FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

FINAL YEAR PROJECT REPORT

TITLE: A REAL-TIME SYSTEM FOR MONITORING AND CONTROLLING UNDERGROUND MINE ENVIRONMENT.

BY

Kyazze Walid

REG. NO: BU/UG/2016/44

EMAIL: kyawa001@gmail.com

TEL: 0758291818

SUPERVISOR: Mr. Bwire Felix

A project Proposal Submitted to the Department of Computer Engineering in Partial Fulfillment of the Requirements for the Award of a Bachelor's Degree in Computer Engineering from Busitema University

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DECLARATION

I Kyazze Walid, BU/UG/2016/44 declare that this project report is original and has not been published or submitted before to any university or higher institution of learning.

Signature: _____

Date: _____

APPROVAL

The final year project report titled “A Real-Time System for Monitoring and Controlling Underground Mine Environment” has been done under my guidance and is now ready for examination.

Signature: _____

Date: _____

Mr. Bwire Felix

Department of computer engineering.

LIST OF ACRONYMS

CO	Carbon monoxide
CO_2	Carbon dioxide
CSS	Cascading Styles Sheets
FY	Financial Year
HTML	Hypertext Markup Language
IDE	Integrated development environment
PHP	Hypertext Preprocessor
PPM	Parts per million
SQL	Structured Query Language
WAMP	Windows Apache MySQL PHP
PID	Proportional Integral Differential
IDE	Integrated Development Environment
ug/m^3	micrograms per cubic meters

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ABSTRACT

After hundreds of years of mining, the more accessible shallow mineral resources are being depleted, and some have now been exhausted. This leaves us underground mining as the only economical way of getting hold of the earth's deeper mineral deposits. However, this method exposes an average mine worker to a harsh underground environment such as excessive ambient temperature in the workspace, dust, carbon monoxide, carbon dioxide, sulfur dioxide, hydrogen sulfide, and nitrogen oxides which are majorly liberated from blasting, mine fires, timber decay, drilling, incomplete combustion, and diesel engines, among others.

This research focused on addressing the major gaps that have been existing in maintaining good underground miners' working conditions. This happens through keeping track of the mine pollutant levels (temperature, carbon monoxide, carbon dioxide, and dust) and controlling their concentrations by varying the mine air flowrate. The system further automatically produces warning signals (both visual and sound) for the worst scenarios.

The system achieves its functionality through the use of a wireless sensor network (WSN) comprised of various sensor nodes around the mine workings that extract data from the mine and transmit it to the sink node that saves this information to the main database plus controlling ventilation fans.

Contents

CHAPTER ONE (Introduction)

1.1 Background:

The extraction of minerals from the earth has been an essential element in the development of human society since the dawn of civilization.[1] In Uganda, the mining sector employs about 26.5% of the entire population either directly or indirectly. It has also contributed to the Gross Domestic Product (GDP) growth that increased from 0.3% in Financial Year (FY) 2012/13 to 0.6% in FY2017/18. The sector has also seen the value of mineral production increase from UGX 159.3 billion in 2013 to UGX 179.7 billion in 2017. [2]

After many years of mining, the more accessible shallow mineral resources are being depleted, and some have now been completely exhausted. This means that the only economical method of exploitation of the earth's deeper mineral resources to meet society's ever-growing demand is underground mining.[3] However, the activities engaged to obtain these minerals expose an average mine worker to a harsh underground environment such as excessive ambient temperature in the workspace, dust, carbon monoxide, carbon dioxide, sulfur dioxide, hydrogen sulfide, and nitrogen oxides which are majorly liberated from blasting, mine fires, timber decay, drilling, incomplete combustion, and diesel engines, etc.[4]

A portion of injuries and fatalities that occur in underground mines can be attributed to human error. However, some circumstances are dictated by the underground ambient conditions which can be blamed for these accidents. One thousand one hundred and thirty-one (1,131) blasting-related injuries were reported by the mining industry during the period 1978-2008 with blast fumes accounting for 8.5% of the injuries.[5] Continuous air quality monitoring and control could eliminate almost all of the re-entry mine challenges.

Considering the many technologies available today, there are still a lot of challenges faced by the mining sector making it one of the most dangerous professions in the whole world. [6] The most common method of monitoring underground ambient conditions involves a person using handheld detectors to go into the mine and report on the conditions of the underground environment.[7] This method is dangerous as the person involved in monitoring the mine environment gets exposed to toxic gases, radiations, flammable gases, excessive ambient temperatures among others in addition to large response time.

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