A Project Report on

Comprehensive Analysis of Integrated Renewable Energy Resources Based Multi-Level Inverter Fed Various Motors Drives

Submitted in partial fulfilment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

Kolli Srinivas	Juvvala Vijay Kumar	Dadi Bhargav Apoor
(22U45A0220)	(22U45A0216)	(22U45A0208)

Under the Esteemed guidance of

Mr. Venkata V Anjaneyulu B
Assoc. Prof., Department of EEE

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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NH-16, Anakapalle – 531002, Visakhapatnam, A.P.

(2021-2025)

I

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ELECTRICAL & ELECTRONICS ENGINEERING

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This is to certify that the project report entitled **"Comprehensive Analysis of Integrated Renewable Energy Resources Based Multi-Level Inverter Fed Various Motors Drives"** submitted by Kolli Srinivas (22U45A0220), Juvvala Vijay Kumar(22U45A0216), Dadi Bhargav Appor (22U45A0208). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology in Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of Bonafide work carried out by them under my guidance and supervision.
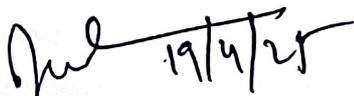
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EXTERNAL EXAMINER

II

ABSTRACT

Integrating renewable energy sources into the main grid enhances its resilience by diversifying power generation, reducing dependency on a single energy source, and reduces Total Harmonic Distortion and enhances power quality and improving grid stability. This approach also supports the development of smart grids, ensuring continuous, long-term energy supply from inexhaustible sources like wind and solar.

Using inverters with motor drives fed by integrated renewable energy resources minimizes high-frequency switching harmonics, reducing electrical noise and mechanical vibrations, leading to quieter and more stable motor operation. Moreover, employing multi-level inverters (MLIs) increases efficiency by reducing switching and conduction losses, while offering superior torque and speed control. MLIs also enhance dynamic response and facilitate the implementation of advanced control algorithms, making them an ideal solution for motor control in renewable-powered systems.

In this paper comprehensive analysis of Integrated Renewable Energy Resources (RERs) feeding Multi-Level Inverters (MLIs) like Neutral Point Clamped (Diode Clamped), Cascaded H-Bridge, and Flying Capacitor feeding various motor drives are tested in MATLAB Simulation environment. Simulation results show that the Cascaded H-Bridge fed BLDC motor gave optimum results in terms of torque, power factor and efficiency which leads to the sustainability for EVs and industrial drive applications.

Keywords— RES'S, THD, Multilevel Inverters, NPC, Cascaded H-Bridge, Flying Capacitor, Motor Drives.

A Project on

A Novel Design Considerations of a Coil for Wireless Charging under Vehicle-to-Vehicle Topology

Submitted in partial fulfilment of the requirements for award of
the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

Vegi Dhanraj
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Kakumanu V K Vasanthachari
(22U45A0217)
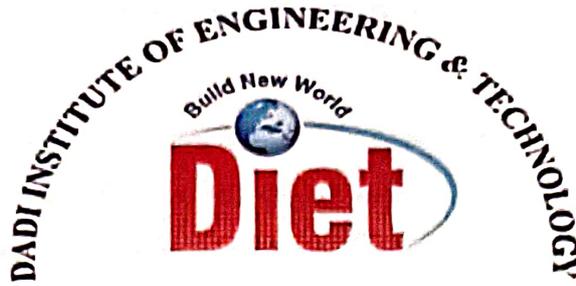
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(22U45A0205)

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DEPARTMENT OF

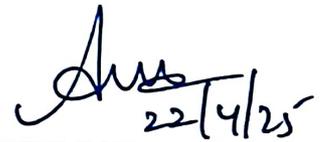# ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"A Novel Design considerations of a coil for Wireless charging under Vehicle-to-Vehicle topology"** submitted by Vegi Dhanraj (22U45A0236), Kakumanu V K Vasanthachari (22U45A0217), Bobbari Lavanya (22U45A0205) in partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of Bonafide work carried out by them under my guidance and supervision.
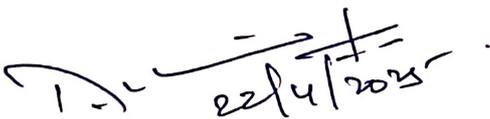
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EXTERNAL EXAMINER

ABSTRACT

This project investigates the key considerations involved in designing coils for Wireless Vehicle-to-Vehicle (V2V) electric charging systems, utilizing ANSYS Electronic Desktop software to perform detailed simulations and optimizations. Wireless Vehicle-to-Vehicle (V2V) charging is an emerging solution for enhancing the efficiency and convenience of electric vehicle (EV) charging, offering potential advantages over traditional wired methods. The concept of inductive power transfer (IPT), in which energy is transferred between coils via electromagnetic fields, forms the basis for V2V charging systems. While promising, the design of these coils involves several complex factors that directly affect their efficiency and performance. The project focuses on understanding and addressing the challenges related to coil design in V2V charging systems. The coil geometry, material selection, and alignment play a critical role in optimizing the transfer of power. Key design parameters such as coil size, number of turns, and frequency are explored to understand how they influence efficiency, energy transfer, and practical limitations in real-world V2V charging applications. By carefully simulating various coil configurations using ANSYS Maxwell 3D components, which specialize in electromagnetic simulations, the project aims to identify the optimal design for reliable and efficient power transfer in a V2V scenario. The software, ANSYS Electronic Desktop, integrates multiple simulation tools that allow for in-depth analysis of coil designs in a 3D environment, facilitating the modelling of system-level interactions and electromagnetic performance. Through these simulations, the project evaluates how different configurations of coils interact in dynamic environments, as well as how alignment and geometry impact the effectiveness of power transfer between vehicles. Furthermore, the project explores the trade-offs between design efficiency, cost, and the practical constraints inherent in real-world implementation. By considering factors such as coil size, the number of turns, and the frequency of operation, the research aims to provide valuable insights for the development of more efficient and cost-effective V2V charging systems.

Key Words: Vehicle-to-Vehicle (V2V) Charging, Wireless power transfer (WPT), Inductive Power Transfer (IPT), power transfer efficiency, power electronics, ANSYS electronic desktop.

A project report on

OPTIMAL PLACEMENT OF SFCL IN DISTRIBUTION SYSTEM

Submitted in partial fulfillment of the requirements for award of the
degree of

BACHELOR OF TECHNOLOGY

In

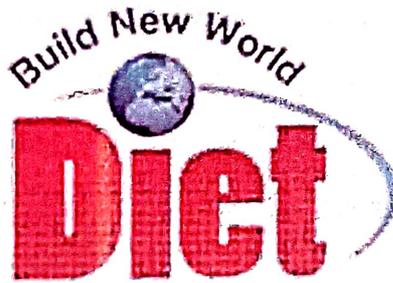## ELECTRICAL & ELECTRONICS ENGINEERING

By

Eerla Archana	Kandula Teja	Bhumaraju Balaji
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This is to certify that the project report entitled ""OPTIMAL PLACEMENT OF SFCL IN DISTRIBUTION SYSTEM" submitted by Eerla Archana (22U45A0211), Kandula Teja (22U45A0219), Bhumaraju Balaji(22U45A0204). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafde work carried out by them under my guidance and supervision.

P.Sravani

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EXTERNAL EXAMINER

ABSTRACT

The modern electrical power grid is increasingly faced with the challenge of ensuring efficient and reliable electricity distribution. As the grid evolves, new obstacles arise, particularly in managing fault currents, which can lead to equipment damage, system instability, and power outages. To address these concerns, Superconducting Fault Current Limiters (SFCLs) have emerged as a promising solution in contemporary power system discussions. The system's performance was evaluated through extensive MATLAB Simulink simulations, demonstrating its effectiveness in reducing short-circuit currents and improving voltage stability across the network. The key advancement lies in the strategic placement of SFCLs, which dynamically respond to fault conditions and adjust impedance to minimize equipment stress and maintain grid stability. Simulation results under various fault scenarios validate the system's ability to limit excessive fault currents while ensuring uninterrupted power supply. Additionally, the proposed methodology enhances system protection coordination, reducing the risk of cascading failures and improving overall network reliability. By leveraging the unique properties of superconducting materials, SFCLs can effectively control fault currents while maintaining grid stability. This article presents an in-depth exploration of SFCLs as a protective technology for modern power systems. It begins by highlighting the growing need for fault current mitigation, driven by the increasing use of sensitive electronics, the integration of renewable energy sources, and the rise of distributed generation. The paper then introduces the principles of superconductivity and how these principles are applied in SFCLs to limit fault currents. To demonstrate the effectiveness of the proposed approach, simulations are performed using an enhanced IEEE 33-bus test system within the MATLAB Simulink environment. This study aims to address key challenges in fault current management, offering a comprehensive approach that combines theoretical insights with practical implementation strategies.

Key Words: Superconducting Fault Current Limiter (SFCL), Fault Current Mitigation, Fault Analysis, IEEE 33-Bus Test System, MATLAB Simulink, Current Contribution-Based Division(CCBD)Method.

A Project report on

Energy Recovery and Performance Analysis of Regenerative Braking in Electric Bicycles

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

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Purna Ganesh Polamarisetti
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Sai Deepak Kotla
(22U45A0223)

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This is to certify that the project report entitled **"Energy Recovery and Performance Analysis of Regenerative Braking in Electric Bicycles"** submitted by Suneetha Chukka (22U45A0207), Purna Ganesh Polamarisetti (21U41A0208), Sai Deepak Kotla (22U45A0223). In partial fulfillment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafide work carried out by them under my guidance and supervision.

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EXTERNAL EXAMINER

ABSTRACT

Electric bicycles (e-bikes) have gained popularity as an eco-friendly alternative to traditional bicycles and motorized vehicles, offering an efficient mode of transportation with reduced dependency on fossil fuels. One of the key advancements in e-bike technology is regenerative braking, which recovers a portion of the kinetic energy lost during braking and converts it into electrical energy to recharge the battery. This study focuses on the design, modelling, and simulation of an electric bicycle integrated with a regenerative braking system to enhance energy efficiency and extend the operational range of the battery.

The system comprises essential components such as a BLDC/PMSM motor, lithium-ion battery, motor controller, regenerative braking circuit, and a drive cycle simulator. A MATLAB/Simulink-based simulation is implemented to analyze the performance of regenerative braking under different riding conditions. The study evaluates key performance parameters, including energy recovery efficiency, state of charge (SOC) variation, braking effectiveness, and system optimization.

The simulation results demonstrate that regenerative braking significantly reduces battery depletion, extends the travel range, and lowers the frequency of external charging requirements. Additionally, it reduces wear and tear on mechanical braking components, improving overall vehicle longevity. The effectiveness of regenerative braking depends on several factors, such as motor efficiency, braking duration, rider behaviour, and road conditions.

This research highlights the importance of regenerative braking in enhancing the sustainability, efficiency, and practicality of electric bicycles. Future developments in braking control algorithms, machine learning-based braking strategies, and improvements in energy recovery systems can further optimize e-bike performance, making them a more viable and energy-efficient mode of urban transportation.

Keywords

A project report on

THRESHOLD BASED FAULT DIAGNOSIS METHOD TO DETECT AND CLASSIFY FAULTS IN SOLAR PANEL

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

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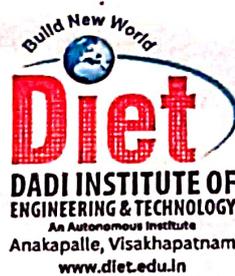
Kambapu Siddardha Reddy

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of
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ELECTRICAL & ELECTRONICS ENGINEERING

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This is to certify that the project report entitled **"Threshold Based Fault Diagnosis Method to Detect and Classify Faults in Solar Panel"** submitted by Girijala Mounika (22U45A0212), Kambapu Siddardha Reddy (21U41A0207), Kotte Divya Naga Bala Sai (22U45A0224). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of Bonafide work carried out by them under my guidance and supervision.

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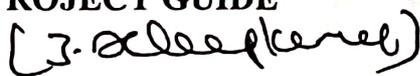
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EXTERNAL EXAMINER

ABSTRACT

The This project focuses on the simulation and fault detection of solar photovoltaic (PV) systems by analyzing I-V (Current-Voltage) and P-V (Power-Voltage) characteristics under normal and faulty conditions using MATLAB. The simulation incorporates real-world solar panel parameters such as short-circuit current (Isc), open-circuit voltage (Voc), series resistance (Rs), and parallel resistance (Rp). Fault conditions, including shading, open-circuit, and degradation, are introduced to study their impact on panel performance. A fault detection and classification mechanism are implemented by comparing faulty and normal characteristics, identifying deviations in power output and current behavior. The results provide a foundation for early fault detection in solar panels, ensuring better monitoring and efficiency optimization in renewable energy systems.

Key Words: *MATLAB-Based Solar Panel Simulation, I-V and P-V Curve Analysis, Solar Panel Fault Detection, Shading, Open-Circuit, and Degradation Faults, Maximum Power Point (MPP) Analysis, Series and Parallel Resistance Effects, Photovoltaic (PV) System Monitoring, Renewable Energy Fault Diagnosis*

A project report on

Fault Detection in CERT'S Microgrid using Wavelet Transform in Combination with Machine Learning

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

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(2021-2025)

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This is to certify that the project report entitled **"Fault Detection in CERT'S Microgrid Using Wavelet Transform in Combination with Machine Learning"** submitted by Koppisetti Baby Sarojini (22U45A0222), Pappala Yaswanth (21U41A0206), Lokanadham Sai KAMAL (22U45A0225). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of Bonafide work carried out by them under my guidance and supervision.
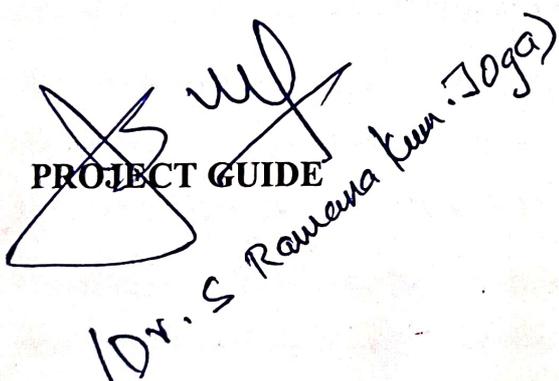
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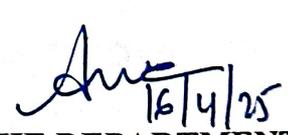
HEAD OF THE DEPARTMENT

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EXTERNAL EXAMINER

ABSTRACT

The increasing integration of renewable energy sources in microgrids has heightened the need for efficient and reliable fault detection mechanisms. CERT's microgrid, a widely recognized testbed for microgrid research, presents unique challenges due to its complex operational dynamics. Traditional fault detection methods often struggle to handle the non-stationary and transient nature of power system faults. This research proposes a novel fault detection approach combining Wavelet Transform (WT) for feature extraction and Machine Learning (ML) algorithms for classification to enhance fault identification accuracy in CERT's microgrid. In this study, Wavelet Transform is employed to decompose current and voltage signals into multiple frequency bands, capturing both transient and steady-state fault characteristics. . The extracted wavelet coefficients are then used as input features for various Machine Learning classifiers, including Support Vector Machine (SVM), Random Forest (RF), and Artificial Neural Networks (ANN), to detect and classify faults. The proposed methodology is implemented and tested using MATLAB, where synthetic fault data from CERT's microgrid is analyzed under different operating conditions. The experimental results demonstrate that the integration of Wavelet Transform with ML models significantly improves fault detection accuracy, achieving superior classification performance compared to conventional methods. Among the models evaluated, Random Forest and ANN exhibit the highest accuracy and robustness in fault classification. This study contributes to the advancement of intelligent fault detection techniques for microgrids, ensuring improved reliability, stability, and fault diagnosis in modern power systems

A project report on

DESIGN AND IMPLEMENTATION OF A DUAL AXIS AUTOMATIC SOLAR TRACKING SYSTEM

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY
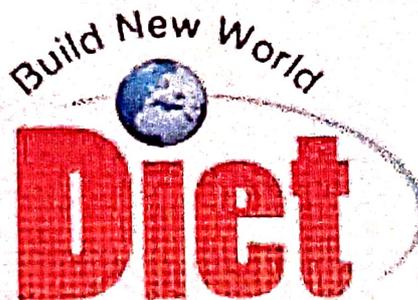
In

ELECTRICAL & ELECTRONICS ENGINEERING

By

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(2021-2025)

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"Design and Implementation of a Dual Axis Automatic Solar Tracking System"** submitted by Barnikana Sravani (22U45A0203), Palaka Sowmya (21U41A0205), Molli Arun Kumar (22U45A0227). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering,** from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafide work carried out by them under my guidance and supervision.

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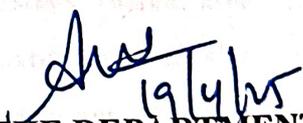
ABSTRACT

The growing demand for renewable energy has led to extensive research on improving solar energy harvesting efficiency. Conventional fixed solar panels suffer from suboptimal energy conversion due to their inability to track the sun's movement. While single-axis tracking systems offer partial improvements, they fail to maximize energy capture throughout the day. This paper addresses this research gap by designing and implementing a dual-axis automatic solar tracking system that continuously aligns solar panels with the sun's position for enhanced energy efficiency. The proposed system integrates light-dependent resistors (LDRs) and servo motors with a microcontroller-based control algorithm to dynamically adjust panel orientation in real-time. Compared to fixed and single-axis systems, the developed dual-axis tracker demonstrates significant improvements in power output and efficiency. The novelty of this work lies in its cost-effective and energy-efficient design, which enhances solar energy utilization with minimal power consumption. Experimental results validate the system's effectiveness, making it a promising solution for sustainable energy applications.

The design and implementation of a Dual Axis Automatic Solar Tracking System aims to optimize the efficiency of solar power generation by continuously aligning solar panels with the sun's position. The system employs a dual-axis tracker, capable of adjusting both the tilt (elevation) and orientation (azimuth) of the solar panel, ensuring maximum sunlight exposure throughout the day. This automated system utilizes sensors, such as light-dependent resistors (LDRs), to detect the intensity of sunlight and an embedded control system to process sensor data and adjust the solar panel's orientation in real-time. The system's microcontroller-based design provides precise and efficient tracking, enhancing energy absorption and improving overall performance compared to fixed solar panels. By reducing energy loss due to misalignment with the sun, this system contributes to higher energy yield and efficiency, making it a cost-effective solution for solar energy applications. The implementation of this dual-axis tracking mechanism demonstrates the potential for increasing renewable energy generation and advancing sustainable energy technologies.

Key Words: Solar Dual-Axis tracking, Solar Panel Alignment, Servomotors, LDR sensors, Arduino UNO microcontroller, Solar, MATLAB Simulation.

<p align="center">A Project on</p>

Detecting Arc and Short Circuit Faults in Transmission Line using Phasor Measurement Units

<p align="center">*Submitted in partial fulfilment of the requirements for award of the degree of*</p>

<p align="center">**BACHELOR OF TECHNOLOGY**</p>

<p align="center">In</p>

<p align="center">**ELECTRICAL & ELECTRONICS ENGINEERING**</p>

<p align="center">By</p>

Madaka Bhargavi	Nakka Vishnu Vardhan Kumar	Mudunuru Kalyan
(22U45A0226)	(22U45A0228)	(21U41A0204)

<p align="center">**Under the Esteemed guidance of**
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Assistant Prof., Department of EEE</p>

<p align="center">**DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING**
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ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"Detecting Arc and Short Circuit Faults in Transmission Line using Phasor Measurement Units)"** submitted by M. Bhargavi (22U45A0226), N. Vishnu Vardhan Kumar (22U45A0228), M. Kalyan(21U41A0204). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of Bonafide work carried out by them under my guidance and supervision.

PROJECT GUIDE

19/4/25

HEAD OF THE DEPARTMENT

Head of the Department
Electrical & Electronics Engg.
Dadi Institute of Engg. Tech.
Anakapalle - 531 002

EXTERNAL EXAMINER

ABSTRACT

Phasor Measurement Unit (PMU)-based techniques play a crucial role in modern power system monitoring and fault analysis. PMUs provide high-resolution synchronized measurements of voltage, current, phase angles, and frequency deviations, enabling real-time detection and classification of power system disturbances. One of the key advantages of PMU-based fault analysis is its ability to capture dynamic system behavior with high accuracy, making it highly effective for identifying different types of faults, including arc faults and short-circuit faults. By leveraging advanced signal processing methods such as Wavelet Transform, PMUs can extract valuable time-frequency features, allowing for precise fault localization and classification. Additionally, integrating machine learning techniques enhances the reliability of fault detection by improving classification accuracy and reducing false alarms. The real-time capabilities of PMUs make them highly suitable for microgrid applications, where fast and accurate fault detection is essential for maintaining system stability and minimizing downtime. Overall, PMU-based fault analysis significantly enhances power system protection, improves fault diagnosis accuracy, and contributes to the efficient operation of modern smart grids. The study leverages MATLAB simulations to model and compare arc and short- circuit faults in a CERTS microgrid using Phasor Measurement Units (PMUs). The transient behavior of both faults is analyzed through voltage and current waveform distortions, phase angle shifts, and frequency deviations. Wavelet Transform is employed to extract critical time- frequency features, which are further processed using machine learning algorithms for fault classification. The comparative results highlight the distinct characteristics of arc and short- circuit faults, demonstrating the effectiveness of PMU-based monitoring in accurately identifying and distinguishing fault types. The findings contribute to the advancement of smart grid protection strategies, ensuring improved reliability and real-time fault mitigation.

Key words: Phasor Measurement Unit (PMU), Fault Analysis, Power System Monitoring, Real-Time Detection, Arc Fault, Short-Circuit Fault, Fault Classification, Microgrid Stability, Signal Processing, Power System Protection.

A project report on

FAULT DIAGNOSIS IN LITHIUM-ION BATTERY PACK FOR ELECTRIC VEHICLE APPLICATIONS USING MACHINE LEARNING

Submitted in partial fulfillment of the requirements for award of the
degree of

BACHELOR OF TECHNOLOGY
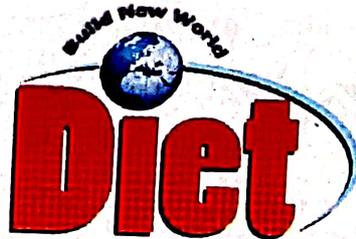
In

ELECTRICAL & ELECTRONICS ENGINEERING

By

Uriti Ravi
(22U45A0235)

Nelaparthi Praveen Kumar
(22U45A0229)

Botcha Shravani Kumari
(21U41A0202)

Under the Esteemed guidance of
Dr. S Ramana Kumar Joga
Associate Prof., Department of EEE

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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(2021-2025)

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"Fault Diagnosis in Lithium-ion Battery pack for Electric Vehicle Applications using Machine Learning"** submitted by **Uriti Ravi(22U45A0235), Nelaparthi Praveen Kumar(22U45A0229), Botcha Shravani Kumari(21U41A0202).** In partial fulfillment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering,** from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafide work carried out by them under my guidance and supervision.
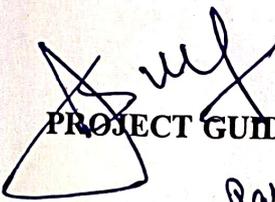
PROJECT GUIDE
(Dr. S Ramarao bvy. Josh)

HEAD OF THE DEPARTMENT
Head of the Department
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Dadi Institute of Engg. Tech.
Anakapalle - 531 002

EXTERNAL EXAMINER

ABSTRACT

Lithium-ion battery packs are the primary energy source for electric vehicles (EVs) due to their high energy density, efficiency, and long lifespan. However, battery faults such as thermal runaway, overcharging, internal short circuits, and capacity degradation can compromise safety, performance, and reliability. Effective fault diagnosis is essential for preventing catastrophic failures, ensuring battery longevity, and optimizing overall vehicle efficiency. Traditional fault detection methods, relying on rule-based algorithms and threshold monitoring, often lack accuracy and adaptability in dynamic operating conditions. To address these challenges, machine learning (ML) has emerged as a powerful data-driven approach for intelligent fault detection, classification, and predictive maintenance.

This study investigates the application of ML techniques for fault diagnosis in lithium-ion battery packs used in EVs. A systematic framework is proposed, encompassing data acquisition, preprocessing, feature selection, and ML model development for accurate fault identification. Various ML algorithms, including support vector machines (SVM), decision trees, artificial neural networks (ANN), and deep learning models, are evaluated based on their accuracy, computational efficiency, and real-time applicability. The study also explores the role of advanced predictive maintenance strategies that leverage ML to detect faults before they escalate, thereby improving battery management system (BMS) performance.

Experimental results demonstrate that ML-based fault diagnosis significantly enhances detection accuracy, provides early warnings, and reduces the risk of battery failure compared to conventional techniques. The findings highlight the potential of integrating ML-driven solutions into BMS for real-time monitoring, fault prediction, and optimized energy management in EVs. Future research directions include hybrid ML models, explainable AI for fault interpretation, and edge computing for real-time implementation.

Keywords: Lithium-ion battery, fault diagnosis, electric vehicles, machine learning, battery management system, predictive maintenance, deep learning.

A project report on

SMART IOT BASED AUTOMATIC BRAKING CONTROL AND MONITORING FOR ELECTRIC VEHICLE

Submitted in partial fulfillment of the requirements for award of

the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

Gudabandi Srinivas
(22U45A0214)

Taneti Gnana prakash
(22U45A0233)

Under the Esteemed guidance of

Mr.B.Muralidhar M.Tech(Ph.D)

Associate Prof. Department of EEE

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(2021-2025)

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ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled "**SMART IOT BASED AUTOMATIC BRAKING CONTROL AND MONITORING FOR ELECTRIC VEHICLE**" submitted by Gudabandi Srinivas (22U45A0214), Taneti Gnana Prakash (22U45A0233). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafide work carried out by them under my guidance and supervision.

PROJECT GUIDE

HEAD OF THE DEPARTMENT

Head of the Department of
Electrical & Electronics Engg.
Dadi Institute of Engg. Tech.
Anakapalle - 531 002

EXTERNAL EXAMINER

ABSTRACT

Electric vehicles (EVs) are increasingly popular for their eco-friendly benefits, but they often lack advanced safety features like automatic braking and real-time monitoring. Traditional systems rely on manual intervention, leading to delayed responses and increased collision risks. To address these limitations, this study proposes a smart IoT-based system that enhances safety, efficiency, and remote monitoring for EVs. This project proposes a Smart IoT-Based Automatic Braking Control and Monitoring for Electric Vehicles. The proposed system leverages an Arduino Uno microcontroller (ATmega328P) as the central processing unit, interfacing with various sensors and modules to ensure safe operation. Infrared (IR) and ultrasonic sensors detect obstacles in real-time, facilitating automatic braking to prevent collisions. A DC voltage sensor monitors the battery's state of charge and power levels, ensuring efficient energy management. A NodeMCU (Wi-Fi module) is one of the essential parts for wireless Internet of Things connection, which allows for remote monitoring and control through an intuitive interface. To provide perfect braking and motor performance, the system combines an electronic relay and relay driver to regulate the EV motor's operation. Real-time status updates, including motor status, voltage levels, and obstacle detection, are also provided by an LCD display. All modules are guaranteed to operate dependably by power supply (+5V and +12V). This IoT-enabled solution enhances safety by providing automatic braking and enables remote monitoring for vehicle diagnostics. By combining smart sensors, IoT, and efficient motor control, the proposed system offers an innovative approach to improving the functionality and safety of electric vehicles.

A Project Report on

Low Voltage Hybrid Microgrid Buck - Boost Converter with Modulation Index Control

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

Anubothu Harikrishna

(22U45A0201)

Balasa Dilesh Madhav

(22U45A0202)

Yenni Karthik

(22U45A0237)

Under the Esteemed guidance of

Mrs .Kezhiyur Alfoni Jose
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(2021-25)

I

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"Low Voltage Hybrid Microgrid Buck - Boost Converter With Modulation Index Control"** submitted by Anubothu Harikrishna (22U45A0201), Balasa Dilesh Madhav(22U45A0202), Yenni Karthik (22U45A0237). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafide work carried out by them under my guidance and supervision.

PROJECT GUIDE

Kezhiyur Alfoni Jose

Asst. Prof., EEE
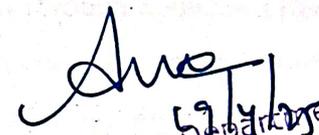
HEAD OF THE DEPARTMENT

Dr. A.S.L.K. Gopalamma

Assoc. Prof., EEE

EXTERNAL EXAMINER

II

ABSTRACT

The increasing demand for reliable and efficient energy solutions has led to the development of low voltage hybrid microgrids that integrate both renewable and conventional energy sources. However, these hybrid microgrids face challenges related to voltage fluctuations and power instability, necessitating advanced power conversion techniques. This thesis explores the design and implementation of a Buck-Boost converter with modulation index control aimed at enhancing voltage regulation, power quality, and overall system efficiency in low voltage hybrid microgrids.

The proposed system employs a modulation index-based control strategy to dynamically regulate the output voltage of the Buck-Boost converter, ensuring stable power delivery under varying load and generation conditions. Unlike traditional fixed-ratio power converters, this novel control approach provides adaptive voltage regulation, improving energy efficiency and minimizing power losses. A thorough literature review reveals significant gaps in existing power conversion and control methods, guiding the development of a robust system design.

To validate the proposed method, simulations using MATLAB/Simulink are performed. The results demonstrate considerable improvements in voltage stability, power conversion efficiency, and system reliability, making this solution highly applicable for modern hybrid microgrid applications. Future research could explore the integration of machine learning-based adaptive control and enhanced energy storage solutions for further optimization of the system.

Keywords: Hybrid Microgrid, Buck-Boost Converter, Modulation Index Control, Voltage Regulation, Power Electronics, Renewable Energy Integration.

A project report on

TRANSMISSION LINE FAULT DETECTION BY USING TRAVELLING WAVE

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

Yegireddy Sirisha
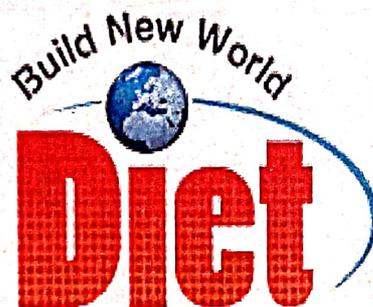
(21U41A0209)

Bobbari Mohansai

(22U45A0206)

Vasamsetti Hari Shankar Ganesh

(22U45A0238)

Under the Esteemed guidance of
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(2021-25)

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"Transmission line fault detection by using travelling wave"** submitted by Yegireddy Sirisha(21U41A0209), Bobbari Mohansai (22U45A0206), Vasamsetti Hari Shankar Ganesh(22U45A0238). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of Bonafide work carried out by them under my guidance and supervision.

PROJECT GUIDE

HEAD OF THE DEPARTMENT

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Dadi Institute of Engg. Tech.
Anakapalle - 531 002

EXTERNAL EXAMINER

ABSTRACT

Transmission line fault detection is a critical aspect of maintaining the reliability and stability of power systems. One of the most effective techniques for detecting faults on transmission lines is the use of travelling waves, which propagate along the line at the speed of light. When a fault occurs, a disturbance or wave is generated at the fault location and travels towards the terminals of the transmission line. The arrival of these travelling waves at the protective relays at either end of the transmission line provides valuable information about the fault type, location, and severity. This method is advantageous due to its high-speed response and accuracy in identifying faults, even under conditions of complex power system configurations. By analyzing the time-of-arrival differences of the travelling waves at different points on the line, the system can precisely determine the fault location, whether it is a short circuit, open circuit, or ground fault. This paper discusses the principles behind travelling wave-based fault detection, the algorithms used to process the wave data, and the advantages of implementing this technique over conventional fault detection methods. It also explores the role of digital signal processing (DSP) and high-speed communication in improving the performance of fault detection systems, offering a robust solution for modern power grid protection. Transmission line fault detection plays a vital role in ensuring the reliability and stability of modern power systems. Among the various techniques for fault detection, the use of travelling waves has proven to be highly effective due to its fast and accurate identification of faults. When a fault occurs, a disturbance or wave is generated at the fault point, which propagates along the transmission line at the speed of light. These travelling waves are detected by protective relays at the line terminals, which can then analyze the wave characteristics to determine fault parameters such as type, location, and severity. By measuring the time-of-arrival (TOA) difference of these waves at various points along the transmission line, it is possible to precisely locate the fault. This technique overcomes the limitations of traditional fault detection methods, offering a higher degree of accuracy, faster response times, and better performance in complex network configurations. The paper explores the principles of travelling wave-based fault detection, the algorithms employed for wave signal analysis, and the integration of digital signal processing (DSP) to enhance detection accuracy. Furthermore, it discusses the advantages of this method, such as early fault detection, reduced system downtime, and improved fault location accuracy, thereby offering a robust and efficient solution for transmission line protection in modern electrical grids.

Key Words: Fault Detection, Fault Location, Protective Relays, Signal Processing, Transmission Line, Travelling wave , Time of Arrival.

A project report on

A SOLAR POWER GENERATION SYSTEM WITH A MUTLI-LEVEL INVERTER

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

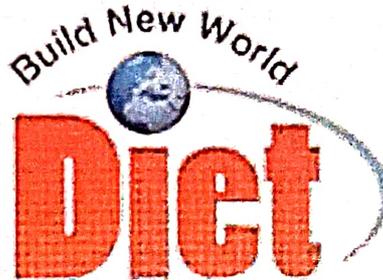## ELECTRICAL & ELECTRONICS ENGINEERING

By

Jonnada Swasthik Kumar   **Kanchumurthy Sharan Sai**   **Koviri Jitendhra Sateesh**

(22U45A0215)   **(22U45A0218)**   **(22U45A0241)**

Under the Esteemed guidance of

Mrs. MUMMANA HEMALATHA

Assistant Professor

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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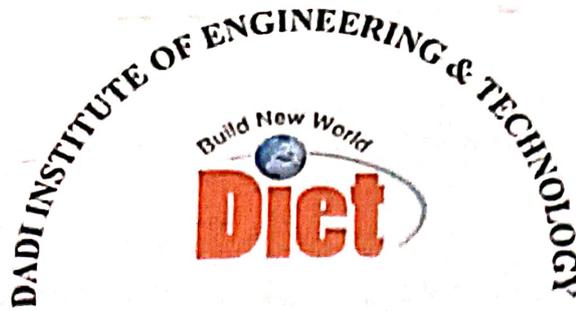
DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"A SOLAR POWER GENERATION SYSTEM WITH A MUTLI-LEVEL INVERTER"** submitted by JONNADA SWASTHIK KUMAR (22U45A0215), KANCHUMURTHY SHARAN SAI (22U45A0218), KOVIRI JITENDHRA SATEESH (22U45A0241). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafide work carried out by them under my guidance and supervision.
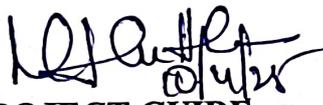
PROJECT GUIDE

HEAD OF THE DEPARTMENT
Head of the Department
Electrical & ...
Dadi Institute of Engg. Tech.
Anakapalle - 531 002

EXTERNAL EXAMINER

ABSTRACT

This paper presents a novel approach to solar power generation using a 25-level multi- level inverter (MLI) with a cascaded H-bridge topology. The proposed system enhances power quality by significantly reducing total harmonic distortion (THD) while improving the efficiency of solar energy conversion. The inverter is controlled using a sinusoidal pulse-width modulation (SPWM) technique, which enhances the smoothness of the output waveform and reduces switching losses. Simulation and experimental results confirm that the proposed system achieves an efficiency of 97.5% and an impressively low THD of 0.2593%, surpassing conventional inverter topologies in terms of power quality. The 25-level output waveform minimizes voltage stress on switching devices and improves overall system reliability, making it highly suitable for high-power solar energy applications. Furthermore, the proposed design contributes to the sustainable development of renewable energy systems by enhancing the feasibility of integrating solar power into modern electrical grids. This research offers valuable insights into the advancement of multi-level inverter technology for solar applications, demonstrating its potential to enable efficient, reliable, and cleaner energy solutions.

Key Words: Solar power generation, Multi-level inverter, Cascaded H-bridge topology, Sinusoidal pulse-width modulation, Total harmonic distortion, Power quality, Renewable energy, Solar photovoltaic system.

A project report on

A Novel Method To Improve Power Quality in Electric Vehicle Charging Station Integrated Distribution System

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY
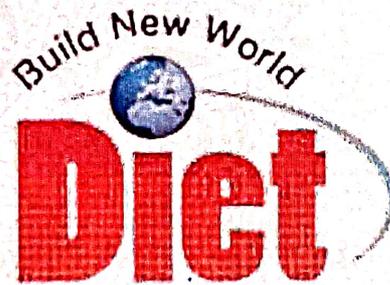
In

ELECTRICAL & ELECTRONICS ENGINEERING

By

Surisetti Jagadeesh	Bheemarasetti Chandu	Senapathi Pavan
(22U45A0232)	(21U41A0201)	(22U45A0240)

Under the Esteemed guidance of
Mrs. Ch.Lakshmi Prasanna
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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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Build New World

Diet

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"A Novel Method to Improve Power Quality in Electric Vehicle Charging Station Integrated Distribution System"** submitted by Surisetti Jagadeesh (22U45A0232), Bheemarasetti Chandu (21U41A0201), Senapathi Pavan (22U45A0240). In partial fulfilment of the requirements for award of the Degree of **Bachelor of Technology** in **Electrical & Electronics Engineering**, from Dadi Institute of Engineering & Technology(A), Anakapalle affiliated to JNTUGV, accredited by NAAC with 'A' grade is a record of bonafde work carried out by them under my guidance and supervision.

16/4/25

PROJECT GUIDE
Mrs. Ch.Lakshmi Prasanna
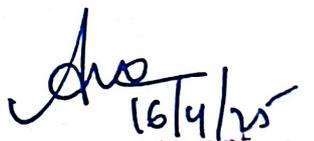
HEAD OF THE DEPARTMENT
Dr. A.S.L.K.Gopalamma

Head of the
Electrical & Electronics Engg.
Dadi Institute of Engg. Tech.
Anakapalle - 531 002

EXTERNAL EXAMINER

ABSTRACT

The growing adoption of electric vehicles (EVs) has introduced notable challenges in maintaining power quality within electrical grids, primarily due to the fluctuating charging demands. These fluctuations can lead to issues such as voltage instability, harmonic distortions on distribution networks. This paper proposes the development of a Distribution Static Synchronous Compensator (D-STATCOM) using a voltage source converter with a DC link, designed to inject reactive power and voltage into the distribution line to address power quality concerns related to EV charging. As a dynamic reactive power compensator, the D-STATCOM helps to stabilize voltage, reduce harmonic distortions, and enhance the overall power factor in distribution systems. This paper demonstrates the implementation of D-STATCOM utilizing a Sinusoidal Pulse Width Modulation (SPWM) control technique is carried out in MATLAB/Simulink.

Key Words: Electric Vehicles (EVs), Power Quality, Distribution Static Synchronous Compensator (D-STATCOM), Voltage Source Converter, DC link, Reactive Power, Voltage Stability, Harmonic Distortions, Sinusoidal Pulse Width Modulation (SPWM).

A project report on

Design and optimization of DC railway traction system dynamics using metaheuristics techniques

Submitted in partial fulfillment of the requirements

for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

By

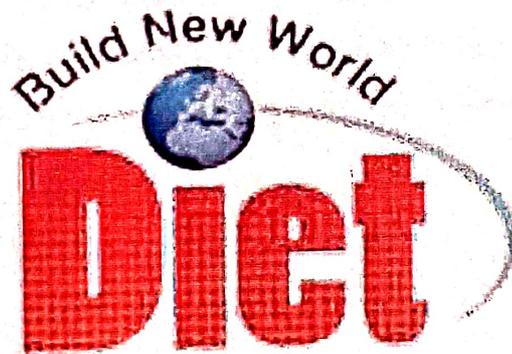**KANTAMREDDY BALA**   **NIDRABINGI GIRIJA**   **DODDI CHAKRADHAR**

(21U41A0203)   **(22U45A0230)**   **(22U45A0239)**

Under the Esteemed guidance of

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Associate Professor & HoD, Department of EEE

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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(2021-2025)

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **"Design and optimization of DC railway traction system dynamics using metaheuristics techniques"** was submitted by Kantamreddy Bala (21U41A0203), Nidrabingi Girija (22U45A0230), and Doddi Chakradhar (22U45A0239). In partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Electrical & Electronics Engineering** from Dadi Institute of Engineering & Technology (A), Anakapalle, affiliated to JNTU GV, accredited by NAAC with an 'A' grade, is a record of Bonafide work carried out by them under my guidance and supervision.
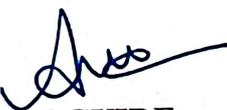
PROJECT GUIDE

HEAD OF THE DEPARTMENT

Head of the Department
Electrical & Electronics Engg.
Dadi Institute of Engg. Tech.
Anakapalle - 531 002

EXTERNAL EXAMINER

ABSTRACT

The increasing demand for energy-efficient and high-performance rail transportation systems has necessitated advanced modeling and optimization techniques for metro train dynamics. This project focuses on the design and simulation of metro train dynamics and tractive effort models using MATLAB simulation. A comprehensive vehicle dynamics model is developed to evaluate the impact of acceleration, braking forces, and energy losses due to resistance (rolling resistance, aerodynamic drag, and gradient resistance). The study also incorporates gear ratio optimization to enhance torque transmission efficiency, ensuring minimal power losses while maintaining optimal train performance. Additionally, the motor-inverter system efficiency is analyzed to assess power conversion losses and control strategies for improved energy utilization. By integrating these elements into a unified Simulink-based framework, the project provides insights into energy-efficient metro train operation while optimizing tractive effort and power distribution. The results from these simulations contribute to the development of sustainable and efficient urban rail transport systems, offering a pathway toward enhanced energy savings and system performance. Optimized the performance parameters of the DC traction system using Particle Swarm optimization (PSO) and Charge system search algorithm (CSS) and analyzed the performance based on the results.

Key Words: Braking chopper, charged system search (CSS), current source, gearbox, particle swarm optimization (PSO), power consumption, speed profile, torque control, traction rectifier, vehicle dynamics.

A Project Report on

DC HARMONICS ANALYSIS IN A HIGH-EFFICIENCY PV SYSTEM USING POWER CONVERTERS

Submitted in partial fulfillment of the requirements for award of the degree of

BACHELOR OF TECHNOLOGY

In

ELECTRICAL & ELECTRONICS ENGINEERING

by

Singampalli Viswakanth	Dasari Aruna	Earusu Ramyanka
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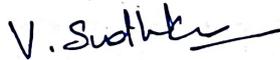
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ABSTRACT

The integration of photovoltaic (PV) systems into modern power grids requires high-efficiency power conversion to ensure optimal performance and grid compliance. However, the presence of DC harmonics originating from high-gain DC-DC converters, DC-AC inverters, and bidirectional power flows poses critical challenges, including power quality degradation, increased converter losses, and grid instability. This study investigates the impact of DC harmonics in a high-efficiency PV system interfaced with a DC bus, energy storage (BESS), and utility grid through multiple conversion stages. A comprehensive Simulink model is developed, incorporating a PV array, high-gain DC-DC converters, DC-AC inverters, and harmonic analysers to evaluate harmonic distortion at key points in the system. The study examines switching frequencies, converter topologies, and grid-side interactions, identifying their contributions to harmonic generation. The role of bidirectional energy storage (BESS) in stabilizing the DC bus and mitigating harmonic distortion is also analysed. To minimize DC harmonics, various control strategies, passive and active filtering techniques, and optimized pulse-width modulation (PWM) methods are explored. Simulation results demonstrate that optimizing converter design, bus voltage regulation, and harmonic filtering significantly improves system efficiency and power quality. Additionally, harmonic monitoring at different stages of the system provides crucial insights into distortion propagation and mitigation strategies. This research offers a systematic approach to analysing and controlling DC harmonics in PV-integrated power systems, ensuring efficient energy conversion, stable grid operation, and compliance with power quality standards. The findings contribute to the design of next-generation PV systems with enhanced harmonic performance, facilitating the transition to a more stable and sustainable energy infrastructure.

Key Words: PV Grid, Utility Grid, THD, Power Converters, High Gain Converter, Bi-directional Converter, Voltage Stability, Harmonic Distortions, Fourier Analyzer.

A Project Report on

Comprehensive Analysis of Integrated Renewable Energy Resources Based Multi-Level Inverter Fed Various Motors Drives

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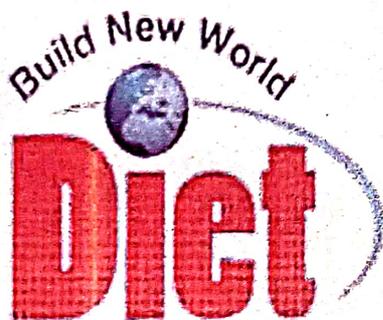BACHELOR OF TECHNOLOGY

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