



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

FACULTY OF ENGINEERING AND TECHNOLOGY.

DEPARTMENT OF ELECTRICAL ENGINEERING

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

FINAL YEAR PROJECT REPORT:

**DESIGN OF A TWO FACTOR AUTHENTICATION ELECTRIC POWER ISOLATION
SYSTEM**

BY

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A final year project report submitted to the department of electrical engineering in partial fulfillment of the requirement for the award of a bachelor of science degree in electrical engineering of Busitema university.

MAY, 2025

DECLARATION

I Nyanja Charles Vincent (BU/UP/2021/1350) declare that this report is my original work except where due acknowledgement has been made. I declare that this work has never been submitted to this university or any other institute of learning for partial fulfillment for any award.

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Signature:

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Date:

.....

APPROVAL

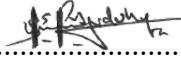
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DEDICATION

I dedicate this project report to God Almighty my creator, my source of wisdom, knowledge and understanding. He has been the source of my strength throughout this program. Much dedication goes to my parents, siblings and friends for their continuous support and encouragement in this journey, am always proud of all of you.

I also dedicate this work to my lecturers who have encouraged us all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started.

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ABBREVIATIONS /ACRONYMS

AC:	Alternating Current
APP:	Application
AVI:	Audio Visual Indicator
DC:	Direct Current
GPRS:	General Packet Radio Service
GSM:	Global System for Mobile communication.
IDE:	Integrated Development Environment
ILO:	International Labor Organization
IoT:	Internet of Things
LCD:	Liquid Crystal Display
LED:	Light Emitting Diode
LOTO:	Lockout/Tag Out
MCU:	Micro Controller Unit
MG:	Meter Gear
MIT:	Massachusetts Institute of Technology
OSHA:	Occupational Safety and Health Administration
OTP:	One- Time Password
PLC:	Programmable Logic Controller
SCADA:	Supervisory Control and Data Acquisition
SIM:	Subscriber Identity Module
SMS:	Short Message Service

ABSTRACT

Electrical power isolation is an essential safety practice in industrial and commercial settings to prevent unauthorized access and protect maintenance personnel. This project introduces the design of an Electric Power Isolation System with Two-Factor Authentication. An Arduino Nano microcontroller is used to process user inputs from a keypad, which in turn controls an MG99R servo motor to operate the isolator switch. A GSM module is integrated to send SMS alerts for both successful and failed authentication attempts, providing real-time notifications to authorized users.

To improve system reliability and user awareness, audio-visual indicators were included—such as a buzzer for incorrect password entries and an LED to indicate system status. The design was initially validated through simulation in Proteus software before being implemented in hardware. The system is particularly suitable for use in industrial switchgear, power distribution units, and maintenance operations where secure control of electrical isolation is vital for safety and efficiency.

The resulting system delivered an automated, secure, and effective solution for managing electrical isolation, minimizing the dangers of unauthorized use and unintended power reactivation. Potential future upgrades would include the integration of biometric authentication, IoT connectivity, and remote access capabilities to further enhance security and usability.

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