

INTEGRATED ENERGY REGENERATIVE SYSTEM FOR ELECTRIC TWO-WHEELER CHARGING USING CHAIN- DRIVEN MOTOR WITH BATTERY COOLING SYSTEM

Submitted in partial fulfilment of the requirements for the award of

Bachelor of Engineering degree in
Mechatronics Engineering

By

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with grade “A++” by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of Bharath Kumar S (Reg. No. 40090005) and Bhagvath Agrawal R (Reg. No. 40090004) who carried out the project entitled "INTEGRATED ENERGY REGENERATIVE SYSTEM FOR ELECTRIC TWO-WHEELER CHARGING USING CHAIN-DRIVEN MOTOR WITH BATTERY COOLING SYSTEM" under our supervision from January 2024 to April 2024.

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We, **Bharath Kumar S (Reg No.40090005)** and **Bhagvath Agrawal R (Reg No. 40090004)** hereby declare that the Project Report entitled "**INTEGRATED ENERGY REGENERATIVE SYSTEM FOR ELECTRIC TWO-WHEELER CHARGING USING CHAIN-DRIVEN MOTOR WITH BATTERY COOLING SYSTEM**" done by us under the guidance of **Mr. K. Balachandar MTech., (Ph.D.)** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Mechatronics Engineering.

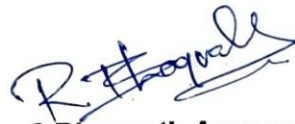
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ABSTRACT

The project presented herein explores an innovative solution for addressing the challenges associated with electric vehicles, primarily their limited range and dependent on external charging infrastructure. Through the integration of a dual-battery system and energy regenerative technology, this project aims to revolutionize the electric vehicle industry by enabling energy regenerative capabilities during operation. Electric vehicle has gained traction as eco-friendly and cost-effective alternative to traditional gasoline powered vehicles. Our project seeks to mitigate these concerns by introducing a novel approach that optimizes energy management and extends the EV's range. The core concept of this project revolves around the implementation of two batteries, Battery A and Battery B, and the use of alternators to harness kinetic energy while riding. When Battery A discharge, Battery B is simultaneously charged through an alternator, and vice versa. These alternators generate AC current, which is subsequently rectified and converted into DC current for charging the battery. This process involves the careful integration of a copper pipe-based cooling system, which enwraps the batteries. This design ensures that the batteries maintain their optimal operating temperature during various riding conditions, addressing the challenges of overheating and thermal management in electric vehicle. One of the project's unique features is the incorporation of alternators to harvest energy from the vehicles motion. These mechanisms will be projected in a display for the user's understanding. Our innovative approach has the potential to revolutionize electric vehicle design and pave the way for more convenient and eco-friendlier transportation options in future. The outcomes of our project deals with the extended EV range, Enhanced energy efficiency, Improved battery performance and Innovation in EV Technology.

Keywords: Energy regenerative, Dual-battery system, Energy management, Energy efficiency, Battery cooling, Battery temperature maintenance, Battery longevity, Range extension.

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LIST OF SYMBOLS AND ABBREVIATIONS

EV	Electric Vehicle
AC	Alternating Current
DC	Direct Current
BMS	Battery Management System
BLDC	Brushless DC motor
Kw	Power (Kilo Watt)
V	Voltage (Potential Difference)
Ah	Current (Ampere Hour)
C	Temperature in Celsius
RPM	Revolution Per Minute
C ₂ H ₆ O ₂	Ethylene Glycol (Coolant liquid)
ESP	Electronic Stability Program
HMI	Human Machine Interface
LVGL	Light and Versatile Graphics Library
DHT-22	Digital Temperature and Humidity sensor
ADC	Analog-Digital Converter
BTMS	Battery Thermal Management System
GPS	Global Positioning System

CHAPTER 1

INTRODUCTION

1.1 Overview

Electric vehicles have emerged as promising alternatives to the traditional gasoline-powered vehicles, offering numerous advantages such as reduced emissions, lower operating costs and quieter operations. Yet, as the electric vehicle (EV) industry continues to evolve, several challenges remain at the forefront of research and development efforts. One of the most critical challenges pertains to battery performance and temperature management. Electric vehicles are powered by lithium-ion batteries, renowned for their energy density and environmental benefits. However, these batteries are sensitive to temperature variations and are susceptible to performance degradation when operated outside their optimal temperature range. This vulnerability has a direct impact on vehicle's range, power output, and safety, making effective thermal management a paramount concern in the design and operation of electric vehicles. In parallel with the pursuit of enhanced battery performance, innovations in battery cooling and management systems have garnered significant attention within the EV industry. These systems aim to mitigate the adverse effects of temperature extremes by maintaining batteries within the ideal operational temperature range, thereby maximizing efficiency, range and battery longevity. Furthermore, the availability and convenience of charging infrastructure remain challenges for electric vehicles. The need for frequent recharging limits the practicality of electric vehicles for long-distance commuting and touring, often referred to as "range anxiety". This project introduces a unique and innovative approach to address these challenges, offering the potential to revolutionize the electric vehicle landscape. Our project focuses on the development of a self-charging electric vehicles, where the electric vehicles own motion serves as a source of energy regeneration. This concept harnesses kinetic energy during acceleration and braking, recapturing energy that would otherwise be lost as heat. By ingeniously incorporating alternators and a dual-battery system, we aim to create a vehicle that not only maintains continuous operation but also extends its range, reducing the reliance on external charging

infrastructure. Furthermore, to ensure the effective management of this energy regeneration system, our project integrates a sophisticated copper pipe-based liquid cooling system. Ethylene glycol, a proven coolant with excellent heat transfer properties, circulated through the copper pipes, regulating the temperature of the batteries. This cooling system safeguards the batteries against overheating during energy regeneration and promotes efficient charging and discharging cycles. This project represents a significant step towards the realization of sustainable, efficient and dependable electric vehicles. Through the fusion of energy harvesting, dual-battery technology and advanced cooling systems, we aim to address the challenges that have thus far hindered the widespread adoption of electric-vehicles. Our innovative approach strives to provide riders with enhanced performance, extended range and increased convenience while contributing to the broader goal of environmentally responsible transportation.

1.2 General Introduction:

- To develop conceptual design of a prototype for an Electric Two-Wheeler.
- To generate electric charges from a belt driven mechanism.
- To prevent battery from over-heating by adding cooling liquid agent allowing it to flow through the copper pipe.
- To display the regenerative mechanism through voltage fluctuation in resistor, temperature of the battery and also charge percentage of the batteries.
- To assemble the belt driven motor which will be connected through a dynamo (for regeneration purpose) through a belt to charge a battery efficiently while driving two-wheeler.

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE SURVEY

2.1.1 Kinetic energy harvesting technologies for applications inland transportation A Comprehensive review (2021): This paper is a comprehensive review of energy harvesting technologies for different applications in the land transportation. First, the commonly used energy harvesting technologies in land transportation are summarized. Second, different energy harvesting systems are presented in terms of designs, simulations, and experiments. Third, a common analysis of energy harvesting technologies is conducted to calculate and simulate the performance of these systems. Also, a comparison of the presented energy harvesting systems is conducted in various ways.[1]

2.1.2 A review on barrier and challenges of electric vehicle in India and vehicle to grid optimization (2020): The paper provides an overview of the studies of Electric Vehicle, Hybrid Electric Vehicle, Plug-in-Hybrid Electric Vehicle and Battery Electric Vehicle penetration rate into the market and discusses their different modelling approach and optimization techniques. The research on the essential barriers and insufficient charging facilities are addressed for a developing country like India that makes the study unique. The development of new concept of Vehicle- to-Grid has created an extra power source when renewable energy sources are not available.[2]

2.1.3 A review of Lithium-Ion Battery for Electric Vehicle Applications and Beyond (2019): This paper reviews recent research and developments of lithium- ion battery used in EVs. Widely used methods of battery sorting are presented. The characteristics and challenges of estimating battery's remaining useful life (RUL) and state-of-charge (SOC) are critically reviewed, along with a discussion of the strategies to solve these issues. A new method of sorting retired

lithium-ion batteries and estimating the RUL and SOC of the retired lithium-ion batteries is proposed.[3]

2.1.4 A review of energy sources and energy management system in electric vehicles (2013): This paper reviews state-of-the-art of the energy sources, storage devices, power converters, low-level control energy management strategies and high supervisor control algorithms used in EV. The comparison on advantages and disadvantages of vehicle technology is highlighted. In addition, the standards and patterns of drive cycles for EV are also outlined. The advancement of power electronics and power processors has enabled sophisticated controls (low-level and high supervisory algorithms) to be implemented in EV to achieve optimum performance as well as the realization of fast- charging stations.[4]

2.1.5 Vibration energy harvesting in automotive suspension system, A detailed review (2018): This paper is a comprehensive review on energy harvesting based vehicle suspensions. Specifically, it focuses on an analytical and statistical study of the vehicle regenerative suspensions and reviewing the concepts, designs, simulations, test rig experiments and vehicle road tests. The most common energy harvesting systems in vehicle suspensions are compared in terms of advantages and limitations. In addition, the challenging issues and research gaps that remain unresolved are addressed and some recommendations regarding such challenges are stated for further research.[5]

2.1.6 Battery Cooling in Electric Two-Wheeler - A Review (2023): This paper reviews the drawback of the E-bikes, they use heat absorbing material to reduce the amount of heat generated by the battery. It is possible to design the battery chamber in addition to implementing it. When the battery is charging and being transported for a long distance, monitoring the battery may be an alternative method of using battery cooling technology. The car might be given some rest to lower the battery temperature. So, understanding the temperature can aid in a variety of battery cooling processes.[6]

2.1.7 Thermal Management Systems for Batteries in Electric Vehicles: A Recent Review (2023): The project reviews the energy source of modern-day EV is a lithium-ion battery pack Temperature sensitivity is a major limitation for the lithium-ion battery performance and so the prevalent battery thermal management systems (BTMS) are reviewed in this study for practical implications. Firstly, the design considerations are analyzed to measure value of thermal safety and the international market potential is studied in this manuscript. Secondly, thermal stability analysis is drawn for thermal runaway situations, extreme weather conditions and aging phenomenon. The effect of sub-zero temperature, charging/discharging rates, failures caused by short circuiting, lack of temperature uniformity and mechanical deformation are also evaluated. In addition, the theoretical and experimental models of various battery thermal management strategies studied by different authors are compared for their effectiveness in hybrid and electric vehicles.[7]

2.1.8 Understanding Charging Behavior of Electric Vehicle Users (2013): This paper examined the psychological dynamics underlying charging behavior of electric vehicle (EV) users. Data from 79 EV users were assessed in a 6-month EV field study. On average, users charged their EV three times per week, drove 38 km per day, and they typically had a large surplus of energy remaining upon recharging. Based on first findings concerning charging style among mobile phone users, we hypothesized that user–battery interaction style (UBIS) is a relevant variable for understanding charging behavior of EV users. We developed measures to assess UBIS. Results show that it is a relatively temporally stable characteristic which also shows some cross-device consistency. As predicted by our conceptual model, UBIS and comfortable range explain the charge level at which people typically recharged. UBIS was related to users' confidence in their mental model of range dynamics, the utilization of range, and to excess energy from renewable sources. This research has implications for optimizing sustainability of electric mobility systems.[8]

2.1.9 Design and Development of Energy Regenerating Electric Two-Wheeler(2020): The paper reviews the economics of developing countries like India are also depended upon the cost of fuel as it is consumed in huge amount daily. Most of the transportation is dependent on the conventional fuel like petrol and diesel. The electric bikes in India have been introduced in 1990s but it was not very popular due to the low performance of battery and less mileage per charging. The performance of electric vehicles has improved now with the new charging and battery technologies developed. Authors have proposed the implementation of energy regenerating electric bike in this paper. A prototype is designed, developed and presented in this paper.[9]

2.1.10 Design and Fabrication of Cooling System in Electric Vehicle (2019): The project is about cooling system which is used to reduce heat dissipation from battery and increase the life of battery pack. Electric and hybrid cars are capable of reducing the uses of fossil fuel. What is common with an electric car and a hybrid car is the use of battery to store electrical energy. To sustain high performance, long lifetime and to keep high safety in an electric vehicle it's very important to control the temperature of the battery cells. Therefore, it's important to have a sufficient and well-designed cooling system that can keep the battery cells within recommended temperature range when the car is operating.[10]

2.1.11 Steady State and Start-Up Transient Responses of a Belt-Driven Starter Generator System for Micro- Hybrid Electric Vehicle (2021): The aim of this work is to present a method to investigate steady-state and start-up transient responses of a typical belt-driven starter generator system with twin tensioner arms for micro- hybrid electric vehicles. A dynamic model of the belt-driven starter generator system is established for this scheme, where a smoothing dynamic friction model considering the velocity-weakening effect is presented to model the tensioner dry friction. Unlike some traditional dynamic models of the belt-driven starter generator system that the engine dynamics and dynamics of the belt-driven starter generator system are decoupled, an engine dynamic model, which is embedded in the dynamic model of the belt-driven starter generator system, is also established to calculate engine resistance torques at the engine

starting process stage. Influences of the tensioner dry friction and stiffness on steady-state responses of the belt-driven starter generator system especially the stick–slip oscillations of the twin tensioner arms are examined.[11]

2.1.12 A review on passive cooling techniques for lithium-ion battery thermalmanagement system of electric vehicle (2021): This project is about the Li-ion batteries, which have gained popularity in electric vehicle application in past few years because of its high energy density and long-life cycle. The high energy density Li-ion batteries are also generating a large amount of heat which needs to be separated for the stability, longevity of the battery and safety of vehicle. Thus, a battery thermal management system (BTMS) is very much essential for the battery system. The objective of BTMS is to maintain the cells temperature and thus improve life cycle of the battery system. It has been reported that the battery pack has better thermal stability and lifetime when operated at a temperature range of 15 to 35 °C and maximum cell temperature difference of 5 °C. Among battery cooling techniques, passive approaches are considered as less complex and less expensive. In this context, a review on passive cooling methods for BTMS has been discussed in this paper. Subsequently, a summary of characteristic parameter for an efficient passive BTMS has been provided.[12]

2.1.13 A Comprehensive Review on the Integration of Electric Vehicles for Sustainable Development (2022): This article provides the concept of an electric vehicle (EV) as a sustainable development (SD) and the viability of the development of electric vehicles is assessed. This study expands the conventional definition of sustainable development by incorporating and prioritizing crucial areas of technology, environment, and policy performance. The proposed review studies have summarized the elements that can promote the integration of electric vehicle technology. The innovation of the EV has just raised the modern innovation. At the same time, some obstacles, such as policy and lower adoption, are resisting its goals. To overcome this situation, electric vehicle has to adopt some innovative approaches that can be another path to success. The review result shows that the proposal discusses the technological

advancements of electric vehicles worldwide and paves the way for further improvements. The results also mention the technological development to reduce emissions created by the non-EV's and help us understand the impact on the environment and health benefits.[13]

2.1.14 Quantifying self-consumption of on-site photovoltaic power generation in households with electric vehicle home charging (2013): This article shows how the Photovoltaic (PV) power production and residential power demand are negatively correlated at high latitudes on both annual and diurnal basis. If PV penetration levels increase, methods to deal with power overproduction in the local distribution grids are needed to avoid costly grid reinforcements. Increased local consumption is one of the options. The introduction of a home-charged plug-in electric vehicle (PEV) has a significant impact on the household load and potentially changes the coincidence between the household load and photovoltaic power production. This paper uses a stochastic model to investigate the effect on the coincidence between household load and photovoltaic power production when including a PEV load. The investigation is based on two system levels: (I) individual household level and (II) aggregate household level. The stochastic model produces theoretical high-resolution load profiles for household load and home charged PEV load over time. The photovoltaic power production model is based on high-resolution irradiance data for Uppsala, Sweden. It is shown that the introduction of a PEV improves the self-consumption of the photovoltaic power both on an individual and an aggregate level, but the increase is limited due to the low coincidence between the photovoltaic power production pattern and the charging patterns of the PEV.[14]

2.1.15 Electric Vehicle Aggregate Power Flow Prediction and Smart Charging System for Distributed Renewable Energy Self-Consumption Optimization (2020): In the context of electric vehicle (EV) development and positive energy

districts with the growing penetration of non-programmable sources, this paper provides a methodology to predict and manage the cluster power flows of charging stations to optimize the self-consumption and load profiles. The prediction method analyzes each charging event belonging to the EV population, and it considers the main factors that influence a charging process, to be specific the EV's characteristics, charging ratings, and driver behavior. EV's characteristics and charging ratings are obtained from the EV model's and charging stations' specifications, respectively. The statistical analysis of driver behavior is performed to calculate the daily consumptions and the charging energy request. Then, a model to estimate the parking time of each vehicle is extrapolated from the real collected data of the arrival and departure times in parking lots.[15]

2.1.16 Integration between electric vehicle charging and PV system to increase self-consumption of an office application (2016): This paper analyzes the introduction of a photovoltaic system satisfying electric, space heating and cooling demand of an office building located in southern Italy. The electric load is due to an electric heat pump, used to satisfy space heating and cooling load, a pure electric demand (personal computers, printers, lighting, etc.) and an electric vehicle charged during working hours. Dynamic simulations to evaluate the energy and environmental performance of the analyzed system considering different photovoltaic peak powers (4.5–9.0 kW), electric vehicle distance per day (40–120 km) and charging method is carried out. The solar based system shows primary energy saving and equivalent carbon dioxide emission reduction higher than 40% in comparison to the reference conventional system based on a natural gas fired boiler, an electric chiller and a diesel car. The results highlight that the solar energy system is more competitive when DC charging system is provided.[16]

2.1.17 Smart Charging of Electric Vehicles According to Electricity Price (2019): This paper reveals a new technique for smart charging of EV's is

proposed and tested with simulation. A fuzzy logic controller is used to control and manage the EV charging process to maximize electric utility and EV owner benefits. The electric utility's benefit is to mitigate the EV charging impacts on the distribution network by shifting EV charging to the off-peak period, while EV owners' benefit is to charge the EV at low cost. The controller regulates and controls the EV charging power depending on electricity price signal provided by the electric utility and EV battery state of charge (SoC). This controller needs basic communication with the electric utility to receive the electricity price signal every 1 hour. The objective of the controller is to charge EVs at low cost while keeping the normal operating conditions of the distribution network. (MATLAB/SIMULINK) are some software used to perform simulations and test the effectiveness of the proposed smart charging method. The results demonstrated that the proposed smart charging method reduced the impacts of EVs charging on the distribution network compared with uncontrolled charging. [17]

2.1.18 Thermal management of lithium-ion batteries for electric vehicles

(2012): This article deals with the thermal issues associated with electric vehicle battery packs can significantly affect performance and life cycle. Fundamental heat transfer principles and performance characteristics of commercial lithium-ion battery are used to predict the temperature distributions in a typical battery pack under a range of discharge conditions. Various cooling strategies are implemented to examine the relationship between battery thermal behavior and design parameters. By studying the effect of cooling conditions and pack configuration on battery temperature, information is obtained as to how to maintain operating temperature by designing proper battery configuration and choosing proper cooling systems. It was found that a cooling strategy based on distributed forced convection is an efficient, cost-effective method which can provide uniform temperature and voltage distributions within the battery pack at various discharge rates. [18]

2.1.19 Experimental study of an OHP-cooled thermal management system for electric vehicle power battery (2014): This paper describes about the issues of global warming and depletion of fossil fuels have provided opportunities for the development of electric vehicles in recent years. Generally, the performance of electric vehicles is directly affected by power battery. However, the performance and cycle life of most of the batteries are affected by the battery temperature. Both excessive high or low temperature and uneven temperature distribution can significantly reduce the lifetime of battery and then result in higher costs and decreasing reliability of the electric vehicles. Both excessive high or low temperature and uneven temperature distribution can significantly reduce the lifetime of battery and then result in higher costs and decreasing reliability of the electric vehicles. This paper has carried out a complete capacity fade analysis of Sony 18650 cells which cycled at elevated temperature, and the results showed that about 31% and 36% of the initial capacity were lost after 800 cycles when the cells cycled at 25 degree Celsius and 45 degree Celsius, but more than 60% after 600 cycles at 50 degree Celsius and 70% after 500 cycles at 55 degree Celsius. As amount of heat will be generated during charging and discharging process, overheating of the battery can even lead to fire when the heat cannot be dissipated rapidly. Therefore, for the purpose of extending the cycle life of power battery and improving the performance of electric vehicles, it is imperative to design an effective battery thermal management (BTM) system to maintain the battery operating at desired temperature range.[19]

2.1.20 Review on battery thermal management systems for energy-efficient electric vehicles (2021): This paper provides an overview of the battery thermal management systems (BTMSs) based on the studies carried out by different researchers across the globe. The focus is on enhancing the thermal performance of the battery with the selection and incorporation of a suitable thermal management system. In addition to this, the performance enhancement of lithium-ion (Li-ion) battery systems using supercapacitor (SC) in parallel topological connection, have been discussed. The design options in BTMS and the

desired level of sophistication are discussed in this study. For ensuring the performance and safety of Li-ion batteries, a suitable BTMS must be designed to regulate and control the thermal load of the batteries. This would not only result in safety but also ensure longer battery life. This paper presents the summary of recent developments in the direction of BTMS with direct and indirect cooling methods and provides significant insights into the use of SC for reducing the thermal load on the Li-ion batteries, which in turn can help in reducing the cost and weight of BTMS required for energy efficient electric vehicles (EVs).[20]

CHAPTER 3

AIM AND SCOPE

3.1 AIM OF THE PROJECT

The aim of our project which involves creating electric two-wheeler with dual-battery regenerative setup and liquid cooling system, encompass several key objective and goal these aims are focused on addressing challenges within the electric two-wheeler industry and advancing sustainable transportation technology. The primary aims of our project includes.

3.1.1 *EXTEND ELECTRIC MOTORCYCLE RANGE:* The project aims to significantly extend the range of electric motorcycles. By implementing self-charging capabilities and a dual-battery setup, the motorcycle can harness and store additional energy, reducing range limitations and making electric motorcycles more practical for everyday use.

3.1.2 *IMPROVE BATTERY MANAGEMENT:* The dual-battery setup and cooling system aim to improve battery management. This includes extending battery lifespan, maintaining stable temperature conditions, and ensuring efficient charging and discharging cycles.

3.1.3 *PROMOTE SUSTAINABILITY:* Our project aims to promote sustainability and reduce the environmental impact of personal transportation. By harnessing renewable energy sources during operation and using an efficient cooling system, the motorcycle contributes to reducing greenhouse gas emissions and reliance on fossil fuels.

3.1.4 *INNOVATE IN ELECTRIC VEHICLE TECHNOLOGY:* By integrating energy harvesting, cooling, and dual-battery technologies into an electric motorcycle, the project aims to push the boundaries of electric vehicle technology. This innovation contributes to the development of more advanced and efficient electric motorcycles.

3.1.5 CONTRIBUTE TO SUSTAINABLE TRANSPORTATION: Ultimately, the overarching aim is to contribute to the global transition to sustainable transportation. Our project aligns with the broader efforts to reduce carbon emissions, improve air quality and promote electric vehicles as a cleaner and more sustainable mode of transportation.

3.2 FUTURE SCOPE OF THE PROJECT

The future scope of our self-charging electric motorcycle project is promising and encompasses several key areas for further development, innovation, and expansion. These future scopes can help advance our project and contribute to the broader goals of sustainable transportation and electric vehicle (EV) technology. Here are the main future scopes for our project:

3.2.1 ADVANCED ENERGY HARVESTING: Continues research and development in energy harvesting technologies. Explore more efficient alternators, regenerative systems or other mechanisms to further improve energy capture during riding.

3.2.2 BATTERY TECHNOLOGY: By staying updated with advancements in battery technology. As battery technologies evolve, consider integrating next-generation batteries with higher energy densities and faster charging capabilities into our vehicle.

3.2.3 RANGE EXTENSION: Exploring ways to further extend the vehicle's range. This could involve optimizing energy management systems, enhancing the dual- battery setup or integrating solar panels for additional energy generation.

3.2.4 CUSTOMIZATION AND PERSONALIZATION: Exploring options for customization and personalization of the vehicle. Allows the riders to tailor the self-charging system and battery management to their specific needs and preferences.

3.2.5 INNOVATION IN COOLING SYSTEMS: Continue researching advanced cooling technologies to further improve battery temperature management.

CHAPTER 4

MATERIALS AND EXPERIMENTAL METHODS

4.1 MATERIALS FOR REGENERATIVE SYSTEM:

4.1.1 MOTOR:



Fig:4.1 48v 1kw BLDC Motor

Type	BLDC
Power	48v DC
Current	1kw
RPM	3000
Load carrying capacity	500kg

Table:4.1 Motor Specification

- **48v 1kw BLDC MOTOR:** We use BLDC motor for the spinning the rear wheel as the primary purpose. It is used for the movement of the vehicle. This BLDC motors are commonly used in all type of electric two-wheelers. This motor is connected with the battery through a controller. The load carrying capacity of this motor is

approx. 500 kgs. The RPM of the motor is 3000.

4.1.2 BATTERY:



Fig:4.2 48v 20Ah Lithium Phosphate Battery

Type	Lithium Phosphate
Power	48V DC
Current	20 Ah
Range	40km
Dimensions	9 x 5 x 7 inches

Table:4.2 Battery Specifications

- 48v 20Ah Lithium Phosphate Battery:** In our project two Lithium Phosphate batteries will be used with the same spec one is for discharging the charges to run the vehicle's motor and another one is used to store the regenerated energy. Lithium Phosphate batteries play a crucial role in Electric vehicles and are often consider as the heart of these vehicles. Lithium Phosphate battery is to store the electrical energy efficiently, they can store a huge amount of energy relativeto their weight and size, making them suitable for powering Electric vehicle. These batteries provide the primary source of energy for the Electric vehicles, suppling the electric charges needed to drive the vehicle's electric motor. The range of vehicle is based on the capacity of the battery, Higher the capacity the range will also increase simultaneously. Lithium Phosphate battery contains

lower discharge rate than other type of batteries, so it is efficient to use in electric vehicles.

4.1.3 DC DYNAMO:



Fig:4.3 40v 3000rpm Dynamo

Type	DC
Power	40V
RPM	3000
Output voltage	80-90V

Table:4.3 Dynamo Specifications

- **40v 3000rpm DC- Permanent Magnet Dynamo:** The input voltage for this dynamo is up-to 40v and the rotation of the dynamo is up-to 3000rpm. The dynamo is allowed to rotate with the help of the chain from 48v motor, when the dynamo gets rotated while driving the vehicle the dc voltage of 70 to 80 voltage is generated along with that the amps produced by the dynamo is 10amps. This dynamo helps to charge the battery when the vehicle is in ride. Additionally, the diode is been used in-between dynamo to the battery so that the problems like polarity and reverse current flow is solved.

4.1.4 CONTROLLER:



Fig:4.4 Controller (DC - 48V 1KW Brushless controller)

Type	BLDC
Power	DC 48v
Current	1000W
Throttle Potential	5v
Ambient Temperature	-20°C to 45°C

Table:4.4 Controller specification

- **48v 1kw BLDC Controller:** A 48V controller is well-suited for low-voltage systems, such as electric bicycles (e-bikes) and some low-speed electric vehicles. It allows for compatibility with 48V battery packs commonly used in these applications. A 1KW controller can manage a power output of up to 1,000 watts. This power level is suitable for smaller electric vehicles, e-bikes, and other light electric vehicles. It provides adequate power for these vehicles to achieve reasonable speeds and performance. Controllers are responsible for managing the power flow from the battery to the electric motor efficiently.

4.2 MATERIALS FOR COOLING SYSTEM:

4.2.1 COPPER PIPE:



Fig:4.5 Copper Coil Pipe

- **Copper Coil Pipe:** Copper is known for its outstanding thermal conductivity. It efficiently transfers heat away from the batteries, helping to maintain stable temperature conditions. This is crucial for prolonging battery life and ensuring consistent performance. Copper is relatively easy to shape and fabricate into the desired cooling channels or coils around the batteries. This flexibility in design allows for efficient heat dissipation while fitting within the motorcycle's frame. Copper is relatively easy to shape and fabricate into the desired cooling channels or coils around the batteries. This flexibility in design allows for efficient heat dissipation while fitting within the motorcycle's frame. Copper has a relatively high heat capacity, allowing it to absorb and distribute heat effectively. This helps in preventing localized hotspots within the battery packs. It typically is integrated into the battery thermal management system to dissipate heat generated during charging and discharging cycles. The copper pipes design would be dependent on the specific layout and the configuration of the battery pack. The cooling pipe would be integrated into the overall thermal management system of the EV, which may include other components such as pumps, heat exchangers and temperature sensors.

4.2.2 COOLANT:



Fig:4.6 Ethylene Glycol Coolant

- **Ethylene Glycol ($C_2H_6O_2$):** Ethylene glycol is commonly used as an antifreeze agent in automotive coolants and industrial cooling systems. It can help prevent engines from freezing in cold temperatures and protect against overheating. Ethylene Glycol to the coolant mixture prevents freezing in cold weather conditions, ensuring that the cooling system remains operational even in sub-zero temperatures.

4.2.3 Coolant Container:



Fig:4.7 Coolant Container

- **Plastic Thermo-Setting Container:** This is a transparent container which is used for the visibility of the liquid inside it. This is used to store the liquid coolant and

it is allowed to flow through the copper pipe efficiently. When the liquid flow through the copper pipe it will again flows back to the container.

4.2.4 MOTOR PUMP:



Fig:4.8 Motor Pump

- **Motor Pump:** It is used to pump the liquid constantly around the battery through the copper pipe. It pressures the liquid from the container to flow through the copper pipe till it reaches the container again.

4.3 MATERIALS FOR COOLING SYSTEM:

4.3.1 DISPLAY:



Fig: 4.9 HMI LVGL 5.0 DISPLAY

- **ESP32 HMI with LVGL (5 inches):** Displays in EV's provide crucial information to the driver, such as battery state of charge, range estimation, speed and energy consumption, temperature of the battery. This information helps the

driver make informed decisions about driving behavior and routeplanning. EV displays often include information about energy consumption and regeneration. This helps the driver optimize their driving style to maximize efficiency and extend the vehicle's range.

4.3.2 MICROCONTROLLER:



Fig:4.10 Esp32 Module

- **ESP32 Module:** ESP32 is a versatile microcontroller module that is commonly used in a wide range of applications due to its powerful features and capabilities. In our project ESP32 is been used for collecting the data from the components and devices such as battery, motor, sensors, etc... This data is been connected to a display and to show the output in the display. The information such as battery capacity, temperature of the battery, speed of the vehicle, etc..., These micro-controllers are used in various fields of electronic world, this micro-controller usually helps to pass out the information's or data's to other devices such as display. It has the capability to store the information of other components such as batteries, speed of the vehicle, Temperature of the vehicle, Interchanging factors of the batteries, Generation of power from the Dynamo, Time, Date, etc. These all operations are controlled by a code or a program which can be customized and stored to the device. The maximum capacity of the power which can be inputted to the ESP32 is 5V and minimum is 3V. It consists the data pins like G21, G22, G23, etc...., and it also consist of three grounds pins. This module is connected with ADS1115, Temperature sensor, Hall sensor, Relay, etc...,

4.3.3 TEMPERATURE SENSOR:

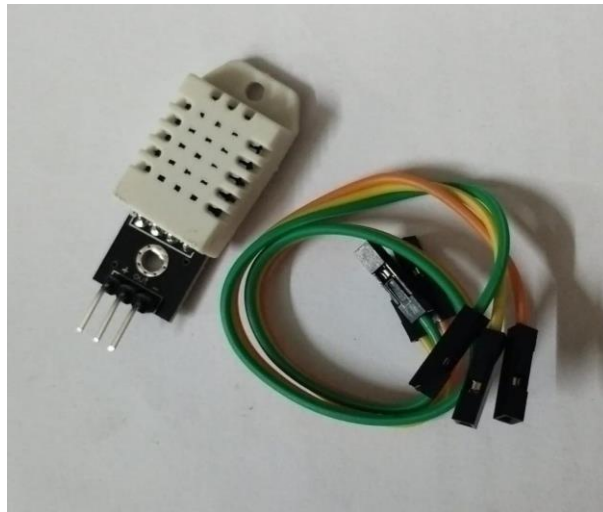


Fig:4.11 DHT-22 Temperature and Humidity Sensor

- **DHT-22 Temperature sensor:** The DHT-22 temperature sensor is a popular temperature and humidity sensor. It is used to sense the temperature of the surrounding areas; in our project the DHT-22 sensor is been used to sense the temperature of the battery by its property. With the help of this sensor the user can able to identify the appropriate temperature of the battery.

4.3.4 RESISTORS:

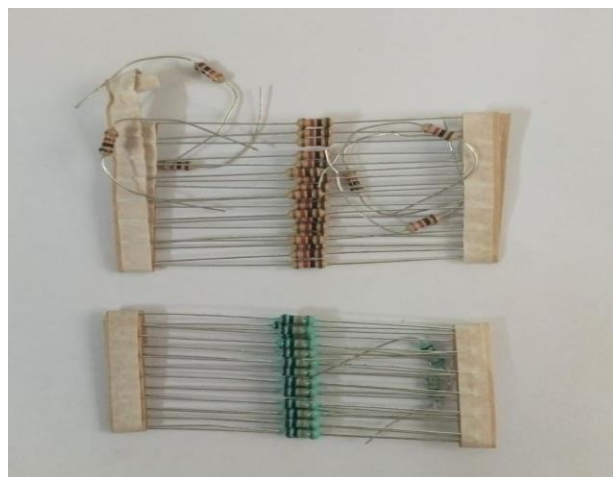


Fig:4.12 Resistor

- **Resistor:** Resistors are a passive electronic component that are widely used in various electrical and electronic circuits. Their primary function is to resistor the flow of electric current. In our case resistor is used for drop down the current from the battery to ESP32 module and other electronic devices.

4.3.5 ANALOG TO DIGITAL CONVERTOR:

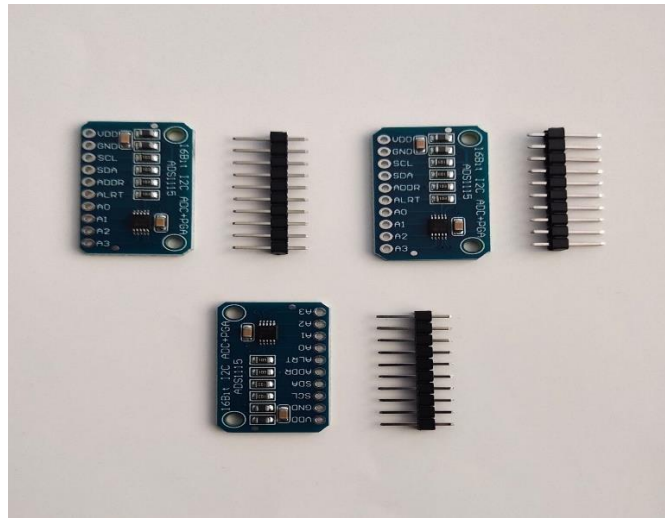


Fig:4.13 ADS1115 16-Bit Module

- **ADS1115 16-BIT Module:** The ADS1115 is a popular analog-to-digital converter (ADC) chip produced by Texas Instruments. It is often used to convert analog voltage signals into digital values for processing by microcontrollers, microprocessors, or other digital devices. The ADS1115 module is commonly used in a wide range of applications where precise analog-to-digital conversion is needed, such as industrial instrumentation, sensor interfaces, data acquisition systems, and more. Programming libraries and example code are available for various microcontroller platforms, making it relatively easy to integrate the ADS1115 module into projects using popular development environments like Arduino, Raspberry Pi, and others. The ADS1115 communicates with microcontrollers or other host devices via the I2C (Inter-Integrated Circuit) serial interface. This allows for simple and efficient communication with a wide range of microcontrollers and other ICs.

4.3.6 HALL EFFECT SENSOR:



Fig:4.14 Hall sensor for speedometer

- **Hall sensor for speedometer:** The Hall Sensor is used to find the speed of the any rotating object the Hall sensor can accurately determine the speed of rotation. It senses the magnetic field placed to the rotating position. The amount of rotating speed is calculated and the speed of the vehicle is calculated. It is placed at the opposite shaft of the motor. This technology is used in the current electric vehicles.

4.3.7 TWO WAY RELAY:



Fig 4.15 Two Way Relay

- **Two Way Relay:** a two-way relay to switch between batteries in an electric vehicle can provide redundancy or the ability to switch between different battery packs for different purposes, such as performance or longevity. When one battery reduces 20% then the relay switches to next battery which is been charged by the battery.

4.3.8 SCHOTTKY DIODE (IN4007):

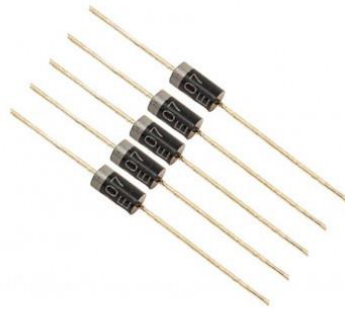


Fig 4.16 Schottky Diode (IN4007)

- **Schottky Diode (IN4007):** The Schottky diode is mainly used to avoid the positive and negative polarity and also stops the reverse flow of the current the diode in our project is used in-between dynamo to battery to safely charge the battery either the vehicle moves forward or backwards. The 1N4007 is a rectifier diode, commonly used in AC-to-DC power supply circuits and other applications where the conversion of alternating current (AC) to direct current (DC) is required. It is part of the 1N400x series of rectifier diodes, known for their ability to handle relatively high currents and voltages. The 1N4007 diode has a maximum repetitive peak reverse voltage of 1000 volts and an average forward current of 1 ampere. Schottky diodes are semiconductor diodes known for their fast-switching speed and low forward voltage drop. Unlike standard rectifier diodes like the 1N4007, Schottky diodes have a metal-semiconductor junction instead of a P-N junction, which contributes to their lower forward voltage drop. Schottky diodes are commonly used in applications where high switching speeds and low power losses are critical, such as in power supply circuits, voltage clamping circuits, and RF (radio frequency) circuits. The 1N4007 diode is widely used in various electronic circuits where rectification of AC to DC is required, such as power supplies, battery chargers, voltage multipliers, and signal demodulation circuits.

4.4 METHODOLOGY

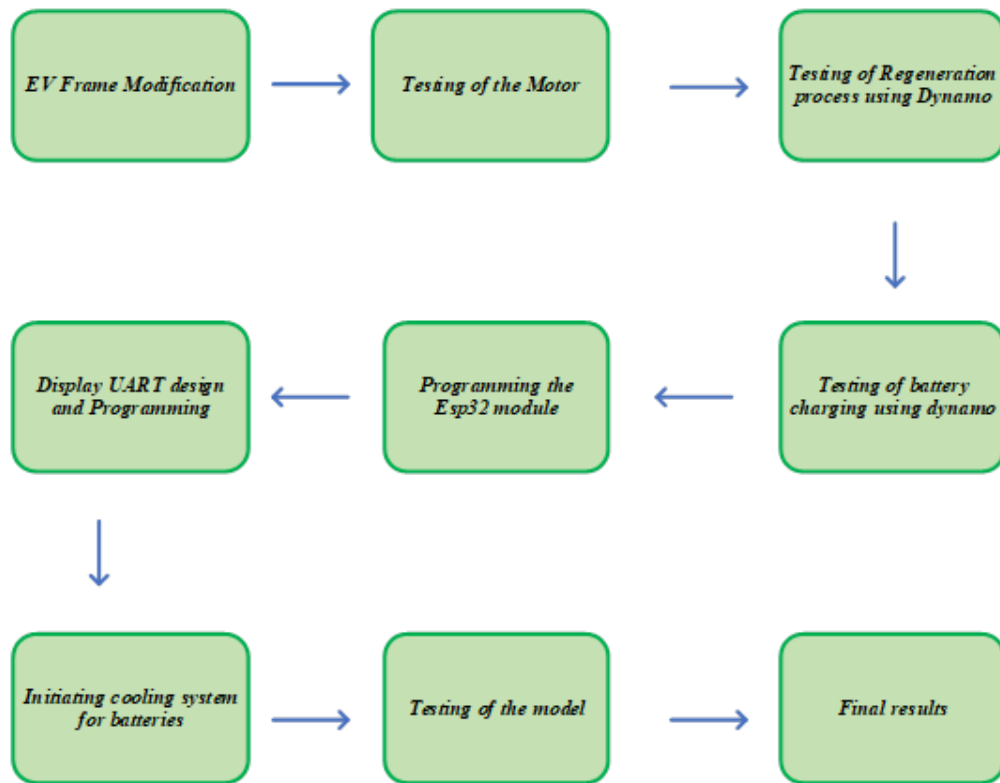


Fig 4.17 Methodology

The study involved developing the regenerative energy of an electric vehicle using a dynamo. Firstly, the electric vehicle frame was modified to position the materials correctly. After this modification, the motor for propelling the vehicle was tested for pulling capacity, RPM check, and torque. Following the motor testing, the evaluation of the regeneration process using the dynamo commenced. This process aimed to check the output current generated by the dynamo while the vehicle was in motion. Another crucial step involved testing battery charging through the dynamo, confirming efficient charging while the rider operated the vehicle. For collecting information on battery charging, the regeneration process, etc., the ESP32 Microcontroller played a vital role in storing and displaying the data. The ESP module was programmed, and a display UART design was created, enabling riders to access all vehicle information and plan their journeys accordingly. Considering that extended battery use can cause overheating, a cooling system using a liquid cooling agent was implemented and tested to standardize battery temperature. Following this procedure, the vehicle components were assembled, and the vehicle was tested with a test drive.

- **EV Frame Modification:** The EV Frame is made up of iron metal which is used to set-up the basic materials. Vehicle parts such as Motor, Dynamo, Wheel, Battery, Shock absorber, Controller and others (as shown in Fig. 2). We have designed the frame with respect to the placement and position of the components by measuring their dimensions of each material. We modified the frame so that the motor and the dynamo can be placed accurately to run the vehicle without any disturbance.



Fig 4.18: EV Frame

- **Testing of Motor:** We used 48v 1kw motor which consist of 3000rpm (revolution per minute) for our vehicle and also, we have tested that the pulling capacity of the motor is up to the weight of carrying 2 persons (Approx. 200kg) (as shown in Fig. 4.19). We used chain drive system for the motor so that it can have enough grip and no energy losses whereas while using belt drive system there will be mild slip between the motor and the wheel due to this there will be a small amount of energy loss.



Fig 4.19: Testing of the Motor

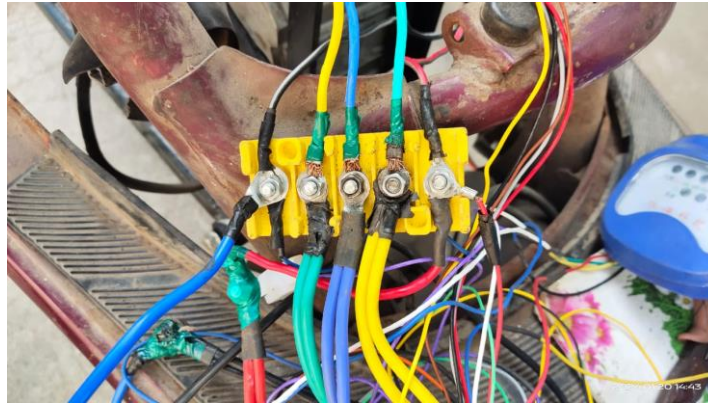


Fig 4.20: Connections of hall sensor and phase wires

Whenever we changed the connections in different probabilities, we got different results we attempted multiple tries and also, we tested hall sensor wires position and we got different feedback same like the phase wire connections finally we skimmed the result which we required and connected the final wire connections with respect to it (as shown in Fig. 4.20).

SL. NO.	TEST	COMBINATION			FEEDBACK
		POSITION 1	POSITION 2	POSITION 3	
1	Test 1	Yellow	Blue	Green	Front Speed No Pickup
2	Test 2	Green	Yellow	Blue	Failed
3	Test 3	Blue	Yellow	Green	Failed
4	Test 4	Green	Blue	Yellow	Failed
5	Test 5	Blue	Green	Yellow	No Smoothness Good Pickup Front Speed
6	Test 6	Green	Yellow	Blue	Reverse Speed Smoothness Front Speed

Table 4.5: Testing of Motors Rotation

- **Testing of Regeneration process using Dynamo:** We are using a belt-drive to connect the motor to the dynamo and connecting the motor to the battery in which the motor starts to run, due to the connection of motor to the dynamo with the belt, now when the motor is been rotated the dynamo is automatically rotated with the belt now when the dynamo is rotated the rpm of dynamo is partially decreased in which the output voltage of the dynamo is calculated with the help of multi-meter.
- **Testing of battery charging using Dynamo:** The charges produced in dynamo cannot be directly transferred to the battery due to fluctuation so, we are using a mini stabilizer in between the circuit of dynamo to battery so that the power is been stabilized and charge a constant power to the battery. Let assume the two batteries named A and B, when the Battery A is in use, automatically Battery B gets charged using dynamo, this process is initiated throughout in vice versa.
- **Programming the ESP32 Module:** We need a Microcontroller which can distribute a power to all the modules and sensors in this situation we are using a ESP32 Microcontroller which can also use to control the data transfer within the system. To programming ESP32 Module we are using Micro-python language.

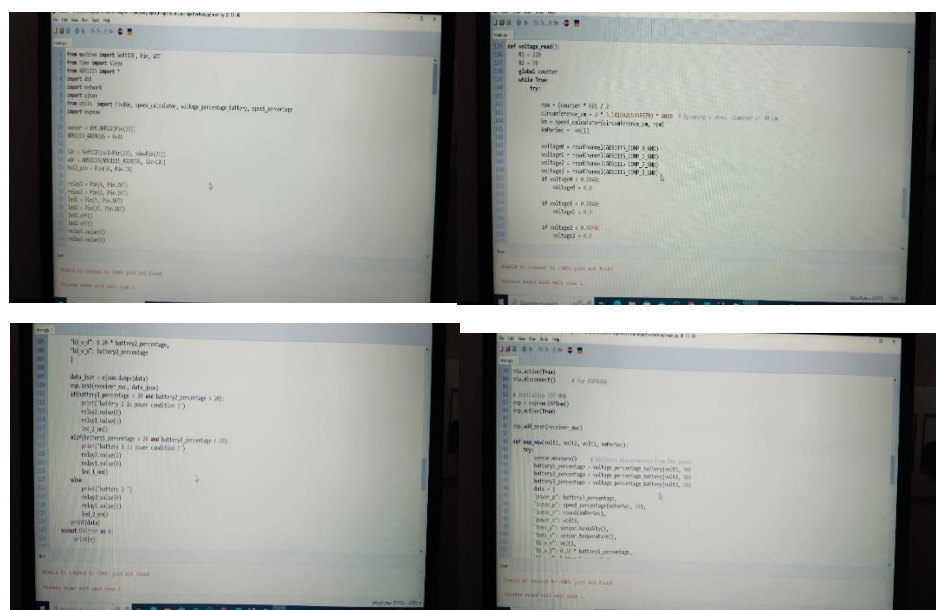


Fig 4.21: Programs for Esp32 Microcontroller

- **Display UART design and Programming:** We are using display so that the user can easily identify the status of the vehicle and plan his journey accordingly, so that we need a display in which the user can understand the vehicle status in better way so we built a good user-friendly UART design using SquareLine software (as shown in Fig. 5 and 6) which contains its own assets.

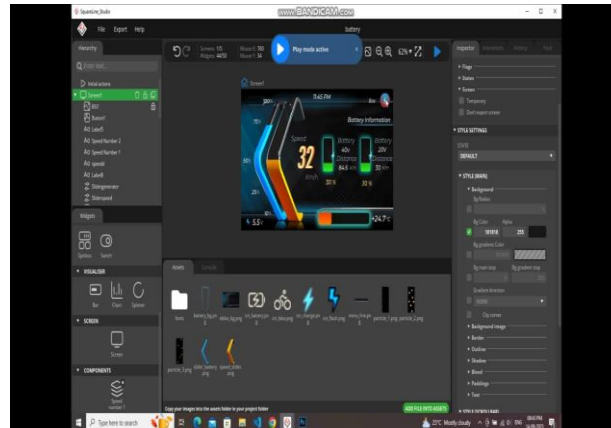


Fig 4.22: UART Design using Square Line Software



Fig 4.23: UART Design of the Display

- **Initiating Cooling System for Batteries:** In Electric Vehicles we are using cooling system to standardize the battery temperature. We are using a Liquid cooling agent named Ethylene Glycol ($C_2H_6O_2$) to pass through the Copper pipe which is winded around the batteries. When this process is happens, the batteries get maintained in a standard temperature (Between 10 to 40°C).

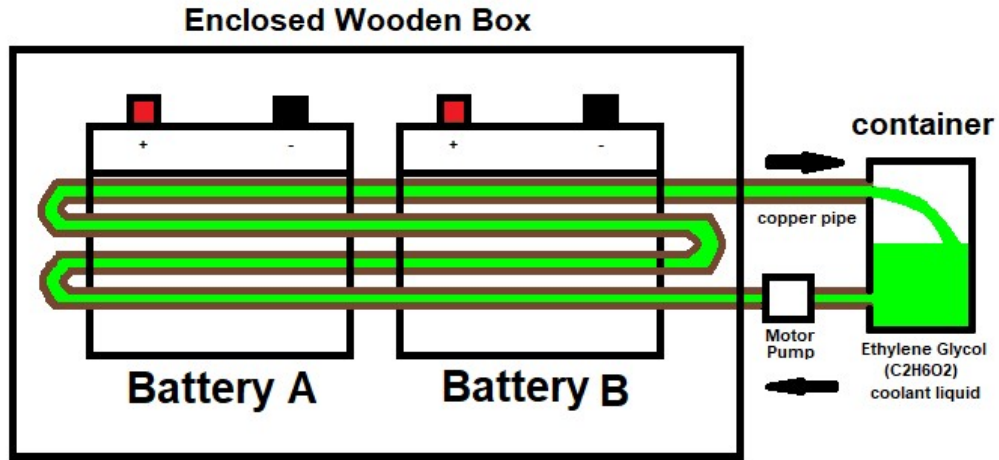


Fig 4.24: Battery Cooling System

- **Testing of the Model:** After assembling process of the vehicle is done, we Test-drive the vehicle and assumed that vehicle is running with good efficiency with the maximum speed of 60 kmph and all the processes is working successfully.
- **Final Result:** Finally, after all the process completion, the vehicle is ready to drive whenever we needed it.

4.5 DESIGNS OF THE PROTOTYPE AND CONNECTIONS:

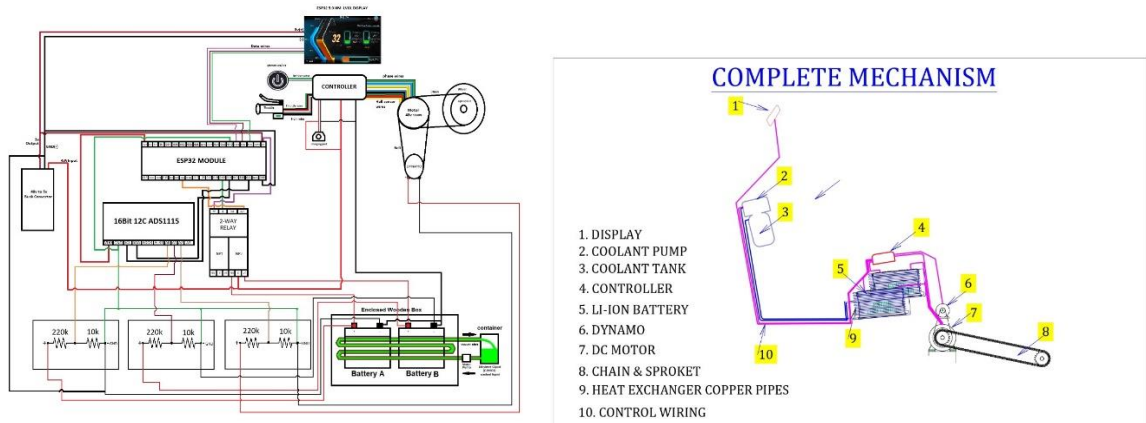


Fig 4.25: Overall Connections of the vehicle



Fig 4.26: U-art Design of the Display

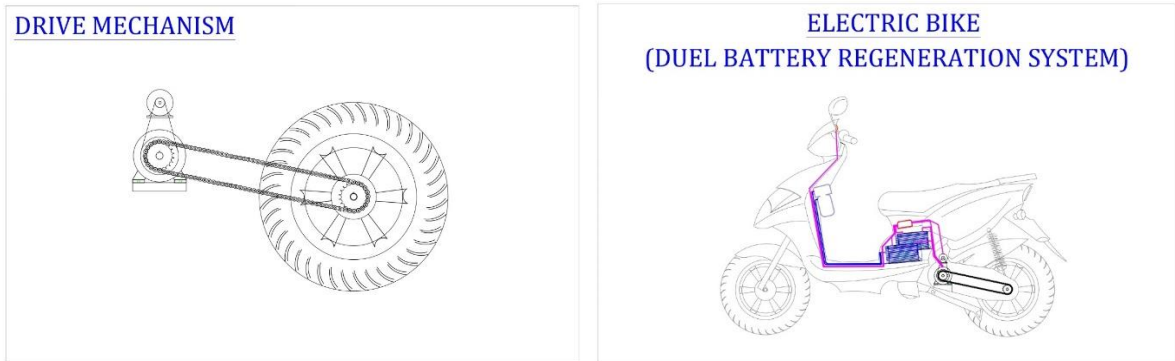


Fig 4.27: Dual Battery Regeneration

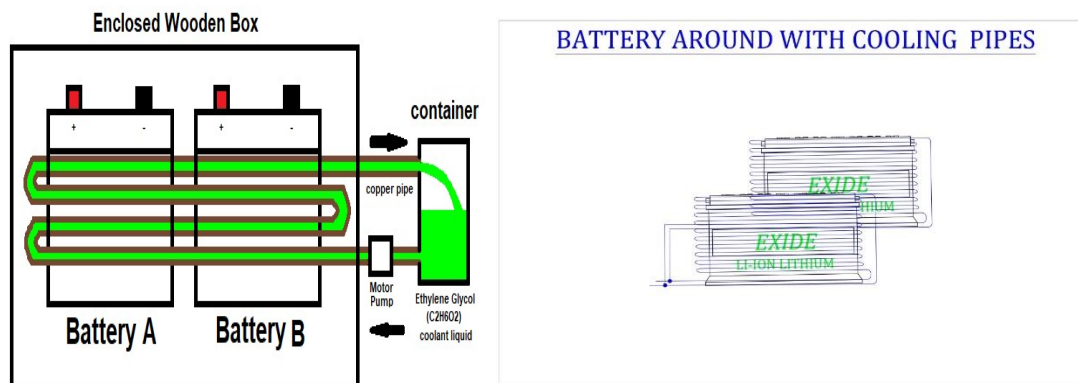


Fig 4.28 Battery Cooling System

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1.1 CALCULATIONS FOR BATTERY SELECTIONS:

Overall weight of the vehicle: 110 kgs(approx.)

Load Carrying Capacity of the 48v 1Kw BLDC Motor: 500kgs

Range calculation of Battery with the help of Motor spec:

(Note: the spec of our motor is 48v 1000w BLDC motor)

Power = voltage x current

(Note: 1Kw = 1000 Watt)

1000w = 48v x current

Current = 1000/48

Current = 20.83 amps

Current = 20 Amps

Power Calculation

The power required to run

1000w motor for 1-hour

1000*1 = 1000watt hour

Efficiency for 80%

(1000/0.8) = 1250WattHour (wh)

Power = 1250 watthour

Battery Calculation

Conversion of watt hour of battery into ampere of

batteryPower = voltage * current

Watt hour = voltage * ampere

hour1250 = 48 * Ampere Hour

(AH)

$$Ah = 1250/48$$

$$Ah = 26.041$$

Ampere hour = 26 Ah

Range: The distance covered by the vehicle in 48v 26ah battery is 52km.

(Note: 1Ah battery can cover up to 2kms in distance, so (1Ah = 2kms))

Solution: To run 1000w motor for 1 hour we need – **48v 26Ah Battery.**

5.1.2 CALCULATION FOR FINDING RESISTANCE FOR ADS1115

$$V_{IN} = 48v$$

$$V_{OUT} = 3.3v$$

We rearrange the formula:

$$R_2 = (V_{in} - V_{out}) / V_{out} \times R_1$$

$$R_2 = 3.3 / (48 - 3.3) \times R_1$$

$$R_2 = (3.3/44.7) \times R_1$$

$$R_2 = 0.0220 \times R_1$$

Now, let's say we choose R1=10kΩ:

$$R_2 = 0.0220 \times 10000$$

$$R_2 = 220\Omega$$

Solution: To read 48v Battery and Dynamo we need **10k and 220k resistor**

The outcomes of our project, includes a dual-battery setup and a liquid cooling system, can have a significant impact on the electric vehicle (EV) industry and sustainable transportation as a whole.

5.1.3 Extended Electric Vehicle Range: The extension of the electric vehicle's range. By implementing self-charging capabilities, making electric vehicle's more practical for longer trips and daily commuting.

5.1.4 Enhanced Energy Efficiency: The project focuses on energy harvesting and advanced battery management can result in improved energy efficiency. This means the vehicle can make better use of available energy.

5.1.5 Improved Battery Performance: The dual-battery setup cooling system can contribute to better battery performance. This includes prolonging battery

lifespan, maintaining stable temperature conditions and optimizing charging and discharging cycles.

5.1.6 Innovation in EV Technology: The innovative approach to energy harvesting, battery management and cooling system can contribute to advancements in electric vehicle technology. It may inspire further research and development in these areas.

By addressing critical challenges in electric vehicle technology, our research project strives to shape a more sustainable and efficient future in transportation. These research outcomes collectively contribute to the ongoing refinement of EVs, rendering them more accessible, dependable, and environmentally conscious. This research paper aims to comprehensively elucidate these findings and their implications for the broader field of electric vehicle technology and sustainable transportation.

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 SUMMARY

The project addresses the limitations of electric vehicles (EVs) concerning their range and dependency on external charging infrastructure. By integrating a dual-battery system and energy regenerative technology, it aims to revolutionize the EV industry by enabling energy regeneration during operation. EVs have emerged as a sustainable and cost-effective alternative to traditional vehicles, but concerns about range and charging infrastructure persist. This project introduces a novel approach that optimizes energy management and extends the EV's range. The core concept involves implementing two batteries, Battery A and Battery B, along with alternators to harness kinetic energy while riding. When one battery discharges, the other is charged simultaneously through an alternator, ensuring continuous power availability. The alternators generate AC current, which is rectified and converted into DC current to charge the batteries. A copper pipe-based cooling system is integrated to maintain optimal battery temperature during various riding conditions, addressing overheating and thermal management challenges in EVs. A unique feature of the project is the incorporation of alternators to harvest energy from the vehicle's motion, with mechanisms displayed for user understanding. This innovative approach has the potential to revolutionize EV design and contribute to more convenient and eco-friendly transportation options in the future.

6.2 CONCLUSION

The Integrated Energy Regenerative System for Electric Two-wheeler Charging using a Belt-driven Motor with a Cooling System is a significant step towards sustainable transportation and energy efficiency. Through this project, we have successfully developed a system that not only powers electric two-wheelers but also produce energy during dynamic state, reducing overall energy consumption. The incorporation of a cooling system ensures that the system operates efficiently, enhancing its longevity and reliability. The project presents a promising solution to the challenges faced by electric vehicles, offering a dual-battery system coupled with energy regeneration

technology. By effectively managing energy and extending the EV's range, it addresses concerns regarding range anxiety and charging infrastructure dependence. The integration of alternators for energy harvesting during motion enhances the sustainability and efficiency of EVs. While the project demonstrates significant potential, further testing and optimization are necessary to validate its performance and scalability. Additionally, considerations for mass production and commercialization need to be explored to realize widespread adoption. Overall, the project signifies a step forward in the evolution of electric vehicle technology, promising a more sustainable and accessible transportation future.

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APPENDIX:

 **SRI SWAMY ELECTRONICS**
1/155, Senthurpuram, Main Road, Kattupakkam, Chennai - 600 056.
Pager: 9632 735173
Off: 4768767
Fax: 4995395

No. 175 Date 9/10/23

RECEIPT

RECEIVED with thanks from M/s. Bhagath / (48V/20Ah Perismatic)
Ala 22 Kamaraj high road maslakadai (2 nos)

the sum of Rupees 15000/- (Gpay)
Fifteenth thousands only

for the value of Bill No. _____ Date _____

by Cheque No. _____ Date _____ Bank Gpay

Signature H. Magesh

Rs. 15000/-

2023.10.09 17:21

 **VIT[®]** **MISCELLANEOUS FEE RECEIPT**

No. 55735 Date 12-12-23

Received with thanks from Mr./Ms./Dr./M/s. Bharath kumar S
of Sathyabama institute of science and technology

a sum of Rs. 1500 /- (Rupees one thousand five hundred Rupees only)

towards IConACES-IN Delegates-Online

by Cash / DD No. _____ Date 12-12-23 Amount _____

Bank _____

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This is an electronically generated Receipt.
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No. 49623

Date. 04-10-23

Received with thanks from Mr./Ms./Dr./M/s. Bhagvath agrawal

of Sathyabama Institute of Science and Technology

a sum of Rs. 1000 /- (Rupees one thousand Rupees only)

towards

RIACT 23-Presentation

by Cash / DD No. Date 04-10-23 Amount

Bank

Place

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₹2,000.00

Paid to ENGINEERING SKILL
DEVELOPMENT

Banking name: ENGINEERING SKILL DEVELOPMENT

December 18, 2023 4:02 PM

UPI transaction ID: 371840914856

K.Munuswamy kaliyappan

✓ Banking name: MUNUSWAMY K

+91 70100 33498

Joined October 2019

Oct 31, 2023 12:34 PM

Payment to K.Munuswamy

₹10,000

✓ Paid • Oct 31, 2023



Scratch card

Expired



Nov 2, 2023 2:39 PM

Payment to K.Munuswamy

₹4,000

✓ Paid • Nov 2, 2023





ELECTRONICSCOMP.COM
ONLINE ELECTRONICS & ROBOTICS COMPONENTS STORE

Invoice #3060648

Order Details	
ElectronicsComp.com Constflick Technologies Limited Building No. 54, 5th Floor, SVP Arcade A Block, Lalbagh Main Road, Next to Passport Office Sudhama Nagar, Bangalore, Karnataka - 560027 India. Customer Support - care@electronicscomp.com Telephone +91-9008032648 E-Mail care@electronicscomp.com Web Site: https://www.electronicscomp.com	Date Added 01/09/2023 Invoice No.: INV/23-24/43175 Order ID: 3060648 Payment Method Cash On Delivery Shipping Method Free Shipping GSTIN No.: 29AAGCC1645N1ZA

Billing Address	Shipping Address
bharath kumar C309,C-block,miro casagrand,aadhanur road , Mannivakkam chennai-48 CHENNAI 600048 Tamil Nadu India Contact No. - 9840227252 Email. - bhagvath8826@gmail.com	bharath kumar C309,C-block,miro casagrand,aadhanur road , Mannivakkam chennai-48 CHENNAI 600048 Tamil Nadu India

Product	Model	HSN Code	Quantity	Unit Price	Tax	Total
ADS1115 16-Bit I2C ADC 4-Channel Programmable Gain Amplifier Module	EC-3214	85381010	3	Rs.209.00	IGST (18%)	Rs.627.00
Sub-Total						Rs.627.00
Free Shipping						Rs.0.00
Cash on Delivery Fee						Rs.35.00
IGST (18%)						Rs.119.16
Total						Rs.781.16

**ORDER # 197957**

CONFIRMED

AUGUST 30, 2023

Items Ordered

PRODUCT NAME	SKU	PRICE	QTY	SUBTOTAL
ESP32  display~5.0 Inch HMI Display 800x480 RGB TFT LCD Touch Screen Compatible with Arduino/LVGL Acrylic Case With Acrylic Case	DIS07050H	\$30.93	Ordered: 1	\$30.93

SUBTOTAL \$30.93

SHIPPING & HANDLING \$15.59

ESTIMATED TOTAL \$46.52

2859 3442

ORDER / ESTIMATE

MAJESTIC COMPUTRONIX

No. 27, Meeran Sahib Street, Mount Road, Anna Salai,
Chennai - 600 002 (Behind Casino Theatre /
Opp. to Malika Residency Business Class Hotel)

No. 041

Date 03/02/2024

M/s

Bhagvath

S. No.	ITEM DESCRIPTION	Qty.	Rate	Amount Rs. P.
1	ESP 32 Micro Controller	1	425	425/-
2	ADS 1115 Sensor	1	450	450/-
			TOTAL	875/-

For MAJESTIC COMPUTRONIX

T : 2859 3442

ORDER / ESTIMATE**MAJESTIC COMPUTRONIX**

No. 27, Meeran Sahib Street, Mount Road, Anna Salai.
 Chennai - 600 002. (Behind Casino Theatre /
 Opp. to Malika Residency Business Class Hotel)

No. 041

Date: 17/1/2024

M/s

Bhagvath.

S. No.	ITEM DESCRIPTION	Qty.	Rate	Amount Rs. P.
1	Esp32 Microcontroller	2		850/-
2.	Hall Sensor	2		190/-
	Jumper Wire N-M M-F	20		40/-
3.	Alligator Clips	200g		250/-
4	Exhaust Mini Fan	2		500/-
			TOTAL	1830/-

For MAJESTIC COMPUTRONIX

T : 2859 3442

ORDER / ESTIMATE**MAJESTIC COMPUTRONIX**

No. 27, Meeran Sahib Street, Mount Road, Anna Salai.
 Chennai - 600 002. (Behind Casino Theatre /
 Opp. to Mallika Residency Business Class Hotel)

No. 041

Date: 12/1/24

M/s.

Bhagvath

S. No.	ITEM DESCRIPTION	Qty.	Rate	Amount Rs. P.
1.	40v Dynamo.	1		1200 1200
2.	Dot Board.	2		100
3.	Relay.	1		95
TOTAL				1995/-

For MAJESTIC COMPUTRONIX

[Signature]

2859 3442

ORDER / ESTIMATE

MAJESTIC COMPUTRONIX

No 27, Meeran Sahib Street, Mount Road, Anna Salai,
Chennai - 600 002. (Behind Casino Theatre /
Opp to Mallika Residency Business Class Hotel)

No. 041

Date 20/12/23

M/s Bhagvath

S. No.	ITEM DESCRIPTION	Qty.	Rate	Amount Rs. P.
1	E-Bike Charger.	1		1200/-
2	Male Plug			80/-
3	Capacity Disphy			450/-
4	10K resistor	10		10/-
5	220K resistor	10		15/-
6	Schokky diode	5		150/-
			TOTAL	1900/-

For MAJESTIC COMPUTRONIX

☎ : 2859 3442

ORDER / ESTIMATE

MAJESTIC COMPUTRONIX

No. 27, Meeran Sahib Street, Mount Road, Anna Salai,
Chennai - 600 002 (Behind Casino Theatre /
Opp. to Mallika Residency Business Class Hotel)

No. **041**

Date: **09/11/23**

M/s

S. No.	ITEM DESCRIPTION	Qty.	Rate	Amount Rs. P.
1	Wires & Tags			550/-
2	DHT22 Sensor	1		350/-
3	Heat Sink.			50/-
TOTAL				950/-

For MAJESTIC COMPUTRONIX

T 2859 3442

ORDER / ESTIMATE**MAJESTIC COMPUTRONIX**

No. 27, Meeran Sahib Street, Mount Road, Anna Salai,
Chennai - 600 002. (Behind Casino Theatre /
Opp. to Malika Residency Business Class Hotel)

No. 041

Date: 19/11/2024

M/s.

Bhagath

S. No.	ITEM DESCRIPTION	Qty.	Rate	Amount Rs.	P.
1	H/Sleeve	6mb	60	60/-	
2.	48/12v Converter	1	550	550/-	
3	3pin Connector	1	20	20/-	
4.	Cups Big.	10	8	80/-	
5.	Cup. Small	7	5	35/-	
			TOTAL	745/-	

For MAJESTIC COMPUTRONIX

T : 2859 3442

ORDER / ESTIMATE**MAJESTIC COMPUTRONIX**

No. 27, Meeran Sahib Street, Mount Road, Anna Salai,
Chennai - 600 002 (Behind Casino Theatre /
Opp to Mallika Residency Business Class Hotel)

No. 041

Date: 22/9/2023

M/s.

Bhagath

S. No.	ITEM DESCRIPTION	Qty.	Rate	Amount Rs.	P.
1.	48v 1Kw Blde Motor KH	1	11000	11000/-	
Paid					
TOTAL				11000/-	

For MAJESTIC COMPUTRONIX

PROJECT CERTIFICATES:

1. VIT RIACT 2023 CONFERENCE CERTIFICATES:





2. JCT 2023 PUBLICATION CERTIFICATES:





3. VIT ICONACES 2023 CERTIFICATES:





VIT[®]
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI



Certificate of Presentation

This is to certify that Dr./Mr./Ms..... *R. Bhagvath Agrawal* of
..... *Sathyabama Institute of Science and Technology* has
participated and presented a paper titled..... *Integrated Energy Regenerative*
..... *System For Electric Two Wheeler Charging Using Belt Driven Motor With Cooling System*

in the One Day International Conference on “**Applications in Computational Engineering and Sciences (IConACES 2023)**” organized by the School of Mechanical Engineering (SMEC), Vellore Institute of Technology Chennai, and Universiti Tenaga Nasional, Malaysia on 15th December, 2023.

M. Sreekanth

Dr. Joseph Daniel

Dr. S. Jeyanthi

Dr. M.N.M. Ansari

Dr. K. Annamalai

Dr. V. S. Kanchana Bhaaskaran

Dr. M. Sreekanth / Dr. Joseph Daniel / Dr. S. Jeyanthi / Dr. M.N.M. Ansari / Dr. K. Annamalai / Dr. V. S. Kanchana Bhaaskaran

Conference Chair's

Dean, SMEC

Pro-Vice Chancellor

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