FACULTY OF ENGINEERING.

DEPARTMENT OF MINING ENGINEERING.

FINAL YEAR PROJECT REPORT.

AN AUTOMATED TEMPERATURE AND HUMUDITY MONITORING AND CONTROL SYSTEM FOR AN UNDERGROUND TUNNEL.

A CASE OF WAGAGAI UGANDA LIMITED.

By

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A project report submitted to the Department of Mining Engineering in partial fulfilment of the requirement for the award of the Bachelor of Science in Mining Engineering of Busitema University.
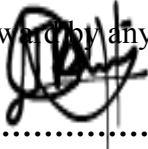
April 2023.

ABSTRACT

This project seeks to design and construct an automated temperature and humidity monitoring and control system for an underground tunnel. The system addresses the major gaps that have been existing in maintaining underground mines' health working conditions. This is achieved through keeping track of the mine temperature and humidity levels and controlling their concentrations by varying the air flow rate automatically signaling for the case of worst conditions in this system. More so, this system measures and continuously displays the temperature and humidity values in the mine to personnel on a liquid crystal display (LCD). The first chapter comprises the introduction, which clearly shows the problem statement, the objectives of the study, the background, and scope of the study. The second chapter comprises the literature review which elaboratively shows how different companies have handled the problem of high ambient air temperature and humidity in tunnels around the world. The third chapter is comprised of the methodology that this study applied. It elaborates on how the data collection will be done, how the data collected will be analyzed, and how they analyze the data will be utilized to design for the automated temperature and humidity monitoring and control system. The fourth chapter includes the results and discussions of every specific objective. Chapter five involves the conclusion, challenges, and recommendations. Chapter six bibliography, which is a list of references that were relied on for an elaborative literature review and appendices.

DECLARATION

I **Tusiimire Rachael** hereby declare that this project report was written by me and has not been utilized for any award by any individual in any learning institution.

Signature …………………………………

Date……25/03/2024…………………………….

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APPROVAL

This report was written and submitted by **TUSIIMIRE RACHAEL**, a fourth-year student at Busitema University, with registration number BU/UP/2019/0053.

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ACRONYMS

WUSN -wireless underground sensor network

WSN-wireless sensor network

SDG- Sustainable development goal

DHT sensor-Digital Humidity and Temperature

IOT -Internet of things

LCD -Liquid Crystal Display

IDE-Integrated Development Environmen

CHAPTER ONE

1 INTRODUCTION

This chapter is comprised of the background of the study, the problem statement, justification, objectives of the study, the scope of this study which includes conceptual scope, geographical scope and the time scope, the significance of the study and finally the conceptual diagram.

1.1 Background

Historically, mining mainly focused on prospecting, exploring and exploiting surface and shallow mineral deposits, which have become hard to find, exhausted and/or are undesirable for extraction due to limited geological confidence, socio-environmental concerns, geotechnical issues, and/or economic feasibility challenges. The mining industry is continuously challenged by resource exhaustion and environmental concerns, while adapting to fulfill the supply of raw materials within the intricate supply and demand, and socio-environmental system (Prno & Scott Slocombe, 2012). CDC, (2020) states it that people go outdoors for plenty of reasons, including work, and mining inclusive. As the shallow mineral resources on Earth's surface have been depleted, several countries worldwide are now successively mining deep resources (Ghorbani et al., 2023). Underground tunnels are used for a variety of purposes such as transportation, mining and storage facilities. Maintaining optimal temperature and humidity levels is crucial to ensure the safety of workers and proper functioning of equipment within these tunnels. However, monitoring and controlling temperature and humidity levels manually can be difficult, time consuming, and sometimes impossible due to the complex nature of the environments (T & Yeoman, 2021).

Physical stress of any kind may be thermal, noise, vibrations, objective lighting, improper barometric pressure, ionizing radiation, etc. has a considerable effect on human performance (Maurya et al., 2015). Heat stress is also among such causes which reduces one's efficiency to do work (T & Yeoman, 2021). Heat stress is the sum of all the internal and external heat factors which cause the body to become fatigued and distressed. Internal factors that determine the level of heat stress on the body include core body temperature, acclimatization, natural heat tolerance and metabolic heat generated by the workload. External factors include ambient air temperature, radiant heat, air velocity and humidity. This is a very serious issue not only for mining fraternity

```
  }
 if(h<45){
   digitalWrite(RELAY_PIN, HIGH);
   digitalWrite (LED_PIN_RED, LOW);
   digitalWrite (LED_PIN_GREEN, LOW);
   digitalWrite (LED_PIN_YELLOW, HIGH);
 }else{
   digitalWrite (LED_PIN_RED, LOW);
   digitalWrite (LED_PIN_GREEN, LOW);
   digitalWrite (LED_PIN_YELLOW, LOW);
 }
}
```

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