

# CHAPTER 1

## INTRODUCTION

Fiber optic communication has revolutionized the Telecommunication industry. The use of fiber optic cable has enabled telecommunication links to be made over longer distances and with much lower levels of loss compared to other transmission media. It provides high data rate transmission, low attenuation and therefore is ideal for megabit to gigabit transmission and even more (Jassey et, al. 2020).. With the advancement in optical sources and photo detectors which can operate at 1500nm wavelength, this technology has significantly increased the amount of data it can transmit per unit time.

The development of the internet significantly increased the demand for this technology due to its high bandwidth, low attenuation, no electromagnetic interference, security, and lightweight features. In the Gambia, the first and widest telecommunication network is owned by GAMTEL. Until recently, this company was the sole internet service provider and voice traffic operator in the country.

With the ECOWAN project, GAMTEL laid a new 24 pair fiber network with a length of 947 km on the North and South banks of the river, forming a ring across the country. It also implemented multiple rings in the GBA, West Brikama, East Ring A and East Ring B for added security and redundancy. (Comms Update, 2019) The company replaced all existing TDM switching and Transmission networks with an all IP-based Next Generation Network (NGN). This network is the backbone of the telecommunication infrastructure in the Gambia. It links all the main towns

and it carries both internet traffic and telephone calls. A fault in this cable can cause a total blackout of an entire town or region. This has very adverse effects on the company as it loses a great deal of revenue before it is repaired.

## **1.1 STATEMENT OF THE PROBLEM**

Gamtel holds a pivotal position in Gambia's telecommunications and information technology sector, possessing exclusive rights to deliver core telecommunication and ICT service Hoffman, A. (2018). Over the past years, there have been frequent interruptions on the GAMTEL fiber optic network. This is mainly caused by cuts on the cable and equipment failure. The company witnesses a considerable drop in revenue due to the prolonged process of understanding and remedying the issue. The technician overseeing network monitoring has to troubleshoot and interpret the alarms that pop up on the network management system (NMS) terminal. Then the operator calls the concern engineers to report the fault. At times the engineers may not be available and even when they are available; it takes several minutes to communicate the fault to them as they would also interrogate the technician to know the exact location of the fault to avoid going back to the field with wrong information. This process causes a lot of delays and increases the network downtime which results to a great loss of revenue.

To minimize the downtime in the backbone fiber network, an enhanced and more precise fault detection mechanism is required. The motivation of this project is to provide a solution to the delays often encountered by the field engineers using a smart error detection tool that will automatically locate a fault and provide an instant alert to the engineers.

This project focuses on the backbone fiber network and by extension on the network failure due to fiber optic cable cuts or equipment failures. It will also provide a mechanism to effectively

locate and restore those faults as soon as possible.



The main factors that lead to the delay in restoring the network by engineers are:

- The information about the exact location of a fault is often unknown, the distance is sometimes estimated.
- The time it takes the operator to relay the information about a fault to the fiber engineers is often long because he/she has to do a proper troubleshooting first.

## **1.2 AIMS OF THE RESEARCH**

The research targets include:

- Develop, build, and integrate a smart error detection mechanism into the Fiber Network to expedite fault identification.
- To investigate the frequency of occurrence of faults on the fiber network.
- To determine the financial loss incurred by GAMTEL when a fault occurs.

### **1.3.2 DETAIL EXACT PURPOSES**

The detail exact purposes are:

- To develop a field base fault detection tool that can be used by the fiber engineers
- To reduce the downtime and quickly restore normal services.

The scope of the study is limited to GAMTEL backbone fiber network. All national calls and internet traffic are carried through this network. It is anticipated that this research project will offer an alternative approach to the process of fault location, detection and network optimization. It will also develop a more efficient method to restore traffic as soon as possible when a fault occurs, thereby maximizing the company's revenue and better customer satisfaction. This study

is expected to develop a more accurate and efficient fault detection tool in the backbone fiber optic network. It will give the engineers the information required to locate fault for quick restoration to normal services.

The report is structured as: Chapter 2 provides an in-depth analysis of relevant literature regarding fault detection in fiber optics. We discuss and compare some of the different approaches taken by previous researchers and highlight the gaps that require further research and improvement. Chapter 3 describes the methodology or procedures used to identify, process and analyze the information gathered during the research. In Chapter 4, we provide the design framework with the intension of deploying the tool in future work. Chapter 5 shows the summary and draws conclusion from the research work.