# CERTIFICATE OF ORIGINALITY

We the undersigned, hereby certify that this dissertation entitled “DISTANCE MANAGEMENT OF A BASE STATION” presented by NGAI ELIZABETH ASOBI, Matriculation number FE14A153 has been carried out by her in the Department of Computer Engineering, Faculty of Engineering and Technology, University of Buea under the supervision of Dr. Tsafack Pierre.

This dissertation is authentic and represents the fruits of her own research and efforts.

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# DEDICATION

I dedicate this work to God Almighty for his infinite strength and knowledge He bestowed on me during the period of my project research, also to my Father: Bisong John Bisong for his unending moral and financial support, to my fellow course mates and friends for their intellectual support all throughout the conception and design of this project.

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# ABSTRACT

As more and more people rely on mobile communication in their daily lives, the smooth functioning of Mobile Communication Base Station is necessary to also ensure smooth functioning of the network. To do this, the BTS comprises many devices as such, the goal of this project is to develop a system capable of detecting faults occurring in these devices and generate alerts immediately and also to control and analyze the overall functioning of this system remotely. The major problems encountered in such sites are fuel theft, unauthenticated entry, temperature fluctuations, unattended smoke detections, no way to check status of power supply, battery and the workability of the generator.

The system will make use of temperature sensors to detect abnormal increase or decrease in temperature outside set threshold values, smoke sensors to detect abnormal presence of smoke, PIR sensors to detect presence of human in the site, RFID authentication system. The system uses Global System for Mobile (GSM) Short Message Service protocol to send instant messages about each activity in the cell site using a GSM modem. This information will be displayed and interpreted on a web interface running locally on a PC management office which can then be used for analyses and control.

**Keywords:** *Arduino Uno, sensors, GSM, SMS, base station.*

# CHAPTER ONE. GENERAL INTRODUCTION

## Background and context of the study

This study outlines the problems faced by network operators in managing their base station cites and subsystems across different geographical locations. As the number of people relying on mobile communications in their daily lives keep increasing, the pressure on telecom infrastructure is increased. We want telecom base stations to achieve higher performance while decreasing operational costs. This can be a real challenge, especially in rural and scarcely populated areas where we might lack a well-developed power grid and the nearest service technician is miles away. There are many actions that can be taken to improve operations and reduce costs, for example using newer energy-efficient equipment and integrated power management systems to use power more efficiently. These actions may work well when a new site is being built, but the investment may be harder to justify on existing sites as it requires replacing existing, well-functioning equipment with new.

## Problem Statement

The problem this study aims to solve is the management of the different devices that control such base stations. Controlling such devices entails controlling the parameters that control the proper functioning of such systems. This control requirements can be divided into three main parts;

* Inefficient Power Consumption/Supply management
* Uncontrolled Environmental Factors
* Technician’s Time Management
* Security

## Inefficient Power Consumption/Supply Management

Being able to detect whether the base station cite is supplied with power or not is one important aspect of monitoring because few minutes of the site being down, can amount to huge losses by the network operators. Another aspect of monitoring and control is the ability to see how much power devices at the sites are consuming so as to be able to measure the site’s Energy Efficient Ratio (EER).

## Uncontrolled Environmental Conditions

Controlling the environmental aspects such as temperature, humidity and smoke is very crucial to the functioning its devices most especially temperature. This is because variations in temperatures can affect the lifespan of batteries and other devices so maintaining the temperature set threshold is very important to increase the lifespan of batteries and devices in such sites.

## Technician’s Time Management

Since the proper maintenance and control of sites are needed to maintain smooth functioning of the site, technicians are forced to pay regular check up visits to all sites in order to make sure the devices are functioning properly. This is time wastage and cost inefficient for the network operators if the sites are actually doing well since most sites are sometimes miles away. So, being able to schedule visits only for sites which need immediate attention is a big challenge.

## 1.2.4 Security

Security has always been a crucial aspect of any system. Base station sites usually face problems of unpermitted entry, fuel theft, theft of wires. The lack of efficient ways to monitor such activities in the sites poses major security threats and lack of tracking methods to catch the thieves.

## Objectives of the Study

Here, we shall describe what we intend to accomplish with this study. This part will be divided into two; general and specific objectives.

## 1.3.1 General Objectives

The general Objectives of this study is to be able to design and implement a system that will be able to manage, control and secure a base station operation site remotely thereby cutting down cost by sending alerts and notification whenever there is a need for a particular service to the appropriate person in charge remotely.

## 1.3.2 Specific Objectives

The specific objectives is to be able to set, manage, control and secure the site through remote monitoring of parameters like temperature, smoke, energy consumption, movement across restricted areas in the site, monitor functioning of devices remotely and check for fault. This system will then send alerts if there is any unusual activity in the site through an SMS. These data gotten from the site will then be displayed on a Web Interface which then interprets the data thereby, enabling the technicians to be able to make predictions about what needs to be done and where. Appropriate sensors, Arduino, GSM module and a SIM card are used to make a system which is there just to monitor the environment and performances of devices in such sites after which, data is sent to the web for analyses.

## Proposed Methodology

There are many things that can be done to improve the operation of existing telecom sites, but the key factor to successfully be able to reduce operational costs is information. By understanding when, how and if equipment is operating, we are able to make better decisions regarding site maintenance and take actions when necessary. Here, we shall be listing the proposed method to reduce cost and better management system remotely.

## 1.4.1 Proposed solution to Power Management

For operators to be able to manage Power supply and measure energy consumption, we propose adding intelligent energy meters at strategic locations in the site to get a detailed overview of how much energy each part of the BTS is consuming. For example, with an AC meter installed directly after the mains, and DC meters which measure the consumption of the telecom load, you can easily calculate the site’s Energy Efficiency Ratio (EER). Additionally, energy meters can be added to individual equipment (the air-conditioning for example) to see how it is performing and when it is time to do maintenance. Also, getting the amount of battery charge left.

The results will help you identify what kind of energy efficiency measures to take [1].

## 1.4.2 Controlling Environmental Conditions

We propose the installation sensors such as, the LM35 which monitors changes in temperature, the gas Sensor which can monitor abnormal presence of gas or smoke in the site so as to be able to remote immediately to the management personnel whenever values go beyond set threshold.

## 1.4.3 Managing Technician’s Time

We propose and interface that will be able to send commands to the site to check for the operational functioning of certain devices remotely. This will give technicians enough time to attend to sites which needs immediate attention and forget about ones working properly. We also propose that the system be able to control the functioning of certain devices automatically without needing the help of a technician; for example, turning on the cameras of the system when entry to restricted areas detected, turning on the cooling/heating systems when temperatures rises/drops below set thresholds.

## 1.4.4 Securing the System

Motion sensors will be placed at different areas of the site to detect levels of entry so as to be analyze the different restrictions. Fuel level sensors will be used to detect abnormal decrease in fuel level. Cameras will be installed in the system which automatically comes on in case of theft detection or motion in restricted areas. Last but not the least, the system will make use of RFID authentication before granting access to restricted sites of the site in case an authorized technician visits the site for maintenance avoiding unnecessary alerts and notifications being sent to the head office.

Finally, a Web site that will be used to display information from data collected from sites at the head office and a well-structured database system which will store these values for use in predictions by graph plots.

## Significance of the study

This study signifies a breakthrough in the deployment of fully functioning Mobile Telecommunication sites in developing countries like Cameroon where speed of internet connectivity is very low especially in rural areas. That is why this study makes use of SMS for control and feedback rather than the Internet.

## Scope of the Study

This study was targeted to fulfilling the requirements for a fully functional Mobile telecommunication base station. However, the problems stated above are similar to proposed faces by other types of base station so this study can be applied to them as well.

## 1.7 Delimitation of the Study

The delimitation of the Study is that it makes use of GSM Short Message Service Protocol to send control data to and from site. The problem though with this protocol is that is has a maximum limit of characters it can send which makes it difficult to adapt to sites where the control parameters are many.

## Definition of Keywords and Terms

* Arduino Uno:
* GSM:
* SMS:
* BTS:
* Sensors:
* Base Station:

## Organisation of the dissertation

This dissertation will be organized as follows;

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

This chapter will present a brief review and findings about this study by other others and dissertations.

**REFERENCES**

[1]: reducing operational costs of Telecom Base Stations with Remote Management.

[2]Remote Management of Telecom Base Station: Project Report by Umeshwari Khot