



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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**This final year project report is submitted to the Department of Electrical Engineering as
part of the fulfillment of the requirement for the award of Degree of Bachelor of Science in
Electrical Engineering at Busitema University.**

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ABSTRACT

Electrical power isolation is a crucial safety measure in industrial and commercial environments to prevent unauthorized access and ensure maintenance personnel's safety. This project focused on the Design of a Two-Factor Authentication Electric Power Isolation System. The system utilized an Arduino Nano microcontroller to process user input via a keypad, controlling an MG99R servo motor to engage or disengage the isolator switch. Additionally, a GSM module was incorporated to send SMS notifications upon successful or failed authentication attempts, ensuring real-time alerts to authorized personnel.

To enhance system reliability, the design included audio-visual indicators, such as an alert buzzer for incorrect password attempts and an LED indicator to display system status. The system was first simulated in Proteus software before hardware implementation to validate its functionality and effectiveness. This project is applicable in industrial switchgear, power distribution systems, and maintenance environments, where controlled access to electrical isolation is critical for safety and operational efficiency.

The developed system offers an automated, secure, and efficient solution for power isolation, reducing the risks associated with unauthorized access and accidental power restoration. Future enhancements may include biometric authentication, IoT integration, and remote-control features for improved accessibility and security.

DECLARATION

I Bwire Emmanuel Reagan (BU/UP/2021/1330) declare that the contents in this project report are original, as a result of my research study and has never been submitted to any institution of learning for reward of any academic qualification.

BWIRE EMMANUEL REAGAN

Signature:



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Date

20/06/2025

.....

APPROVAL

This Project report has been submitted with the approval of the following supervisors.

1. DR. MIRONDO G. KIBALYA

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2. ENG JENSEN NDUHUURA

Signature: 

Date: 11 / 06 / 2025

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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LIST OF ACRONYMS

2FA:	Two-Factor Authentication
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 Labour 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
NFPA:	National Fire Protection Association
OSHA:	Occupational Safety and Health Administration
OTP:	One- Time Password
PLC:	Programmable Logic Controller
RFID:	Radio Frequency Identification
SCADA:	Supervisory Control and Data Acquisition
SIM:	Subscriber Identity Module
SMS:	Short Message Service

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