with data acquisition system to acquire information about the status of the remote equipment for display.

3 It's a kind of industrial control system that monitors and control industrial process.

3.2.1 SCADA system performs four functions

- Data acquisition
- Network data communication
- Data presentation
- Control

3.2.2 These functions are performed by four kinds of SCADA components:

1. Sensors (either digital or analogue) and control relays that directly interface with the managed system
2. Remote telemetry units (RTUs). These are tiny computerized units deployed within the field at specific sites and locations RTUS serve as local collection points for gathering reports from sensors and delivering commands to control relays.
3. SCADA master units these are larger computer con- soles that serve as the CPU for the SCADA sys- tem. Master units provide a human interface to the system and automatically regulate the managed system in response to sensor inputs.
4. The communications network that connects the SCADA master unit to the RTUs in the field
5. Communication network that connects the SCADA master unit to the RTUS in field

3.3 Technologies used in SCADA

3.3.1 Electrical Technologies used in SCADA

(a) RMU (Ring Main Unit)

- RMU is a piece of switch gear to connect a transformer's primary winding to a high voltage ring main.
- It consists of three load breaking switches each with three positions: on, off, and earth.
- They allow the transformer to be connected/disconnected to the ring
- The earth positions allow the transformer's secondary to be earthed.

(b) Sectionalizer:

- In electric power distribution, are closed or auto- reclosed is a circuit breaker equipped with a mechanism which can automatically close the breaker when it's been opened because of a fault.
- Re closed is used on overhead distribution system to discover and interrupt momentary (short) faults.
- This re closer are cooperated with a protective device called sectionalizes, usually a dis connector equipped with a tripping mechanism.
- A Sectionalizer is usually not rated to interrupt fault current and is therefore cheaper than are closer.
- It detects and counts fault current interruptions by the re closer. After number of interruption, the Sectionalizer will open thereby isolating the faulty section of the circuit.

(c) Fault Passage Indicator:

Figure 5: Fault passage indicator

Figure shows the FPI its mount on the tower. It's connected with the cables and location is defined and FPI is going to mount and when the fault is accrued it's going to operate and give the command to the DCU and then give the command to the SCADA room Gandhinagar

The main function of FPI is to identify fault occurring in the downstream section from the point of its installation.

Any increase in current along with absence of voltage is signaled by the equipment. Fault condition is indicated by flashing lights in FPI

This information is sent using radio signals to the communication gateway installed nearby for onward transmission to SCADA system at the control center through a suit- able communication channel

(d) DCU (Data Concentrated Unit)

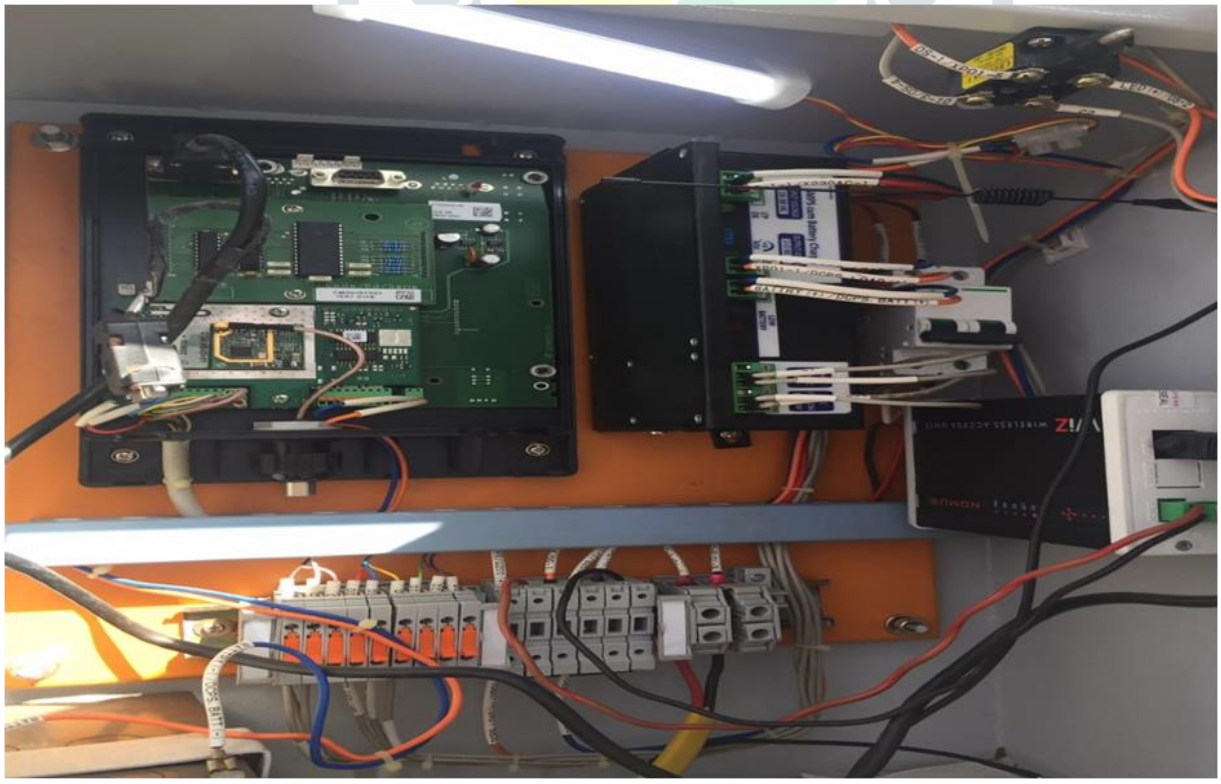

Figure 6: DCU data concentrated unit

Figure shows DCU when the fault is occurring FPI will give the command to the DCU and it will give the signal to the SCADA room.

- DCU is operated with ac supply system but when fault is occurred, and then it is operated with battery.
- DCU is connected with FPI by programming.
- It is connected in between FPI to SCADA system.
- When the fault occurs FPI locates the fault and sends the signal to DCU.
- DCU sends the signal of fault with the location to the SCADA system.
- There are many functions of DCU which indicates in the SCADA system, when door is opened, when the battery is low or when the fault is occurred.

3.4Communication & Information technologies:

(a) Copper cable:

Twisted-pair copper cable is the most popular medium used for SCADA communications and it has been used in its present form for many years. It is similar to copper cables used by telephone companies and contains pairs of conductor. Copper cables used for SCADA purposes can be underground, direct buried or aerial installations. Aerial cables would be more appropriate within the utilities service area since they may own a large number of distribution poles from that cable can be suspended.

(b) Co-axial Cable:

Coax cable is simply a transmission line consisting of an unbalanced pair made up of an inner conductor encircled by a grounded outer conductor, which is control by concentric configuration by a dielectric. The dielectric can be of many varieties, such as PVC, foam, Spiral, air or gas. Coaxial cable can transmit high frequency signals up to several MHZ with low attenuation compared to cop- per wires used for telephone services. Strategies of coaxial cable installations are underground, direct buried and aerial constructions.

(c) Fiber Optic Cable:

Fiber optic as a transmission medium has an operatively unlimited bandwidth. It has excellent properties as low as

0.25 dB/km. Losses of this order of magnitude, similarly because of the development of appropriate lasers and optical detectors, allow designers to consider fiber optics technologies for systems of huge bandwidth over long distances.

Optical fibers carries with it an inner core and protection of silica glass and plastic jackets that physically protects the fiber. There are 3 categories of optical fiber distinguished by their modal and physical properties, and they are single mode, step index (multi-mode), and graded index (multi-mode). Single mode fiber supports higher signaling speed due to its smaller diameter and mode of light propagation. Cable installations could be underground, direct buried, under sea, or aerial.

3.5 Distribution Management System (DMS):

In the recent years, utilization of electrical energy increased exponentially and customer demand and quality definitions of power were changed tremendously. As the

Electric energy became an essential part of the daily life, its optimal usage and reliability became important. Real-time network view and dynamic decisions have become instrumental for optimizing resources and managing demands, thus making a distribution management system which could handle proper work flows, very critical.

Why DMS:

- Reduce the duration of outages
- Improve the speed and accuracy of outage predictions
- Reduce crew patrol and drive times through improved outage locating
- Improve the operational efficiency
- Determine the crew resources necessary to achieve restoration objectives,
- Effectively utilize resources between operating regions.
- Determine when best to schedule mutual aid crews.
- Increased customer satisfaction
- A DMS incorporates IVR and other mobile technologies, through which there is an
- Improved outage communications for customer calls.
- Provide customers with more accurate estimated restoration times.
- Improve service reliability by tracking all customers affected by an outage, Determining
- Electrical configurations of every device on every feeder, and compiling details about each restoration process.

IV. CONCLUSION

Feeder Automation and SCADA system reduce outage duration and increases the reliability of power system. FA system component availability is evaluated based on its performance criterion with simple method during its operation rather than solely depending on their old data based, which are provided by the suppliers. Reliability of power system operation depends on its accuracy in modeling. The conventional models are based mostly on trial and error due to a complexity of the power system. SCADA gives accurate power systems information status on real time and thus avoids modeling errors.

I. ACKNOWLEDGMENT

” To achieve something that we had never before, we need to do something better which we have never done before.”

First of all, we would like to thank the almighty, for giving me the strength and health to do this project work until it was done.

We are also grateful to Dr. Jaydeep Chakravorty, Head, Department of Electrical Engineering, Indus Institute of Technology & Engineering for giving me opportunity to perform the research work under the premises of the college.

Throughout this project, we would like to thank Professor Honey Sharma, my supervisor, for guiding me in this re- search work for the difficulties we faced, and who has given me valuable feedbacks in designing this system as whole. We are very thankful to him for his patience, motivation, enthusiasm and immense knowledge.

We also like to convey my gratitude to all other faculties of Electrical Engineering Department. For providing their helping arm to me during my research work by always shows me pros and cons of project.

Thanks to The Almighty, our Parents, and colleagues for their continuous support and encouragement to strive for our goals.

The methodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample of the study,Data and Sources of Data, study’s variables and analytical framework. The detailsare as follows;