M.KUMARASAMY
COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
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ISO 9001:2015 Certified Institution
Thalavapalayam, Karur – 639 113.

A Minor Project Report

On

SHORT CIRCUIT PROTECTION SYSTEM FOR ELECTRIC VEHICLE

Submitted by

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to Anna University, Chennai)

THALAVAPALAYAM, KARUR-639113.

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(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this Report titled **"SHORT CIRCUIT PROTECTION SYSTEM FOR ELECTRIC VEHICLE"** is the bonafide work of **BOOMIKA V (927622BEE013), DEEPAN R (927622BEE017), HARIPRABHU S M (927622BEE038)** who carried out the work during the academic year (2023-2024) under my supervision. Certified further that to the best of my knowledge the work reported here in does not form part of any other project report.

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Submitted for Minor Project II (18EEP202L) viva-voce Examination held at M.Kumarasamy College of Engineering, Karur-639113 on ……

DECLARATION

We affirm that the Minor Project II report titled **"SHORT CIRCUIT PROTECTION SYSTEM FOR ELECTRIC VEHICLE"** being submitted in partial fulfillment for the award of **Bachelor of Engineering in Electrical and Electronics Engineering** is the original work carried out by us.

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VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully-engaged, learner - centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

- ✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.
- ✓ Produce highly competent professionals with thrust on research.
- ✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

- ✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and also allied disciplines.
- ✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers
- ✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.
- ✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions:

Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

- ✓ **PSO1:** Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.
- ✓ **PSO2:** Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.
- ✓ **PSO3:** Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real-world problems.

Abstract (Key Words)	Mapping of POs and PSOs
DC Motor, relay, Bell push Buttons, LED's, Connecting Leads, One Way Switch, PCB Board, Buzzer.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

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We would like to express my deep gratitude to our Minor Project Guide **Dr.K.Sundararaju M.E., Ph.D., Professor, Department of Electrical and Electronics Engineering,** for his constant encouragement, kind co-operation, valuable suggestions and support rendered in making our project a success.

We offer our wholehearted thanks to our Minor project coordinator **Mr.P.Maniraj M.E., Assistant Professor, Department of Electrical and Electronics Engineering,** for his constant encouragement, kind co-operation and valuable suggestions for making our project a success.

We are glad to thank all the **Faculty Members** of **Department of Electrical and Electronics Engineering** for extending a warm helping hand and valuable suggestions throughout the project.

Words are boundless to thank **Our Parents and Friends** for their constant encouragement to complete this Minor project successfully.

TABLE OF CONTENTS

ABSTRACT

We often come across news of EVs catching fire or batteries overheating and exploding. To address this, our Electric Vehicle Safety project focuses on protecting the motor and battery from short circuits using relays in electric vehicles. The world relies heavily on crude oil, such as petrol and diesel, for vehicle energy. However, these fossil fuels are limited and not sustainable for the long term. That's why there is growing interest in finding solutions through electrical power. Electric vehicles (EVS) are gaining popularity as an alternative to traditional fuel-powered cars. However, EVS face challenges with various components, including motor malfunctions, battery overheating, power losses, and coil heating. Accidental short circuits can occur when the terminals of batteries or power supplies connect improperly This can cause them to become hot, degrade, and even produce sparks. Short circuit protection plays a vital role in preventing excessive current flow. It detects overcurrent situations and instantly interrupts the circuit to prevent damage or hazards.


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CHAPTER 1

SURVEY FORM ANALYSIS

1.1 NAME AND ADDRESS OF THE COMMUNITY:

1.) RAMASAMY,
KUTHANGAL MEDU,
NAMAKKAL.

2.) DHAYALAN,
KUTHANGAL MEDU,
NAMAKKAL.

3.) VANITHA,
KALAPPANAICKENPATTI,
NAMAKKAL.

4.) VINOTHINI,
KALAPPANAICKENPATTI,
NAMAKKAL.

5.) KARTHICK,
THALAVAPALAYAM,
KARUR.

6.) VENKADESH,
THALAVAPALAYAM,
KARUR.

1.2 PROBLEM IDENTIFICATION:

False Tripping: Incorrect detection of a short circuit, leading to unnecessary shutdowns.

Delay in Response: Slow reaction time to identify and isolate short circuits, risking damage to the vehicle or components.

Sensitivity Issues: Overly sensitive protection system triggering on minor fluctuations, impacting system reliability.

Communication Errors: Failures in communication between components, hindering effective coordination for short circuit protection.

Temperature Dependence: Performance variations due to temperature changes affecting sensor accuracy and overall system effectiveness.

CHAPTER 2
LITERATURE REVIEW

Paper 1: Title: A New Method of Coordinating ZCBs and Fuses for a Reliable Short-Circuit Protection in DC Power Networks

Inference:

- ✓ With the increasing installations of solar energy, electric vehicles, and other dc-nature power devices in modern power systems.
- ✓ As a promising protective device, Z-source Circuit Breaker (ZCB) has some unique good features over other approaches.

Paper 2: Title: Comparison and Discussion on Shortcircuit Protections for Silicon-Carbide MOSFET Modules: Desaturation Versus Rogowski Switch-Current Sensor

Inference:

- ✓ This article presents a comprehensive analysis and discussion on the SIC MOSFET module SC protection and performance
- ✓ The results demonstrate that both methods are successful in protecting the module in all SC types.

Paper 3: Title: Comprehensive Fault Diagnosis and Fault-Tolerant Protection of In-Vehicle Intelligent Electric Power Supply Network

Inference:

- ✓ A multilevel fault-tolerant protection method is proposed to achieve power supply security and avoid false protection.
- ✓ The process of device is appropriately monitored, and the fault-tolerant method is able to realize remediation and protection in real time.

Paper 4: Title: Research on Electric Vehicle Charging Safety Warning Based on A-LSTM Algorithm

Inference:

- ✓ Compared with traditional fuel vehicles, electric vehicles (EVs) have significant advantages in saving oil resources and reducing carbon emissions.
- ✓ However, the frequent occurrences of spontaneous combustion and fires in EVs have caused serious economic losses.

Paper 5: Title: An Innovative Method for Short Circuit Protection of a Three -Phase MOSFET Power Inverter

Inference:

- ✓ An innovative mechanism for short circuit protection of a three-phase MOSFET power inverter system driving an electric motor is presented.
- ✓ Its application drastically reduces manufacturing costs and complexity.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM

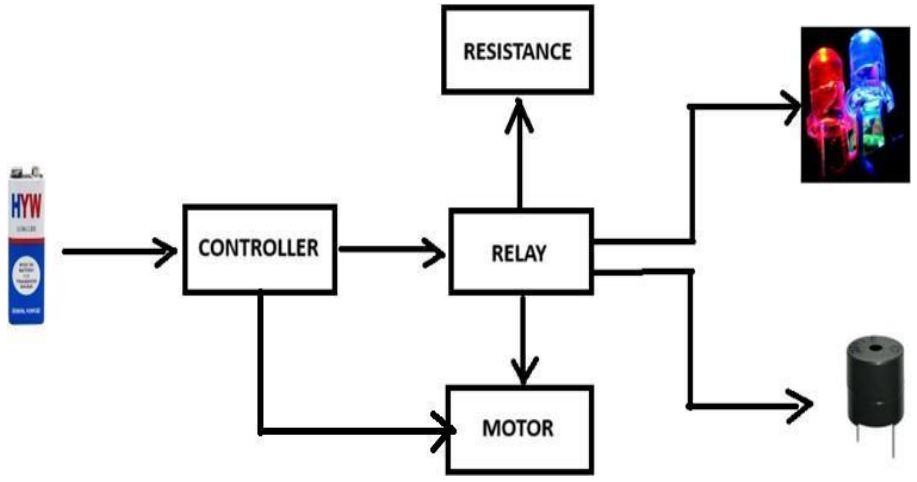

fig 3.1 BLOCK DIAGRAM

3.2 DESCRIPTION

The use of electric engines will become more and more significant in future in automotive engineering. At present, various concepts exist for hybrid vehicles as well as purely electric vehicles. In particular, in the case of purely electric vehicles, the total amount of energy required for the drive system must be stored in batteries. These batteries are regularly high voltage batteries, providing several 100V. Maximum currents of more than 100 A are possible in these batteries. Safety aspects are coming more into focus because of the constantly increasing prevalence of electric engines and therefore high voltage batteries. The terminal voltage is frequently so high in the use of batteries for electric vehicles that an electric insulation between the battery poles has to have high dielectric strength. If vehicles of this type come upon bad weather conditions, however, or if the maximum fording depth is reached, the poles of the battery may come into contact with water.This water can lead to short circuits between the poles or within the battery. Because of the high energies which the batteries can provide for electric vehicles, short circuits frequently lead to harm to people or to fires.

3.3 PROJECT - TOTAL COST

S.NO	COMPONENTS	QUANTITY	COST
1	DC MOTOR (12 V DC)	1	200
2	RELAY (12 V)	1	150
3	VOLTAGE SENSOR	1	200
4	RESISTANCE	2	30
5	LED'S	2	20
6	CONNECTING LEADS	Required	50
7	MICROCONTROLLER	1	150
8	PCB BOARD	1	200
9	BUZZER	1	150
		TOTAL	1150

table 3.3 PROJECT - TOTAL COST

CHAPTER 4
RESULT AND DISCUSSION

4.1 HARDWARE COMPONENT DESCRIPTION

VOLTAGE SENSOR

A voltage sensor is a device that measures voltage. Voltage sensors can measure the voltage in various ways, from measuring high voltages to detecting low current levels. These devices are essential for many applications, including industrial controls and power systems.

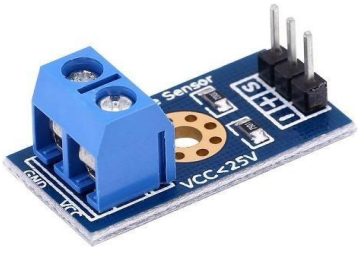

fig 4.1 VOLTAGE SENSOR

MICROCONTROLLER

Arduino Uno is open-source microcontroller board that can be integrated into a variety of electronics project. This board can be interfaced with other Arduino boards, Arduino shields and can control relays, LED's and motors as an output. Arduino boards can read inputs light in a sensor, a finger on a button, and turn it into an output activating a motor, turning on an LED, publishing something online. It consists of various pins, which makes it more compatible and can be used to connect different electronic components. It is the most popular and widely used development board.

fig 4.2 MICROCONTROLLER

RELAY

The primary purpose of a relay is to protect the electrical system from too high of a voltage or current, allowing the safe operation of any equipment it connects to. They are commonly found in a variety of applications, from commercial and industrial uses to home and consumer products. Relays control one electrical circuit by opening and closing contacts in another circuit. There is an open contact when the relay is not energized.

fig 4.3 RELAY

4.2 HARDWARE KIT

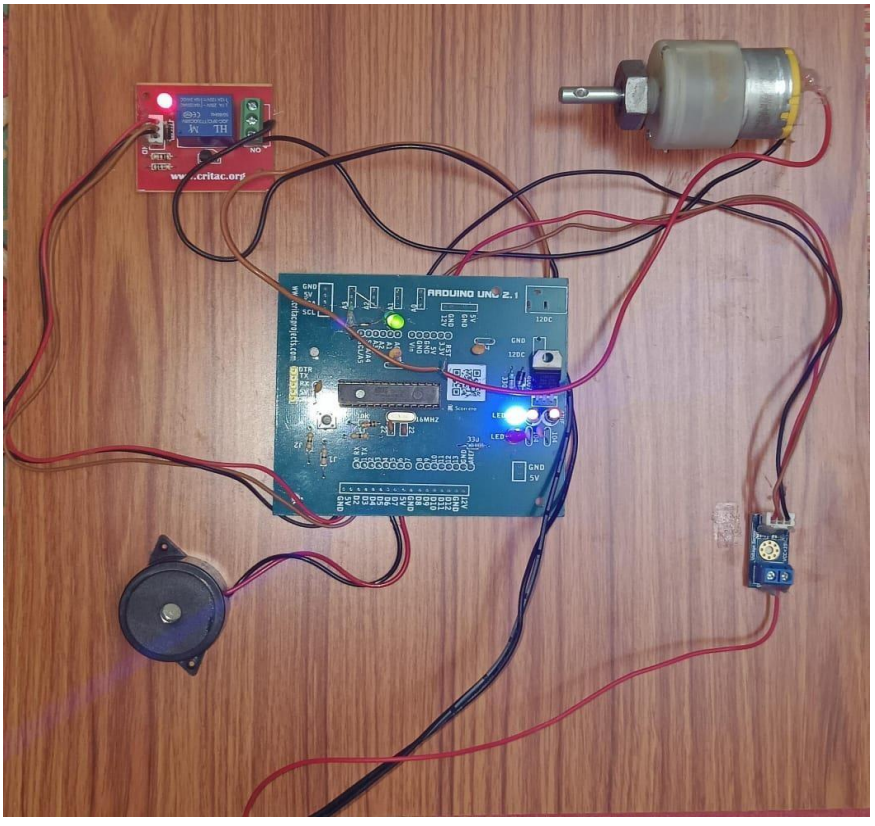

fig 4.4 HARDWARE KIT

4.3 WORKING PRINCIPLE

In step 1 of the operation, the relay circuit is normally open and a red LED glow when we connect a power source to the input terminal of the circuit. When we press the bell push button, a coil of the relay becomes active and it switches from normally closed to normally open contact. In this condition Green LED and motor are ON and start to operate i.e. the vehicle starts to operate. Here manually short-circuited the terminals of the motor to understand the short circuit condition in EV the voltage across the motor is led to zero so the relay becomes discharged because both the relay and motor are connected in parallel. Finally, if the relay is discharged then Red LED and buzzer both are ON and thus motor and battery both are separated and protected. A short circuit protection system works by detecting and responding to abnormal current levels. It continuously monitors the current using devices like current transformers, shunt resistors, or Hall effect sensors. When a short circuit causes a surge in current, the system detects this abnormality. It then triggers a response mechanism, typically involving circuit breakers or fuses. Circuit breakers can be thermal, magnetic, or thermal-magnetic, and they trip to interrupt the circuit. Fuses, on the other hand, melt to break the circuit when excessive current flows. Modern systems might use solid-state devices for rapid interruption. Effective protection requires proper coordination and selectivity to ensure only the faulty section is disconnected, minimizing disruption. Regular maintenance and testing are essential to ensure the system's reliability.

CHAPTER 5
CONCLUSION

The short circuit protection system for electric vehicles ensures the safety and reliability of the vehicle's electrical system. By quickly detecting and isolating short circuits, it prevents damage to components and reduces the risk of fire or electrical hazards. With its robust design and swift response, the system contributes to the overall safety and performance of electric vehicles, providing peace of mind for both drivers and manufacturers.

Short circuit protection system plays a vital role in preventing excessive current flow. It detects the overcurrent situations and instantly interrupts the circuit to prevent damage or hazards and protect the motor and battery from short circuit. We are also gaining the popularity as an alternative to traditional fuel powdered electric vehicles.

PROJECT IMPLEMENTATION GEOTAG PHOTO

PROJECT DEMONSTRATION VIDEO LINK

https://drive.google.com/file/d/1JGEq_x_zceBI3ML_j50qMlEtqjxljfWT/view?us p=drivesdk

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