

Smart Vehicles Performance Improvement Using Clean Energy (Photovoltaic + Electricity)

¹Er. Ashutosh Mishra, ²Er. Amit Kumar, ³Krishna Kant Jha

¹Junior Manager, ²Technical Supervisor, ³Secretary

¹Nextonik Corporation, Laxmi Nagar, New Delhi – 110092 (India),

²Noida Aluminium Co. Pvt. Ltd., Ph-II, Noida, U.P. – 201305 (India),

³Solar Promotion Society, Sec. 91, Faridabad, Haryana – 121013 (India)

Abstract - The paper is a detailed analysis of the performance improvement of smart vehicles using clean energy resources such as photovoltaic and electricity. Smart vehicles are the future of the automobile industry and the paper explains the many benefits and possibilities of using smart vehicles. It also explains the role clean energy resources have to play in reducing pollution. The paper shows the areas in which the performance of smart vehicles can be improved using clean energy resources like photovoltaics. The paper invites the reader to take precautionary actions against the increase of pollution in vehicles due to the emission of carbon dioxide. Driving can be made a pleasant and great experience with the use of smart vehicles and photovoltaic systems. Detailed explanations of these topics are covered in the paper. Technological intervention and advancement have made the life of people different and smart vehicles have a huge role to play in this. It will change the way we look towards driving and traveling. We need to find methods that can reduce pollution and make driving convenient and pleasant. The paper is a roadmap to a reader to know everything about smart vehicles and their performance improvement using renewable resources.

keywords - Smart Vehicles, Photovoltaic, Electricity, Automobile industry, Convenience

I. INTRODUCTION

Smart vehicles are vehicles that interact with their environment and come to conclusions. Smart vehicles are the future of the automobile industry as these are highly convenient and responsive. The performance of these vehicles can be considerably increased with the help of clean energy sources. Clean energy sources like biomass, wind, solar, geothermal, hydropower, etc. can be used to improve and enhance the performance of smart vehicles. Clean energy is expected to outplay the traditional methods we have relied upon to us vehicles. Photovoltaics is one of the best methods to charge and power smart vehicles.

II. WHAT ARE SMART VEHICLES?

Smart vehicles are those vehicles that can understand or sense the environment and make decisions accordingly. This is related to artificial intelligence and machine learning. A smart vehicle may understand the path of other vehicles on the road and may identify the traffic signals. The possibilities are very huge and it can really transform the way the vehicles behave. A smart vehicle may sense a vehicle far behind and could give instructions to it to slow down or overtake.

Pollution is increasing drastically and nations and automobile owners are looking for ways to make vehicles more convenient to users. Smart vehicles that use photovoltaics and electricity will soon become a common scenario on our roads. Smart vehicles use vehicles to cloud connectivity and vehicle to vehicle connectivity. That means the vehicle will be connected to a server and also worth other vehicles around it on the street.

In this way with all vehicles interconnected with each other, they can communicate with each other and transmit messages. This is a great step forward in reducing misunderstanding between drivers and avoiding accidents. As information is passed in real time between vehicles, traveling and driving become easy. The speed of the other vehicle, the direction, and position are all observed in smart vehicles. Hence it makes smart vehicles highly safe to use. There are sensors and GPS systems working and a 360-degree view is made possible. The GPS facility enables smart vehicles to detect whenever another vehicle comes within a specific range.

The driver in smart vehicles needs only to respond to the signals and messages given by the vehicle. The majority of the actions are done by the vehicle itself and the driver is just supporting the vehicle. Smart vehicles will reduce pollution to a great extent. In the future petrol stations will be rarely seen. With high pollution caused by the smoke generated from the vehicles, smart vehicles can really give us a solution to this problem. The performance of smart vehicles can be increased with photovoltaics and electricity. Clean energies are renewable energy sources that can be used in the replacement of traditional energy sources. The cost of maintaining these smart vehicles are considerably less compared to other traditional methods. Smart vehicles will be easy to buy and may soon replace ordinary vehicles which is an advantage [2], [6].

III. ADVANTAGES OF USING CLEAN ENERGY IN SMART VEHICLES

Clean energy is the energy derived from renewable resources and also zero-emission sources. This comprises of energy saved through energy efficiency measures. Renewable energy is made from natural sources that are regenerative over short

periods and will not be depleted. The commonly used renewable energy sources are biomass, hydropower, the geothermal, wind, and solar. Clean energy with both renewable and energy efficiency measures is the most sustainable one.

Using clean energy in smart vehicles can boost the performance and productivity of the vehicles. Clean energies like photovoltaics are pollution-free and are convenient. These are got from direct sunlight and have no side effects. Traditionally vehicles use petrol or diesel to power the engine and these have side effects in the sense they are not eco-friendly. This is not the case with clean energies like photovoltaics and can be used freely by anyone. Using clean energy is also affordable as there is no need to spend extra on these. Resources that are available directly from nature are used and it comes without any expense. The benefits of using clean energy are many and are soon expected to outperform traditional methods.

Smart vehicles with clean energy are just the perfect match and give great comfort and freedom to vehicle users. The many technologies and benefits provided by smart vehicles are many and if it can be operated with clean energy sources will provide all the reasons to consider it as the future of automobiles. High cost-effectiveness, no risk, convenience, etc. are some of the benefits of clean energy. A smart vehicle reduces the risk and makes the riding a more pleasant experience for the driver. Petrol and diesel are costly and using clean energy can be a better way to be economical [3].

IV. PHOTOVOLTAICS AS A CLEAN ENERGY SOURCE

Photovoltaics is the process by which solar energy is converted into electricity that can be used for different purposes. Photovoltaic devices make use of electricity derived from sunlight by an electronic process that occurs naturally in the semiconductors. PV devices can be used to give power to anything from small household appliances to large machines in businesses. Photovoltaics can also be used in vehicles in replacement for petrol and diesel. The costs of solar photovoltaics have decreased considerably in the last few years. This makes the technology highly affordable to use. The price of a completed PV system has reduced by 59% in the last decade.

The PV technology is rapidly used in many applications today and is expected to grow in the future also. Photovoltaics can be used in smart vehicles to improve their performance. As these are renewable and clean energy resources it gives the vehicle a superior performance and risk-free feeling. Now many companies have introduced photovoltaic panels for users with different options and facilities. The photovoltaic industry is growing and many companies and individuals are shifting to the photovoltaic energy source. Photovoltaic is common in America and some other countries and is slowly making their mark in Asia and Europe. New innovations are coming up in the PV industry making it much easier for people to use. Smart vehicles using PV energy are sure to make a greater impact in the future [4], [5].

V. SMART VEHICLES PERFORMANCE IMPROVEMENT USING PHOTOVOLTAIC AND ELECTRICITY

Charging a smart vehicle through your own photovoltaic system is a rewarding experience. A PV system that uses an output of 5 kWp is able to supply 5000 kWh (Kilowatt hours) of electricity per year. If the smart vehicle has a consumption of 17 kWh/100 km, then one is driving 2500 km per month emission-free. This makes PV usage highly emission-free and also at the same time economical. There are different ways in which PV usage can help and increase the performance and usability of smart vehicles [4].

- **Charging with PV power can save money as one increases consumption** - Instead of privately bought electricity consumption PV generated electricity consumption is far better and convenient. There is a need to store as much of this power as possible in order to use it and let it go. Since you will get it every day it is so easy to make use of it. The amount of electricity generated depends on the size and capacity of the PV system that is implemented. The larger the size, the more electricity, and vice versa.
- **Increase in the charging power and mileage** - Charging a smart car with PV can increase the charging power of the car compared to traditional methods. This means that the user will get more mileage by using PV. Solar energy is more durable than petrol and diesel and provides more power and easiness in driving. The car can perform better and safely with solar energy. Also, there is no need to worry about any leakage or fire problems. There are many instances in which petrol has leaked and the car was caught up in the fire. But with PV, all these problems do not exist.
- **Reduced CO₂ emissions** - PV enables vehicles to release very less CO₂ compared to ordinary vehicles. This makes it very eco-friendly to use. As pollution is increasing and causing many threats to the environment and people smart vehicles with PV and electricity is definitely an advantage. If the automobile industry becomes PV focused, then there will be drastic environmental improvement leading to healthy surrounding and safety of the people. Renewable resources are available to us freely and we need to make use of it in a planned and secure manner. CO₂ can cause a lot of diseases and reduce the energy level of travelers continuously exposed to it. Replacing something that does not cause large emissions of CO₂ will be a great step forward in making the earth pollution free and safe. Apart from convenience, affordability, and mileage, this one is a major benefit of PV enabled smart vehicles.
- **Special designs and curvature possible** - Another advantage for smart vehicles with PV model is the option of special designs and curvature. Since PV model vehicles use electricity to run, the vehicle can be model in such a way that it gets sunlight in the best possible manner. There is no need to have separate tanks for petrol and diesel and the car can be designed aesthetically. Special designs and shapes will match the smart vehicles perfectly as it gives a smart look to the vehicles. With advanced technologies used by smart vehicles, the aesthetic design will give it more attractiveness. Next-generation vehicles will be smart vehicles with unique and original looks.
- **Increase in the smoothness and power of the vehicles** - PV enabled vehicle is smooth to drive compared to traditional vehicles. As the vehicle uses electricity derived from sunlight, there is no extra pressure on the engines to take the vehicle forward. This is not the case with petrol and diesel-fueled engines. Traditional engines require a lot of effort and power generation to drive in hilly areas. By using PV-enabled vehicles driving becomes a smooth experience and the power of

the vehicle also increases considerably. The engine needs less effort, and the vehicle gets great pick up and power. Smart vehicles using PV and electricity are effortless to drive and are powerful.

VI. PHOTOVOLTAIC AS A WHOLE SYSTEM

Photovoltaic cells and panels are both interlinked and connected with each other. The solar cells make up a solar panel and the solar panel makes a solar system. Solar cells are individual cells that receive sunlight directly and a group of these individual solar cells constitutes solar panels. It is this solar panel that gives energy to smart vehicles. A single photovoltaic cell is able to convert sunlight into electricity, but it is not sufficient for any use. Hence multiple photovoltaic cells combine together and form a photovoltaic panel and electricity from this can be used for different large purposes. Photovoltaic systems are highly efficient in smart vehicles to increase their durability and performance [5].

VII. SMART VEHICLES WITH PHOTOVOLTAIC AND ELECTRICITY WILL CHANGE THE WAY WE TRAVEL IN THE FUTURE

Global warming is a major concern today and countries are coming together to find appropriate means to fight the situation. With 400 ppm, the earth's atmosphere had more than a record level of CO₂ emission. If the situation continues it will have a huge negative impact on the existence of mankind. It is something that has to be stopped immediately or otherwise poses a major threat. Smart vehicles have a huge role to play in this scenario. Smart vehicles with a photovoltaic system are a great solution to pollution problems. Even though the solution is not a complete one it certainly can bring a huge positive impact on reducing pollution.

Traveling will be easy and pollution-free in the future. The way one thinks and acts while driving will change with the increase in smart vehicles. Accidents will reduce and drivers will have greater understanding and freedom. There will not be a thing that holds us back when it comes to driving. We will see many new innovations and technologies in the field of smart vehicles. Surely it is something that is good for humanity and also for the environment. It will also make traveling less expensive and everyone will feel a sense of security and comfort [1], [4].

VIII. THE FUTURE OF THE AUTOMOBILE INDUSTRY WITH SMART VEHICLES

The future looks wonderful for the automobile industry. With many inventions and modern technologies coming up it is certainly heading towards a better, safe, and pollution-free state. Smart vehicles have certainly contributed and will continue to contribute to this in the future. Smart vehicles with the photovoltaic system will revolutionize and change the way people consider traveling and going out on the roads. With accidents increasing day by day and the security of traveling in a challenging phase we are encouraged and inspired to use smart vehicles and renewable energy sources. Smart vehicles will decrease pollution and photovoltaic system will also eliminate pollution. It is the right combination to use on our roads which will provide us with a sense of easiness and protection. The future looks safe with smart vehicles and renewable energy sources such as photovoltaics. However, we need to be conscious of the dangers of careless driving even with smart vehicles. A smart vehicle will increase convenience but should not be taken as a guarantee for safety. It is in the hands of the users to make the proper effort and ensure safety [1], [6].

IX. WILL SMART VEHICLES WITH CLEAN ENERGY REPLACE ORDINARY VEHICLES AND IMPROVE OUR CONVENIENCE?

Studies show that smart vehicles are ready to replace the traditional vehicles we see on the roads. Clean energy sources are being identified and used on a larger scale nowadays. People are shifting more towards renewable sources that are not harmful and can be used by anyone. Convenience is a great parameter in choosing a vehicle and smart vehicles can provide us with convenience. People use solar energy in many ways. It can be used for cooking and can be used as a fuel as well. Solar energy is lasting and to use this in smart vehicles is a great intervention in our era.

The energy received from sunlight is pure and durable. It is a natural form of energy and using it in any means assures the improvement of quality and effectiveness. While artificial energy sources can have negative impacts on our usage, renewable and natural sources offer us protection and safety. The same case applies to smart vehicles. By using clean energy in smart vehicles, quality, and safety is guaranteed. Already many traditional and artificial methods of using energy sources have been replaced with natural ones and the trend continues in the automobile industry also. The automobile industry is experiencing fast changes and innovations than any other industry in the market. With new experiments and technologies invented everyday smart vehicles will have a new outlook in the future. Smart vehicles with the photovoltaic system are an idea and also a reality in this regard.

Ordinary vehicles are good but they cannot replace the technology and safety that smart vehicles bring. Smart vehicles with a photovoltaic system can give an extra technological advantage and pollution-free effect. Many options are available in the market for people to buy. With the promotion and knowledge about smart vehicles with clean energy, the automobile industry is all set to make a new move in the market. Near are the times when we will see vehicles that communicate and take decisions on their own. Vehicles that can recognize movements and inform the driver are going to be a common reality in the streets. It is sure that smart vehicles with clean energy such as photovoltaics will replace ordinary vehicles and make driving and traveling a whole new experience for people of every nation [1].

X. CONCLUSION

Smart vehicles are vehicles that can communicate with each other and make adjustments accordingly. Artificial intelligence is the technique used by these vehicles to analyze the environment and respond in real-time. The performance of smart vehicles can be improved with the use of a photovoltaic system. It is a renewable resource and reduces pollution caused by the emission of carbon dioxide. The power, mileage, smoothness, etc. of the smart vehicles can be increased by using the photovoltaic

system. Pollution control is one of the major advantages of using smart vehicles with photovoltaic systems and electricity. The future looks bright with the emergence of smart vehicles with a photovoltaic system and electricity.

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REFERENCES

- [1] Kharab, P. (2018, January 12). How smart vehicles will change the way we travel in future. Retrieved from Auto Tech Review. [Online]. Available: <https://autotechreview.com/technology/how-smart-vehicles-will-change-the-way-we-travel-in-future/>.
- [2] Smart Vehicles: a green and safer future. (2016, May 05). Retrieved from Electronics for u. [Online]. Available: <https://www.electronicsforu.com/india-corner/smart-vehicles-green-safer-future/>.
- [3] what is clean energy. Retrieved from NC sustainable energy association. [Online]. Available: <https://energync.org/what-is-clean-energy/>
- [4] Charge electric car photovoltaic electricity emission free driving. Retrieved from The Mobility House. [Online] Available: https://www.mobilityhouse.com/int_en/knowledge-center/charge-electric-car-photovoltaic-electricity-emission-free-driving/.
- [5] Solar Blog. (2017, February 02). Retrieved from Infinite Energy: <https://www.infiniteenergy.com.au/what-is-the-difference-between-a-solar-panel-and-a-photovoltaic-cell/>.
- [6] Smart electric drive. (2020, November 03). Retrieved from Wikipedia. [Online]. Available: https://en.wikipedia.org/wiki/Smart_electric_drive/.

