M.KUMARASAMY COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
Approved by AICTE & Affiliated to Anna University
ISO 9001:2015 Certified Institution
Thalavapalayam, Karur – 639 113.

A Minor Project Report
On

FIRE PROTECTION AND CHARGE MONITORING OF ELECTRIC VEHICLE

Submitted by

DEEPIKA S	**(927622BEE018)**
DURGADEVI N	**(927622BEE028)**
KAVIN V	**(927622BEE055)**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
M.KUMARASAMY COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to Anna University, Chennai)
THALAVAPALAYAM, KARUR-639113.

MAY 2024

M.KUMARASAMY COLLEGE Of ENGINEERING

(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this Report titled **"FIRE PROTECTION AND CHARGE MONITORING OF ELECTRIC VEHICLE"** is the bonafide work of **DEEPIKA S (927622BEE018), DURGADEVI N (927622BEE028), KAVIN V (927622BEE055)** 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 herein does not form part of any other project report.

SIGNATURE

SUPERVISOR

Mr.M.RAMESH M.E.,
Assistant Professor
Department of Electrical and
Electronics Engineering
M.Kumarasamy College of
Engineering, Karur.

SIGNATURE

HEAD OF THE DEPARTMENT

Dr.J.Uma M.E., Ph.D.,
Professor & Head
Department of Electrical and
Electronics Engineering
M.Kumarasamy College of
Engineering, Karur.

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 "**FIRE PROTECTION AND CHARGE MONITORING OF ELECTRIC VEHICLES"** 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.

REG.NO	STUDENT NAME	SIGNATURE
927622BEE018	**DEEPIKA S**	--------------------------
927622BEE028	**DURGADEVI N**	---------------------------
927622BEE055	**KAVIN V**	---------------------------

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
Electric vehicles-charging circuitry-battery condition-buzzer signal.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11, PO12, PSO1, PSO2, PSO3

ACKNOWLEDGEMENT

Our sincere thanks to **Thiru.M.Kumarasamy, Founder and Dr.K.Ramakrishnan B.E, Chairman** of **M.Kumarasamy College of Engineering** for providing extra ordinary infrastructure, which helped us to complete the Minor project in time.

It is a great privilege for us to express our gratitude to our esteemed **Principal Dr.B.S.Murugan M.Tech., Ph.D.,** for providing us right ambiance for carrying out the project work.

We would like to thank our **Head of the Department Dr.J.Uma M.E., Ph.D., Department of Electrical and Electronics Engineering,** for her unwavering moral support throughout the evolution of the project.

We would like to express my deep gratitude to our Minor Project Guide **Mr.M.Ramesh M.E., Assistant 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

Electric vehicles surely are the future of transportation, but EV technology has not been fully developed with respect to efficiency and safety as of 2022. We come across electric vehicle battery fire and similar incidents as the EV market expands. Most electric vehicle fire incidents occur due to battery blast or fire. So, we attempt to solve the problem by using some sensors and battery pack based system powered by an STM32 controller. The system monitors as well as protects an EV battery at all time. The system we design will not only monitor the battery and charge it safely but also protect it to avoid accidents from occurring. While charging the voltage sensor is used to check voltage and limit the flow of current too to the battery using charging circuitry. The system cuts off the supply when the temperature of the battery deviates. The temperature sensor is used to monitor the temperature of the battery while charging as well as discharging. The system automatically cuts off input as well as output supply and displays the temperature as well as a buzzer alert on the LCD display. Thus the system allows for a smart and efficient battery charging as well as protection system.


45 46 45
08 78 92
Hero
TN 48 AZ 1748
TN 47 U 9543
GPS Map Camera
Thalavapalayam, Tamil Nadu, India
326W+XQF, Thalavapalayam, Tamil Nadu 639113, India
Lat 11.062447°
Long 78.046788°
22/09/23 09:27 PM GMT +05:30
Google

CHAPTER 1
SURVEY FORM ANALYSIS

1.1 NAME AND ADDRESS OF THE COMMUNITY:

Name: Manikandan M

Address: K.Pudhupalayam, Namakkal

Name: Baskar C

Address: Kalipalayam, Namakkal

Name: Gowshika G

Address: Ramaanur, Namakkal

Name: Priya T

Address: Thanjavur

Name: Asma S

Address: Karur

Name: Kaya N

Address: Karur

Name: Tharmaraj S

Address: No. 17, Veerarajapuram, Karur

Name: Tamilarasan T

Address: East Street, Thalavapalayam, karur

Name: Karupanan T

Address: West, Thalavapalayam, Karur

1.2 PROBLEM IDENTIFICATION:

In survey we have Identify the problem which was that the electric vehicles fire incident and battery fire occurs due to overcharging of the battery. It involves addressing challenges such as overheating prevention, improving Battery Management Systems (BMS) for overcharging avoidance, implementing safety measures for rapid charging, and developing real-time fault detection systems to prevent potential fire incidents. It revolves around potential safety risks during the charging process. It include the need to prevent overcharging, mitigate thermal-related risks, detect faults promptly, and establish emergency shutdown protocols.

CHAPTER 2
LITERATURE REVIEW

Paper 1

Title: IOT - based battery monitoring system for electric vehicles

Author: L. S. B, A. Sangari, E. K, K. V, J. A. Sheeba and D. Sivamani **Year:** 2022

Inference: It proposes an IoT-based battery monitoring system for electric vehicles to address performance decline concerns. It monitors key battery metrics, such as voltage, current, and temperature, using various sensors. The data is transmitted to a microcontroller unit, then sent to the cloud for display on an Android smartphone and computer simultaneously. This real-time monitoring aims to prevent overcharging or deep discharge, enhancing battery efficiency and lifespan. The system includes a user interface and result presentation, effectively notifying users of weakened battery performance.

Paper 2

Title: Automotive Battery Management System

Author: Jon P Christopherson, Setu Madhavi Namburu **Year:** 2008

Inference: The Battery Management System in automobiles safeguards the battery, predicts its life, and ensures operational health. It uses a data-driven approach, employing an equivalent circuit battery model with resistors, capacitor, and Warburg impedance. Support vector machines predict capacity, power, and state of charge. Parameters are estimated from electrochemical impedance spectroscopy data using non-linear least squares techniques. Support vector regression predicts Remaining Useful Life based on power fade and capacity fade estimates.

Paper 3

Title: Charge operation of Electric vehicles through Vanadium-air flow battery technology

Author: Mrs SK Daryabi , Mummana Harini, Gedela Karunakar **Year:** 2021

Inference: It is related to fire incidents during charging of electric vehicles. It introduces that the Vanadium-air flow battery system enclosed in a protective box. Nitrogen injection minimizes fire risk when the vehicle is parked. During charging, the battery consumes oxygen, enhancing safety. The system, comprising the Vanadium-air battery, protective box, and nitrogen reserve.

Paper 4

Title: Solar Wireless Electric Vehicle Charging

Author: P. Sri Haritha1, G. Srinivasa Rao, G. Jaya Sravani **Year:** 2022

Inference: It is a solution that enables electric vehicle owners to charge their vehicles wirelessly using solar energy. This system is powered by a Raspberry Pi Pico microcontroller, and it features coils, an LCD display, a rechargeable battery, and a boost converter. The system harnesses solar energy to charge the battery and wirelessly transfer the charge to the vehicle's battery. The LCD display provides clear indications of the charging progress, making it easy for the user to monitor the charging process. With the SWEVCS, electric vehicle owners can charge their cars without relying on the grid, making it a sustainable and eco-friendly option

.

Paper 5

Title: Battery Monitoring system Based on PLC

Author: DS Suresh, R Sekar, S Mohamed Shafiulla **Year:** 2012

Inference: This proposed PLC-based battery health monitoring system aims to enhance the performance of uninterruptible power supply systems. Unlike conventional methods, it monitors individual battery parameters through SCADA, allowing for precise observation. The system includes a GSM module for alerting authorized personnel in critical battery conditions or elevated room temperatures, ensuring continuous power supply and efficient load performance. This system monitors the individual battery’s electrical parameters. GSM module is for giving alert message to authorized person whenever the condition of the battery is under critical and the room temperature increases than the set value.

CHAPTER 3
PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM

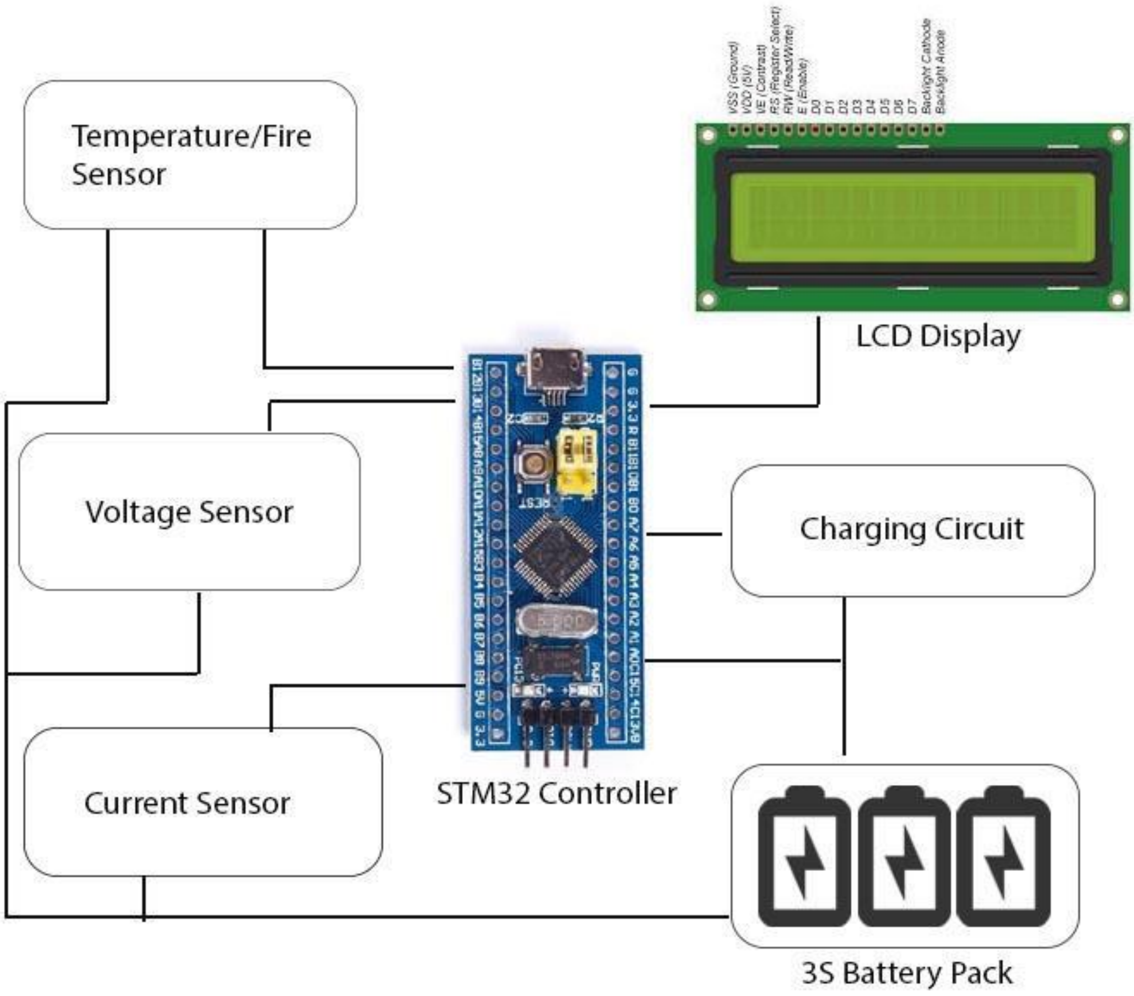

fig 3.1 BLOCK DIAGRAM

3.2 DESCRIPTION

To enhance fire protection for electric vehicles, consider implementing thermal monitoring systems, fire-resistant materials in the vehicle's construction, and rapid shutdown mechanisms. Charge monitoring involves using smart charging stations and real-time data analysis to ensure safe and efficient charging, preventing overcharging or overheating of the battery. The system is designed to constantly monitor battery voltage current temperature and instantly cut off the input or output from battery as soon as any unusual behavior is detected. The system when turned on uses its charging and monitoring circuitry that allows user to safety charge the 3S battery. It extended the battery life by reducing overcharging of battery and protect from battery fire or blast**.**

3.3 PROJECT - TOTAL COST

SNO	COMPONENTS DESCRIPTION	QUANTITY	PRIZE
1	STM-32 Microcontroller	1	200
2	Voltage Sensor	1	250
3	Temperature sensor	1	250
4	Battery	1	250
5	LCD Display	1	150
6	ADDITIONAL COMPONENTS	2	300
		TOTAL	**1400**

table 3.3 PROJECT-TOTAL COST

CHAPTER 4
RESULT AND DISCUSSION

4.1 HARDWARE COMPONENTS DESCRIPTION

VOLTAGE SENSOR

To use a voltage sensor with an Arduino Uno, connect the sensor's VCC to 5V, GND to GND, and the signal pin to an analog input. Connect the voltage to be measured to the sensor's VIN+ and VIN- pins. In the Arduino code, read the analog input, convert it to voltage using the appropriate formula, and print the result to the Serial Monitor. This setup enables you to monitor voltage levels in real-time.

fig 4.1 VOLTAGE SENSOR

TEMPERATURE SENSOR

A temperature sensor measures temperature through electrical signals. Types include thermocouples for wide ranges, RTDs for high accuracy, thermistors for specific ranges, semiconductor sensors for integrated circuits, infrared sensors for non-contact measurement, and digital sensors for microcontroller integration. Each type has pros and cons in terms of accuracy.

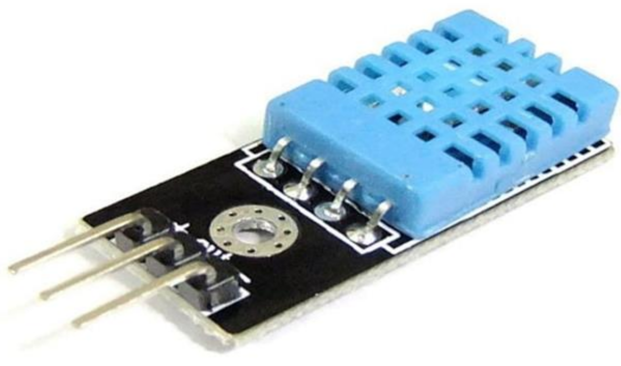

fig 4.2 TEMPERATURE SENSOR

STM-32 MICROCONTROLLER

The STM32 microcontroller operates by executing instructions stored in its memory. During operation, the microcontroller can interact with external devices or sensors, read input signals, process data, and generate output signals. It can also communicate with other devices or systems using various communication protocols. Overall, the STM32 microcontroller operates by executing instructions, interacting with peripherals, and performing tasks based on the programmed code. It's a powerful and flexible platform for building a wide range of applications.

fig 4.3 STM-32 MICROCONTROLLER

ARDUINO UNO BOARD

The Arduino Uno board operates by executing code that you write and upload to it. The board has various pins that you can use to connect sensors, actuators, and other components. When you upload your code to the board, it runs the instructions and interacts with the connected components based on your program. It's a simple and versatile platform for building all sorts of projects.

fig 4.4 ARDUNIO UNO BOARD

4.2 HARDWARE KIT

The following figure shows that the protection of electric vehicle from battery blast or fire. It also helps to monitor the charging of the battery. With the help of the LCD display we can easily monitor the temperature and the voltage flowing through the circuit. Thus, the system helps to improve the efficiency of the battery.

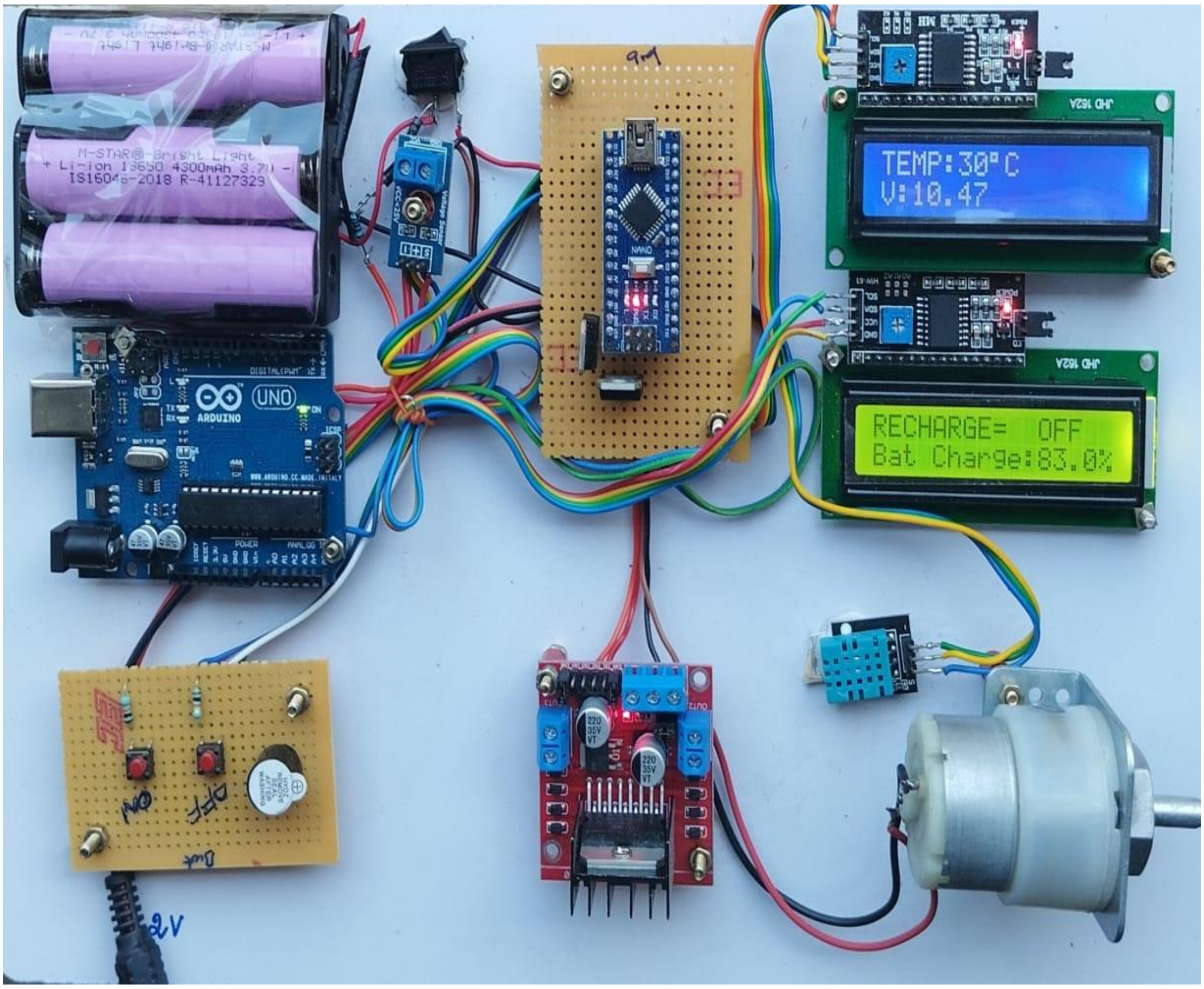

fig 4.5 HARDWARE KIT

4.3 WORKING PRINCIPLE

The working principle for fire protection and charge monitoring of electric vehicles involves a combination of sensors, monitoring systems, and safety mechanisms. For fire protection, the sensors, such as smoke detectors or heat sensors, continuously monitor the charging area for any signs of fire or overheating. When these sensors detect abnormal conditions, they send signals to the monitoring system. The monitoring system receives the signals from the sensors and processes the data. It analyzes the information to determine if there is a potential fire or overheating event. If a fire or abnormality is detected, the monitoring system triggers an alarm to alert the relevant parties. In terms of charge monitoring, voltage and current sensors measure the electrical parameters of the charging process. These sensors monitor the charging voltage and current levels to ensure they remain within safe limits. The data from these sensors is then processed and displayed on a monitoring unit or sent to a central control system. To ensure safety, a safety disconnect mechanism is implemented. This mechanism is designed to automatically cut off the power supply in case of emergencies or abnormalities. It acts as a fail-safe measure to prevent further damage and ensure the safety of the vehicle and charging station. Overall, the working principle involves continuous monitoring of the charging area, analyzing sensor data, triggering alarms in case of fire or abnormalities, and implement safety mechanisms to protect the vehicle and charging station.

CHAPTER 5
CONCLUSION

The fire protection and charge monitoring of electric vehicle is critical to enhancing their safety, reliability, and overall user acceptance. The charge monitoring systems are crucial to ensure the efficient and safe charging of electric vehicles. This project can provide real-time monitoring of the charging process, including monitoring the temperature and voltage levels to prevent overcharging or overheating.

By implementing this project, it can enhance the safety of electric vehicle charging stations and minimize the risk of fire accidents. It helpful to monitor the battery charging level and protect from the overcharging condition.

PROJECT IMPLEMENTATION – GEOTAG PHOTO

PROJECT DEMONSTRATION VIDEO LINK

https://drive.google.com/file/d/1NM1z3UxwXnX3wTf9RQKpVo-q7Gj5D-aj/view?usp=drivesdk

REFERENCES

[1] Ayman S. Elwer, Samy M. Ghania, Nagat M. K. A. Gawad, “Battery Management Systems for Electric Vehicle Applications”.

[2] Aniket Rameshwar Gade,” The New Battery Management System in Electric Vehicle” International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV10IS070210 www.ijert.org Vol. 10 Issue 07, July-202.

[3] Nitin Saxena, Anant Singh , Aniket Dharme , “IOT- Based Battery Management System Inelectric Vehicle”.

[4] Rui Hu University of Windsor.” Battery Management System for Electric Vehicle Applications”2011.

[5] A. Sowmiya, P. Aileen Sonia Dhas, L.Aquiline Lydia, M.Aravindan , K.Rajsaran,” Design of Battery Monitoring System for Electric Vehicle” IARJSET International Advanced Research Journal in Science, Engineering and Technology Vol. 8, Issue 11, November 2021.

[7] Aswinth Raj, “Battery Management System (BMS)for Electric vehicles” December 5, 2018.

[8] Anjali Vekhande, Ashish Maske,” IOT-Based Battery Parameter Monitoring System for Electric Vehicle “© 2020 IJCRT | Volume 8, Issue 7 July 2020 | ISSN: 2320-2882

[9] A. Hariprasad, I. Priyanka , R. Sandeep, V. Ravi, O. Shekar,” Battery Management System in Electric Vehicles” IJERTV9IS050458,Volume 09, Issue 05 (May 2020).

[10] Mahadik Tejaswini J., Prof. Shivdas S.S,” Implementation of Charging Station for E-Vehicle using Solar Panel with IOT” Volume 7, Issue 8 (ISSN-2349-5162) JETIR2008339 Journal of Emerging Technologies and Innovative Research (JETIR).