A

PROJECT REPORT

ON

"DESIGN OF SELF CHARGING ELECTRIC VEHICLE USING SOLAR AND WIND POWER"

SUBMITTED BY

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SAVITRIBAI PHULE PUNE UNIVERSITY

2021-2022

Dissertation Approval Sheet

This is to certify that the project work titled **"DESIGN OF SELF CHARGING ELECTRIC VEHICLE USING SOLAR AND WIND POWER"**, has been submitted in partial fulfillment of the Bachelor's degree in Electronics Engineering during the academic year of 2021-2022 by following students:

- HRUGVED MANBHEKAR B150133832

This project confirms to the standards laid down by the Savirtibai Phule Pune University and has been completed in satisfactory manner as a partial fulfillment for the Bachelor's degree in Electronics Engineering.

External Examiner	Internal Guide	Head of Department
	(Prof. R.R.Khinde)	(Prof. Dr.D.M.Chandwadkar)

ABSTRACT

To shift from Conventional Vehicles to Electric Vehicle, more charging time is very important factor. So, recharging Electric Vehicle while driving increases its efficiency. Nowadays, Solar and Wind Energy are wasted in Electric Vehicle while driving. Thus, using this energy to recharge the battery is one of the good solution for it. For this we are going to use Solar panel, Wind turbines, BLDC motors, Recharge-able batteries, Arduino/Microcontroller, Inverter, Rectifier, over charging avoiding circuits, wheels, vehicle's structure. The working, While the Electric Vehicle starts moving with power motor placed at the rear part, the generator motor generates the power with the moving wheels. At the same time wind mills and solar panel generates the power to boost recharging. When the battery is completely charged the power from other generators is cut using Microcontroller programming. This Technology can also be applied to 3 wheelers and 4 wheelers, commercial vehicle and also in trains. The moto of this project is to make Electric Vehicle self-sufficient in charging it, using Wind and Solar Power.

ACKNOWLEDGEMENT

I would like to express my deep gratitude to **Prof. R.R.KHINDE** Sir for his patient guidance, enthusiastic involvement and useful critiques of this project work. My grateful thanks extends to him for his advice and assistance in keeping our progress on schedule right from project synopsis to project report. I'm very much thankful to him for encouraging us to acquire knowledge of LaTeX system, which is a document preparation system for high-quality typesetting.

I would also like to extend our thanks to the technicians of the laboratory of the E&TC department for their help in offering us the resources in running the program.

Hrugved Manbhekar

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CHAPTER 1

INTRODUCTION

1 INTRODUCTION

1.1 Introduction

The electric vehicles are the future of the transport sector. The trains and some other vehicles are electrified. But charging and powering them is a big task. To make the problem easier the idea of self charging EV has been proposed.

1.2 Need

Since long time, dependence on fossil fuel powered vehicles is largely increased, which leads to serious global hazards. To overcome this problem renewable and ecofriendly energy powering vehicles can be used. One of which is "Electic Vehicle". Here the phenomenon is charging the battery and power it. But frequent and long charging time makes it less fessible according to the time. To counter this we can make a self charging vehicle which gets recharged while moving using solar and wind power.

1.3 Targeted Community

The whole automobile industry is the target community of this project. If this project is applied in large scale then it will make a big revolution in the electric vehicle sector.

1.4 Scope

The Scope of the project is in the electric automobile industry and power (charging) industry.

1.5 Objective

To make Electric Vehicle self sufficient in charging it using Wind and Solar Power.

1.6 Gantt Chart

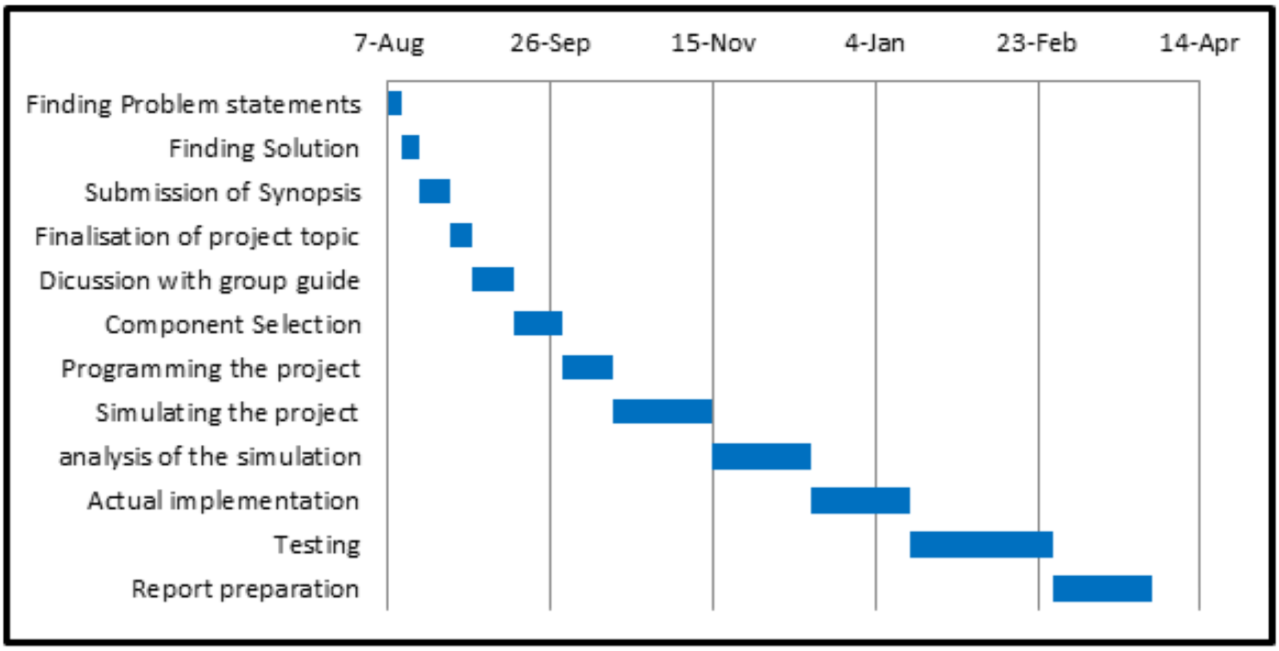

Figure 1.6.1: Gantt Chart

CHAPTER 2

LITERATURE SURVEY

2 LITERATURE SURVEY

2.1 Liturature Review

The Solar Wind Hybrid Electric Vehicle aims to develop an energy efficient, self-sustaining, wide-ranging ecofriendly vehicle having a feature of an automatic switching program to effectively utilize the power produced by the solar panel.[1]

In the past few years, because of the interest taken in the questions concerning energy consumption and green house effect, renewable energy has become a main concern. Among the different technologies used, wind energy is probably the one which has been developed with the more spectacular increase [1]. Because of their higher efficiency, fast running horizontal axis wind turbines (HAWT) are generally used, but the implementation costs and the necessity to reduce the return-on-investment time have consequently conducted developers to install wind turbine on selected sites where wind velocities are as high as possible. Most of these sites are now equipped and other solutions must be found.

Regarding the necessity of using smart grids for energy generation and use, it is clear that local production of electricity has become a necessity, notably on isolated sites and even near or on buildings [2]. In such configurations, not only the delivered power (linked to the efficiency) but also the produced energy must be considered. For example, small turbines running all the time should be preferred to higher ones which only work around nominal running points, generally at a high value of the wind velocity, very rare in such sites.

The Savonius rotor [3] or wind turbines derived from this concept are probably interesting solutions which can be found in miscellaneous geometries [4]. Savonius rotors are slow running vertical axis wind turbines (VAWT), i.e. their axis is perpendicular to the incident wind, and their high starting torque permits a running at low wind velocities; finally a main advantage of this is that the behavior does not depend on the wind direction.

However, Savonius rotors have two main disadvantages: their efficiency is rather poor and the flow around these machines is very unsteady. These two problems lead to the necessity to correctly predict their aerodynamic performances, which can be done either using numerical simulations (see ref. [5], [6] for example) or using specific experiments. But because of their financial cost, experiments are very difficult to hold and when they are decided, it is generally only for a given geometry. In such a context, an alternative flexible, economical experimental way to assess Savonius rotors is highly desirable.

The present study proposes a methodology and an experimental apparatus to predict the aerodynamic performances of slow running VAWTs. The idea is to use very small models (around 10 cm high) which are used in a subsonic wind tunnel. The interest of small models is the ease and speed of manufacture. Testing many models permits to choose the ones which have the most stationary behavior (which is important to minimize mechanical fatigue) and the higher aerodynamic efficiency. However, the use of such small models raises the problem to evaluate a low torque value, in a range where only scarce devices can be found and not totally appropriated to the described objective.

To overcome that situation, a mechatronic approach of the problem lead to the development of a simple specific apparatus, which consists in a VAWT linked to a DC motor used as a generator. The characteristics of the motor led to the determination of the mechanical torque on the axis of the turbine and consequently its aerodynamic performances.

The present paper presents the methodology to predict the aerodynamics performances of a slow running VAWT using experiments on small models in a specific wind tunnel. In the following the choice of a model is presented, then the apparatus and the experimental protocol are described. Consequently, experimental results are presented and interpreted before we conclude on the concept and the obtained results.

A rapid prototyping process was used to fabricate the small form wind turbine airfoil, a DC motor was used as a generator to evaluate the generated power and torque. The aerodynamic performance of the slow running vertical axis type wind turbine was evaluated experimentally.[2]

Conventional energy sources based on oil, coal, and natural gas have proven to be highly effective drivers of economic progress, but at the same time damaging to the environment and to human health [3]. Nowadays, Renewable energy technologies such as fuel cell and solar are gaining popularity for vehicle application. Not only these energy sources reduce gas in the cities, but they also reduce dependability on the fossil energy [1]. Renewable energies are sources considered as infinite since it can be recycled typically from natural resources found on earth–like solar, wind, and hydro power. Energy saving has been the major pursuit for many who are living in developed cities. In the present day, the most important part of modern living is electricity; we consume electricity to power our homes, offices, and to perform all our daily tasks. Energy conservation has now reached the transportation sector and it has become vital in decreasing the amount of energy we consume. The advent of vehicles with more fuel-efficient engines and the improvement of alternative energy sources have greatly contributed to the conservation of energy.

Since Energy consumption and CO2 emission of the road transport are the main issues amongst all impact [5], we develop a vehicle with a renewable source. PV-Wind-Battery-DG hybrid system is the most optimal solution regarding cost and emission among all various hybrid system combinations [2].

Furthermore, maximum power point tracking (MPPT) charge controller, instead of the typical PWM-based charge controller, was developed and integrated in the proposed vehicle to attain the maximum power from the solar panel during partial shading at lower and higher solar panel temperature [6]. With the maximum power tracked, a higher current and impedance/load match may be expected.

The output power of solar panel that decreased due to shading has been improved using bypass diode method. The placement of bypass diodes increased the output current and power.[3]

The need for renewable energy keep increasing [1] by time because the world is running out fossil fuels which were formed millions years ago. If renewable sources are used, the fossil fuels will last longer. The main fossil fuels are oil, natural gas and coal. Oil has some disadvantages such as generating corbon dioxide, causing acid rain and being not clean. Natural gas also has some problems like creating greenhouse gas emmision, being volatile and being dangerous if carelessly transported. Like oil and natural gas, coal creates harmful waste, acid rain and health problem for the miners. The renewable energy is a solution to decrese dependence on fossil energy [2]. There are many sources of renewable energy such as wind, solar and hydroelectricity. Being noisy, being unpredictable and disturbing television and radio signals are three of disadvantages of wind power. Hydroelectricity also has some minuses like disrupting ecosystems, being costly and requiring expensive construction material. Compared to other sources of renewable energy, solar energy is very promising [3] because it is clean [4], cheap, abundant [5], silent [6] and having no pollution. The solar energy is converted into electrical energy in order to be used in many appliances. A solar cell is an electronic device that use photovoltaic phenomenon to convert sunlight into electrical energy. The smallest building block of solar cell that can generate electricity is called a p-n junction. When packets of energy called photons hit the p-n junction, atoms in, for example, n type region will absorb a photon, so an electron and a hole will be dislodged. After that, a free electron and free hole will be created. These free electrons and holes will later generate current. Mono crystalline, poly crystalline and thin film solar cells are common types of solar cells available in the world. The main material for mono crystalline and poly crystalline solar cells is silicon which is commonly used in the semiconductor industry. Meanwhile, gallium diselenide, amorphous silicon and cadmium telluride are the common materials which are used to fabricate thin film solar cells. The higher efficiency compared to other type of aolar cells is the main advantage of mono crystalline solar cell. However, due to processes used to enhance the purity, monocrystalline solar cells are expensive compared to other types of solar cells. The highest efficiency of mono crystalline solar cells is around 17 pc-18 pc. There are many factors that can degrade the performance of the solar cell like high temperature, excessive radiation, sand, dust covering the surface of the solar cell and shading. The aim of this work is to improve the performance of solar cells using bypass diodes and blocking diodes.

This paper presents a combined experimental and computational study into the aerodynamics and performance of a small scale Vertical Axis Wind Turbine (VAWT)[4].

Wind tunnel performance results are presented for cases of different wind velocity, tip-speed ratio and solidity as well as rotor blade surface finish. It is shown experimentally that the surface roughness on the turbine rotor blades has a significant effect on performance. Below a critical wind speed (Reynolds number of 30,000) the performance of the turbine is degraded by a smooth rotor surface finish but above it, the turbine performance is enhanced by a smooth surface finish. Both two bladed and three bladed rotors were tested and a significant increase in performance coefficient is observed for the higher solidity rotors (three bladed rotors) over most of the operating range. Dynamic stalling behaviour and the resulting large and rapid changes in force coefficients and the rotor torque are shown to be the likely cause of changes to rotor pitch angle that occurred during early testing. This small change in pitch angle caused significant decreases in performance.

The performance coefficient predicted by the two dimensional computational model is significantly higher than that of the experimental and the three-dimensional CFD model. The predictions show that the presence of the over tip vortices in the 3D simulations is responsible for producing the large difference in efficiency compared to the 2D predictions. The dynamic behaviour of the over tip vortex as a rotor blade rotates through each revolution is also explored in the paper.

This paper focuses on a more economical, noiseless, emission free and uninterrupted alternate source of electric and hybrid self charging inverter.[5]

Aerosolar vehicles are powered by wind and sun/solar energy.[6]
Wind energy, solar energy, dynamo motors, solar array, alternators, DC motor.

CHAPTER 3

DESIGN METHODOLOGY

3 DESIGN METHODOLOGY

3.1 System Requirements and Specifications

Solar Panel - 10 Watt

This 10W solar panel is rigid with a metal frame. Superior durability over flexible panels. Great for portable or permanent installations. Can be used to charge any 12V battery, for example, those powering electric fence energizers, camping, recharging automotive batteries, etc. The panel can be purchased with a charge controller so it is safe for use in charging 12V batteries.

Specification

- Performance : Best in Class Efficiency 10.03p.c, Innovative cell technology ensures optimum solarpower generation providing high value for money upto16.5p.c.
- Enhanced Performance : Low - Light Performance, After 25 years, Loom Solar 10W is guaranteed at least 80
- Application : Perfect for charging Power Bank/Mobile/Small Battery upto 20AH
- Technology : Poly Crystalline Technology, PID Resistance Technology
- Dimension : (L*W*H) mm 285 x 350 x 22mm

Figure 3.1.2: Solar Panel 10W

Wind Turbine – 3 blades Vertical Axis

Specification

- Material: Plastic+Electrical components
- Color: White and Pink
- Output voltage : DC 0.01v - 5.5v
- Output current : 0.01 - 100mA
- Rated speed : 100 - 6000 rev/min
- Motor diameter : 24.5mm/0.96"(appr.)
- Motor height : 34.2mm/1.35"(appr.)
- Motor shaft diameter : 2mm/0.079"(appr.)
- Motor shaft length : 13.5mm/0.53"(appr.)
- Blade Size: (Dia.)X(H)10*7cm(after assembling)

Figure 3.1.3: Vertical Axis Wind Turbine

DC Motor

The 6V 250mA Brushed DC Motor is a standard '130 size' DC hobby motor. It comes with a wider operating range than most toy motors: from 4.5 to 9VDC instead of 1.5-4.5V. This range makes them perfect for controlling with an Adafruit Motor

Shield, or with an Arduino where you are more likely to have 5 or 9V available than a high current 3V setting. It will fit in most electronics that already have 130-size motors installed and there's two breadboard-friendly wires soldered on already for fast prototyping

Figure 3.1.4: DC Motor 6v

Microcontroller – PIC18F4550

This family of devices offers the advantages of all PIC18 microcontrollers – namely, high computational performance at an economical price – with the addition of high endurance, Enhanced Flash program memory. In addition to these features, the PIC18F2455/2550/4455/4550 family introduces design enhancements that make these microcontrollers a logical choice for many high-performance, power sensitive applications

Figure 3.1.5: Microcontroller PIC18F4550

BLDC Motor

A motor converts supplied electrical energy into mechanical energy. Various types of motors are in common use. Among these, brushless DC motors (BLDC) feature high efficiency and excellent controllability, and are widely used in many applications. The BLDC motor has power-saving advantages relative to other motor types.

Specification

- Frame size: 23 Frame
- Power (watt) 60W
- Current (Amp) 3A to 6A
- Torque 0.3 to 0.8 Nm
- Voltage range ±Variation (± 10pc) 12V or 24V or 48 V
- Speed (RPM) 1500 or 3000
- Motor poles 4Pole
- Hall Sensor Yes 3 hall sensors
- Mounting Flange
- Degree of protection IP 44
- Class of insulation F
- Ambient Temp. / Max Temp. 50° C / 70° C
- Duty / Rating S1/ continuous
- Direction of rotation Bi-directional
- Cooling Naturally Ventilated
- Shaft 12 Dia X 29 mm L
- Motor 65 mm diameter X 65 mm Length

Figure 3.1.6: BLDC Motor 60W

Battery

A lithium-ion battery is a family of rechargeable battery types in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. Lithium-ion batteries are common in consumer electronics. They are one of the most popular types of rechargeable battery for portable electronics, with one of the best energy-to-weight ratios, high open circuit voltage, low self-discharge rate, no memory effect and a slow loss of charge when not in use.

Specification

- Voltage: 12 Volt
- Battery Type: Lithium-Ion or Dry-Cell
- Capacity: 2.5Ah

Figure 3.1.7: Lithium-Ion Battery 12v, 2.5Ah

LM3914

The simplified LM3914 block diagram is to give the general idea of the circuit's operation. A high input impedance buffer operates with signals from ground to 12V, and is protected against reverse and overvoltage signals. The signal is then applied to a series of 10 comparators; each of which is biased to a different comparison level by the resistor string.

In the example illustrated, the resistor string is connected to the internal 1.25V reference voltage. In this case, for each 125mV that the input signal increases, a comparator will switch on another indicating LED. This resistor divider can be connected between any 2 voltages, providing that they are 1.5V below Vplus and no less than Vminus If an expanded scale meter display is desired, the total divider voltage can be as little as 200mV. Expanded-scale meter displays are more accurate and the segments light uniformly only if bar mode is used. At 50mV or more per step, dot mode is usable.

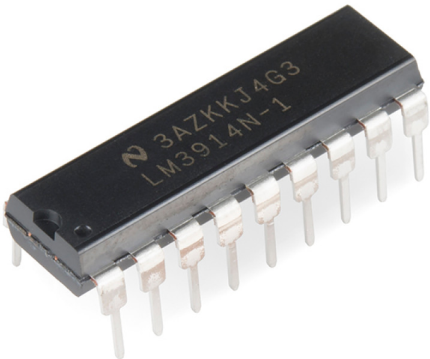

Figure 3.1.8: LM3914 IC

Buck Converter

The TPS40222 is a fixed-frequency, current-mode, non-synchronous buck converter optimized for applications powered by a 5-V distributed source. With internally determined operating frequency, soft-start time, and control loop compensation, the TPS40222 provides many features with a minimum of external components.
The TPS40222 operates at 1.25 MHz and supports up to 1.6-A output loads. The output voltage can be programmed to as low as 0.8 V. The TPS40222 utilizes pulse-by-pulse current limit as well as frequency foldback to protect the converter during a catastrophic short circuited output condition.

Figure 3.1.9: Buck Converter

3.2 Block Diagram and Description

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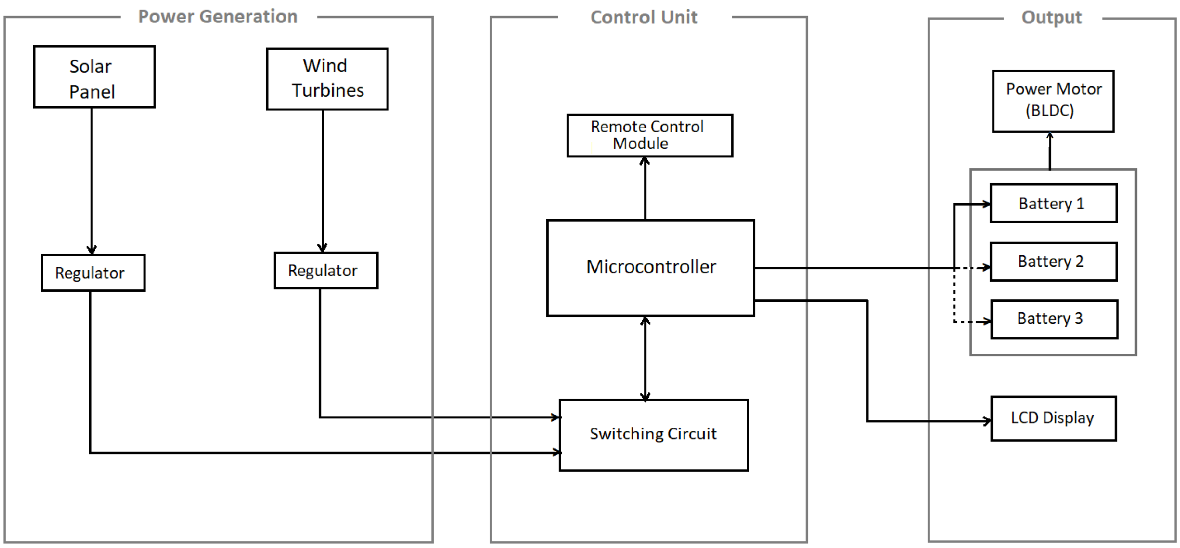

Figure 3.2.10: . Block diagram

Block Discription

The block diagram mainly consists of three blocks:-

- Power Generation Block
- Control Block
- Output Block

3.2.1 Power Generation Block

It consist of solar panel and vertical wind turbine as power generation. The regulators are used to regulate the voltage generated by both. The solar panel generates more power as compared to wind turbine. Hence solar panel recharges the battery at higher rate than wind turbine.

3.2.2 Control Block

This block contains remote control module, microcontroller and overcharging avoiding circuit. The remote control module is used to move the vehicle wirelessly. Microcontroller PIC24 is the heart of the vehicle, which controls the charging of the batteries. The overcharging avoiding circuit saves the battery from overcharging.

3.2.3 Output Block

The output block contains power motor(BLDC), battery and LCD display. The BLDC motor is used to drive the vehicle. The battery block has 3 batteries of same specifications. To connect a battery with the motor we used rotative switching technique. LCD displays the battery percentage.

3.3 Hardware Design

Hardware

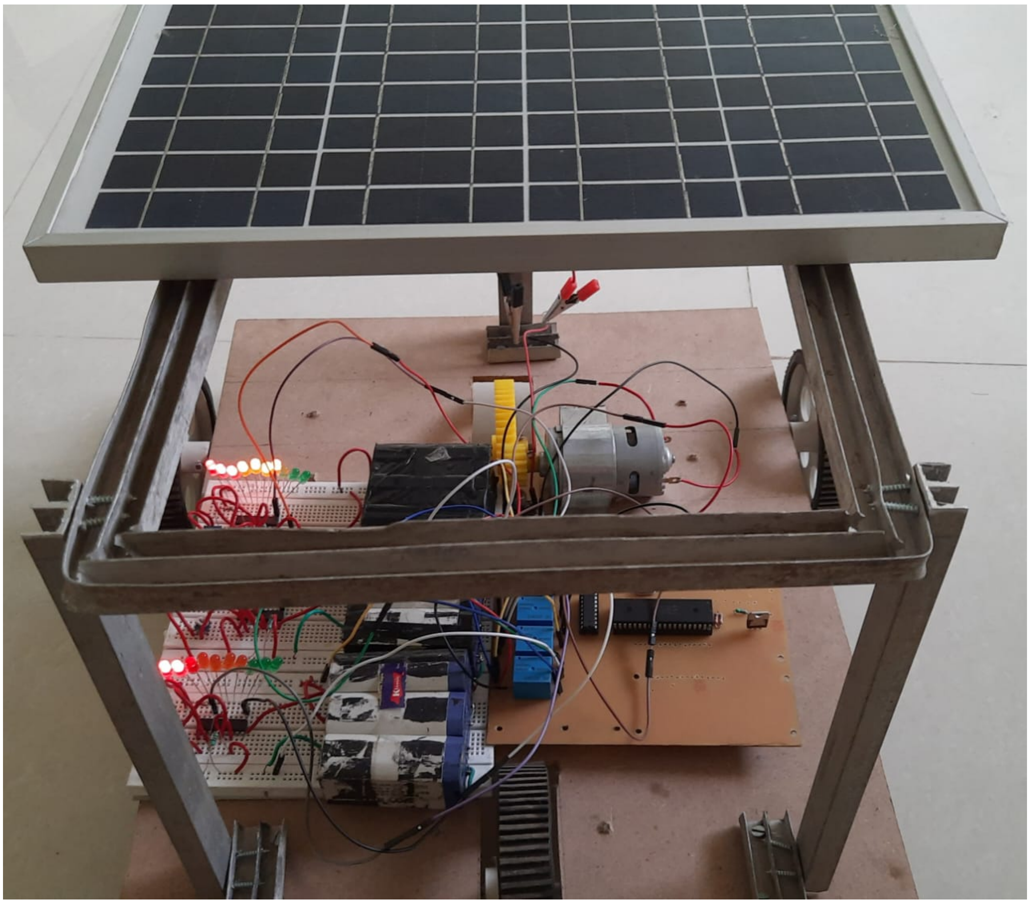

Figure 3.3.11: . Hardware

The above image show the hardware circuit of the project. Here three batteries are connected to switching circuit and are powering the motor. Also the discharged batteries are charged.

This 10W solar panel is rigid with a metal frame. Superior durability over flexible panels. Great for portable or permanent installations. Can be used to charge any 12V battery, for example, those powering electric fence energizers, camping, recharging automotive batteries, etc. The panel can be purchased with a charge controller so it is safe for use in charging 12V batteries.

Front View of EV

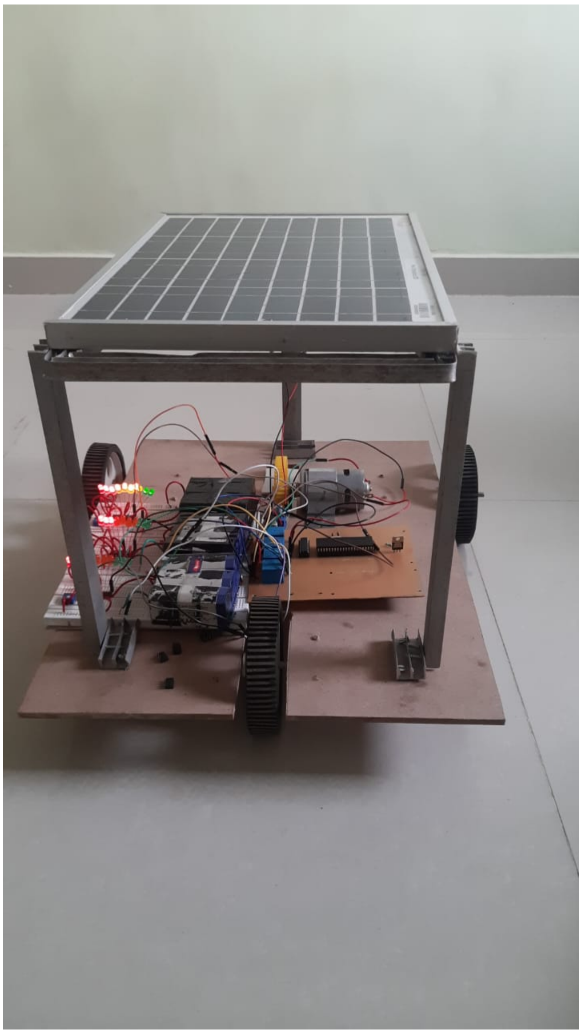

Figure 3.3.12: . Front View of EV

The above figure shows the front view of the electric vehicle.
A motor converts supplied electrical energy into mechanical energy. Various types of motors are in common use. Among these, brushless DC motors (BLDC) feature high efficiency and excellent controllability, and are widely used in many applications. The BLDC motor has power-saving advantages relative to other motor types.

Side View of EV

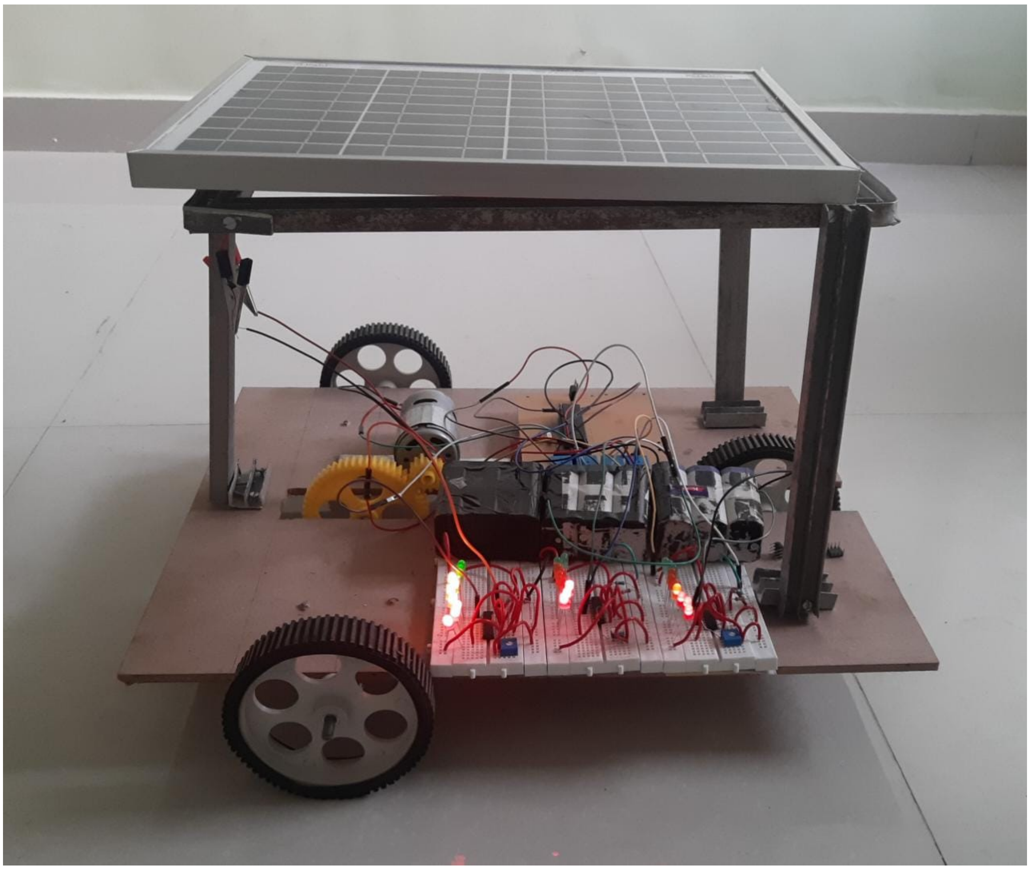

Figure 3.3.13: . Side View of EV

The above figure shows the side view of the electric vehicle.

Calculations

Mass of the vehicle=20Kg
Max. Velocity= 10m/s
Total force required for the vehicle F=6N
Total Power required P=F x V= 6 x 10= 60Watt
Therefore, the required battery is of 12V x 2.5A= 60Watt

3.4 Methodology

- Solar panel and wind turbine are used for charging the batteries with voltage regulators and rectifiers.
- Over charging of the batteries is avoided with the help of microcontroller and over charging avoiding circuit.
- The power motor gets a sufficient power from batteries using microcontroller for driving the vehicle.
- Remote controlled module is used for performing the movement of the vehicle.
- The LCD display will show the percentage of battery.
- Microcontroller will switch between the batteries according to their remaining percentages with the help of rotative switching technique.
- The rotative switching technique works with simple trick. Initially the BLDC motor is powered by 'Battery1'. When it discharges upto 40 percent, then the power from 'Battery1' is switched to 'Battery2' and the 'Battery1' starts charging from solar panel. The same process happens when 'Battery2' is discharged, but here solar panel charges 'Battery2' and 'Battery1' is charged with wind turbine. This process continues until the average percentage of all batteries come upto 10 percent.
- As the battery percentage is below 10 percent, it will initiate the alarm.

3.5 Software Design

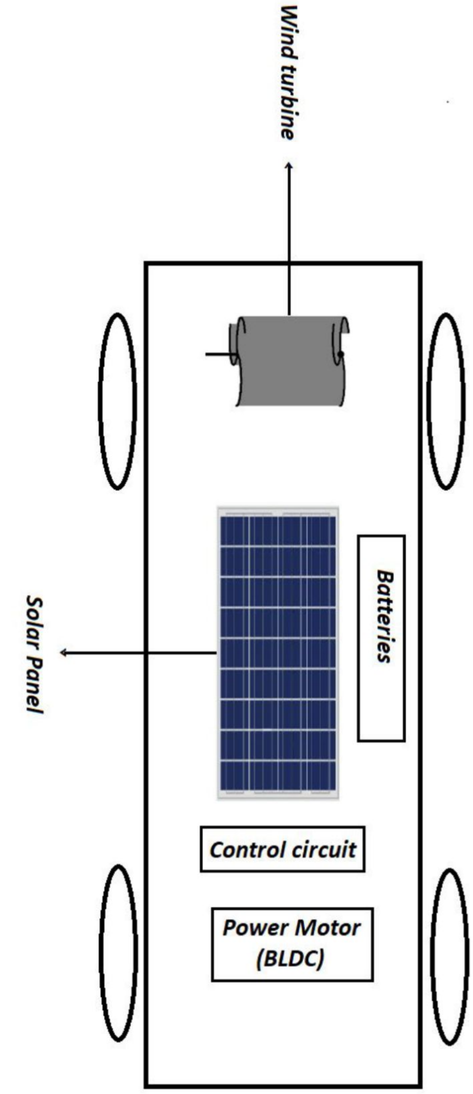

Figure 3.5.14: . Schematic Design

Figure 3.5.14 shows the annimated top view of the EV.

3.5.1 Modern Tools Used

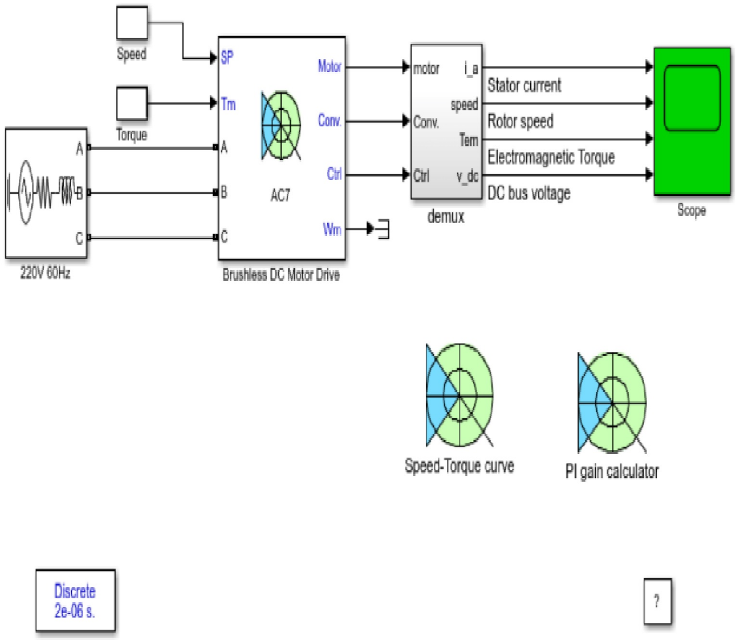

Figure 3.5.15: . Brushless DC Motor Drive During Speed Regulation

Figure 3.5.15 shows the simulation of BLDC motor driving in simulink.

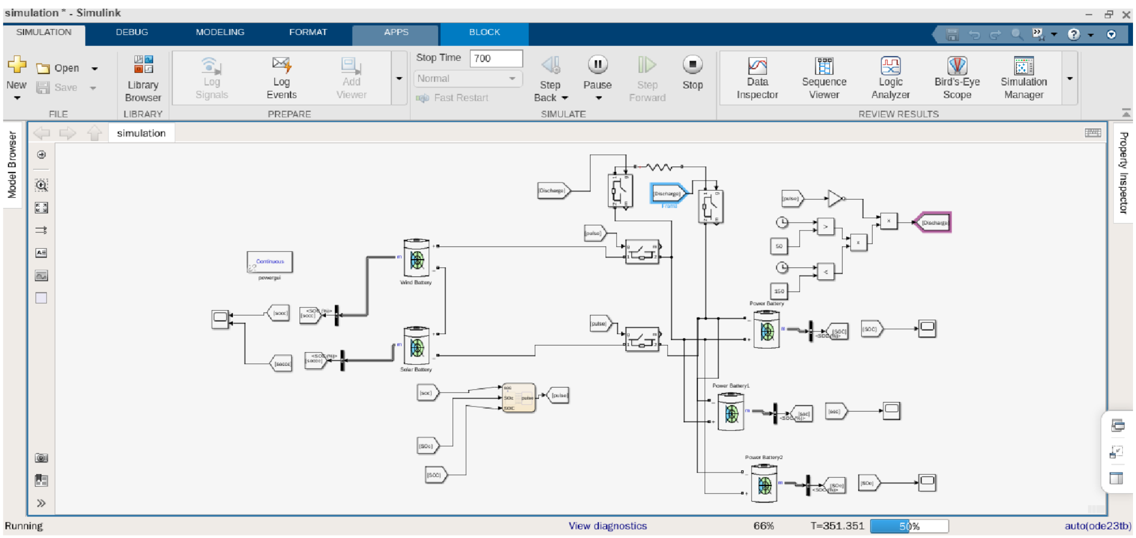

Figure 3.5.16: . Matlab Simulation

Figure 3.5.16 shows the simultaion of switching circuit in simulink.

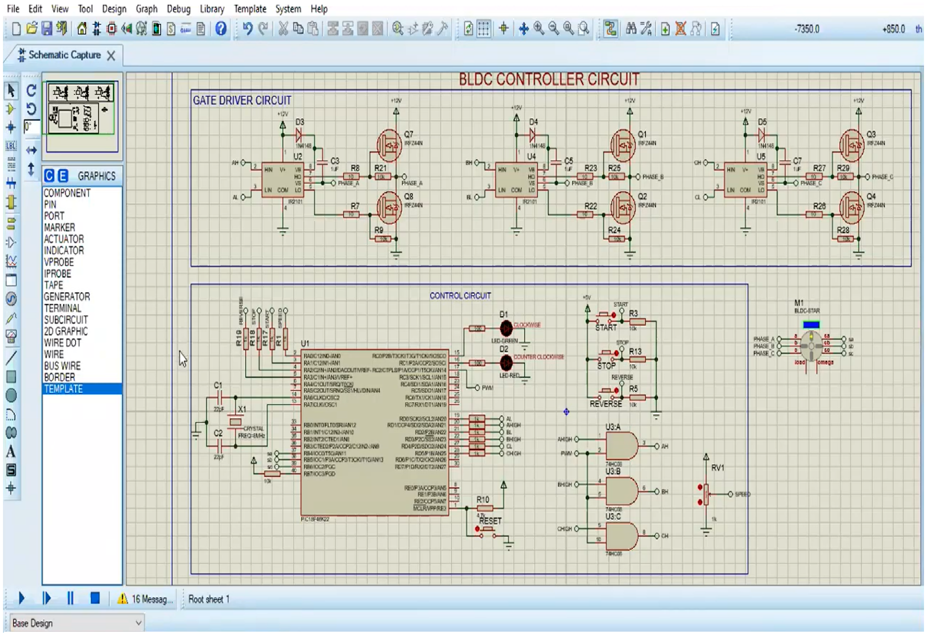

Figure 3.5.17: . BLDC Motor Driver Circuit

Figure 3.5.17 shows the BLDC motor driver circuit in proteus.

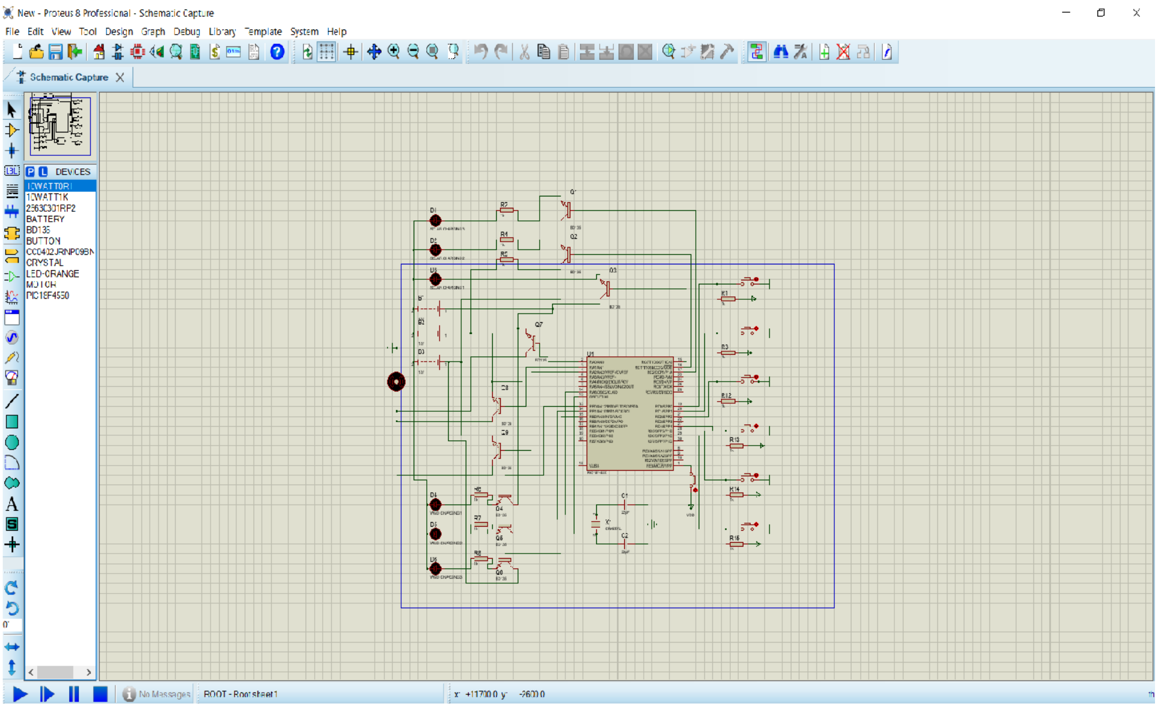

Figure 3.5.18: . Switching Circuit

Figure 3.5.18 shows the switching circuit in the proteus. This shows the solar charging battery, wind charging battery and the discharging battery, and also switches between them according to their battery percentage.

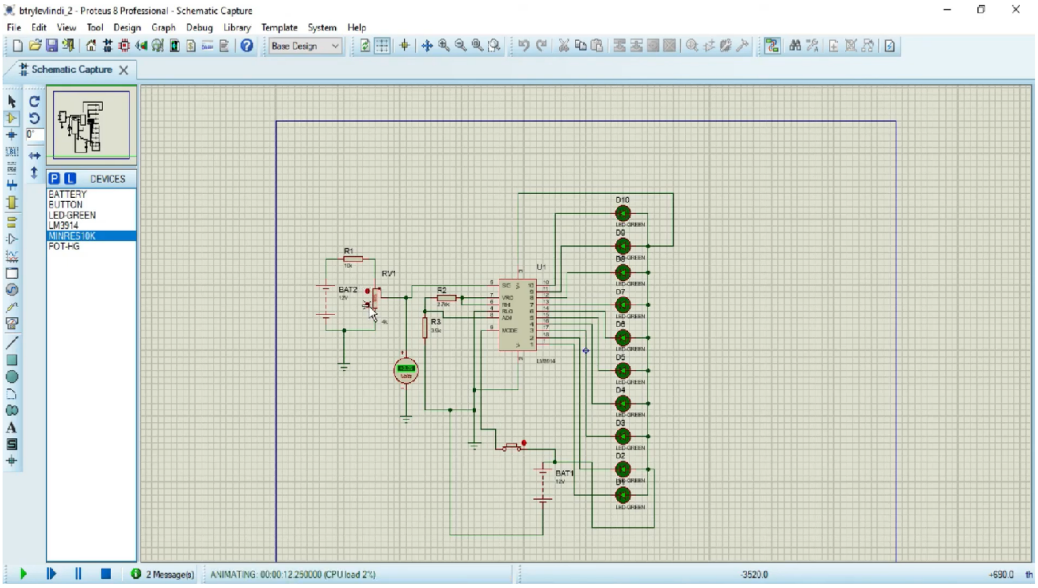

Figure 3.5.19: . Battery Level Indicator Circuit

Figure 3.5.19 shows the battery level indicator. It shows how much charge percentage is remaining in the battery. It has 10 LEDs that show 10percent battery each.

3.6 PCB

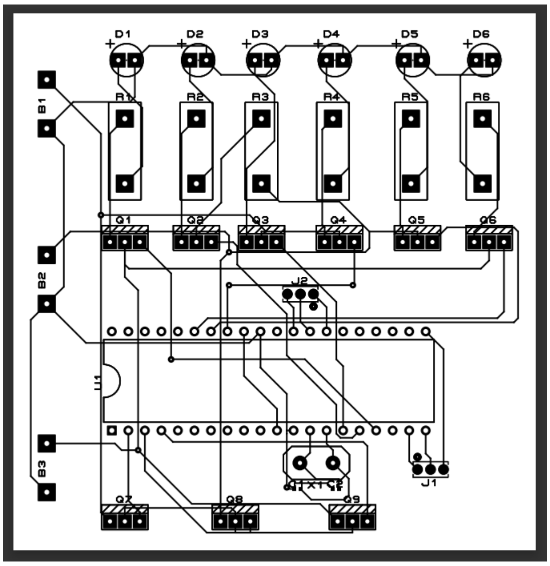

Figure 3.6.20: . PCB Layout

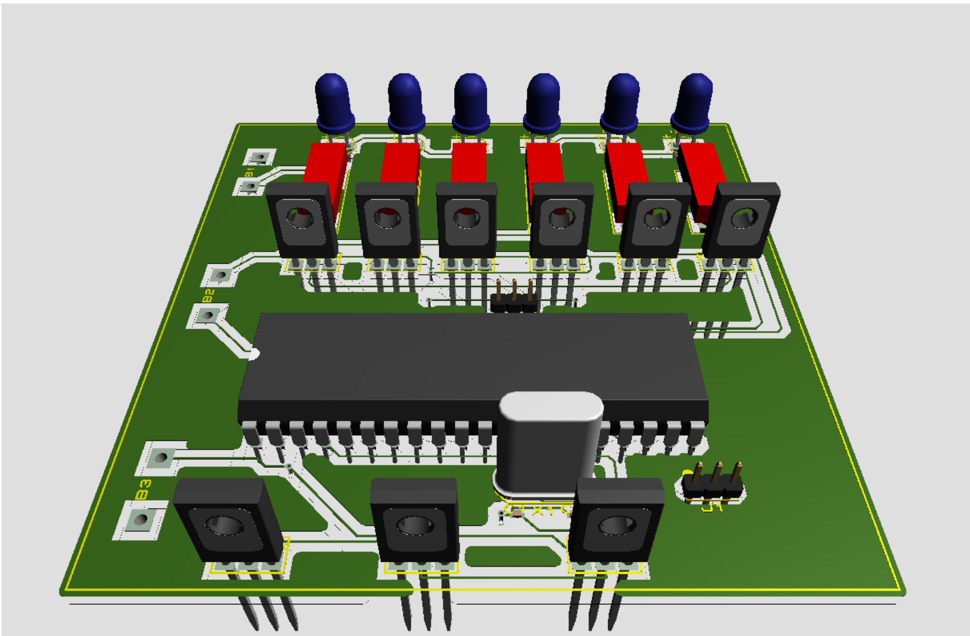

Figure 3.6.21: . 3D view PCB

CHAPTER 4

TEST PROCEDURES AND AND RESULTS

4 Test Procedure and Results

4.1 Simulation Results

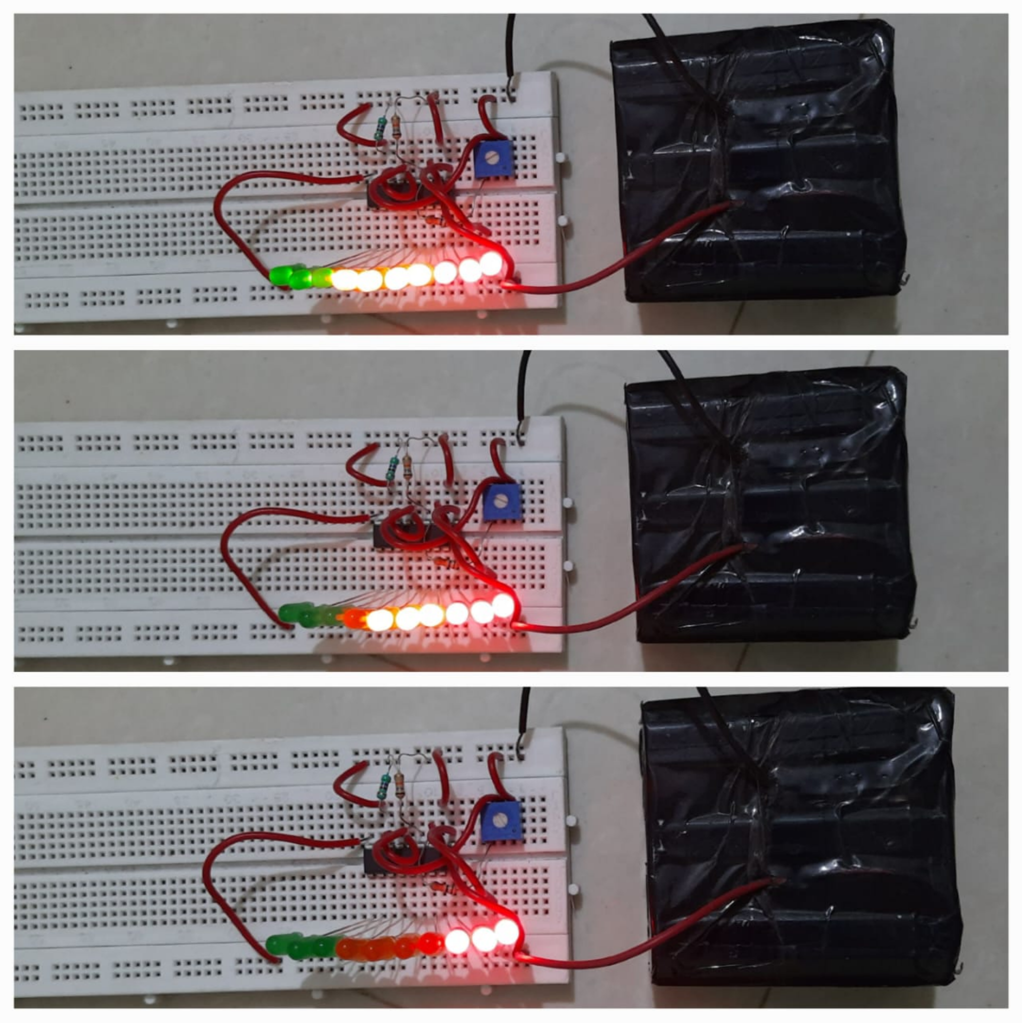

Figure 4.1.22: . Battery Level Indicator

The image shows the battery level indicator. Each LED shows 10pc charge. First image shows 100 pc battery charged. Second image shows 60 pc battery charged. Third image shows 30 pc battery charged.

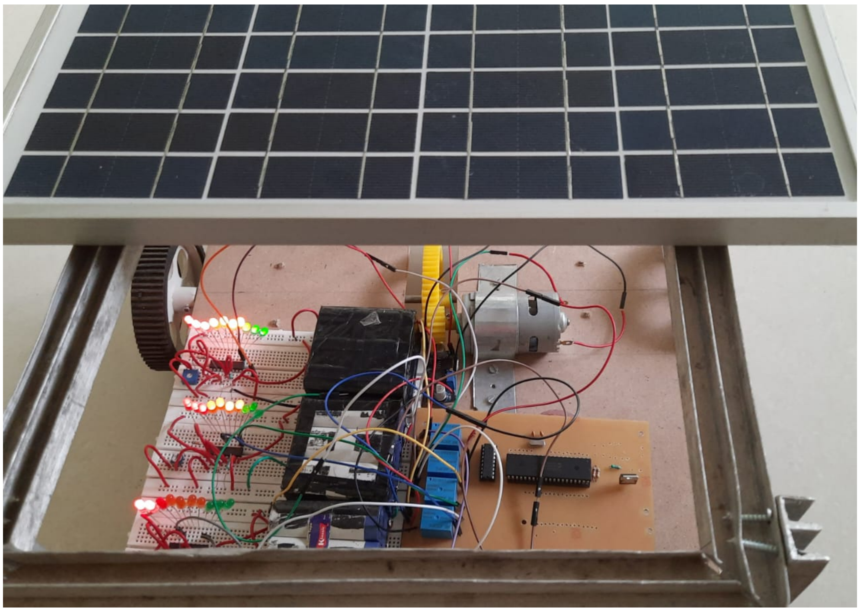

Figure 4.1.23: . Test Stage1

Here 1st battery is discharged and it has started charging. And 2nd battery started discharging.

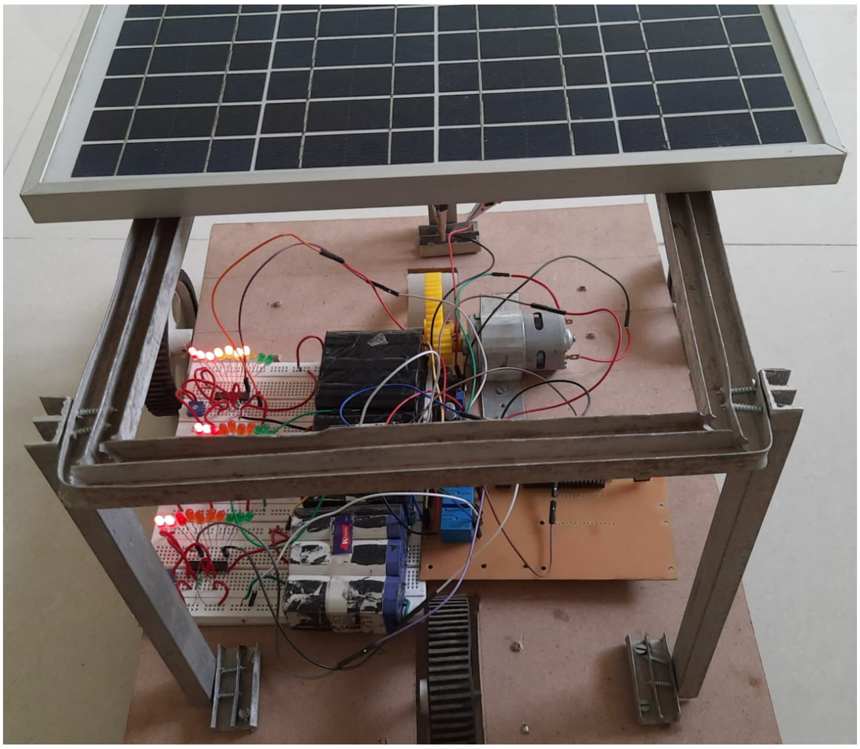

Figure 4.1.24: . Test Stage2

Here 2nd battery is discharged and it has started charging. And 3rd battery started discharging.

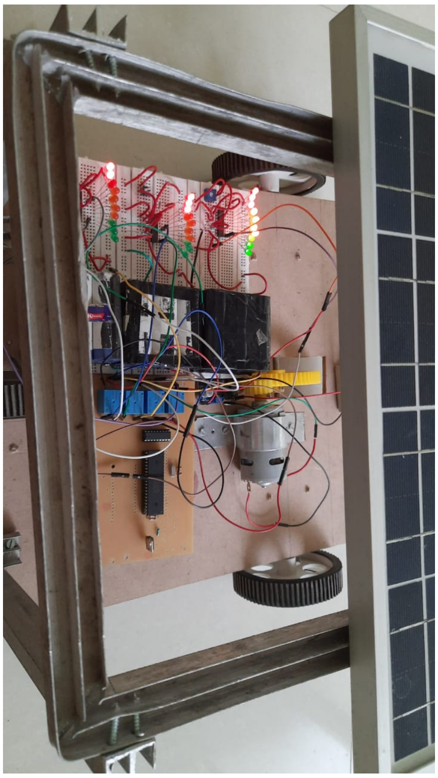

Figure 4.1.25: . Test Stage3

Here 3rd battery is discharged and it has started charging.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5 Conclusion and Future Scope

5.1 Conclusion

After completing the project "DESIGN OF SELF CHARGING ELECTRIC VEHICLE USING SOLAR AND WIND POWER" we found that this project can resolve many charging problems of electrical vehicles.

5.2 Future Scope

- Electric Vehicles are quieter, cleaner and cheaper to operate and maintain, and will last much longer than typical cars.
- In large scale of equipment would used in Electric Vehicles in future it is useful in various sector like gardening, tourism spot and driving.

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[3] Wind Tunnel and Numerical Study of a Small Vertical Axis Wind Turbine.Fadliondi, Haris Isyanto, Budiyanto/2018

https://www.sciencedirect.com/science/article/abs/pii /S0960148109003048?via

[4] Bypass Diodes for Improving Solar Pane Performance.Robert Howell, Ning Qin, Jonathan Edwards, Naveed Durrani/2010

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[5] Self Charging Electric Vehicle.G. H. Chore, K. R. Pandao, R. B. Mode, Y. P. Bagade/2016

[6] Design And Development of Aerosolar Car.P. A. Bhagat. P. R. Dharme ,P. B. Nikhade, A. L. Wadaskar/2015

APPENDIX A: Course Detail Sheet

Course Detail Sheet

Programme: 2015	Class: B.E(Electronics)						Sem. I&II	
Course Code: 404208 & 404215	Course Project Phase-I and Project Phase-II							
Course Teacher: Project Guides	Department: Electronics and Telecommunication Engineering							
Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory			Lab		
(hrs/ week)	(hrs/ week)	(hrs/ week)	~~Online~~/ Insem	Endsem	Sessional	Term Work	Practical	Oral
----	----	2+6 hrs	---	---	---	150	---	50+50

Abstract: By learning this subject students will be able to Identify complex problem and define the methodology to solve the problem. Construct, analyze and approach problem solution as a team, plan, and co-ordinate and control the complex and diverse activities in project. Design appropriately using a modular construction approach to solve the problem as per specifications and implement the selected methodology to solve the problem by selecting the correct hardware according to specifications and software for simulation and programming and develop leadership skills by aligning with the objective of the project and lead the team towards its goal

Prerequisite: All Subjects of Electronics Engineering

Delivery Methods (DM)

Chalk & Talk	ICT Tools	Group Discussion	Industrial/ Field Visit	Expert Talk	Survey	Mini project	Lab
--	√	--	--	--	√	--	--

Course Outcomes (COs)

Course Outcome	After successful completion of course students will be able to
CO404208.1& CO404215.1	Define, analyze and solve complex real life problem.
CO404208.2& CO404215.2	Work in collaborative team as a member or leader.
CO404208.3& CO404215.3	Apply project management techniques.
CO404208.4& CO404215.4	Identify and apply appropriate tools.
CO404208.5& CO404215.5	Communicate effectively in verbal and written form.
CO404208.6& CO404215.6	Imbibe ethical practices.

Learning objective for CO1 **Students will be able to:**	
1	Identify specification of the problem.
2	Structure the problem.
3	Identify the appropriate methodology to solve the problem.
4	Define the methodology to solve the problem.
Learning objective for CO2 **Students will be able to:**	
1	Adapt the vital skills of compromise and collaboration.
2	Construct , analyzes and approach problem solution as a team
3	Fully understand the role of each individual in a group to accomplish the goal.
4	Develop leadership skills by aligning with the objective of the project and lead the team towards its goal.
Learning objective for CO3 **Students will be able to**	
1	Plan, co-ordinate and control the complex and diverse activities in project
2	Predict any problems and find solution for it
3	Plan the progress to result in total completion of the project.
Learning objective for CO4 **Students will be able to**	
1	Design appropriately using a modular construction approach to solve the problem as per specifications.
2	Implement the selected methodology to solve the problem.
3	Select the correct hardware according to specifications.
4	Select the correct software for simulation and programming.
5	Validate the result and draw conclusion.
Learning objective for CO5 **Students will be able to**	
1	Present the work done by proper documentation
2	Present paper in national / international conferences, project exhibitions & competitions
Learning objective for CO6 **Students will**	
1	Develop professional practice.
2	Recognize how *to do the project to its best*.
3	Develop ethical Practices.

Mapping of Course Objectives to Course Outcomes:

Course Objective	Course Outcomes					
	1.	2.	3.	4.	5.	6.
C-I	•					
C-II		•				
C-III			•			
C-IV				•		
C-V					•	
C-VI						•

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. 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.
4. 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.
5. 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.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. 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.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. 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.
11. 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 multidisciplinary environments.
12. 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 (PSO):

1. Analyze and design electronic systems for hybrid engineering application.
2. Implement functional blocks of hardware, software or hardware-software co-design for electronics applications.

Mapping of Course Outcome (CO) with
Program Outcome (PO) and Program Specific Outcome (PSO)
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put **"-"**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO404208.1 & CO404215.1	3	3	3	3	-	-	2	-	-	-	-	-	3	3
CO404208.2 & CO404215.2	-	-	-	-	-	-	-	-	3	-	2	-	2	2
CO404208.3 & CO404215.3	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO404208.4 & CO404215.4	2	2	-	3	3	-	-	-	-	-	-	2	-	-
CO404208.5 & CO404215.5	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO404208.6 & CO404215.6	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Average	2.5	2.5	3	3	3	-	2	3	3	3	2.5	2	2.5	2.5

Course-PO matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
404208 & 404215	2.5	2.5	3	3	3	-	2	3	3	3	2.5	2	2.5	2.5

APPENDIX B: Circuit Schematic

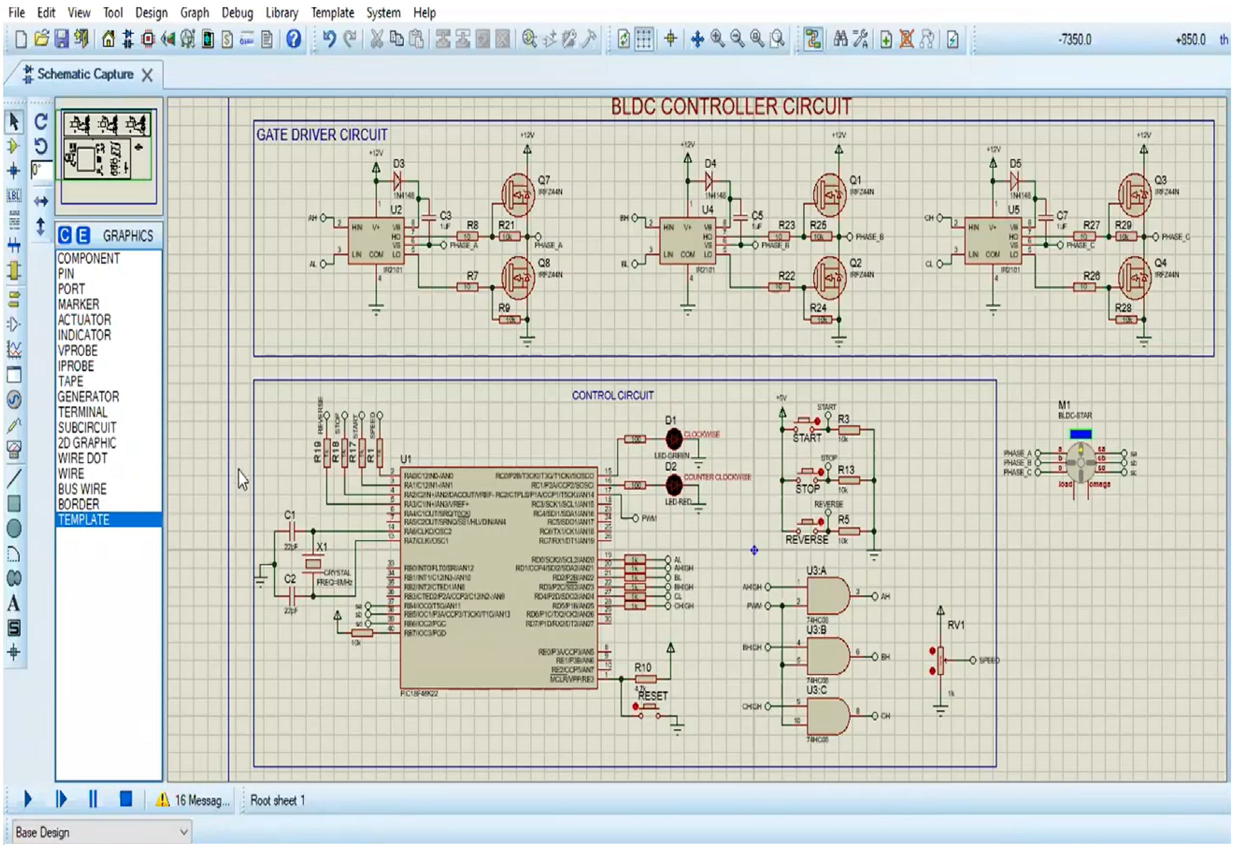


Figure 0.0.26: . BLDC Motor Driver Circuit

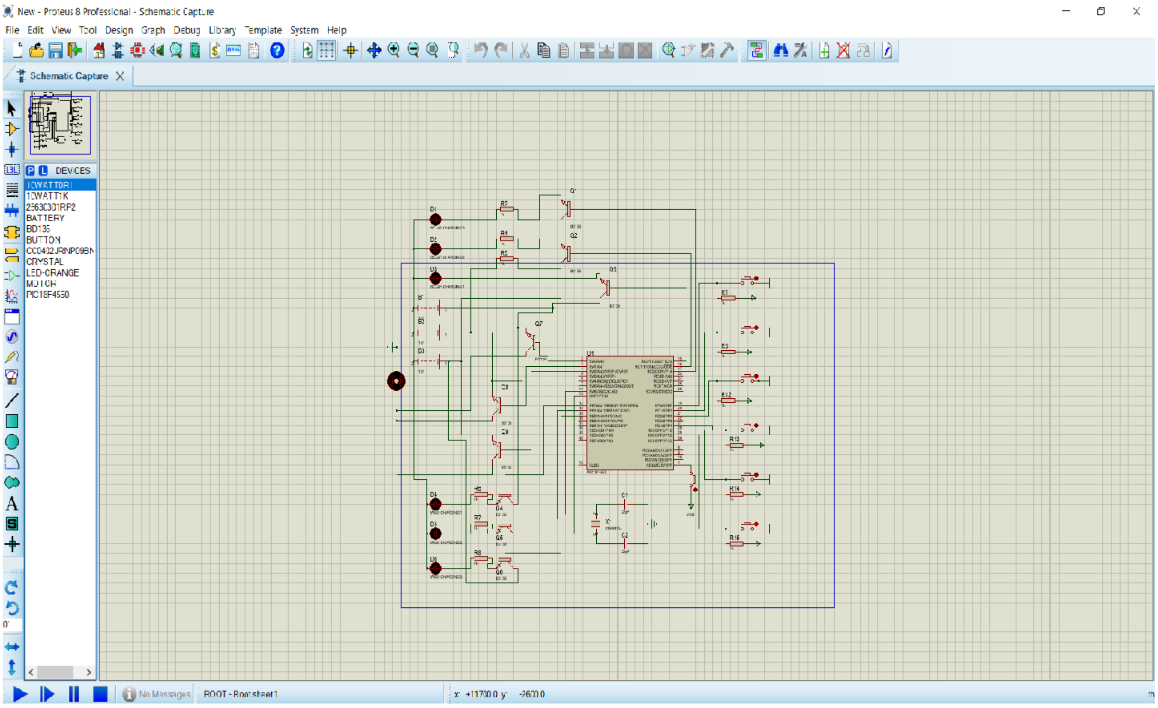


Figure 0.0.27: . Switching Circuit

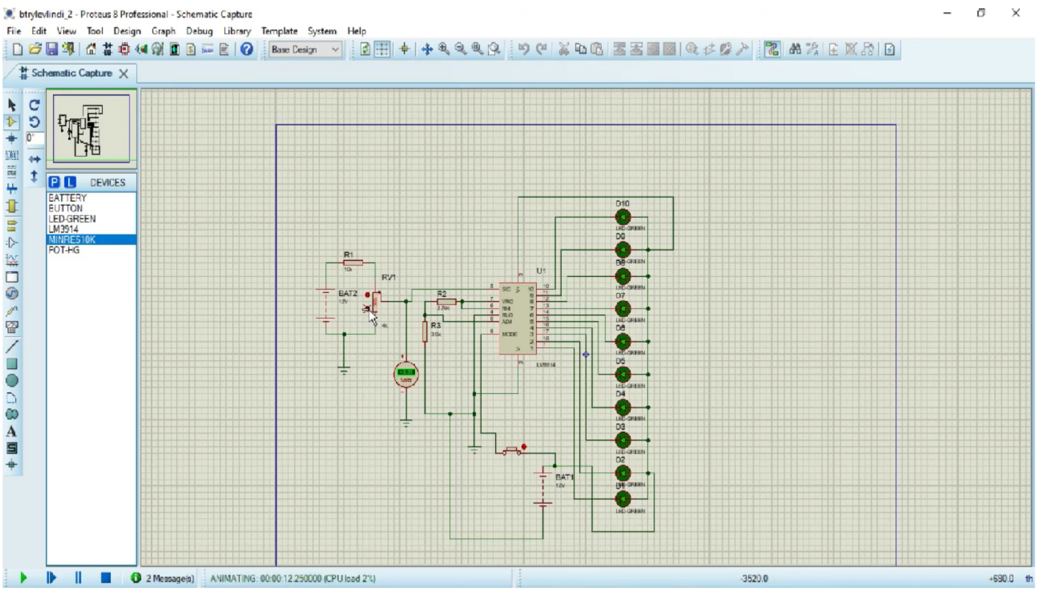


Figure 0.0.28: . Battery Level Indicator Circuit

APPENDIX C: Bill of Material

Sr No.	Components	Cost
1	PIC18F4550	550/-
2	Motors	800/-
3	Solar Panel	1000/-
4	Batteries	1800/-
5	PCB	500/-
6	IC LM3914	200/-
7	Opamp	50/-
8	Others	700/-
	Total	5600/-

Table 1: Bill of Materials

APPENDIX D: Certificate of Paper Presentation/Project Competition

K. K. WAGH EDUCATION SOCIETY'S

K. K. Wagh Institute of Engineering Education and Research

CERTIFICATE

OF PARTICIPATION

This is to certify that Mr./Ms. Hrugved Manbhekar of BE-Electronics had participated for the **Project Competition** in the event **Telekinesis**, organised by E&TC Department on May 5th, 2022 at K. K. Wagh Institute of Engineering Education and Research, Nashik.

Dr. S. A. Ugale (Patil)
UG Co-Ordinator
K.K.W.I.E.E.R., Nashik

Dr. D. M. Chandwadkar
Head of Department
K.K.W.I.E.E.R., Nashik

Dr. K. N. Nandurkar
Principal
K.K.W.I.E.E.R, Nashik

APPENDIX E: Report for Plagiarism Check

Plagiarism Certificate

This is to certify that the project work titled **"DESIGN OF SELF CHARGING ELECTRIC VEHICLE USING SOLAR AND WIND POWER"**, is a part of project work carried out by **"Hrugved Manbhekar"** under the guidance of **Prof R.R.Khinde** at K. K. Wagh Institute of Engineering Education and Research, Nashik, in the partial fulfillment of the requirements for Bachelor's degree in Electronics and Telecommunication Engineering.

To the best of our knowledge, the work included in this report is an original work carried out by us independently. The percentage of plagiarism is 6 percent. The results of the project work in part or whole have not been submitted to any other Institute/University for the award of any degree.

Hrugved Manbhekar
B.E. Electronics

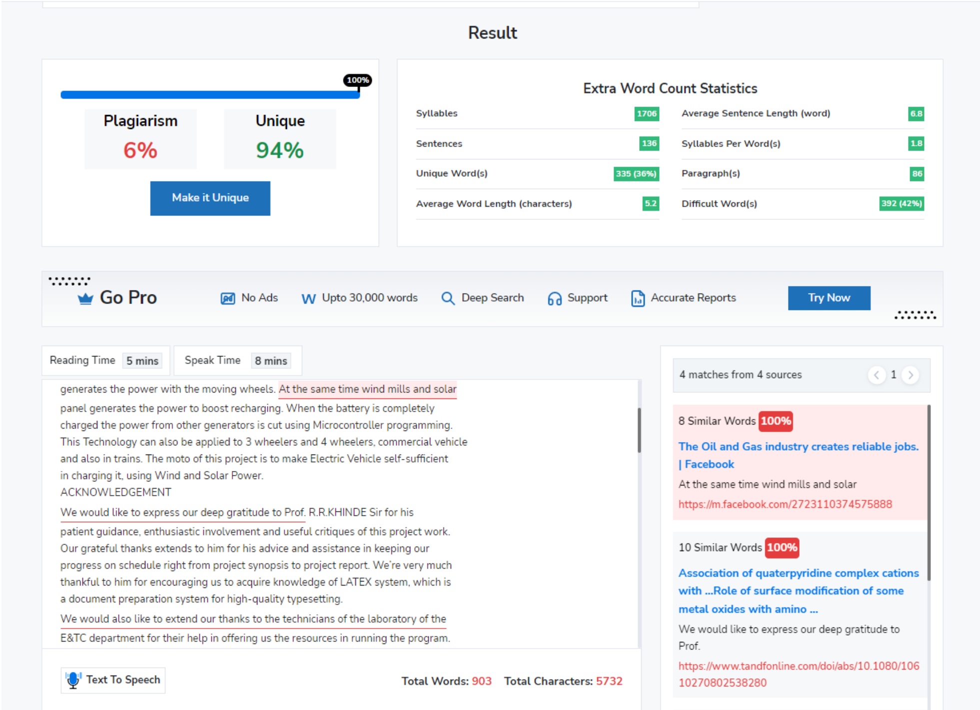


Figure 0.0.29: . Plagiarism Result

APPENDIX F: Data Sheets

PIC18F4550 Datasheet

MICROCHIP **PIC18F2455/2550/4455/4550**

28/40/44-Pin, High-Performance, Enhanced Flash, USB Microcontrollers with nanoWatt Technology

Universal Serial Bus Features:

- USB V2.0 Compliant
- Low Speed (1.5 Mb/s) and Full Speed (12 Mb/s)
- Supports Control, Interrupt, Isochronous and Bulk Transfers
- Supports up to 32 Endpoints (16 bidirectional)
- 1 Kbyte Dual Access RAM for USB
- On-Chip USB Transceiver with On-Chip Voltage Regulator
- Interface for Off-Chip USB Transceiver
- Streaming Parallel Port (SPP) for USB streaming transfers (40/44-pin devices only)

Power-Managed Modes:

- Run: CPU on, Peripherals on
- Idle: CPU off, Peripherals on
- Sleep: CPU off, Peripherals off
- Idle mode Currents Down to 5.8 μA Typical
- Sleep mode Currents Down to 0.1 μA Typical
- Timer1 Oscillator: 1.1 μA Typical, 32 kHz, 2V
- Watchdog Timer: 2.1 μA Typical
- Two-Speed Oscillator Start-up

Flexible Oscillator Structure:

- Four Crystal modes, including High-Precision PLL for USB
- Two External Clock modes, Up to 48 MHz
- Internal Oscillator Block:
  - 8 user-selectable frequencies, from 31 kHz to 8 MHz
  - User-tunable to compensate for frequency drift
- Secondary Oscillator using Timer1 @ 32 kHz
- Dual Oscillator Options allow Microcontroller and USB module to Run at Different Clock Speeds
- Fail-Safe Clock Monitor:
  - Allows for safe shutdown if any clock stops

Peripheral Highlights:

- High-Current Sink/Source: 25 mA/25 mA
- Three External Interrupts
- Four Timer modules (Timer0 to Timer3)
- Up to 2 Capture/Compare/PWM (CCP) modules:
  - Capture is 16-bit, max. resolution 5.2 ns ($T_{CY}/16$)
  - Compare is 16-bit, max. resolution 83.3 ns (T_{CY})
  - PWM output: PWM resolution is 1 to 10-bit
- Enhanced Capture/Compare/PWM (ECCP) module:
  - Multiple output modes
  - Selectable polarity
  - Programmable dead time
  - Auto-shutdown and auto-restart
- Enhanced USART module:
  - LIN bus support
- Master Synchronous Serial Port (MSSP) module Supporting 3-Wire SPI (all 4 modes) and I^2C™ Master and Slave modes
- 10-Bit, Up to 13-Channel Analog-to-Digital Converter (A/D) module with Programmable Acquisition Time
- Dual Analog Comparators with Input Multiplexing

Special Microcontroller Features:

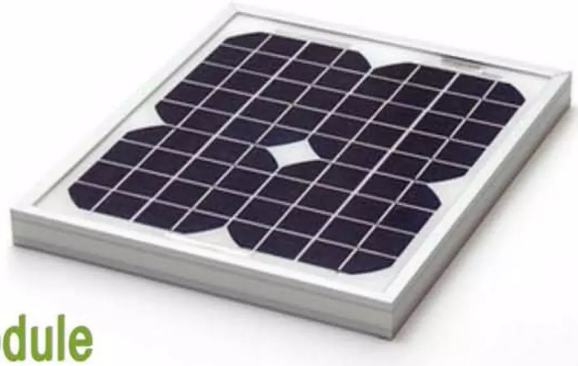
- C Compiler Optimized Architecture with Optional Extended Instruction Set
- 100,000 Erase/Write Cycle Enhanced Flash Program Memory Typical
- 1,000,000 Erase/Write Cycle Data EEPROM Memory Typical
- Flash/Data EEPROM Retention: > 40 Years
- Self-Programmable under Software Control
- Priority Levels for Interrupts
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 41 ms to 131s
- Programmable Code Protection
- Single-Supply 5V In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) via Two Pins
- Optional Dedicated ICD/ICSP Port (44-pin, TQFP package only)
- Wide Operating Voltage Range (2.0V to 5.5V)

Device	Program Memory		Data Memory		I/O	10-Bit A/D (ch)	CCP/ECCP (PWM)	SPP	MSSP		EUSART	Comparators	Timers 8/16-Bit
	Flash (bytes)	# Single-Word Instructions	SRAM (bytes)	EEPROM (bytes)					SPI	Master I^2C™			
PIC18F2455	24K	12288	2048	256	24	10	2/0	No	Y	Y	1	2	1/3
PIC18F2550	32K	16384	2048	256	24	10	2/0	No	Y	Y	1	2	1/3
PIC18F4455	24K	12288	2048	256	35	13	1/1	Yes	Y	Y	1	2	1/3
PIC18F4550	32K	16384	2048	256	35	13	1/1	Yes	Y	Y	1	2	1/3

 DS39632E-page 1

Solar PV Module Datasheet

Shine solar
萨恩光电



Datasheet

10Wp

Monocrystalline solar PV module

Model Number	SN-M010
Maximum Power (pmax)	10Wp
Optimum Operating Voltage/Vmp	18.0V
Optimum Operating Current/Imp	0.56A
Open Circuit Voltage /Voc	21.6V
Short Circuit Current /Isc	0.66A
Module Efficiency	10%
Power Tolerance (%)	±3
Maximum Series Fuse Rating	15A
Maximum system voltage	1000 V DC

	Maximum Data	
Operating Temperature	-40℃~+80℃	℃
Storage temperature	from-40℃~+80℃	℃
Instulation cut voltage	1000	DC
Maximum wind resistance	60m/s	N/㎡or max Km/h
Surface maximum load capacity	200	Kg/㎡
Maximum hail load capacity	25mm	80km/h

EFFICIENCY

- Low voltage-temperature coefficient allows higher power output at high-temperature condition
- High efficient, high reliable solar cells ensure our product output stability

DC Motor Datasheet

Micro Dc Motor

RS–385 SH/SA

Application:

Hair Dryer、Water pump、Vacuum Cleaner。

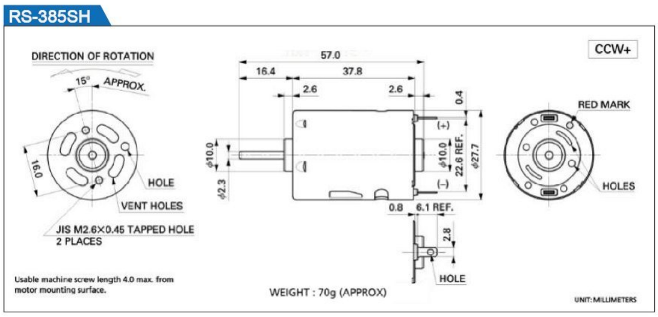
Electrical Specification

Model	Voltage		No Load		At Maximum Efficiency					Stall		
	Operating Range	Nominal	Speed	Current	Speed	Current	Torque		Output	Torque		Current
			r/min	A	r/min	A	mN·m	g·cm	w	mN·m	g·cm	A
RS385SH-17100	DC 9-18V	DC 12V	7000	0.12	5580	0.436	6.74	68.8	3.94	33.3	340	1.8
RS-385SH-2160	DC 9-18V	DC 12V	10000	0.22	8190	1.00	8.5	86.8	7.31	47.04	480	4.5
RS-385SH-2175	DC 12-24V	DC 24V	20000	0.23	17000	1.38	12.7	130	22.8	87.8	896	8.1
RS-385SA-2546	DC 6-15V	DC 12V	16000	0.34	13800	1.5	9.3	95	13.4	68	693	8.8
RS-385SA-12200	DC 6-12V	DC 12V	3400	0.09	2700	0.21	3.9	40	1.13	20.8	212	0.8

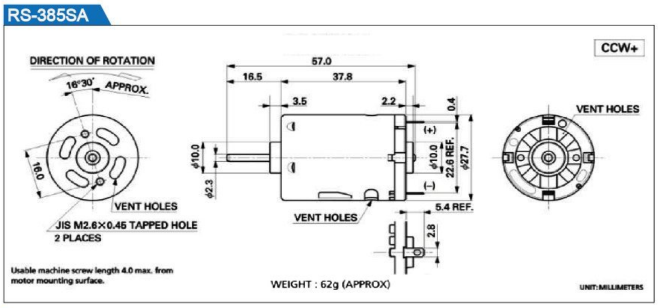
*Note:It's only typical technicai data for reference, Special requirement can be customized.

Mechanical Dimensions

RS-385SH



RS-385SA



Ningbo Leison Motor Co.,Ltd. Http://www.nbleisonmotor.com Tel:86–574–27950958

APPENDIX G: Rubrics for Project Phase-I and Phase-II

Rubrics

Rubrics for Project Phase-I

Maximum Marks: 50

Review-I

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Problem Definition (5)	Problem Statement clearly defined. (5-4)	Problem Statement partially defined. (4-2)	Problem Statement not defined. (2-0)
2	Scope & Objectives (10)	Description of scope of project is clearly stated and objective of project is clear (10-8)	Description of scope of project is somewhat clearly stated and objective is somewhat clear (8-5)	Scope and Objective of project is not clear (5-0)
3	Literature Review (10)	Many and relevant IEEE paper refereed. Comprehensive review providing a good basis for the project. Entire Coverage with relevant and accurate support. (10-8)	Few and relevant Papers Referred but not IEEE. Systematic survey attempted but incomplete and inconsistent. Little coverage and less accurate support. (8-5)	Very few and no relevant papers referred. No evidence of research been conducted. (5-0)
4	Methodology (10)	Methodologies which will be used are clearly described. (10-8)	Methodology which will be used are partially described (8-5)	Methodology are not described (5-0)
5	Block Diagram / Architecture (10)	Block Diagram and Design is Correct. (10-8)	Block Diagram and Design is partially Correct (8-5)	Block Diagram and Design is incorrect (5-0)
6	Project Planning (5)	Highly effective use of available resources. Effective management of workload (5-4)	Moderate use of available resources. Less effective management of workload (4-2)	No use of available resources No management of workload. (2-0)
	Total (50)	(50-40)	(40-27)	(25-0)

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Department of Electronics and Telecommunication Engineering

Rubrics

Rubrics for Project Phase-I

Maximum Marks: 50

Review-II

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Requirement Specification (10)	Properly stated and correct Specification (10-8)	Not clearly stated and incorrect Specification (8-5)	Not Properly stated and incorrect Specification (5-0)
2	Literature Review (5)	Additional improvement in the Literature Review (5-4)	Less improvement in the Literature Review (4-2)	No improvement in the Literature Review (2-0)
3	Detailed Design (10)	Designing is stated correctly (10-8)	Design is partially correct (8-5)	Designing is not correct (5-0)
4	Experimental Setup / Simulation (10)	Proper simulation and correct Experimental Setup (10-8)	Simulation and Experimental Setup is partially correct (8-5)	Simulation and Experimental Setup is not done. (5-0)
5	Performance Parameters (10)	Performance Parameters are stated clearly. (10-8)	Performance Parameters partially stated. (8-5)	Performance Parameters not stated. (5-0)
6	Efficiency Issues (5)	Efficiency Issues addressed. (5-4)	Efficiency Issues partially addressed. (4-2)	Efficiency Issues not addressed. (2-0)
	Total (50)	(50-40)	(40-27)	(25-0)

Rubrics

Rubrics for Project Phase-I

Maximum Marks: 50

Stage-I Documentation

Sr.No.	Criterion for (Project Stage-I)	**Excellent**	**Good**	**Beginner**
1	Documentation (50)	All Contents are covered with the given format and well organized report. (50-40)	Content are covered but the format is not proper and somewhat organized report. (40-20)	Content are not covered, format is not proper and report not organized. (<20)

Sr.No.	Criterion
1	Project Review 1 (50)
2	Project Review 2 (50)
3	Documentation (Project Stage-I Report) (50)
	Average of Review-1, Review-2 and Documentation stage is taken for 50 marks Evaluation

Rubrics

Rubrics for Project Phase-II

Maximum Marks: 150

Review –III

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Revised Final Design (10)	Final Design is correct (10-8)	Final Design is somewhat correct (8-5)	Design is incorrect, to be revised again (5-0)
2	Tools and Techniques Used (10)	Appropriate tools and techniques used(10-8)	Tools and techniques to some extent only used (8-5)	Tools and techniques not used(5-0)
3	Partial Implementation (15)	Project is partially implemented (15-12)	Project implementation is just started. (12-7)	Project implementation is not yet started. (7-0)
4	Partial Results (15)	Partial Results are correct. (15-12)	Partial results are somewhat correct. (12-8)	Results not obtained. (8-0)
	Total (50)	(50-40)	(40-25)	(25-0)

Review –IV

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Implementation Status (10)	Project implementation is complete. (10-8)	Project implementation is partially completed. (8-5)	Project implementation is incomplete. (5-0)
2	Modular Testing (10)	Modular testing is correct (10-8)	Modular testing is somewhat correct(8-5)	Modular testing is incorrect. (5-0)
3	Intermediate Results (15)	Desired results are shown (15-12)	Results are partially shown. (12-8)	Results are not obtained. (8-0)
4	Conclusion and Future Scope (10)	Conclusion and future scope are clearly stated (10-8)	Conclusion and future scope are somewhat clearly stated (8-5)	Conclusion and future scope are not clear. (5-0)
5	Cost Analysis (5)	Cost analysis is correct. (5-4)	Cost analysis is somewhat done (4-2)	Cost analysis not done.(2-0)
	Total (50)	(50-40)	(40-25)	(25-0)

Rubrics

Rubrics for Project Phase-II

Maximum Marks: 150

Stage-II Documentation

Sr.No.	Criterion for (Project Stage-II)	**Excellent**	**Good**	**Poor**
1	Documentation (50)	All Contents are covered with the given format and well organized report. (50- 40)	Content are covered but the format is not proper and somewhat organized report. (40-20)	Content are not covered, format is not proper and report not organized. (<20)

Sr.No.	Criterion
1	Project Review 3 (50)
2	Project Review 4 (50)
3	Documentation (Project Stage-II Report) (50)
	Total of Review-3, Review-4 and Documentation stage is taken for 150 marks Evaluation