SOLAR VEHICLES

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Abstract: A solar vehicle, also known as a solar electric vehicle (SEV), is an electric vehicle powered by solar energy. It utilizes photovoltanic (PV) cells to convert sunlight into electricity, which then charges the vehicle, s battery and powers its electric motor. These vehicles are designed to be environmentally friendly and co-effective, offering an alternative to traditional gasoline –powered cars. Solar vehicle must be light and efficient to get the best range from their limited captured power. 1400kg (3000lb) pound or even 1000 kg (2000lb) vehicles would be less practical because the limited solar power would not take them as far. A concentrated solar vehicles uses stored solar energy to run a heat engine, such as Rankine, Stirling or Brayton cycle, of the piston and crank type directly powering the vehicle or a free-piston linear generator, powering a hybrid electric car system. The solar term " Solar vehicles" usually implies that solar energy is used to power all or part of a vehicle,s propulsion. Solar power may also be used to provide power for communications or controls or other auxiliary functions.

Key words: Alternative, Batteries, Electric vehicle, Environmentally, Emission, Green house, Photovoltanic, Regenerative, Solar vehicle, Traditional,

Introductions:-

In 1955, a General Motors employee, Willium cobb invented the first model solar-powered car, a tiny 15-inch vehicle, which caused quite a stir when it debuted at a car show in Chicago. 12 Aug. 2022.

The basic principle of solar vehicle is to use energy that is stored in a battery during and after charging it from a solar panel. The charged batteries are used to drive the motor which serves here as an engine and moves the vehicle in reverse or forward direction. The benefits of solar vehicles are to reduce greenhouse gas emissions and dependence on non-renewable fossil fuels. It can also improve air quality, reduce noise pollution, and create jobs in the renewable energy sector. A solar vehicle is a vehicle for use on public roads. Solar vehicles are electric vehicles are that use self contained solar cells to provide full or partial power to the vehicle via sunlight. Solar vehicles typically contain a rechargeable battery to help regulate and store the energy from the solar cells and from regenerative braking. Some solar vehicles can be plugged into external power sources to supplement the power of sunlight used to charge their battery.

Solar vehicles combine technology typically used in the aerospace, bicycle, alternative energy and automotive industries. The design of solar vehicles always emphasizes energy efficiency to make maximum use of the limited amount of energy they can receive from sunlight. Most solar vehicles have been built for the purpose of solar car races. However several phototypes of solar cars designed for use on public roads have been designed and built. Guinness World Records recognize a land speed records for vehicles powered only by solar panels. This record is currently held by the Sky Ace TIGA

from the Ashiya University. Vayve Eva gets a flexible solar panel on the roof which can add up to 10 km of range daily. Vayve mobility launched Vayve Eva, the first-ever solar energy-powered electric car in India at the auto expo 2025 of Bharat Mobility Global Expo. 20 Jan. 2025. Industry experts predict that by 2030 , Evs could account for 30% of new vehicle sales, with solar charging infrastructure covering all major highway. Solar-powered public transport is expected to become the norm in major cities, while contributing technological advancements should drive costs down by 40-50% . There are some disadvantages of solar powered vehicle because there is no solar power at night, a big battery bank is required. Some people believe they are unattractive. Devices that operate only on direct current are more costly. The size of solar panels varies depending on the geographical location for the same electricity output.

Methods and materials:

Key components and functions.

Solar panels:

These panels, made up of photovoltanic cells, capture sunlight and convert it into electricity.

Electric motor:

The electricity generated by the solar panels power an electric motor, which drives the wheels of the vehicles.

Batteries:

Some solar cars also have batteries to store excess energy generated by the solar panels for use later, especially in cloudy conditions or at night.

Drive train:

A system of gears and axies transmits power from the electric motor to the wheels.

How they work:

1. Sunlight is absorbed by the photovoltanic cells on the solar panels.

2. The cells convert the sunlight into electricity, creating an electric current.

3. This electricity can be used directly to power the electric motor or stored in batteries.

4.The motor then drives the vehicles, with the power transmitted through the drive train.

Benefits of solar vehicles:

Reduced Emissions:

Solar vehicles produce no tailpipe emissions, contributing to cleaner air and a smaller carbon footprint.

Cost savings:

They can significantly reduce fuel cost and eliminate the need for gasoline purchases.

Renewable Energy:

They utilize a renewable energy source, making them a sustainable transportation option.

Reduced Noise Pollution:

Electric motors are generally quieter than internal combustion engines, further reducing noise pollution.

Limitations:

Dependence on Sunlight:

The performance of solar vehicles can be limited by weather conditions and the availability of sunlight.

Limited Range:

The range of solar vehicles may be shorter than traditional electric vehicles due to factors like solar panel efficiency and battery capacity.

High Initial Cost:

Solar vehicles may have a higher initial cost than conventional cars, though this can be offset by long term savings.

Results and discussions:-

Solar-powered vehicles present a promising path towards sustainable transportation, offering reduced emissions and reliance on fossil fuels. However their current practically is limited by factors like sunlight availability and the need for energy storage solutions. While solar vehicles are environmentally friendly and can be cost-effective in the long run they may not be suitable for all driving conditions or needs.

Future outlook:-

Technological Advancements:

Continued advancements in solar panel efficiency, battery technology and lightweight materials will likely improve the performance and practicality of solar vehicles.

Cost reduction:

As solar technology becomes more mainstream, the costs of solar panels and batteries are expected to decrease, making solar vehicles more accessible to a wider range of consumers.

Infrastructure Development:

The development of solar charging infrastructure, both in public areas and at home, will play a crucial role in facilitating the widespread adoption of solar vehicles.

Current Status:

While solar vehicles are not yet as common as traditional vehicles, they are going popularity particularly in competition and for experimental purposes.

Future Potential:

Technological advancements, such as more efficient solar cells and lighter, more powerful batteries, could make solar vehicles a more viable option for everyday transportation.

Future of solar vehicles:

- Research and development are ongoing to improve solar cell efficiency, better technology, and overall vehicle design.
- The integration of solar panels into traditional electric vehicles is also ongoing traction.
- Some predict a future where solar-powered public transportation and solar charging infrastructure are common.

The future of solar vehicles market expected to grow significantly over the forecast period due to stringent regulation to implement sustainability in the automotive industry. One of the key innovations is the production of maximum power point tracking (MPPT) circuits that has optimized energy generation from solar panels. Additionally, some other advancements in manufacturing include improved battery performance and hybrid-electric technology. Notably, growing environmental concerns regarding green gas emission have motivated authorities and regulatory bodies across various nations to initiate the utilization of ecofriendly vehicles, while maintaining road safety.

Conclusions:

Solar vehicles offer a promising alternative to traditional transportation but they are not a perfect solution for everyone. Their current limitations, such as sunlight dependence and range, are being addressed through ongoing technological advancements. As solar technology continues to evolve and become more affordable, solar vehicles are likely to play a more significant role in the future of sustainable transportation.

The next major development in technology may be the solar vehicles. The direct conversion of sunlight into energy allows these power vehicles to run entirely without using any fuels. They have a variety of significant functions in industries, with the reduction of pollution being their main goal.

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