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Solar Powered E-Vehicle with Manual Transmission

G. Ashok[1], V. Parameshwar rao[2], M. Rudrateja[3], P. Anil kumar[4], P. Achyuth[5]
[1]*Assistant Professor, Department of EEE, Aditya Institute of Technology and Management, K. Kotturu, Tekkali*
[2, 3, 4, 5]*UG Scholar, Department of EEE, Aditya Institute of Technology and Management, K. Kotturu, Tekkali*

Abstract: ***The main fair of the paper is to build a solar powered Electric vehicle. A solar vehicle that is powered entirely or moderately by the energy from the sun, to convert sunlight into electricity. Solar vehicles are premeditated to be environmentally friendly, as they do not emit any greenhouse gases or other pollutants during operation. One of the main challenges in designing and building solar vehicle is to determine the balance between the weight of the vehicle and the size of the solar panel array. The larger the solar panel array, the more energy the car can capture from the sun, but a larger array also increases the weight of the vehicle, which can reduce its efficiency. In this paper, we will see the sights to manage the flow of electricity generated by an array of solar panels into a battery pack. The stored energy will then be used to power a PMSM motor, which will drive the car. We will use a motor controller to control the car's speed and direction of motion. In addition, we will cover the process of incorporating all mechanical equipment's of car together. [5] The usage of several gear ratios has several potential benefits, including empowering the electric traction machine and inverter to operate in a more efficient region, increasing vehicle acceleration, gradeability, and top speed, and falling overall traction system mass and volume. Performance vehicles, light to heavy-duty trucks, and buses may especially benefit from multi-speed gearboxes due to their high torque and power wants. Finally, we will show how to wire the electrical system onto the mechanical body of the car.***
Keywords: Solar E-Vehicle, Manual Transmission, Electrical power, Motor Controller

I. INTRODUCTION

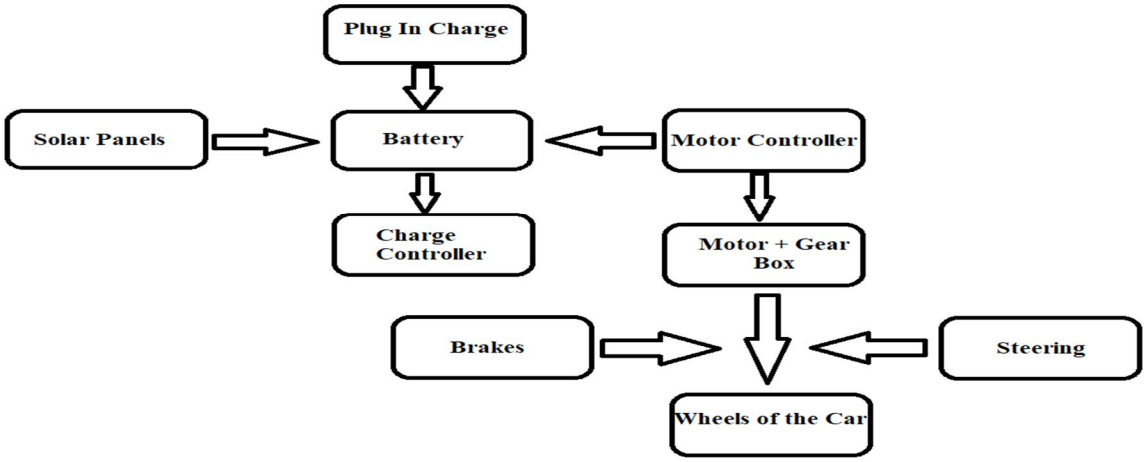
The solar energy is preferred since it could provide the cleanest sustainable energy for the longest duration of time the next few billion years. Due to its incalculable benefits in environmental, economic, and social aspects PV systems have becomes the world's fastest growing energy technology. Nothing on earth is free of cost, but what if we could find a way to implement free rides? Indeed, it would be wonderful if our vehicles could continue to run without us having to spend billions on fossil fuels every year and to deal with natural hazards that their combustion leave behind. If we could drive a solar-powered vehicle, [1]A solar panel is a packaged, connected assembly of solar cells which are solid state devices that can convert solar energy directly into electrical energy through quantum mechanical transitions. They are noiseless and pollution-free with no rotating parts and need minimum maintenance. The electricity thus generated would then fuel the battery that would run the car's motors. Therefore, we would obtain an electrically driven vehicle that would travel on "free" energy with no harmful emissions, that can utilize its full power at all speeds, and would have very little maintenance cost. Basically, automatic transmissions are easier to use and more comfortable for the driver, while manual transmission vehicles are less expensive and more involved. Now what happen in manual gear system, if we shift transmission to heavier gear, we will get more torque and low rpm and if we shift transmission to lighter gear, we will get low toque but high rpm.

II. RELATED WORKS

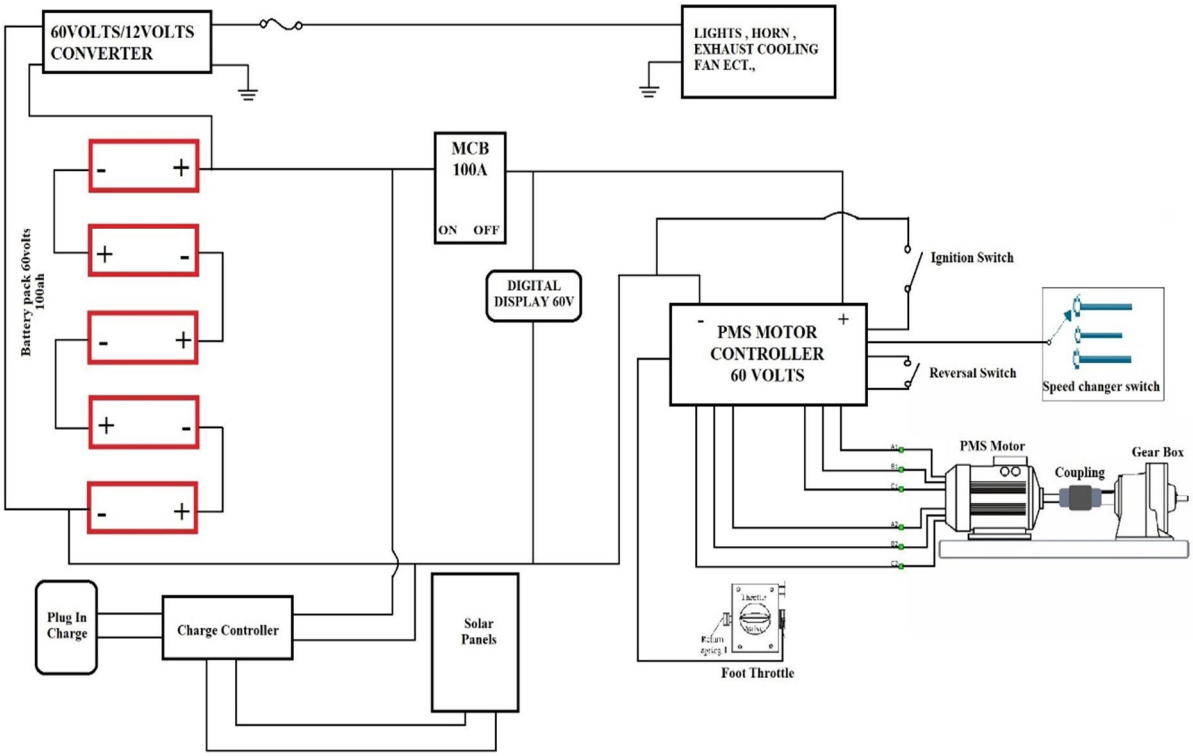
Some efforts reported in the literature at the engineering department at Tel Aviv University in Israel, Arye Braunstein and his colleagues created a solar car in 1980. The solar car had a solar panel on the hood and on the roof of the criti car compromised of 432 cells creating 400 watts of peak power. The solar car uses 8 batteries of 6 volts each to store the photovoltaic energy. The 1320-pound solar criti car is said by the engineering department to have been able to reach up to 40 mph with a maximum range of 50 miles. In 1981.Hans Tholstrup and Larry Perkins build a solar powered solar race car. In 1982, the pair became the first to cross a continent in solar car, from Perth to Sydney. The GM sun racer in 1987 completed an 1866-mile trip with an average speed of 42 mph, since this time many solar cars invented at universities for competitions such as Shell Eco Marathon. There is also a commercially available solar car called the venture astrolabe. Solar car uses technology typically used in aerospace, bicycle, alternative energy, and automotive industries.

During the 1990s, regulations require an approach to 'Zero emissions' from vehicles increased interest in new battery technology. Battery systems that offer higher energy density became the subject of most research by federal and auto industry scientists.

III. BLOCK DIAGRAM



IV. CIRCUIT DIAGRAM



[2] If we use Solar electric car on manual gear system we will get very fascinating outcomes, which are

- ✓ Higher speed
- ✓ Good torque
- ✓ Good efficiency
- ✓ Smoothness

V. DESIGNING

Design is not too complex as we have use only gear box of manual transmission car. What I have did is that I had removed the transmission system which was attached to the gear box and design extra parts which were fitted with the box and engine use of bearing set and a steel plate which full up the whole remaining area of gear box. [5] This way our combustion engine is converted into electrical with higher speed and higher efficiency by using less power of motor.

This car consists of 3000w of PMSM motor with 100ah of controller and batteries contain lead acid batteries of 12V and 100ah connected in series. Now what happen when we test this car on road, the results are very amazing. The car gross weight is 550kg and the motor lift weight up to 1100kg over all weight and its speed with 4 person goes up to 60km/h and as I have used lead acid batteries so the mileage is between 50/60km. According to theories the 3KW motor cannot lift that much of weight and the theoretical speed is 50-60km/h max. But why this car speed goes upto 60/h? The answer is the manual gear system. [6] The manual gear system increases the rpm of motor from 3000 to 6000 And also gives basic torque which it needs for moving. the flow of electricity generated by an array of solar panels into a battery pack. The stored energy will then be used to power a PMSM motor, which will drive the car.

Table 1
Features and Technical Points

Speed	60km/h (while testing)
Backup	50km (Depend on Batteries)
Torque	46.3NM
Max Load Limit	1100kg
Speed With Load	50km/h
Net Weight	550kg
Gear Ratio	1: 43/12, 3.583 2: 39/18, 2.166 3: 32/24, 1.333 4: 27/30, 0.900 Reverse: 37/22x22/11, 3.363 Final: 87/20, 4.350
Motor	3000W PMSM
Batteries	Lead-Acid 60V
Electric Power	100Ah
Transmission	4-Speed (forward all-synchromesh) F8B gearbox

VI. BATTERY AND SOLAR PANEL CALCULATIONS

1) Battery capacity= 12 x 100 x 5 = 6000 Wh
2) Let us say battery is discharged 50% Then, Discharged battery capacity (Watt - hour) = 6000 x 50% = 3000 Wh
3) Let us assume we use Lead Acid batteries. Then, at 85% efficiency Then, Energy required for full charge (Watt - hour) = 3000 / 85% = 3529 Wh
4) Let us say you are using a 250W solar array and an MPPT charge controller. Then, Solar output = 250 x 95% = 237.5 W
5) The National Renewable Energy Laboratory's PV Watts Calculator uses 14.08% as its default value for system losses, so we use that number here. Adjusted solar output = 237.5 x (100% - 14.08%) =204.06 W
6) Charge Time = 3529/204.06 =17.27 hours

VII. BATTERY CHARGING TIME (WHEN IT IS CHARGED OVER AN EV CHARGER)

1) Battery capacity = 100Ah
2) Charge current rating = 15A
3) Charger voltage = 60 V
4) Lead Acid battery efficiency = 80 to 85 %
5) Charge time = (Battery capacity x Depth of Discharge) / (Charge current x Charge efficiency) = (100 x 50%) / (15 x 85%) = 3.92 hours

VIII. CONCLUSION AND OUTLOOKS

This paper deliberates the recent expansion in Solar electric vehicle. This paper first describes general structure and converses the energy storage module. It then outspreads to the future vehicle component. Soon, uniting diverse energy bases and powertrains in optimum way, as well as carrying out an accurate and vigorous power management regulation, will be essential to build a consistent and reasonable Solar EV while protective our environment and wisely using our limited resources. As the world hunt for to replace conventional resources of locomotion with new and green ones, they need to be striking adequate and cost effective to drive the shift in the direction of them. Solar vehicles do have some shortcomings like minor speed range, opening cost is high. [5],[2]Also, the rate of conversion of energy is not reasonable (only 17% - 18%). But these shortcomings can be situated easily overcome by leading additional research in this zone; like the tricky of solar cells cSan be solved by using the ultra-efficient solar cells that give about 30-35% proficiency.

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AUTHOR BIOGRAPHY

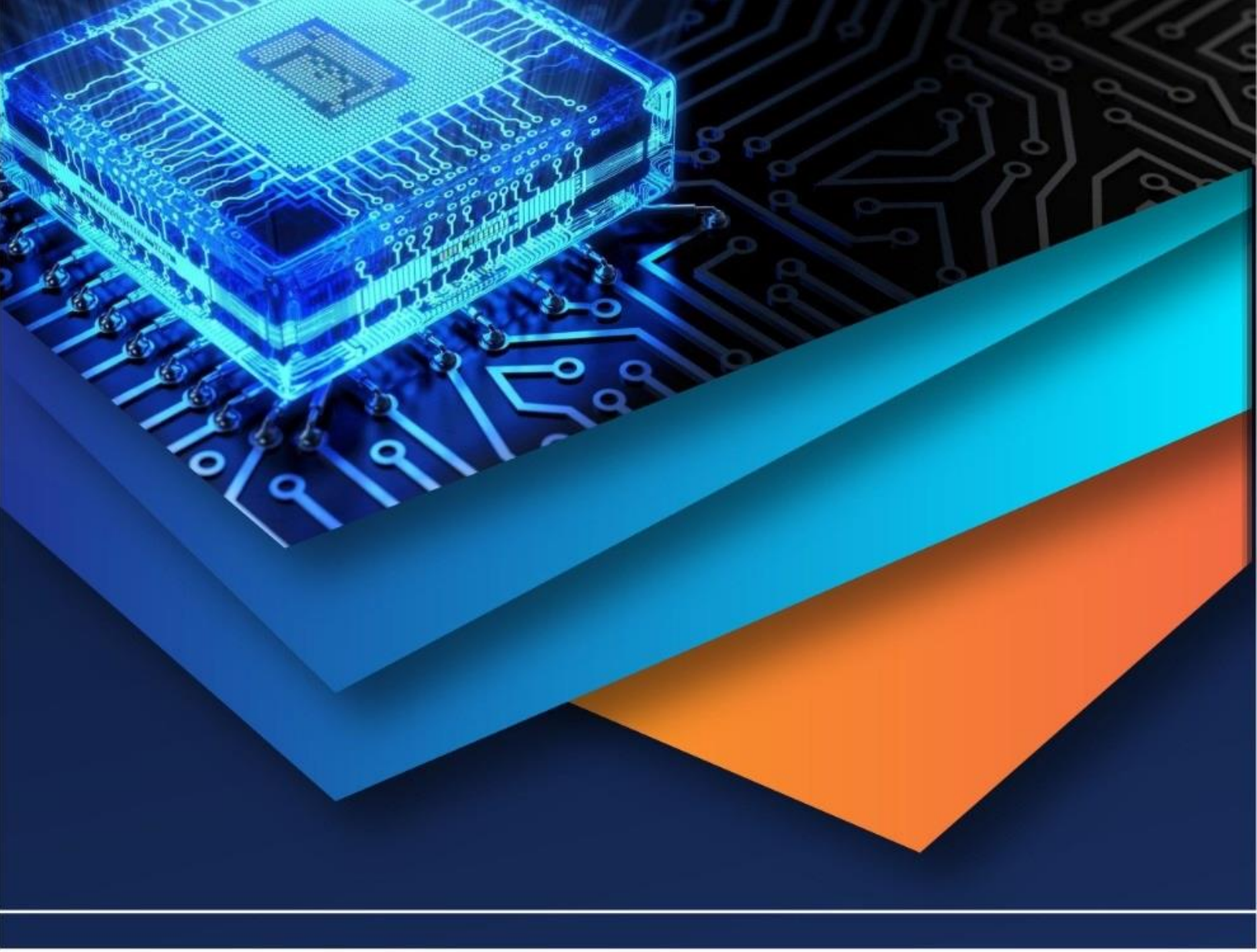
SRI. ASHOK GANGA M.Tech., (Ph.D.)
Sri. Ashok Ganga is currently working as an Assistant Professor at Aditya Institute of Technology And Management, Tekkali and had given continuous critical suggestions and extension of proper working atmosphere, providing generous assistance, abiding interest that has finally evolved into this research work.
E-mail id: ganga201@gmail.com

Vajja. Parameshwar Rao
Mr. Vajja. Parameshwar Rao is currently pursuing Bachelor of Technology in the field of Electrical and Electronics Engineering at Aditya Institute of Technology And Management, Tekkali. He belongs to 4th year of his course, and has keen interest in the field of Electric Vehicles, Solar energy and Solar associated research work.
E- mail id: parameshv2002@gmail.com

Moyya. Rudrateja
Mr. Moyya. Rudrateja is currently pursuing Bachelor of Technology in the field of Electrical and Electronics Engineering at Aditya Institute of Technology And Management, Tekkali. He belongs to 4th year of his course, and has keen interest in the field of Electric Vehicles, Solar energy, and Solar associated research work.
E- mail id: rudratejamoyya@gmail.com

Pilaka. Achyuth
Mr. Pilaka. Achyuth is currently pursuing Bachelor of Technology in the field of Electrical and Electronics Engineering at Aditya Institute of Technology And Management, Tekkali. He belongs to 4th year of his course, and has keen interest in the field of Electric Vehicles, Solar energy, and Solar associated research work.
E- mail id: achyuthpilaka@gmail.com

Podilapu. Anil Kumar
Mr. Podilapu. Anil Kumar is currently pursuing Bachelor of Technology in the field of Electrical and Electronics Engineering at Aditya Institute of Technology And Management, Tekkali. He belongs to 4th year of his course, and has keen interest in the field of Electric Vehicles, Solar energy, and Solar associated research work.
E- mail id: yoyoanilkumar0277@gmail.com



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