



**BUSITEMA  
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*Pursuing Excellence*

**FACULTY OF ENGINEERING**

**DEPARTMENT OF COMPUTER AND ELECTRICAL ENGINEERING**

**FINAL YEAR PROJECT**

**Topic: A TRACKING AND ALERTING SYSTEM FOR UNDERGROUND MINERS**

**BY**

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## **DEDICATION**

I dedicate this report to all my beloved parents biological, mental and spiritual. Your contribution to my education has shaped me into what I am now. Your words of encouragement made me strong and believe in them. I love you all and may the almighty God reward you with unfathomable blessings, glory be to God Almighty.

**DECLARATION**

I WALYAULA GERALD ANOLD, do here by declare that this project is my original work and has never been published and/or submitted for any other degree award to any other university or institution of higher learning.

Signature: W. Anold.....

Date: 29<sup>th</sup> 10/11/2021.....

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**APPROVAL**

This is to certify that the project under the topic “A TRACKING AND ALERTING SYSTEM FOR UNDERGROUND MINERS” has been done by this student under my supervision and is now ready for examination.

Signature:  .....

date: 10/21/2021 .....

MR. BWIRE FELIX

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## LIST OF ACRONYMS

INS	Inertial Navigation System
WSN	Wireless Sensor Network
RFID	Radio Frequency Identification
PPG	Photo plethysmography technique
RFID	Radio Frequency identification
UART	Universal Asynchronous Receiver
SMS	short messaging service
API	Application Programming Interface

## KEY WORDS

I2C	It is a communication medium that uses SPI and interfaces them together.
SMS API	SMS API refers to a software integration interface that enables code to send short messages through an SMS API platform.
API	It is set of functions and procedures allowing the creation of applications that access the features or data of an operating system, application, or other service.



## **ABSTRACT**

The project is designed for the mining industry. It focuses basically on providing information about the miners during their daily duties. The project involves consists of wearable device for tracking the miners location, depth, movements and life status. It uses the INS technology to track motion and PPG technology to monitor the pulse rate. The system is real time information provided at any time defines the miner's conditions.

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# 1 CHAPTER ONE: INTRODUCTION

## 1.1 BACKGROUND

Mining is one of the economic activities that contribute to the revenue of most countries and it has led to civilization in the current world[1]. Different minerals are mined all over the world as raw materials for processing consumer goods. These minerals are classified as metals such as gold, silver, platinum, iron, copper and many others; semi metals such as arsenic and bismuth; and none metals such as graphite, diamond and sulfur[2]. The major methods used in mining are the surface (open-pit) mining for shallowly placed minerals and underground mining for deeply buried minerals[3].

The primary objective of underground mining is to extract ore from underneath the earth as safely and economically as possible while producing as little waste as possible and tailing as well as preserving the natural environment[4][3]. Although most large-scale mining involves open pit mining, many large underground mines are all around the world. The deepest underground mine is over 3.8km deep, found in South Africa[5]. The largest open pit mine is more than 4km wide and 1km deep, at Bingham Canyon Mine near Salt Lake City, Utah.

Uganda lies within the African Plate which is a continental crust[6]. These rocks are endowed with a wide variety of minerals as evidenced by past mining records and the numerous mineral occurrences in many parts of the country[7]. The mining industry in Uganda reached peak levels in the 1950's and 1960's when the sector accounted for up to 30% of Uganda's export. According to the report of the 2009/2010 financial year, the energy and minerals sector contributed 0.3% of the GDP[8] and by 2014 it was accounting for 1.4%[9], [10]. with an increase in government expenditure, the mineral sector contribution towards the nations GDP is expected to increase by 2020. The NDP phase II intends to invest more in the mineral sector so as to boost its contribution to the national economy as it is expected to raise to 7%.

Though the mining sector is employing over 150,000 people and it's expected to provide over 300,000 jobs, there are still challenges that the sector faces[11]. The health and safety of people working in these underground mines needs to be addressed. Miners in such area face a variety of problems that affects their health status and jobs. An example is of an incident that happened in 2016 in Busitema sub-county where ~~two~~ three people were covered by the earth[12].

Free fall or (cave-ins) is a term used to classify accidents related to unexpected movements of rock, mass and the uncontrolled release of debris and rock because of gravity and or pressure, strain burst or rock burst. These falls of ground may occur as soon as the face is exposed after

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