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Electrical Car using Solar Energy

S. Rathinavel[1], Sudharshan. S[2], Praveen Kumar. G[3], Rajkumar. T[4], Sivanandhan. S[5]
[1]*Assistant Professor,* [2, 3, 4, 5] *Students, Department of Electrical and Electronics Engineering, Paavai Engineering College (Autonomous), Namakkal - 637 018, Tamilnadu, India.*

Abstract: ***In our ecosystem mostly Gasoline engine cars are used by the public which have high cost of refueling that cause emission of greenhouse gases. In this way to reduce the automotive emission which causes the Greenhouse gases, an alternative technology is needed. The most convenient way is to use renewable energy sources. In this scenario we provide an alternative fuel for vehicles by using renewable energy resources. Among the various resources available, we design a solar power controlled motor device for automotive application.***
In this project, the Electric Car is the way to alter the energy source. Sunlight is the main source of energy to obtain light energy which is converted into electricity. Amount of energy obtained from the source may vary from time-to-time. The vehicle chosen for the experiment is Marathi Omni. The solar panels are placed on the top of the car. Energy obtained from the solar panel is given to the charge controller. Charge controller can prevent overcharging and also the over discharging of the battery. Output of the charge controller is given to the Valve Regulated Sealed Lead-Acid Battery. Then the Valve Regulated Sealed Lead-Acid Battery is given to the Motor through Driver circuit which controls speed of the Motor.
Battery charging time through charge controller is four to five hours and the Electric Car travels for the distance of about 150Km with the speed of 30 to 40 Km/hr. Thus the proposed system of automotive vehicle helps to achieve zero pollution, zero noise effect and fuel consumption.
Keywords: Congestion management, Deregulated Electricity market, Transmission Congestion Distribution Factor.

I. INTRODUCTION

A. Electric Car

An Electric Car Is An Automobile That Is Propelled By One Or More Electric Motors, Using Electrical Energy Stored In Rechargeable Batteries. Electric Motors Give Electric Cars Instant Torque, Creating Strong And Smooth Acceleration. They Are Also Around Three Times As Efficient As Cars With An Internal Combustion Engine.

Electric Cars Are Significantly Quieter Than Conventional Internal Combustion Engine Automobiles. They Do Not Emit Harmful Pollutants, Giving A Large Reduction Of Local Air Pollution, And, Can Give A Significant Reduction In Total Greenhouse Gas And Other Emissions. They Also Provide For Independence From Foreign Oil, Which In Several Countries Is Cause For Concern About Vulnerability To Oil Price Volatility And Supply Disruption.

Electric Vehicles (Evs) Like The Nissan Leaf, Chevy Volt, And Tesla Model S Are Becoming More And More Popular Because Of Their High MPG Ratings, Their Convenient Ability To Be Plugged-In And Recharged, And The Frustrating And Unpredictably Wild Increases In The Price Of A Gallon Of Gasoline. The Cost Of Filling Up Your Tank Is Decreased To Charging Your Vehicle's Batteries With Electrical Energy, And The Savings Are Even More Dramatic When That Energy Comes From Your Own Solar Power System.

The First Practical Electric Cars Were Produced In The 1880. Electric Cars Were Popular In The Late 19th Century And Early 20th Century, Until Advances In Internal Combustion Engines, Electric Starters In Particular, And Mass Production Of Cheaper Gasoline Vehicles Led To A Decline In The Use Of Electric Drive Vehicles. The Energy Crises Of The 1970 And 1980 Brought A Short-Lived Interest In Electric Cars Although Those Cars Did Not Reach The Mass Marketing Stage, As Became The Case In The 21st Century.

A Solar Car Is A Solar Vehicle Used For Land Transport. Solar Cars Only Run On Solar Power From The Sun. Solar Thermal Energy Which Converts Solar Energy To Heat, PV Cells Directly Convert Sunlight Into Electricity.

To Keep The Car Running Smoothly, The Driver Must Monitor Multiple Gauges To Spot Possible Problems. Cars Without Gauges Almost Always Feature Wireless Telemetry, Which Allows The Driver's Team To Monitor The Car's Energy Consumption, Solar Energy Capture And Other Parameters And Thereby Freeing The Driver To Concentrate On Driving.

Solar Cars Combine Technology Used In Aerospace, Bicycle, Alternative Energy And Automotive Industries. The Design Of A Solar Vehicle Is Severely Limited By The Amount Of Energy Input Into The Car. Most Solar Cars Have Been Built For The Purpose Of Solar Car Races. Some Solar Cars Are Designed Also For Public Use List Of Prototype Solar-Powered Cars

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Solar Cars Depend On A Solar Array That Uses Photovoltaic Cells (PV Cells) To Convert Sunlight Into Electricity. Unlike Solar Thermal Energy Which Converts Solar Energy To Heat For Either Household Purposes, Industrial Purposes Or To Be Converted To Electricity, PV Cells Directly Convert Sunlight Into Electricity. When Sunlight Strike PV Cells, They Excite Electrons And Allow Them To Flow, Creating An Electric Current. PV Cells Are Made Of Semiconductor Materials Such As Silicon And Alloys Of Indium, Gallium And Nitrogen. Crystalline Silicon Is The Most Common Material Used And Has An Efficiency Rate Of 15-20%.

The Design Of A Solar Car Is Severely Limited By The Amount Of Energy Input Into The Car. Solar Cars Are Built For Solar Car Races And Also For Public Use List Of Prototype Solar-Powered Cars. Even The Best Solar Cells Can Only Collect Limited Power And Energy Over The Area Of A Car's Surface. This Limits Solar Cars To Ultralight Composite Bodies To Save Weight. Solar Cars Lack The Safety And Convenience Features Of Conventional Vehicles

Chinese Solar Panel Manufacturer Hanergy Plans To Build And Sell Solar Cars Equipped With Lithium-Ion Batteries To Consumers In China. Hanergy Says That Five To Six Hours Of Sunlight Should Allow The Cars' Thin-Film Solar Cells To Generate Between 8-10kwh Of Power A Day, Allowing The Car To Travel About 80km On Solar Power Alone. Maximum Range Is About 350km (217 Mi.).

The First Solar Family Car Was Built In 2013 By Students In The Netherlands. This Vehicle Is Capable Of 550 Miles On One Charge During Sunlight. It Weighs 850 Pounds And Has A 1.5kw Solar Array. Solar Vehicles Must Be Light And Efficient. 3,000 Pound Or Even 2,000 Pound Vehicles Are Less Practical. Stella Lux The Predecessor To Stella Broke A Record With A 932 Mile Single Charge Range. The Dutch Are Trying To Commercialize This Technology. During Racing Stella Lux Is Capable Of 700 Miles During Daylight. At 45mph Stella Lux Has Infinite Range. This Is Again Due To High Efficiency Including A Coefficient Of Drag Of 16.

The Average Family Who Never Drive More Than 200 Miles A Day Would Never Need To Charge From The Mains. They Would Only Plug In If They Wanted To Return Energy To The Grid. Solar Cars Are Often Fitted With Gauges And/Or Wireless Telemetry, To Carefully Monitor The Car's Energy Consumption, Solar Energy Capture And Other Parameters. Wireless Telemetry Is Typically Preferred As It Frees The Driver To Concentrate On Driving, Which Can Be Dangerous In Such A Small, Lightweight Car. The Solar Electric Vehicle System Was Designed And Engineered As An Easy To Install (2 To 3 Hours) Integrated Accessory System With A Custom Molded Low Profile Solar Module, Supplemental Battery Pack And A Proven Charge Controlling System.

As An Alternative, A Battery-Powered Electric Vehicle May Use A Solar Array To Recharge; The Array May Be Connected To The General Electrical Distribution Grid.

A Solar Vehicle Is An Electric Vehicle Powered Completely Or Significantly By Direct Solar Energy. Usually, Photovoltaic (PV) Cells Contained In Solar Panels Convert The Sun's Energy Directly Into Electric Energy. The Term "Solar Vehicle" Usually Implies That Solar Energy Is Used To Power All Or Part Of A Vehicle's Propulsion. Solar Power May Be Also Used To Provide Power For Communications Or Controls Or Other Auxiliary Functions.

Solar Vehicles Are Not Sold As Practical Day-To-Day Transportation Devices At Present, But Are Primarily Demonstration Vehicles And Engineering Exercises, Often Sponsored By Government Agencies. However, Indirectly Solar-Charged Vehicles Are Widespread And Solar Boats Are Available Commercially.

Recharging Can Take A Long Time And In Many Places There Is A Patchy Recharging Infrastructure. For Long Distance Driving, Many Cars Support Fast Charging That Can Give Around 80% Charge In Half An Hour Using Public Rapid Chargers. While Battery Cost Is Decreasing Fairly Rapidly, It Is Still Relatively High, And Because Of This, Most Electric Cars Have A More Limited Range And A Somewhat Higher Purchase Cost Than Conventional Vehicles. Drivers Can Also Sometimes Suffer From Range Anxiety- The Fear That The Batteries Will Be Depleted Before Reaching Their Destination.

The Dell-Winston School Solar Car Challenge Is An Annual Solar-Powered Car Race For High School Students. The Event Attracts Teams From Around The World, But Mostly From American High Schools. The Race Was First Held In 1995. Each Event Is The End Product Of A Two-Year Education Cycle Launched By The Winston Solar Car Team.

In Odd-Numbered Years, The Race Is A Road Course That Starts At The Dell Diamond In Round Rock, Texas The End Of The Course Varies From Year To Year. In Even-Numbered Years, The Race Is A Track Race Around The Texas Motor Speedway. Dell Has Sponsored The Event Since 2002.

There Are Other Distance Races, Such As Suzuka, Phaethon, WGC (WSR/JISFC/WSBR) And The World Solar Rally In Taiwan. Suzuka And WGC Is A Yearly Track Race In Japan And Phaethon Was Part Of The Cultural Olympiad In Greece Right Before The 2004 Olympics.

Venturi Eclectic Is A Ventri Automobiles Built The Flanking Not Closed Three Seater Eclectic As Prototype In 2006. Range With Solar Charging Only In 7 Kilometers Per Day. Range With Fully Charged Accumulator Is 50 Kilometres. Top Speed 50km/Hr. Price

Middle Of The Road Was Announced But Serial Production Never Started. There Is Also A Small Electric Car With The Name Eclectic 2.0 From The Same Company Existing.

Since 2008, A Renaissance In Electric Vehicle Manufacturing Has Occurred Due To Advances In Batteries And Energy Management, Concerns About Increasing Oil Prices, And The Need To Reduce Greenhouse Gas Emissions. Several National And Local Governments Have Established Tax Credits, Subsidies, And Other Incentives To Promote The Introduction And Now Adoption In The Mass Market Of New Electric Vehicles Depending On Battery Size And Their All-Electric Range.

The World's All-Time Top Selling Highway-Capable Electric Car Is The Nissan Leaf, Released In December 2010, With More Than 250,000 Units Sold Worldwide Through December 2016. The Tesla Model S, Released In June 2012, Ranks Second With Global Sales Of Over 158,000 Units Through December 2016. The Model S Has Been The World's Top Selling Plug-In Car For Two Years In A Row, 2015 And 2016.

The First Solar Family Car Was Built In 2013.Researchers At Case Western Reverse University, Have Also Developed A Better Solar Car Which Can Recharge More Quickly, Due To Better Materials Used In The Solar Panels.

In Japan, Kaiton II From The Goko High School Was Built For 2013 World Solar Challenge And Owl Was Built For The 2015 World Solar Challenge In The Cruiser Class By Kogakuin University.

As Of December 2015, There Were Over 30 Models Of Highway Legal All-Electric Passenger Cars And Utility Vans Available For Retail Sales, Mainly In The North America, China, Japan, And Western European Countries. Cumulative Global Sales Of Highway-Capable Light-Duty Pure Electric Vehicles Passed The One Million Unit Milestone In September 2016. About 61% Of The Global Stock Of 2 Million Light-Duty Plug-In Electric Vehicles By The End Of 2016 Were Pure Electric Cars And Vans.

Venturiastrolab Is A Venturiautomobiles Is Building The Open Two Seater Astrolab Since 2006. Range With Solar Charging Only In 18 Kilometers Per Day. Range With Fully Charged Accumulator Is 110 Kilometers. Top Speed 120 Km/Hr.

The World Solar Challenge Features A Field Of Competitors From Around The World Who Race To Cross The Australian Continent, Over A Distance Of 3,000 Kilometres (1,900 Mi). Speeds Of The Vehicles Have Steadily Increased. So, For Example, The High Speeds Of 2005 Race Participants Led To The Rules Being Changed For Solar Cars Starting In The 2007 Race And 2014 Also.

In Italy, P-Mob With An EU Project Led By Fiat From May 2010 To April 2013 A Complete Solar Car With Three Seats Was Developed. This Small Car Have Four Wheel Drive. Range With Solar Charging Only Is 20 Kilometers Per Day. Range With Fully Charged Accumulator Is 120 Kilometers.

In Australia, Solar Spirit 3 With Three Seat Was Built By TAFE South Australia For The 2011 World Solar Challenge. Sun Swift V (Eve) From The University Of New South Wales Was Built For The 2013 And 2015 Worls Solar Challenge.

The American Solar Challenge, Previously Known As The 'North American Solar Challenge' And 'Sunrays USA', Features Mostly Collegiate Teams Racing In Timed Intervals In The United States And Canada. This Race Also Changed Rules For The Most Recent Race Due To Teams Reaching The Regulated Speed Limits. The Most Recent American Solar Challenge Took Place On July 21–28, 2014 From Austin, Texas To Minneapolis, Minnesota. The South African Solar Challenge Is An Epic, Bi-Annual, Two-Week Race Of Solar-Powered Cars Through The Length And Breadth Of South Africa. Teams Will Have To Build Their Own Cars, Design Their Own Engineering Systems And Race Those Same Machines Through The Most Demanding Terrain That Solar Cars Have Ever Seen. The 2008 Race Proved That This Event Can Attract The Interest Of The Public, And That It Has The Necessary International Backing From The FIA. Guinness World Records Recognize A Land Speed Record For Vehicles Powered Only By Solar Panels. This Record Is Currently Held By The Sky Ace TIGA From The Ashiya University. The Record Of 91.332 Km/H (56.75 Mph) Was Set On 20 August 2014 At The Shimojishima Airport, In Miyakojima, Okinawa, Japan. The Previous Record Was Held By The University Of New South Wales With The Car Sunswift IV. Its 25-Kilogram (55 Lb) Battery Was Removed So The Vehicle Was Powered Only By Its Solar Panels. The Record Of 88.8 Km/H (55.2 Mph) Was Set On 7 January 2011 At The Naval Air Base HMAS Albatross In Nowra, Breaking The Record Previously Held By The General Motors Car Sunraycer Of 78.3 Kilometres Per Hour (48.7 Mph). The Record Takes Place Over A Flying 500 Metres (1,600 Ft) Stretch, And Is The Average Of Two Runs In Opposite Directions. In Germany, Hochschule Bochum Is A Solar Vehicle Built In 2015 To Cross The Desert Of Tanami In Australia. Range With Fully Charged Accumulator Is 50 Kilometers. The Car Have A Solar Roof With 160 Wp And In A Box Below The Roof 1943 Wp Solar Panels For Extension During Driving Breaks. Power Core Suncruise With 2 Seats Was Built By Hochschule Bochum For 2015 World Solar Challenge. Maximum Power Created On Its $3m^2$ Solar Roof Is 870 Wp. Car Is Equipped With Two Wheel Hub Electric Engines And Comfort Electronics. Top Speed Is 120km/H. Range With Solar Charging Only Is Up To 600 Kilometers Per Day. Range With Fully Charged Accumulator Is Up To 1100 Kilometers. The Four Seater Stella Lux Was Built As Successor Of Stella For The 2015 World Solar Challenge By Eindhoven University. With A Top Speed Of 125 Km/H And An European Range Of 1000 Kilometers It Is Substantial Achievement With Respect To Common Electric Vehicles.

B. Objective Of Project

1) To Evaluate The Energetic Feasibility Of An Electric Car Automatic Charging System. At What Speed The Car Can Contribute Electricity Of Power The Automatic Charging The Car Battery During Operation In The Specification.

2) To Evaluate The Electricity Generation Of An Electric Car System In Comparison To An Automatic Recharge System.

C. Organization Of Project

1) *Chapter 2:* Deals With Electric Car And Solar System.

2) *Chapter 3:* Deals With Charge Controller, Battery, Driver And Differential Motor.

3) *Chapter 4:* Deals With Proposed System.

4) *Chapter 5:* Deals With Electric Car Using Solar System And It's Benefits

5) Chapter 6: Deals With Conclusion And Future Scope

II. BLOCK DIAGRAM

We Decided To Do Something That Would Be Benefited To The World Environment. The Greater Importance Of The Environment In The World Lead To An Opportunity For Students. With The Economy Trying To Get Out Of The Worst Depression, There Are Plenty Opportunities For Us To Help Out. This Is Our Opportunity To Contribute A Greener And More Efficient Planet. The Main Aim Of Our Project Is To Save Our Environment From Pollution.

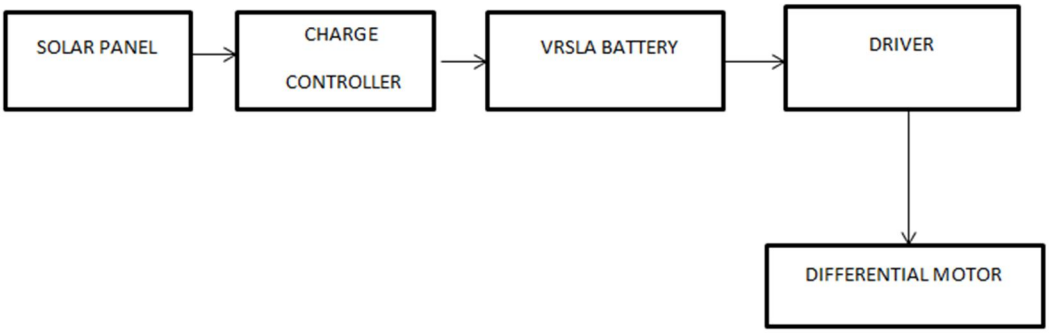

Figure 2.1 Block Diagram Of Proposed System

For That, Electric Car Would Be The Best Fit. This Electric Car Has Zero Pollution, Zero Noise Effected And No Fuel Consumption. In The Recent Years, India Has Increasing Encouraged A Cleaner Environment And Less Dependence On Foreign Oil. Block Diagram Of Proposed System Is Show In Figure 4.1

The Price Of Fuel Has Increased Significantly Over The Past Few Years And There Seems To Be No Turning Back. In Our Ecosystem, Most Gasoline Cars Are Used By The Public Which Have High Cost Of Refuelling That Causes Emission Of Greenhouse Gases. To Reduce The Automotive Emission, An Alternative Technology Is Needed. The Environment Has Also Been More Focus Throughout The Worlds In Past Few Years And It Seems That Cleaner Alternative Have Been Steadily On The Rise With No End In Sight.

In Our Project, The Electric Car Is The Way To Alter The Energy Source. In This Project We Are Using Solar Panel, Charge Controller, Vrsla Battery, Driver Circuit And Differential Motor. Source Of Energy Obtained From Light Energy Is Converted Into Electricity.

In This Project, The Electric Car Is Been Charged Through Renewable Energy. Energy Obtained From The Solar Panel Is Given To The Charge Controller. Instead Of Internal Combustion Engine, Solar Car Uses The Combination Of Solar Panel And Electric Motor Powered By Stored Battery System. In Our Project, We Are Using A Vrsla (Valve Regulated Sealed Lead Acid Battery). The Motor Used Here Is The Differential Motor. The Motor Gets Supply From Batteries And Vehicles Moves. The Battery Is Discharging Upto 90% And The Battery Is Been Charged Through Solar And It Is Used To Run The Motor And At The Same Time Battery Can Be Charged From Solar. An Extra Benefit To Building The Electric Car Is That, It Can Also Show How Much It Is Cheaper It Would Be To Convert Regular Car Into An Electric Car Rather Than Driving In The Gasoline Engine.

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A. Valve Regulated Sealed Lead-Acid (Vrsla) Battery

Vrsla Battery Stands For Valve Regulated Lead-Acid Battery Commonly Known As Sealed Lead-Acid Battery, Gel Battery Or Maintenance Free Battery Which Is A Type Of Lead-Acid Rechargeable Battery. There Are Three Primary Types Of Vrsla Batteries Such As Sealed Vr Wet Cell, Agm (Absorbed Glass Mat) And Gel. Due To Their Construction The Gel And Agm Types Of Vrsla Can Be Mounted In Any Orientation And Do Not Require Constant Maintenance. Maintenance Free Batteries Are Used In Large Portable Electrical Devices And Off-Grid Systems Even Though They Require Regular Functional Testing. The Outer View Of Vrsla Battery Is Shown In The Figure 4.2

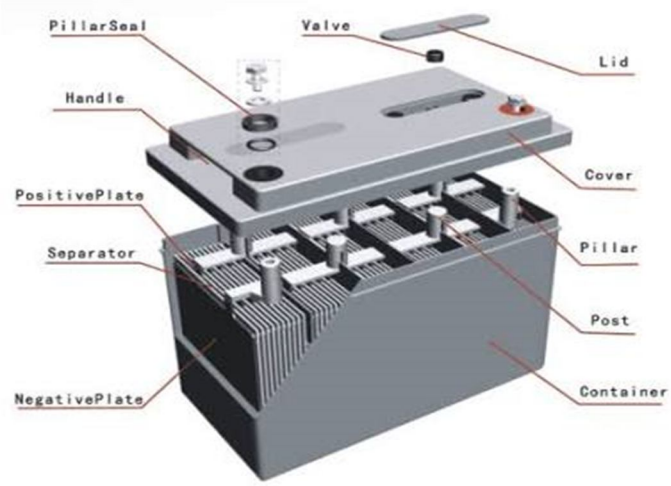

Figure 2.2 Valve Regulated Sealed Lead Acid Battery

B. Driver Circuit

Driver Is An Electrical Circuit Or Electronic Component Used To Control Another Circuit, Such As A High-Power Transistor, Liquid Crystal Display (Lcd). They Are Used To Regulate Current Flowing Through A Circuit. Often Used, For A Specialized Integrated Circuit That Controls High-Power Switches In Switched-Mode Power Converters.

An Amplifier Can Also Be Considered A Driver For Loudspeakers, Or A Constant Voltage Circuit That Keeps An Attached Component Operating Within A Broad Range Of Input Voltages. The Driver Stage Of A Circuit Requires Different Characteristics To Other Circuit Stages. For Example In A Transistor Power Amplifier, The Driver Circuit Requires Current Gain, For The Ability To Discharge, And Low Output Impedance To Avoid Distortion.

C. Differential Motor

A Differential Is A Gear Train With Three Shafts That Has The Property That The Angular Velocity Of One Shaft Is The Average Of The Angular Velocities Of The Others, Or A Fixed Multiple Of That Average.

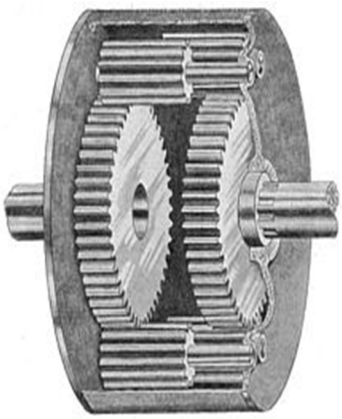

Figure 2.4 Differential Motor

Table 2.1 Specification Of Differential Motor

S.No	Specification	Range
1	Power	3hp, 1500w
2	Rated Voltage	60v
3	Rated Current	12a
4	Rated Speed	2500rpm
5	Rated Torque	112w, 210nm
6	No Load Current	1.6a

The Basic Principle Of The Differential Gear Unit Can Be Understood By Using Equipment That Consists Of Two Gears Pinion And Rack. Both Rack Can Be Moved In The Vertical Direction As Far As The Weight Rack And Slip Resistance Will Be Lifted Simultaneously. Placed Between The Tooth Pinion Rack And Pinion Gear Connected To The Braces And Can Be Moved By These Braces. When The Same Load "W" Placed On Each Rack Then Braces (Shackle) Is Pulled Up The Second Rack Would Be Lifted At The Same Distance, This Will Prevent The Pinion Gear Does Not Rotate. But If A Greater Burden Placed On The Left Rack And Pinion Buffer Will Then Be Drawn Up Along The Gear Rack Rotates The Load Gets Heavier, Which Is Attributed To Differences In Prisoners Who Are Given The Pinion Gear, So The Smaller The Burden Will Be Lifted. The Raised Rack Spacing Is Proportional To The Number Of Turns Pinion Gear. In Other Words That Rack Gets Custody Larger Still And While Prisoners Who Received A Smaller Load Will Move. This Principle Is Used In The Planning Of Differential Gears.

III. CONCLUSION

The Solar Cell Based Electric Vehicle Has Developed And Validated Through Hardware Model. The Solar Cell Produces 1000 Watts Power Which Is Applied To Differential Dc Motor. The Differential Dc Motor Rating Of 1250w, 2500 Rpm Is Controlled By Driver Circuits. The Driver Circuit Perform With High Ripple Rejection Which Is Controlled By Pulse Width Modulation Technique. In Battery Simultaneously, Both Charging And Discharging Takes Place. When The Battery Of The Vehicle Is Fully Charged, It Can Run Continuously At An Average Speed Of 30-40 Km/H.. The Electric Vehicle Has Been Satisfactorily Completed The Prototype That Vehicle Can Run In Normal Surface With An Entire Power Of 660kg. Through This Project, We Increase The Mileage Of The Vehicle. Our Project Is Eco-Friendlily And Causes No Air Pollution.

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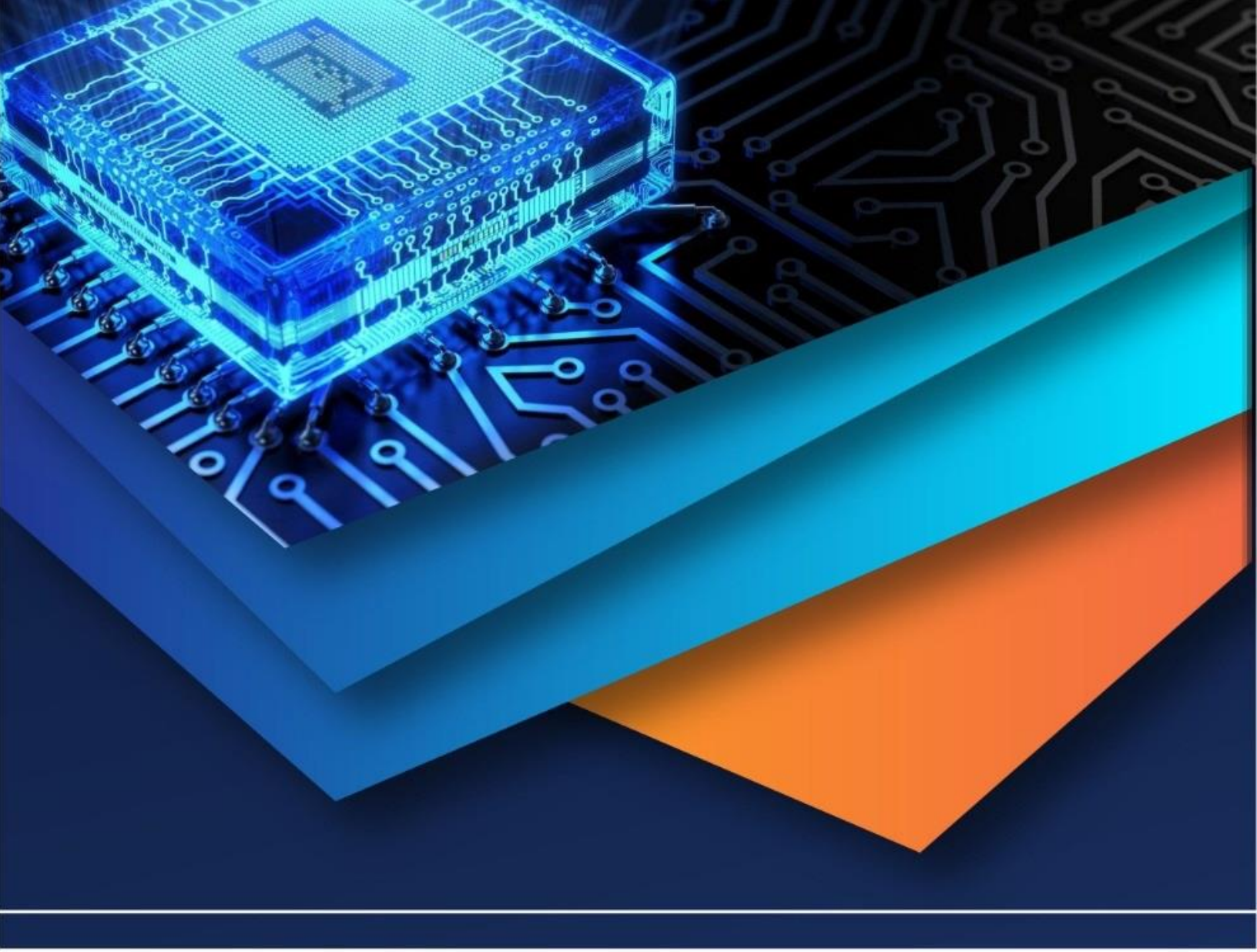

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